

Report of the Scientific Committee

The meeting was held at the Radisson Blu Hotel, Tromsø from 30 May-11 June 2011 and was chaired by Debra Palka. A list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Chair's welcome and opening remarks

The Chair welcomed the participants to the beautiful city of Tromsø, inside the Arctic Circle, and thanked the Government of Norway, and in particular Lars Walløe, Arne Bjørge and Sidsel Grønvik for their work in assisting the Secretariat to arrange the excellent facilities and Einar Tallaksen of the Norwegian Ministry of Foreign Affairs, who assisted greatly with obtaining customs clearance for all of the equipment.

On behalf of the Scientific Committee, the Chair expressed deep condolences to our Japanese colleagues and countrymen over the tragic earthquake and tsunami that occurred on 11 March 2011 and caused such widespread devastation and loss of life.

The Committee also paused in silence to remember Robert Clarke who died in Peru after a long illness on 8 May 2011, at the age of 92. Robert was well-known for his work on sperm whales and whaling history. His seminal Discovery Report 'Sperm Whaling in the Azores', describing the relict open boat whaling industry there, was recently reprinted in Portugal in recognition of its historical importance. He also worked as a biologist on Antarctic factory ships and on whale marking cruises. In the late 1950s he began a long-term study of sperm and other whales off western South America under FAO, reporting to the Permanent Commission for the South Pacific. In the late 1950s and early 1960s, and again in the 1970s, he attended meetings of the Scientific Committee, particularly special meetings on sperm whales, and most recently was a special guest of the Committee at its meeting in Santiago, Chile, in June 2009. There he was accompanied by his wife, Obla Paliza, also a biologist, with whom he was still working up sperm whale data from the 1960s.

Robert was a colourful character with wide interests; his research included not only whales, especially sperm whales, but whaling, whaling history, whale conservation, squid and deep sea fishes. He was the technical consultant to the 1956 film of 'Moby-Dick', and retained a strong scholarly interest in whaling matters, including ambergris and scrimshaw, until very late in life.

1.2 Appointment of rapporteurs

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

1.3 Meeting procedures and time schedule

Brockington 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

As intimated last year (IWC, 2011e, p.65) and included in the draft agenda, three pre-meetings preceded the start of the Scientific Committee: the Working Group on the

Implementation Assessment of western North Pacific common minke whales met to consider progress on tasks specified in SC/63/Rep3, AWMP met to discuss progress on the development of *SLAs* for the Greenland hunts and the Working Group on the assessment of humpback whale Breeding Stock B met to complete the assessment. In addition, the intersessional meeting for the Southern Hemisphere minke whale abundance estimate continued its business.

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 D1 - Working Group on the *pre-Implementation Review* of Western North Pacific Common Minke Whales (NPM);

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 H - Sub-Committee on Other Southern Hemisphere Whale Stocks (SH);

Annex I - Working Group on Stock Definition (SD);

Annex J - Working Group on Estimation of Bycatch and other Human-Induced Mortality (BC);

Annex K - Standing Working Group on Environmental Concerns (EC);

Annex K1 - Working Group to Address Multi-species and Ecosystem Modelling Approaches (EM);

Annex L - Standing Sub-Committee on Small Cetaceans (SC);

Annex M - Sub-Committee on Whalewatching (WW);

Annex N - Working Group on DNA (DNA).

1.5 Computing arrangements

Brockington informed the participants of the arrangements for delegates computing.

2. ADOPTION OF AGENDA

The adopted Agenda is given as Annex B1. Statements on the Agenda are given as Annex S. The Agenda took into account the priority items agreed last year and approved by the Commission (IWC, 2011a, pp. 31-2). 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. He was pleased to note that this year, the percentage of people opting to receive their primary papers entirely electronically was almost double that of last year (and now is around 50%) and he hoped that this percentage would continue to grow in future years. To encourage this, the Secretariat provided participants with a memory stick with all of the papers that had been received

by the official deadline. The Committee commended this procedure and requested that it continue. Revised or new papers and reports were uploaded onto the IWC website. The list of documents is given as Annex C.

3.2 National Progress Reports on research

National Progress Reports presented at the 2002-10 meetings are accessible on the IWC website. Reports from previous years will also become available in this format in the future.

The Committee **reaffirms** its view of the importance of national Progress Reports to its work in a number of sub-committee's and **recommends** that the Commission continues to **urge** member nations to submit them following the approved guidelines (IWC, 1993b). Non-member nations wishing to submit Progress Reports are welcome to do so. It also draws attention to the need for those countries that do provide them to ensure that they are completed fully (e.g. see Items 7.3, 7.7, 14.5). Donovan reported that a prototype online submission system and database has been developed (IWC, 2011e, p.1) that will be trialled by a number of participants during and immediately after the meeting. It is expected that the online system can be used for next year's national Progress Reports. The Committee **welcomes** this development.

A summary of the information included in the Progress Reports presented this year is given as Annex O.

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 2010 meeting. In response to a question concerning data from non-member nations, Allison explained that any such data would be incorporated into the IWC database, but that the only information she had received recently was a letter from Canada regarding catches of bowhead whales in 2010. During the course of the meeting Reeves provided new information on bowhead whale catches by Canada from 1994-2010 (see Annex F, Appendix 3). Since no information was available on catches by Indonesia, the Committee requested the Secretariat contact the Government of Indonesia to request such information.

3.3.2 Progress of data coding projects and computing tasks

Allison reported that Version 5.0 of the catch databases was released during the year. Work has continued on the entry of catch data into both the IWC individual and summary catch databases, including data received from the 2009 season and additional information from inspectors' notebooks that are being incorporated into existing records from Durban, Albany and South Georgia. Some new data from an archive in St. Andrews University from the 1920s and 1930s are also being encoded. Entry of data into the bycatch database developed by Simon Northridge is continuing.

Data from the 2009/10 SOWER sightings cruise have been validated and incorporated into the DESS database. Work to encode and validate data from the 2010 Japan/IWC Joint Cetacean Sighting Survey in the North Pacific has begun.

Programming work during the past year has focussed on preparation of data and development of the control programme for western North Pacific common minke whale trials (see Item 6.3).

