Report of the Scientific Committee

The meeting was held at the Sheraton Santiago Hotel and Convention Centre, Santiago, Chile from 1-13 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 Government of Chile for hosting the meeting and for providing the excellent facilities. He expressed his pleasure at seeing the growth of the Scientific Committee over the three years, particularly with respect to the number of invited participants. However, he noted that less than half the IWC member countries were currently sending delegations to Scientific Committee meetings and hoped that this situation would improve in future years.

Bjørge announced that a special evening session would be held to celebrate the work of two scientists, Robert Clarke and Obla Paliza, who have been working on sperm whale biology in South America for over 50 years and have been involved in the work of the IWC Scientific Committee throughout this time.

With sadness, Bjørge announced the recent death of Kay Radway Allen, who died peacefully on 16 February 2008 just after his 97th birthday. Kay made an enormous contribution to the work of the Scientific Committee and in particular in establishing its leading role in the use of population dynamics modelling in a management context. His first encounter with the Scientific Committee was as a member of the independent Committee of Three (later four) in 1962 until 1964. His final encounter was as a guest of honour at the Scientific Committee dinner in Adelaide in the year 2000, nearly four decades later. In between he was a member of the Scientific Committee from 1965 until 1981, only missing the 1967 meeting. During that time he represented Canada for seven years and Australia for nine years. He was Chair of the Scientific Committee for five years from 1975 until 1979 and pioneered the use of computer modelling, initially on his own and then with Geoff Kirkwood. A quick examination of the IWC database reveals him to have authored over 90 IWC documents. He published over 140 scientific papers on fisheries and marine mammal management, as well as his 1981 classic monograph, The Conservation and Management of Whales. These statistics, impressive as they are, reveal only part of the story – as well as his immense scientific contribution to cetacean conservation and management, including being the prime mover behind the New Management Procedure, Kay was a perfect gentleman, perceived by all as fair and impartial, as illustrated by his ability to write on the blackboard with both hands at the same time. He was generous with his time in sharing his expertise with young and old alike – as well as a glass of whiskey or two. The Committee stood for a minutes' silence in his memory and honour.

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

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

1.4 Establishment of sub-committees and Working Groups
Three meetings preceded the start of the Scientific Committee during 30-31 May. Both the sub-committee on the Revised Management Procedure (RMP) and the Aboriginal Whaling Management Procedure (AWMP) Standing Working Group (SWG) met, in which agenda items covered were incorporated into their main agendas and reports (Annexes D and E respectively). A two-day Workshop on cetacean skin diseases and their impacts on cetaceans was held jointly by the SWG on environmental concerns and the standing sub-committee on small cetaceans and its report is given as SC/60/Rep8.

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 (BRG);
Annex G – Sub-Committee on In-Depth Assessments (IA);
Annex G1 – Working Group on the In-Depth Assessment of Western North Pacific Common Minke Whales, with a Focus on J Stock (IANP);
Annex H – Sub-Committee on Other Southern Hemisphere Whale Stocks (SH);
Annex I – Working Group on Stock Definition (SD);
Annex J – Sub-Committee on Estimation of Bycatch and other Human-Induced Mortality (BC);
Annex K – Standing Working Group on Environmental Concerns (E);
Annex K1– Working Group to Address Multi-species and Ecosystem Modelling Approaches (EM);
Annex L – Standing Sub-Committee on Small Cetaceans (SM);
Annex M – Sub-Committee on Whalewatching (WW); and
Annex N – Working Group on DNA (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.

Table 1
List of data and programs received by the IWC Secretariat since the 2007 meeting.

Date	From	IWC ref.	Details
Catch data:			
25/04/08	Norway: N. Øien	CD144	Individual minke catch records from the Norwegian 2007 commercial catch. Access restricted (specified 14/11/00)
27/05/08	Japan: H. Okada	C07	Individual catch records from the Japanese 2007 North Pacific special permit catch (JARPN II) and 2007/08 Antarctic special permit catch (JARPA II)
31/05/08	Iceland: G. Víkingsson	C07	Individual catch records from the Icelandic Special Permit and commercial catch 2007
02/06/08	Russia: R.G. Borodin	C07	Individual catch records from the aboriginal harvest in the Russian Federation in 2007
07/ 07	Nat. Archives Scotland		Individual catch records from Scottish land stations 1904, 1908-14
20/01/08	Greenland: O. Heinrich	CD146	Revised individual catch data from Greenland 1987-2006
22/02/08	T. Smith	CD147	American offshore whaling voyage data 1784-1924
02/08	J. Breiwick		Daily catch data from the NE Pacific 1908-19 (from the Lagen collection)
Sightings data:			
30/11/07	Norway: N. Øien		Norwegian sightings survey data 2002-07 for use in the North Atlantic (NA) minke whale *Implementation Review* 2008
15/05/08	Norway: N. Øien	CD145	Dive time information from VHF series for use in the NA minke whale *Implementation Review*
30/11/07	Japan: H. Shimada		Revised sightings data of WNP Bryde's whales
01/03/08	P. Ensor	CD64-79	2007/08 SOWER cruise data (sightings, effort, weather, ice edge etc. and photographs)
01/03/08	L. Burt	CD80	DESS Version 3.61 (2008)
Other data:			
29/11/07 and 26/02/08	Norway: H. Skaug	CD81	Genetic data held by Norway for use in the NA minke *Implementation Review* 2008
01/12/07	Iceland: G. Víkingsson	CD83	Icelandic minke whale genetic data for use in the NA minke *Implementation Review* 2008
01/12/07	Iceland: G. Víkingsson	CD83	EG1 fin whale age readings for use in the North Atlantic fin whale *ISTs*
10/03/08	Iceland: T. Gunnlaugsson	CD83	Icelandic *Discovery* marking data 1980-82
13/06/08	L. Witting	CD86	Program associated with SC/60/AWMP2 to test large whale strike limits off West Greenland
13/06/08	A. Punt	CD86	Stand alone versions of the bowhead and gray whale *Strike Limit Algorithms* (*SLAs*); details are given in Punt and Breiwick (2008)
31/05/08	D. Palka	CD85	Simulated IDCR line transect data sets 2008 (SC/39-SC/54)

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, 2008b, pp.64-65). Annex B2 links the Committee's Agenda with that of the Commission.

3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

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

3.2 National Progress Reports on research
National Progress Reports presented at the 2002-08 meetings are accessible on the IWC website. Reports from previous years will also become available in this format in the future.

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

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 6 January 2009. The importance of using the agreed template was **emphasised** by the Committee.

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 2007 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 2007 season and also the historic data listed in Table 1. Detailed validation of the revised Southern Hemisphere individual catch data 1948-72 has begun including entry of some detailed biological information.

Allison requested that, as almost all outstanding catch records have now been entered, members of the Committee inform her of any potential new sources of data for incorporation into the catch databases.

Work has begun on entry of bycatch data into a database using a format developed by Simon Northridge.

Data from the 2006/07 SOWER sightings cruise have been validated and incorporated into the DESS (Database and Software System) database and work on encoding and validation of data from the 2007/08 cruise has begun.

Programming work during the past year has focussed on development of a control program for use in North Atlantic fin whale *Implementation Simulation Trials* (*IST*s) and is discussed further under Item 6.2.

4. COOPERATION WITH OTHER ORGANISATIONS

4.1 Convention on the Conservation of Migratory Species (CMS)

4.1.1 Scientific Council

The Scientific Council of CMS did not meet during the intersessional period. The Committee agrees that Perrin should continue to represent it at the Council.

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

The report of the IWC observer at the 15th meeting of the Advisory Committee to ASCOBANS held in Bonn, Germany from 31 March-3 April 2008 is given as IWC/60/4E[1]. The main topics of relevance to the IWC are summarised below.

(1) Workshops and meetings held in conjunction with ASCOBANS during 2007/08:

  (a) the ECS/ASCOBANS workshop, held in April 2007, on offshore wind farms and selection criteria for Marine Protected Areas for cetaceans;

  (b) the HELCOM/ASCOBANS workshop, held in October 2007, on small cetacean population structure in the ASCOBANS area and genetics and population structure of the harbour porpoise in the Baltic Sea;

  (c) preliminary workshops in Sweden and Finland for the SAMBAH (static acoustic monitoring of Baltic harbour porpoises) project; and

  (d) the 4th Jastarnia group meeting held in Sweden during February 2008.

(2) The Jastarnia Plan (recovery plan for Baltic harbour porpoises).

(3) The ASCOBANS conservation plan for harbour porpoises in the North Sea, which is expected to be finalised during 2008 and adopted in 2009 (several of the authors are members of the IWC Scientific Committee).

(4) A review of new information on pollution, underwater sound and disturbance, which addressed the following issues:

  (a) high speed ferries in the member states - as IWC, IMO and ACCOBAMS are also concerned about ship strikes, it was proposed that ASCOBANS should liaise closely with these organisations; and

  (b) controlled detonation of unexploded ordnance in German waters and its potential danger to small cetaceans and other animals - disposal of munitions not only raises noise issues but also causes the release of potentially dangerous chemicals.

An intersessional working group on acoustic disturbance will present its findings to the next Advisory Committee meeting. The Committee thanked Scheidat for the report and **agrees** that she should represent the Committee as an observer at the next ASCOBANS Advisory Committee meeting.

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

Donovan, the IWC observer, reported on the considerable cooperation with ACCOBAMS that had occurred during the past year. ACCOBAMS held its Third Meeting of the Contracting Parties from 22-25 October 2007 in Dubrovnik, Croatia. The meeting was chaired by Ana Štrbenac from Croatia. The full report can be downloaded from *http://www.accobams.org*. A number of resolutions were passed related to cetacean conservation in the region. These included: the ACCOBAMS wide abundance survey; the Conservation Plan for Black Sea cetaceans; the conservation of the Mediterranean common dolphin; further work on marine protected areas; bycatch, competitive interactions and acoustic devices; ship strikes on large whales in the Mediterranean Sea, guidelines for tissue banks establishment; guidelines on the release of cetaceans into the wild; establishment of a joint sightings database; towards a label for whalewatching; guidelines on coordinated stranding response; and guidelines to address the impact of anthropogenic noise. Many of these resolutions had their origins in the work of the ACCOBAMS Scientific Committee.

The most recent ACCOBAMS Scientific Committee meeting was held in Rome from the 17-19 April 2008. Its report will soon become available on the ACCOBAMS website. A number of the important issues addressed by the ACCOBAMS Scientific Committee are also relevant to the IWC Scientific Committee and have been presented in documents to this meeting and/or considered by sub-committees. These include progress with the major abundance survey in the ACCOBAMS region (SC/60/O16) already endorsed by the IWC Scientific Committee; progress with work on ship strikes (SC/60/BC7) for which there is already considerable collaboration; work on population structure and genetic analysis relevant to Working Group on stock definition; the holding of a regional workshop on cetacean bycatch (part of the BYCBAMS project on the assessment and mitigation of the adverse impacts of interactions between cetaceans and fishing activities in the ACCOBAMS area); Marine Protected Areas (MPAs); anthropogenic noise etc.

Finally, Donovan reported on the meeting held to further the practical plans for the ACCOBAMS survey (SC/60/O16) held in Monaco from 15-17 May 2008. This was a successful meeting for a very ambitious project and his Chair's report will shortly be available on the ACCOBAMS website.

He concluded that the cooperation with ACCOBAMS is important and of mutual benefit to both IWC and ACCOBAMS. The next meeting of the ACCOBAMS Scientific Committee will be in December 2009.

The Committee thanked Donovan for his reports and agrees that he should continue to represent it with respect to ACCOBAMS.

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[1]Documents can be downloaded from *http://www.ascobans.org.*

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

The report of the IWC observer documenting the 2007 activities of ICES is given as IWC/60/4A. During the year, the ICES Working Group on Marine Mammal Ecology (WGMME) met from 27-30 March in Vilm, Germany to review new information on population sizes, bycatches and mitigation measures for fisheries that have a significant impact on small cetaceans and other marine mammals[2]. The Working Group also summarised the observations planned by ICES member states to meet EU Regulation 812/2004 (on monitoring and estimating bycatch of marine mammals in certain fisheries).

Preliminary results from the SCANS II survey (Small Cetaceans in the European Atlantic and North Sea) were presented and reviewed. SCANS II has provided the first comprehensive estimates of small cetacean abundance in the whole west European Atlantic continental shelf region and is relevant with respect to the development of a framework for management of bycatches.

The WGMME assessed information on how changes in hydrodynamics and sea temperature affect changes in distribution, population abundance and condition of marine mammals. A workshop on marine mammal health is planned for later in 2008, to be held in Belgium.

During the Annual Science Conference (ASC) held in Helsinki, Finland from 17-21 September 2007 several ICES committees dealt with marine mammal issues. A number of sessions were of relevance to the Committee, including those describing:

(1) comparative marine ecosystem structure and function, which assessed the variable role of important marine mammal species;
(2) the effects of hazardous substances on ecosystem health, which included the results of impact studies on white whales;
(3) stock identification, which addressed questions related to minke whale stock structure using DNA analyses; and
(4) management of marine ecosystems.

A joint symposium with NAFO and NAMMCO is planned for September/October 2008, which is entitled 'the role of marine mammals in the ecosystem in the 21st century'.

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 2007 meeting of IATTC.

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

No observer for the IWC attended the 2007 meeting of ICCAT.

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

The report of the IWC observer at the 26th Meeting of the CCAMLR Scientific Committee (CCAMLR-SC), held in

Hobart, Australia from 22-26 October 2007 is given as IWC/60/4B. Results from the 2007 IWC meeting relevant to CCAMLR were presented by Kock. The main items considered at the CCAMLR meeting of relevance to the IWC included:

(1) status and trends of Antarctic fish stocks, krill, squid and stone crabs;
(2) incidental mortality of marine mammals;
(3) harvested species (krill, fish and stone crabs and their assessment);
(4) ecosystem monitoring and management;
(5) management under conditions of uncertainty;
(6) joint activities with respect to ecosystem modelling in the Southern Ocean; and
(7) planned Inter-Polar Year (IPY) and IWC cooperation with CCAMLR.

A joint IWC-CCAMLR Workshop on modelling Antarctic krill predators is scheduled for August 2008. Further discussion of this collaboration appears under Item 13.1 and in Annexes K and K1. Reports of the CCAMLR-SC and its Working Groups are available through the CCAMLR secretariat and on its website (*http://www.ccamlr.org*).

Several reports on cetacean-fisheries interactions were submitted to CCAMLR in 2007. These are summarised in SC/60/O9.

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

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 Annual Meeting of the NAMMCO Scientific Committee will be available after its full report is presented at the Annual Council Meeting in September 2008. Walløe will report back to the Scientific Committee next year.

Council
There were no Council meetings during the intersessional period. The 17th NAMMCO Annual Council Meeting will take place 2-4 September 2008 in Greenland.

4.8 International Union for the Conservation of Nature (IUCN)

As noted under Item 10.7, the IUCN Western Gray Whale Advisory Panel (WGWAP) has met twice since the last meeting and held four workshops, one on photo-ID, two on seismic surveys and one on oil spills. All WGWAP reports are available on the IUCN website[3]. The WGWAP's task is to advise Sakhalin Energy Investment Company (SEIC) on mitigation measures to limit the impact of their petroleum extraction activities on western gray whales. Several IWC Scientific Committee members are also members of the

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[2]Information can be found at:
http://www.ices.dk/iceswork/wgdetailacfm.asp?wg=WGMME.

[3]*http://www.iucn.org/themes/marine/sakhalin/publications.html.*

WGWAP. A progress report on the Panel's work is given as Annex F, Appendix 2.

In view of the findings of the population assessment that anthropogenic impacts outside the Sakhalin area, specifically bycatches on the Pacific coast of Japan, may not be sustainable, the IUCN Global Marine programme is convening a rangewide workshop on western gray whales in Tokyo in September 2008. A number of Scientific Committee members are on the steering group of the workshop and the report of the workshop will be available for discussion by the Committee next year.

The IUCN Red List Programme is in the process of updating Red List entries (*http://www.redlist.org*) for mammals globally, in conjunction with the Global Mammal Assessment[4]. It has now largely completed its review of Cetacea, the results of which are expected to be announced shortly. Following the publication of revised global species-level listings, additional regional listings of subspecies and subpopulations of particular concern will be developed.

The World Conservation Congress, including IUCN's quadrennial Members' Assembly, will take place in Barcelona, Spain, 5-14 October 2008, where the IUCN programme for 2009-12 will be adopted[5]. The deadline for submission of motions has passed, and the list of submitted motions will be posted shortly.

4.9 Food and Agriculture Organisation (FAO) related meetings – Committee on Fisheries (COFI)
No information on the activities of COFI was provided. An FAO workshop on ecosystem modelling is discussed under Item 13.2.1.

4.10 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)
The statement of the Chair of the Commission to the 14th Conference of the Parties can be found at *http://www.cities.org*.

4.11 North Pacific Marine Science Organisation (PICES)
The report of the IWC observer at the 15th annual meeting of PICES held 26 October-5 November 2007 in Victoria, Canada is given as IWC/60/4C. The Marine Birds and Marine Mammals Advisory Panel (MBM-AP) held a successful session on the implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries. The AP agreed to work on a report on prey consumption by marine birds and mammals in the PICES region, incorporating new data sets on both populations and diet. Information on PICES can be found at *http://www.pices.int*.

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

4.12 Eastern Caribbean Cetacean Commission (ECCO)
No information on the activities of ECCO was provided.

[4]*http://www.iucn.org/themes/ssc/biodiversity_assessments/gma/indexgma.htm.*
[5]*http://cms.iucn.org/news_events/congress/index.cfm.*

4.13 Protocol on Specially Protected Areas and Wildlife (SPAW) of the Cartagena Convention for the Wider Caribbean
The meeting of SPAW has been rescheduled for July 2008. Carlson will represent the IWC at this meeting and will report back to the Scientific Committee next year.

4.14 Indian Ocean Commission (IOC)
The report of the IWC observers documenting the 2007 activities of IOC is given as SC/60/O15. During the year, a workshop was held 1-4 July 2007 in Sainte-Marie, Madagascar to promote research and conservation of cetaceans (and the dugong) in the IOC countries. The main results of the workshop were:

(1) assessment of initiatives regarding conservation of cetaceans in the Western Indian Ocean;
(2) a consensus was reached for the creation of a cetacean network to exchange information and experiences and to develop common projects; and
(3) preparation of a regional project on the conservation of cetaceans and dugongs in the region.

As a result of (2) above, a number of projects are now being undertaken, including:

(1) humpback whalewatching in Comoras;
(2) boat based surveys (including diversity, distribution and photo-identification studies) in Réunion;
(3) various humpback whale and humpback dolphin studies in Madagascar. A series of workshops were also held in Madagascar to try to find solutions to mitigate the pressure of dolphin hunting on the population;
(4) initiation of a monitoring programme on sustainable management of dolphin watching in Mauritius; and
(5) studies on depredation of tuna by cetaceans in the Seychelles.

A paper on the IOC regional network was presented to the 17th Biennial Conference on the Biology of Marine Mammals in Cape Town held 29 November-3 December 2007.

The Committee thanked Etienne, Bonne, Drouot-Dulau, De Toma Cadinouche, Giroux and Razafindrakoto for their report and **agrees** they should represent the Committee at future IOC activities.

5. REVISED MANAGEMENT PROCEDURE (RMP) – GENERAL ISSUES (SEE ANNEX D)

The Committee recognised that the highly technical nature of the work undertaken by the sub-committee on the Revised Management Procedure, meant that its reports, and the Committee's own summary, were often difficult to understand for those not directly involved in the discussions. The Committee therefore **recommends** that during the intersessional period, Donovan considers an appropriate way to make the Committee's report on matters related to the RMP more accessible, including the development of a template to assist rapporteurs in this regard. This is relevant to Items 5 and 6 of the Committee's report. In this regard, it was noted that a simple overview of the RMP is given in the Chair's Report of the 57th meeting (IWC, 2006a).

5.1 Review MSY rates, and if appropriate suggest changes to the plausible range

5.1.1 Review the MSYR Workshop report

Last year, the Committee re-emphasised the importance of a review of maximum sustainable yield rates (MSYR) in the context of RMP issues, especially with respect to considering modifications to the *Catch Limit Algorithm* (*CLA*), and approved the holding of an intersessional Workshop (IWC, 2008c). The Committee received the report of that Workshop (SC/60/Rep5) held in Seattle 16-19 November 2007. A summary report by the Workshop Chair (Donovan) appears in Annex D, item 2.2.1.

The Committee expressed appreciation to Workshop participants and particularly to Donovan for his chairmanship. Although the Workshop reviewed the available MSYR estimates for baleen whales and made considerable progress, it had not been possible to fully explore some of the issues needed to complete the review. In particular, remaining issues included the limitations of existing methods, the impact on environmental stochasticity on the ability to estimate MSYR (see Item 5.1.2), and the reconciliation of past trajectories with models including MSYR. Given the importance of completing the review, attention focused on the work plan between now and the next meeting (see Annex D). The issue of how MSYR is integrated into mixed-stock models of population dynamics (density dependence on the feeding grounds vs the breeding grounds) was beyond the scope of the review of MSY rates, and the Committee **agrees** that this latter issue should be taken up in the context of specific *Implementations*, for example for North Atlantic fin whales (see Item 6.2).

5.1.2 Modelling MSY-related parameters under stochastic dynamics

Cooke referred to recently completed analyses that developed further the work presented last year (in SC/59/RMP10) relating to the implications of environmentally-induced variability in population dynamics on the plausible range of sustainable yield rates for baleen whales. The simulation studies presented last year had been extended to keep track of cases where stocks of whales increased faster than expected under an assessment model that ignored environmentally-induced variability. The results suggested that ignoring environmental variability can result in overestimation of median MSYR. The Committee **agrees** that this issue should be discussed at the intersessional Workshop proposed under Item 22 and **encourages** Cooke to provide a full paper to that Workshop.

5.2 Finalise the process for reviewing proposals to amend the RMP

The Committee was pleased to see the progress made at the MSYR intersessional Workshop but recognised that considerable additional work was needed before the process for reviewing proposals to amend the RMP could be finalised. Most of this work related to the plausible range of MSY rates considered in the RMP, discussed under Item 5.1, but there was also a need to integrate this into a final process for reviewing the results from simulation trials as previously specified in IWC (2007c, pp.89-91).

Last year, the Committee had agreed that it would be in a better position to review a need for additional trials to model any further environmental variation once the review of MSY rates had been completed (IWC, 2008c, p.91). The Committee **agrees** that, depending on the results of the review of MSY rates, intersessional work might be needed to accomplish this and that sufficient time should be allocated for this item at next year's meeting so that the process for reviewing proposals to amend the RMP could be finalised. An intersessional group under Butterworth (Q3) will address this issue.

5.3 Consideration of the Norwegian proposal to amend the RMP

Aldrin and Huseby (2007) presented last year contained results for all single stock trials for a proposed revision to the *CLA*. The Committee reiterated its agreement last year that detailed consideration of these results should await completion of the work to reconsider the plausible range for MSY rate (see Item 5.1). This work and the process for reviewing proposals to amend the RMP (Item 5.2) should be finalised at next year's meeting and the Committee **agrees** that the Norwegian proposal should be considered at that time. If additional trials are required, advance notice will need to be given to allow full consideration of the proposal next year.

5.4 Work plan

Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

6. RMP – PREPARATIONS FOR IMPLEMENTATION (SEE ANNEX D)

6.1 Western North Pacific Bryde's whales

6.1.1 Finalise abundance estimates for western North Pacific Bryde's whales

SC/60/PFI2 presented abundance data by survey block and mode for western North Pacific Bryde's whales from the more recent sighting surveys (1998-2002) and the past ones (1988-96). SC/60/PFI3 used the data in SC/60/PFI2 to obtain abundance estimates by *Small Area* for use in the *CLA*. The estimation procedure comprised three stages, as described in Annex D, item 3.1.1. Abundance estimates from the 1988-96 surveys, which were not subject to oversight by the Committee because no oversight procedures existed at that time, did not affect the point estimates of abundance intended for use in the *CLA* but were used for the estimation of process error.

Computations were made for nine different run sets to assess the impact of model assumptions and the data utilised in the estimation of the process error and abundances, with the results given in Annex D, item 3.1.1. SC/60/PFI3 also provided estimates for a count-based model so survey blocks with zero counts could be included in the analyses.

Table 2

Agreed abundance estimates and their CVs (1998-2002) for use in the *CLA* for the western North Pacific Bryde's whales.

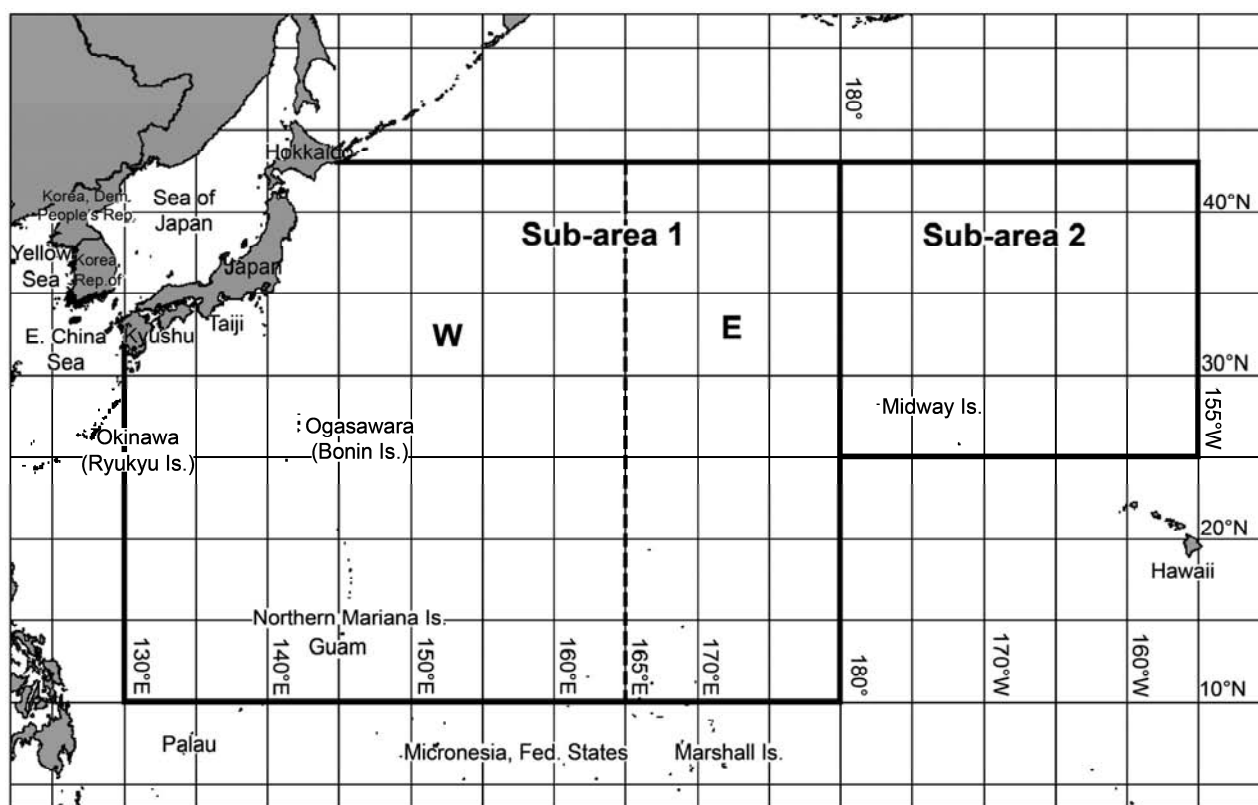| Area	Estimate	CV
1W	4,957	0.398
1E	11,213	0.498
2	4,331	0.553
Total area	20,501	0.337

Fig 1. North Pacific Bryde's whale sub-areas.

The Committee **agrees** that these two papers represented a substantial improvement both in the analyses and documentation for the western North Pacific Bryde's whale abundance surveys. It appreciated the considerable effort that had gone into addressing the issues raised at last year's meeting and **agrees** that all of the substantive issues raised last year had been addressed satisfactorily.

For reasons detailed in Annex D, item 3.1.1, the Committee **agrees** that estimates based on Run #1 model 4 (Annex D, table 2) were accepted for use in the *CLA* (see Table 2 and Fig. 1).

6.1.2 Review of proposed research plan
Last year (IWC, 2008c) three of the four RMP variants (1, 3 and 4) considered during the *Implementation* for the western North Pacific Bryde's whales had been recommended for implementation without a research programme but the fourth, variant 2, was not acceptable without research. The Committee's 'Requirements and Guidelines for *Implementations*' (IWC, 2005b) explain this process in some detail, particularly with respect to what comprises an acceptable research programme.

SC/60/PFI9 provided a research proposal in response to last year's decision, to determine whether or not sub-stocks occur in sub-area 1 (stock structure hypothesis 4). It used the *pro forma* agreed last year and considered most of the Committee's specific suggestions made at that time.

The Committee welcomed the revised research proposal and noted that it closely followed the format recommended last year (IWC, 2008c, pp.96-97). Discussion focused on the age-composition data, but two conflicting points of view were expressed (see Annex D, item 3.1.2). The research proposal aims to examine earplug data for future whaling operations in sub-areas 1W and 1E. However, it

was not clear whether the effect (the difference in total mortality rate between sub-areas 1W and 1E) would be as large today as during the period of commercial whaling. This can be examined using the *Implementation Simulation Trials* based on stock structure hypothesis 4 and the Committee **recommends** that this be done.

Some members noted that there were no plans to present results of power analyses for the genetic work before 2010 even though the genetic work was core to the research proposal. Pastene noted that results of power analyses have been presented to previous meetings (e.g. Kitakado *et al.*, 2005) and the Committee **recommends** that the results from previous (and any new) power analyses for the western North Pacific Bryde's whales be presented and discussed at next year's meeting.

Other members highlighted the value of tag-based techniques to evaluate stock structure hypotheses. In that context, Pastene stated that the research programme would not commence until the RMP is implemented for the western North Pacific Bryde's whales.

After much discussion, and noting that Japan intended to take catches in both sub-areas 1W and 1E (rather than just sub-area 1W as expected under variant 2), the Committee **agrees** that it is not necessary to make a final decision regarding the research proposal at this year's meeting, and that the proposal would be discussed further next year.

6.1.3 Recommendations
The Committee **agrees** that following acceptance of the abundance estimates for use in the *CLA* (Item 6.1.1), it would be in a position to compute catch limits under variants 1, 3 or 4, should the Commission so request.

6.1.4 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

6.2 North Atlantic fin whales
6.2.1 Continue the Implementation *process for North Atlantic fin whales*
Details of the *Implementation* process can be found in the 'Requirements and Guidelines for *Implementations*' (IWC, 2005b).

6.2.1.1 REPORT OF THE FIRST INTERSESSIONAL WORKSHOP
Last year the Committee recommended that the *Implementation* for North Atlantic fin whales be started, thus entailing a meeting of a small technical group and the holding of the first intersessional Workshop during 2007/08.

The Committee received the report of the Workshop (SC/60/Rep3). A summary of the report is given in Annex D, item 3.2.1. The Committee thanked Donovan and the participants, noting that successful completion of this Workshop and the associated work arising from its deliberations were essential for the Committee to be able to complete the *Implementation* for the North Atlantic fin whales within the two-year timeframe identified in the 'Requirements and Guidelines for *Implementations*'.

The primary objective of the first intersessional Workshop was to develop an appropriate *Implementation Simulation Trials* structure and to specify the associated conditioning so that it could be carried out before the present Annual Meeting. The aim of such trials is to encompass the range of plausible scenarios involving *inter alia* stock structure, MSY rates (MSYR), Catch-cascading from a risk- and catch-related perspective, with a view to recommending an appropriate variant for implementation of the RMP for a specific species/area.

The Committee **agrees** that this work has been accomplished.

6.2.1.2 OBJECTIVES OF THE FIRST ANNUAL MEETING
The primary purpose of the first Annual Meeting is to review the results of the conditioning and to finalise the *Implementation Simulation Trials*. The specific objectives (IWC, 2005b) are:

(1) final consideration of the plausibility of the various hypotheses and hence the weight assigned to each of the trials (the overall balance of the *Implementation Simulation Trials* will be accounted for when weights are assigned);

(2) discussion of what data/research may reduce the number of hypotheses and possible time-frames for this research/data collection;

(3) updates/improvements to standard data sets (i.e. abundance, catches, bycatches) for use by the *CLA* in final trials and when evaluating the plausibility of hypotheses and hence assigning weights to trials (new data would not be used when conditioning the trials);

(4) specification of operational features (geographical and temporal) and management variants;

(5) development of a timetable for the remaining work (including circulation of trial results and format); and

(6) initial discussion of the inputs for actual application of the *CLA* (catches, bycatches, estimates of abundance and projected future anthropogenic removals).

6.2.1.3 REVIEW RESULTS OF CONDITIONING
The manner in which the trials were to be conditioned was specified in SC/60/Rep3. The work was guided by an intersessional steering group, which led to some changes to the specifications developed during the Workshop. Specifically, a tag-reporting rate was estimated for Discovery tags released in Canada for the bulk of the trials, and trials were conducted for $MSYR_{mat}=2.5\%$ as well as for $MSYR_{mat}=1\%$ and $MSYR_{mat}=4\%$. The Committee thanked Allison and Rademeyer for their considerable work during the intersessional period.

The *Implementation Simulation Trials* for the North Atlantic fin whales are based on abundance and tagging data (all trials) and catch per unit effort (CPUE) data (a subset of the trials). A small group was established to give initial consideration to the results of the conditioning which had been conducted during the intersessional period. This small group identified several diagnostic tables and plots (see Annex D, Appendix 3) for examination by the Committee. The full set of diagnostic tables and plots will be archived by the Secretariat and be available to the Committee.

After further consideration, including the addition of two new trials (see Annex D, item 3.2.3), the Committee **agrees** that the conditioning has been achieved satisfactorily for the purposes of conducting *Implementation Simulation Trials*.

6.2.1.4 UPDATES TO STANDARD DATASETS
SC/60/PFI13 presented abundance estimates for fin whales from the Icelandic and Faroese survey areas. Combined single platform estimates were provided using three degrees of certainty in species identification, and with and without a bias correction for distance estimation. In addition an estimate of $g(0)$ using mark-recapture (or sight-resight) methods was provided. Total abundance for the combined platform estimate was 21,628 (95% CI=15,731-27,739). The double platform analysis resulted in a mean value for $g(0)$ for the primary platform of 0.77 (CV=0.10), which is similar to that estimated for 2001. The magnitude of other sources of bias in the data was also analysed, but the uncorrected estimate for the combined platforms was considered most comparable to earlier survey estimates. This estimate is lower (but not significantly so) than the total estimate for 2001 of 24,887 (95% CI=18,186-30,214) (Víkingsson *et al.*, 2007).

6.2.1.5 FINAL CONSIDERATION OF PLAUSIBILITY (INCLUDING WEIGHTING OF TRIALS IN TERMS OF OVERALL BALANCE)
The Committee reviewed the *Implementation Simulation Trials*, including the trials selected following the review of the conditioning (see Item 6.2.1.3). It assigned plausibility ranks of 'High', 'Medium', 'Low' to each hypothesis (factor) and hence to each trial, as specified in the 'Requirements and Guidelines for *Implementations*' (IWC, 2005a, pp.86-87). Using the process described in Annex D, item 3.2.5, of the final set of 57 trials (see Annex D, table 2), 25 were assigned 'high' weight, 25 were assigned 'medium' weight, and 7 'low' weight. In accord with the 'Requirements and Guidelines', the Committee agrees that the seven trials assigned 'low' weight will not be considered further.
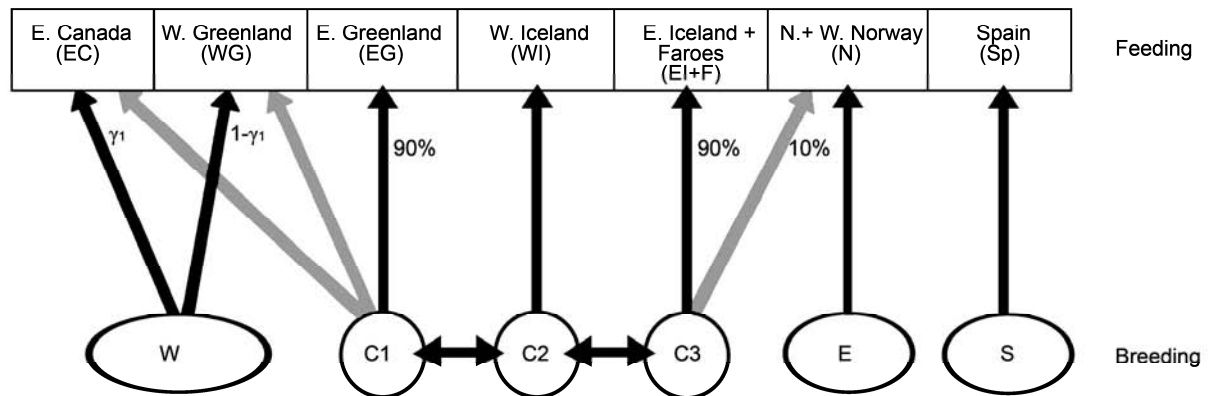
Hypothesis (I). Base case: 4 breeding stocks with separate feeding sub-areas
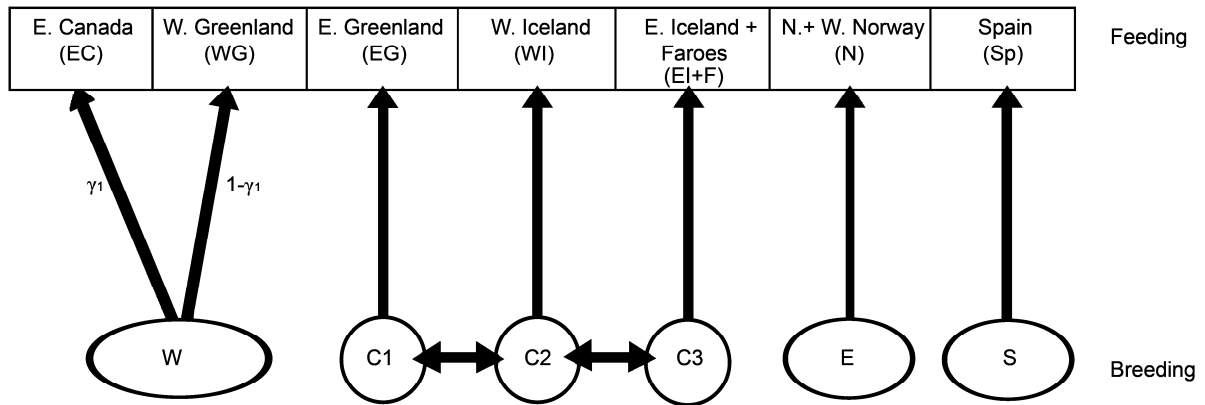
Hypothesis (II). 4 breeding stocks with the W and E stocks also feeding in the central sub-area
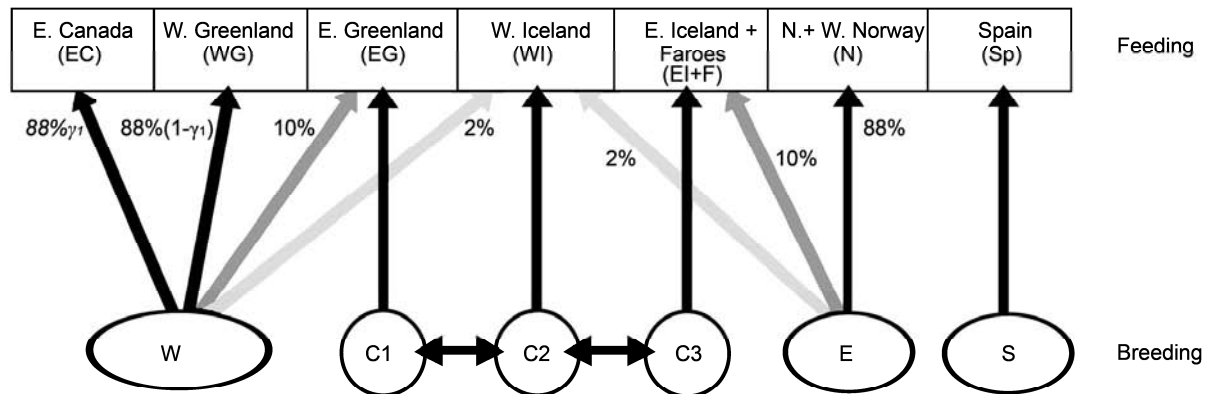
Hypothesis (III). 4 breeding stocks with the C stock feeding in adjacent sub-areas

Hypothesis (IV). 4 breeding stocks but without interchange between the C sub-stocks
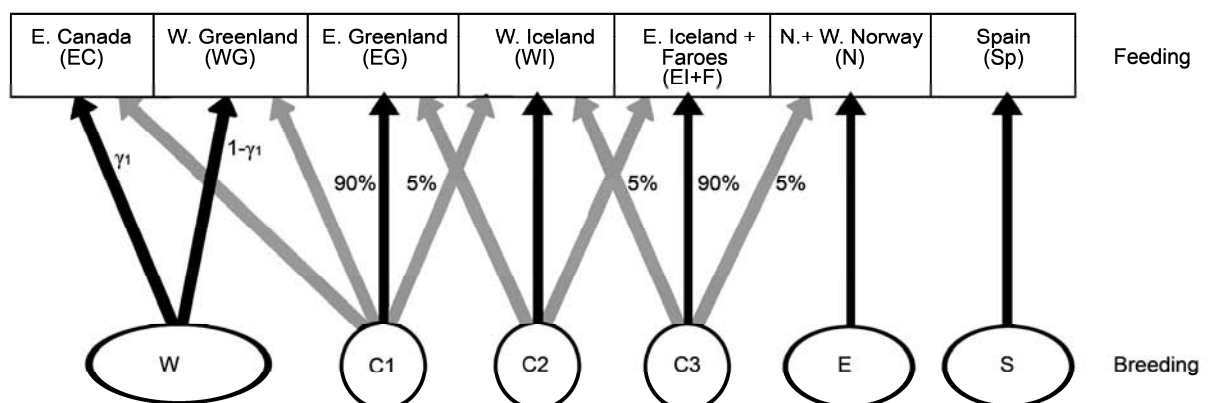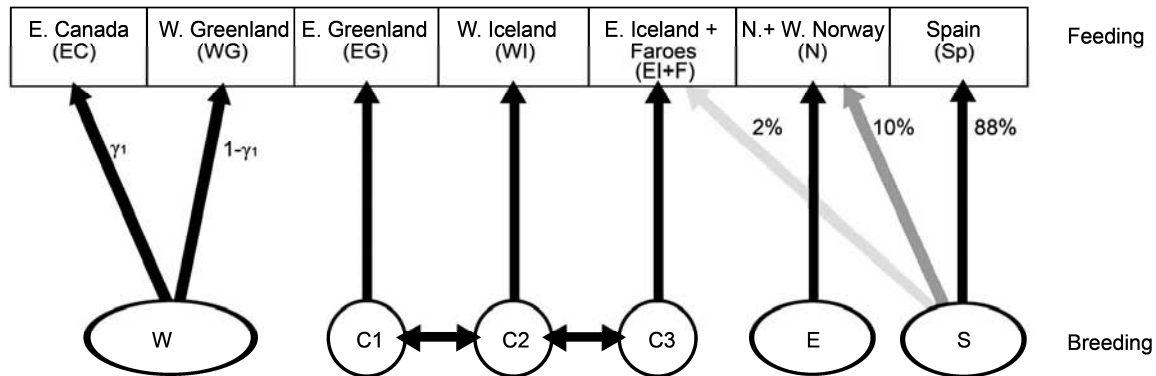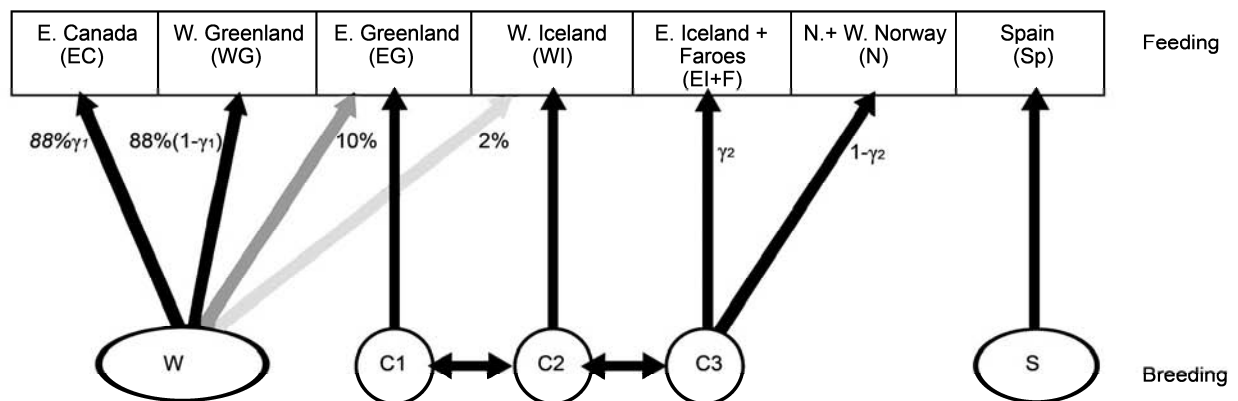

Fig. 2. Stock structure hypotheses for North Atlantic fin whales [continues on next page]

Hypothesis (V). 4 breeding stocks with the S stock feeding in the two adjacent sub-areas

Hypothesis (VI). 3 breeding stocks
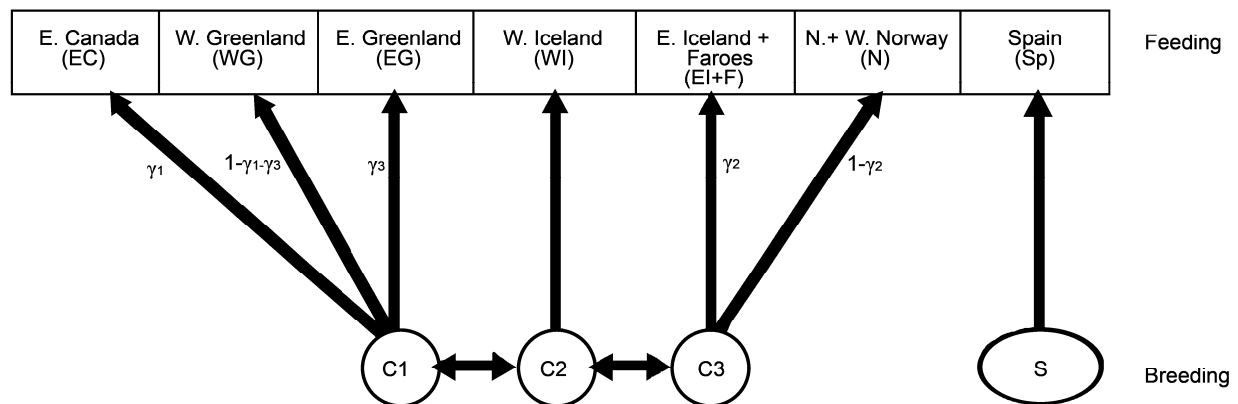

Hypothesis (VII). 2 breeding stocks

Fig. 2 cont. Stock structure hypotheses for North Atlantic fin whales

6.2.1.5.1 STOCK STRUCTURE HYPOTHESES
The Committee noted that the genetic data for North Atlantic fin whales are equivocal regarding the number of stocks (see Annex D, item 3.2.5.1). After considerable discussion of the available information at the Workshop (SC/60/Rep3), seven stock structure hypotheses were developed (Fig. 2).