4. COOPERATION WITH OTHER ORGANISATIONS

The Committee noted the value of co-operation with other international organisations to its work. The observers' reports below briefly summarise relevant meetings of other organisations but the contributions of several collaborative efforts are dealt with in the relevant sub-committees. There were no reports of activities this year from several organisations including: the FAO Committee on Fisheries; the Convention on International Trade in Endangered Species of Wild Flora and Fauna; the Eastern Caribbean Cetacean Commission; the Indian Ocean Commission; Southern Ocean GLOBEC; and Conservation in the SE Pacific under the framework of the Lima Convention.

4.1 Convention on the Conservation of Migratory Species (CMS)

4.1.1 Scientific Council

The Report of the IWC observer at the 16th Meeting of the CMS Scientific Council held in Bonn, Germany from 28-30 June 2010 is given in IWC/63/4C.

Table 1
Data and programs received by the IWC Secretariat since the 2010 meeting.

Date	From	IWC ref.	Details
Recent catch data			
09/12/10	Japan: Hiruma	E88 Cat2009	Revised individual records for Japan special permit catch, 2009, North Pacific (JARPN II coastal, Sanriku).
27/04/11	Norway: Øien	E98 Cat2010	Individual records from the Norwegian 2010 commercial catch. Access restricted (specified 14/11/00).
16/02/11	Iceland: Thordarson	E98 Cat2010	Individual records from the Icelandic commercial catch 2010.
28/05/11	Japan: Hiruma	CD97 Cat2010	Individual data for Japan special permit catch 2010 North Pacific (JARPN II) and 2010/11 Antarctic (JARPA II).
30/05/11	Russia: Borodin	E98 Cat2010	Individual records from the aboriginal harvest in the Russian Federation in 2010.
Sightings data			
19/11/10	Japan: Matsuoka	CD95 + paper	2010 Japan/IWC Joint Cetacean Sighting Survey in the North Pacific.
01/04/11	Burt	CD96	DESS Version 3.64 2011.
04-12/12/10	Japan: Matsuoka	E95	2010 Japanese sighting survey in the North Pacific (inc. weather, effort, sighting + distance and angle experiment data).
Other data			
30/11/10	USA: Palka	E94	Data for use in gray whale <i>Implementation Review</i> .
18/11/10	Japan: Pastene	E93	Japan North Pacific minke bycatch data.
14/12/10	Korea: An	E93	Korea North Pacific minke bycatch data (includes data on location, date and sex).
Programs			
07/06/11	Muller	E99	Program files and documentation of SC/63 SH humpback whale BSB runs.

The Council reviewed a proposal by Spain to list two beaked whale species, *Ziphius cavirostris* and *Mesoplodon densirostris*, on Appendix I of the CMS Convention (requires complete protection by the Parties) on the grounds that they are susceptible to death caused by acoustic pollution, particularly military sonar and that they occur in small local populations as evidenced by results of surveys in the Canary Islands and Hawaii. The Council noted that the two species are distributed widely around the world and that there are no estimates of global abundance. Both are listed by the IUCN as Data Deficient. It was agreed that there is not sufficient information available on abundance and conservation status to justify Appendix I listing.

The Council recommended that funding be sought to support a workshop to assess status of and threats to small cetaceans in the western Indian Ocean. A proposal to organise the workshop is under consideration by the CMS Secretariat.

The Committee thanked Perrin for his report and **agrees** that Perrin will represent the IWC at the next CMS Scientific Council meeting.

4.1.2 Conference of Parties (COP)

There were no meetings of the Conference of the Parties during the intersessional period. The next COP, the tenth, will be held in Bergen, Norway from 20-22 November 2011. The Secretariat will represent the IWC at that meeting.

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

The Report of the IWC observers at the 17th and 18th meetings of the Advisory Committee to the Agreement on Small Cetaceans of the Baltic and North Seas (ASCOBANS) is given in IWC/63/4D. The 17th meeting of the Advisory Committee was held in Bonn, Germany from 4-6 October 2010 and the 18th meeting was held in Bonn, Germany from 4-6 May 2011. The full reports of the meetings can be found at <http://www.ascobans.org/>. The main topics of relevance to the IWC are as follows:

- (1) extension of the area covered by the Recovery Plan for Baltic Harbour Porpoises is under discussion;
- (2) work on the implementation of the new Conservation Plan for Harbour Porpoises in the North Sea is continuing;
- (3) new information was reviewed on bycatch and other causes of mortality (including ship strikes), pollution, underwater noise and disturbance.

The Committee thanked Scheidat, van de Huevel-Greve and Geelhoed for their report. Simmonds, van de Huevel-Greve and Geelhoed will represent the Committee at the next ASCOBANS Advisory Committee meeting.

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

The fourth Meeting of the Parties to ACCOBAMS met in Monaco from 9-12 November 2010. The report of the IWC observers is given in IWC/63/4K.

The Parties passed a number of resolutions relevant to cetacean conservation issues. Details can be found on the ACCOBAMS website (<http://www.accobams.net>), along with the full report of the meeting.

The ACCOBAMS Scientific Committee met in Monaco from 21-31 March 2011. It was attended by members of the Scientific Committee, representatives from the Sub-Regional Coordination Units, representatives from International Organisations and observers, including representatives of official ACCOBAMS Partners. Five Task Managers

were nominated to act as facilitators between the Chair of the ACCOBAMS Scientific Committee and the groups of experts that will deal with the 23 conservation actions included in the ACCOBAMS Work Programme.

The next meeting of the ACCOBAMS Scientific Committee is planned for November 2012 at the Oceanographic Museum of Monaco. The full report of the 7th meeting of the ACCOBAMS Scientific Committee can be found on the ACCOBAMS website <http://www.accobams.org>.

The Committee thanked Donovan and Fortuna for their report. Donovan will represent the IWC at the forthcoming ACCOBAMS Scientific Committee meeting.

4.1.5 Memorandum on the Understanding on the Conservation of the Manatees and Small Cetaceans of Western Africa and Macronesia

There was no report related to the MoU on the Conservation of the Manatee and Small Cetaceans of Western Africa and Macronesia. Perrin will represent the Committee at future meetings.

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

The report of the IWC observer documenting the 2010 activities of ICES is given as IWC/63/4B.