The Committee **agrees** that hypothesis VII should be accorded 'medium' for the reasons given in Annex D. The only disagreement arose as to whether hypothesis IV should be assigned 'high' or 'medium' plausibility. After considerable discussion, all but one member agreed that this hypothesis should be assigned 'high' plausibility. Annex D, Appendix 4 provides a minority statement from that member and the rationale for the opposing view.

In summary, the Committee **agrees** that given little basis to select among any of the stock structure hypotheses,

hypotheses I-VI should be assigned 'high' plausibility and hypothesis VII 'medium' plausibility.

6.2.1.5.2 OTHER
Discussions concerning a number of other matters are reported in Annex D, item 3.2.5.2. They are: MSYR; catch series; alternative boundary between WI and EI/F; alternative abundance estimates/CPUE data; alternative mark loss rates; higher weight on the tagging data; selectivity decreasing; and reporting rate for tags placed in Canada.

The sub-committee did not have time to review the conditioning for the new trials specified under this item and Item 6.2.1.3. It established a small group (Allison, Butterworth, Donovan, Gunnlaugsson, Punt, and Wade) to review the conditioning and provide a short report to plenary (Annex D, Appendix 3). The Committee **agrees**

with the view of that group that the conditioning for trials 43-49 was adequate. The trials in which the contribution of the mark-recapture data to the likelihood function was increased by a factor of ten led to slightly better fits to the mark-recapture data (as expected), but to much poorer fits to the abundance data. It **agrees** that these trials should be accorded 'low' plausibility and hence not be taken any further.

6.2.1.6 DATA/RESEARCH TO REDUCE HYPOTHESES
As noted above, genetic data are somewhat difficult to interpret for fin whales. Specifically, DNA-based analyses revealed low levels of genetic divergence among geographic fin whale samples which may be interpreted in two different ways: (1) the degree of gene flow between sampling partitions is high; or (2) the rate of gene flow in fact is low, and the low degree of genetic divergence is due to a recent divergence of current North Atlantic fin whale populations.

In addition, divergent selection has been invoked as an explanation for the discrepancy between the DNA- and allozyme-based results (and the implications for the number of breeding stocks). Data analyses aimed specifically at detecting signatures of selection could be undertaken to resolve this uncertainty. A proposal to conduct this work is given in Annex D, Appendix 5, and discussed further under Item 22.

6.2.1.7 SPECIFICATION OF OPERATIONAL FEATURES AND MANAGEMENT VARIANTS
The Committee noted that all future catches will be assumed to be taken from the West Iceland sub-area, given advice regarding the expected whaling operations. Information on management variants is given in Annex D, item 3.2.2.

6.2.1.8 SPECIFICATION AND CLASSIFICATION OF FINAL TRIALS
The full list of specified trials, including the weights of each trial, is found in Annex D, Appendix 6.

6.2.1.9 INPUTS FOR ACTUAL APPLICATION OF THE *CLA*
The Committee noted that documents are needed regarding the selection of the catches and abundance estimates for use in the *CLA* (as opposed to the trials). It **agrees** that this matter should be discussed at the second intersessional Workshop (see Item 3.2.10) and finalised at the 2009 Annual Meeting.

6.2.1.10 WORK PLAN
The Committee **agrees** that the tasks that have to be completed during the first Annual Meeting had been completed successfully and that the *Implementation* for the North Atlantic fin whales remained on schedule for completion at the 2009 Annual Meeting.

In accordance with the 'Requirements and Guidelines for *Implementations*' (IWC, 2005a, pp.84-92) plans were developed for the second intersessional Workshop for the North Atlantic fin whale *Implementation*. The objectives for the Workshop are given in Annex D, item 3.2.10. Specifically, the Committee re-established a Steering Group under Donovan (Q2) to guide the work for this Workshop. It will be held in Spring 2009, in a location to be decided, for a period of five days. The financial implications are considered under Item 22. The tasks to be completed before the Workshop are also detailed in Annex D, item 3.2.10.

The Committee anticipates completing the *Implementation* at the 2009 Annual Meeting, during which the Committee will:

(1) review the results of the second intersessional Workshop (including any additional trials); and
(2) agree recommendations for *Implementation* including the specifications of the inputs to the *CLA*.

6.3 North Atlantic common minke whales
6.3.1 Complete the Implementation Review *for North Atlantic minke whales*
The Committee noted that the last *Implementation Review* for North Atlantic minke whales was conducted in 2003 (IWC, 2004c, pp.171-83) and a new one had been scheduled last year for 2008 (IWC, 2008c, pp.99-100).

A working group met immediately prior to the Annual Meeting to conduct the Review. Its report is contained in Annex D, Appendix 7, and the main conclusions and further discussion are summarised in Annex D, item 3.3.1. Particular points of interest were as follows.

6.3.1.1 STOCK STRUCTURE
New analyses were available in SC/60/PFI10 and SC/60/PFI11. The former reported little genetic variation, possibly consistent with a panmictic population, although the results were also consistent with recent divergence from a small founding population. The latter found no significant genetic divergence between *Small Area*s, in contrast to results considered during the 2003 *Implementation Review*.

Given a change in laboratory in 2003, with the possibility that the apparent heterogeneity found in the 1997-2002 data had been caused by laboratory errors, the Committee **recommends** that the 1997-2002 data be analysed in more detail with a view to determining whether the apparent heterogeneity could be a laboratory artefact.

6.3.1.2 ABUNDANCE ESTIMATES
The abundance estimates for all areas, and their current status, are given in Annex D, Appendix 7, table 2.

For the northeast Atlantic (Norwegian and Barents Seas) and CM *Small Area* (Jan Mayen), new but unfinalised estimates were provided in SC/60/PFI4. The Committee **agrees** that they can be used for conditioning *Implementation Simulation Trials*, but not for use in the RMP until they are finalised.

For the North Sea (EN *Small Area*), the Committee **agrees** that the estimate from the SCANS 2005 shipboard survey for the EN *Small Area* was acceptable for use both in conditioning *Implementation Simulation Trials* and in the RMP. Estimates from aerial surveys were not considered suitable for the reasons given in Annex D, Appendix 7. Results from 2007 surveys were not considered, pending finalisation of the analysis.

The Committee **agrees** that Icelandic coastal estimates from a reanalysis of the 1987 and 2001 aerial surveys (Borchers *et al.*, 2008) are acceptable for use in conditioning *Implementation Simulation Trials* and in the RMP. However, there was considerable discussion of estimates of abundance from an aerial survey in 2007 (SC/60/PFI12). Despite a difference in detections and the fact that one observer did not detect any minke whales within 200m of the trackline and duplicated none of the minke whales detected by the control observer precluding estimation of distance error or $g(0)$, the Committee **agrees**

that there was no *a priori* reason to exclude those data, and that the abundance estimate based on data from both observers meets the requirements for use in conditioning trials and for use in the RMP. Gunnlaugsson believed that a higher estimate based on data from the observer for whom it was possible to estimated *g*(0) also met these requirements; he noted that the lower estimate was incompletely corrected for *g*(0).

For West Greenland, the Committee noted that the AWMP Standing Working Group had accepted a 2005 aerial survey estimate (IWC, 2008d, p.126). The Committee **agrees** that this estimate was suitable both for conditioning trials and also, should it be required, for use in the RMP.

For the Western North Atlantic, the Committee **accepted** an estimate for the Gulf of Maine, Bay of Fundy and western Scotian shelf (Waring *et al.*, 2007) for use in conditioning trials, but noted that its use in the RMP was unlikely to be called for.

6.3.1.3 *IMPLEMENTATION SIMULATION TRIALS*
The Committee **agrees** that no new *Implementation Simulation Trials* are needed at this time. It also noted that the North Atlantic *Implementation Simulation Trials* were developed before the 'Requirements and Guidelines for *Implementation*' (IWC, 2005a, pp.84-92) were adopted, but considered that they follow the intent of the Requirements and Guidelines. It therefore **agrees** that it is not necessary to modify the existing trials for the current *Implementation Review*, but that the next *Implementation Review* in 2013 should be based more formally on the 'Requirements and Guidelines'.

The Committee identified a number of research topics relating to stock structure, the results from which could enhance the 2013 *Implementation Review*; these are listed in Annex D, Appendix 7.

6.3.1.4 MANAGEMENT AREAS
The Committee **recommends** that the *Medium Areas* remain unchanged. There is no new evidence to support additional population differentiation in the North Atlantic and thus the earlier evidence on which the *Medium Areas* were based remains valid.

Walløe proposed that the boundary between EW and EB *Small Areas* that had been introduced in 2003 should be removed, on the grounds that the original evidence on which it had been based was weak and that the new information (see Annex D, item 3.3.1.2) did not support it. To evaluate this proposal, the Committee considered three additional analyses, detailed in Annex D, item 3.3.1.5, in addition to those discussed in Annex D, Appendix 7.

The Committee **agrees** that a decision on deleting the EW/EB boundary should be postponed to next year, pending an examination of whether there are differences between the 1997-2002 and the 2003-07 data and whether these could be explained by changes in laboratory procedures (see Annex D, item 3.3.1.2).

There was no proposal to change the boundaries of the ES *Small Area*. Although there was no genetic evidence to support it being separate from the EB and EW *Small Areas*, it was considered desirable to retain the sub-area from a precautionary and operational point of view.

6.3.2 Recommendations
The Committee **recommends** that the *Implementation Review* be completed next year, when a recommendation

on boundary changes can be made based on the additional work identified above and other relevant information. It is expected that finalised abundance estimates for the eastern and CM areas will also be available then.

6.4 North Pacific common minke whales
Last year (IWC, 2008b, p.10), the Committee had agreed that rather than starting an *Implementation Review* this year, it would be better to discuss and synthesise the available new information first (in the spirit of a *pre-Implementation assessment*). An intersessional steering group under Kitakado (Q9) had been established and some aspects of the work with respect to J-stock had been progressed through the North Pacific minke whale working group (NPM) at this meeting (see Annex G1).

Japanese scientists reported that they currently have a very heavy workload in preparing data and analyses for the forthcoming JARPN II review (see Item 17.3). In addition, the in-depth assessment of western North Pacific minke whales, with emphasis on J-stock, is currently underway (see Item 10.6). Both will contribute to the *Implementation* process. In the light of the above, and the experience of the lengthy original *Implementation* which had led to the development of the 'Requirements and Guidelines for *Implementation*', they believed it was appropriate to delay consideration of this item until the JARPN II review and the in-depth assessment have been completed.

Noting that the agreement last year related to preparing for the *Implementation Review* and not undertaking it, the Committee **agrees** to defer further general consideration of this item until next year.

6.5 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

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

7.1 Estimate anthropogenic mortality from:
7.1.1 Bycatch in fishery operations
The Committee reviewed a compilation of bycatch and ship strike reports (Annex J, table 1) from all received national Progress Reports (information included ranged from 2005 to the current year); there was some variation amongst Progress Reports with respect to inclusion of unconfirmed reports. In order to facilitate reporting, the Committee **requests** the Secretariat to circulate the Progress Report template by 6 January each year (see Item 3.2). It also **reiterates** the need for the template to be followed by compliers.

7.1.1.1 ESTIMATION OF BYCATCH BASED ON GENETIC DATA USING INFORMATION FROM MARKET SURVEYS
SC/60/BC2 described the results of genetic analyses of 99 whale-meat products purchased in Japan. Based on mtDNA sequences, the 39 fin whale products for 2007 represented 12 individuals while the 15 products purchased in 2006 represented eight, five of which were also found in 2007. None of the 15 haplotypes from these surveys matched to haplotypes found on the market prior to 2006. The authors found it difficult to explain this minimum census of 15 individual fin whales given the total reported take of 13

from JARPA II and the number and timing of fin whale entanglements in official reports of bycatch in recent years.

In the discussion of this paper in Annex J, it was noted that previous Japanese market surveys had found products derived from fin whales and that it had been assumed that the primary source was long-term storage of Icelandic products; sequences from most products identified in early market surveys (1993-2003) grouped with reference sequences from the North Atlantic. After 2003, there had been an increase in the number of fin whale products identified from Japanese markets that did not group with the available North Atlantic reference sequences. Information on sequences from the complete set of common minke whales (189) from the Icelandic scientific permit takes 2003-07 and from the commercial catch of minke whales in 2006/07 (7) and fin whales in 2006 (7) are included in the Icelandic DNA registry. Additional genetic data on fin and common minke whales were made available to the Committee for use in the relevant RMP *Implementation* and *Implementation Review*, respectively, of these two species. Earlier data pre-2003 are not as complete as the more recent data included in the Icelandic DNA registry. Requests for genetic information from the DNA registry should be directed to the Icelandic Ministry of Fisheries.

The Committee welcomed this information from Iceland. Whilst recognising the differing views of various member governments over this issue, it **reaffirms** its view that availability of data from DNA registers will improve estimates of total take from market surveys (e.g. IWC, 2006b) and it **agrees** that discussion of the information presented in SC/60/BC2 would be facilitated by comparison with registry sequences from whales taken in the JARPA II hunt and documented bycatch. The Committee **requests** that these data be made available through the Committee's Data Availability Agreement (DAA).

7.1.2 Entanglements
7.1.2.1 ESTIMATING RISK AND RATES OF ENTANGLEMENT
SC/60/BC1 used mark-recapture techniques to examine the fate of humpback whales involved in entanglements on the east coast of the USA. Of 95 live entanglement cases examined from 1998-2006, 58 were sufficiently documented to allow the individual to be re-identified. Analyses accounting for differential detection probabilities indicated that juvenile survival might have been lower after entanglement, although further data are required. Despite a specific concern previously expressed about mouth entanglements in baleen whales (IWC, 2007g), mouth entanglements known to have persisted up to 46 days did not appear to reduce survival: other entanglement configurations were not studied. Reasons for possible biases in the results of the analysis were identified. It was thought that the extensive disentanglement effort in the region also improved survival in some cases.

The value of using photo-identification data to examine the fate of previously entangled whales is recognised and the Committee **encourages** the use of other methods (e.g. underwater photography and molecular genetic matching). It also **welcomes** advances in developing health assessment techniques for live entangled large whales.

7.1.3 Estimation of cetacean mortality from ship strikes
7.1.3.1 RESULTS FROM STUDIES OF COLLISIONS BETWEEN WHALES AND VESSELS
SC/56/BC6 reported that 11% of 556 cetacean carcasses found ashore in the Canary Islands between 1991 and 2007 had been classified as fatalities from collisions with vessels. The authors noted that lethal ship strikes appear to have increased considerably in recent years. Sperm whales were the most frequently reported. Potential mitigation measures include the use of dedicated look-outs, changes in ferry routes and speed limitations within potentially high-risk areas. Dedicated look-outs and the introduction of an obligatory reporting system of vessel-whale collisions would assist in assessing collision rates.

In discussion, it was noted that rigorous necropsies and forensic methods using tissue samples (especially heart and lung) had been conducted where possible to determine whether the animals had been struck before or after death. However, such data were not available for many animals. Abundance and trend data are required to understand population level significance of ship strike mortality as well as to interpret changes in reported collision rates, and compare areas thought to have the highest collision risk with reported strandings/carcass locations.

SC/60/BC9 reported on ship collisions with Bryde's whales off northern New Zealand. Vessel traffic coincides with Bryde's whale habitat, especially around the main port of Auckland, in the Hauraki Gulf. Bryde's whale abundance in the Hauraki Gulf area is estimated to be between 46 and 159 individuals, some of which are found year-round. A review of stranding data for northern New Zealand, showed that between 1989 and 2007, about 34% of Bryde's whale carcasses (*n*=38) were confirmed or suspected to have died due to vessel strike injuries.

7.1.3.2 MODELLING COLLISION RISK
In SC/60/BC4, Geographic Information System (GIS) data were used to integrate coastal attributes, vessel and southern right whale distribution around the city of Puerto Madryn in Argentina. Coincidentally, the southern right whale population, the human population of the city of Puerto Madryn and vessel activity in the adjacent bay each had an average annual growth rate of 7%. Patterns of use of coastal waters by whales and vessels were analysed at different spatial scales. A number of scenarios for the bay were generated, based on vessel activity and abundance of whales in the bay, suggesting an increasing risk of collision events. The Committee **commends** this study, noting that this was a well studied population with good estimates of abundance and mortality; such information provides useful baseline data for interpreting any changes in collision risk related to increasing vessel traffic.

SC/60/BC3 estimated shipping density and vessel speed distributions using information received from VHF radio Automatic Identification Systems (AIS) during a survey for cetaceans in the eastern Mediterranean, to provide data on shipping density for modelling of risk index; AIS also provides information on vessel speeds.

In discussion, it was noted that although there are limitations to the use of AIS data (e.g. variability in reception range, problems with fine scale concentration of shipping density, not all vessels are required to transmit AIS signals), gathering such data during cetacean surveys has the advantage of using designed tracklines and allows cetacean and shipping density to be compared directly.

While AIS data can be obtained from archives from fixed aerials on shore, the range is limited and it is easy to collect and store data while at sea.

SC/60/BC8 examined indices of risk generated by comparing patterns of shipping and whale density using spatial models to predict areas of high ship strike risk for humpback, fin and killer whales in British Columbia, Canada. The analyses used data from a systematic line transect survey in 2004 and 2005, and additional data from summer 2006. Shipping information was provided by the Canadian Coast Guard. Risk indices were produced for each species to show the expected distribution of interactions between whales and ships, defined as the product of average whale density and shipping intensity (total number of ships transiting the grid cell during the year). Ship strike risk was expected to increase for humpback and fin whales due to increased ship traffic. The authors suggested that the analysis framework should also be useful for allocating resources efficiently for monitoring ship strike mortality in sparsely populated parts of the coastline.

In discussion it was suggested that the variability in species distribution in the three seasons of survey effort may not have fully captured the extent of known variability in distribution of fin and humpback whales; however, for killer whales the survey results were consistent with previous studies based on almost 30 years of observations. Likely high risk areas for humpback and fin whales were far from human population centres and thus carcass detection may be low. The highest risk for killer whales was identified to be those areas which are heavily utilised for whalewatching and so collision events are more likely to be detected.

This paper raised several general issues regarding modelling relative risk and the generation of species-specific indices of risk for a specific area. These include: incorporation of other variables (e.g. surface behaviours; seasonal changes in habitat use; age/reproductive state vulnerability; vessel type; and speed) which might increase vulnerability to collisions; comparison of year-round shipping data with seasonal whale data; use of a Generalised Linear Model (GLM) or similar approach. More detailed discussions can be found in Annex J. It was noted that converting indices of relative risk to estimates of absolute risk would require models that incorporated further data from reported incidents such as those being collected in the IWC global database (see Item 7.2.3).

7.1.4 Marine debris
SC/60/BC8 also presented a spatial modelling analysis of the distribution of floating marine debris in coastal waters of British Columbia, Canada and that of cetaceans. Debris was concentrated off southern Vancouver Island and off northern Queen Charlotte Islands; perhaps surprisingly concentrations were low off the city of Vancouver. Preliminary examination of the data revealed a stronger overlap of the distribution of debris with that of fin and humpback whales rather than killer whales.

The lack of obvious correlation between proximity to large urban areas and density of marine debris suggests that this analysis identifies areas of debris accumulation rather than sources of debris. Such analyses may also be useful for identifying priority areas to search for whale carcasses that have become entangled in marine debris. The Committee also discussed the incidence of plastic ingestion as a cause of mortality. Plastic bags have been frequently found in cetacean stomachs although most instances have involved small cetaceans. The Committee **agrees** that further consideration of estimation of mortality rates in large whales due to ingestion of marine debris would be valuable and encouraged the submission of papers for next year.

7.1.5 Mortality from acoustic sources
Yang *et al.* (2008) reported on 23 cetacean strandings along the coast of China, Taiwan in 2005; of 15 initially reported as live strandings, 3 were released. A total of 3 of 15 animals examined post-mortem were sufficiently fresh to allow detailed pathological examination; 2 were beaked whales that had severe injuries consistent with gas emboli. The cause of death could not be conclusively determined. There were some features in common with sonar-related cetacean strandings but a number of differences including the fact that the strandings occurred over a longer period and larger geographical range. The Committee **agrees** that there is a need for internationally coordinated research to address gaps in knowledge on the issue of sonar-related cetacean strandings including improving the ability to conduct necropsies as quickly as possible, standardising data collection on the animal's environment at the time of the death/stranding, and coordinating with military or other government agencies so that all factors related to the stranding are examined (see also Item 11.1).

7.1.6 Other sources
SC/60/E5 reports on an apparently unusual mortality event featuring strandings of a number of species in the British Isles over the first three months of 2008 (this paper was also discussed under Item 12.6). Most were dead when they stranded and many were in advanced stages of decay, making determination of the causal factors especially difficult. A modelling exercise of drift patterns prior to stranding is being conducted to try to determine the region(s) of origin of the bodies and thereby try to narrow down the factors involved. In addition to loud noises, factors potentially involved could include disease, acute prey changes and fisheries.

The Committee looked forward to results of further investigations of these strandings that might have implications for estimating human-induced mortality, such as use of oceanographic modelling to relate location of death to possible human causes and studies of pathology.

7.2 Data collection, collation and sharing
7.2.1 Collaboration with FAO
The Committee has been working on collaboration with the FAO on collation of relevant fisheries and bycatch data with the aim of identifying fisheries where further monitoring would be valuable. Entering data from all bycatches reported to IWC since 1980 continued intersessionally. Further discussions with the FAO to determine how the bycatch data can be related to their fisheries database are planned once the data entry is complete. There is a need for an agreed data format before a Memorandum of Understanding with the FAO FIRMS (Fishery Resource Monitoring Scheme) can be completed. Work on this will continue intersessionally.

7.2.2 Collaboration with ACCOBAMS on ship strikes
The ACCOBAMS Scientific Committee has established a steering committee (Panigada, Donovan and Hammond)

and larger working group to carry out the recommendations of two inter-related Workshops held in 2005 on the status and threats to fin whales and on ship strikes of all species in the ACCOBAMS area (SC/60/BC7). An early focus will be to liaise with riparian nations and others to obtain information on cetaceans and vessel traffic that may enable the identification of potential high risk areas for ship strikes. Cooperation with the IWC vessel strike data standardisation group and use of the same database will continue. Work is also underway to develop a form to be distributed to shipping companies, relevant bodies and researchers to gather information on ship strikes throughout the Mediterranean Basin.

The Committee **encourages** continued collaboration between the IWC and ACCOBAMS, especially on compiling and storing data compatible with the IWC database.

7.2.3 Progress on developing a global IWC database of ship strikes

The need for a global database of incidents involving collisions between vessels and whales has been recognised by the Committee as well as other bodies such as the International Maritime Organization (IMO) and ACCOBAMS. A database design was agreed by the Committee in 2007 and has also been approved by ACCOBAMS for their work. To date, 763 records, mainly from published sources, have been entered in the database. SC/60/BC5 identified some problems encountered during data entry, particularly validation of data sources and assessing the uncertainty surrounding source data. This process is greatly facilitated by papers to the Scientific Committee which review data on a regional basis such as two examples discussed this year (SC/60/BC6 and BC9). Suggested improvements to the database, including converting some descriptive fields to categorical fields for easier quantitative analysis, were identified.

The Committee noted that further development and ongoing maintenance of the database required some one-off tasks but also ongoing work to enter new reports. The Committee **recommends** the work plan outlined in Annex J involving the Secretariat and a ship strike review group (Q22). This is discussed further under Item 22. It was stressed that the ship strike review group should pay particular attention to further development and implementation of data quality standards for validating and assessing uncertainty with original source data, and metadata standards for importing information into the database.

7.3 Other issues

7.3.1 Bycatch in longline fisheries

SC/60/O9 described studies of depredation by killer whales and sperm whales in long-line fisheries for Patagonian toothfish in the Southern Ocean and found few instances of fatal cetacean entanglements. The authors noted that modifications to reduce depredation involving the use of net sleeves are likely to be introduced in long-line fishing from the 2007/08 season. Successful mitigation measures to reduce depredation should result in further reduction in entanglement risk by removing the incentive for whales to approach long-line gear.

7.3.2 Progress towards a second Workshop on estimating bycatch through genetic market sampling

The Committee held an initial Workshop on the use of market sampling to estimate bycatch of large whales in 2005 (IWC, 2006b). Subsequently the Committee agreed that the planned follow-up Workshop would be valuable, provided several identified tasks had been completed. Related to these tasks, the Committee had considered information on spatial distribution of bycaught whales in 2006. Results from simulation trials had also been presented at previous meeting and the Committee had concluded that a mark-recapture method gave consistent but negatively biased estimates of the number of whales entering the market and that current understanding of markets was adequate for application of such methods.

A quantity of minke whale meat was reported to have been confiscated by the authorities in the Republic of Korea in January 2008; the matter is still under investigation but is relevant to previous market survey data analyses that suggested higher numbers of minke whales than reported entering the market (Baker *et al.*, 2007b); true numbers of bycaught animals are required for RMP *Implementation*. An noted that up until now fishermen and whale meat sellers submitted DNA samples of bycaught animals voluntarily in the Republic of Korea and the DNA sequences have been archived. However, as the DNA data are being used for forensic purposes during the present investigation, it is suspected that fishermen and whale meat sellers will no longer submit samples. Given this, the authorities are preparing regulations and protocols for collecting tissue samples of bycaught animals to register DNA sequences and monitor pollutants.

Issues considered by the Committee related to using market sampling to estimate the number of whales entering the market are relevant to a much wider body of scientists involved in monitoring wildlife and fishery trades, including the trade in bush meat and non-cetacean bycatch in several countries. Synergies in interest exist between the Committee and these other situations with potentially similar issues and solutions. The Committee **reaffirms** that once identified tasks have been completed, the proposed follow-up Workshop would be valuable. Consideration should be given to a possible joint Workshop with other disciplines/organisations facing similar issues.

7.4 Work plan

Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

8. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE (AWMP)

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995). The report of the SWG on the development of an 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) general considerations on the provision of interim *ad hoc* advice;

(2) all aspects of the management of Greenlandic fisheries;

(3) review of management advice for the humpback whale fishery of St. Vincent and The Grenadines; and

(4) 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 held in Copenhagen (SC/60/Rep2).

8.1 General consideration of the provision of *ad hoc* advice

Last year, the Committee had drawn attention to the general difficulty regarding the provision of *ad hoc* interim advice on catch limits and, in particular, its view that it was inappropriate to provide such advice for long time periods (IWC, 2008d). This is a problem that has often faced the Committee in the past. An approach to examining this had been presented by Witting at the intersessional workshop (SC/60/Rep2) which welcomed this work and made several recommendations for improvements.

SC/60/AWMP2 provided an extended and updated version of Witting (2008). It evaluated simple methods for providing *ad hoc* interim management on strike limits using trial simulations for fin whales and humpback whales off West Greenland, and bowhead whales off West Greenland and Eastern Canada to assess the safety of *ad hoc* interim management advice.

Whilst recognising that the analyses were not sufficient (nor designed) to allow decisions to be made regarding *Strike Limit Algorithm*s (*SLA*s) for use over a long period (this will require more careful consideration of scenarios and uncertainties), the SWG had agreed that the approach provided an excellent basis to move forward to evaluate methods for providing *ad hoc* interim advice. It tested a wide range of scenarios that represented a major challenge for any methods for providing *ad hoc* advice (see Table 3).

Recognising the need for Secretariat validation of software/analyses on which management advice will be based, the calculations were made using Secretariat-validated software based on the control program used to evaluate the *Gray Whale SLA*. Technical details can be found in Annex E.

It was agreed to examine three candidate methods, all of which were of the form:

$$C_t = \min(Q_t, r\, N_{\text{last},t} e^{-z CV_{\text{last},t}})$$

where C_t is the number of strikes for year t, Q_t is the need for year t, $N_{\text{last},t}$ is the most recent estimate of abundance in year t, $CV_{\text{last},t}$ is the CV of $N_{\text{last},t}$, and r and z are control parameters.

The three options were:

Option A: the catch limit is 1% of the lower 5th percentile of the most recent estimate of abundance (r=0.01; z=1.645);

Option B: the catch limit is 2% of the lower 2.5^{th} percentile of the most recent estimate of abundance (r=0.02, z=1.96); and

Option C: the catch limit is 2% of the lower 5th percentile of the most recent estimate of abundance (r=0.02; z=1.645).

The options were evaluated on the basis of examining three conservation-related statistics and one need-related statistic (the details of each are given in Annex E, Appendix 2). Priority was given to conservation performance over a 100-year period in the following manner:

(1) assess the conservation performance of each option for each plausible trial as adequate if either the lower 5th percentile of the final depletion exceeds 0.6 (the conventional MSY level) or a value for the lower 5th percentile for relative recovery statistic is larger than 1 if the lower 5th percentile for the final depletion is less than 0.6; and

(2) rank the options which perform adequately in terms of conservation in terms of their need satisfaction (particularly over the first 20 years).

In examining the results for fin, humpback and bowhead whales, option C (2% of the lower 5th percentile of the most recent estimate of abundance) performed best (Annex E, Appendix 2).

In conclusion, the Committee is pleased to have developed a safe method to provide interim management advice for the three fisheries concerned and it thanked Witting, in particular, for his work in this regard. It **agrees** that option C can be used to provide advice on catch limits for **up to two quota blocks** i.e. 10 years, by which time a full *SLA* approach should have been developed. It also **agrees** that no changes will be made to the approach used to provide interim management advice unless a change is proposed to the need requirement, when re-evaluation would be required.

The Committee **reaffirms** its view that long-term management advice should be based on an agreed AWMP *SLA*.

Management advice based on option C is discussed under Items 9.4, 9.5 and 9.6.

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

Progress towards developing an *SLA* requires the selection of a set of operating models (models that capture the situation being managed, which also characterise uncertainty), and finalisation of the sex ratio assessment discussed under Item 9.3.2 will provide an important basis for this selection. The Committee noted that 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 (see Annex E, item 3.5), the SWG had made the technical recommendation that the trials for common minke whales off West Greenland be coded so that the *SLA*s are standalone programs; this will assist in the development process. The Committee **concurs** with this recommendation.

The Committee also **reaffirms** its view on the importance of making progress with the development of an appropriate *SLA* for West Greenland fin whales. It recognises that the work on the sex ratio method for West Greenland common minke whales has been given high priority in the last year, but **agrees** that the work on developing a fin whale *SLA* should be also accorded high priority and be considered at the intersessional Workshop (see Item 19).

Table 3

A summary of the trial used to evaluate measures to provide interim advice for fin, humpback and bowhead whales off West Greenland. Key: N_{2008} or N_{2002} – fixed number of animals assumed in either 2008 or 2002; d – fixed level of assumed depletion; MSYR/MSYL – fixed values for maximum sustainable yield rate and level, respectively; need – assumed level of need.

Fin and humpback whale trials

Trial	N_{2008}	d	MSYR	MSYL	Need	Trial	N_{2008}	d	MSYR	MSYL	Need
F01	2,900	0.2	2%	60%	20	H01	2,500	0.2	4%	60%	10
F02	2,900	0.5	2%	60%	20	H02	2,500	0.5	4%	60%	10
F03	2,900	0.8	2%	60%	20	H03	2,500	0.8	4%	60%	10
F04	2,900	0.2	1%	60%	20	H04	2,500	0.2	2%	60%	10
F05	2,900	0.5	1%	60%	20	H05	2,500	0.5	2%	60%	10
F06	2,900	0.8	1%	60%	20	H06	2,500	0.8	2%	60%	10
F07	1,900	0.2	2%	60%	20	H07	1,300	0.2	4%	60%	10
F08	1,900	0.5	2%	60%	20	H08	1,300	0.5	4%	60%	10
F09	1,900	0.8	2%	60%	20	H09	1,300	0.8	4%	60%	10
F10	1,900	0.2	1%	60%	20	H10	1,300	0.2	2%	60%	10
F11	1,900	0.5	1%	60%	20	H11	1,300	0.5	2%	60%	10
F12	1,900	0.8	1%	60%	20	H12	1,300	0.8	2%	60%	10
F13	800	0.2	2%	60%	20	H13	600	0.2	4%	60%	10
F14	800	0.5	2%	60%	20	H14	600	0.5	4%	60%	10
F15	800	0.8	2%	60%	20	H15	600	0.8	4%	60%	10
F16	800	0.2	1%	60%	20	H16	600	0.2	2%	60%	10
F17	800	0.5	1%	60%	20	H17	600	0.5	2%	60%	10
F18	800	0.8	1%	60%	20	H18	600	0.8	2%	60%	10
F22	2,900	0.5	2%	50%	20	H22	2,500	0.5	4%	50%	10
F23	2,900	0.5	2%	80%	20	H23	2,500	0.5	4%	80%	10
F24	1,900	0.5	2%	80%	20	H24	1,300	0.5	4%	80%	10
F25	2,900	0.5	2%	60%	40	H25	2,500	0.5	4%	60%	20
F26	1,900	0.5	2%	60%	40	H26	1,300	0.5	4%	60%	20

Bowhead whale trials

Trial	N_{2002}	d	MSYR	MSYL	Need	Trial	N_{2002}	d	MSYR	MSYL	Need
A01	6,000	0.1	2%	60%	5	A01-H	6,000	0.1	2%	60%	10
A02	6,000	0.3	2%	60%	5	A02-H	6,000	0.3	2%	60%	10
A03	6,000	0.5	2%	60%	5	A03-H	6,000	0.5	2%	60%	10
A04	6,000	0.1	1%	60%	5	A04-H	6,000	0.1	1%	60%	10
A05	6,000	0.3	1%	60%	5	A05-H	6,000	0.3	1%	60%	10
A06	6,000	0.5	1%	60%	5	A06-H	6,000	0.5	1%	60%	10
A07	3,000	0.1	2%	60%	5	A07-H	3,000	0.1	2%	60%	10
A08	3,000	0.3	2%	60%	5	A08-H	3,000	0.3	2%	60%	10
A09	3,000	0.5	2%	60%	5	A09-H	3,000	0.5	2%	60%	10
A10	3,000	0.1	1%	60%	5	A10-H	3,000	0.1	1%	60%	10
A11	3,000	0.3	1%	60%	5	A11-H	3,000	0.3	1%	60%	10
A12	3,000	0.5	1%	60%	5	A12-H	3,000	0.5	1%	60%	10
A13	1,500	0.1	2%	60%	5	A13-H	1,500	0.1	2%	60%	10
A14	1,500	0.3	2%	60%	5	A14-H	1,500	0.3	2%	60%	10
A15	1,500	0.5	2%	60%	5	A15-H	1,500	0.5	2%	60%	10
A16	1,500	0.1	1%	60%	5	A16-H	1,500	0.1	1%	60%	10
A17	1,500	0.3	1%	60%	5	A17-H	1,500	0.3	1%	60%	10
A18	1,500	0.5	1%	60%	5	A18-H	1,500	0.5	1%	60%	10
A22	6,000	0.3	2%	50%	5	A22-H	6,000	0.3	2%	50%	10
A23	6,000	0.3	2%	80%	5	A23-H	6,000	0.3	2%	80%	10
A24	3,000	0.3	2%	80%	5	A24-H	3,000	0.3	2%	80%	10

8.3 Issues arising out of the bowhead whale *Implementation Review*

The SWG did not have time to consider this fully at the present meeting. The Committee noted that those matters identified last year (IWC, 2008d) related to the Data Availability Agreement (DAA) were being considered by the data availability group whilst those related to genetic data were being addressed by the Working Group on Stock Definition (see Annex I).

Donovan and Craig agreed to prepare a full paper on this issue for next year, and members with suggestions for items to include in the review are requested to contact them directly.

9. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT ADVICE (SEE ANNEX F)

9.1 Bering-Chukchi-Beaufort Seas (B-C-B) stock of bowhead whales

9.1.1 New scientific information

SC/60/BRG24 provided information on a computer-assisted matching program that has been developed to assist with matching of bowhead whale images, and SC/60/BRG18 provided a preliminary abundance estimate for the B-C-B stock of bowhead whales based on aerial photographs obtained near Barrow, Alaska, during spring 2003 and 2004. These surveys were conducted *inter alia* to obtain an abundance estimate that could be compared to the

ice-based estimate from 2001. The impetus for investigating photographic mark-recapture estimates was concern that unstable ice conditions resulting from warming trends in the Arctic might make future ice-based censuses difficult. The 2003-04 abundance estimate was some 11,800 (95% CI=6,800-20,600), very similar to the forward projected ice-based estimate for 2004 of 11,600.

The Committee **endorses** the general approach of using photo-identification data to obtain abundance estimates and it looked forward to receiving the final, and perhaps extended analyses next year. The Committee **agrees** that the implications (if any) of moving from the ice-based census to a mark-recapture approach should be considered by the SWG on the AWMP in the context of use of the *Bowhead Whale SLA*.

9.1.2 Review of recent catch information
SC/60/BRG10 summarised the data from the 2007 Alaskan hunt. A total of 63 bowhead whales were struck resulting in 41 animals landed (17 were males and 24 were females, including an autumn calf), almost identical to the 10-year average of 41.1 (SD=7.5). The efficiency (no. landed/no. struck) of the hunt was 65%, lower than the 10-year average (mean=79%, SD=7%) for a number of environmental and logistical reasons. Of the four mature females examined closely, three (75%) were found to be pregnant. The Alaskan Eskimo Whaling Commission determined that hunters mistakenly harvested the 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. The Committee **agrees** that from the perspective of the *Bowhead Whale SLA*, there is no additional conservation concern over the taking of a calf.

SC/60/BRG37 reported that no bowhead whales were taken by Russian hunters, primarily because the animals migrated farther off the coast than usual.

9.1.3 Management advice
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 and will not harm the stock.

9.2 Eastern North Pacific stock of gray whales
9.2.1 New scientific information
SC/60/BRG6 presented an estimate of abundance of eastern gray whales from the 2006-07 southbound migrating shore counts carried out in central California; the resultant estimate was 20,110 (SE=1,766). Fitting an exponential growth model to the available 1967-2007 time series yields a growth rate of 1.5% (SE=0.32%) although the authors note that a logistic model provides a better fit to the data than an exponential growth model. The estimate of carrying capacity was 22,326 (SE=1,788). The Committee **agrees** that this abundance estimate is acceptable for use in assessments.

SC/60/BRG30 presented counts of gray whales in Laguna San Ignacio based on boat surveys during several periods: 1978-82, 1996-2000, 2003 and 2005, 2006-08. Counts were greatest during the baseline period of 1978-82. Overall counts in 2008 were the lowest recorded in Laguna San Ignacio during winter.

SC/60/BRG38 proposed that a 'stinky whale' be defined as 'a whale that has a strong, unnatural, pungent odour that makes the whale inedible'. Results of the analysis of tissue samples from two stinky gray whales and one edible control whale collected in 2007 were presented.

The Committee discussed whether an appropriate definition for such whales can be found. Although a scientific definition cannot be developed now, the Committee recognised that the 'stinky' condition is a real phenomenon characterised by a distinct odour not found in the majority of whales. This odour may be detectable from landed whales or sometimes from the whale's blow. The reason for this condition is unknown, but research into it is ongoing.

9.2.2 Preparation for Implementation Review in 2009
The Committee noted that the purpose of an *Implementation Review* for this stock of gray whales is not to undertake an in-depth assessment of this stock, but rather to examine whether there is any information to suggest that the parameter space used to evaluate the *Gray Whale SLA* was inadequate. Primary responsibility for determining this is given to the SWG on the AWMP who will evaluate information provided to it (e.g. with respect to abundance, stock structure, biological parameters) by the sub-committee on bowhead, right and gray whales in that context, as was the case for the recent bowhead whale *Implementation Review* (IWC, 2008d).

Information on new data and analyses likely to be presented next year is summarised in Annex F. This will include estimates of past and present abundance, calf counts on migration and in the winter areas, estimates of calving intervals, information on strandings, ship strikes and entanglements, a revision of the catch history, information on feeding range in relation to regime shifts and an update of the population dynamics modelling framework.