The ICES Working Group on Marine Mammal Ecology met in the Azores from 12-15 April 2010. Issues considered included the effects of wind farm construction and operation on marine mammals, and the assessment of current contaminant loads in marine mammals within the ICES Area. Other topics included population, abundance, structure and status of marine mammals off the Azores, further development of a framework for surveillance and monitoring of marine mammals, and evaluation of the scope for a European marine mammal tissue bank.

The ICES Study Group for Bycatch of Protected Species met at the ICES HQ in Copenhagen from 1-4 February 2011. It noted that information on the extent of cetacean bycatch in European waters had improved during the past three or four years, but that monitoring and mitigation efforts could be better focussed. They reviewed ongoing and recent work on protected species bycatch reduction in the ICES region and elsewhere. It also reiterated its view that collaboration with ongoing discard sampling schemes would be desirable to improve knowledge of the areas and gear types where protected species bycatch might be expected.

A Joint NAMMCO/ICES Workshop on Observation Schemes for Bycatch of Mammals and Birds was held at the ICES HQ in Copenhagen, Denmark, 28 June-1 July 2010. The Workshop covered a range of topics including bycatch, ship strikes, strandings and data collation/reliability of data.

The 2010 ICES Annual Science Conference was held in Nantes, France, 20-24 September 2010. The conference included no particular theme session devoted entirely to marine mammals, but some topics discussed included: the effects of contaminants in the marine environment, methodology for describing and testing non-linear spatio-temporal changes, patterns and relationships and marine biodiversity and climate variability in northern hemisphere marine ecosystems. The next ICES Annual Science Conference will take place from 19-23 September 2011 in Gdansk, Poland. More information is available on the ICES web site at <http://www.ices.dk>.

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

4.3 Inter-American Tropical Tuna Commission (IATTC)

The report of the IWC observer at the 81st meeting of the Inter-American Tropical Tuna Commission held in Antigua, Guatemala, 23 September-1 October 2010 is given in IWC/63/4H.

The Antigua Convention (Convention), which was negotiated to strengthen and replace the 1949 Convention establishing the IATTC, entered into force on 27 August 2010. Ecosystem impacts of fisheries were discussed during the IATTC Scientific Advisory Committee meeting.

The next IATTC meeting will take place on 29 June-8 July 2011 in La Jolla, California, USA. The Committee thanked Rusin for his report and **agrees** that he should represent the Committee as an observer at the next IATTC meeting.

4.4 Agreement on the International Dolphin Conservation Program (AIDCP)

The 23rd Meeting of the Parties to the Agreement on the International Dolphin Conservation Program (AIDCP) and is given in IWC/63/4I.

The IATTC provides the Secretariat for the AIDCP programme. The on-board observer programme of the AIDCP mandates 100% coverage by observers of fishing trips by purse seiners of carrying capacity greater than 363 metric tons in the Agreement Area. In 2009 and 2010, 100% of these vessels were sampled by independent observers. The increasing trend in sets made on tuna in association with dolphins during 2008-10 is cause for some concern within AIDCP. Dolphin and ecosystem assessment surveys scheduled for 2009 and 2010 have been delayed due to lack of resources, so it is unclear when abundance estimates for cetaceans in the eastern tropical Pacific will be available to update the most recent survey data collected in 2006.

The next AIDCP meeting will take place from 18-19 October 2011 in La Jolla, CA, USA. The Committee thanked Rusin for his report and **agrees** that he should represent the Committee at the next meeting of the AIDCP.

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

No IWC observers attended recent ICCAT meetings. Donovan, Hammond and Cañadas have been assisting ICCAT in the development of an aerial survey programme to provide fisheries independent data for management (<http://www.iccat.int/GBYP/en/Products.htm>).

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

The report of the IWC observer at the 29th Annual Meeting of the Commission and Scientific Committee is given as IWC/62/4A. The meeting was held in Hobart, Tasmania, Australia, from 25 October-5 November 2010.

The main items discussed of relevance to the IWC included: Southern Ocean whale population estimates; Southern Ocean ecosystems including predator/prey distribution; and killer and sperm whale interaction with longline fisheries.

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

4.7 North Atlantic Marine Mammal Commission (NAMMCO)

4.7.1 Scientific Committee (SC)

The 17th meeting of the NAMMCO Scientific Committee was held as a video-conference between Tromsø, Nuuk,

and Torshavn, from 21-23 April 2010 due to the eruption of the Icelandic volcano Eyjafjallajökull. The report of the IWC observer is given in IWC/63/4L. The meeting received reports from four NAMMCO Scientific Committee Working Groups: WG on Abundance Estimates; WG on Walrus; WG on Marine Mammals and Fisheries Interactions; and WG on Assessment. Ecosystem modelling of the Barents' Sea and Icelandic waters is to be undertaken by the NAMMCO scientific network project. T-NASS abundance estimates were presented. The Council had requested the Scientific Committee to complete an assessment of fin whales in the North Atlantic, including estimates of sustainable catch levels in the Central North Atlantic, details are available in the full NAMMCO meeting report (<http://www.nammco.no>). The NAMMCO Scientific Committee considered that the IWC RMP provides an appropriate basis to calculate catch limits and concluded that annual strikes of up to 154 fin whales from the WI (west Iceland) sub-area are sustainable at least for the immediate 5-year period. Narwhals and white whales were also discussed (and see Item 14.4.5).

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

4.7.2 Council

The report of the IWC observer at the 19th Annual Meeting of the North Atlantic Marine Mammal Commission (NAMMCO) is given as IWC/63/4G. The meeting was held from 31 August to 2 September 2010, in Tórshavn, Faroe Islands. The full report of the NAMMCO meeting is available on the NAMMCO website. Key topics from the meeting relevant to the IWC included the following.

- (1) A priority task for the NAMMCO Scientific Committee in coming months would be the finalisation of an updated abundance estimate for pilot whales in the North Atlantic.
- (2) NAMMCO, through its Scientific Committee, is now committed to an extensive and unique modelling programme that will involve experts from countries both within and outside NAMMCO, including Canada, Japan, Russia and South Africa.
- (3) An expert working group undertook a review of data and information on recent and ongoing research on improvements and technical innovations in hunting methods and gears used for the hunting of large whales in NAMMCO countries.
- (4) Based on the most recent advice on humpback quotas for Greenland from the NAMMCO Scientific Committee, it was concluded that a total removal of up to 20 humpback whales per year from 2010 to 2015 would be sustainable.