Depending on the results of these analyses, there may be a need for additional simulation trials. All data to be considered during the gray whale *Implementation Review* need to satisfy the Data Availability Agreement (DAA). The requisite deadlines are:

Datasets/type of paper	Time before	Deadline
Final datasets available	6 months	30 November 2008
Papers using 'novel methods'	3 months	28 February 2009
Papers using 'standard methods'	2 months	30 March 2009
Papers responding to those above	1 month	30 April 2009

The Committee was informed by the Russian Federation that it was considering a proposal to the Commission that would involve consideration of struck-and-lost whales and 'stinky whales' when addressing need (Annex E, Appendix 4). It was noted that the *SLA* approach evaluates conservation performance and is used to provide management advice solely in terms of strike limits. Furthermore, *SLA* performance evaluation and application is limited to a particular range of need levels referred to as a need envelope. It is a Commission matter to address need requirements. Should the Commission request advice on a specific level of need, the first step is for the Committee to examine whether this fits within the need envelope used to evaluate the *Gray Whale SLA*. If this is the case, further trials and evaluation are not required. The Committee noted that the proposal provided by the Russian Federation for

taking into account struck-and-lost whales and 'stinky whales' was within the tested parameter space for the *Gray Whale SLA*. It also drew to the Commission's attention that it cannot evaluate the risk of a catch limit established solely in terms of landed whales, since a limit on strikes is required to control total mortality.

The Committee discussed the best process for conducting the 2009 gray whale *Implementation Review*. It **agrees** that this can be accomplished during the 2009 Annual Meeting if there is no need to change the hypotheses, need envelope or range of parameter values used in trials, but that a pre-meeting or intersessional meeting might be required if new trials need to be specified and run. The best manner in which to conduct the *Implementation Review* will be apparent at the latest by the time that papers need to be submitted under the DAA i.e. 28 February 2009 and the Committee will be informed immediately.

9.2.3 Review of recent catch information
SC/60/BRG37 summarised data on the 126 gray whales landed and utilised by aboriginal hunters of Chukotka, Russia in 2007. A total of 48 gray whale males and 78 females were taken in 2007; in addition 3 were killed but lost and 2 were 'stinky' (inedible). The length of the whales taken varied between 8.0 and 13.5m (average 9.6m). Body weights ranged from 6.0 to 26.3 tons (average 10.05 tons); the largest female taken was 13.5m and 26.3 tons. In response to a question regarding hunter selectivity for females, it was reported that there are more females and calves in the inshore hunting area; males are farther offshore. Hunters do not take females with calves; only single whales are harvested.

9.2.4 Management advice
The Committee **reaffirms** its advice from last year that the *Gray Whale SLA* remains the most appropriate tool for providing management advice for this harvest. Use of this confirmed that the current limits are acceptable and will not harm the stock. An *Implementation Review* is scheduled for 2009 as discussed under Item 9.2.2.

9.3 Common minke whale stocks off Greenland (AWMP)
9.3.1 New information
A total of 161 common minke whales was landed in West Greenland (121 females; 38 males; 2 unidentified sex) and 6 were struck and lost during 2007 (SC/60/ProgRep Denmark). Genetic sampling continued from the catch and 108 genetic samples were taken. No new genetic analyses were presented at this year's meeting.

Two common minke whales were caught off East Greenland in 2007 (1 female; 1 unidentified sex) and there were none struck and lost (SC/60/ProgRep Denmark). A genetic sample was taken from one of these whales. Relevant new information on the Central stock of common minke whales was considered under the *Implementation Review* of common minke whales in the North Atlantic discussed in Annex D, Appendix 7.

9.3.2 Sex ratio based assessment of common minke whales off West Greenland
Since 2006, the SWG has focussed on developing 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 different levels of carrying capacity and productivity. In particular, the broad lack of change in the catch sex ratio, despite the consistently high catch of females, implies that catches off West Greenland have not markedly affected population size. However, this inference is based on the assumption that, for example, there is no confounding of the trend over time in sex ratio and other factors.

Since last year's meeting, considerable progress has been made at the intersessional Workshop (hereafter called 'the Workshop'; SC/60/Rep2) and that progress has been maintained in the work of the SWG this year. Attention has focused on two areas: understanding the sex ratio data themselves and examining any potential confounding factors that might preclude their use in assessments; and the development of the assessment methods themselves.

The Workshop was pleased to receive a paper (Laidre *et al.*, 2008) which extended analyses presented to the 2007 Annual Meeting (Simon *et al.*, 2007) in response to recommendations from the Committee. These analyses guided the Workshop in relation to the work that was needed to complete the assessment. The Committee **concurs** with the Workshop's recommendation that assessments should be based on the three regions (NW, CW, SW) originally suggested by Kapel (1980) and used in Laidre *et al.* (2008). The data and analyses were also important in determining appropriate models to consider. Of the six models originally proposed, the Workshop agreed that three (3, 4b and 5 – see Fig. 3) were worthy of further consideration although not all were considered of equal plausibility and some Workshop participants considered model 5 implausible, *inter alia* given the level of site fidelity required and the manner in which it was modelled. A full account of the rationale for the models and the discussions surrounding them is given in SC/60/Rep2 (pp.5-7). Following past practice that only hypotheses for which there was consensus that they should be eliminated from consideration would be removed, model 5 was retained for further consideration at this year's meeting.

At the present meeting, SC/60/AWMP8 provided an update of Laidre *et al.* (2008). It examined the patterns in the sex ratio of common minke whale catches over time, season, space, and relative to sea temperature in West Greenland based on 2,400 records from inshore Greenlandic subsistence whaling operations (1960-2006) and 2,072 records from offshore Norwegian commercial operations (1968-85).

The Committee thanked the authors for this paper which represented the accumulation of a considerable body of work over three years. As at the Workshop, there was considerable discussion of the paper and in particular the inferences drawn with respect to the finding that the significant decline in the female sex ratio in the SW region was removed if the data for 2001-06 were excluded (a period when there was a significant increase in water temperature due to the Irminger Current). There will be further work undertaken in relation to this (see Table 4). In discussion, the authors of SC/60/AWMP8 suggested two possible (not mutually exclusive) explanations for the statistically significant reduction in the proportion of females in the SW: (1) movement of females to the north

Model	3	4b	5	
NW + CW / SW	υ / υ	υ_1 / υ_2	υ_1 / υ_2	**Model 3.** West Greenland is divided into two strata (NW+CW and SW), the data for NW+CW and SW strata are included separately in the likelihood function, and separate (and time-invariant) values for the parameters determining the degree of sex imbalance are estimated for each stratum. Allowance is made for time-dependent exchange of females and males between the NW+CW and SW strata. **Model 4b.** As for model 3, except that there is no time-dependent exchange; rather the fraction of males in the SW stratum is assumed to be change over time (or as a function of temperature). **Model 5.** The animals in the NW+CW and SW strata exhibit site-fidelity. For computational simplicity, this model is implemented by treating the animals in the NW+CW and SW strata as separate populations.
Likelihood				
Data used	NW+CW, SW	NW+CW, SW	NW+CW, SW	
Estimable parameters	υ; α^m, α^f, β^m, β^f	$\upsilon_1, \upsilon_2(t)$	υ_1 (popn 1) υ_2 (popn 2)	υ determines the degree of sex imbalance α, β determines how υ changes over time

Fig. 3. Schematic representation of the three models being considered for common minke whales off west Greenland.

(although the increase in proportion of females in the central and northern regions is not significant); and (2) movement of males from southeast Greenland to southwest Greenland.

SC/60/AWMP5 examined fluctuations in relative abundance of minke whales off West Greenland based on the results of a time series of aerial surveys of large cetaceans conducted at regular intervals since 1984. The indices of relative abundance the authors derived revealed large variation. They suggested that this meant that there is not a consistent fraction of minke whales from the North Atlantic that use the West Greenland banks as a summer feeding ground and that it is unlikely that there is pronounced site fidelity. After some discussion, the Committee **agrees** that although there is considerable variation in the indices from one year to the next, the coefficients of variation of the indices are also very large and thus the power of the data to reject hypotheses related to site fidelity off southwest Greenland and/or whether there is an influx of males into this area is low.

Moving on to the assessment methods themselves, the Workshop proved extremely valuable in developing the framework for developing an estimate of the lower bound of the status of common minke whales from time series of sex ratio data; this is not a trivial matter from a statistical viewpoint. The technical details of the discussions can be found on pp.4-5 of SC/60/Rep2 and they formed the basis for the two assessment method papers presented at this year's meeting, described in SC/60/AWMP1 and in SC/60/AWMP9. Although the approaches were quite similar (e.g. same population dynamics model, same basic data), there were differences between them particularly with respect to model fitting and the way simulated data are generated. These differences are valuable in ultimately providing a robustness test to the use of sex ratio data.

The Committee **agrees** that **considerable progress** had been made towards identifying a method for providing management advice for common minke whales off West Greenland, and that the methods in SC/60/AWMP1 and SC/60/AWMP9 provided the first scientifically justifiable way to overcome the Committee's past inability to provide management advice based on a population model. However, the numerical issues (e.g. with respect to convergence) identified in SC/60/AWMP9 and examined further in Annex E, Appendix 2 meant that the Committee was unable to be fully confident that the results were sufficiently robust to form the basis for management advice at this meeting. The SWG therefore focussed on the additional work and process needed to complete a population model-based assessment of common minke whales off West Greenland. The list of topics is given in Table 4.

The SWG had agreed that the best way to maintain effective progress on this high priority work is through intersessional meetings. Specifically, the SWG recommended that two meetings take place:

(1) a technical meeting between the authors of SC/60/ AWMP1 and SC/60/AWMP9 later in 2008; and
(2) a full AWMP intersessional Workshop in spring 2009.

The purpose of the first meeting is to standardise methods and solve technical issues, while the purpose of the second meeting is to review the results of the work in relation to the work plan to ensure that the SWG and thus the Committee will be in a position to make management recommendations at the

Table 4

Intersessional work needed to finalise work on an assessment method for common minke whales.

(a) High priority topics (in approximate temporal order)
(1) Conduct additional checks to ensure that the two approaches are based on exactly the same age- and sex-structured population dynamics models.
(2) Model 3 appears to be over-parameterised and this may be a partial explanation for the convergence problems noted in SC/60/AWMP9. An exploration of the data and alternative models should be undertaken to identify a more parsimonious parameterisation.
(3) Construct profile likelihoods for each of the parameters of the model in turn for specific choices of K to further examine the behaviour of the estimation framework.
(4) Examine methods to deal with the technical issues related to convergence (SC/60/AWMP9 and Appendix 2). Results exploring these technical issues should focus on cases shown in SC/60/AWMP1 and SC/60/AWMP9 to lead to the greatest number of convergence problems.
(5) Review the approaches for handling the additional variation and examine the reasons for the differences in results for two approaches identified at the Intersessional AWMP Workshop (see SC/60/Rep2 item 2.2).
(6) Examine whether the extent of variation in the sex ratio of the catch is captured reliably and, if not, modify the approach used to generate the pseudo data sets and ensure that this is the case.
(7) Conduct a sensitivity test that involves ignoring, in turn, the early Greenlandic data for each stratum; these sensitivity tests will allow the impact of the apparent residual patterns to be examined.
(8) The computer programs used to implement methods should be validated by the Secretariat (although two groups independently implementing essentially the same set of specifications should enhance the confidence that the SWG has that the methods are correctly implemented).

(b) Optional topics
(1) Explore the use of a beta-binomial likelihood function in SC/60/AWMP9 (noting that the slight methodological differences between the approaches in SC/60/AWMP1 and SC/60/AWMP9 would assist the SWG to examine the robustness of conclusions).
(2) Conduct, as a minimum, sensitivity tests in which the abundance estimates are treated as indices of relative abundance (the sensitivity to using abundance data in a sex-ratio-based assessment has been explored in the past (Witting and Schweder, 2007) but at that time there was no time-series of abundance estimates, and the sensitivity was not based on current statistical estimation framework).
(3) Conduct a sensitivity test in which fraction female in model 4b relates to temperature rather than year (see Annex E, Appendix 4).
(4) Explore methods of speeding up the computational aspects of conducting the analyses.

2009 Annual Meeting. A Steering Group was established under Donovan (Q1) to guide this process.

Notwithstanding the differences of view over model 5, the SWG had agreed that all final model runs would be based on the age- and-sex structured population model, and that the two groups of developers (Witting-Schweder; Butterworth-Brandão) would (at a minimum) present results for models 3 and 4b with a $MSYR_{1+}$ fixed at 1% and 2%, and for model 5 with $MSYR_{1+}$ fixed at 2%. The SWG had also agreed that the final set of model runs would be specified (and if possible run) during the planned Intersessional AWMP Workshop. The Committee **concurs** with this process.

9.3.3 Management advice
9.3.3.1 WEST GREENLAND
In 2007, the Commission agreed to a quota of 200 minke whales struck annually off West Greenland in part based on the range 170-230 advised by the Committee. The Committee again **stresses** that it has made great progress towards being able to provide firm management advice for this stock. In particular, there is an accepted abundance estimate from the 2005 aerial survey of 10,800 (95% CI=3,600-32,400). In addition, considerable progress was made at both the intersessional workshop (SC/60/Rep2) and the present meeting on developing an assessment method incorporating the available sex ratio data. With a further intersessional workshop, it should be possible to finalise work on the applicability of sex ratio data to provide management advice at the 2009 Annual Meeting. Should this work prove successful, it would also represent an important step forward towards the development of a full *SLA* approach for providing long-term advice.

In terms of advice this year, the 2005 abundance estimate is not statistically significantly different from the 1993 estimate accepted by the Committee, although the power to detect differences is low owing to low precision. Questions about stock structure remain. Although the survey estimate does not apply to the whole population, it is still not presently possible to determine by how much it is an underestimate. This issue will be addressed should the

proposed assessment method prove to be applicable next year. However, despite the great improvement in the situation compared to previous years, the Committee **remains concerned** that it is not in a position to give authoritative advice on safe catch limits this year. Given that, it **agrees** that it is not possible for it to give more than interim *ad hoc* advice for the forthcoming season, noting that it believed that there was a reasonable chance that it would be in a position to provide advice next year. It notes that last year it had recommended that any quota established by the Commission on the basis of the interim *ad hoc* advice below be limited to one year only.

Until the work on the sex-ratio methods is completed next year, the Committee is therefore in the same position as in the past two years. It **again stresses** that the Commission should exercise caution when setting catch limits for this stock. The Committee thus is not in a position to **recommend** a single number, but repeats its previous advice to the Commission: under the assumption that (1) $MSYR_{mat}$ is 3%; (2) that the true population has a sex ratio of 1:1; and (3) that the population is underestimated by factors between 2 and 2.7, the estimated annual replacement yield ranges from about 170 to 230 whales if the lower bound of the revised 2005 aerial survey estimate is used. The replacement yield is the catch level yielding no net increase in abundance.

It **re-emphasises** its view that safe long-term management of aboriginal whaling is best accomplished under an agreed AWMP *SLA*. It therefore **agrees** that development of an *SLA* for this fishery should begin as soon as practical (see Item 8.2).

9.3.3.2 EAST GREENLAND
In 2007, the Commission agreed to a quota of 12 minke whales struck annually from the stock off East Greenland for 2008-12, which the Committee stated was acceptable in 2007. The present catch limit represents a very small proportion of the Central Stock (see Table 5). The Committee **agrees** that the present catch limit will not harm the stock.

Table 5
Most recent abundance estimates for the central North Atlantic
(for details see Annex D, Appendix 7).

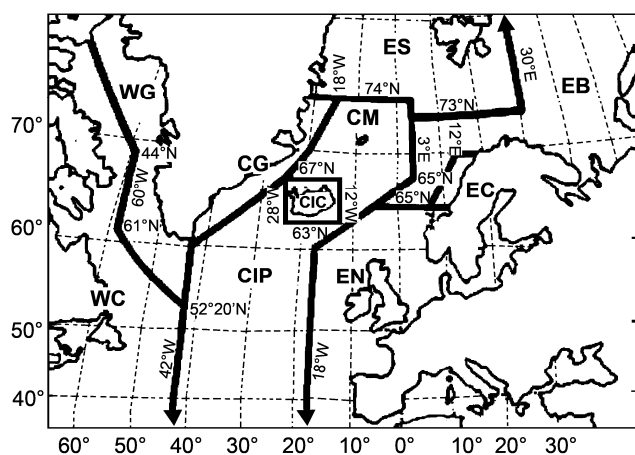| Small Area(s)	Year(s)	Abundance, CV and 95% CI
CM	2005	24,900 (CV=0.45); 10,700, 57,700
CIC	2007	10,700 (CV 0.29); 6,100, 18,700
CG, CIP	2001	23,600 (CV=0.26); 14,300, 39,000

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

9.4 Fin whales off West Greenland

9.4.1 New information

The Workshop had reviewed an estimate of abundance for fin whales off West Greenland based on an aerial line transect survey conducted in August-September 2007 (SC/60/Rep2). It had agreed that although the conventional distance sampling (CDS) estimate was based on fewer sightings (18 rather than 24) compared to the mark-recapture distance sampling (MRDS) estimate, some aspects of the results from the MRDS method were unexpected and hence that the CDS estimate was to be preferred. It agreed that the estimate of abundance of 4,656 (CV=0.46; 95% CI=1,890-11,470) was acceptable for use in assessments. The Committee **endorses** the use of this estimate for assessment purposes and the provision of management advice.

9.4.2 Updated assessment

Last year, the Committee accepted a Bayesian assessment of fin whales off West Greenland (IWC, 2008d). The intersessional workshop received an updated version of that assessment using the 2007 abundance estimate. It noted that the updated assessment would be useful not only for developing interim *ad hoc* management advice, but also for the development of a long-term *SLA* for fin whales off West Greenland.

SC/60/AWMP4 presented an updated assessment of fin whales off West Greenland incorporating the new 2007 abundance estimate. The author noted that compared to the previous assessment in 2007, the estimate of the current (exponential) rate of growth was higher (0.07; 90% CI=0.03-0.12) in the current assessment than in the 2007 assessment (0.03; 90% CI=-0.02-0.08). Consequently, the probability that the population will increase under an annual catch of 20 whales increased from 69% (2007 assessment) to 95% (current assessment) based on the exponential or inertia models.

The SWG had made a number of suggestions for incorporation into future assessments. The Committee **endorses** these and also **endorses** the assessment as being appropriate for formulating the basis for management advice and thanked the author for the updated analysis.

9.4.3 Management advice
9.4.3.1 SUMMARY OF PREVIOUS SEASON'S CATCH DATA
A total of 10 (4 females, 6 males) fin whales were landed, and 2 struck and lost, in West Greenland in 2007 (SC/60/ProgRepDenmark). Genetic samples were taken from five of these whales.

9.4.3.2 MANAGEMENT ADVICE
In 2007, the Commission agreed to a quota (for the next five years) of 19 fin whales struck annually off West Greenland based on the range 14-26 advised by the Committee last year.

This year, the Committee was pleased to have developed an **agreed** (option C) approach for determining interim management advice for this stock and the details are provided under Item 8.2 and Annex E (Appendix 2). Given this, the Committee **agrees** that the current strike limit will not harm the stock. The abundance estimate on which this calculation was based was the agreed estimate of 4,656 (CV=0.46).

9.5 Eastern Canada-West Greenland bowhead whales

9.5.1 Review of stock structure and abundance of eastern Canadian and West Greenland bowhead whales

SC/60/BRG20 examined historic and recent data on the distribution patterns and movements of bowhead whales in Baffin Bay and Hudson Bay and the authors identified several discrepancies with the two stock model currently accepted by the IWC. They concluded that a variety of evidence (including tagging (telemetry), evidence of segregation and a lack of sightings of calves in some areas) could best be explained by the hypothesis that bowhead whales summering in the eastern Canadian Arctic and wintering off West Greenland comprise a single Eastern Canada-Western Greenland population, segregated by age and sex.

SC/60/BRG19 examined sex segregation and site fidelity based on data obtained from biopsy samples of 333 bowhead whales collected between 1995 and 2007 at four localities in the Eastern Canadian Arctic and at one locality in West Greenland (Disko Bay). Females predominated in Disko Bay (81% female) whereas a more balanced sex ratio (~50% female) was found in the Eastern Canadian Arctic. Observations on length suggest that it is primarily large mature females without calves in Disko Bay and mother-calf pairs at Igloolik. The authors interpreted their results to suggest that the population size is large and that there is limited annual individual site fidelity to specific localities.

These papers elicited a broad discussion of a number of issues related to movements, segregation, feeding ecology and stock structure. Details can be found in Annex F.

Due to problems they identified during the meeting with their genetic data, Canadian scientists reported that during the coming year, following the recommendations in Annex I, they will develop a suitable dataset for genetic analysis. Thus, no genetic data regarding stock structure were presented this year. On the basis of the information available to it, the Committee **reconfirms** that a single

shared Canada-Greenland stock in the eastern Arctic should be considered the working hypothesis given that this is considered more plausible in the light of results from satellite tagging. However, it further **recommends** that a thorough discussion on stock structure, including revised analyses of genetic data, should occur at next year's meeting. The Committee also **encourages** continued tagging and a combined analysis of all satellite tracks.

Two papers were presented addressing recent abundance information: SC/60/BRG34 and SC/60/BRG21 revised. There was considerable discussion of the abundance estimates given in these papers (see Annex F, item 5.2.2.1) and the report of a working group established to identify or develop a suitable abundance estimate for use in the development of interim management advice for the West Greenland aboriginal harvest of bowhead whales is given as Annex F, Appendix 3. The Committee **agrees** that the abundance estimate of 6,344 (95% CI=3,119-12,906) for the single eastern Arctic bowhead whale stock is suitable for use in development of management advice for aboriginal harvest of bowhead whales off West Greenland. The estimate was expected to be negatively (conservatively) biased because of the strip transect approach adopted and because the survey effort covered only a portion of the population. Under the alternative but less plausible two-stock hypothesis, the Committee **agrees** that the conservative estimates of 6,344 (95% CI=3,119-12,906) and 1,525 (95% CI=333-6,990) were acceptable for the Baffin Bay-Davis Strait and Foxe Basin-Hudson Bay stocks, respectively.

9.5.2 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.

This year, the Committee was pleased to have developed an **agreed** (option C) approach for determining interim management advice for this stock and the details are provided under Item 8.2 and Annex E (Appendix 2). Given this, the Committee **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.

9.6 Humpback whales off West Greenland
Last year, the Committee had noted that the 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 (IWC, 2008d). It therefore had agreed that the West Greenland feeding aggregation was the appropriate management unit to consider when formulating management advice. Last year, the Committee was unable to respond to the request for management advice for humpback whales off West Greenland. In particular, it discussed, but did not endorse, the 2005 abundance estimate (IWC, 2008d, pp.130-31).

9.6.1 New information
New information on abundance, trends and an assessment method had been considered at the intersessional workshop (SC/60/Rep2). This has been incorporated as appropriate into the discussion below. In particular, the Workshop had received the report of the intersessional group established under Hammond to examine abundance estimates from aerial surveys and in particular the estimate for the 2005 aerial survey. It concurred with the intersessional group that the 2005 estimate of abundance (1,158 (CV=0.35)) was acceptable for use in assessments. The Committee **endorses** this estimate.

At the present meeting, SC/60/AWMP7 reviewed the results of the aerial line transect surveys that have been conducted off West Greenland eight times between 1984 and 2007. For the most recent (2007) survey the authors provided two fully corrected (for availability and perception bias) abundance estimates that used slightly different methods to correct for perception bias but used the same method to correct for availability bias. The details of the approaches used are discussed in Annex E, item 6.2. In addition, the authors used the data from the surveys to generate an index of relative abundance from which they estimated the trend.

The Committee **agrees** that the fully corrected estimate for 2007 based on the simple Petersen estimator (3,039 (CV=0.45)) was acceptable for use in assessments. It noted that this estimate was similar to the estimate based on the mark-recapture distance sampling (MRDS) method (3,299 (CV=0.57)). The Committee also **agrees** that the approach used to calculate a rate of increase for humpback whales off West Greenland was appropriate; the resultant estimate was 0.0917^{yr-1} (SE=0.0124).

The comment was made that apparently few calves were reported from West Greenland given this rate of increase and the Greenlandic scientists agreed to examine the original field notes from the surveys to examine this.

9.6.2 Assessment methods
SC/60/AWMP3 presented a Bayesian assessment for humpback whales off West Greenland based on the new time series of survey abundance estimates, and the time series of mark-recapture estimates from the late 1980s and early 1990s (an earlier version had been presented to the intersessional Workshop). After some discussion (see Annex E, item 6.3), the Committee **concurs** with the view expressed at the intersessional Workshop i.e. that while modelling exercises such as that in SC/60/AWMP3 are interesting and provide some information on underlying population dynamics, it is more appropriate to focus future efforts on the approach discussed under Item 8.2 with respect to providing management advice.

9.6.3 Management advice
Last year, the Committee had been unable to provide management advice for the humpback whale aggregation off West Greenland. This year, the Committee was pleased to have developed an **agreed** (option C) approach for determining interim management advice for this feeding aggregation and the details are provided under Item 8.2 and Annex E (Appendix 2). Given this, the Committee **agrees** that strikes of up to 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
The Committee received no reports of catches of humpback whales off St. Vincent and The Grenadines occurred during 2008 and there was no new information on stock structure or on abundance and trends for this stock[6]. The Committee **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 Committee **agrees** that the North Atlantic Whale Archive maintained by Per Palsbøll at Stockholm University is 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 catch limit block will not harm the stock.

9.8 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

10. WHALE STOCKS

10.1 Antarctic minke whales (see Annex G)

10.1.1 Abundance estimates of Antarctic minke whales using SOWER data

10.1.1.1 ANALYSES OF PREVIOUS IDCR/SOWER CRUISES
SC/60/IA6 described results from visual sightings surveys (SCANS II, CODA and SOWER) where photogrammetric methods were used alongside reticle binoculars to compare estimated distances and angles with measured values. There was an indication that when using reticles, closer distances were over-estimated and further distances under-estimated. Bearing data showed around 5% of the estimates had gross errors attributed to mistakes; for the remaining values, root mean square errors were 6-7%. Although there are technological challenges and practical difficulties in operating complex electronic systems at sea, these methods can improve the data quality. The Committee **expresses** its appreciation for this work.

SC/60/IA7 summarised the two types of BT experiments (BT-NSP and BT-Option-2 – technical details explaining these are given in Annex G) that had been carried out on the 2005/06 and 2006/07 IWC/SOWER cruises. BT methods allow the probability of detection on the trackline, $g(0)$, to be estimated. Underlying theory requires that the 'trackers' search further ahead than the primary observer. There appeared to be considerable overlap of search regions in BT-NSP mode but less so in BT-Option 2. Using different models and combinations of data, $g(0)$ for the topmen in the barrel in BT-NSP mode ranged from 0.4 (CV=0.32) to 0.7 (CV=0.23); these estimates are directly comparable with existing SOWER/IDCR data. In BT-option 2 mode, $g(0)$ for the independent observer platform (IOP) ranged from 0.25 (CV=0.59) to 0.32 (CV=0.49); note that these estimates are not directly comparable with past SOWER/IDCR data because no binoculars are used by the IOP.

The Committee **agrees** that trialling these methods during the SOWER cruises had been valuable in helping to interpret estimates from existing IDCR/SOWER data and to developing methods for future surveys. The operational ease of BT-option 2 was noted, especially with regard to the assessment of duplicate status.

10.1.1.2 CP SERIES
To expedite the estimation of Antarctic minke whale abundance using the IWC/SOWER data, a Workshop was held in Seattle during February 2008 (SC/60/Rep4). Three new analytical methods are being developed for this analysis: the OK (Okamura and Kitakado) method using a hazard probability model; the IM (Integrated Model) method of Cooke using a hazard probability model and spatial model for density; and the BHWP (Bravington, Hedley, Wood and Peel) method using a spatial point independence model. A detailed comparison of these models was compiled and can be found in Annex G. The Workshop also examined recent SOWER experimental data, documented how variance and additional variance (i.e. year-to-year variability in true abundance from the same location) should be calculated, and defined a list of diagnostics to examine the fits of the models.

SC/60/IA8 described the OK method and applied it to obtain abundance estimates for Antarctic minke whales from the CPII and CPIII IDCR/SOWER survey data. The OK method is a type of hazard probability model, such as that developed for North Atlantic minke whales, which was extended to deal with school size error problems, semi-independent platforms, and measurement errors of distances and timings of recording. The estimate of $g(0)$ for minke whale schools was on average 0.47 for CPII, and 0.53 for CPIII. Using the 'survey-once' method, abundance in the survey areas were 1,048,801 for CPII and 722,923 for CPIII without the common northern boundaries (CNB), and 1,040,654 for CPII and 652,612 for CPIII using the CNB. The corresponding ratio of total abundances for CPII and CPIII was 1.00 to 0.69 without the CNB and 1.00 to 0.63 with the CNB. Estimates in Areas I, II, and V showed a large difference. Areas II (Weddell Sea) and V (Ross Sea) can have large polynyas. Therefore, the authors believed that it is important to develop a method to estimate the proportion of minke whales residing in the pack ice.

SC/60/IA17 described the methods of the BHWP approach to minke whale abundance estimation, and presented some preliminary results for CPIII. The method includes separate spatial models for school size and school density, a model for school size error that is based partly on recent school-size experiment and NSP data, and a trackline-conditional-independence model for estimating $g(0)$. The estimates suggested strong variability in school size spatially (primarily with latitude, but also with longitude within some years) and often a correlation between high mean school size and high school density. The immediate priorities for development of this method are to carry out further checks, and to explore more parsimonious formulations of the sighting probability model.

There was also some discussion of whether it was necessary to adopt a model-based approach for density

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[6]After the close of the meeting, the Secretariat was informed by St. Vincent and The Grenadines that in 2008, one female was taken and one animal struck and lost.

estimation, because some transects had followed the ice edge and there is often a strong gradient in density with distance from ice. The Committee **agrees** that the sensitivity of all analysis methods to inclusion or exclusion of these transects should be investigated.

Of the three methods being developed, the OK method was the only method for which a full set of diagnostics was presented to the Committee (SC/60/IA9). In discussion of papers SC/60/IA8 and IA9, the Committee noted that, while some of the diagnostic plots suggested good fits between observed and predicted values in some aspects of the OK model, other diagnostic plots revealed lack of fit. Some aspects of the OK model formulation therefore appeared to have either insufficiently flexible or inappropriate functional form. Similar failures of fit were also seen in some diagnostic plots when applying the OK method to North Pacific common minke whale data (SC/60/NPM7). The Committee suggests that the present Cartesian form of the model (perpendicular and forward distances (x,y)) might be more canonically expressed in polar coordinates (radial distance and sighting angle (r,θ)). It also suggests that the functional forms used for North Atlantic minke whales (e.g. Cooke, 1997; 2001; Schweder *et al.*, 1997) could be applied to the IWC/SOWER data.

In terms of adjusting for underestimation of school size in Independent Observer (IO) mode compared to Closing mode, the OK method showed considerable agreement with school size experimental data from 2006/07, indicating that it has largely corrected for this particular source of potential bias. It was also noted that, although the OK method generally had low bias in estimated whale density from the simulated data (see Item 10.1.1.3), the low overall bias appears to result from cancellation between a positive bias in mean school size and a negative bias in school density, which needs further investigation. Moreover, in the analysis of real SOWER/IDCR data using the OK method, there was an unexpected degree of consistency in the stratum estimates of mean school size (ranging from about 1.4 to 2.0) and little obvious pattern in space or time, whereas the expectation based on experience from SOWER cruises and from results using the 'standard method' was that school sizes exhibited more systematic variability over space and time. The OK model also predicted a significant number of initial sightings of large schools close to the vessel; this runs counter to experience on IDCR/SOWER cruises, where large schools would usually be seen at relatively large distances from the vessel.

The Committee's previous experience in testing abundance estimation methods has been that the specification of diagnostics is an iterative process, and thus the set proposed at the intersessional Workshop may well need to be amended. Some suggestions for specific diagnostics may be found in Annex G, and these will be refined intersessionally by a Working Group under Palka (Q11).

The Committee **recognises** the value of the IO data collected during the SOWER/IDCR cruises, and **agrees** that the data make a great contribution to the ongoing work of the Scientific Committee. Collection of IO data requires considerable extra work on the cruises, but such data are essential for all the new methods that are attempting to reduce bias in the abundance estimates.

The Committee also **recognises** the hard work conducted by the developers, and in particular those responsible for the OK method. However, the Committee also **stresses** that caution should be used in interpreting the OK estimates in SC/60/IA8, given the unresolved issues with the diagnostics. The Committee notes that the overall progress towards an agreed set of abundance estimates is now well advanced; substantial progress had been made intersessionally, helped in no small part by the opportunity to discuss technical details of the three new methods at the intersessional Workshop. Progress towards agreed abundance estimates for Antarctic minke whales is hopefully near completion.

10.1.1.3 SIMULATED DATA

To test the robustness of new analysis methods, simulated data sets were produced which incorporate biases due to heterogeneity in factors related to the distribution, density and behaviour of minke whales, and to the manner in which the surveys were conducted. A new series of data sets incorporated measurement errors, mis-classification of duplicate status, and added complexity in the school density, group size, weather and detection function interaction.

Of the methods to be tested, only the OK and standard methods presented results for a full set of simulation trials. SC/60/IA10 presented a summary of results from applying a simplified version of the OK method to the simulated data. The authors considered that the OK model provides near-unbiased density under various uncertainties and heterogeneities, except for those scenarios with mis-identified duplicate sightings.

As expected, neither the OK nor standard method performed well when duplicate sightings were mis-identified. It is not possible to assess the frequency of mis-identified duplicates from the IDCR/SOWER data. Comparing results with 'Definite' duplicates and 'Definite+Possible' duplicates would provide a sensitivity test on the likely effects.

Currently, there are no specific suggestions for modifications or additions to the range of scenarios. It was considered that the conditioning of the simulations could be improved, alternative measures of robustness could be developed, and methods to investigate the interactions between potentially biasing factors could also be developed.

10.1.1.4 WORK PLAN

The Committee **recommends** the working group on analysis methods (Q11) to continue to work intersessionally by email to continue the development and examination of the new methods, and then to apply them to the IDCR/SOWER data to estimate Antarctic minke whale abundance for CPII and CPIII. The Committee **agrees** that the intersessional Workshop had been of great value with respect to making progress towards this aim last year, and **recommends** that a similar Workshop be held intersessionally to enable the Committee to reach agreement on the best available abundance estimates for Antarctic minke whales at next year's meeting. The Committee **recommends** that a steering group for the Workshop (Q13) make the final decision as to whether the Workshop should be held. In addition, Skaug, Okamura and Kitakado will work together to derive and compare alternative model formulations for the hazard probability models.

10.1.2 Review reasons for (possibly area specific) differences between Antarctic minke whale abundance estimates from CPII and CPIII

Shimada reported progress on work to investigate the relationships between Antarctic minke whale abundance estimates and sea ice. Sightings, effort, sea ice extent and sea ice concentration data sets had been prepared. The Committee **welcomes** the progress made and looked forward to receiving the results from analyses by 10° longitudinal slice, possibly using estimates from the new methods being developed.

SC/60/IA12 examined the relationship between sea ice concentration and Antarctic minke whale abundance, by Area in CPII and CPIII, where abundance was estimated using the OK method (SC/60/IA8). The authors hypothesised that, if abundance estimates from CPII and CPIII were substantially different, then the sea ice concentration should also be different. This relationship was clearly seen in Area II (Weddell Sea) and Area V (Ross Sea). The authors concluded that these observations strongly support their hypothesis, but further analyses are still required to reconcile the discrepancy in CPII and CPIII estimates.

The Committee thanked the authors for this work; it **suggests** that JARPA data can be used similarly. It was speculated that Antarctic minke whales might be encountered in higher densities and in larger schools in places where large concentrations of ice had recently melted. This could be investigated by comparing minke densities to ice conditions at an earlier time, perhaps a month earlier.

It was suggested that Antarctic minke whale abundance in the surveyed area could be affected by at least three ice-related variables: ice extent; ice concentration; and areas where ice recently melted; this would result in a complex relationship between sea ice and minke whale abundance. The power to detect this using the methods in SC/60/IA12 would be low, given only six pairs of abundance estimates. One possible way to increase the power is to compare these variables on a finer scale; however trade-offs between bias and variance have to be considered. The Committee **recommends** the intersessional working group on abundance estimates and sea ice changes continue (under Kitakado, Q9) and consider these suggestions.

The Committee noted the importance of obtaining more data from studies within the pack ice region, and **encourages** future collaborative work with any such programmes.

SC/60/IA15 presented spatial models for Antarctic minke whales using generalised additive models (GAMs) based on IDCR/SOWER data. Covariates included: distance from sea ice edge, bathymetric depth, distance from the shelf edge, sea surface temperature, latitude, and distances from the Southern Antarctic Circumpolar Current Front and from the Southern Boundary of the Antarctic Circumpolar Current.

The Committee **welcomes** this paper, noting that the approach could provide an independent comparison with other analyses of Antarctic minke whale data from CPII and CPIII. In that regard, it was important to ensure that the data used in SC/60/IA15 were consistent with those used by others (e.g. SC/60/IA8).

The Committee **recommends** that the table on possible hypotheses to explain the differences in CPII and CPIII be updated for next year's meeting, by adding references to the work contained in SC/60/IA12 and SC/60/IA15.

10.1.3 Other issues
10.1.3.1 REVIEW CATCH-AT-AGE ANALYSES OF ANTARCTIC MINKE WHALES
Four tasks related to ageing errors had been identified as high priority for the Intersessional Working Group (Q10) on this issue (see IWC, 2007f and Annex G, Appendix 3). Continued development of the catch-at-age models was also a high priority for intersessional work. Updated JARPA data provided intersessionally to the Working Group through the data access group were used to assist with model development.

10.1.3.1.1 AGEING ERRORS
SC/60/IA14 explored the robustness of the population modelling results to errors in ageing data using ages of Antarctic minke whale earplugs determined by nine independent readers (IWC, 1984). Cross comparison of the age estimates by the different readers indicated that systematic inconsistency (i.e. ageing bias) existed for at least some of the readers, and that the amount of bias was related to the age of the animal. In addition, there was substantial variability among readers in their assessment of the readability of an earplug. The author concluded that this requires further investigation.

In discussion, it was emphasised that the reading of the earplugs of Antarctic minke whales is considerably more difficult than for other whales. It was suggested that general experience in reading whale earplugs was not necessarily directly transferable to reading those from Antarctic minke whales, and that specific training was required; this may be at least part of the reason for the differences among readers at the 1983 Workshop. The Committee noted that the experience of readers is important and that there was a paucity of experienced readers. Nevertheless, the Committee **agrees** that the type of data collected by the Workshop was the type required to develop ageing error models, and that the approaches used in SC/60/IA14 were appropriate for developing such age error models.

Fujise reported that he has been investigating alternative approaches to ageing minke whales, including racemisation of aspartic acid in eye lenses (as used for bowhead whales - see George *et al.*, 1999) and microchemical analysis of earplugs. The Committee **encourages** this work and a presentation of the work next year. It was noted that one approach that has been successful at verifying age estimates in fish has been the use of bomb radiocarbon chronometer techniques. It was not known if this approach would work with earplugs or other whale tissue, but the Committee **agrees** that this should be investigated.

SC/60/IA16 provided information on sample sizes required to detect ageing bias in future ageing studies for Antarctic minke whales. The assumptions of linear functional relationships for both bias and variance means that the power estimated is higher than would have been estimated if a non-linear form had been assumed. Nevertheless, the author concluded that a sample size of 250 as tentatively proposed last year for a comparative age reading experiment (Donovan *et al.*, 2008) or even a smaller sample size of 150 would provide high power to detect bias.

The Committee thanked the authors for this work. It was noted that the combined distribution of the age estimates from the JARPA data used as the assumed 'true' age distribution in the simulations showed a large peak in the estimated number of two year old whales, with about 70% more 2-year olds than 3-year olds. Such a large peak was inconsistent with previous catch-at-age analyses estimates. It was suggested that it would be informative to also include diagnostics based on combined age distributions to determine whether small, but consistent, lack of fit exists that may not be apparent in the annual age distributions.

The Committee noted the importance of ageing data for the catch-at-age modelling work and the importance of the catch-at-age modelling results for the in-depth assessment of Antarctic minke whales. The robustness of the results and estimates of natural mortality rates are dependent upon the age estimates being consistent over time (e.g. no drift or reader-dependent effects). The Committee **reiterates** 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.

A proposal for further work to resolve questions concerning ageing of Antarctic minke whales was presented (Annex G, Appendix 4). The proposal would require Lockyer to undertake independent age readings of 250 minke whale earplugs from five groups of years corresponding to periods near the start and end of commercial whaling, and the start, middle and end of JARPA (overall 1974-2006). The Committee **recommends** that the proposed work be undertaken (and see Item 22). It was recognised that the proposal entailed a substantial amount of work not only for Lockyer but also for Japanese scientists in selecting the random samples that would be aged.

At last year's meeting, progress had been reported on checking for coding errors in the ageing data (Zenitani *et al.*, 2007) and that the work was being extended to older age classes. Kato reported that the work was now completed. The Committee **appreciates** the efforts undertaken to complete this work and **recommends** that the data on these coding errors be supplied to the IWC Secretariat to update the IWC database.

In 2006, the Committee developed a questionnaire to gain a better understanding of the problems involved with any potential errors in the age and length data from the Antarctic minke whale catch-at-age data (IWC, 2007f). Initial responses to the questionnaire were summarised in Polacheck (2007) and in last year's report (IWC, 2008f). Intersessionally, a response was obtained from Mikhalev (translated by Ivanshenko). In particular, he suggested the following: some length measurements (primarily of immature animals) were intentionally misreported to have been larger then they actually were; associated with the misreporting of lengths was an under-reporting of the number of whales caught (e.g., three smaller whales could be reported as two larger ones). Mikhalev did not suggest how extensive the misreporting may have been but did state that it continued to some degree after 1972 - i.e. when the international observer scheme was implemented. He suggested that more detailed information may be retrievable. The Committee **agrees** that the implications of potential misreporting are important to consider in the catch-at-age modelling and **encourages** attempts to retrieve more quantitative information on the magnitude of the above phenomena. Substantial differences exist in the reported length frequency data for the commercial minke whale catches by the USSR and Japanese fleets, but to date the reason for this is unclear. It is possible that the misreporting referred to above is a contributory factor but the absence of information on the extent of misreporting precludes evaluating this. As one approach, the Committee **recommends** that future catch-at-age analyses should include scenarios in which the true length distributions for the USSR catches are assumed to be the same as those for the Japanese fleet, to determine the sensitivity to possible misreporting of the length data.

10.1.3.1.2 PRELIMINARY RESULTS
SC/60/IA2 presented further developments of the statistical catch-at-age approach developed by Punt and Polacheck. The model was updated to investigate the influence of the JARPA indices, ageing bias and ageing imprecision. The results confirm previous analyses suggesting that the recruitment of Antarctic minke whales in Areas III-W to VI-W increased until about the early- to mid-1960s and declined thereafter. Sensitivity tests show that the estimator is more stable and the results more biologically realistic when parameters are assumed to be equal for the W and E stocks, and that the results are insensitive to omitting the JARPA indices of abundance from the analysis. Estimates of natural mortality rates (M) and the ability of the model to yield biologically realistic estimates are sensitive to the level of random ageing error assumed. A preliminary application of the Markov Chain Monte Carlo (MCMC) algorithm to characterise uncertainty was unsuccessful, perhaps because of the complexity of the model. Future simulation evaluation needs to explore a broader range of operating model scenarios and estimation procedures. The results remain preliminary because of the unresolved questions about the model input and structure, including abundance estimates and ageing error.

Additional results were presented to further explore the sensitivity of M to the assumed amount of ageing error. The best fitted estimates of M for ages 0-3 increased with increasing ageing error, and when the ageing error CVs were high (about 20%), biologically implausible estimates resulted (e.g. estimates of the number of calves per female exceeding 1.0 per year). These results confirm the need to determine the likely range of ageing error associated with the actual age estimates.

In discussion, it was suggested that one way to ensure biologically reasonable results was to impose upper bounds on M at low ages, based on maximum plausible pregnancy rates. The lack of sensitivity of the estimates of M to the inclusion of JARPA abundance estimates was unexpected. Previous analyses indicated that the JARPA abundance estimates were informative, particularly with respect to the variance associated with M. It was suggested that the lack of sensitivity may be due to some structural constraints of the stock-recruitment relationships within the model. The Committee **agrees** that this warrants further investigation.

SC/60/IA13 reported two modifications to the ADAPT-VPA model of Mori *et al.* (2007), which was applied to Antarctic minke whales from Areas IIIE to VW (the W-stock). One involved a change to the form of density-

dependence in the stock-recruitment relationship, and the other concerned simplification of the functional form for the variation of carrying capacity over time. With these modifications, the specifications of the ADAPT-VPA model correspond more closely to those of the approach of Punt and Polacheck (2006).

10.1.3.1.3 FUTURE WORK
The Committee **agrees** that resolution of questions concerning ageing of Antarctic minke whales was the highest priority task for the catch-at-age modelling work. Thus, it **reiterates** that the proposed reading of earplugs by Lockyer (Annex G, Appendix 4) be undertaken. In addition, it **recommends** that the development of catch-at-age models should be continued and the intersessional Working Group on catch-at-age analyses of Antarctic minke whales also continue. It also **agrees** that updated JARPA data were not required for the work that will be conducted for next year's meeting, given that the primary purpose of this work is the exploration of methods using a common dataset. Budgetary implications are discussed under Item 22.

10.2 Southern Hemisphere humpback whales (see Annex H)
10.2.1 Assessment of breeding stocks B and C
Last year, the Committee agreed that the completion of the assessment of breeding stocks B (western Africa) and C (eastern Africa) was considered high priority and recommended a number of tasks to be completed by this year's meeting (IWC, 2008g, p.217).

10.2.1.1 BREEDING STOCK B
10.2.1.1.1 POPULATION STRUCTURE
The only known breeding area for breeding stock B is centred on Gabon (hereafter B1). An additional sub-stock off southwest Africa is called B2. The remainder of the
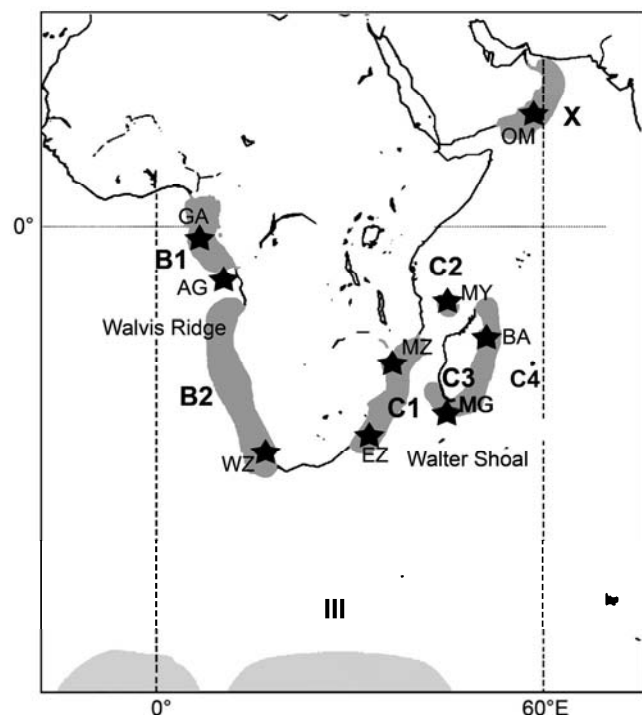

Fig. 5. Map with Breeding Stocks B, C and X and IWC Area III. Key: GA=Gabon; AG=Angola; WZ=western South Africa; EZ=eastern South Africa; MG=southern Madagascar; BA=Antongil Bay, Madagascar; MZ=Mozambique; MY=Mayotte and the Comoros; OM=Oman.

southwest African region outside Gabon (hereafter BX) may contain one or more additional breeding stocks. In further discussion, the Committee **agrees** that sub-stock B2 should be divided in two arbitrary sub-regions; B2 south (B2S; to the south of 16°S) and B2 north (B2N; to the north of 16°S).

Mitochondrial DNA (mtDNA) analyses of breeding stocks and feeding areas presented in SC/60/SH11 detected no maternal differentiation between feeding areas associated with breeding stocks B and C, and between feeding areas associated with breeding stocks C and D. This may reflect interchange of breeding stocks on the feeding grounds, or poorly understood migratory processes occurring between breeding and feeding stocks across the regions. The feeding area associated with breeding stock B (20°W-10°E) showed significant differentiation from sub-stocks B1, C2 and C3, but not from sub-stocks B2 and C1.

SC/60/SH44 presented a preliminary analysis of temporal variation in mtDNA diversity of humpback whales from Gabon (B1) and west South Africa (B2). Details are given in Annex H, item 2.3.1. Significant haplotype differentiation between B1 and B2 for all seasonal partitions investigated indicated some population structure. In B1, the sex ratio is male-skewed, especially late in the season (2.9 males [M]:1 female [F]). The reason for this is unknown but possible explanations are given in Annex H. The sex ratio on B2 (0.7M:1F - winter and 0.8M;1F - summer) is similar to that seen in feeding areas i.e. typically biased toward females (Brown *et al.*, 1995; Mackintosh, 1942). Significant differences between females sampled in the early (July-August) and late season (September-October) in Gabon were detected. The results suggest that humpback whales in breeding stock B may exhibit some temporal population substructure, but further studies are required to confirm this hypothesis. However a higher degree of resolution is needed to differentiate animals from B1 and B2, and to clarify population structure in this area.

In region B2S (west South Africa), there are very few observations of singing and escort activity. However, some feeding has been observed, and the water temperatures are lower than in breeding grounds in other areas (see Rasmussen *et al.*, 2007). There have been a small number of between-region genotypic recaptures between B1 and B2S but the available mtDNA data suggest significant genetic differentiation between B1 and B2S (Rosenbaum *et al.*, 2006). One explanation is that there may be offshore migratory streams associated with B1 that are not captured in the B2S sampling surveys. The Angola/Benguela front occurs between B1 and B2N and may influence interchange between these areas. The geographic boundaries of breeding stock B need further consideration, especially the potential separation zones between B1 and B2, and between B2N and B2S. Currently B1 is considered equivalent to Gabon plus possibly Cabinda, while the Angola/Benguela Current front (at about 16°S) is considered a possible environmental 'delimiting factor' to humpback whale migration up the west coast. It is still unclear if the boundary between B1/B2 should be shifted south to this frontal zone, if this zone represents a division between B2N and B2S, or if there is in reality a cline rather than a latitudinal boundary. Therefore, the Committee **recommends** that a compilation of all available

information that might clarify stock structure within breeding stock B is presented at the next year's meeting.

The Committee **agrees** that the data are consistent with B2 containing a mixture of animals from B1 and one or more other breeding stocks. The Committee also **agrees** that B2S is likely a migratory/transit corridor with some potential for feeding.

After consideration of the stock structure for breeding stock B, the Committee **recommends**:

(1) collection of genetic and photo-identification data from B2N;
(2) the undertaking of a mixture modelling analysis to identify the proportion of animals from Antarctic feeding areas and B2S that could be allocated to B1 and neighbouring stocks; and
(3) further analyses of photographic and genotypic recaptures between B2S and B1 using a subset of sampling related to catch histories and animals that have a higher recapture rate.

10.2.1.1.2 ABUNDANCE AND TRENDS
The Committee received two papers containing estimates of abundance for B1.

SC/60/SH28 presented estimates from capture-recapture models using fluke photographs and genetic multi-locus genotypes utilising multiple sites along the coast of Gabon between 2001 and 2006. Estimates from the Iguela region during 2001-05 were 6,560 (CV=0.15) from photo-identification data and 8,163 individuals (CV=0.12) from genotypic data. Discussion of the details and limitations of the analysis can be found in Annex H.

SC/60/SH40 presented maximum likelihood and Bayesian approaches to estimating parameters of a simple exponential growth model for the humpback whales of B1 using the same dataset used in SC/60/SH28. The results presented were intended to illustrate the methods, and to facilitate further discussion and model refinement. The authors stated that this would need, *inter alia*, to consider the appropriateness of aggregating data from different sites.

In discussion, it was noted that effort and survey times varied substantially between years, probably causing heterogeneity in capture probability if an age/sex structured migration stream is being sampled. It was also noted that the abundance estimates were sensitive both to model choice and the years surveyed. Resightings among sites could be used to estimate levels of site-fidelity of individuals and comparisons with expectations of B1 abundance under panmixia. Although such an analysis may prove not to be useful given the strong likelihood of complete inter-mixing over a small geographic area, the Committee **recommends** that within and between year resighting rates among sites within sub-stock B1 be presented at next year's meeting.

The Committee also **recommends** that:

(1) sex biases in photographic and genetic sampling be explored in order to evaluate possible biases on population estimates; and
(2) analysis and inspection of genotype error rates, followed by reanalysis of abundance estimates, if required.

Due to insufficient time, these abundance estimates from breeding stock B were not discussed further; they will be evaluated at next year's meeting.

10.2.1.1.3 ASSESSMENT MODELS
SC/60/SH41 summarised updated Bayesian stock assessment results for B1 incorporating abundance estimates presented in SC/60/SH28. The preliminary results suggest this population presently to be within the range of 65-90% of its pre-exploitation size but the authors noted that alternate options for input to these assessments were possible and needed to be discussed by the Scientific Committee.

Shortage of time prevented a full evaluation of the preliminary results of the assessment presented in SC/60/SH41. In terms of the assessment, the Committee **notes** that:

(1) the integration of capture-recapture data within the population assessment model is a more statistically inclusive approach than secondarily incorporating abundance estimates from independent capture-recapture studies; and
(2) alternative population dynamic models including depensation could be explored, but because the minimum depletion levels estimated for B1 are substantially larger than estimated the minimum population at the bottleneck (N_{min}), a model incorporating depensation is not likely to be an improvement over the model presented.

The Committee **agrees** that:

(1) due to the absence of trend information for sub-stock B1, the choice of an informative prior from a previous population assessment of breeding stock A (Zerbini *et al.*, 2006) was appropriate; and
(2) trend estimates from feeding grounds - IDCR/SOWER cruises (Branch, 2007b) should not be used in the assessment of B1 because the surveys probably did not extend far enough north to include most of the feeding ground of this sub-stock.

The Committee **recommends** that future assessments:

(1) account for the effects of 19th century whaling of humpback whales including possible sex selectivity;
(2) re-consider allocation of historical catches after the question of sub-divisions of breeding stocks is considered more carefully;
(3) evaluate the degree to which Angolan catches need to be included in the assessments of B1; and
(4) take into account possible mixing of breeding stock B and breeding stock C in the feeding grounds when allocating catches.

The Committee recognised that only a limited amount of time was spent discussing information from breeding stock B compared to the time spent on breeding stock C; it therefore **agrees** to consider the assessment of breeding stock B further at next year's meeting. A working group under Zerbini (Q6) was formed to work on this intersessionally.

10.2.1.2 BREEDING STOCK C
10.2.1.2.1 POPULATION STRUCTURE
The Committee re-examined information presented during the Southern Hemisphere Humpback Whale Comprehensive Assessment Workshop (IWC, 2006c), which divided breeding stock C into sub-stocks C1 (further subdivided into regions C1S and C1N), C2, C3 and C4 (see fig. 5, p.29). The Committee agreed last year (IWC, 2008g) that since sub-stock C2 is data-deficient and previous

genetic work suggests that it is not significantly differentiated from C3, C2 and C3 should be considered one unit (C2 + C3) for the purposes of the assessment.

The Committee discussed the basis for the subdivision of breeding stock C. Mitochondrial and microsatellite DNA sequences were obtained from individuals biopsy sampled in each of C1S (east South Africa and Mozambique), C2 (Mayotte) and C3 (Antongil Bay). Pair-wise F_{ST} comparisons found significant differences between C1S and C3 and C1S and C2 for mitochondrial and microsatellite data respectively. No genetic data were available from C1N or C4.

In discussing the genetic differentiation of stocks using F_{ST}, three points were noted.

(1) With very large population sizes (N>5,000) significant (p<0.05) F_{ST} values are likely to reflect demographic independence (Waples and Gaggiotti, 2006). However, F_{ST} estimates assume genetic equilibrium among populations, which may be violated by recent exploitation. This may cause a temporary increase in estimated F_{ST}s (differentiation) between populations. Estimated migration rates arising from $F_{ST} = 0.005$ are of the order of <1%$^{yr-1}$. This assumes a generation length of 20 years. Estimated migration would be lower for species with longer generation lengths, and vice-versa. The utility of these estimates in interpreting mark recapture estimates of abundance and amounts of interchange is dependent on assumptions about 'visitors' versus current and ongoing gene flow.

(2) F_{ST} values have associated confidence intervals that might include zero, in which case there is no statistically significant evidence for differentiation.

(3) Given that each individual has a low probability of reproductive success, individuals moving between regions have a low probability of contributing genetically to those regions by producing offspring. Therefore genetic estimates of effective migrants by way of F_{ST} might underestimate demographic exchange.

The Committee also noted that the long-term number of effective migrants reported in Pomilla *et al.* (2006) and Rosenbaum *et al.* (2006) were not inconsistent with the reported F_{ST} values. Further discussion was held on the 'non-genetic' rationale for the divisions in the structure put forward in (IWC, 2006c), including catch histories and oceanographic boundaries. The Committee noted that temporal differences in catches between C1 and C3 also suggested demographic independence between these stocks. The Committee **agrees** that while these observations were compelling for the hypothesis of two stocks, it was unclear how strong the genetic evidence was for stock structure. For this reason, the Committee also **agrees** that the assessment should account for some degree of population overlap, which would therefore be compatible with the small F_{ST} estimates reported.

The Committee noted that new information on photo-identification from sub-stock C4 and existing data from sub-stock C2 should help to better understand stock structure hypotheses off western Africa. Photo-identification comparisons between these groups will be performed intersessionally.

The Committee **recommends** that data that will further contribute to a better understanding of the population structure of breeding stock C be collected and reported to the Committee.

Mitochondrial DNA analyses of breeding stocks and feeding areas (SC/60/SH11) detected no maternal differentiation between feeding areas associated to breeding stocks B and C, and between feeding areas associated to breeding stocks C and D. This may reflect interchange of breeding stocks on the feeding areas, or poorly understood migratory processes occurring between breeding and feeding stocks across the regions. The feeding area associated with breeding stock C was significantly different from breeding stocks A and B, but not from breeding stock C. All models found the feeding area associated with breeding stock D to be significantly different from breeding stock B, whereas only the Naïve model revealed significant differentiation between the feeding area associated with breeding stocks D and C.

Previous assessments of humpback whales used the Naïve, Fringe and Overlap models (IWC, 1998) as a way to consider sensitivity to how feeding ground catches are allocated to breeding stocks. For some stocks, new boundaries (named 'Core') were created (IWC, 2006c). Changes in stock boundaries for some stocks have resulted in inconsistencies in the assignment of catches to longitudinal sectors of the Antarctic. For example, the Naïve model for breeding stocks C and D was originally proposed to lie between 10-60°E and 60-110°E, respectively. Boundaries for breeding stock D were changed to a Core area (80-100°E), so that a sector of 20° between 60°E and 80°E was not being considered within the Naïve model. It was also noted that there was no fringe region between the feeding areas associated with breeding stocks B and C.

The Committee also noted that potential mixing may occur across the longitudinally defined border between breeding stocks B and C feeding grounds (at 10°E). The northerly positions of Soviet catches on the feeding grounds south of breeding stock B may suggest some latitudinal structure near this border. The known westward limit of the C3 feeding ground was defined by a Discovery mark linking C3 and 10-11°E (IWC, 1998). Two inter-oceanic genotypic matches have been made between B1 and C3 (Pomilla and Rosenbaum, 2005; Rosenbaum, pers. comm.), indicating exchange between populations in western and eastern Africa. The Committee recommends that a haplotype assignment test, wherein Antarctic 'mixed' genetic data (partitioned into longitudinal sections) is fitted to 'pure' breeding stock data in B1, B2 and C1, C2 and C3, be conducted to estimate stock mixing. This could be performed in a variety of frameworks and would improve catch allocation because the proportion of each breeding stock in the feeding grounds would be more accurately described.

10.2.1.2.2 EXCHANGE RATES BETWEEN SUB-STOCKS

SC/60/SH33 used photo-identification data to assess the degree of exchange and overlap between C1 and C3 from 2000 to 2006. Recaptures across years were more common in C3 than in C1 but were limited in both areas. Comparison across sub-stocks revealed only two recaptures. An analysis combining all years indicated greater than expected within-region recaptures and less than expected between-region recaptures. Photographic comparisons indicated that some exchange between C1 and C3 occurs. However, the data indicate that the structure is

neither one of a single randomly mixing population, nor one of two distinct and non-overlapping breeding stocks. The authors identified limitations to the data and the analyses.

SC/60/SH37 reported initial results of a capture-recapture analysis of humpback population sizes and increase rates for C1 and C2+3. The results presented were intended to be illustrative, and the aim was to facilitate further runs and refinements of the models.

In discussion the Committee **agrees** that the estimates of parameters were probably biased due to possible amplification errors in the genotypic data ('allele drop out'). Additional model runs were undertaken as an attempt to better illustrate the performance of the model used in SC/60/SH37. After review of these runs, the Committee **recommends** that:

(1) the genotypic data of the dataset in question should not yet be used in the estimation of model parameters due to the possibility of false exclusion due to genotypic error;

(2) error checking be performed on the genotypic data along with identification of matches common to genetic and photographic data for presentation at next year's meeting; and

(3) model performance is addressed through simulation testing 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 representation of the underlying interchange process.

With regard to the inclusion of both capture-recapture and line transect data available for C1 in the models presented in SC/60/SH37, it was noted that temporal and spatial differences between the line-transect and capture-recapture estimates provided for C1 are substantial and that some age and sex structuring of whales both during migration and arrival at breeding grounds may be inadequately captured in the framework of the capture-recapture model.

The Committee **agrees** that estimation of parameters using C1 capture-recapture data will probably lead to imprecise estimates. After quality control of photo-identification data, only a single recapture between C1 and C3 was available - such a small sample size will result in poor estimates of exchange rates. A preliminary analysis of exchange rates between C1 and C3 from a multi-state likelihood capture-recapture model indicated exchange probabilities from 1% to 4%. Despite its preliminary nature, it was agreed that the lower bound estimate of interchange (1%) could be used in assessment models.

The possibility of using migration rates from coalescent analysis as an alternative index of exchange among C1 and C3 (e.g. Rosenbaum *et al.*, 2006) was discussed. Such estimates may represent long-term migration rates between populations on an evolutionary time-scale, which falls outside the temporal scope of an assessment. However, it was also noted that the very low F_{ST} estimates available for this population suggest either recent common ancestry or some ongoing gene flow.

In discussing possible exchange rate scenarios between C1 and C3 for the purpose of population modelling, for reasons given in Annex H it was **agreed** that a scenario of 100% interchange is implausible and that scenarios of '50% interchange' and '1% interchange' should be

explored as upper and lower bounds in the assessment models. The upper bound is substantially higher than the range reported in SC/60/SH37 and than the ones described by the multi-strata model. For practical purposes, the lower bound on interchange in the exploratory results was zero because this makes minimal difference to the Bayesian posterior estimates from the assessment model.

10.2.1.2.3 ABUNDANCE AND TRENDS
SC/60/SH32 reports estimates of abundance for C3 using identification photographs of tail flukes and multi-locus microsatellite genotypes collected in Antongil Bay from 2000-06. Methods used were similar to those used in SC/60/SH28. Few recaptures resulted in estimates of low sighting probabilities. A 'lower best' (4,610; CV=0.39), a 'best' (6,737; CV=0.31) and 'higher best' (7,715; CV=0.24) estimates of abundance were proposed taking into consideration the limitations of the models (detailed discussion found in Annex H, item 2.4.3). For reasons also detailed in Annex H, only the photographic data (excluding the year 2002) should be used in the assessment models.

In discussion of the photo-identification dataset it was noted that photo-identification surveys cover 90% of the time that humpback whales are present and are consistent between years and within-bay residency time appears to be short. In addition, only a small part of C3 is being sampled and spatial structuring within the population makes it unlikely that every whale in C3 has the same probability of visiting Antongil Bay at some time. In this case, the estimate for C3 from Antongil Bay will be negatively biased. Finally, the differences in the sex ratio may reflect different availability patterns in different regions, a bias in capture probabilities between sexes, or both (e.g. differential availability of flukes for capture). Such a bias will also cause an underestimation of abundance.

SC/60/SH37 (see above) analysed sub-stock C3 photo-ID data within the framework of an exponential model of population growth, gave an estimated abundance for 2003 with Bayesian posterior median of 6,475 and 95% CI=4,987; 8,677. An estimate of 5,965 (CV=0.17) is available from a line transect survey of part of C1S (Findlay *et al.*, In press).

A number of sources of trend information were available from the migration corridor to the breeding grounds for C1 (SC/60/SH38). For reasons discussed in Annex H, the Committee **agrees** that the 6-22 July relative abundance estimates described in Findlay and Best (2006) and the aircraft SPUE data (1954-75) should be included in fitting the assessment model.

No trend data were available for C3 in the breeding grounds, but trend data from the feeding grounds in Area III were available from the IDCR/SOWER survey estimates 1978-93 (Branch, 2007b).

10.2.1.2.4 ASSESSMENT MODELS
As noted earlier, for assessment purposes, C2 and C3 are considered to represent one combined stock (see also IWC, 2006c).

SC/60/SH38 reported updated assessments of C1 and C2+3. The results were intended to be illustrative only, with the variety of choices available for the various model inputs requiring further discussion.

In light of the discussions of population structure, exchange rates, abundance and trends, a number of

preliminary sensitivity analyses were conducted at the meeting. After consideration of the results it was decided that a final set of two analyses (denoted RUN1 and RUN2) would be explored as discussed in Annex H. The assumptions made with respect to a number of factors including catch allocation, abundance and trends are given in Annex H.

Results of RUN1 are illustrated in Annex H, table 1 and figures 2 and 3. The Committee noted that the probability intervals of the predicted historical population trajectories were narrower for C1 (fig. 2a) and wider for C2+C3 (fig. 3a). This occurs because trend information from indices of abundance are available for C1, but not for C2+C3.

The Committee **agrees** that the scenario implemented in RUN1 represents a suitable initial upper boundary on the depletion levels of C1 and C2+C3. However the RUN2 scenario was considered implausible due to the substantial breeding ground catch asymmetry imposed on the two stocks. Additional scenarios were proposed to investigate the depletion levels of these populations as alternative lower boundaries, but there was no agreement on an appropriate allocation of catches for such analysis. A minority statement in this regard is given in Annex H. The Committee **agrees** that further modelling scenarios, encompassing alternative models of stock interchange and catch allocation, should be explored intersessionally by working groups under Zerbini (Q6 and Q7).

With respect to interchange, it was suggested that the results from the open capture-recapture model presented in SC/60/SH37 be compared with other types of capture-recapture population models (e.g. those implemented in program MARK) in order to address differences between the estimates obtained by these models and to develop alternative models of interchange within a framework that incorporates both capture-recapture and population dynamics. Population models that assume density dependent effects relate to abundance levels on feeding rather than breeding grounds (as conventionally assumed) should be explored.

10.2.2 Other
10.2.2.1 GENERAL INFORMATION
SC/60/SH4 described a non-lethal method for estimating ages of humpback whales from measurements of specific fatty acids present in their outer blubber layer. The Committee welcomed this interesting and informative work. Further discussion of this paper is found in Annex H, item 2.1.

SC/60/SH30 presented a review of recent data on life-history parameters influencing rates of population growth in humpback whales, including survival, age at first parturition and calving rate. Monte Carlo simulations were used to compute a distribution of rates of increase (ROI) taking into account uncertainty in biological parameters. The authors proposed that the upper 90% CI (10.3% $^{yr-1}$) be established as the upper bound on plausible ROI for humpback whales; this approach suggests only a 5% probability that the maximum ROI is greater than the proposed value. Possible sources of positive and negative biases in the estimates were discussed, but it is difficult to evaluate these without additional data.

The Committee evaluated the methods used in this paper along with a similar estimate of the ROI for blue whales (SC/60/SH8) as summarised under Item 10.3.1.4 and in Annex H, Appendix 2. The Committee **agrees** that the choice of any particular percentile as a delimiter is somewhat arbitrary, but that for the time being the 99th percentile should be used as a common delimiter to determine the upper boundary of plausible ROI for modelling purposes (although concerns regarding the biological implausibility of such rates were noted). This corresponds to eliminating the upper 1% of the estimated distribution and equates to an annual increase of 11% for humpback whales.

10.2.2.2 OTHER SOUTHERN HEMISPHERE BREEDING STOCKS
10.2.2.2.1 DISTRIBUTION, MOVEMENTS AND POPULATION STRUCTURE
SC/60/SH20, SC/60/SH22, SC/60/SH23 SC/60/SH26 and SC/60/SH27 presented information on photo-identification and on short- and long-range movements of humpback whales wintering off the western coast of South America and summering in feeding grounds near Isla de Chiloé, Corcovado Gulf, Magellan Strait and the Antarctic Peninsula. The Committee **welcomes** these reports that address earlier recommendations. The papers described collaborative catalogue comparisons among various groups working in the west coast of South America and the Antarctic Peninsula. The Committee **recommends** that such collaborative work continue.

SC/60/SH1-3, 5 and 13 provide new information on movements of individually identified humpback whales among breeding stocks D, E and F and Antarctic Areas IV, V, VI and I. Some migratory connections were identified between the Balleny Islands (Antarctic Area V) and eastern Australia, and between eastern Australia and New Zealand. Notably, a match was also made between American Samoa and the Antarctic Peninsula, suggesting the potential for overlap between breeding stocks F and G on common feeding grounds. This is one of the largest mammalian migrations on record, although it did not necessarily occur during a single migration. In a genotype survey of up to 17 microsatellite loci from across the region (SC/60/SH13), connections between New Caledonia and Area V, Tonga and Area VI, Tonga and Area I (n=2), and Colombia and Area I (Antarctic Peninsula) were identified.

SC/60/SH34 described the satellite tagging of 12 humpback whales off New Caledonia and six off the Cook Islands. Humpback whales from New Caledonia moved south or southeast, generally in the direction of Norfolk Island or New Zealand. This migratory movement of the small numbers of whales seen in New Caledonia towards New Zealand supports the idea that these whales comprise a single small population which may be separate from the large, increasing stock off eastern Australia. All Cook Islands whales travelled towards or across the Tonga Trench in a westerly movement. These papers were also welcomed as they address some earlier recommendations. Discussion of these papers is presented in Annex H, item 2.5.1.

SC/60/SH15 presented mixed-stock analyses of mtDNA haplotypes for allocation of humpback whales from Antarctic feeding areas IV, VI and I to South Pacific humpback wintering grounds breeding stock D, breeding sub-stocks E1, E2, E3, breeding stock F and breeding stock G. Migratory allocation was estimated using an expanded dataset of mtDNA haplotypes from the wintering grounds (n=1,072; Olavarria *et al.*, 2007) and Antarctic feeding areas (n=144). Assuming that the breeding grounds represent the 'pure stocks' and that each feeding area

represents the 'mixed stocks', Area IV was allocated in nearly equal proportions to Western Australia (33.1%) and New Caledonia (31.0%), Area VI whales were allocated primarily to Tonga (78.9%) and Area I was allocated primarily to Colombia (78.3%).

The Committee **welcomes** this work and notes that such assignment analyses can be sensitive to variations in population sizes between stocks and to small sample sizes in the mixed stocks. It was observed that that the surprising allocation of New Caledonian samples to Antarctic Area IV may have been driven by the absence of samples from east Australia; in this analysis New Caledonia is the next closest breeding stock to Area IV after west Australia. The Committee noted that since haplotypes are allocated toward the most genetically similar stock, haplotypes from New Caledonia may have acted as a proxy for the much larger breeding grounds off east Australia, a region for which there is much more evidence of connections with Area IV. The Committee also noted that east Australia and Antarctic Area V were excluded from this analysis as there is little genetic information presently available from these regions. Data gaps on the breeding grounds may affect allocation proportions on the feeding areas.

The Committee **agrees** that this work provides a useful framework which can be developed further and its value to the issue of catch allocation was highlighted. The Committee **recommends** further research into this subject.

SC/60/SH21 reported on the 2008 annual meeting of the South Pacific Whale Research Consortium. As in previous years, synoptic surveys of humpback whales were conducted to collect genetic samples, individual identification photographs and song recordings in the four primary regions: New Caledonia, Tonga, Cook Islands and French Polynesia. Other regions surveyed in 2007 included Samoa, American Samoa, New Zealand, Hervey Bay, Norfolk Island and Tuvalu. Some of the more significant results of Consortium activities were reported in SC/60/SH1-3, 5, 13-15, 31 and 34.

The Committee expressed appreciation for the substantial amount of research presented for breeding stocks E and F and observed that results from these studies will be very helpful to upcoming assessment of these stocks.

SC/60/O12 examined nineteenth-century logbooks which suggest possible oceanic migration routes of humpback whales in the South Atlantic. Whales were reported east of Agulhas Bank and also between about 17 and 28°30'S along 28-29°W. The latter sightings may be humpback whales migrating north towards the Albrohos Bank off Brazil while the former may be migrants from a wintering concentration at the island of St. Helena. This may represent an alternative migratory route for humpback whales wintering in the tropical South Atlantic (possibly Brazil).

SC/60/SH43 reported further evidence of a discrete population of humpback whales off Oman in the Arabian Sea (breeding stock X). Comparison of humpback tail fluke catalogues from Oman, Madagascar and the east African mainland found no matches. The importance of continued and increased research effort into the status and distribution of, and threats to, the Arabian Sea population across its range (including Yemen, Oman, Iran, Pakistan and India) was stressed. The Committee welcomed this report and **recommends** the continuation of this important study on a geographically isolated population.

10.2.2.2.2 ABUNDANCE AND TRENDS
SC/60/SH31 presented a land-based survey of humpback abundance on the east coast of Australia (Point Lookout). Results yielded a long-term annual rate of increase of 10.9% (95% CI=10.5-11.4%); showing that the long-term high increase rate of the east Australian population of humpback whales continues. Aerial surveys were also conducted concurrently with the land-based surveys during which 249 groups (an estimated 399 whales) were seen from the air. Analysis confirms that ~3% of groups pass more than 10km off the headland, consistent with estimates from Bryden (1985) despite an approximately 15-fold increase in the population over this time. This supports a key assumption of the land-based counts, that they are not greatly affected by whales missed as a function of increasing distance offshore. An estimate of absolute abundance for 2007 was made by extrapolating from the 2004 absolute abundance estimate: 9,683 whales (95% CI=8,556-10,959).

The Committee **welcomes** this report. Further discussions are found in Annex H, item 2.5.2.

10.2.2.2.3 ASSESSMENT
SC/60/SH14 presents a preliminary population assessment of humpback whales breeding along the coast of east Australia (sub-stock E1) and near the islands of Oceania, South Pacific (sub-stocks E2, E3 and BSF) using a two-stock Bayesian density-dependent logistic population model. The Committee **welcomes** this report as it shows progress on population modelling for breeding stocks E and F, for which an assessment will be forthcoming. It **requests** a detailed summary of CPUE and other potentially informative trend data from these regions for future discussion.

An updated assessment for breeding stock G was presented (Annex H, table 2). This was based on a revised estimate of the abundance produced by Félix *et al.* (in press). The new estimate is 6,118 (CV=0.21) in 2004. Inclusion of the new abundance estimate has a marked impact on the estimated status of breeding stock G. In particular, the estimated intrinsic growth rate has changed from 0.060 to 0.100, and the current depletion level of the stock (N_{2007}/K) has increased from 0.277 (95% CI=0.185-0.391) to 0.650 (0.486-0.815).

10.2.2.2.4 ANTARCTIC HUMPBACK WHALE CATALOGUE
SC/60/SH19 presented a interim report of the Antarctic Humpback Whale Catalogue (AHWC), part funded by the IWC. During the contract period, 332 images representing 183 individuals were catalogued. These images were submitted by 37 individuals and research organisations. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 48 previously known individuals. These submissions bring the total number of catalogued whales identified by fluke, right dorsal fin/flank and left dorsal fin/flank photographs to 2,858, 409 and 405 respectively. Matches made during the contract period to previously sighted individuals include resightings between Ecuador and the Antarctic Peninsula (4), American Samoa and the Antarctic Peninsula (1). Within-region sightings include resightings in the Antarctic Peninsula (9), Brazil (1), Ecuador (1), American Samoa (1)

and eastern Australia (1). The Committee thanks the authors for this work and **recommends** that it continues (see Item 22).

10.2.2.2.5 OTHER

SC/60/O14 examined the resighting histories of seven humpback whales to which implantable radio tags were attached in Alaska between 1976 and 1978. All of these whales have been resighted repeatedly over time-spans ranging from 17 to 32 years; five of the seven whales were still being seen more than three decades after tagging. These results suggest that any effects of the implantable tags (which were larger than some tags currently in use) were minimal. Discussion of this paper is found in Annex H, item 2.7.

The Committee **welcomes** the results in SC/60/O14, and noted that a study undertaking a comparison between tagged and untagged animals (a controlled experiment) would be of interest if control animals with similar characteristics to the tagged animals could be identified. The Committee **agrees** that follow-up studies on invasive tagging are essential. The Committee **recommends** that all tagged whales be individually identified photographically; biopsy sampling of tagged whales would provide an alternative means of individual identification (via genotyping), as well as information on sex and data for genetic and other studies. The Committee also **recommends** that the design and dimension of the tags deployed should be included in all reported studies using satellite tagging and that further studies of the short-term impacts and responses of whales to tagging be conducted. It notes that the issue of satellite tagging next year will include discussion of the US Marine Mammal Commission report as discussed under Item 10.7.

The Committee **endorses** two no-cost proposals to analyse breeding and feeding ground population structure of humpback whales in the South Pacific (Annex H). One requests mtDNA data from the South Pacific Whale Research Consortium while the other requests access to biopsy samples collected by IDCR/SOWER. Noting that the IDCR/SOWER tissue samples can only be sub-sampled a few times before they are depleted, it was suggested that genome amplification may aid in archiving of these data. It was noted that a review paper on the archiving of and access to the IDCR/SOWER samples is expected next year.

10.2.3 Work plan

Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

10.3 Assessment of Southern Hemisphere blue whales (see Annex H)

10.3.1 New information

10.3.1.1 REPORT OF THE CAPE TOWN WORKSHOP

The Committee received the report of a one-day Workshop held in Cape Town, South Africa, in association with the Marine Mammal Society Biennial Conference, November 2007. A series of 18 presentations covered a wide range of topics and was followed by discussion sessions on: taxonomy; population identity, status and movements; breeding biology; feeding ecology/critical habitat; threats; and research priorities. A number of threats to blue whales were identified and several priority topics were recognised by the workshop. Details of this report are found in Annex H, item 3.1.1.

10.3.1.2 DISTRIBUTION, MOVEMENTS AND POPULATION STRUCTURE

The Committee received a number of papers on distribution, population structure, biological parameters, ecology and acoustics of Southern Hemisphere blue whales. Details of these papers are found in Annex H, item 3.1.2.

SC/60/O4 reported the new information on blue whale sightings in Antarctic Areas III, IV and V during the 2007/08 JARPA II cruise. A total of 49 schools (92 individuals) was sighted, primarily in Area IV. Biopsy samples and photo-identification data were collected from 5 and 23 individuals, respectively.

Branch *et al.* (2007) estimated the proportions of pygmy and Antarctic blue whales in different regions of the Southern Hemisphere and northern Indian Ocean using a Bayesian mixture model. South of 52°S, 99.2% of catches were estimated to be Antarctic blue whales, while north of 52°S and between 35°E and 180°, 99.9% were estimated to be pygmy blue whales; outside of 35°E-180°, most land station catches were estimated to be Antarctic blue whales. The lengths of sexually mature Chilean blue whales was intermediate between those of pygmy and Antarctic blue whales, and can only be explained if this is a distinct population or subspecies. This finding is consistent with their discrete distribution, and differences in call type and genetics compared to pygmy and Antarctic blue whales.

Branch *et al.* (2008) explored the production of ovarian corpora in blue whales. The relationship between length and ovarian corpora count is quite different for pygmy blue whales and Antarctic blue whales. Only 0.1% (95% CI=0.0-0.4%) of the Antarctic-region blue whales were estimated to be pygmy blue whales. This fact was used to estimate the proportion of pygmy blue whales in the Antarctic region. Over a period of four decades, despite substantial depletion of Antarctic blue whales, the proportion of pygmy blue whales in the Antarctic did not increase, suggesting that pygmy blue whales did not shift southwards to take advantage of the more vacant Southern Ocean habitat.

LeDuc *et al.* (2007) described subdivision among Southern Hemisphere blue whales. Genetic differentiation was found between the southeast Pacific Ocean, Indian Ocean and the Antarctic. Data suggest that pygmy blue whale populations are as differentiated between the two oceans as either is from Antarctic blue whales. Two vagrants have been sampled: one southeast Pacific blue whale ('Chilean' blue whale) in the Antarctic; and one Antarctic blue whale in the Pacific.

SC/60/SH29 presented a study on photo-identification of Antarctic blue whales. Over 21,000 identification photographs were collected during 19 IWC IDCR/SOWER cruises conducted from 1987/88 to 2007/08; photographs representing a minimum of 311 whales. Results thus far show that four whales were re-sighted in Area III in multiple years, including one whale with a 12-year sighting interval. The within season re-sighting rates for 2005/06 and 2006/07 were 11% and 17%, respectively. This document pointed out that blue whale photographs were still missing from seven years. The Committee **recommends** that:

(1) the IWC Secretariat make a concentrated effort to locate the most important outstanding photographs taken during three recent cruises in Area V: 2001-02, 2002-03 and 2003-04, when 52 blue whales were photographed;

(2) blue whale photographs collected by JARPA be incorporated into the collection of photographs described in SC/60/SH29 - Japanese scientists agreed to add JARPA photographs to the catalogue after archiving and examining these photographs;

(3) analyses of the JARPA blue whale photographs be presented at the next IWC meeting; and

(4) archiving photographs from the IDCR-SOWER cruises reported in SC/60/SH29 continues and that the resultant analysis is presented to the Scientific Committee next year.

SC/60/SH24 summarises blue whale studies off Chiloé, Chile, in 2008. A total of 250 individuals have been photo-identified since the study began in 2004. Recapture information supports the hypothesis that the feeding ground off southern Chile is extensive and dynamic. Comparisons of the Chilean blue whale catalogue with the eastern tropical Pacific and the Antarctic is currently under way. Photo-identification data are available to compute abundance estimates and the Committee **recommends** that these estimates are provided at next year's meeting.

SC/60/SH46 described the movement, behaviour and space use of humpback, blue and sei whales on the coast of Chile (southward from Chiloé Island and Corcovado Gulf) through shore-based observations using a theodolite. The Committee **recommends** that a full report of the boat-based data and calibrations should be presented at next year's meeting.

10.3.1.3 ACOUSTICS
SC/60/SH45 presented preliminary findings from opportunistic acoustic recordings of Chilean blue whales in the Corcovado Gulf, southern Chile. The results support the hypothesis that Chilean blue whales belong to a separate subspecific grouping and suggest that acoustic recordings could be used in field identification of populations.

10.3.1.4 BIOLOGICAL INFORMATION
Branch and Mikhalev (2008) presented an analysis of ovarian corpora data recovered from the original logbooks recorded during Soviet operations in the Southern Hemisphere and northern Indian Ocean. Although a statistically significant difference was found they do not believe it is sufficient to consider northern Indian Ocean blue whales as a separate subspecies.

In SC/60/SH6, biological parameters are estimated for pygmy blue whales based on new biological data from Soviet whaling, and re-analyses of existing published data from Japanese whaling. The results suggest that in the early 1960s, the potential rate of population change for pygmy blue whales in the Indian Ocean was less than 2% $^{yr-1}$.

Details of the discussion of Branch and Mikhalev (2008) and SC/60/SH6 are found in Annex H, item 3.1.4.

SC/60/SH8 computed maximum plausible rates of increase are estimated for Antarctic blue whales based on biological parameters using Monte Carlo simulations. The mean annual growth rate for this species was estimated at 4.1% (SE=1.9%) and the maximum annual rate, the upper 99th percentile of the resulting distribution of growth rates,

was estimated at 8.5%. Rates of increase estimated for Antarctic blue whales from IDCR/SOWER and JARPA were within plausible values. The methods used in this paper were discussed along with SC/60/SH30 (Annex H, Appendix 2). The Committee **agrees** that the use of the 99th percentile in determining an upper bound of plausible growth rates of Antarctic blue whales was appropriate for the time being. This equates to an annual rate of increase of 8.5% for blue whales. The Committee also **agrees** that the approach used in SC/60/SH30 should be used to explore the maximum plausible growth rates for blue whales (e.g. by looking at maximum life history parameter values) and that these values should be used as upper bounds in prior distributions in assessment models.

SC/60/SH25 reported different types of skin lesions identified from Chilean blue whale photographs taken off the northwestern coast of Isla Grande de Chiloé, Chile, in 2006 and 2007. The main lesions were: (1) cookie-cutter sharks; and (2) blister-like or vesicular lesions.

10.3.1.5 ABUNDANCE AND TREND ESTIMATES
SC/60/SH10 presented a minimum bottleneck abundance (214) estimated for Antarctic blue whales based on the observation that each mtDNA haplotype in the population at the present time must have been represented by at least one female at the time of the bottleneck; this can be used as a lower bound for the population size of Antarctic blue whales. Discussion of this paper is summarised in Annex H, item 3.1.5, along with recommendations for further work.

SC/60/SH16 presents a capture-recapture estimate of pygmy blue whale abundance from western Australia (Perth Canyon). Open and closed models yielded abundance estimates of 791 (95% CI=569-1,147) and 1,019 (95% CI=712-1,754) respectively. The authors discuss the limitations of the estimates and propose that the coordinated matching of photographs between sites throughout Australia and the Indian Ocean will improve the population estimate and the understanding of structure within and among pygmy blue whales populations. The Committee welcomed the presentation of this work and **recommends** that it continues.

10.3.1.6 CATCH DATA
SC/60/SH9 describes a worldwide catch series for five regional groupings of blue whales during the modern whaling period, 1868-1978. Details are given in Annex H.

10.3.2 Assessment
10.3.2.1 ANTARCTIC BLUE WHALES
SC/60/SH7 uses Bayesian modelling to assess the current status of Antarctic blue whales: an exponential model is used to assess recent trends in abundance, and a logistic model to estimate pre-exploitation abundance and population trajectories. This assessment explored a number of sensitivity scenarios which included alternative (1) prior distributions on parameter r, minimum abundance (N_{min}) scenarios, and data inclusion. Details are presented in Annex H, item 3.2.1, fig. 4 and table 3.

The Committee **agrees** to the following posterior median estimates of the status of Antarctic blue whales (with 95% credibility intervals in brackets): pre-exploitation abundance of 256,000 (235,000-307,000) decreasing to a minimum abundance of 395 (235-804), which was 0.0015 (0.0010-0.0028) of the original abundance, followed by an estimated rate of increase of

6.4% (2.4-8.4%) per annum. The most recent survey abundance estimate of 2,280 in 1997 (from Branch, 2007a) is 0.009 (0.007-0.010) of the estimated original abundance. Compared to the previous assessment (Branch *et al.*, 2004), this revised assessment indicates a higher pre-exploitation abundance, slightly lower estimated rate of increase, and similar depletion levels. It has generally narrower 95% credibility intervals around the parameters of interest.

The Committee **agrees** that the assessment for Antarctic blue whales (when combined at a circumpolar level) is complete.