The Committee thanked Morishita for attending on its behalf and **agrees** that he should represent the Committee at the next NAMMCO Council meeting.

4.8 International Union for Conservation of Nature (IUCN)

A report on IUCN activities is given in IWC/63/4M.

4.8.1 WGWAP

The IUCN Western Gray Whale Advisory Panel has continued its work (www.iucn.org/wgwap). Apart from a week's delay ascribed to mobilisation issues, the monitoring and mitigation measures developed by the joint panel/

industry Seismic Survey Task Force were implemented as planned for the seismic survey conducted by Sakhalin Energy near the main Sakhalin gray whale feeding ground. Analysis of the data collected has not yet been completed. Two other surveys in the area were conducted in 2010 by other companies, one of which overlapped the northern part of the feeding ground, but the Panel has received no detailed information on those surveys, despite requests. Sakhalin Energy has reported that it is considering the installation of a third offshore platform just offshore of the gray whale feeding ground.

4.8.2 Red List updates

The latest update (21 June 2011) of the Red List includes the recognition of two full species of *Neophocaena* (finless porpoises), *N. phocaenoides* and *N. asiaorientalis*, each listed as Vulnerable, and separate assessments for the two species of *Sotalia* (*S. fluviatilis* and *S. guianensis*), both listed as Data Deficient. For more information see: <http://www.redlist.org>.

4.8.3 IUCN Cetacean Specialist Group

The IUCN Cetacean Specialist Group now has its own website at <http://www.iucn-csg.org>. Cetacean Specialist Group members have collaborated in a South Asia regional workshop on Determining and Quantifying Threats to Coastal Cetaceans, held in February 2011 by the Sarawak Dolphin Project at the Universiti Malaysia Sarawak.

The next IUCN 4-yearly World Conservation Congress will be held in September 2012 in Jeju, Korea (see: <http://www.worldconservationcongress.org>).

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

4.9 North Pacific Marine Science Organisation (PICES)

The report of the IWC observer at the 2010 annual meeting of PICES (PICES XVIII) held 22-31 October 2010 in Portland, Oregon, USA is given in IWC/63/4F. The Marine Birds and Mammals Advisory Group (AP-MBM) reviewed aspects of the new PICES science programme, FUTURE. The programme is focussed on: understanding climate change and anthropogenic impacts on marine ecosystems in the PICES region; forecasting future ecosystem change; and better communications with society. The AP-MBM discussed how the many long-term and large-scale datasets on marine birds and mammals in the North Pacific could be used in analyses and especially in models of marine ecosystem change and noted that to date PICES modelling efforts, e.g. NEMURO and NEMURO.FISH, have yet to integrate data on top predators. AP-MBM defined its focal points as:

- (1) updating, enhancing, and integrating models of prey consumption for top predators in the North Pacific;
- (2) defining critical habitats and high use areas for top predators in the North Pacific;
- (3) using marine birds and mammals as indicators of ecosystem change in the North Pacific; and
- (4) conserving threatened and endangered marine birds and mammals in the North Pacific.

The next PICES annual meeting (PICES 2011) will be held 14-23 October 2011, at Khabarovsk, Russia. The Committee thanked Kato for the report and **agrees** that he should represent the Committee as an observer at the next PICES meeting.

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

The report of the IWC observer is given as IWC/63/4E.

The 6th Conference of Parties (COP6) took place in October 2010. Progress on the implementation of the Marine Mammal Action Plan was acknowledged. A working group in charge of the Review for the Criteria for the Listing of Species in the Annexes to the SPAW Protocol was re-established and requested as part of its remit to identify any species receiving protection from any other International Agreements and internationally recognised lists that are not listed on the SPAW Annexes. The objectives of the Protecting Habitats and Migration Corridors for Marine Mammals in the South and Northeast Pacific and the Wider Caribbean through Marine Protected Area Networks (LifeWeb Project) are to:

- (1) provide an overview of essential habitats and regional-scale migration routes for marine mammals in need of better management in Southeast and Northeast Pacific, Wider Caribbean and adjacent regions;
- (2) introduce integrated planning approaches, including providing technical guidance, regional training and learning exchanges on marine spatial planning, MMPA (marine mammal protected areas) networks design, transfer of skills, tools and good practices on transboundary governance and equitable sharing of MMPA benefits;
- (3) apply integrated marine spatial planning and management approaches and tools in two demonstration projects (Southeast and Northeast Pacific Region and Wider Caribbean); and
- (4) develop strategic communication products to 'Make the Case' for integrated, transboundary management of marine mammal migration routes and critical habitats.

Activities to date were reported. The main objectives of the Improving Capacity in the Wider Caribbean Region project are:

- (1) improve and centralise the level of information and knowledge on the status, distribution and threats of marine mammals in the region;
- (2) identify critical habitats for marine mammals in the region; and
- (3) improve understanding of tourists and tourism stakeholders on marine mammal natural history, conservation and best practices for marine mammal viewing.

A Marine Mammal Watching Workshop will take place in Panama (25-29 October 2011).

The Committee thanked Carlson for her report and **agrees** that she continue to act as observer to SPAW for the IWC.

4.11 International Maritime Organization (IMO)

No IWC observer was present at the IMO's Marine Environment Protection Committee (MEPC) 61st meeting which took place from 27 Sept to 1 Oct 2010. The MEPC's 62nd meeting is scheduled to take place 11-15 July 2011. An update on the progress of work of joint interest to the IMO and IWC is given as IWC/63/4J.

The Committee thanked Leaper for this update.