The Committee **expresses** its appreciation for the considerable work done by Branch in undertaking this assessment and other blue whale analyses discussed by the Committee.

10.3.3 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

10.3.4 Blue whale photo-identification catalogue
Annex H, Appendix 6 details a proposal to establish a central web-based catalogue of blue whale identification photographs, primarily for the Southern Hemisphere. The system is designed to facilitate matching of blue whale photographs among a wide number of researchers and result in a considerably increased understanding of the basic questions relating to Southern Hemisphere blue whale populations. The Committee welcomes and **endorses** the proposal. Budgetary implications are discussed under Item 22.

10.4 Southern Hemisphere right whales (Annex F)
A considerable amount of information on southern right whales was presented this year and this is discussed in Annex F, item 6.3. Only a brief summary of that extensive work is given here.

10.4.1 Australia and New Zealand area
SC/60/BRG12 provided updated estimates of demographic parameters for southern right whales from a long-term (1991-2007) data series from south Australia. The mean calving interval excluding intervals >5 years is 3.38 years (95% CI=3.29, 3.46 years). Mean age at first calving was estimated as 9.1±0.48 years, range 7-13 years, with sexual maturity reached at 6 years in some individuals.

SC/60/BRG14 reported the results of a long-term series of aerial surveys off the southern Australian coast. The number recorded in 2007 (286 animals including 57 cow-calf pairs) was considerably lower than the highest number recorded (in 2005, 591 animals, including 177 cow-calf pairs) although the 2007 'unaccompanied' animals count was not unexpectedly low. The 1993-2006 cow-calf increase rate of 8.10% (95% CI=4.48, 11.83) has been taken as the current 'best estimate' of annual increase. Current population size for animals visiting the area surveyed is estimated to be *ca.* 2,100, with a total Australian population of *ca.* 2,400.

Information on right whale research in New Zealand is summarised in Annex F, Appendix 5.

10.4.2 South Africa area
SC/60/BRG8 reported that in September 2001, 21 satellite-monitored radio tags were deployed on southern right whales in South African coastal waters. Six whales whose tags transmitted for between 64 and 161 days all eventually left the coast, and all but one were then tracked to oceanic feeding grounds. The whales tracked showed a wide variety of feeding strategies including the use of a coastal feeding ground and movements between the regions of the sub-tropical convergence and the Antarctic polar front. The Committee **agrees** that this study illustrates the considerable value of such telemetry.

SC/60/O12 reported on the findings of three nineteenth-century whaling log books which provide evidence of the distribution of right whales in the pelagic South Atlantic.

10.4.3 South America area – east
SC/60/BRG1 summarised sightings of southern right whales along the coast of the Río Negro province, northeast Patagonia, between 1991 and 2008. A total of 308 records (425 whales) was collected.

SC/60/BRG4 reported that an increasing number of southern right whales has been recorded from May to September in the Golfo San Jorge, Patagonia, Argentina from La Lobería (46º07'S/67º38'W) to Caleta Olivia (46º26'S/67º31'W). Between 2004 and 2006, a total of 122 right whales, including 10 calves, were recorded from shore. Results presented in the paper, even though preliminary, indicate the relevance of the area for the species and the need for further research.

SC/60/BRG15 reported systematic efforts to evaluate southern right whale health through postmortem examinations of stranded animals at Península Valdés, Argentina, since 2003, and examined an unusual mortality event that occurred in 2007; 60 calves and 1 adult died, an unprecedented number. The dead animals were in good body condition and the search for a consistent infectious cause of death was inconclusive. Water samples taken at the time showed highly elevated densities of two harmful algal blooms (HABs), *Alexandrium tamarense* and *Pseudonitzschia* spp, which have been known to produce biotoxins in other parts of the world. High numbers of strandings were not observed in other parts of Argentina or off Brazil.

The Committee **commends** the efforts of the Argentinean stranding response network. However, it **recommends** that strong partnerships be developed between local and national governments, researchers and private stakeholders to increase detection capacity, decrease response time and ensure financial and logistical support for the long term continuation of this work. The Committee also **recommends** consistent monitoring of ocean water to detect harmful algal blooms and their associated biotoxins that may be ingested by whales. It also **recommends** that more work be performed on the lactational transfer of specific HAB-associated biotoxins.

SC/60/BRG13 described a novel approach for studying the population genetic structure of southern right whales on their feeding grounds by combining genetic and stable-isotopic analyses of skin samples collected from live whales on their nursery ground off Península Valdés, Argentina. SC/60/BRG13 also showed that some mitochondrial lineages have relatively large stable isotope ranges, suggesting that a few members of those lineages had experimented with different locations or prey types in the recent past. The Committee **commends** the authors' efforts in bringing isotope and genetic data together.

There was considerable discussion of this paper as seen in Annex F. The Committee expressed interest in what the

isotope values from skin biopsies represent. The Committee **recommends** that: (1) a study be conducted on a fresh stranded right whale to determine whether samples from different depths of the epidermis showed stratification of isotopic signatures; and (2) further analysis of haplotypes with the greatest level of isotopic variability be concluded.

SC/60/BRG23 described a method for inferring foraging paths from variation of carbon isotope values in baleen.

SC/60/BRG29 presented research on the interactions of killer whales and southern right whales. The authors suggested that Península Valdés has features that are advantageous in reducing the risk of killer whale predation.

10.4.4 South America area – west
SC/60/BRG22 reviewed the status of southern right whales off Chile and Peru by analysing sightings between 1976 and 2007. The Committee welcomed this paper and thanked the authors for their effort to collect the sighting data.

SC/60/BRG36 presented the report of a workshop on the southern right whale population of Chile-Peru held in Santiago, Chile, prior to the Scientific Committee meeting. Twenty two scientists, researchers and representatives from several government and non-government organisations from Chile participated in this workshop. Historical catches were reviewed, and it was noted that catches in Chile from 1929 to 1976 occurred in a period when this population had already been reduced by whaling. The participants agreed that in light of the small number of records, the Chile-Peru stock of southern right whales is in critical danger, that it is likely to be affected by loss of habitat due to anthropogenic factors, and that there is a lack of relevant information regarding this stock. All the workshop participants emphasised the importance of compiling all sightings and collecting other data such as photo-identification images and skin samples.

After full consideration of the presented papers and results of the workshop, the Committee made the following **recommendations:**

(1) to endorse further international cooperation among researchers;
(2) to increase photo-identification and biopsy-sampling efforts on southern right whales;
(3) to encourage research into protected areas for southern right whales; and
(4) to conduct a revised assessment of southern right whales that would be focused on stock-specific variability in their recovery in historic and current breeding areas.

An intersessional group was formed under Brownell to plan an assessment of southern right whale populations (Q5). Its report will be reviewed at the next Annual Meeting.

10.5 SOWER cruises (see Annex G)
10.5.1 General review of 2007/08 cruises
Initial planning for the IWC/SOWER cruise had occurred at the 2007 annual meeting and plans had been finalised at the planning meeting held in September in Tokyo (SC/60/Rep7). It was agreed that the highest priority for the cruise should be collaboration with an aerial survey planned by the Australian Antarctic Division. In addition the BT-option 2 mode would be continued as well as trials

for school size estimation, visual dive time, biopsy sampling, photo-identification, acoustic studies and direct data entry.

The aerial survey of minke whales planned by the Australian Antarctic Division was to be conducted off east Antarctica (based at Casey Station, 66º17'S 110º32'E) during December 2007 and January 2008 and would overlap with the SOWER survey. The primary objective was to compare relative densities of minke whales in sea ice to open water adjacent to the ice edge. Unfortunately, due to unforeseen and unavoidable delays, the aerial survey was cancelled. There was, however, still an opportunity to undertake testing of the equipment and the capability of the CASA-212 aircraft (SC/60/IA4). The CASA-212 aircraft proved a capable platform and the equipment worked well. The Australian Antarctic Division plans to undertake another small-scale pilot study of an aerial survey for minke whales in sea ice in the Casey region over the 2008/09 summer and, if possible, a broader-scale aerial survey over the 2009/10 summer season. The pilot study and the 2009/10 broader-scale survey would both investigate relationships between sea ice habitats and minke whale distribution and abundance.

The Committee **thanks** the Government of Australia for this initiative and reiterated that this contribution facilitates the work of the Scientific Committee, particularly to understanding Antarctic minke whale distribution in sea ice. The Committee **agrees** that, if possible, collaborating with the 2009/10 summer aerial surveys should be considered at next year's meeting.

SC/60/IA1 presented the report of the 2007/08 SOWER cruise. This was the 30th annual cruise in the series. The priority research objective, which would potentially provide information relevant to both interpretation of past cruise data and inform the design of future SOWER cruises, was a systematic survey for minke whales, intended to coincide with the Australian Antarctic Division aerial survey; although as noted above, the aerial survey was not undertaken, the SOWER cruise continued as planned. Other priority objectives were to continue research on blue, fin, southern right and humpback whales.

The research region was between 105° and 120°E (Area IV). The Japanese research vessel *Shonan Maru No. 2* departed Fremantle on 24 December 2007 and returned to Benoa, Bali, Indonesia on 26 February 2008. The plan was to cover the research region west to east and then return east to west using the same tracklines. Several modifications to the survey methods were implemented: BT-option 2 was used to evaluate its potential as an alternative to IO mode, and schoolsize-II (SS-II) mode was used instead of Closing mode. Minke whale research commenced at 105°E on 31 December 2007 and covered a total of 1,270 n.miles. The re-survey (east to west) started on 13 January and covered a total of 1,050 n.miles.

The SCANS-II video recording system was used to collect additional distance measurements (SC/60/IA6). Three minke whales and 62 sightings of other species (mainly humpback whales) were recorded on video.

Sightings in the research region included minke, blue, fin, humpback, southern right, sperm, killer, southern bottlenose and pilot whales and hourglass dolphins, as well as 5 groups (6 animals) of spectacled porpoise. Minke whales were sighted during the entire coverage of the research area and included 35 groups (71 individual

animals): 15 groups (22 animals) were detected during the first phase and 20 groups (49 animals) during the re-survey. Additionally, 9 groups (15 animals) classified as 'like minke' whales were recorded. Humpback whales were the most frequently sighted species in the research area, with 283 groups (483 animals) observed. One group of Antarctic blue whales (2 animals) was sighted adjacent to the ice edge near the end of the survey. There were also sightings of fin whales (14 groups, 42 animals) and southern right whales (7 groups, 8 animals). A solitary southern right whale was also observed during the transit from Fremantle to the research area.

Biopsy samples were collected from 3 fin, 7 humpback, 9 southern right and 1 killer whale. Photo-ID images of 2 blue, 3 fin, 56 humpback, 9 southern right and 16 killer whales were obtained. In addition, 28 minke whales were photographed opportunistically with no research time allocated. Acoustic recordings were conducted at 48 stations using sonobuoys. The minke whale visual dive time experiment was planned for 0.5 days; however, no suitable opportunities arose and so no trials were completed. The estimated angle and distance training exercise and experiment were completed as in previous years. Gedamke reported that post-cruise analyses of acoustic data suggests that sounds identified as 'humpback whales' on this and at least one previous cruise (Ensor *et al.*, 2006) were actually made by leopard seals; this will be investigated further.

It was confirmed that of the nine southern right whales photographed, five had been matched to whales photographed off the Australian coast. There had been concern that fewer whales would be seen in BT-option 2 mode as compared to IO mode, but this had not been the case. It was confirmed that the large number of sightings recorded as 'unidentified large baleen whales' were detected at large distances and only blows had been visible.

The Committee **recognises** that potential legal and other issues had resulted in the need for the home port to be changed from Fremantle to Bali. These matters were beyond the control of the IWC. The last minute change of home port had resulted in considerable extra work for the Secretariat and the Committee **expresses its thanks** to Bernard Lynch for coordinating the logistics with respect to this.

Ensor (Cruise Leader on the *Shonan Maru No. 2*) expressed his thanks to the Captain and crew for their hard work and fellow researchers for their substantial contribution and to the many people and organisations who had provided equipment and help for this cruise. The Committee again **expresses** its sincere gratitude to the Government of Japan for providing the vessel and thanks the officers and crew, the Cruise Leader and the researchers for all their work to ensure a successful cruise. The Committee also **expresses** its appreciation for the whole programme of SOWER cruises and acknowledges the importance of the programme to its work through several Committee sub-committees and working groups.

The Committee **recognises** the extensive amount of information on a variety of cetaceans that has been collected during the 30 years of the IWC-IDCR/SOWER cruises. To acknowledge this achievement, the Committee **recommends** an intersessional Working Group (Q14: convened by Bannister and Donovan) develop plans to commemorate these cruises by considering updating the IWC webpage to include more cruise information and creating a special volume of the *Journal of Cetacean Research and Management* reviewing the extensive scientific work undertaken over the 30 years.

10.5.2 Proposal for 2008/09 cruise and short-term objectives
For the 2008/09 cruise, several possible projects that investigated the relationship of Antarctic minke whales to the ice, including collaboration with Australian and German sea ice research programmes, and the commencement of a fourth circumpolar series were discussed. The Committee **welcomes** the news of the Australian and German research programmes which are examining the relationship of minke whales and pack ice. The Committee **encourages** these endeavours and looks forward to receiving reports of their results.

Although the Government of Japan had not taken a final decision on the availability of a research vessel it is hoped that the vessel *Shonan Maru No. 2* will be available. Morishita noted that it was becoming increasingly difficult to secure from his Government the budget for supporting the SOWER cruise, because of the general financial situation of the Government and the recent developments in the IWC.

Due to high fuel costs and the fact that the Australian aerial survey will only be a limited pilot study, the Committee **recommends** that for the 2008/09 season, the IWC/SOWER cruise investigate temporal changes in the spatial distribution of minke whales in relationship to the ice recession in Area IV, and in the slightly longer term, continues its cooperative project with the Australian aerial survey programme with a possible collaborative survey in 2009/10.

The 2008/09 cruise will take place over the same time period as last year, and the target species and order of priority will be as in previous years (Appendix 2, Annex G). The survey area will be in Area IV near the Australian Antarctic base of Casey, tentatively spanning the ten degrees of longitude (105°-115°E). The cruise will be about 53 days in length and four researchers, including the Cruise Leader, will be required.

Recommended methods to conduct this survey are detailed in Annex G, Appendix 2. In essence, the plan is for a systematic sighting survey by the SOWER vessel using established standard protocols. There will be several longitudinal traversals of the research area, with the northern boundary of the research area being the same for each traverse, and the southern boundary following the ice recession. Since sample size may be restricted, a simple power analysis should be conducted beforehand of the ability to detect changes in distribution with respect to changes in ice. This analysis should include consideration of the utility of mark-recapture methods (based on biopsies and/or photo-ID) as well as sighting surveys. Bravington will undertake these analyses in time for the Tokyo planning meeting in September.

The Committee notes that telemetric methods to investigate the use of the pack ice habitat by minke whales continue to be of great relevance. The Committee **encourages** Gales and Ensor to report to the Tokyo planning meeting information on possible satellite tagging options and the appropriateness of using these tags on

minke whales in the Antarctic environment using the *Shonan Maru No. 2*, and to summarise any available information on the potential impact of tagging.

The Committee **recommends** final plans for the 2008/09 cruise be completed and discussions of future cruises continue at the Tokyo Planning Meeting (convened by Kato) during 26-29 September 2008. The SOWER steering group (Q12) comprises Kato (Convenor), Bannister, Best, Bravington, Brownell, Donovan, Ensor, Gales, Hedley and Palka.

10.5.3 Future of SOWER programme

SC/60/IA5 described an update to the survey design framework in Hedley *et al.* (2007), dealing with CVs of minke whale abundance that could be obtained from future shipboard line transect surveys (e.g. IDCR/SOWER). To fully apply these methods, it would be necessary to specify objectives and logistic constraints more tightly, as well as to make appropriate allowance for additional variance. While noting Morishita's caveat on vessel availability, the Committee **encourages** the authors of SC/60/IA5 to continue developing this tool so that it can be used in designing future abundance surveys.

10.6 In-depth assessment of western North Pacific common minke whales with a focus on J-stock (Annex G1)

10.6.1 Stock structure

Two years ago, the Committee had agreed a set of tasks that should be undertaken to try to distinguish among a set of stock structure hypotheses for J-stock animals (IWC, 2007e, pp.185-86). Progress had been made in achieving some of these tasks (IWC, 2008e, pp.197-98) but some work remains.

The Committee recalled the four stock structure hypotheses for J-stock animals (IWC, 2007e, p.186). There was considerable discussion about whether other hypotheses were appropriate to investigate, in particular to account for animals east of Japan; this issue has been discussed a number of times in previous meetings. Maps and descriptions of the present stock structure hypotheses and a discussion of these are given in Annex G1 (see Annex G1, Appendices 3 and 4). After considerable discussion, the Committee did not reach agreement on the additional hypotheses and retained the hypotheses agreed in 2006. However, after the results of analyses described below and results from the JARPN II review are presented next year, the Committee may consider additional hypotheses.

Plans for work to be accomplished by Japanese and Korean scientists in the coming year include:

(1) standardise Japanese and Korean microsatellite data (end of 2008);
(2) conduct heterogeneity tests on samples stratified by month and season, as well as sex;
(3) include recent data from 2005-07 to increase sample sizes and power for mtDNA and microsatellite analyses;
(4) investigate whether previously found heterogeneity is due to the 1999 data in general or just a few individuals in this year;
(5) analyse the 1982 Korean commercial samples (27) together with recent samples (recommended at SC/59); and

(6) include samples from the Pacific side of Japan in work related to the JARPN II review.

The Committee **welcomes** these plans and looks forward to the results of new analyses at next year's meeting.

The Committee recalled that there is still a lack of information on stock structure in sub-areas 10 and 11 (see Fig. 6); information on this is very important to the in-depth assessment (IWC, 2007d, p.180). The Committee reiterates its strong recommendation that the Russian Federation be requested, as a matter of priority, to give permission for biopsy samples to be taken during surveys in its waters in these areas. The Committee also **recommends** that attempts continue to investigate the presence/absence of cookie cutter shark scars on minke whales in these areas.
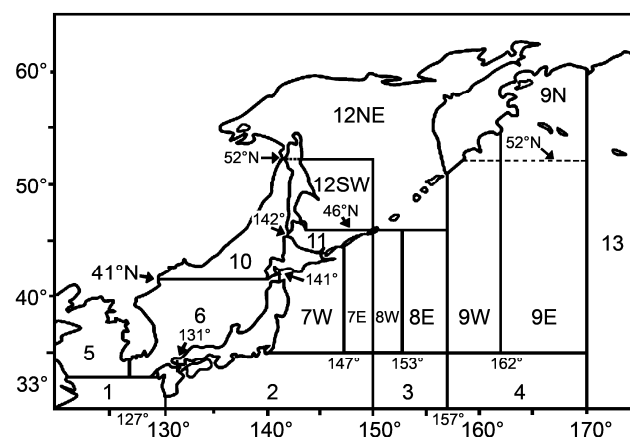

Fig. 6. The 18 sub-areas used for North Pacific common minke whales.

10.6.2 Distribution and abundance

The Committee welcomed the report of the Japanese sighting survey conducted in the Japanese Exclusive Economic Zone (EEZ) in the Sea of Japan and Sea of Okhotsk from May/June in 2007 (SC/60/NPM4). During about 1,600 n.miles of searching effort (92% of the designed track line), primary sightings of 39 schools (47 animals) of common minke whales were made. The species was abundant in the shallow waters in the Sea of Okhotsk, but there were no minke whale sightings in the deep waters where fin whales were found. In the Sea of Japan, common minke whales were widely distributed from coastal to offshore waters.

Following the suggestion made last year, attempts were made to record observations of cookie cutter shark scars during the survey (this was to investigate the presence of O stock animals that typically live in deeper waters, as does the cookie cutter shark) but as noted in Annex G1, this proved difficult. Estimating the mixing rate of stocks on this basis is thus premature at this stage. It was however suggested that, as well as taking high-quality photographs, a standardised body area on the flank/back be defined as a way to systematise data that might be collected in future.

The Committee also welcomed the report of a Korean survey conducted in Korean waters of the East Sea from April/May in 2007 (SC/60/NPM1). During about 1,050 n.miles of searching (covering about 6% of sub-area 6), a total of 21 primary schools (22 animals) of common minke whales were sighted by the primary platform. Sighted

minke whales were aggregated in coastal waters; only three were observed in offshore waters. Field efforts to collect data for estimation of $g(0)$ were unsuccessful. The Committee noted that this area had now been surveyed seven times since 1999 using the same vessel and the same protocol. This time series is potentially valuable for investigating trends and the Committee **recommends** that surveys continue in this manner in this area.

SC/60/NPM2 reported an abundance estimate of 501 (CV=0.38) common minke whales from a survey conducted in Korean waters of the East Sea/Sea of Japan in 2007. This estimate is not corrected for $g(0)$ and distance and angle experiment data collected were not incorporated into the analysis. The Committee **recommends** that this be done.

SC/60/NPM6 also reported the results of analyses to estimate the abundance of minke whales from recent Korean surveys. In the Yellow Sea surveys (the eastern part of sub-area 5), abundance was estimated at 1,685 (CV=0.24) in 2001 and 1,287 (CV=0.65) in 2004. In the East Sea surveys (western part of sub-area 6), abundance was estimated at 527 (CV=0.20) in 1999, 738 (CV=0.41) in 2000, 437 (CV=0.33) in 2002, 758 (CV=0.68) in 2003, 1,349 (CV=0.52) in 2005, 1,286 (CV=0.31) in 2006 and 501 (CV=0.38) in 2007. These estimates are not corrected for $g(0)$. The Committee again **recommends** that the distance and angle experiment data collected be incorporated into future analyses.

The Committee welcomed this comparison of estimates. In discussion, it was noted that the area surveyed in each year was different and that the blocks also changed from year to year. In particular, the boundaries of and coverage within the offshore blocks were highly variable from year to year. The inshore area covered is more consistent but has also changed over time to a lesser extent. The Committee **recommends** that data from the Korean surveys in sub-area 6 be analysed in as consistent a manner as possible in order to investigate trends in abundance over time. The survey platform has been the same in all surveys so data can readily be pooled, using covariates such as sea state, year, and possibly observer as well as perpendicular distance in models to estimate the effective search width. Model averaging may also be appropriate, as may selection of a common area that had been surveyed consistently over all years. The Committee looks forward to the results of such an analysis at next year's meeting.

SC/60/NPM5 reported conventional line transect abundance estimates of common minke whales in Japanese waters in sub-areas 6 and 10 ($g(0)$ was assumed equal to 1) corrected for measurement errors. The survey methods followed the guidelines for conducting sighting surveys under the RMP (IWC, 2005c, pp.92-101) and were under Committee oversight. Abundance estimates were obtained for 6EN and 6ES in sub-area 6 and 10E and 10W in sub-area 10 (Annex G1, Appendix 2). Estimates in block 6EN were similar at 1,441 (CV=0.54) in 2002 and 1,319 (CV=0.37) in 2003. In block 6ES, abundance was estimated as 365 (CV=0.73) animals in 2002 and 111 (CV=0.50) animals in 2003. In block 10E, the point estimates in 2002 and 2003 were different: 1,441 (CV=0.57) in 2002 and 401 (CV=0.64) in 2003, which might be explained at least partially by much colder sea surface temperature in 2003 than in 2002. In block 10W, abundance was estimated at 2,891 (CV=0.32) in 2006.

These estimates are neither corrected for $g(0)$ nor for whales in unsurveyed waters on the continental side of the sea. The Committee welcomed this paper, particularly the presentation of a comparison of estimates in one paper. In discussion, it was noted that if data were pooled over years, a common detection function could be estimated and estimates could be made for years in which there were insufficient data for independent analysis. It was noted that the effective search width in 2002 and 2003 might better be estimated by using vessel as a factor rather than simply pooling data over vessel. The Committee **recommends** that these analyses be conducted and results presented to next year's meeting.

SC/60/NPM7 provided the abundance estimates in Russian waters of sub-area 10 (10W) in 2006, taking $g(0)$ estimation into consideration. The analyses were conducted using the OK method (Okamura and Kitakado's method, see SC/60/IA8 and Annex G), a hazard probability model that was originally developed to estimate Antarctic minke whale abundance. The estimated $g(0)$ values were much higher than those estimated for North Atlantic minke whales; the authors noted that the reason for this difference is not clear and this requires further investigation. The estimated abundance in the Russian waters was 3,322 (CV=0.41).

The Committee welcomed this analysis in response to a recommendation last year and a number of suggestions were made to improve the estimate. The Committee looked forward to results based on the larger sample size observed in the 2006/07 surveys.

Last year, an *ad hoc* working group had been established to examine methods for estimating abundance, including taking additional variance into account when combining multi-year surveys. Methods for estimating abundance by survey block were proposed (Annex G1, Appendix 2). In discussion, it was clarified that focusing on the surveys conducted in mid-April to early-June (or alternatively early May to late June) would lessen possible double-counting of animals during the northward and southward migrations. In addition, because the surveys were partially conducted from north to south during the northward migration, double-counting during the surveys themselves should be lessened. However, further consideration of migration in relation to which abundance estimates to use is needed. The Committee **encourages** the work proposed in Annex G1 (Appendix 2) to be completed and looks forward to receiving the results at next year's meeting.

Plans for a sighting survey in the East Sea in April/May 2009 were presented (SC/60/NPM3). The Committee welcomed this survey plan, made a number of recommended improvements and appointed An to provide Committee oversight. A Working Group was established under Miyashita to plan the sighting survey (Q16).

The Committee was informed of the activities of the intersessional group on collaboration between countries to obtain complete survey coverage of the region. The Committee was pleased to be informed that two Chinese scientists had participated on the Korean survey last year and had been invited to participate on the survey this year. No progress had been made on cooperation with North Korea. The Committee thanked the intersessional group for its work and encouraged future efforts to obtain complete survey coverage in the region.

10.6.3 Other
No new information on catch data was received. The Committee was informed that attempts were continuing to find missing information related to Korean CPUE data. The Committee **reiterates** its encouragement for these attempts to continue because of the importance of this information for the in-depth assessment. Last year, the Committee had noted that if efforts to find additional information on Korean CPUE data were unsuccessful it would need to consider what inference can be drawn from existing data. This matter will be discussed at the 2009 Annual Meeting.

The question of how information on reported bycatch and other sources of human-induced mortality would be incorporated into the assessment was raised. Time series of historical bycatch estimates provided important information for the assessment, and could be useful for the in-depth assessment. The Committee recalled its discussion over a number of years on the possibility of generating time series of bycatch per unit effort. The Committee was informed that a revision in the law in Japan meant that bycatch now had to be included in the DNA register and the Japanese Progress Reports include all information on bycatch. In Korea, information on all bycatches is reported although a concern about unreported catch was raised. The Committee **recommends** that work be undertaken to attempt to generate such time series data.

The Committee again **expresses its concern** about the continued high levels of reported bycatches of minke whales from the J-stock and other coastal population as well as recent suspicion of illegal catches from J-stock.

The Committee **agrees** that more complete information on the migration of minke whales through the Sea of Japan (sub-areas 6 and 10) would greatly assist the assessment and **encourages** members to provide any new relevant information on this topic.

10.6.4 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

10.7 Western North Pacific stock of gray whales (Annex F)
10.7.1 New scientific information
SC/60/BRG7 presented data on gray whale observations (sightings and catches) in the Okhotsk Sea as recorded in the logbooks of American whaling voyages in the 19th century. The information from whaling logbooks may be of potential value in the planning of survey effort and in formulating or evaluating hypotheses on sub-stock structure.

SC/60/BRG3 presented research on the western gray whale population summering off northeastern Sakhalin Island, Russia. Since 1995, the collaborative Russia-US research programme has produced important information on the present day conservation status of this critically endangered population. In 2007, 83 whales, including nine calves and two previously unidentified non-calves were photo-identified. The 1994-2007 catalogue includes 169 individuals although not all are assumed to be alive. Biopsies of 142 (84%) have been collected.

SC/60/BRG11 provided an update of the population assessment considered last year, incorporating data from the 2007 field season and using the photo-identification data discussed in SC/60/BRG3. Forward projections of the population model to 2050, assuming no additional mortality or disturbance to reproduction, indicate a high probability (>99%) of population increase. Five whales (all female) have been caught or found dead on the Pacific coast of Japan during the past 36 months, at least four of which died in fishing nets. Projections of the female population incorporating this level of extra mortality indicate a high (~25%) probability of population decline and a substantial (~10%) risk of extirpation by 2050. The Japanese scientists noted that the government of Japan will continue to make every effort to reduce anthropogenic mortality and implement practical recommendations adopted by the Committee and that no anthropogenic deaths were reported in Japan in the last year. This is discussed further under Item 10.7.2.

It was noted that whilst the small size of this population (around 130 animals) and the effects of continued additional mortality meant that it remains critically endangered, it was encouraging to note from the analyses in SC/60/BRG11 that the population had been increasing up to at least 2005 and that the calving interval had decreased.

SC/60/BRG16 presented progress made on an ongoing analysis of seasonal and annual variation in the body condition of western gray whales off northeastern Sakhalin Island, Russia. Photo-identification images of 150 whales collected by the Russia-US western gray whale research programme (see SC/60/BRG3) between 1994 and 2005 were used to visually assess western gray whale body condition. The Committee complimented the authors for this work and welcomed the fact that the results of the analysis of the body condition of individually identified whales will be incorporated into the population modelling work. Ilyashenko requested more information on the future of skinny whales and survival of skinny calves.

SC/60/BRG9 provided an executive summary of the Northeast Sakhalin Gray Whale Monitoring Program in 2007. Vessel and shore-based surveys carried out during the summer-autumn season showed that the distribution of gray whales in their feeding areas in both the Piltun and the offshore feeding areas changed in comparison to the previous year. The total number of whales identified off northeast Sakhalin in 2007 increased from 2006 (from 126 to 131 individuals), based on photo-ID data. In discussion of this paper, the Committee noted that it was difficult to properly review summary documents that presented little detail of the methods used; primary papers were preferable. This is considered further below.

SC/60/O8 reported that on 1 January 2008, Japan had introduced a new regulation regarding gray whales incorporated into the 'Fisheries Resources Protection Law'. The Committee **commends** the Government of Japan for this action (and see Item 4.1.2). In discussion it was noted that although they could not definitively rule out human interactions as a contributor to the stranding, the research team's conclusions were that it did not appear that the stranded gray whale reported in SC/60/O8 had been bycaught and then stranded afterwards.

10.7.2 Conservation advice
The Scientific Committee and the Commission have expressed concern about the critically endangered western gray whale on a number of occasions (e.g. IWC, 2007b, pp.35-36). Particular attention has been focused on existing

and planned oil and gas developments which pose potentially serious threats to the population through habitat damage, ship strikes, noise and oil spills. More recently, entanglements in fishing gear in Japan have been shown to pose a serious threat to the population. The following recommendations and advice are aimed at improving the conservation status of the population and progress on a number of issues raised in previous reports of the Committee is updated.

The Committee welcomed the papers provided this year on western gray whales and discussed above. For future meetings, it **reaffirms** its view that rather than executive summaries of extensive research programmes, full papers on the various components of the programmes be presented to facilitate a complete scientific discussion of the work undertaken.

The Committee was pleased to hear that the IUCN Western Gray Whale Advisory Panel (WGWAP) had established a photo-identification 'Task Force' that had facilitated the comparison of the photo-identification catalogues (or reference set of photographs) maintained by the Russia-US research programme (initiated in 1995) and the Russian research programme (initiated in 2002). The two catalogues had been cross-matched by representatives from both teams and an independent reviewer in October 2007. The catalogues exchanged included 150 individuals identified by the Russia-US programme between 1995 and 2005, and 135 whales identified by the Russian research programme between 2002 and 2005, in both cases off the coast of northeastern Sakhalin Island, Russia. The cross-comparison resulted in 130 matches between the catalogues, with 20 and 5 whales unique to the Russia-US and Russian programme catalogues, respectively (see *http://cms.iucn.org/wgwap/publications_and_reports/index .cfm*). The Task Force concluded that the work of the two teams was complementary. The Committee **recommends** that an updated cross-comparison of the two catalogues take place annually and that an evaluation of resightings and potential joint analyses be completed as soon as possible.

In order to provide advice on minimising potential disturbance to whales from the two photo-ID research programmes working in the same general region off Sakhalin, the WGWAP Photo-ID Task Force recommended that an analysis be carried out to evaluate the extent of overlap in research effort (in space and time) between the two programmes. The Committee **encourages** this work and the plan of the WGWAP to examine this further. It looks forward to receiving a report on the outcome. In this regard, Ilyashenko expressed his concern about the potential effects on this small population of the extensive research conducted by several groups working off Sakhalin Island involving frequent approaches for photo-identification and biopsy sampling over the last several years.

As discussed above, SC/60/BRG11 provided valuable information on the status and dynamics of western gray whales from photo-ID and genetic data provided by the Russia-US programme, including detection of a significant male-biased sex ratio for calves and a shortening of the modal calving interval for reproductive females. These results illustrate the value of the photo-identification and genetics data collected and the Committee **recommends** that this research programme (photo-ID and biopsy),

continue in order to provide the basis for future assessments of the population's status. The Committee **concurs** with the view of the WGWAP on the value of integrating (where possible) in assessments, the photo-ID data from the two complementary research programmes working in the area.

The Committee also **welcomes** updated information on western gray whales photo-identified off southeastern Kamchatka in summer 2007 (SC/60/BRG9). Given the importance of such work to the understanding of the range of western gray whales and the relationship between western and eastern gray whales, the Committee **recommends** the continuation, and if possible extension, of work in this area and other parts of the suspected range, and looks forward to the presentation of the results of such work at forthcoming meetings. Examination of issues related to stock structure and other population characteristics, based on individuals photographed off Kamchatka or elsewhere, will be greatly facilitated by comparison of the photographs with both western gray whale catalogues, and the Committee **recommends** that such comparisons be undertaken.

The Committee **reaffirms** the potential disturbance to western gray whales caused by the oil and gas developments near the Sakhalin Island feeding ground. As offshore oil and gas activities continue and expand off Sakhalin and elsewhere in the Okhotsk Sea, there will be a need for repeated seismic surveys over time, creating the distinct possibility of sequential or simultaneous surveys being conducted by the various operators working in the region. While two surveys, one in 2001 by ExxonMobil (Johnson *et al.*, 2007) and one planned for 2009 by Sakhalin Energy Investment Company (see *http://cms.iucn. org/wgwap/publications_and_reports/index.cfm*) have been carefully designed to monitor and mitigate possible disturbance to feeding whales, there is no assurance that other operators in the area will adhere to such rigorous planning. Obtaining information from some operators on when and where seismic surveys in the area will occur has often proved difficult. In the light of the potential disturbance to this critically endangered population from seismic surveys, the Committee **emphasises** the importance of having information regarding planned surveys made available to the Committee and others (e.g. WGWAP) well in advance of planned operations. This would allow evaluation of planning efforts and proposed monitoring and mitigation actions prior to implementation of a seismic survey. The Committee **urges** all oil exploration companies to participate fully in the process by providing timely information.

In this regard, the Committee **acknowledges** the value of the distribution and density data collected by the Russian research programme as well as the acoustic modelling efforts in helping to formulate advice on how to mitigate potential impacts from seismic surveys and **recommends** that such efforts be continued in the future.

In addition to these threats on the feeding grounds, western gray whales face threats throughout their range, for example from bycatch in fishing gear. For the August 2007 stranding reported in SC/60/O8, and any future strandings and/or fatal entrapments, the Committee **recommends** that range states make every effort to determine if the stranded or entangled individual(s) can be matched to known individuals in the two available photo-ID catalogues

and/or the genetic archive of the Russia-US research programme and to determine the cause of death. The Committee **recognises** the difficulty in determining anthropogenic causes of mortality especially in large whale strandings where the animals rapidly decompose. Therefore the Committee **recommends** that all range states make every effort to document stranded or floating dead animals (including taking photographs) and to examine each carcass thoroughly as soon as possible after discovery. Evidence of human interaction may rapidly disappear as the animal decomposes.

The Committee **reiterates** the fact that the development of mitigation measures for the threats to the western gray whale population are greatly hindered by the lack of information on migratory routes, breeding destinations and extent of its feeding range. The Committee has recognised the great value of telemetry work to providing this information, but also the need to exercise great care before undertaking such work on an endangered population. Last year, a coordination group had been established, to provide scientific advice and ensure consistency between the IWC Scientific Committee's recommendations and those of the WGWAP. Noting that any telemetry work will occur in Russian waters, the Committee **suggests** that a Russian scientist be identified and added to this coordination group. An intersessional correspondence group was formed under Childerhouse (Q4) to discuss telemetry and its potential effects on whales in preparation for a joint session of IA/BRG/SH at the next Annual Meeting.

The Committee has previously noted the urgency of reducing anthropogenic mortality to zero in this population (e.g. IWC, 2008) and several suggestions were made towards developing an effective mitigation strategy for releasing entrapped animals. The Committee **reaffirms the urgent need to reduce anthropogenic mortality to zero** in this critically endangered population. The Committee was pleased to be informed that Japan has implemented administrative guidance to release gray whales bycaught in set nets and amended the Fisheries Resources Protection Law to prohibit catch of gray whales in Japanese waters as well as sale and possession of gray whale products (SC/60/O8). The Committee noted that such action addresses some of the elements in the mitigation strategy the Committee considered last year. The Committee **commends** Japan for taking this important conservation measure and **encourages** Japan to continue working towards providing fishermen with incentives to release trapped whales immediately on discovery and ensure that trapped animals are released alive. The Committee also **encourages** other range states to continuously pursue all practical actions to eliminate anthropogenic mortality in this population and to minimise anthropogenic disturbances in the migration corridor and breeding and feeding grounds. Noting that the planned IUCN range-wide workshop in September 2008 intended to facilitate this, the Committee **endorses** the IUCN workshop and looks forward to reviewing the workshop report at the next Annual Meeting.

Finally, the Committee **endorses** the work of the WGWAP, acknowledging its overall contribution to the conservation of western gray whales, and **recommends** continued cooperation between the Committee and the IUCN/WGWAP. In addition, the Committee **commends**

the participation of the oil company Sakhalin Energy Investment Company in the WGWAP process, and **recommends** that other oil and gas development companies working on the Sakhalin Island shelf cooperate fully with the WGWAP process.

10.8 Other (see Annex F)

10.8.1 North Atlantic right whales
SC/60/ProgRepUSA outlined ongoing studies conducted on North Atlantic right whales. Scientists from the USA conducted biopsy sampling, photo-identification work, and deployed time-depth recorders on North Atlantic right whales. None of these studies were presented or discussed by the Committee.

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 and encourages the USA to provide annual updates on the status of this population.

10.8.2 North Pacific right whales
The eastern North Pacific right whale population is known to be extremely small; although there are no agreed estimates, it is generally agreed that the population contains fewer than 100 individuals. The Committee noted that budget constraints have restricted survey effort in recent years. The US Minerals Management Service is now funding studies of distribution, abundance, genetics, acoustics, foraging ecology and satellite tagging in the Bering Sea. The Committee **expresses concern** about this probably small population and **encourages** this research be carried out as soon as possible to determine distribution and abundance.

10.8.3 Small stocks of bowhead whales
SC/60/BRG32 reported on the results from two surveys for bowhead whales in the northeast Atlantic along the ice edge between Svalbard and Greenland in April 2006 and March 2008. In 2006, about 20 bowhead whales were observed at eight locations between 80°N and 81°N. Reviewing the available information, the author concluded that there has been an apparent increase in observations of bowhead whales in the area between East Greenland and Franz Josef Land in recent years. It is not known whether these sightings are animals that are stragglers from other areas or survivors of the Spitsbergen stock. If these few animals are from the Spitsbergen population, it is probably one of the most endangered stocks of large whales in the world. The Committee **recommends** additional work to clarify its status as soon as practicable.

SC/60/BRG35 reviewed the scant information on bowhead whales in the Okhotsk Sea; it has been poorly studied and little is known about its distribution and current status. Whaling on this population began around 1846, was pursued intensively for two decades, and continued sporadically until about 1913. Catches resumed in 1967 when the USSR began taking bowhead whales illegally, although the number of whales taken remains unknown. Estimates of pre-exploitation population size have ranged from 3,000 to 20,000 whales. Genetic data indicate that the Okhotsk Sea stock is separate from the Bering-Beaufort-Chukchi population, but that the two populations share a common ancestry. The Committee thanked the authors for this review. In light of its recent history of exploitation, probable small size and unknown anthropogenic threats,

the Committee expressed great concern about the status of this stock. It **recommends** that further work to investigate its status be conducted as soon as possible.

10.8.4 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

10.9 Progress towards a proposal for an in-depth assessment of North Pacific sei whales
The last assessment of North Pacific sei whales was conducted in 1974 (IWC, 1977). Last year, recommendations were made for work to prepare for an in-depth assessment of North Pacific sei whales (IWC, 2008f, p.190). This year various items of work were assigned to individuals (Annex G, Appendix 5). The work topics are: catch history; stock structure; abundance, distribution, and trends; and biological parameters. The group focussed on non-JARPN sources of information, because analyses of JARPN sei whale abundance, stock structure and distribution are expected to be submitted to the forthcoming JARPN II review. The Committee **recommends** the work plan in Annex G, Appendix 5 and **agrees** that the intersessional group (Q15: Cooke, Allison, Brownell, Kato, Miyashita and Ohsumi) should continue and report next year. Based on the group report and the Committee's other work priorities, a decision can be made at the 2009 Annual Meeting as to when to initiate an in-depth assessment of North Pacific sei whales.

10.10 Work plan and budget request
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

11. STOCK DEFINITION (SEE ANNEX I)

11.1 Statistical and genetic issues related to stock definition
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, 2008, Annex F). 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[7], and have re-emphasised the importance of developing suitable quality protocols for genetic data used in providing management advice. There are associated issues in terms of the Data Availability Agreement (DAA), 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 Stock Definition Working Group (SDWG) developed an initial proposal for such a protocol (IWC, 2008h, p.229), which has already been of value in the Scientific Committee's discussions this year.

This year, the SDWG reviewed and updated its proposals on DNA data quality control for genetic studies relevant to IWC management advice (Annex I, Appendix

2). The guidelines address commonly-used DNA marker types (sequences; microsatellites; mitochondrial DNA; Single Nucleotide Polymorphisms, (SNPs); possibly nuclear DNA sequencing in the future) and two distinct aspects of DNA data quality: marker validation (related to intrinsic characteristics of loci), and systematic quality control (related to sufficiency of tissue, sample quality, and adequacy/consistency of subsequent lab processing). A literature list is included, but there are currently no suggestions for numerical benchmarks of DNA data quality; a review will be compiled intersessionally and the matter will be a priority topic at next year's meeting. The guidelines and considerations represent common practice subject to ongoing discussion, and will need maintenance in future meetings; the topic of DNA analysis in population genetics continues to develop rapidly.

The Committee **endorses** the detailed recommendations in Annex I, Appendix 2. Although compliance to the guidelines is highly desirable, this may not always preclude consideration of genetic work failing to fully meet these standards. All submitted studies should endeavour at least to report on the extent to which the guidelines in Appendix 2 have been met; it was noted that this reporting requirement might be appropriate for the *Journal of Cetacean Research and Management* (see Item 25). The guidelines will assist the Committee in judging the respective reliability of information from genetic studies. At least for future studies explicitly carried out to provide stock structure advice in a management context (e.g. with respect to the RMP and AWMP), the Committee **strongly recommends** adherence to the guidelines.

The Committee also **agrees** that it would be useful and possible to begin developing analogous guidelines on the various population genetic analyses that can be applied to reliable DNA data. There are two levels to this: commenting on the properties of commonly-used (but not always fully-understood) fundamental procedures, such as multiple hypothesis testing; and summarising in lay terms the scope and limitations of 'higher-level' population genetic methods (e.g. STRUCTURE). An intersessional e-mail working group under Waples (Q20) will prepare an initial discussion document for discussion at next year's meeting.