5. REVISED MANAGEMENT PROCEDURE (RMP) – GENERAL ISSUES

5.1 Review MSY rates

Since 2007, the Committee has been discussing maximum sustainable yield rates (MSYR) in the context of a general reconsideration of the plausible range to be used in population models used for testing the *Catch Limit Algorithm (CLA)* of the RMP (IWC, 2008e). The current range is 1% to 7%, in terms of the mature component of the population. As part of its review, the Committee has been considering observed population growth rates at low population sizes. Cooke (2007) had noted that simple use of such rates could lead to incorrect inferences being drawn regarding the lower end of the range of plausible values when environmental variability on population growth rates is high. Last year, the Committee agreed a Bayesian approach (IWC, 2011e, p.6; Punt, 2010) for calculating a probability distribution for the rate of increase for an ‘unknown’ stock in the limit of zero population size, r_0 (i.e. for stocks that are a low fraction of their carrying capacities), once the inputs needed to apply it (the extent and temporal auto-correlation in environmentally-driven factors, s and r) become available. The 2010/11 work plan had focussed on estimating those inputs, using data on calving intervals and calving rates supplied to the 3rd Workshop on baleen whale MSYR (IWC, 2011n, p.402).

SC/63/RMP20 and SC/63/RMP30 presented three approaches for the analysis of selected data sets to estimate s and r . Although these approaches differed in several respects, after examination it was found that the three approaches lead to similar estimates given common assumptions and data sets. Given its generality, the Committee **agrees** to use the estimates from the approach in SC/63/RMP20; technical details can be found in Annex D, Appendix 2.

SC/63/RMP26 addressed two of the three tasks identified last year related to the correlation between variability in reproductive rates and in survival rates. It concluded using modelling that the assumption of a constant survival rate would probably result in underestimation of the variability in net recruitment rate. The Committee **agrees** that it was not worth pursuing the third task (direct estimation of variability in survival rates) because data are only available for two stocks, Southwest Atlantic right whales and eastern gray whales, and it is unlikely that inferences based on those stocks would be sufficient to draw general conclusions regarding inter-annual variation in survival.

The Committee **agrees** that it should take account of a potential positive correlation between survival and reproductive rates (negative correlation between reproductive rate, f , and natural mortality, M). In the absence of information to specify the magnitude of variation in survival, it **agrees** that analyses should be conducted in which: (a) the correlation is zero; and (b) there is a perfect negative correlation between f and M , with variability in M comparable with that for f .

The Committee identified an algorithm to estimate a probability distribution for r_0 (Annex D, Appendix 3), using information on observed rates of increase and their uncertainty, as well as the distributions for s and r . However, there was insufficient time to discuss the several assumptions it entails. A steering group has been established (Annex R1) to review Annex D, Appendix 3 and to identify any additional and alternative analyses, including how the correlation between M and f is to be modelled, in preparation for completing the MSYR review at next year’s Annual

Meeting. Alternative approaches, if fully-specified, could be presented to the steering group for consideration.

SC/63/RMP25 explored some implications of estimating MSYR from the recovery trajectories of competing populations using simulation. Both MSY and MSYR depend on the state of the competing populations. The MSYR of interest to management is the one where both species are maintained at their MSYL. This value of MSYR can be less than that applying to either species alone. Fitting a single species model to each recovery trajectory leads to estimates of MSYR that are close to the value applicable to each population alone. These estimates of MSYR are not estimates of the MSYR required for management when both species are maintained at higher levels of abundance. Discussion on SC/63/RMP25 focussed on two issues:

- (1) the realism of the population dynamics model on which the analyses were based; and
- (2) whether the RMP process would be able to appropriately use information on MSYR from syntheses of rates of increase at low population size given the possible implications of multi-species effects.

Several views were expressed on the issue, as detailed in Annex D.

On a related matter, the Committee **agrees** that an appropriate way to bring multi-species considerations into RMP discussions, in the context of multi-species operating models, is to hold a joint session of the RMP sub-committee and the EM Working Group next year.

In conclusion, the Committee noted that last year it had agreed that it should complete the MSYR review this year on the basis of the data and analyses available, accepting that it was not appropriate to keep extending the time available for the review given its importance to finalising the approach for evaluating amendments to the *CLA* (IWC, 2011e, p.7). Although it was regrettable that the review had not been completed this year, the Committee **stresses** that it has agreed an intersessional work plan such that it will not only complete the review but will also finalise the approach for evaluating amendments to the *CLA* at next year’s meeting.

5.2 Finalise the approach for evaluating proposed amendments to the *CLA*

When it last discussed this issue (IWC, 2007b), the Committee agreed that two steps still had to be completed: (1) finalisation of the MSYR review; and (2) specification of additional trials for testing amendments to the *CLA*. The latter related to modelling the effects of possible environmental degradation in addition to, or possibly replacing, the trials in which K , perhaps with MSYR, varies over time. The Committee re-established a working group under Allison to develop and run such trials for consideration at next year’s meeting (Annex R2).

5.3 Evaluate the Norwegian proposal for amending the *CLA*

The Committee was unable to complete its evaluation of the Norwegian proposal. It will complete the task once the MSYR review is complete and any additional trials (see Item 5.2) have been specified and run.

5.4 Relationship between phase-out rule and abundance estimates based on multi-year surveys

Last year, the Committee recommended a number of changes to the RMP specifications and annotations (IWC, 2011h, pp.102-3) which were endorsed by the Commission.

One of these was to extend, from five to six years, both the period for which catch limits are set and the preferred interval between *Implementation Reviews*. The Committee had agreed that this year it would reconsider the number of years since the last survey after which catch limits start to be phased out under the RMP specifications (currently eight years). This is because an eight-year phase-out rule can be problematic in cases such as the northeastern Atlantic, where each survey of the full management area is spread out over a number of years.

A change to the phase-out rule involves a change to the RMP specifications, and not merely to the annotations. Changes to the RMP specifications (IWC, 1994c, p.47) require that the Committee's agreed list of standard simulation trials be run for the proposed revision. Previous trials showed no degradation in risk-related performance when the inter-survey interval was extended to 10 years (IWC, 1993b, p. 58; 1993c, p. 94) and thus the Committee **agrees** that no further trials are required for this proposed revision. It therefore **recommends** that all references to eight years in section 3.4 of the RMP specification be amended to ten years. If a larger change is sought in the future, further simulation trials would be required.

The Committee does not foresee any further amendments to RMP specifications in the near future. It **recommends** that the full RMP and its annotations should be published in the next supplement of the Journal and placed on the IWC website. This also applies to the most recent versions of the requirements and guidelines for surveys (see Item 5.6), as well as the guidelines for data collection and analysis under the Revised Management Scheme (RMS) other than those required as direct input for the *CLA*.

5.5 Modify the 'CatchLimit' program to allow variance-covariance matrices

The Committee has agreed on the need to modify the 'CatchLimit' program to allow variance-covariance matrices (IWC, 2011e, p.66). The 'CatchLimit' program was originally written by the Norwegian Computing Center and the Committee **recommends** that they be asked to undertake this work in collaboration with Allison.

5.6 Update requirements and guidelines for conducting surveys and Implementations

While the last detection distance recorded for each sighting has been used consistently in abundance analyses of the Iceland/Faroese NASS shipboard data for large baleen whales, the common practice is to use the first detection distance. Based on further details available in SC/63/RMP2, the Committee **endorses** the use of the last detection distance for analyses of data from the T-NASS surveys. Given that such issues are survey specific, no changes to the guidelines are required.

No additional changes to the requirements and guidelines were suggested at this year's meeting although the question of the acceptability of model-based estimates will be considered next year. As noted under Item 5.4, the updated guidelines, taking into account the modifications suggested last year (IWC, 2011g, p.92) will be published in the next issue of the *Journal* (Supplement) and included on the IWC website.

5.7 Other

On a related general matter arising out of a discussion of SC/63/RMP19 (Item 6.2.1), the Committee **requests** Allison and Punt to examine: (1) whether and when the optimisation

method used when conditioning trials fails to find the actual minimum of the objective function; and (2) the implications, if any, of this for previous results of *Implementation Simulation Trials*.

5.8 Work plan

The Committee's discussions on the sub-committee's work plan (Annex D) are incorporated under Item 21.

6. RMP – PREPARATIONS FOR IMPLEMENTATION

6.1 Western North Pacific Bryde's whales

In 2007 (IWC, 2008e), the Committee agreed that three of the four RMP variants (1, 3, and 4) considered during the *Implementation* for western North Pacific Bryde's whales performed acceptably from a conservation viewpoint and recommended that they could be implemented without a research programme. It also agreed that variant 2 (where sub-area 2 is treated as a *Small Area*) was not 'acceptable without research' given its performance for one of the stock structure hypotheses. Last year, the Committee received a revision of an original research proposal (Pastene *et al.*, 2008) and recommended that it be revised further. The Committee was advised that a revised proposal had not been written given that the Commission had not yet decided to implement the RMP for western North Pacific Bryde's whales. Rather, Japan will present new information related to stock structure during the forthcoming *Implementation Review*.

The Committee **agreed** to begin to prepare for the 2013 *Implementation Review* for the western North Pacific Bryde's whales during next year's meeting.

6.2 North Atlantic fin whales

6.2.1 Consideration of research proposal associated with variant 2

The Committee has agreed that if the RMP is implemented for North Atlantic fin whales, variants 1, 4, 5 and 6 could be implemented without a research programme, whilst variants 2 and 3 were not 'acceptable without research' (IWC, 2010e). Last year, the Committee received a draft research proposal from Iceland (Gunnlaugsson *et al.*, 2010) that proposed to use biopsy sampling and satellite tagging late in the season to determine whether stock structure hypothesis IV (four breeding stocks, but with no dispersal among the stocks near Iceland), the basis of the trials that led to variant 2 being unacceptable without research, should have been assigned 'low' plausibility. It had noted that the aim of any research proposal should be to assess the probability of hypothesis IV relative to the probabilities for the other stock structure hypotheses and that the *Implementation Simulation Trials* could be used to assess the effect sizes on which power analyses should be based (IWC, 2011g).

SC/63/RMP19 (written in response to a Committee request last year), used *Implementation Simulation Trials* to determine that a mixing rate of 22% would allow variant 2 to perform 'acceptably' for stock structure hypothesis IV. Further, the analysis estimated the mixing rate to be 8% for all values of $MSYR_{mat}$, rejecting a mixing rate of 5% for $MSYR_{mat}$ of 1% with 95% confidence. The author noted that these results support an earlier power analysis (in Appendix 5 of Gunnlaugsson *et al.*, 2010) and believed no further power analyses were needed.

In thanking the author, the Committee **agrees** that the results, in combination with Gunnlaugsson *et al.* (2010),

provide an adequate basis to justify sample sizes. It looks forward to seeing a revised version of the research proposal at next year's meeting.

In discussing the draft research proposal last year, it had also been noted that the proposed genetic mark-recapture studies could be partially confounded by male-mediated genetic exchange between breeding stocks (c.f. humpback whales); such genetic exchange would reduce the power of genetic mark-recapture data to distinguish among the existing hypotheses (IWC, 2011g). This was addressed in SC/63/RMP5 which reported a high proportion of female-female pairs in the potential parent-offspring matches from a relatedness study using catches of North Atlantic fin whales from the grounds west of Iceland which was caused by sex bias in the genetics sample.

The Committee agreed that the indications were that male-mediated genetic exchange was unlikely but given time constraints, it **defers** discussion until next year's meeting when the revised research proposal should be available.

In addition to the question of a research proposal to address the plausibility of hypothesis IV, the Committee also received a paper (SC/63/RMP4) that explored the issue using existing Discovery mark recoveries by *Small Areas*. The author concluded that the hypothesis is inconsistent with these data and that there is no need for an extensive sampling scheme.

The Committee **agrees** that while the results in SC/63/RMP4 are suggestive that hypothesis IV can be rejected, the analyses were not conducted within the context of the *Implementation Simulation Trials*; it **recommends** that this be done. Further, it noted that SC/63/RMP4 had shown that the marking data are not comparable with the abundance estimates for the entire stock, which suggests that the component of the stock which is marked is much smaller than the whole population. This needs to be accounted for and will require that the *Implementation Simulation Trials* be modified accordingly for the analysis suggested.

6.2.2 Other

SC/63/RMP1 presents the first analyses of data from the Icelandic DNA registry for North Atlantic fin whales. It provides information on feeding migration patterns, including a highly significant genetic match based on microsatellite loci between a mother-foetus pair caught in 2009 and a potential father caught in 2010. Despite the small sample size, the suggestion is that individuals occurring on the same mating ground are likely to exhibit similar timing and migration routes, and not 'roam across the Atlantic' as has been suggested before. The Committee **welcomes** this paper and looks forward to similar analyses being presented to assist stock structure discussions.