11.2 Review of progress on the Testing of Spatial Structure Models (TOSSM) project
The Committee instigated the TOSSM project in 2003 (IWC, 2004b, pp.27-28; 2004d, pp.469-85). The main aim is to develop simulation tools that can be used to examine the performance of current and future genetic population structure techniques, akin to the simulation-testing approach used in the RMP and the AWMP. The focus of TOSSM is on management implications, in that the genetic techniques are used to suggest management boundaries, which in turn are used to set or subdivide catch limits according to a prespecified rule; the performance of different genetic methods is ultimately to be assessed in terms of how well a simulated management regime performs (in the context of conservation and productivity) if the suggested boundaries are used. There is little tradition in population genetics of such management testing. Further, there is often a considerable gap between what parameters a population genetics method is designed to estimate, and what parameters are required for reliable

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[7]Genetic data are also used for other management purposes besides stock structure inference, such as abundance estimation and species ID. Discussions in the Stock Definition Working Group have, understandably, focused on stock structure applications, but most of the fundamental data quality issues also apply more generally.

management advice; this gap needs to be bridged somehow, both for simulation testing and for specific management cases. TOSSM was (and is) therefore an ambitious project with several phases of development. By last years' meeting, TOSSM had been used to test Boundary-Setting Algorithms (BSAs) based on five population-genetic methods (Geneland, STRUCTURE, BayesAss, Mixprop and sequential hypothesis testing; see (IWC, 2007a, pp.489-98; 2008i) on simple population scenarios.

This year, substantial improvements were made to the TOSSM package (i.e. the computer program) itself, including implementation of fully-spatial sampling and harvest, graphical outputs, and an alternative algorithm for setting catch limits. In addition, the datasets and settings for the Initial Performance Trials specified last year (IWC, 2008h) have been created. A paper on TOSSM is about to be submitted to a population genetics journal, summarising the package and showing how it can be used to evaluate the management performance of a very simple BSA (see Annex I and SC/60/SD2). The Committee **welcomes** this important link with the population genetics community. It was reported this year that TOSSM has also been used in some non-IWC applications, because of its general suitability and comparative ease of use for mammal-like population dynamics. This outreach has always been an important objective of TOSSM.

Underlying the Scientific Committee's discussions of population structure, there is a fundamental question: how high would the dispersal rate between breeding subpopulations need to be to avoid local depletion under single-stock RMP management? SC/60/SD3 used TOSSM simulations to address this in the context of a simple two-subpopulation scenario, with dispersal between the breeding grounds but no mixing on the feeding/ sampling/harvest grounds. If subpopulations are of unequal size and harvesting was concentrated on the smaller (i.e. not fulfilling the RMP definition of a *Small Area*), local depletion under single-stock management could result even when $MSYR_{1+}$ is 4% and dispersal is high (0.5% per year) - a rate higher than population-genetic methods would normally expect to detect in large populations. The results reaffirm the value of spatially-diffused harvest in avoiding local overdepletion, and the need to use the most powerful population genetic methods (or indeed other methods) in order to minimise the range of dispersal rates that would not be detected.

TOSSM was also used to test four further BSAs in simple scenarios (one, two or three subpopulations with limited dispersal but no mixing). One method (Wombling) performed poorly, but two others (Monmonnier and Waples/Gaggiotti) did rather better than has been the experience in previous TOSSM trials, being able to successfully detect dispersal rates less than 0.05% per year. Combined with paper SC/60/SD3, there seems to be about an order-of-magnitude gap in the range of dispersal rates that are too low to allow single-stock management without local overdepletion, but too high to be detected with the methods tested to date. This gap is considerably narrower than in previous years. These conclusions are of course specific to the one scenario and sample size examined (30 microsatellite loci, 600 sample animals, combined population size 7,500; for further details see SC/60/SD2 and SD3) and further work is needed.

The fourth analytical method tested this year (in SC/60/SD5) was quite different to anything examined in TOSSM so far. Genetic data are used to identify closely-related individuals within and between two or more hypothesised breeding populations, and the decision as to whether separate management is required depends on the proportion of related pairs that cross the hypothesised boundaries. The method, which is still at an early stage of development, showed impressive performance, quite often successfully identifying the need for separate management even at the 0.05% per year dispersal rate at which no other methods have been effective. Since the method does not require genetic differences between the subpopulations, it is, for example, capable of distinguishing recently-separated populations. A number of issues were highlighted which might require attention in different scenarios (see Annex I), and the Committee **encourages** further work on this approach.

Prior to this meeting, no population genetic method tested in TOSSM had shown much ability to detect the need for separate management when the dispersal rate between subpopulations is high[8]. However, this year several methods have shown promise, even at fairly high dispersal rates, in certain scenarios. It is therefore now worthwhile to expand the range of scenarios tested, both towards general archetypes of population structure and towards more specific scenarios related to issues of immediate concern to the Committee.

Directions for further work in TOSSM over the coming year fall into four main categories. First, individual developers will continue to implement and test further analytical methods within TOSSM. Second, a number of technical issues are identified in Annex I, both following on earlier TOSSM plans (e.g. implementing a population archetype that has clinal structure), and from results at this year's meeting (e.g. handling dispersal between subpopulations of unequal size). Third, there is a need to provide standard documentation for inclusion in papers, concerning TOSSM itself and the specific simulated datasets available on the TOSSM website, and to add automatic tools within TOSSM for summarising population-genetic parameters of the datasets, as well as management-oriented parameters and performance statistics. This will facilitate presentation of results and interchange/uptake with the non-IWC population genetics community.

Finally, the Scientific Committee's current priorities include a number of hypothesised population structures that are more complex than the archetypes in TOSSM to date, which have been deliberately kept simple in order to develop our understanding of the various genetic analytical methods under test. TOSSM has now reached the point where more complicated and realistic scenarios can usefully be tested, and the TOSSM Steering Group (Q18) will select a subset of such for intersessional development.

Overall, it is encouraging to see that a number of different developers (some new to TOSSM) have been able to get stock structure methods running inside TOSSM over the last two years, and that there is now some non-IWC usage too. This impressive level of uptake is undoubtedly due to the major improvements made intersessionally in developing and documenting the TOSSM code. These improvements have been made possible by the

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[8] 'High' means high in population-genetic, not management, terms.

employment of a dedicated programmer, whose position at SWFSC has over the last two years been part-funded by the US Government and part-funded (50%) by the Scientific Committee.

11.3 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

12. ENVIRONMENTAL CONCERNS
(SEE ANNEX K)

12.1 Workshop on skin diseases in cetaceans in South America
A Workshop entitled 'Skin Diseases in Cetaceans' was held in Santiago, Chile from 30-31 May, 2008 (SC/60/Rep8). The state of knowledge on the examination of, distribution of, and causes of skin diseases in cetaceans was reviewed with a focus on cetaceans of South America. Overall, there were 19 presentations which included overviews of skin diseases of cetaceans worldwide, specific discussions on known etiological agents such as poxvirus, reviews of specific lesions in various baleen whales and small cetacean populations, and reviews of epidemiological, modelling and diagnostic approaches to determine impacts and causes of skin diseases in cetaceans. The Committee **recognises** the potential for impacts of skin diseases in small populations of cetaceans especially in areas in which there are high levels of environmental degradation and **agrees** that special attention should be given to the prevalence and impact of skin disease in dolphins from southern and southeastern Brazil.

Three categories of recommendations were formulated:

(1) research needs - including pathogenesis, aetiology, research questions addressing risk factors and exposure characterisation to environmental pollutants and other anthropogenic factors;
(2) standardisation - of protocols, disease and lesion characterisation, and data analyses standards; and
(3) enhanced information dissemination.

To advance research, the Committee **recommends** that long-term datasets be evaluated for specific epidemiological outcomes and that whenever possible, tissue samples of lesions (including the borders of the lesions) be obtained and evaluated. To support standardisation, the Committee **recommends**: (1) that a list of appropriate diagnostic laboratories be developed by country/region and that standardised environmental measures be included in areas in which the biological studies on skin diseases in cetaceans are ongoing; and (2) the development of standardised protocols for the collection of the samples and the assessment of lesions given the critical importance of lesion documentation through photography and sample analysis. The Committee also **recommends** that avenues for information dissemination be developed including the use of current and newly emerging information technology mechanisms to enhance collaboration and data sharing. In addition, the Committee **strongly encourages** the use of meetings at regional, national and international levels for information dissemination, discussion and data sharing. Finally, the Committee **endorses** the formation of a sub-group under its Cetacean Emerging and Resurging Disease (CERD) Working Group (Q26) to produce standardised protocols for assessing skin diseases in cetaceans and that the CERD co-Convenors solicit scientists with relevant expertise to participate in this skin disease sub-group.

12.2 Planning for the 2nd Workshop on Climate Change
It is now almost 12 years since the first IWC Workshop on Climate Change and Cetaceans. Climate forecasting is now within the context of the 4th IPCC report, which provides both conclusive evidence of climate change and analyses at temporal and spatial scales of relevance to cetaceans (*http://www.ipcc.ch/*). As agreed last year, an intersessional scoping group met and developed a provisional outline for a second workshop to be held at the University of Siena (Appendix 3) in spring 2009. The outline was reviewed and amended by the Committee (see Annex K).

The primary goal of the Workshop is to determine how climate change is/may be affecting cetaceans now and how it may in the future and how best to determine these effects. The Workshop will bring together - and enhance collaborations amongst - experts in cetacean biology, modeling, marine ecosystems and climate change, as well as reviewing current understanding and seeking to improve conservation outcomes for cetaceans under climate change scenarios described in the IPCC 4th report. A five day Workshop is envisaged. The Workshop will be convened by Simmonds and chaired by Gales. A Steering Committee has been established (Q23) to agree a final agenda and list of invited participants.

12.3 Planning for POLLUTION 2000+ Phase II
Due to time constraints, the POLLUTION 2000+ Phase II modelling Workshop planned for spring 2008 was not held. A new steering group (SG) has been assembled (Q25), based on recommendations of the Workshop held in Barcelona in 2007 (IWC, 2008a). The field and analytical programmes of Phase I will be augmented by two new efforts: (1) a modelling/risk assessment Workshop; and (2) validation and critical assessment of biopsy techniques, with applications to large whale species selected for study during the new programme. The SG is finalising plans for the intersessional Workshop (Annex J, Appendix 4), that will emphasise:

(1) establishing a framework for modelling the effects of pollutants on cetacean populations;
(2) identifying cetacean populations to be studied;
(3) developing protocols for validating biopsy samples with respect to pollutant studies and applying the protocol to large whale species; and
(4) developing proposals for terms of reference for Phase II of the programme.

12.4 Cetacean Emerging and Resurging Disease (CERD) Report
The terms of reference for the CERD Working Group (Q26) developed last year included two specific tasks for review at SC/60: (1) preparation of an information table that will provide available information on cetacean pathogens, biotoxins, and disease reports; and (2) organisation of a focus topic on the examination or review of cetacean skin disease with specific emphasis on the issues in South America (see Annex K, item 12.1). The CERD WG evaluated two types of information table: a list of pathogens and biotoxins that have been associated with

disease in marine mammals (Annex K, Appendix 5, table 1), using a ranking system adapted from Gaydos *et al.* (2004); and a collation of written reports on diseases, pathogens and biotoxins published over the last 10 years (Annex K, Appendix 5, table 2).

The CERD WG also reviewed progress with regard to: (1) disease identification and standardisation and case definition; (2) diagnostic laboratories; and (3) data sharing, communication and information dissemination Given the paucity of available or targeted diagnostic laboratories and diagnostic tests specific for marine mammals the Committee **recommends** that it compiles and maintains a list of laboratories and experts for specific or general diagnostic capabilities by country, continent and/or region. There are significant differences in capacity and interest by the different member countries and the Committee should identify appropriate researchers in each country or region to compile such a list through known contacts.

12.5 State of the Cetacean Environment Report (SOCER)

The 2008 version of the State of the Cetacean Environment Report (SOCER; Annex K, Appendix 6) focused on the Atlantic Ocean and, as in past years, also contains a global section. It contains information on issues in the marine environment relevant to cetaceans from 2006 to the present. It is based on input through standardised submission forms and literature searches conducted by the three editors (Q24). An introductory paragraph outlining the history of SOCER was followed by five sections:

(1) a literature analysis;
(2) succinct entries on the Atlantic and;
(3) global events (under headings corresponding to key issues identified by the SWG);
(4) a glossary of terms used in the report (e.g. species names, ecological terms, pollutant types); and
(5) a set of tables providing an overview of specific pollutant levels in cetaceans.

Almost half of all the literature published on cetaceans in 2007 dealt primarily with conservation related issues. The focus of the next SOCER report will be the Pacific Ocean.

12.6 Other habitat related issues

A Workshop entitled 'Monitoring climate change impacts: establishing a Southern Ocean Sentinel program' will be held in Hobart, Tasmania from 20-24 April 2009. The workshop will focus on sentinel species, as well as the entire ecosystem. Members interested in the Workshop were directed to e-mail *sos@aad.gov.au* for additional information.

SC/60/E5 reported at least 45 small cetaceans (beaked whales and pilot whales) stranded over a three month period across the coasts of Ireland and the UK. During the same period, a large number of beaked whales stranded on the coast of France. The scale of this mortality is unprecedented in the northeastern Atlantic, (see Annex K); at present the cause remains unknown.

12.6.1 New information on anthropogenic noise

Two papers addressed the potential impacts of seismic surveys on cetaceans. SC/60/E9 reported a simulation framework that accounted for uncertainty when assessing the risk of temporary threshold shift (TTS) in baleen whales exposed to noise from seismic surveys. The

Committee considered this work a useful contribution towards managing interactions between seismic activities and whales. SC/60/E14 was a preliminary analysis of survey data suggesting that some Bering-Chukchi-Beaufort (B-C-B) Seas bowhead whales continue to feed near seismic operations, in contrast to past reports showing that migrating whales deflect their path at greater distances. The full discussion is found in Annex K, Item 11.1.

An atypical mass stranding event of four beaked whales on 26 January 2006 in the region of Almeria was reported in 2006 (IWC, 2007h), but at that time it was unknown if any naval exercises using mid-frequency sonar had been underway. New information available in an Environmental Impact Statement reported that mid-frequency sonar training had been conducted within 50 n.miles of the stranding site (US Department of the Navy, 2008).

New information on shipping noise and marine mammals included a 'Statement of Participants' from the international workshop on shipping noise and marine mammals convened in Hamburg, Germany (April 2008), where a specific goal for noise reduction was established. The goal is for 'initial global action that will reduce the contributions of shipping to ambient noise energy in the 10-300Hz band by 3dB in 10 years and by 10 dB in 30 years relative to current levels'. The Committee **endorses** this noise reduction goal.

12.6.2 New information on marine renewable energy

A recent European symposium was dedicated to considering impacts from windfarms on marine mammals (Evans, 2008). The authors commented that 'offshore renewable energy represents perhaps the fastest moving industrial development facing the coastal zone of Europe' and noted the extensive developments 'in shallow waters across northern Europe, particularly in a wide band from the Irish Sea eastwards across the southern North Sea to the Baltic.' SC/60/E6 illustrated the extent of current developments in northern Europe where at least 50 marine windfarms exist, are under construction or planned. A more detailed consideration of marine renewable energy issues is anticipated next year.

12.7 Work plan

Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

13. ECOSYSTEM MODELLING (SEE ANNEX K1)

13.1 Planning for the joint CCAMLR/IWC Workshop on modelling Antarctic krill predators

The Scientific Committees of the Commission for the Conservation of Antarctic Marine Living Resources (SC-CCAMLR) and the IWC Scientific Committee have agreed to hold a joint Workshop to review input data required for ecosystem models being developed to provide management and conservation advice on krill predators in the Antarctic marine environment. A joint steering group (JSG; Q28) was established in 2006 to plan for the Workshop following the agreed Terms of Reference (IWC, 2007i).

SC/60/EM6 was prepared by the co-Convenors of the CCAMLR/IWC Workshop on behalf of the JSG (Q28) and reported progress and preparations for the Workshop. The Committee was informed that the work of all the expert groups was progressing well, except for the group on flying birds, for which interim strategies are in place.

The Committee discussed the Terms of Reference for expert groups, and in particular noted the need for clarification of the northern boundary of the study area. The Committee **agrees** that there was a need for some flexibility in this, and noted that the CCAMLR northern boundary was an appropriate limit. The manner in which these various spatial scales will be compared will be a key focus of the Workshop. During a discussion of the data to be compiled by the expert groups, issues of quality and comparability were raised and the Committee **agrees** on the need to clearly specify the data, including a discussion of its potential strengths and weaknesses and whether it is raw or derived from models. Synergies with an upcoming CCAMLR land-based predator Workshop to be held in Hobart in June were noted, and that it will provide useful information for the August Workshop.

A meta-database has been established at the Australian Antarctic Division to act as a repository of the metadata being collated by the expert groups. The metadata and database will be forwarded to CCAMLR and IWC Secretariats when complete. Options for reporting on the outcomes of the Workshop were presented, including the possibility of combining the reports of the expert groups and the Workshop into a book. The Committee **agrees** that discussion of the report format will best be finalised at the Workshop.

The Workshop is open to any member of the IWC or CCAMLR Scientific Committee. The JSG (Q28) has selected potential invited experts and invitations have gone out. The Committee was informed of some changes in the allocation of the budget which allows a greater number of funded experts to attend the Workshop. The change was primarily because no expenditure has as yet been needed in preparation of the papers by the expert groups. The Committee **agrees** with this approach.

SC/60/EM5 provided a summary of the nature of ecosystem modelling platforms in CCAMLR and the IWC. Examples of draft metadata summary tables for the ecosystem models and descriptions of attendant data uncertainties and biases were provided as guides for the expert groups.

SC/60/EM2 summarised the results of the expert group reviewing data on Southern Ocean odontocetes for the workshop. The review briefly considered the main types of data identified by the Workshop steering group (abundance, distribution, population dynamics, feeding ecology, and exploitation). Eight species were identified as being most likely to be ecologically important south of the CCAMLR boundary. It was noted that there is generally less information on Southern Ocean odontocetes than for baleen whales and that analyses to generate abundance estimates from visual surveys are complicated by the duration of deep dives and inconspicuous surface behaviour of many odontocete species. In addition some species show considerable responsive movement. The paper reviewed a number of potential sources of abundance estimates and possible sources of bias. These include IDCR/SOWER, JARPA, Japanese scouting vessel (JSV) and regional multi-disciplinary cruises. The Committee **agrees** that the approach taken by the odontocete expert group is appropriate for the workshop and thanked them for their work.

The Committee noted the importance of further defining the spatial boundaries and possible spatial extrapolations for the odontocete survey data. It also suggested that further detail on available foraging ecology and life history data would be advantageous, and that the nature of uncertainties of these should be discussed. The authors of SC/60/E2 noted that these data were not available for many odontocetes and that modellers will require proxies from elsewhere. The Committee requested that, if possible, the expert group should suggest suitable potential life history or foraging/energetic proxies.

SC/60/EM3 summarised the preliminary results of the expert group reviewing data on Southern Ocean baleen whales for the workshop. The paper contained a description of data sources on the biology, ecology, distribution, habitat utilisation, movements, abundance and trends of baleen whales and includes whaling operations and various research programmes. Emphasis was given to information obtained in the Antarctic (summer/feeding grounds), but in some cases data from low latitudes (winter/breeding grounds) were included. SC/60EM3 also discussed possible uncertainties and biases in estimates of population size and rates of increase from two of the most comprehensive studies on baleen whales in the Southern Hemisphere: the IWC IDCR/SOWER and the JARPA research cruises. Information on consumption rates and life history parameters will be incorporated in the paper before the Workshop in Hobart.

The Committee thanked the expert group on baleen whales for their hard work and **agrees** that the structure of the paper was appropriate for the Hobart Workshop. It was noted that there remain substantial data series to include in the final paper, including catch histories and data from some large-scale, international collaborations such as Southern Ocean-Global Ocean Ecosystem Dynamics (SO-GLOBEC). Zerbini and Tynan were asked to coordinate the summary and access to the SO-GLOBEC series.

The aggregation of information such as multiple rates of increase for different populations was considered. In dealing with these series, the Committee noted that it is important to state whether informative or non-informative priors were used when considering information derived from Bayesian models. It was suggested to combine all data on rates of increase into a single model for each species and use this to investigate the overall rate of increase with a non-informative prior constrained within agreed demographic bounds. It is likely that work of this nature is beyond the scope of the tasks of the expert groups, and that such work will form part of the Workshop.

The Committee noted the need to define the proportion of time each species spends within the CCAMLR and IWC management areas, as well as the influences on population processes that are exerted in other regions, such as sub-tropical breeding grounds.

The expert groups on odontocetes and baleen whales will need to enter their data summaries as meta-data prior to the Workshop. An example of a meta-data summary for pack ice seals, including a brief commentary on biases, was discussed as a template, and the Committee **agrees** this was an appropriate approach.

The Committee **agrees** that the two cetacean expert groups should concentrate on the primary tasks of data compilation, summary and commentary in the period leading up to the joint Workshop. Additional tasks discussed by the Committee would likely form a major part of the Workshop activities in August.

13.2 Other issues

13.2.1 Review and update relevant models

SC/60/EM1 described progress towards the development of ecosystem models to examine trophic interactions between marine mammals and fisheries in northwest Africa, the Caribbean and the tropical South Pacific. The food web models are being constructed using ECOPATH with ECOSIM to examine the potential impact of a reduction in the abundance of great whales on fishery yield. The paper specifically presented preliminary results from a northwest African fishery model. The model includes 10 marine mammal groups and 17 additional groups comprised of fish, seabirds, invertebrates, benthos and plankton. Both local and foreign fleets are included in the model. Preliminary results indicate that: (1) the overlaps between prey species consumed by marine mammals and species target by fisheries is low; and (2) given a wide range of assumptions about whale abundances, diet composition and food consumption in breeding areas, the study consistently found that: (1) whale consumption is several orders of magnitude lower than fishery catches; (2) food intake of whales in the study area is two orders of magnitude lower than the amounts taken by other trophic groups (e.g. pelagic fishes); and (3) in preliminary simulations, reducing whale biomass does not influence the biomass of commercially important fish, nor any other species in the food web. The authors suggest this modelling approach will begin to answer questions about possible competition between baleen whales and commercial fisheries in the regions examined, and will allow the identification of data gaps and additional research needs.

The Committee thanked the authors for presenting their preliminary results. It was noted that the regions selected were primarily baleen whale breeding areas and that the relative lack of trophic interactions with these species and fisheries were thus not unexpected. The authors stated that claims of interactions between cetaceans and fisheries are nonetheless a feature of these regions and that their models will help to better inform these debates. They intend to apply their approach to other areas, including areas of great baleen whale feeding intensity, in due course.

There was substantial discussion of issues related to the use of ECOPATH with ECOSIM. In particular, issues of having to 'balance' the system, with the inherent assumptions this requires were noted. For example, if a system is unbalanced, then assumptions of competition may be wrong. As there are no data on which to assess this assumption, the authors noted that as a preliminary step an assumption of balance was reasonable. Given the issues of scales of uncertainty in the key input parameters (abundance, feeding rates and diet composition), the Committee **notes** the importance of providing a list of estimates and uncertainties. It also noted the importance of describing how data were re-scaled, for example from global to regional estimates. The authors noted the data-poor aspect of the study region and that parameter adjustment and sensitivity testing had been used to assess the effects of estimate assumptions. The Committee **agrees** that quantifying uncertainty, particularly for providing tactical advice, is critical, and relying simply on the 'pedigree' (Christensen *et al.*, 2000) of the data may not be that useful. Any artificial constraints on uncertainty need to be clearly defined and understood.

The Committee **agrees** that factors such as prey resource limitation, diet overlap, and temporal and spatial overlaps in distribution need to be understood before conclusions about competition can be drawn. In addition, despite considerable research over the last 20 years on ecosystems such as the North Atlantic, it still remains difficult to determine feeding functional relationships and their magnitude. These functional relationships risk being pushed unreasonably into fitting the available data using only vulnerability parameters.

The Committee noted the importance of assessing the power of this and other modelling approaches to predicting ecosystem form and function, and **agrees** that simulation testing of multiple models is a valuable approach. Within such an approach, the sensitivity of each model to single or multiple parameter adjustment would be required. Additionally, the use of Monte Carlo simulations was suggested in order to add a range of variation to each parameter and varying them at the same time would produce a range of outputs for each parameter. However, this assumes that uncertainties are not correlated.

The Committee **agrees** that the ecosystems that we are attempting to model are extremely complex and dynamic, so a wide range of modelling efforts should be applied and assessed. The Committee **reaffirms** the conclusion of the IWC intersessional meeting in 2002 which '….agreed that no single approach could be recommended at this stage to provide reliable information of value to consideration of cetacean dynamics in an ecosystem context. However, this does not necessarily rule out the possibility of inferences that could be drawn if a number of different approaches yield qualitatively similar results' (IWC, 2004a). The Committee **agrees** that it may be some time before this situation changes.

SC/60/EM4 summarised the conclusions from a July 2007 FAO workshop on modelling ecosystem interactions for informing an ecosystem approach to fisheries (EAF). The group considered that ecosystem models are not yet at the stage where a single model of this type could be selected as a 'management model'. Rather they considered that the immediate use for such ecosystem models was to provide a range of operating models for testing simpler models (e.g. the RMP) for providing management advice, so as to confirm that these provided satisfactory and robust performance in the presence of ecosystem interactions and objectives related to ecosystem aspects.

13.3 Work plan

Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

14. SMALL CETACEANS (SEE ANNEX L)

14.1 Review of conservation issues regarding small cetaceans in the southeast Pacific

The southeast Pacific region extends along the coast of western South America from about 8°N to 60°S and includes Colombia, Ecuador, Peru and Chile. The westward extent of the region was set at 120°W for purposes of this review. The coastline runs mostly north-south and the adjacent continental shelf is extremely

narrow. Several oceanographic regimes characterise the region, including the Intertropical Convergence Zone, the Colombia current, Equatorial Front and the Humbolt (Peru-Chile) current. At least 39 species of small cetaceans have been documented in this geographical area, including 12 Ziphidae, 22 Delphinidae, two Phocoenidae, two Kogidae and one Iniidae. In considering the priority topic, the Committee did not adopt a species by species approach, but rather reviewed all species under each main agenda item, with a view to identifying information gaps and highlighting issues/areas/species of concern.

14.1.1 Abundance and distribution
Information on small cetacean distribution and abundance was provided in a number of papers, full details of which are in Annex L, using different methods, including dedicated surveys (SC/60/SM4, 7), platforms of opportunity (SC/60/SM4, 7, 11, 23), strandings (SC/60/SM21) and photo-ID (SC/60/SM23).

In general, large parts of the southeast Pacific coast of South America have not been covered by surveys. The Committee **recommends** that further surveys be conducted at regional and local scales to better quantify the abundance and distribution of small cetacean species in these areas. The Committee noted that while platforms of opportunity (e.g. oceanographic surveys) are not a substitute for dedicated surveys to estimate abundance, they may be a practical means for determining seasonal patterns in distribution and abundance, as well as providing information to assist in the design of dedicated surveys; it **encourages** the placement of marine mammal observers on platforms of opportunity. The Committee also noted that there is little information on distribution and abundance of many of the coastal species, that are probably most impacted by anthropogenic activity, including Burmeister's porpoise (*Phocoena spinipinnis*), Peale's dolphin (*Lagenorhynchus australis*), bottlenose dolphin (*Tursiops truncatus*) and the Chilean dolphin (*Cephalorhynchus eutropia*). It **recommends** that surveys be conducted to obtain information on abundance, distribution and residency patterns of these species.

The Committee was concerned at the apparent rarity of Chilean dolphins, particularly in light of rapidly developing aquaculture and coastal industry (SC/60/SM23). While groups are resident in some local areas, it appears that abundance in the Chilean fjords is very low. Little information exists on abundance and distribution patterns of Chilean dolphins along the open coast north of 41°S. The Committee **recommends** that well-designed line transect surveys of the Chilean fjords and outer coast be conducted in order to estimate the species' abundance and assess its conservation status.

14.1.2 Population structure
SC/60/SM10 presented a preliminary morphological comparison of skulls of common bottlenose dolphins from Peru and Ecuador. Differences were found between Peruvian inshore ecotype and Ecuadorian skulls. The Committee noted that published information is available on stock structure in the region for Burmeister's porpoise, dusky dolphins (*L. obscurus*) and common dolphins (*Delphinus* spp.) and that genetic analysis was ongoing for Chilean dolphins.

The Committee noted the value of studies of population structure; understanding population structure is essential in determining conservation status. It **recommends** that morphometric and genetic analyses be extended to include data from as wide a study area as possible for all species in the southeast Pacific region, but particularly for the more coastal species.

14.1.3 Life history and ecology
In general, there is limited information available on the life history and ecology of small cetaceans in the region. There is published information on Burmeister's porpoise and the dusky dolphin in Peru. SC/60/SM22 presented the preliminary results of a study on the trophic ecology of small cetaceans of the southwestern-most South Atlantic as revealed by stable isotope analysis. The results showed Peale's dolphin as the most inshore species, feeding very near the coast. Commerson's dolphins (*C. commersoni*) and Burmeister's porpoises were also considered coastal, but in addition, had ratios consistent with feeding over the Patagonian shelf and even over the continental slope. The southern right whale dolphin (*Lissidelphis peronii*) appears to forage over the slope and in deep waters, but sometimes comes onto the shelf, as does the false killer whale (*Pseudorca crassidens*). The Committee **encourages** the inclusion of other cetacean species in such analyses and the analysis of prey species to better understand the trophic ecology over the wider geographical range.

Stranded specimens can provide important information about life history and ecology and the collection of skeletal remains may provide information on species that occur in isolated or remote areas where other types of studies are difficult. It noted that it is important to keep even incomplete skulls and skeletons, as they may be useful for DNA and isotope research (and new procedures may be developed in the future). The Committee **encourages** the continuation of current strandings programmes and the initiation of new stranding programmes in areas and countries without them. The Committee also noted that a centralised depository of specimens would facilitate research and collaboration. Finally, the Committee **recommends** that fresh specimens from strandings, direct and incidental catch events should be collected and sampled when possible for *inter alia* life history, genetic and contaminant studies.

14.1.4 Habitat
SC/60/SM23 presented summary results of habitat modelling which showed a distinct pattern of spatial habitat partitioning among Chilean dolphins, Peale's dolphins and Burmeister's porpoises in the Chiloé Archipelago, southern Chile. Chilean dolphins preferred shallow waters (<20m) close to shore (>500m) and in the vicinity of rivers (with estuarine influence). This area overlapped extensively with shellfish farming. Peale's dolphins also selected shallow nearshore waters but seemed to roam over wider areas.

The Committee noted that more than 800 salmon farms might be developed in Chile in the next four years, and that studies of the habitat use by small cetaceans prior to this development would be crucial in assessing the potential for habitat exclusion. The Committee **expresses concern** with respect to both habitat degradation and the exclusion of small cetaceans from their habitat by aquaculture developments. The Committee **encourages** a local

initiative to compile information on the spatial distribution of cetaceans and the salmon farming industry with a view to improved spatial planning of the aquaculture industry.

14.4.5 Directed takes

In the 1970s and 1980s, directed takes of small cetaceans for bait constituted an important threat to small cetacean populations in southern Chile, but these seem to have decreased due to the availability of alternative bait products. However, some directed kills may continue in low levels in some parts (SC/60/SM5). In the 1970s, Burmeister's porpoise and Peale's dolphins were taken for crab bait in Tierra del Fuego, Argentina (SC/60/SM21) but there is no known recent directed take. The predicted shortage of bait is of concern with respect to the possible resumption of direct takes of small cetaceans and the Committee **emphasises** that continued attention must be paid to controlling and improving the mechanisms to obtain, distribute and predict the need for bait.

The hunting of dolphins for bait continues in Peru (SC/60/SM19) and in areas of Colombia appears to be a relatively new practice that could become more common as traditional taboos are overcome. SC/60/SM6 evaluated dolphin hunting for bait in Bahía Solano, Chocó, Colombia, from July 2005 to April 2006 by carrying out interviews with fishermen. Only fishermen using longlines (n=94; 37.3%) confirmed using dolphins for bait. The species most probably captured were the bottlenose and pantropical spotted dolphins (*Stenella attenuata*), since these are the most commonly encountered species in coastal waters. A minimum of nine dolphins was reported killed during the study period (one dolphin per month). As information about population parameters of dolphins in the region is not available, it is impossible to estimate the effect of the mortality inflicted by the directed takes.

The Committee recognised that directed take for bait is a conservation issue for small cetaceans in some parts of the region. The Committee **encourages** relevant organisations and governments to help reduce the use of cetaceans as bait through cooperation with fishermen. The Committee **recommends** that non-wildlife bait be made available as widely as possible (provided the ecological consequences of their use have been evaluated) and that there be further development of alternative long-lasting bait such as perforated plastic bottles containing fish offal. A bioeconomic model of the use of different baits in fisheries may provide useful insight. Improved education and awareness of conservation might also help to reduce directed takes. The Committee also **encourages** observer programmes to monitor the use of cetacean meat as bait. The Committee noted that observers could use separate boats in situations where placing observers on fishing boats is not practical.

14.1.6 Incidental takes

Interaction between cetaceans and marine fisheries is an issue of growing concern for the government and private organisations in Peru (García-Godos, 2007). When compared with the 1980s and early 1990s, a decrease of at least one order of magnitude is clear in landings of small cetaceans. However, current catch rates are impossible to estimate due to black market activity. There has been an increase in recent years in government efforts to monitor Peruvian fishery operations, implement control measures for incidental catch and improve research on this issue.

SC/60/SM19 presented information on small cetacean captures and catch per unit effort estimates in artisanal fisheries operating from a port in northern Peru from 2005-07. This is the first direct, at-sea monitoring of small cetacean interactions with Peruvian artisanal gillnet and longline vessels. In at least one port in northern Peru, incidental catch and harpooning of small cetaceans persist at high levels and on a regular basis, particularly in driftnet vessels, despite the existence since the mid-1990s of a national ban on the capture of small cetaceans and commerce in their products. Interactions observed from a port in northern Peru from 2005-07 consisted of 231 animals caught in gillnets, 1 in a longline and 21 directed takes by harpooning for use as bait. The most commonly captured species were long-beaked common dolphins (*Delphinus capensis*), dusky dolphins, common bottlenose dolphins (offshore stock) and Burmeister's porpoises. Based upon total fishing effort for the port, the authors estimated the average annual small cetacean incidental catch at around 2,600 animals for 2002-07. The formerly unknown practice of at-sea discarding of carcasses stands in sharp contrast with current, high small cetacean discard rates found in this study.

Incidental mortality in fishing gear has been observed for Chilean dolphins, Peale's dolphins and Burmeister's porpoises in the Chiloé Archipelago, but bycatch rates have not been quantified (SC/60/SM23). No systematic information has been collected on bycatch of small cetaceans in any type of fishery in Chile. Anecdotal and localised observations show that Chilean dolphins are prone to incidental entanglement in coastal gillnets and shore-based set nets, like most other small cetacean species. In recent years, evidence of entanglement has been reported from most areas where systematic studies of these dolphins are underway, e.g. near Constitucíon and off Chiloé. Hucke-Gaete *et al.* (2004) reported on the interaction between cetaceans and the Patagonian toothfish fishery. Entanglement was documented in industrial and artisanal fisheries.

In Tierra del Fuego, Argentina, incidental catch mainly involved Commerson's dolphins, spectacled porpoises, Peale's dolphins and Burmeister's porpoises (SC/60/SM21). Coastal fishing is mainly on the northern coasts where the flat beaches permit the setting of nets in the intertidal zone. SC/60/SM21 also reported on a 631cm adult male Shepherd's beaked whale (*Tasmacetus shepherdii*) that stranded with four longline hooks in its stomachs and intestines, which may have contributed to its death. This documents a possible interaction with a longline fishery and provides indirect evidence of a beaked whale feeding on longlines.

The Committee noted that incidental catch of several species has been documented in various fisheries in the region including small-scale artisanal and large-scale industrial fisheries. In many cases, extrapolation to fleet level is not possible, either because of a lack of a systematic approach to estimating bycatch and/or lack of information on fishery statistics (total fishing effort and landings). The Committee **encourages** efforts to improve estimates of incidental catch in these fisheries. While observer programmes often provide the most accurate estimates of bycatch, they are most easily implemented in large-scale industrial fisheries. Rapid assessment approaches, similar to some of the work presented this

year, can provide useful information about smaller fisheries in remote areas. Mitigation of incidental catch of small cetaceans in fisheries was also discussed. The Committee noted that potential approaches include acoustic deterrent devices and spatial and temporal fishery closures to reduce overlap between the distribution of fishing effort and cetaceans.

14.1.7 Other

Van Bressem *et al.* (2007) reviewed and documented new cases of diseases of the skin and the skeletal system, and external traumata in cetaceans from Ecuador, Colombia, Peru, Chile, Argentina, Uruguay, Brazil, and Venezuela. The survey revealed 590 cases diagnosed with a significant pathology, injury or malformation on a total of 7,635 specimens of 12 odontocete species examined or observed in 1984-2007. Tattoo skin disease (TSD), lobomycosis-like disease (LLD) and cutaneous diseases of unknown aetiology seem to be emerging in several populations. The Committee **recommends** focussed research on the effects of human activities on the spread of diseases in cetaceans, particularly in near-shore populations that utilise highly degraded coastal habitats (see Item 12).

14.1.8 Consideration of status and general recommendations

Marine and coastal environments in the southeast Pacific contain diverse habitats which are increasingly subject to anthropogenic stress. Known and potential threats to small cetaceans in this region include bycatch, directed take especially for bait (e.g. SC/60/SM5, SM6) and habitat degradation or loss from coastal development, including aquaculture and port development (SC/60/SM23).

The waters around the southeast Pacific are highly productive, with intense fishing activity, both artisanal and industrial. In all states (Colombia, Ecuador, Peru, Chile), there is evidence that small cetaceans are caught in different gear types and in some areas, directly hunted for bait. In most areas and for most fisheries, the level of bycatch has not been quantified. The Committee **recommends** that nations establish small cetacean bycatch monitoring programmes (using on board monitoring) as part of their regular fisheries monitoring and that they report bycatch information to relevant regional and international bodies (e.g. IWC, CPPS). Furthermore, the Committee **recommends** continuation of existing bycatch monitoring programmes, particularly in relation to mitigation efforts.

The Committee recognised that a number of species of small cetaceans, particularly those having small coastal populations, including bottlenose dolphins, Peale's dolphins and pantropical spotted dolphins, may be threatened by unregulated and undocumented directed takes. The Committee **recommends** that the impacts of such removals be assessed and that the status of affected populations be documented. Furthermore, the Committee **recommends** the development of alternative non-wildlife bait (that do not have adverse ecological consequences) and that this bait be made available as widely as possible.

While some work has been carried out to understand and document the impacts of fishery bycatch and directed catches on cetacean populations in some areas, this work is hampered by the lack of abundance estimates. Noting the almost complete lack of abundance estimates (with the exception of some small coastal populations), the Committee urges scientists to collaborate in developing programmes to estimate cetacean abundance throughout the region. The Committee **recommends** that particular attention should be given to small vulnerable populations of coastally distributed cetaceans, including Chilean dolphins, Burmeister's porpoises, pantropical spotted dolphins, Peale's dolphins and bottlenose dolphins.

There is a paucity of studies on stock structure in this region, which also hampers the ability to determine status (see Annex L, table 1). In particular, small coastal populations may be fragmented and more vulnerable to anthropogenic removals. The Committee **recommends** that samples (e.g. skin, bone) are collected from stranded and bycaught specimens and analysed to elucidate stock structure for all species in the region, but particularly for endemic species such as Peale's dolphin, Burmeister's porpoise, Commerson's dolphin, and the Chilean dolphin.

The Committee encouraged the continued development of existing strandings monitoring programmes that incorporate standardised protocols and **recommends** further collaboration in the establishment of new stranding programmes. It further **recommends** the collection of tissue samples for studies of life history parameters and feeding ecology. The potential impacts of chemical pollution and the link to health and disease status in small cetaceans in this region deserve greater attention, including a careful analysis of stranded and bycaught animals and consistent effort in assessing their exposure to contaminants. The Committee **recommends** that whenever possible, data are collected in ways that allow and facilitate investigation of the causes of morbidity and mortality. Having baseline data will be crucial in the event of unusual mortality events involving marine mammals in the region.

The unregulated growth and expansion of industrial activities in coastal waters, including port development and aquaculture, are cause for concern. Major threats to small coastal cetaceans arise from physical exclusion from critical habitat, incidental entanglement in aquaculture gear, gillnetting to recapture escaped salmon, pollution, and increased maritime traffic. Of particular concern is the currently ongoing large-scale intensification and expansion of fish farming and associated industrial activity in southern Chile. The Committee was informed about an initiative by the Chilean environmental commission to compile information on the spatial distribution of cetaceans and the salmon farming industry. The Committee **encourages** this work with a view to improved spatial planning of the aquaculture industry.

The Committee **recommends** that collaborative research projects with ongoing or planned regional programmes consider the inclusion of small cetaceans as appropriate. It noted that the upcoming CPPS meeting for the regional implementation of integrated coastal area management of IOC/UNESCO had amongst its objectives to develop both national and regional data and information systems and indicator-based assessments as a backbone to prioritise issues in coastal area management. This type of approach should incorporate small cetaceans, and would probably require spatially explicit data on the presence, abundance and conservation status of coastal species.

The Committee **urges** researchers to continue to develop regional networks, collaborative studies and training activities to promote scientific understanding of the cetacean fauna of the region and to further develop the

scientific and technical capacity of the region. Notably, the first South American marine mammal stranding and necropsy workshop was conducted prior to SC/60 (Item 12.4). As detailed in Annex K, the Committee recognises the value of this type of capacity building in other countries and recommends the conduct of similar workshops in South America and elsewhere.

14.2 Progress on previous recommendations
IWC Resolution 2001-13 (IWC, 2002a, p.60) 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 (*Phocoena sinus*). SC/60/SM3 described a quantitative analysis of the data accumulated between 1997 and 2007, applying passive acoustic techniques to study the population trend of vaquitas. The species was only detected in a small area near the west coast of the Upper Gulf, in about 20% of the total area surveyed. The current encounter rate was estimated to have declined by 58.1% from 1997. In 1997, a line transect estimate suggested that 567 vaquitas inhabited the Upper Gulf (Jaramillo-Legorreta *et al.*, 1999). The population decline reported in SC/60/SM3 suggests an abundance of 119 animals for 2007 (assuming that each acoustic detection represents two individuals, the average group size for this species). This figure closely agrees with the estimate of current abundance obtained using a simple population model incorporating known fishing effort (Jaramillo-Legorreta *et al.*, 2007). The results in SC/60/SM3 support the inference of a recent and further reduction of the population.

The Committee noted that the current vaquita population size was considered by most, including the Mexican Government, to be no more than 150 animals. This represents an extraordinarily rapid decline of approximately 75% in a decade. If this scale of fishery mortality continues, it will likely result in the effective extinction of the species in a maximum of 5 years and probably less. Whilst the Committee welcomes information that the Government of Mexico is taking measures to eliminate the fishery gear that is drowning vaquitas, **it is greatly concerned** that that the proposed phase-out period of 'within three years' may not be rapid enough to prevent extinction. Certainly that if this schedule was to slip, then extinction of the vaquita is probable in a short time.

In conclusion, the Committee once again **reiterates its extreme concern** about the conservation status of the vaquita which is the most endangered cetacean species in the world. It expresses its **great frustration** that despite more than a decade of warnings, this species has continued on a rapid path towards extinction due to a lack of effective conservation measures in Mexico. It **strongly recommends** that, if extinction is to be avoided, all gillnets should be removed from the upper Gulf of California **immediately**. In the extremely unfortunate circumstance that this does not occur immediately, it must certainly occur within the three year period starting in 2008. In order to meet this schedule, the Committee **encourages** the international community including IWC member countries and NGOs, to assist the Government of Mexico in this task.