SC/63/RMP24 presents fin whale (and other species) abundance estimates for European Atlantic waters using data collected during shipboard sightings surveys conducted in 2005 and 2007. Details given in Annex D include discussion of a method to account for animals unidentified to species. The Committee (and the author) noted that an implicit (and untested) assumption of this approach is that all species have identical rates of identification. This is clearly not the case generally, but may be an adequate assumption for large baleen whales.

In discussion, it was noted that SC/63/RMP24 provided design- and model-based estimates, the latter being more precise and better able to account for inability to follow the original design. This matter is also discussed under Item 5.6.

6.2.3 Recommendations and work plan

The Committee **agrees** that it will review a revised research proposal at the next Annual Meeting and start preparing for a possible 2014 *Implementation Review* of North Atlantic fin whales at the same time.

6.3 North Pacific common minke whales*

6.3.1 Implementation Review

At last year's meeting, the *pre-Implementation assessment* was completed (IWC, 2011f) and an *Implementation Review* initiated according to the schedule given in the Committee's Requirements and Guidelines for *Implementations* (IWC, 2005a). At the *pre-Implementation assessment* it was recognised that meeting the 2-year schedule for an *Implementation Review* of western North Pacific minke whales would be challenging because of its complexity but, given the importance of this work to the Commission, it had been agreed to try to meet this schedule. A preparatory meeting to the scheduled 'First Intersessional Workshop'¹ had taken place to aid progress.

The meeting this year was the 'First Annual Meeting', the primary purpose of which is to review the results of the conditioning and to finalise the *Implementation Simulation Trials*. This review may include new analyses of data available up to the time of the 'First Intersessional Workshop', but new data may not be introduced at this meeting. After reviewing the results of the conditioning, the *Implementation Simulation Trials* themselves may be changed, but the overall structure cannot.

The primary output of the First Annual Meeting should be the detailed specifications of the final *Implementation Simulation Trials*, which requires: final consideration of the plausibility of the various hypotheses and hence the weight assigned to each of the trials; updates/improvements to standard data sets (i.e. abundance, catches, bycatches); and specification of operational features (geographical and temporal) and management variants.

A description of what is required to specify the final trials is given in Annex D1, item 2. A description of the steps to be taken following the First Annual Meeting and the implications of those steps for the work of the First Annual Meeting is given in Annex D1, Appendix 2.

6.3.1.1 REPORT OF THE FIRST INTERSESSIONAL WORKSHOP

The report of the First Intersessional Workshop and its preparatory meeting is given in SC/63/Rep3. The Committee **thinks** the Governments of Japan and Korea for hosting these meetings and Donovan for chairing them.

The primary focus of intersessional work was to develop an appropriate *Implementation Simulation Trials* structure and to specify the associated conditioning to be carried out before the Annual Meeting. A major component of the *Implementation* process is to examine a range of plausible hypotheses such that uncertainty around stock structure can be incorporated into the trials. This involves reviewing the evidence and, if necessary, eliminating any hypotheses shown to be incompatible with the data. This task took place at the Intersessional Workshop.

The Workshop built upon the extensive work undertaken at the 2010 Annual Meeting (IWC, 2011f), focusing on specification of hypotheses, specification of trials and conditioning. The Workshop narrowed down the five hypotheses developed at the *pre-Implementation assessment*

*Editorial note: Hypothesis I, II and III will in future be called Hypotheses A, B and C.

¹The terms 'First Intersessional Workshop' and 'First Annual Meeting' etc. are taken from the Requirements and Guidelines for *Implementations* (IWC, 2005a) and have specific tasks and expected outputs allocated to them.

into three primary hypotheses with the other two hypotheses being treated as sensitivity tests. The primary hypotheses can be summarised as: (I) a single J-stock distributed in the Yellow Sea, Sea of Japan, and Pacific coast of Japan, and a single O-stock in sub-areas 7, 8, and 9; (II) as for hypothesis (I), but a different stock (Y-stock) which resides in the Yellow Sea and overlaps with J-stock in the southern part of sub-area 6; and (III) five stocks, referred to Y, JW, JE, OW, and OE, two of which (Y and JW) occur in the Sea of Japan, and three of which (JE, OW, and OE) are found to the east of Japan. Annex D1, fig. 1 illustrates these hypotheses.

While recognising that considerable differences of opinion exist over the relative plausibility of the hypotheses, the Workshop agreed that they were sufficiently plausible to take forward to the next step in the *Implementation* process.

Other hypotheses considered included the use of $g(0)$ for abundance estimates, MSYR and catch series.

For the specification of trials, the Workshop considered time steps and sub-areas (illustrated in Annex D1, fig. 2); expected future operations, future survey plans, and the structure of the trials. For conditioning, the Workshop considered abundance estimates, CPUE data, biological and technological parameters, mixing proportions and dispersal rates, and management options (RMP variants). A more detailed summary is given in Annex D1, item 3.

6.3.1.2 CONDITIONING

Conditioning is the process of specifying the values of the parameters of the operating model for a given simulation trial such that the conditioned model is consistent with the available data, given the set of hypotheses that define the trial.

A control program that implemented the specifications developed during the First Intersessional Workshop had been written. Annex D1, Appendix 3 gives the specifications for the trials proposed at the Workshop, including the current structure of the mixing matrices. However, no trials had been conditioned prior to the meeting because some aspects of the specifications had needed to be clarified. Technical details of these aspects are described in Annex D1, item 4.2. The following **agreements** reached regarding them are summarised below:

- (1) that the J-stock proportions from the bycatch samples would be used to allocate bycatches to stock for sub-areas 7CS and 7CN and that the bycatches for the remaining sub-areas would be allocated to stock using the catch mixing matrices;
- (2) to impose a minimum standard error for the mixing proportions of 0.05;
- (3) that the abundance estimate for 2007 for sub-area 8 (391, CV 1.013) would apply to sub-areas 7E and 8 combined, and that the zero abundance estimate for 2002 would be used for conditioning, but would be assumed to be normally rather than log-normally distributed (and 0 in all replicates);
- (4) in relation to bycatches for the years prior to 2001 (Japan), 1996 (sub-area 6W) and 2000 (sub-area 5), that the relationship between bycatch and effort and population size would be estimated for each replicate separately, rather than being set equal to the estimated bycatch from the fit of the operating model to the actual data;
- (5) that two essentially arbitrary ways should be used to model the incidental catches off China: (i) the incidental catches in sub-area 5 are multiplied by 3; and (ii) incidental catches off China are ignored.