14.2.2 Harbour porpoise
Harbour porpoise bycatch was reported from gillnet fisheries for cod and anglerfish in coastal Norwegian waters; 159 individuals in 2006 and 166 in 2007 (Bjørge, pers. comm.) and in salmon gillnet fisheries in southern British Columbia (BC) and adjacent inland waters of Washington State, USA (Williams *et al.*, 2008). In the Norwegian study, as yet, no attempt has been made to extrapolate from this sample to provide an estimate of the total bycatch. These data were reported by fishermen under contract, because their small vessels were unable to take independent observers on fishing trips lasting more than one day. In discussion, the Committee **reiterates** that the best way to obtain reliable bycatch information is through observer programmes. It also noted that observers could use separate boats, e.g. patrol or coastguard vessels, in situations where placing observers on fishing boats is not practical. In BC, estimated bycatch mortality in 2004 and 2005 exceeded the most precautionary limits (of those tested) for harbour porpoise.

The Committee welcomed information on the effects of pingers on harbour porpoise and seal bycatch in the US northeast gillnet fishery (SC/60/SM2). This analysis is one of the first to show the effect of pinger use in a real fishery. Since the 1999 implementation of a plan that requires pingers in specified times and areas, over 24,000 gillnet hauls have been observed in this fishery. In times and areas that require pingers, the harbour porpoise bycatch rate (animals per metric tons of landings) from hauls without pingers were on average twice the rate from hauls that used the required number of pingers. In addition, the rate from hauls with some but not all of the required number of pingers was on average twice the rate from hauls without pingers; it is not clear why this pattern occurred. There was no evidence for temporal trends (over years or over months within a year) in the bycatch rates over the time period that pingers have been required; suggesting that harbour porpoises and seals have probably not habituated to the pingers. However, seal bycatch in hauls with pingers in gillnets south of Cape Cod was generally higher than for hauls without pingers, and the landings in pingered nets was less than in non-pingered nets; suggesting evidence of the 'dinner-bell' effect in the gillnets south of Cape Cod. The results show that properly-maintained pingers did reduce bycatch, but that the level of reduction was much less than had been reported in earlier experiments. More importantly, malfunctioning pingers can actually increase the bycatch compared to nets without any pingers. This emphasises the need to monitor the effects of mitigation measures and to ensure full compliance in their use.

14.2.3 Franciscana
The Committee reviewed information on franciscanas (*Pontoporia blainvillei*) in the Babitonga Bay estuary, Brazil (SC/60/SM15). Franciscanas are present in the estuary all the year-round and a comparative study with animals outside the estuary revealed differences in feeding ecology, parasite prevalence and intensity and in stable isotope signatures between the franciscanas inside and outside the estuary. This small, possibly resident population is thought to be at risk from harbour development activities in the estuary, which include dredging, blasting, toxic contamination, noise and mangrove degradation or destruction. The ICMBio

(Government Environmental Agency) has proposed the establishment of a wildlife reserve (Reserva de Fauna Baía da Babitonga) to reduce the impacts of development on dolphins and other biota. The Committee welcomed the information provided in SC/60/SM15 and shared the authors concern about this small, relatively accessible franciscana population. The Committee **encourages** the authors to continue their efforts to study the franciscanas in the Babitonga Bay estuary.

In a recent paper on franciscana population genetics in northern Argentina, Mendez *et al.* (2008) found strong quantitative evidence for at least two genetically recognisable populations of franciscanas (San Clemente and Claromeco) within Franciscana Management Area (FMA) IV, the southernmost of four FMAs defined by Secchi *et al.* (2003). Mendez *et al.* (2008) also found support for the genetic isolation of animals in FMA IV from those in the FMAs in Brazil and Uruguay, as proposed previously by other investigators. They also found suggestive evidence that bycatch in gillnet fisheries has a differentially heavy impact on mothers and calves in the San Clemente area and that population sizes are declining. The Committee welcomed this study and **encourages** this international collaboration to continue and expand the investigations of franciscana population structure and its implications for conservation and to report their results to the Committee.

14.2.4 Boto

Last year, the Committee expressed great concern regarding the illegal takes of botos (*Inia geoffrensis*) and recommended that the Government of Brazil make every effort to determine the numbers killed and the geographic extent of the hunt, and to assess the impact of removals on the boto population (IWC, 2008j, p.315).

SC/60/SM17 summarised current understanding of the taking of botos for catfish bait. The catfish *Calophysus macropterus*, known mainly as 'piracatinga' in Brazil and as 'mota', 'simi' or 'mapurite' in Colombia, Peru and Venezuela, is a scavenger species that was, until recently, sold and consumed on a commercial scale only or primarily in Colombia. Boto carcasses are a preferred source of bait in the fishery and an estimated 600 dolphins per year (1994-2007) have been killed illegally for this purpose in and around Mamirauá Sustainable Use Reserve in the central Brazilian Amazon (Serrano *et al.*, 2007). It is now evident that the geographic scale of boto hunting for catfish bait is far greater than previously recognised, encompassing areas within Brazil, Colombia, Peru and Venezuela. Little or no information is available on the magnitude of the take in most places. Where such data are available (e.g. parts of the Brazilian Amazon) it appears that the hunt is unsustainable and that dolphin numbers have declined by more than 50% in less than a decade (Martin, pers. comm.). The Committee noted that range states had become increasingly aware of the scale and severity of this hunt over the past year and had convened meetings of scientists, fishery managers and enforcement agencies to discuss how to address the problem. It was encouraging to learn that management of the piracatinga fishery and enforcement of existing laws protecting the boto could, if properly implemented, lead to a rapid reduction and even cessation of the boto hunt in at least three of the four countries – Brazil, Peru and Venezuela.

The Committee **reaffirms its concern** about the conservation status of the boto, and the fact that directed killing of this species continues without restriction or limit. The Committee **recommends** that immediate steps be taken by Brazil, Colombia, Peru and Venezuela to stop this hunt, and that range states provide information to next year's meeting on progress in this regard.

14.2.5 Dall's porpoise

SC/60/SM24 once again drew the attention of the Committee to the hand-harpoon hunt for Dall's porpoises in the western North Pacific near Japan (see IWC, 2008j, p.315). This hunt targets a population of *truei*-type porpoises as well as a population of *dalli*-type porpoises found in the Sea of Japan and the southern Okhotsk Sea. The Committee has previously expressed concern for the conservation of these populations (IWC, 1992; 1993b; 2002b; 2008j). Since last year's meeting, new estimates of abundance have been calculated from Japanese survey data collected in 2003 - 173,638 (CV=0.21) for *dalli*-type porpoises and 178,157 (CV=0.23) for *truei*-type porpoises. The new estimates are lower than those from 1991. Although the quotas for the hunt have been adjusted slightly in recent years, they have not been lowered substantially. The full abundance estimates from the 2003 survey include extrapolations into unsurveyed areas based on the earlier 1991 survey data and other old data.

SC/60/SM24 updated the information presented to the Committee last year (IWC, 2008j, p.315), using various methods to calculate thresholds used for scientific evaluation of catch levels. The average catch over the most recent 5 years for which data are available (2002-06) represents 3.6% (*dalli*-type) and 4.5% (*truei*-type) of the new abundance estimates. This catch is 1.8 (*dalli*-type) and 2.3 (*truei*-type) times higher than the largest alternative threshold calculated, and is more than 4 times higher than the more conservative thresholds, such as a 'potential biological removal' (PBR) calculated with a 'recovery factor' of 0.5. Total removals from these populations are probably higher than the reported catches because struck-and-lost porpoises are not included nor are porpoises killed incidentally in fisheries.

The Committee welcomed the calculation of new abundance estimates but noted that extrapolation of density and abundance into unsurveyed areas was undesirable. Therefore, the Committee **recommends** that a complete survey of the ranges of the populations be undertaken as soon as feasible and that sightings data on Dall's porpoises collected during whale surveys be incorporated into a new assessment.

The Committee **reiterates** its concern for these stocks and repeats its previous **recommendations** that:

(1) catches are reduced to sustainable levels as soon as possible;
(2) research is undertaken to quantify accurately the number of bycaught animals and to investigate population structure of Dall's porpoises in the Okhotsk Sea (see IWC, 2002b, for further details); and
(3) a full assessment of the status of each affected population be conducted as soon as possible.

14.2.6 Hector's dolphin

SC/60/SM12 presented a quantitative assessment of proposed protection measures for Hector's dolphins announced by the New Zealand Minister of Fisheries on 29

May 2008, to be implemented in October 2008. The proposed protection measures are a major step forward, substantially reducing the overlap between gillnets (both commercial and recreational) and Hector's dolphins (including the North Island subspecies, also known as Maui's dolphin). Hector's dolphin populations in areas with a year-round gillnet ban extending offshore to at least four n.miles are predicted to increase slowly. However, populations in areas not included in the protection measures and in areas with a relatively low level of protection (e.g. west coast of South Island, with protection to only two n.miles offshore for three months of the year), are predicted to continue to decline. If the proposed measures are not adopted SC/60/SM12 estimated that by 2050 populations would decline to 5,369 but would recover to 15,776 if fishery mortality is reduced to zero. Under the proposed new measures, Hector's dolphins are expected to decline by a further 600 individuals to 7,168 individuals in 2050. Therefore, although the proposed measures represent significant progress they may not ensure the conservation and recovery of Hector's dolphins.

The Committee expressed its appreciation for the analysis provided in SC/60/SM12 and **commends** New Zealand for the large investment by government agencies in the development and implementation of the proposed protection measures. However, the Committee **stresses** that additional measures may be required to ensure recovery of the species.

14.2.7 Killer whale
The conservation status of killer whales was reviewed by the Committee at its meeting in 2007. SC/60/SM8 provided an update of killer whale distribution in Venezuelan waters between 2001-08, all in the period December to May and off the central or northeastern coast in depths of 10-1,500m. Kock drew the Committee's attention to new developments in the mitigation of longline depredation by killer whales in the Southern Ocean, identified as a potential conflict with fisheries issue last year (see summary of SC/60/O9 in the report of the bycatch sub-committee – see Item 7).

14.2.8 Abundance estimates for offshore European Atlantic waters
SC/60/O2 provided preliminary abundance estimates of cetaceans in offshore European Atlantic waters. The objectives of the Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) project are to map summer distribution, generate unbiased abundance estimates, and investigate habitat preferences for several cetacean species in offshore waters of the European Atlantic. This project was endorsed by the Scientific Committee. A shipboard survey was conducted using a 'trial configuration' (or 'BT mode'). The survey area was stratified in 4 blocks and almost 10,000km were searched on effort. For short-beaked common and striped dolphins and for pilot whales there were enough duplicate sightings for a mark-recapture line transect (MRLT) analysis, therefore estimating $g(0)$, accounting for responsive movement, and yielding unbiased estimates. The bottlenose dolphin and beaked whale sightings were analysed using a conventional line transect (CLT) sampling approach, and thus results should be considered potentially negatively biased. Such bias is likely to be large in the case of beaked whales given their long dive times. The final pooled abundance estimates for the 4 blocks were: 162,266 (CV=0.46) common dolphins; 82,585 (CV=0.54) striped dolphins and 282,749 (CV=0.38) for a combined group of common, striped and a common/striped category; 83,441 (CV 0.47) long-finned pilot whales; 86,722 (CV=0.46) for a combined group of long-finned, short-finned and a *Globicephala* spp. category; 19,295 (CV 0.25) bottlenose dolphins; and 9,771 (CV=0.44) beaked whales (including individuals identified as Cuvier's and Sowerby's beaked whales and unidentified beaked whales). All of these abundance estimates should be considered preliminary.

The Committee **welcomes** these preliminary abundance estimates, noting that they provide estimates for the first time for some species in this region and look forward to receiving the updated analysis next year.

14.2.9 Abundance of cetaceans in the ACCOBAMS region
SC/60/O16 provided an update of Cañadas *et al.* (2006a) on planning for surveys of the Mediterranean Sea, contiguous Atlantic waters and the Black Sea (the ACCOBAMS region). The Committee has endorsed this proposal. The main objective of the proposed survey is to obtain baseline information on abundance and distribution for all species throughout the region. All parts of the ACCOBAMS area will be covered. This includes 27 countries, which together with the large diversity of cultures and political conditions, make the design, planning, and funding of these surveys a considerable challenge. The planned data collection methods are: (1) aerial survey in the Aegean Sea, central and northern Adriatic Sea and offshore Black Sea; and (2) visual and acoustic shipboard survey with BT method (for visual survey) in the rest of the areas. Visual survey data will be analysed both with conventional distance sampling methods and with density surface modelling. The Committee thanked Cañadas and colleagues for their hard work towards realisation of this long-overdue, much-needed survey programme, and **reaffirms its endorsement and recommends** that planning and implementation proceed as quickly as possible.

14.2.10 Bycatch information
The Committee has consistently expressed concern over bycatches in fishing gear as a threat to cetacean populations. A number of papers related to this issue were presented.

Carretta and Enriquez (2007) reported the 2006 bycatch of short-beaked and long-beaked common dolphins (*Delphinus*), California sea lions, and loggerhead sea turtles in the California/Oregon large mesh drift gillnet fishery for thresher shark and swordfish. Bycatch estimates from this fishery have been documented since 1990 and regularly reported to the Committee. It was observed that the entanglement rates (animals per set fished) of short-beaked common dolphins is lower (3.5 animals per 100 sets) since the introduction of acoustic pingers, as compared to sets without pingers (5.9 animals per 100 sets). This is consistent with results presented elsewhere to the Committee in relation to harbour porpoise (SC/60/SM2). At the same time, entanglement rates of California sea lions have been higher in the years following the use of pingers (2.6 animals per 100 sets) versus years without pingers (1.0 animals per 100 sets). A number of factors that may be responsible for these changes in sea lion entanglement include habituation, attraction to pingers,

changing in population sizes, shifts in the distribution of prey and a 2001 area closure that shifted fishing effort into southern California waters.

SC/60/SM13 reviewed marine mammal bycatch in the southwestern Indian Ocean. The paper covered marine mammal diversity and status, fisheries, marine mammal bycatch and bycatch mitigation measures in most of the countries in the SW Indian Ocean, namely: Kenya; Tanzania; Mozambique; the Federation of Comoros; Madagascar; the Seychelles; Mauritius; and the French islands of Mayotte and Réunion. Data came mostly from opportunistic reports, stranding records and interview surveys. The review underlined the highly variable level of marine mammal bycatch across the region and the generally poor and heterogeneous level of information available. However, it appeared that coastal species (Indo-Pacific bottlenose dolphin, Indo-Pacific hump-backed dolphin, and the highly endangered dugong) were most at risk along the coasts where extensive gillnet fisheries operate and, in some places, there are also directed takes. The Committee welcomes this work as a good first step towards quantifying levels of incidental mortality of small cetaceans in this long-neglected region. It **encourages** the continuation of the cooperative approach reflected in SC/60/SM13 and emphasised the need not only for rapid assessment but also for the implementation of appropriate mitigation measures where needed.

14.2.11 Other information presented

The Committee briefly reviewed other presented information. A photo-ID study of bottlenose dolphins in the northern Gulf of San Matías, Patagonia, Argentina (SC/60/SM1) suggested some degree of residency in the Natural Protected Area Bahía de San Antonio and also that individuals move throughout the entire northern part of the gulf including the estuary of the river Rio Negro. SC/60/SM9 reported two sightings of long-beaked common dolphins off the central coast of Venezuela some 250km west of what is considered the typical range of common dolphins in the Caribbean Sea. A stranding in 2002 at Peninsula de la Guajira, near the Colombia-Venezuela border, also was noted. In discussion, the importance of validating such records of 'range extension' with documentary evidence (e.g. photographs) was noted.

SC/60/SM20 investigated population structure of *Delphinus* in the NW Africa region using two independent tools: the relative abundance of nitrogen and carbon stable isotopes in different individuals and the morphometrics of the skull in comparison with other North Atlantic populations. Details can be found in Annex L, item 10. It was agreed that SC/60/SM20 adds an ecological line of evidence to ongoing discussions of how to resolve the taxonomy of the *Stenella-Tursiops-Delphinus* complex. It gives further reason for caution against the tendency to assume that long-beaked and short-beaked common dolphins outside the eastern North Pacific fall into the same model as described for that region by Heyning and Perrin (1994). The Committee **recommends** that more work be carried out, particularly genetics, on the taxonomy and systematics of common dolphins.

Williams, Lusseau and Hammond presented data on killer whale usage of a small marine protected area in Johnstone Strait, British Columbia, Canada. Concern has been expressed about this population's vulnerability to stochastic catastrophic events, such as oil spills, because individuals form permanent social units that tend to aggregate temporarily in summer. The authors encourage methodological development to incorporate aggregations and social structure explicitly into models of extinction risk for highly social odontocetes. The Committee noted that social structure and the tendency of social cetaceans to aggregate is an important consideration in conservation efforts.

14.3 Review of takes of small cetaceans

The Committee reviewed the compilation of information on takes of small cetaceans found in National Progress Reports (see Annex O) and thanked the Secretariat for compiling the records. The Committee welcomed the information submitted by some member countries and encouraged others to contribute data. It was agreed that the tables should include a statement regarding incompleteness, noting that they contain only the information as reported in the available progress reports taken at face value. The Committee noted the apparent paucity of bycatch monitoring data from European fisheries since EU Regulation 812 2004, and **recommends** that information on the efficacy of this regulation be submitted to the Committee for evaluation.

Funahashi provided information on the direct catches of small cetaceans in Japan from 1997-2006 from the National Research Institute of Far Seas Fisheries, Fisheries Research Agency website (see Annex M, Appendix 2). Flóres provided information on the large numbers of Guiana dolphins bycaught in gillnets in the Brazilian states of Pará and Amapá northwest of the Amazon River Delta. A preliminary onboard survey by researchers who observed 12 fishing trips and about 100 net sets found that catches by a single set ranged from 0 to as high as 88 dolphins.

The Committee noted the recent reports of live-captures and exports of Indo-Pacific bottlenose dolphins in the Solomon Islands. At least 28 dolphins were captured and exported in 2007 and more exports are expected. A workshop to develop a case study on how such island-associated populations of small cetaceans can be assessed is being planned for later this year in Samoa under the aegis of the IUCN Cetacean Specialist Group. The approach should be applicable for CITES 'nondetriment' findings as well as for assessing the effects of any other types of removals (e.g. bycatch). Sequeira noted that a potentially large live-capture operation is also being planned in Guinea-Bissau, apparently targeting common bottlenose dolphins. No population assessment has ever been made for this region and available data suggest that recent takes are unsustainable (Van Waerebeek *et al.*, 2008).

The Committee **reiterates its previous concerns** about direct takes, including live-captures, from populations of small cetaceans that have not been properly assessed.

14.4 Consideration of revision of the IWC cetacean list
14.4.1 Replacement of name from Mesoplodon pacificus (Longman's beaked whale) to Indopacetus pacificus

Brownell summarised the nomenclatural history of this taxon. When the first IWC List of Recognised Cetacean Species was developed, the Longman's beaked whale, described as *Mesoplodon pacificus* Longman, 1926 had been placed in the new genus *Indopacetus* (Moore, 1968).

However, the new generic name was not widely accepted and the original *M. pacificus* was retained. Recently, Dalebout *et al.* (2003) reconsidered the genetic distinctiveness of Longman's beaked whale and concluded that this species should be considered a species outside the genus *Mesoplodon* and that it should be the sole member of the genus *Indopacetus*. All authors since then have considered the Longman's beaked whale as *I. pacificus*. The Committee **agrees** that the widely accepted genus *Indopacetus* be formally recognised and that the name for Longman's beaked whale in the IWC List of Recognised Cetacean Species be changed from *Mesoplodon pacificus* to *Indopacetus pacificus*.

14.4.2 Common English name of Sotalia guianensis
Last year it was agreed that two species of *Sotalia* should be recognised and that *S. guianensis* should be added to the IWC List of Recognised Cetacean Species. SC/60/SM16 proposed 'Guiana dolphin' to be the preferred English common name, primarily since this name is associated with the geographic location where the species was first described. In recognition of the broad consensus among researchers working on the species, the Committee **endorses** this proposal.

14.5 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

15. WHALEWATCHING (SEE ANNEX M)

15.1 Review of the report of the Workshop on strategic planning of large-scale whalewatching research
SC/60/Rep6 presents the report of the intersessional Workshop to plan a Large-scale Whalewatching Experiment (LaWE), held in Bunbury, Australia, 30 March-4 April 2008. The Workshop was originally planned as a two-day pre-meeting of the Committee, but was held in Australia primarily as additional funding became available to allow for a longer Workshop. The Committee thanked Bjørge, Lusseau, Bejder and Weinrich for their efforts and **endorses** the report of the Workshop.

SC/60/Rep6 (Item 7) referred to a proposal for a large scale experimental study (LaWE); an intersessional steering group (Q31) whose main task is to finalise a draft proposal (Annex M, item 5, table 2) has been established as an advisory group, representing regional and species expertise. The Committee **looks forward** to receiving the final proposal next year.

15.2 Review of whalewatching in South America
Iñíguez and colleagues presented an overview of whalewatching in South America (Annex M, item 6, table 1). The Committee is concerned that aerial whalewatching activities in Chile and Brazil, especially those using helicopters, have the potential for disturbing whales. It was pleased to note that Parsons will collate information for consideration at next year's meeting.

Bolaños-Jiménez *et al.* (2007) presented a review of the origin and development of whalewatching in Aragua State, Venezuela. A proposal for a code of conduct includes a 'rest period' of 1-2 days per week in which no dolphin watching trips would occur and a request for scientific research and monitoring on permitted vessels. The Committee commended the development of the guidelines that should assist the environmental authorities responsible for regulating dolphin watching, particularly in areas that target vulnerable freshwater species.

Since next year's meeting will be held in Madeira, Portugal, the Committee **encourages** local scientists to submit information on whalewatching in the region. It was pleased to note that Sequeira will collate information on whalewatching in Portugal (Azores, Madeira), the Canary Islands and the Strait of Gibraltar.

15.3 Developing methodology and assessing the biological impacts of whalewatching on cetaceans
15.3.1 Short-term methods and results
SC/60/WW1 summarises several papers on short-term whalewatching impacts: Stockin *et al.* (2008) described behavioural changes of common dolphins (*Delphinus* sp.) as the result of boat activity in the Hauraki Gulf, North Island, New Zealand; Stamation *et al.* (2007) monitored migrating humpback whales from whalewatching vessels (2002, 2003 and 2005) and two land-based whale-watching sites on Montague Island (2002-05) off the coast of New South Wales, Australia; and Carrera *et al.* (2008) documented impacts of boat traffic on Guiana dolphins in Baía dos Golfinhos (Dolphin Bay), Brazil. Summaries are presented in Annex M, item 7.1.

SC/60/WW3 and SC/60/WW4 detailed an experimental study quantifying changes in behaviour and movement patterns of southern right whales in the presence of three swimmers. Results show a significant decrease in remaining in a resting state or continuing social activities. Resting to travelling transitions significantly increased and surface active/social to travelling transitions increased as well. Mother-calf pairs showed the greatest changes in movement patterns, avoiding the boat and swimmers, increasing their travel speed and reorienting more.

The Committee **welcomes** the use of an experimental approach although some commented that a control was not used to examine and separate the effects of the vessel approaching the whales at 10-20m from the divers' presence. Future studies should examine possible impacts of vessel approaches.

SC/60/WW8 describes the exposure level of humpback whales to unregulated whalewatching activities in New Caledonia. On average, whales were in the presence of 3.4 boats for two hours; 43% of all groups were in the presence of boats for over two hours, and sometimes up to six hours. Boats tended to spend more time at closer distances with groups containing calves.

New results reported regarding whales tracked before the arrival of boats and while boats were present showed that 96% of the groups significantly changed their behaviour when in the presence of boats. There was no general trend in increase or decrease in the behavioural variables measured, suggesting that calculating means averages out the overall response to the presence of boats. The Committee **encourages** the authors to present the full results at next year's meeting.

SC/60/WW10 presented a review and combined analysis of studies to date on whalewatching effects although the authors acknowledged that their search may have missed some studies (sources reviewed are detailed in Annex M, item 8.1).

Pereira *et al.* (2007) described surface behavioural responses of Guiana (marine tucuxi) dolphins to boats in a protected area in southern Brazil from 1993-2003. These

tourism operations target a population of Guiana dolphins with a restricted, discrete distribution. Behavioural responses of dolphins showed decreased negative response and increased neutral response over the years. Increased integration and cooperation between boat operators, the scientific community and local people, as well as adequate boat approach enforcement, may reduce boat activity impacts.

15.3.2 Long-term methods and results

SC/60/WW9 studied the resilience of cetacean behaviour and its relationship to the diversity of behavioural sequences modeled using Markov chains. The study and the discussion of it is detailed in Annex M, item 7.2.

General concerns were raised about intensive whalewatching activities on breeding grounds, on small, resident populations and on populations where whalewatching activities occur throughout their range (breeding, migration and feeding locations). The Committee **agrees** that this applies to any important habitat and life history stage and that particular attention should be paid to whalewatching pressure on mother-calf pairs in the first several months of the calf's life.

15.4 Review reports of intersessional Working Groups

15.4.1 Preparation and conduct of a meta-analysis to assess the influence of cetacean biology and ecology on short-term impact effect size from whalewatching vessel traffic

SC/60/WW10 presented a meta-analysis of results from the literature review presented in Annex M, item 7.1. Details of the study are given in Annex M, item 8.1. The authors concluded that meta-analysis can be an important tool in determining which variables may be important indicators of disturbance, and perhaps to relate behavioural modifications to effects on life history parameters. They noted that standardisation of methodology between studies is necessary and suggested that this may be an appropriate task for the sub-committee on whalewatching to undertake. Discussion of this paper and the possible biases arising out of such a meta-analysis can be found in Annex M.

15.4.2 Identifying data sources from platforms of opportunity of potential value to the Scientific Committee

Robbins described efforts to maintain and expand a database of data collection programs from whalewatching platforms and commented on the difficulty of tracking these programmes. She recommended that the working group (Q32) expand in number and diversity to capture more information through local knowledge and combining these and other data into a single database summarising areas where whalewatching occurs, data collection programmes and codes of conduct (already maintained by Carlson). A web-based interface, wherein whalewatching operations can maintain their own information, may help to ensure that this information remains current.

15.4.3 Further development of a questionnaire to assess the extent and potential impact of swim-with-whale operations

The Committee notes that Rose (Convenor of the Working Group: Q33) will present an update of this 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/60/WW2 reports on the use of data gathered by tour operators to examine dusky dolphin long-term occurrence patterns near Kaikoura, New Zealand. The data set is the longest continuous sightings record of dusky dolphins in the area and the authors were able to obtain useful biological information from them. In Kaikoura, tour operator data fill a gap in data collection abilities and allow for the comparison of long-term trends. The sub-committee on whalewatching thanked the author for presenting this thorough and useful study. Other sub-committees within the Scientific Committee have noted the difficulty of obtaining long-term data sets for analyses essential to their work and it was noted that data gathered in an appropriate manner by whalewatching vessels may make a valuable contribution.

SC/60/WW11 presented results of an attempt to assess biases of SPUE (sightings per unit effort) data from whalewatching vessels in the Stellwagen Bank area in the USA. Methods of the analyses are summarised in Annex M, item 9.1. The analyses showed that the distribution of past sightings affects the survey coverage for a particular habitat and the interpretation of whale distribution based on data from whalewatching vessels. This work can assist developing protocols for standardised data collection aboard whalewatching vessels which will improve its applicability to cetacean studies. In discussion in the sub-committee on whalewatching it was noted that whalewatchers often find whales by expectation or by using spotting networks. In such cases, trackline information may underestimate effort and lead to overestimates of SPUE. It was noted that effort data already are collected by some long-term data collection programmes in the Stellwagen Bank area. These data have been shared to facilitate management decisions (i.e. to move an existing shipping lane). Even though correction of analyses of such data for errors of probable bias may prove problematic, this is outweighed by their availability and quantity in circumstances where research surveys are typically infrequent or absent. The Committee nevertheless emphasised that appropriately planned research surveys remain the best approach to obtain unbiased estimates of trends in abundance and distribution.

Given the importance of such information for the analysis of long-term trends in distribution, the Committee **recommends** the collection of suitable effort data (e.g. tracklines, weather data, time on watch) from whalewatching platforms whenever possible.

SC/60/SH19 reported on the progress of the Antarctic Humpback Whale Catalogue (see Items 10.2 and 22). Progress continues to stimulate submission of opportunistic data throughout the region to expand understanding of exchange between areas in the region and in some cases provided information previously unavailable.

SC/60/SM11 reported on a cetacean survey in the Chilean fiords on a platform-of-opportunity (POP). During discussions it was noted that POP surveys can provide valuable information on the distribution of targeted species and that such data can be useful to the Scientific Committee as they can be used to assist in the design of dedicated abundance surveys.

SC/60/DW3 and DW18 describe skin lesions on humpback whales and SC/60/BC1 reviewed entanglement impacts on Gulf of Maine humpback whales where subsets of data used in these studies were collected on whalewatching vessels. These are examples of additional areas of research where information has been gathered by whalewatching vessels. Such data make valuable contributions to studies on individual and population health as well as contributing to the understanding of rare events.

15.5.2 Review of whalewatching guidelines and regulations
SC/60/WW1 described studies that evaluated the effectiveness of codes of conduct and whalewatching guidelines: Allen *et al.* (2007) reported on studies of compliance by cetacean tour boats with codes of conduct in New South Wales; and Anwar *et al.* (2007) produced a model to investigate whalewatching operator strategies in the St. Lawrence Estuary and the benefits or disadvantages of cooperation between whalewatching operators. Results and discussion of these studies can be found in Annex M, item 9.2.

SC/60/WW7 reported on the undertaking by New Zealand to report on the actions that had been taken to increase protection of bottlenose dolphins within the Doubtful Sound Complex. In January 2008, a management strategy was implemented that included:

(1) a voluntary code of management for all vessels within the Doubtful Sound Complex that includes boat speed and distance regulations and boat exclusion zones;
(2) a research and monitoring strategy;
(3) education and awareness programmes for all vessels; and
(4) measurement of compliance and monitoring of these voluntary measures.

The effectiveness of these management measures will be reviewed in 2009. The authors commented that the remoteness of this area emphasises the importance for cooperation with stakeholders in order to achieve the best possible protection.

The Committee noted that due to enforcement difficulties, adherence to regulations governing vessel behaviour around whales and dolphins, or to codes of conduct, is sometimes poor and that there may be resistance to 'top down' management. Nevertheless, it **expresses some concern** at the apparent trend for government agencies to use voluntary codes of conduct (that have proved to be of limited value in a wide variety of other locations (see Annex M, item 9.2 for references)) rather than legal regulations. It was noted that in some areas, a mixture of a 'top down' regulatory approach combined with stakeholder involvement in drafting discussions ('bottom up') including appropriate involvement of scientists, appears to be effective. The Committee **recommends** that, in general, codes of conduct should be supported by appropriate legal regulations and modified if necessary as new biological information emerges. However, the Committee noted that enforcing regulations at sea may be difficult in some areas.

SC/60/BRG2 reviewed data collected on southern right whales in the Natural Protected Area Bahía San Antonio, province of Río Negro, northern Patagonia, Argentina and the potential for whale-based tourism.

The Committee was informed of a new Spanish regulation for the protection of cetaceans (R.D. 1727/2007). The Decree introduces a 'Mobile Area for the Protection of Cetaceans', defined as a virtual cylinder with a radius of 500m, a height of 500m and a depth of 60m, surrounding a cetacean or group of cetaceans. The regulations are further described in Annex M, item 9.2. The Committee **commends** the Spanish government for this development.

Similarly, the Committee received an update on the proposed guidelines for blue whale and other cetacean watching endorsed last year (IWC, 2008k). Based in part on this endorsement, the Chilean Navy implemented the guidelines in August 2007.

Carlson reported that the compendium of whalewatching guidelines and regulations around the world has been updated and is available on the IWC's website (*www.iwcoffice.org*).

15.5.3 Review of risk to cetaceans from collisions with whalewatching vessels
Mattila reported that collisions with whalewatching boats have continued to occur in Hawaii and he will provide an update at next year's meeting. The Committee **encourages** continued reporting of both collisions and trends in the types and speeds of whalewatching vessels (which may be used to model the risk of collisions, as is being done in the bycatch sub-committee).

15.5.4 Other
In Croatia in July 2006, the Ministry of Culture declared preventive protection for the Cres-Lošinj Special Marine Reserve. The original proposal for a marine protected area (MPA) for dolphins was written in 1993 and included the 'Management Plan for the Conservation of the Cres-Lošinj Archipelago' (Island Development Centre, 1997). In 2002, a new proposal was developed, based primarily on the findings of two ongoing PhD studies. One of these studies, presented to and endorsed by the sub-committee in 2006 (Cañadas *et al.*, 2006b), became an important component behind the declaration of preventive protection, and the 'exclusion zone' positioned in the core of the proposed MPA.

Štrbenac further reported on recent progress and noted that Croatian authorities are working with stakeholders to discuss a code of conduct for the protected area. The Committee **commends** Croatia for the measures taken to date and **encourages** further development of the codes.

Simmonds and Stansfield (2007) and SC/60/WW5 provide a review of recent 'solitary sociable' dolphins in UK waters. One conclusion from these studies, and the other recent examples of this phenomenon in the UK and elsewhere, is that habituation to humans makes the animals vulnerable to harm or being killed. The Committee **recommends** that this process of habituation should be avoided.

15.6 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

16. DNA TESTING (DNA)

16.1 Review genetic methods for species, stock and individual identification
Following a suggestion made last year, the Committee reviewed Rohland and Hofreiter (2007a; 2007b) which

present a method designed to maximise recovery of PCR-amplifiable DNA from ancient bone and teeth specimens and at the same time to minimise co-extraction of substances that inhibit PCR. Details and discussion on these papers are found in Annex N

Ballantyne *et al.* (2007) examined two whole genome amplification methods for genotyping of LCN and degraded DNA samples. Both methods (WGA kits) amplified genomic DNA, producing microgram quantities from sub-nanogram templates. Meudt and Clarke (2007) presented the applications, analyses and advances of amplified fragment length polymorphism (AFLP) DNA fingerprinting. Details and discussion on these papers are found in Annex N.

The Committee noted that for the past several years various techniques to extract and amplify DNA from 'difficult' samples have been presented and discussed. It **agrees** to review current knowledge at next year's meeting.

16.2 Conduct the first round of sequence validation and continue discussion of plans for sequence validation

Last year the Committee agreed to conduct the first round of sequence validation in *GenBank* using *DNA Surveillance* and a curated reference sequence alignments known as *Witness for the Whales* (Ross *et al.*, 2003; Ross and Murugan, 2006), under a research contract. Specifications for the first round of sequence validation were given in IWC (IWC, 2008l, pp.338-39).

SC/60/SD6 presented the results of the first round of validation. A total of 922 sequences from baleen whales published in *GenBank* prior to 2007, were examined. Of these, 42 sequences were identified as belonging to a different species and 44 to a different subspecies, from that recorded in *GenBank*. A species identity could not be assigned unambiguously to seven sequences. Although a small number of sequences were suggestive of poor or unreliable quality, in each case the species identity as recorded in *GenBank* was confirmed. The authors suggested that taxonomic revision is probably the greatest source of disagreement in the species identities given by *GenBank* and *DNA Surveillance*. 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 felt that this was a useful exercise showing no major issues in *GenBank* IDs. Most disagreements appeared to be due to a lag in taxonomy rather than errors. It was noted that the survey is not strictly validation as the 'true' type has not been established but is rather a measure of consistency. The Committee **agrees** to change the terminology 'sequence validation in *GenBank*' to '*GenBank* sequence assessment for species assignment'. Details and discussion on the results of this first assessment are found in Annex N.

It was noted that the reference database *Witness for the Whales* considers the classification of Bryde's whale into three species as suggested by Wada *et al.* (2003). The Committee has not agreed yet on this classification.

The Committee also **agrees** to conduct a second round of *GenBank* sequence assessment for species assignment of baleen whale sequences deposited in *GenBank* in 2007 (400+ sequences). Specifications for the next assessment (Annex N, Appendix 2) are similar to those in the last year,

but include some additional suggestions derived from discussion on SC/60/SD6 this year.

As agreed by the Committee last year, any anomaly detected in the 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. A member of the Committee needs to be identified to carry out this work. The Committee **agrees** that this should be considered after the second *GenBank* sequence assessment for species assignment is completed next year.

The Committee noted that in the future, assessments of *GenBank* sequences may be conducted less often and less formally. This will be considered after the Committee evaluates the results of the second *GenBank* sequence assessment for species assignment.

16.3 Collection and archiving of tissue samples from catches and bycatches

The collection of tissue samples in Norway is from the commercial catches of North Atlantic common minke whales from 1997 to 2007. A total of 592 whales were landed in 2007 (see Annex N, Appendix 3).

The collection of samples in Japan is from scientific whaling in the Antarctic (JARPA and JARPA II) and North Pacific (JARPN II), bycatch and strandings. The collection includes complete coverage for 2007 throughout the 2007/08 Antarctic season. The Committee was informed that a total of 551 genetic samples of the Antarctic minke whale were collected from the 2007/08 austral summer survey under JARPA II. From JARPN II in the western North Pacific (NP) samples stored in 2007 were: NP common minke whale, $n=207$; NP Bryde's whale, $n=50$; NP sei whale, $n=100$; and NP sperm whale, $n=3$. The samples from bycatch stored in 2007 were: NP common minke whale, $n=155$; NP humpback whale, $n=1$; NP gray whale, $n=1$; NP fin whale, $n=1$. Genetic samples were stored for the following stranded whales in 2007: NP common minke whale, $n=8$; NP Bryde's whale, $n=1$; NP sperm whale, $n=3$; NP gray whale, $n=1$ (see Annex N, Appendix 4).

Some of the collection of samples from Iceland is taken from scientific whaling. Tissue samples stored in 2007 were from North Atlantic common minke whale, $n=36$. For commercial whaling samples stored in 2007 were from North Atlantic common minke whale, $n=6$ (see Annex N, Appendix 5).

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, short tandem repeats (STRs) and sex entered in the Norwegian register for years through 2006. Laboratory work is being conducted for samples collected in 2007 (see Appendix 3 of Annex N).

For the Japanese register, all the genetic analyses (mtDNA and STRs) have been completed for NP common minke, NP Bryde's, NP sei and NP sperm whales taken by scientific whaling through 2007. The genetic samples of Antarctic minke whales have not been analysed yet, except for sex and for STR of 190 samples taken in 2006/07. The

genetic analysis (mtDNA and STRs) of Antarctic fin whales was completed for 2005/06 and 2006/07. For bycatch samples, genetic analyses (mtDNA and STR) have been completed for all samples through 2007. For the stranding mtDNA analysis was completed for samples collected through 2007 (see Annex N, Appendix 4).

For the Icelandic register genetic analyses (mtDNA and STR) were completed for common minke whales taken by scientific whaling in 2007. Laboratory work of samples taken under commercial whaling in 2007 is under way (see Annex N, Appendix 5).

The Committee **encourages** that new technological and analytical improvements are incorporated into the national registries when appropriate, and **encourages** that such improvements be reported to the Working Group on DNA Testing.

16.5 Work plan
Issues related to the work plan are dealt with under Item 20; budgetary matters are considered under Item 22.

17. SCIENTIFIC PERMITS (SEE ANNEX P)

17.1 Review of results from existing permits
17.1.1 Japan – Antarctic minke whales, fin whales – progress report, authors' summary
SC/60/O4 is the cruise report of JARPA II in the 2007/08 season. This cruise was carried out as a full-scale survey following feasibility studies in the 2005/06 and 2006/07 austral summer seasons. Two dedicated sighting vessels, three sighting and sampling vessels and one research based ship engaged in the research from 15 December 2007 to 24 March 2008. The planned research area was Area III East (35-70°E), Area IV (70-130°E), Area V West (130-165°E) and a part of Area V East (165-175°E). The research activity was interrupted several times by violent action by anti-whaling groups. As a result, both sighting and sampling surveys in the Area V East were cancelled and the sampling survey in the Area IV East and Area V West was not completed.

The results of the sighting survey showed that the number of humpback whales was far greater than that for Antarctic minke whales in Areas III and IV. Conversely, Antarctic minke whale sightings were less than half the rate they were in the previous survey conducted in the same area in 2005/06. It was suggested that the increase and habitat expansion of humpback whales in those areas may have affected the distribution of Antarctic minke whales in the Antarctic. A sighting and sampling survey in a polynya revealed that mature female Antarctic minke whales were concentrated within the polynya and that they were segregated from humpback whales, which were distributed outside the polynya. The results support the hypothesis that many Antarctic minke whales, especially mature females, are distributed in the ice-free area beyond the ice-edge, where research vessels could not enter. For the improvement of the management of whales in the Antarctic, elucidation of the interactions between humpback and Antarctic minke whales related to habitat and prey and elucidation of the behaviour of Antarctic minke whales in pack ice are necessary. A combination of lethal and non-lethal methods, such as comparison of results obtained from stomach content analysis and net sampling, is important to elucidate the role of whales in the

Antarctic ecosystem. General Committee discussion occurs under Item 17.1.4.

17.1.2 Japan – North Pacific common minke, Bryde's, sei and sperm whales – progress report, authors' summaries
SC/60/O5 reported on the sixth cruise of the full-scale survey of the second phase of the Japanese Whale Research Programme under Special Permit in the western North Pacific (JARPN II) - offshore component - which was conducted from 11 May to 6 September 2007 in sub-areas 7, 8 and 9 of the western North Pacific. JARPN II combines both lethal and non-lethal methods. A total of six research vessels were used: one dedicated sighting vessel, three sighting/sampling vessels, one trawl and dedicated sighting survey vessel equipped with quantitative scientific echo sounder and one research base vessel. A total of 17,200.5 n.miles was surveyed in a period of 119 days. During that period 157 common minke, 707 sei, 687 Bryde's, 25 blue, 71 fin, 97 humpback, 1 North Pacific right and 971 sperm whales were sighted. Non-lethal methods including biopsy skin sampling, photo-ID experiments and the satellite tag tracking were utilised. Biopsy samples were collected from 2 fin whales and 1 humpback whale. Ten blue whales and 3 humpback whales were photographed. A satellite tag was attached to one sei whale. A total of 100 common minke, 100 sei, 50 Bryde's and 3 sperm whales was sampled by the SSVs. Biological sampling and research on all whales sampled was conducted on board the research base vessel. Common minke whales fed mainly on Pacific saury and mackerels in sub-area 8 and 9 and on Japanese anchovy in sub-area 7. Sei whales fed mainly on mackerel in May and June and on copepods and Japanese anchovy in August. Bryde's whales fed mainly on Japanese anchovy. Sperm whales fed mainly on various kinds of squids, which inhabit the mid- and deep-waters. The cooperative survey on the prey species and whale sampling to compare with results of echo sounder and stomach contents were conducted with the participation of the five vessels using midwater trawl, IKMT and NORPAC net, CTD and XCTD observations between 9 July and 13 August. The data will be used for developing ecosystem models and these results will be reported to the JARPN II review meeting.

SC/60/O6 outlined the results of the fourth survey of the JARPN II coastal component off Sanriku (sub-area 7) conducted from 16 April to 31 May in 2007, off Sanriku district, northeastern Japan (middle part of sub-area 7), using four small-type whaling catcher boats and one echo sounder trawl survey vessel. In this survey, sampling of common minke whales was conducted in coastal waters mainly within 30 n.miles from Ayukawa port in the Sanriku district, and all animals collected were landed on the JARPN II research station established by the port for biological examination. During the survey, a total of 7,793.7 n.miles (716.5hrs) was surveyed for whale sampling, 166 schools (171 individuals) of common minke whales were detected, and 57 animals were caught. Average body length of the animals was 6.25m (SD: 1.30, n=21) for males and 5.67m (SD: 1.16, n=36) for females. Dominant prey species found from the forestomachs of animals were Japanese sand lance and Japanese anchovy throughout the survey period. Krill was observed from only one individual. The seasonal pattern of the dominant prey species through the survey period was different from the past three coastal surveys off Sanriku. These results

indicate that the feeding habits of common minke whales in coastal waters off Sanriku changes year by year.

SC/60/O7 presented the fifth survey of the JARPN II coastal component off Kushiro, northeast Japan, conducted from 10 September to 31 October 2007, using four small-type whaling catcher boats and one echo sounder-trawler and dedicated sighting survey vessel. The sampling was conducted in the coastal waters within 50 n.miles from the port at Kushiro. All whales sampled were landed on the land station in Kushiro port for biological examination. During the survey, a total of 6,827.7 n.miles (637.6hrs) was searched for whale sampling, 98 schools/99 individual common minke whales were sighted and 50 whales were sampled. The average body length of sampled whales was 6.45m (SD=1.10, n=33) for males and 5.49m (SD=0.81, n=17) for females, respectively. In males, 15 out of 33 animals were sexually mature, while all females (17 animals) collected were sexually immature. Dominant prey species found in the forestomach contents were Japanese anchovy (38.0%) and walleye pollock (30.0%). The ratio of whales feeding on walleye pollock was relatively high in 2007 compared with the results of the previous surveys conducted in 2002 to 2006. Larger and mature whales tend to take Pacific saury (*Cololabis saira*) and common squid (*Todarodes pacificus*), while immature whales mainly took walleye Pollock. These results suggested the possible difference in the food preference between mature and immature individuals in the coastal waters off Kushiro in autumn, and the variability in the effects for the inshore marine ecosystem and local coastal fisheries through the yearly change in the composition of the whales migrating to the local coastal area.

General committee discussion occurs under Item 17.1.4.

17.1.3 Iceland – North Atlantic common minke whales – progress report, authors' summary
SC/60/O13 reported on progress made in the Icelandic research programme on common minke whales in Icelandic waters. The programme was discussed by the Committee in 2003 and assumed a catch of a total of 200 common minke whales, 200 fin whales and 100 sei whales (Marine Research Institute, 2003). Implementation of the part of the research programme concerning common minke whales was initiated in August 2003. The primary objective of this research is to increase our knowledge on the feeding ecology of minke whales in Icelandic waters through studies on diet composition, energetics, seasonal variation in distribution and abundance, consumption of different prey species and multispecies modelling. Several secondary objectives were defined including studies on genetics, movements, pathology, biological parameters and pollutant levels.

During 27 April-20 June and 24 August-2 September, 34 and 5 respectively, common minke whales were caught under special permit in accordance with the original research proposal. With these, the originally proposed takes of 200 minke whales for the research programme has been achieved. No decision has been taken by Icelandic authorities regarding implementation of the part of the programme concerning fin and sei whales. Overall, the sampling has been close to representative of the distribution in the continental shelf as judged from sightings surveys in recent decades.

SC/60/O13 summarises the composition of the sample (catch position, sex and length), the samples taken and the status of other subprojects including energetics, stable isotope ratios, seasonal variation in distribution, genetics, satellite tracking, parasitology, haematology, urinalysis, histology, microbiology and pollutant studies.

Due to the temporal and spatial distribution incorporated in the design of the research programme, it was deemed premature for most of the studies to present results before sampling was completed. Samples collected for many of the subprojects have already been analysed or are at a final stage of laboratory analyses. For other projects, requiring complex setup for chemical analyses (pollution, genetics) it was considered unfeasible to start the laboratory work until all samples were available. After finishing the sampling in 2007 these studies were initiated and are presently at various stages of analysis.

Compared to the limited data available prior to this study, preliminary results from the analysis of stomach contents indicate considerably higher proportions of cod, haddock, and other large teleost fishes and also somewhat higher incidence of sandeel, while capelin and euphausiids were found in lesser amounts. There appears to be considerable overlap in the size of cod and haddock taken by common minke whales and the fishery fleet and a pronounced geographical variation in the diet within the Icelandic continental shelf area. Work on design and construction of multi-species models based on the diet data will be initiated in the autumn of 2008 in cooperation with the University of Iceland.

General Committee discussion occurs under Item 17.1.4.

17.1.4 Scientific Committee discussion of results from existing permits
As in past years, some members disputed the need for lethal sampling of whales to gain information relevant to IWC management. They also noted the lack of scientific evidence for the authors' claims regarding a direct relationship, mediated by inter-specific competition, between the purported increase in humpback whale abundance and the distribution of Antarctic minke whales. These members agreed that a multi-species study of the foraging ecology of Antarctic baleen whales would be of interest, but stated that such an investigation should be conducted through more sophisticated non-lethal methods, notably with an integrative study of niche separation that combines digital tagging of individual whales with fine-scale oceanographic sampling; they noted that similar studies have been successfully conducted in several habitats (e.g. Baumgartner *et al.*, 2003, for North Atlantic right whales), including on humpback and minke whales in the Antarctic (Friedlaender *et al.*, 2006). Furthermore, they noted that such work would more effectively be conducted in cooperation with appropriate regional organisations such as CCAMLR, and that the upcoming IWC-CCAMLR workshop (SC/60/EM6) represented a good opportunity to establish such collaborations.

Some members noted that the very high pregnancy rate (93.2%) in mature female minke whales reported from the JARPA II survey (SC/60/O4, p.7) could be interpreted as either (1) evidence of strong population segregation; (2) recovery of a depleted population; or (3) animals responding reproductively to abundant food resources in the absence of competition from other species. None of these explanations are consistent with the suggestion in SC/60/O4 that minke whales

were being displaced from their habitats because of competition from humpback whales.

The same members also commented on the surprisingly low number of fin whales (9) found by the JARPA II survey. In addition, they noted the statement in SC/60/O4 that targeting of all fin whales in JARPA II had to be restricted to animals less than 20m in length because of processing restrictions; they pointed out that this would effectively mean that sampling (and therefore the study's results) would be strongly biased towards sexually immature animals.

A number of members associated themselves with the following statement. This year the Committee was asked to review and comment on five substantial reports that resulted from work conducted under special permit (JARPN II: SC/60/O5, O6, O7; JARPA II: SC/60/O4; Iceland: SC/60/O13). The Committee was also required to further develop and attempt to agree on procedures towards an improved review process for new, ongoing and concluding programmes. While in previous years these tasks have required substantial time convened in a separate sub-committee, this year discussions were limited to a relatively brief time in Plenary. The appropriate review of work conducted under special permit is important and yet a full review of the cruise and progress reports was not possible in the time provided. Previous Committee reports highlight that many members have substantial reservations about the scientific merit of work resulting from special permit research. The rapid expansion in number and range of whale species taken for this work adds to this concern. While the proposed process for review of special permit proposals will, if adopted, improve the independent scientific review of proposals, some members expressed their concern that the very abbreviated discussion and review of the documents at this meeting cannot adequately accommodate the intended Committee review function. General comments in previous reports go some way to summarising the nature of the scientific concerns of these members, but with almost 1,500 whales being killed annually for this work, the continued inadequate review process remains a major concern. It is worth noting that takes under special permits represent by far the greatest level of take under the rules of the IWC. When compared with the extensive and careful review of information relevant to the other takes, the scientific permit takes clearly receive inadequate attention, and this situation requires serious attention. The review process notwithstanding, some members also noted that there appeared to have been very limited response from the Government of Japan to changing research methodologies in their special permit work in response to previous reviews. These members sincerely hope that the additional effort that is now proposed to enhance the review process will lead to increased adoption of recommendations and a willingness to modify methodologies.

In response to the above comments, Hatanaka, Fujise and Miyashita issued the following statement. The authors of the said reports expressed their disappointment at the statements made by some Committee members which repeated similar arguments against the special permit studies in the past meetings of the Scientific Committee. The arguments denied the need for and merits of lethal sampling research without providing clear non-lethal alternative methods to provide some important information required for the management and conservation of whale populations, e.g. accurate age determination, reproductive capacity, and quantitative data that indicates health conditions of whales, to name a few. The authors believe that the past approaches to oppose lethal sampling categorically had undermined the cooperation amongst members of the Scientific Committee.

The authors welcome objective and thorough review of the achievements of the special permit studies and therefore appreciate the discussion for the development and agreement of a process for the review of proposals and results from research conducted under special permit (Article VIII). They also support strengthened scientific cooperation with other regional and global organisations which are interested in the science of marine ecosystems. As to the overall achievements of the special permit studies, the authors drew attention to previous responses to the issues raised by some Committee members (see references below) as well as the most recent review of JARPA by the IWC's Scientific Committee in December 2006, which made a number of recommendations for additional data analysis and concluded that:

> 'the dataset provides a valuable resource to allow investigation of some aspects of the role of whales within the marine ecosystem and that this has the potential to make an important contribution to the Scientific Committee's work in this regard as well as the work of other relevant bodies such as the Convention for the Conservation of Antarctic Marine Living Resources'.

Japan welcomes constructive comments and suggestions on its research plans and has carefully considered discussions and concerns expressed by some members of the Scientific Committee in the past and have made improvements to sighting surveys as well as feeding studies. JARPA II data have shown continuous high pregnancy rates of Antarctic minke whales and a reduction of food intake with subsequent reduction of blubber thickness of minke whales. On the other hand, a rapid increase of humpback whale numbers has happened in recent years. Therefore, there is a time difference between these phenomena and they are not necessarily inconsistent. The surveys have detected that the distribution of humpback whales expanded southward and the distribution of minke whales was compressed near the pack ice year by year. These results suggest interaction between minke whales and humpback whales which will be elucidated by further research and analyses. With regard to the comments on fin whales, the correct numbers of sightings of fin whales during the 2007/08 JARPA II survey are 9 school/43 individuals by SSV and 39 school/91 individuals by SV (table 4 in SC/60/O4). The number of sightings this season was not as high as those in previous years because fin whales were distributed more in the northern areas as compared to previous survey seasons. With regard to fin whale sampling, the 20m restriction could produce some bias but a large number of animals less than 20m are sexually mature and the samples collected include mature animals. The authors believe an appropriate handling of the obtained data would produce useful information.

17.2 Planning for the JARPN II review
The Committee agreed that a review of JARPN II will take place intersessionally and the review process will follow

Table 6
Workshops and intersessional meetings planned for 2008/09.

Subject	Agenda item	Venue	Dates	Steering Group
SOWER cruise: planning meeting and future	Annex G, App. 2	Tokyo	26-29 Sep. 2008	Q12
SOWER abundance estimates Workshop	Annex G, Item 10.1	St. Andrews	Apr. 2009	Q13
IWC/CCAMLR Workshop on ecosystem modelling	Annex K1, Item 1.2	Tasmania	Aug. 2008	Q28
Pollution 2000+ Phase II scoping group meeting	Annex K, App. 4	TBA	Feb. 2009	Q25
Climate change Workshop	Annex K, App. 3	Siena	Spring 2009	Q23
Workshop on Greenland fisheries	Annex E, Item 3.3	Copenhagen	Spring 2009	Q1
Technical AWMP meeting	Annex E, Item 3.3	TBA	Late 2008	Q1
Second North Atlantic fin whale *Implementation* Workshop	Annex D, Item 4	TBA	Spring 2009	Q2
MSYR review Workshop	Annex D, Item 4	TBA	Spring 2009	Q3
Pre-meeting RMP (early start)	Annex D	Madeira	2 day pre-meeting	Q
Pre-meeting AWMP (early start)	Annex E	Madeira	2 day pre-meeting	Q1
Meeting of Large-Scale Whalewatching (LaWE) Steering Group	Annex M, Item 21	Aberdeen	Intersessionally	Q30
Workshop on humpback whale population modelling	Annex H, App. 4	TBA	Intersessionally	Q7
JARPN II Review Workshop	Annex P, Item 17.2	Spring 2009	Spring 2009	Q34
MPA Workshop	Raised in Plenary	Hawaii	Mar. 2009	N/A

the new Committee procedure for such reviews (see Item 17.4 and Annex P). According to the agreed procedure, the Committee Chair shall at an Annual Meeting establish a Standing Steering Group (SSG). The main Terms of Reference (ToR) for the SSG is to give advice to the Chair regarding independent experts to the specialist review workshop. The Committee discussed different approaches to nomination of the SSG. After considerable discussion and recognition of the importance of fairness and experience, the Committee **agrees** that the SSG should be composed of the four most recent chairs of the Committee. This will ensure that SSG members have the respect of the full Committee and that they have a broad oversight of the work of the Committee.

17.3 Improving the Committee's procedure for reviewing scientific permit proposals
Last year, the Committee agreed on a process for reviewing new proposals and, in principle, to periodic and final reviews of existing proposals (IWC, 2008m, pp.351-52). The Committee also agreed to discuss further details on the latter aspect at this year's meeting.

An intersessional correspondence group chaired by DeMaster discussed necessary additions to Annex P to make it applicable to periodic and final reviews. The intersessional correspondence group amended Annex P. However, some diverging views were noted, e.g. regarding the schedule for submission of documents and holding the expert Workshop. Therefore, it was left to this meeting of the Committee to develop a time schedule of events and agree on the final wording. A small group developed a schedule of events and a draft text for review of special permit research results. The schedule of events is now incorporated as table 1 in the revised Annex P.

The Committee **agrees** the new procedure for the review of Scientific Permit Proposals and Research Results from Existing and Completed Permits (see Annex P) and **recommends** this to the Commission. The Committee **agrees** that the forthcoming review of JARPN II will be the first test of this procedure, and that the text may be adjusted based on the experience gained by that review. The Committee is aware of the ongoing process in the Commission regarding the future of the IWC. It notes that the agreed procedure might therefore be subject to changes subsequent to any Commission decision on the use of

ICRW Article VIII. In addition, the Committee **agrees** that it would not discuss ongoing permit results in the years between periodic reviews; rather it would merely note short annual reports provided by those undertaking the permit research.

18. WHALE SANCTUARIES
No new proposals for sanctuaries were received.

19. RESEARCH AND WORKSHOP PROPOSALS AND RESULTS
Table 6 lists the proposed intersessional meetings and workshops. Financial implications and further details are dealt with under Item 22.

Results from IWC funded projects are dealt with under the relevant Agenda Items.

19.1 Review proposals for 2008/09
The Committee was informed about an upcoming conference on Marine Protected Areas and marine mammals being held in March 2009. It will address a number of issues relevant to the Committee's work and is discussed further under Item 22.

20. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2009 MEETING
At this year's Scientific Committee meeting, 13 sub-committees (including Standing Working Groups) were established. The number of available sessions for sub-committee deliberations was 84 over a seven-day period, based on three concurrent sub-committee meetings for each of four work sessions per day, starting at approximately 08:30 and ending typically at 18:00. In addition, this allowed for several *ad hoc* working groups to meet in the evening, typically from 18:15 to approximately 21:00, and for occasional longer sessions of sub-committees beyond the scheduled 18:00 finish time. However, because of the inability to schedule certain sub-committees opposite other sub-committees only 79 of the possible sessions could be scheduled. This meeting schedule was only possible due to the seventh day for sub-committees this year, and this schedule proved efficient as it allowed for rapporteurs and *ad hoc* working groups to work during the evening. The

Scientific Committee **agrees** to continue this schedule at next year's meeting.

20.1 Committee priorities for 2009

As in recent years and with the Scientific Committee's agreement, the Convenors met after the close of the Committee meeting and drew up the following basis of an initial agenda for the 2009 meeting. The same criteria as previous years were taken into account (e.g. IWC, 2004b, p.51). The Committee recognises that priorities may have to be reviewed in light of decisions made by the Commission. A maximum of 84 working sessions will be available during the seven-day period for sub-committees. Items of lower priority on sub-committee agendas will only be discussed if time allows. Therefore, the Committee **stresses** that papers considering anything other than priority topics will probably not be addressed at next year's meeting. It **agrees** that this information should be included on the website when the information about document submission is published next year. There will again be Working Groups established to consider North Pacific common minke whales, ecosystem modelling issues and for the discussion of special permit results. In addition, the Committee **agrees** that two pre-meeting meetings will probably be required, depending on intersessional progress; the proposal is that RMP and AWMP+BRG will share two days. The joint pre-meeting meeting of the AWMP and BRG is dependent on intersessional progress on gray whales (see Item 9.2.1); the RMP pre-meeting will again depend on intersessional progress and will cover either the North Atlantic fin whales *Implementation Review* or MSYR. The Committee **stresses** that these pre-meetings are part of the main sub-committee or SWG agendas; discussion will not be re-opened during the main sub-committee week and the agenda items to be discussed may vary from those expected, depending on progress. The Committee will be informed of the final topics as soon as possible and certainly by three months prior to the Annual Meetings (see Item 23).

Revised Management Procedure (RMP)
The following issues are high priority topics:

(1) review MSY rates;
(2) dependent upon results of (1), finalise the approach for evaluating proposed modifications to the *CLA*;
(3) complete *Implementation* for the western North Pacific Bryde's whales;
(4) complete *Implementation* for North Atlantic fin whales; and
(5) complete *Implementation Review* for North Atlantic minke whales.

Aboriginal Whaling Management Procedure (AWMP)
The following issues are high priority topics:

(1) complete work on sex ratio methods for common minke whales off West Greenland;
(2) conduct *Implementation Review* of eastern North Pacific gray whales;
(3) carry out annual review of aboriginal catch limits for Greenland and St. Vincent and The Grenadines fisheries;
(4) continue work on developing *SLA*s for the Greenland fisheries; and
(5) consider lessons learned from the bowhead whale *Implementation Review*.

Bycatch and other anthropogenic removals (BC)
The following issues are high priority topics:

(1) collaboration with FAO on collation of relevant fisheries data;
(2) progress on joining the Fishery Resource Monitoring System (FIRMS);
(3) estimation of bycatch mortality of large whales;
(4) estimation of risk and rates of entanglement;
(5) review progress in including information in national Progress Reports;
(6) review methods to estimate mortality from ship strikes, including modelling risk; and
(7) continue to develop a global database of ship strike incidents.

The following will be discussed only if there is time and documentation available:

(8) continue to consider methods for assessing mortality from acoustic sources and marine debris.

Bowhead, right and gray whales (BRG)
The following issues are high priority topics:

(1) assess stock structure and abundance of the eastern Canada and West Greenland bowhead whales;
(2) provide information to the SWG on the AWMP for the *Implementation Review* of eastern North Pacific gray whales;
(3) perform annual review of catch information and new scientific information for B-C-B Seas bowhead and eastern North Pacific gray whales;
(4) review new information on western North Pacific gray whales including the report of the IUCN rangewide workshop;
(5) review the report of the intersessional Steering Group on the assessment of southern right whales; and
(6) review new information on all stocks of right whales and the small stocks of bowhead whales.

Environmental concerns (E)
The following issues are high priority topics:

(1) review report of the second climate change Workshop;
(2) review report of the POLLUTION+ Phase II planning Workshop;
(3) receive the State of the Cetacean Environment Report (SOCER); and
(4) review report from the intersessional group on cetacean emerging and resurging disease (CERD), including skin disease.

The following will be discussed only if there is time and documentation available:

(5) review any new information on anthropogenic noise and marine energy production.

Ecosystem modelling (EM)
The following issues are high priority topics:

(1) review report from the joint CCAMLR/IWC Workshop; and
(2) review models from JARPN II.

In-depth assessment (IA)
The following issues are high priority topics:

(1) produce agreed abundance estimates of Antarctic minke whales from IDCR/SOWER data (highest);

(2) conduct an analysis of ageing errors that could be used in catch-at-age analyses of Antarctic minke whales;

(3) continue development of the catch-at-age models of the Antarctic minke whales;

(4) continue to examine the differences between minke abundance estimates from CPII and CPIII (these may be Area-specific differences), particularly the impact of sea ice conditions on abundance estimates; and

(5) develop recommendations for future SOWER cruises, both for the short- and long-term.

The following will be discussed only if there is time and documentation available:

(6) evaluate the JARPA abundance estimates, focusing on minke whale estimates; and

(7) initiate planning of in-depth assessment of sei whales.

North Pacific common minke whales (NPM)
The following issues are high priority topics:

(1) conclude discussions about stock structure in the Sea of Japan;

(2) consider new information on J-stock animals along the Pacific coast of Japan; and

(3) integrate information from abundance estimates with the assumption of $g(0)=1$ in surveyed areas.

Stock definition (SD)
The following issues are high priority topics:

(1) statistical and genetic issues relating to stock definition (including further discussion of DNA data quality, and guidelines for appropriate analysis);

(2) progress on TOSSM; and

(3) criteria for unit-to-conserve.

Southern Hemisphere whales other than Antarctic minke whales (SH)
The following issues are high priority topics:

(1) humpback whales - complete the assessments of BSB and BSC and continue assessment of breeding stocks D, E and F; and

(2) blue whales (with emphasis on non-Antarctic blue whales).

Small cetaceans (SM)
The following issues are high priority topics:

(1) review systematics, population structure and status of common dolphins;

(2) review progress on previous recommendations; and

(3) review takes of small cetaceans.

Whalewatching (WW)
The following issues are high priority topics:

(1) discuss the proposal for a large-scale whalewatching experiment (LaWE);

(2) review whalewatching in Portugal (Azores, Madeira), Canary Islands and Strait of Gibraltar;

(3) assess the impacts of whalewatching on cetaceans; and

(4) review reports from Intersessional Working Groups.

The following will be discussed only if there is time and documentation available:

(5) consider information from platforms of opportunity of potential value to the Scientific Committee;

(6) review whalewatching guidelines and regulations; and

(7) review risks to cetaceans from whalewatching vessel collisions.

DNA (DNA)
The following issues are high priority topics:

(1) review genetic methods for species, stock and individual identification;

(2) review *GenBank* sequence assessment for species assignment and continue discussion of plans for *GenBank* sequence assessment for species assignment;

(3) collection and archiving of tissue samples from catches and bycatches; and

(4) reference databases and standard for diagnostic DNA registries.

Special permits (SP)

(1) review report from the specialist Workshop to evaluate results from JARPN II; and

(2) receive (but not review) cruise reports from ongoing special permit programmes.

21. DATA PROCESSING AND COMPUTING NEEDS FOR 2008/09

The Committee identified and agreed the requests for intersessional work by the Secretariat given in Table 7.

Table 7

Computing tasks/needs for 2008/09.

RMP – preparations for *Implementation*
(1) Complete development of a control program for, and run the set of North Atlantic fin whale *Implementation* trials specified in Annex D, item 3.2
(2) Conduct an audit of the survey data for western North Pacific Bryde's whales

AWMP
(1) Validation of computer programs associated with *Implementations* and assessments (Annex E, item 3.3)
(2) Any work arising from the intersessional workshop

In-depth assessment
(1) Validation of the 2007/08 SOWER cruise data and incorporation into the sightings database

Southern Hemisphere whale stocks
(1) Preparation of a 'final' revised Southern Hemisphere catch data series including validation of new individual data

By-catch
(1) Work with Northridge to input bycatch data into database (see Annex J, item 6.1)

22. FUNDING REQUIREMENTS FOR 2008/09

Table 8 summarises the complete list of recommendations for funding made by the Committee. The total required to meet its preferred budget is £341,670. The Committee **recommends** all of these proposed expenditures to the Commission.

However, it understands that the projected amount available for funding is about £305,400. It therefore carefully reviewed the full list, taking into account its work plan, priorities and the possibility that some of the work requiring funding could be postponed to a future year or years. Such considerations are difficult and the Committee **stresses** that projects for which it has had to suggest reduced funding are still considered important and valuable. Should the Commission be unable to fund the full list of items in Table 8, the Committee **agrees** that the final column given in the table represents a budget that will allow progress to be made by its sub-committees and Working Groups in its priority topics. Progress will not be

Table 8

Budget requests.

	Plenary Item first	Short title	Requested (£)	Reduced (£)
	RMP			
1	Item 5.1; Annex D	RMP MSYR intersessional meeting	3,000	3,000
2	Item 6.2; Annex D	Second Intersessional Workshop for the North Atlantic fin whale *Implementation*	10,000	8,000
3	Item 5.8; Annex D, E	Continue augmentation of the committee's computing capabilities with respect to RMP and AWMP *Implementations*	20,000	20,000
4	Item 6; Annex D	Investigate the apparent anomalies between the results of allozyme analyses and DNA-based analyses	18,000	14,500
	AWMP			
5	Item 9	Workshop on Greenland fisheries	10,000	8,000
	IA			
6	Item 10.1.2; Annex G	Continue development of statistical catch-at-age estimators for Antarctic minke whales	2,000	2,000
7	Item 10.1.2; Annex G	Independent reading of Antarctic minke whale earplugs	10,000	10,000
8	Item 10.1.1; Annex G	Workshop to complete abundance estimates for Antarctic minke whales using the IWC/SOWER data	8,000	8,000
9	Item 10.1.1; Annex G	Import and analysis of 2007/08 SOWER data	10,000	10,000
10	Item 10.1.1; Annex G	SOWER 2008/09 cruise and planning meeting	67,700	67,700
	SH			
11	Item 10.2; Annex H	Workshop on modelling methodologies for mixing and substructure of humpback whale populations	10,000	10,000
12	Item 10.2; Annex H	Development of additional humpback whale assessment models	2,000	2,000
13	Item 10.2; Annex H,	Antarctic humpback whale catalogue	6,600	6,600
14	Item 10.3; Annex H	SH blue whale photo-ID catalogue	7,800	7,800
	SD			
15	Item 11.2; Annex I	Progress on the TOSSM project	17,000	17,000
	BC			
16	Item 7.1.3; Annex J	Develop web based system for data entry into IWC global ship strike database	2,000	2,000
	E			
17	Item 12.2; Annex K	Workshop on Climate Change Implications for Cetaceans	45,000	22,500
18	Item 12.3; Annex K	Pollution modelling Workshop: development of phase II of Pollution 2000+	1,000	1,000
19	Item 12.5; Annex K	State of the Cetacean Environment Report (SOCER)	3,000	2,000
	SP			
20	Item 17.2.2; Annex P	JARPN II review workshop	15,000	15,000
	WW			
21	Item 15.1; Annex M	LaWE steering group meeting	3,000	3,000
	DNA			
22	Item 16; Annex N	Sequence assessment for species assignment for sequences deposited in *GenBank* in 2007	2,500	2,500
	OTHER			
23	Item 19.2	Participation in conference on Marine Mammal Protected Areas	15,270	10,000
24	**ALL**	Invited Participants to the 2009 Annual Meeting	52,800	52,800
		Total	341,670	305,400

possible in some important areas, as outlined below and the Committee **requests** that the Commission or individual member governments provide additional funding in these areas. The Committee **strongly recommends** that the Commission accepts its reduced budget of £305,400.

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.

Revised Management Procedure
(1) WORKSHOP TO REVIEW MSY RATES
The workshop is to enable sufficient progress to be made to be able to have a thorough review of and if necessary revise the range of plausible MSY rates (currently $MSYR_{mat} = 1\%$ to 7%) for use in RMP trials by the 2009 meeting.

(2) - (3) SECOND INTERSESSIONAL WORKSHOP FOR THE NORTH ATLANTIC FIN WHALE *IMPLEMENTATION*
The Commission has endorsed the process recommended four years ago by the Committee with respect to the time schedule if an *Implementation* begins (IWC, 2005b, pp.84-

92). In 2007 (IWC, 2008c), the Committee began the North Atlantic fin whale *Implementation*. The ability to complete the programming work needed to implement and condition the *Implementation Simulation Trials* was substantially enhanced by the extra computational support for the Secretariat that was funded last year. A continuation of this support is requested (3) in order for the Committee to meet the strict timetable agreed in the Requirements and Guidelines for *Implementations* (IWC, 2005b). The Committee should be in a position to complete the *Implementation* at next year's meeting and funding is required for invited participants at the second Intersessional Workshop in spring 2009.

(4) INVESTIGATE THE APPARENT ANOMALIES BETWEEN THE RESULTS OF ALLOZYME ANALYSES AND DNA-BASED ANALYSES
In the case of North Atlantic fin whales and North Atlantic minke whales, different genetic methodologies have revealed highly contrasting results. Allozyme analyses conducted in the early 1990s estimated large very high degrees of genetic divergence between samples from western, central and eastern North Atlantic fin whales and

minke whales at several loci. These results are in sharp contrast to the DNA-based analyses (mtDNA and microsatellite loci) which so far has revealed low levels of population genetic structure among the North Atlantic regions. The lack of congruence among different genetic analyses has important consequences for the *Implementation Simulation Trials* for North Atlantic fin whales which have to include stock hypotheses covering the full range of these contrasting genetic analyses. This funding will be used to determine the sequence of nucleotides at the exons encoding the most divergent allozymes identified in Daníelsdóttir *et al.*'s allozyme study of North Atlantic fin whales. Genomic DNA extractions from ~50 of the fin whale samples used in the original allozyme study by Daníelsdóttir and co-workers are already available. This work will be undertaken by Pasbøll and Bérubé.

Aboriginal Whaling Management Procedure
(5) WORKSHOP ON MANAGEMENT OF GREENLANDIC FISHERIES
The Committee has been unable to provide satisfactory management advice on common minke whales off West Greenland. However, it has made considerable progress in developing an assessment method for common minke whales using sex ratio data and established an ambitious work plan to complete this work by the 2009 Annual Meeting. Although a safe method for providing interim advice has been developed for fin, bowhead and humpback whales (see Item 8.1), it is important that work on developing an *SLA* for fin whales begins immediately. An intersessional Workshop is essential to maintain momentum on both these important tasks.

In-depth assessments
(6) CATCH-AT-AGE ANALYSIS
This work has been recommended by the Committee in the past and is essential in furthering the work on exploring the reasons for differences in Antarctic minke whale abundance from CPII and CPIII and working towards an in-depth assessment. The data have been generously been made available by the Institute of Cetacean Research (Tokyo) under the Data Availability Agreement. This work will be undertaken by Punt.

(7) INDEPENDENT READING OF ANTARCTIC MINKE WHALE EARPLUGS
Analyses of the combined commercial and JARPA catch-at-age data have provided robust indication of trends in minke whale recruitment which have important implications for understanding of the population's dynamics. However, this result is dependent on ageing having been carried out consistently over time, as a drift in reader performance could produce the trend in question as an artefact. The Committee has agreed a process to investigate this and the funding will be used to cover travel, subsistence and salary costs for an independent expert (Lockyer) to visit Tokyo, as well as preparation of the sample materials.

(8) ANTARCTIC MINKE WHALE ABUNDANCE ESTIMATION WORKSHOP
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 in-depth assessment of Southern Hemisphere minke whales has already taken much longer than anticipated and if the Committee is going

to finish this soon, then an intersessional technical Workshop to develop abundance estimates using the three proposed methods is essential. After such a Workshop (and some associated intersessional email correspondence), the Committee in 2009 should be able to quickly reach agreement on best available estimates, leaving enough time during the 2009 meeting for discussion of interpretation.

(9) ANALYSIS OF THE BT MODE DATA AND IMPORTATION OF 2007/08 SOWER DATA INTO DESS
BT-option 2 mode survey data from 2007/08 needs to be incorporated promptly into the IWC-DESS database so that appropriate analyses can be carried out, preferably before the Planning Meeting in Tokyo at the end of September. This would then complete the analyses of the trials of both BT mode and BT-option 2 mode that have been conducted since the 2005/06 cruise. This work will be undertaken by the IWC Secretariat in conjunction with Burt.

(10) SOWER CIRCUMPOLAR CRUISE
The Committee and the Commission have both given high priority to obtaining agreed abundance estimates for Antarctic minke whales and for explaining the differences between CPII and CPIII. The high priority plans for this year's survey are directed at experiments to address these problems including a cooperative study with an Australian aerial survey over the ice. In addition there will be continued work related to: (1) improving estimates of distance/angle estimation; and (2) research on blue whales and humpback whales which are the subject of a comprehensive assessment. The funding is for planning, equipment and participation by international scientists. The vessel is generously provided by the Government of Japan.

Southern Hemisphere humpback and blue whales
(11)-(12) INTERSESSIONAL WORKSHOP ON ASSESSMENT METHODOLOGY FOR HUMPBACK WHALE POPULATIONS
It has become evident that advances are required in the 'isolated stock' methodology that has been used to assess Breeding Stocks A and G of Southern Hemisphere humpback whales in order for it to handle the complexities of the mixing and sub-stock structure, which are associated with Breeding Stocks B and C, and D, E and F. Funding is required for an expert (Holloway) to further develop such methodology. This work will be reviewed at an intersessional Workshop, for which funds are required for the attendance of Invited Participants. Agreement of an appropriate methodology at the Workshop should enable more rapid completion of the Comprehensive Assessment of Southern Hemisphere humpback whales.

(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 mainly required for database management and incorporation of IWC photographs from the SOWER cruises.

(14) SH BLUE WHALE PHOTO-ID CATALOGUE
Funding is requested to establish a central web-based system by which Southern Hemisphere blue whale photo-ID matching can take place. The system will be developed so that photo-ID and associated regional and institutional data will be accessible to users for uploading, updating, and managing their data within a data-base with advanced

and multiple search capabilities for matching. The project will result in a report of comparisons and resulting matches made across the three regions. An important component is the incorporation of IWC photographs from the SOWER cruises.

Stock definition
(15) PROGRESS ON THE TOSSM PROJECT
Prior to this year, no population genetic method tested in TOSSM had shown much ability to detect the need for separate management when the dispersal rate between subpopulations is high. However, this year several methods have shown promise even at fairly high dispersal rates. Now that there is evidence that some methods might work in certain scenarios, it has become worthwhile to expand the range of scenarios tested, both towards general archetypes of population structure and towards more specific scenarios related to issues of immediate concern to the Committee. Progress on the TOSSM project has been greatly accelerated over the last 18 months because of the employment of a full-time technical assistant (part-funded by IWC). Funding is requested to extend the position by a further six months. Continuity in the technical assistant position is crucial to making efficient progress with TOSSM and bringing forward the results into the Committee's work.

Bycatch and other human-induced mortality
(16) WEB BASED SYSTEM FOR DATA ENTRY INTO IWC GLOBAL SHIP STRIKE DATABASE
The need for a global database of incidents involving collisions between vessels and whales has been recognised by the Committee, as well as other bodies such as the International Maritime Organization (IMO) and ACCOBAMS.

A web based system including a dedicated section of the IWC website will assist in data entry and also help to ensure that governments, industry and other relevant bodies are made fully aware of the database. Funding is requested to pay a commercial contractor to work closely with the IWC website manager in order to develop this.

Environment
(17) CLIMATE CHANGE WORKSHOP
The IWC last convened a Workshop focused on impacts of climate change on cetaceans in 1995 (IWC, 1996). Since then, much has been learnt about both how climate change is manifesting its impacts in the oceans and how to extrapolate those impacts at temporal and spatial scales relevant to cetaceans. Following endorsement of the proposal by the Commission last year, a Scoping Group met in February 2008 to develop the agenda for the Workshop. The primary aim of the Workshop is to determine how climate change is/may already be affecting cetaceans and how best to determine these effects. Funding is required for Invited Participants at the Workshop, which is expected to be held in Spring 2009 in Siena.

(18) POLLUTION MODELLING WORKSHOP: DEVELOPMENT OF PHASE II OF POLLUTION 2000+
The Committee has agreed that it will be valuable to begin Phase II of POLLUTION 2000+. The initial work will concentrate on developing: (1) an integrated modelling framework for examining the effects of pollutants on cetacean populations; and (2) a protocol for validating the use biopsy samples in pollution related studies. An important component of this work will be to identify suitable focal populations for future work. 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 is scheduled for Spring 2009. Further funding is required for Invited Participants at the Workshop.

(19) STATE OF THE CETACEAN ENVIRONMENT REPORT
The Scientific Committee regards SOCER to be a useful document that provides a 'snapshot' of environmental developments potentially relevant to cetaceans for scientists and non-scientists alike. A token amount of money is requested to show the support of the IWC for the report and thus enable the authors to seek alternative sources of funding.

Scientific permits
(20) JARPN II REVIEW WORKSHOP
The Committee has finalised a new process for the evaluation of scientific permits (new and ongoing). The funds are requested for Invited Experts to attend a review Workshop which will be hosted by Japan in Spring 2009.

Whalewatching
(21) WORKSHOP FOR STRATEGIC PLANNING OF LARGE-SCALE WHALEWATCHING RESEARCH
A successful Workshop on large-scale whalewatching experiments (LaWE) was held 30 March to 4 April 2008 in Bunbury, Australia. Due to unforeseen circumstances, the Steering Group was unable to finalise its proposal for future work at this year's Scientific Committee meeting. Therefore funding is required for the group to meet intersessionally in Aberdeen.

DNA
(22) GENBANK SEQUENCE ASSESSMENT FOR SPECIES ASSIGNMENT
In 2006, the Committee agreed to continue with the development of plans for sequence validation in *GenBank*. This funding is for the second year of the project and will provide a contract to Dr. Ross of New Zealand. Validation will take the form of a report with the following provisions:

(1) list the *GenBank* accession number and species identity of each mysticete control region sequence published in *GenBank* during 2007 with the species identity as determined using the most recent version of the *Witness for the Whales* reference sequence alignments (see Baker *et al.*, 2007a) and the *DNA Surveillance* software engine;

(2) the above list to be supported by phylogenetic trees, one per sequence, showing the placement of the *GenBank* sequence in relation to the reference sequence; and

(3) an evaluation of the types of inconsistencies/errors (quality of submitted sequences, accuracy of species identification and accuracy of geographical location).

Other
(23) PARTICIPATION IN THE FIRST INTERNATIONAL CONFERERNCE ON MARINE MAMMAL PROTECTED AREA
In March 2009, the National Oceanic and Atmospheric Administration (NOAA), along with several international partners, will host the first International Conference on Marine Mammal Protected Areas (ICMMPA). Some of the topics that will be included in both invited presentations and workshops include: scientific criteria for determining critical habitat; developing management plans; performance measures and monitoring programmes; and reviewing issues such as bycatch, ship strikes,

anthropogenic sound and emerging diseases. The Scientific Committee includes a number of these issues within its current remit and therefore supports the proposal. Funding is required to cover only a small percentage of the estimated costs of the Workshop.

(24) 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.

23. WORKING METHODS OF THE COMMITTEE

The Committee received brief reports of the scientific aspects of papers to be presented to the Commission. Gales introduced IWC/60/15 which considered the use of conservation management plans and IWC/60/16 which considered regional non-lethal research partnerships and a proposal to establish one for the Southern Ocean. Walløe introduced IWC/60/8 that *inter alia* praised the work of the Scientific Committee in the context of the Commission's work. There was no discussion of these papers.

Donovan briefly introduced SC/60/O17, which was not originally intended as a paper for the Scientific Committee *per se* but was rather the product of the authors' response to their experiences with various successful and not-so-successful attempts to develop conservation plans for some species and areas in other fora. The paper proposes an approach towards developing conservation plans that should optimise the likelihood that such plans are effective. They conclude that well-developed conservation plans represent an important approach for effective cetacean conservation. Their development involves integrating information on the population(s) of interest with information on threats in a co-ordinated and quantitative manner with respect to prioritised quantifiable objectives. Whilst a sound scientific basis and continuing scientific programme is essential, consideration of the appropriate legal framework and the involvement of a broad range of stakeholders throughout the development and implementation process is also critical for success. Conservation plans should be seen as living documents and an appropriate monitoring programme to evaluate whether objectives are being met and a strategy for regular evaluation and if necessary updating of plans must be an integral part of the plan.

In discussion, the authors suggested the approach outlined in SC/60/O17 could provide a useful framework for the Committee's work, particularly with regard to those populations that are not considered by RMP or AWMP. Clearly developing a full conservation plan is a major undertaking and an ongoing process. Priorities need to be established (e.g. on the basis of identified conservation needs); for western North Pacific gray whales - they noted that this will be considered at the IUCN rangewide workshop. They suggested that the approach identified in fig. 1 of SC/60/O17 could prove useful in focusing Committee discussions on a number of species/populations – while this may lead ultimately to conservation plans it could in any case be valuable in identifying research and other priorities from a conservation and management standpoint. It may also provide a focal point in terms of linking the work of different sub-committees (e.g. species-based sub-committees with the more general groups such as SD, E and WW). There was no time for a full discussion of the paper but the Committee **agrees** that Convenors should consider this approach when developing their agendas for next year's meeting.

In recent years it has become common for the Scientific Committee to hold pre-meetings immediately prior to the Scientific Committee meeting. There are two categories of such meetings: (1) self contained independent workshops; and (2) early starts of sub-committee business (typically the AWMP and RMP sub-committees). The Committee discussed ways to improve the communication with Committee members with respect to the agendas for the latter meeting type, so that members do not miss discussions to which they would like to contribute. It is difficult for sub-committees that rely heavily on intersessional work to set their agendas far in advance, but items to be discussed during the pre-meeting period will be circulated by the Secretariat as early as is possible.

Finally, Donovan and Hammond agreed to provide a reference document for next year that summarises the overall structure and working practices of the Committee, and, if appropriate, suggest possible improvements.

24. ELECTION OF OFFICERS

This year is the third year of the three-year term of Bjørge as Chair and Palka as Vice-Chair. According to the Rules of Procedure for the Scientific Committee, the Vice-Chair will become Chair at the end of the three-year term unless he/she declines. The Committee was therefore scheduled to elect a new Vice-Chair this year. The election process is undertaken by the Heads of Delegations. During the deliberations of the Heads of Delegations it became clear that the Vice-Chair had recently received extra commitments for the next 12 months, but that she would be able to take up the position as Chair after IWC/61 in 2009. Therefore, the Heads of Delegations agreed that the best way forward would be for the Chair and Vice-Chair to continue in their current positions for another year, and a new Vice-Chair be elected in 2009 when Palka becomes Chair. The Committee **concurs** with this approach.

25. PUBLICATIONS

Donovan reported that the *Journal of Cetacean Research and Management* is doing well and subscriptions are steadily increasing in numbers. He had recently been approached by a company that wished to make all the *Journal* papers available electronically on a pay-per-download basis and he is actively pursuing this possibility. The 'Guidelines for Authors' is to be updated shortly to include advice on reporting genetic errors and Baker has agreed to help with this matter. Approximately 75% of the papers to be included in the Special Issue on Southern Hemisphere humpback whales have been finalised and it is hoped that the volume will be going to print shortly. Work on the long-awaited Special Issue on the Revised Management Procedure has continued intersessionally. Donovan thanked the publications staff for all their hard work and noted the extra work that had gone into the latest and largest ever issue of the *Supplement*. The Committee **recognises** the importance of

the *Journal* to its work and thanked the Secretariat and the Editorial Board for their work during the year.

26. OTHER BUSINESS

Two recent mass strandings were reported. In Madagascar approximately 60 melon-headed whales stranded on 31 May 2008. The cause for this unusual stranding event is not yet established, but further research will be undertaken.

In the largest mass stranding in the region for several decades, on 9 June at least 26 common dolphins stranded and died on the south coast of Cornwall, UK. This was a very unusual event and most were found dead or dying in widely spaced estuaries. The Committee looks forward to receiving further information next year.

The Committee **endorses** the contents of a very special working paper thanking the Chair for his wisdom and fairness in steering the process for developing the new approach for addressing the review of scientific permits.

On behalf of the Committee Bjørge thanked Pastene for organising the Scientific Committee dinner, which was enjoyed by all. He thanked the Secretariat for ensuring the meeting ran smoothly and Miller for efficiently dealing with all the work related to the attendance of Invited Participants. Finally he praised Donovan for all his help and support and noted that whenever asked a difficult question, he was always there to whisper the correct answer in his ear.

27. ADOPTION OF REPORT

The report was adopted at 17:30hrs on 13 June 2008. As usual, final editing was carried out by the Convenors after the meeting.

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