Considerable progress on conditioning trials was made during the meeting (see Annex D1, item 4.2), particularly for Hypotheses I and II, but further work is required, especially given the complicated objective function and the large number of parameters for trials based on Hypothesis III. Consequently, conditioning was not completed at this meeting. The implications of this are described below.

The Committee thanked Allison and de Moor for the considerable amount of work that they had undertaken since the First Intersessional Workshop and at the meeting.

6.3.1.3 UPDATES TO STANDARD DATASETS

The Committee received a number of summaries of abundance estimates from past surveys and new information on recent surveys as described in Annex D1, item 5. The Committee **recommends** that the 2010 survey off Korea (SC/63/RMP27 and 28) be adopted for use in the RMP.

The Committee also received some information regarding CPUE data for Japanese small-type catcher boats and analyses thereof. This was in response to a recommendation from the First Intersessional Workshop that a summary of the operational information requested by the Comprehensive Assessment workshop on CPUE (IWC, 1989a) as well as a revised analysis of CPUE data needed to be provided to the current meeting if these CPUE data are to be used as a 'reliability check' and hence to inform the assignment of plausibility.

After discussion, the Committee **agrees** that it could re-consider the use of CPUE data for the period 1977-87 if additional operational information and analysis are provided such that agreement could be reached on whether they were sufficiently robust to provide a qualitative 'reliability' check. In particular, analyses of the impact of factors such as possible changes in the location of operations and vessel efficiency should be provided.

6.3.1.4 CONSIDERATION OF PLAUSIBILITY

A key aim of the First Annual Meeting is to assign weights ('high', 'medium', 'low') to all of the trials based on the plausibility of the hypotheses (or assumptions) underlying those trials and on the results of conditioning (IWC, 2005a). The weights assigned to each trial determine how it is to be used later in the *Implementation* process: trials assigned 'low' weight are not considered further; while 'high' and 'medium' weighted trials are used when deciding whether RMP variants are 'acceptable', 'acceptable with research', or 'unacceptable'. Assigning plausibility to hypotheses so that trials can be assigned weights is thus a critical aspect of the *Implementation* process. Additional information regarding this, and how trials are used when selecting among RMP variants, is given in Annex D1, Appendix 2.

The Committee received some suggestions for procedural aspects of assigning plausibility, details of which are given in Annex D1, item 6.1. It also discussed approaches to summarising information pertinent to assigning plausibility weights. There was general agreement that a lack of some data sources for a particular area could not be used as a basis to assign 'low' plausibility to a hypothesis which suggests some structure in the area. The Committee **agrees** that a tabular structure should be used to summarise the evidence which can then be used to assign plausibility to hypotheses, where the columns of the table are the 'key questions' that distinguish the hypotheses.

Although the Committee would have preferred a quantitative approach to assigning plausibility to hypotheses and weights to trials given the tabular summary, it recognised that the assignment of plausibility cannot be automated, in

particular because different scientists will place different emphasis on different sources of information; hence this assignment process will necessarily involve a degree of 'human integration' and expert judgement.

STOCK STRUCTURE

The Committee received a substantial number of papers on stock structure of relevance to assigning plausibility to Hypotheses I, II and III, as defined above. These papers primarily summarised the large amount of information that existed on stock structure of North Pacific minke whales as discussed at the *pre-Implementation assessment*, but some new information was presented arising from discussions at the First Intersessional Workshop. Details of these summaries, the new information, and the record of the discussion are given in Annex D1, item 6.2. A recurring theme that has limited progress in interpreting analyses to differentiate among the stock structure hypotheses is that no data are available from breeding grounds in winter where 'pure' breeding stocks are assumed to exist.

Two papers attempted to summarise the evidence for Hypotheses I, II and III, reaching different conclusions. They are summarised below.

SC/63/RMP8 considered the information on population structure from biological information on conception dates and genetic data collected from year-round coastal bycatch and whales caught under Special Permit during migration. The authors summarised the available evidence on conception dates as follows. Whales in the Yellow Sea have only autumn conception dates, whales in the Sea of Japan and along the Pacific coast of Japan have a mix of autumn and winter conception dates, and whales from the rest of the Pacific only have winter conception dates. The authors considered that Hypotheses II and III are equally consistent with data on conception dates, but Hypothesis I is not, and so has low plausibility. Regarding genetic data, the authors noted that the results from both mtDNA and microsatellite genotypes show significant differences in most pairwise comparisons between areas. They considered that the significant differences seen between three regions in the Pacific Ocean (the coast of Japan; nearshore waters greater than 10 n.miles from the coast; and offshore waters) plus the significant differences seen between both coasts of Japan, were of primary importance for distinguishing between Hypotheses II and III. One explanation proposed for these significant differences is that there are differing proportions of just two stocks ('J-stock' and 'O-stock') in each of these four areas. However, the authors considered that allozyme and microsatellite allele frequencies only show strong evidence for mixing of stocks along the Korean coast of the Sea of Japan and north of Hokkaido; the four previously mentioned locations do not show strong evidence for simple mixing of two well-differentiated stocks. Therefore, they considered Hypothesis II to have low plausibility and that only Hypothesis III, which has differentiated stocks in each of these four locations, is in agreement with the genetic data, and therefore is considered to have high plausibility.

SC/63/RMP22 determined the criteria for using different kinds of information to define stocks: genetics, biological, life history, distribution gaps and migration, ecology and abundance and CPUE trend. This exercise took into account discussions at the Standing Working Group on Stock Definition and as part of the western North Pacific Bryde's whale *Implementation* on the use of different information to define stocks. Based on previous work of the Committee, the authors developed a simple procedure to assign plausibility to hypotheses. Different types of information were analysed

under two strategies: (1) all samples of J and O stock individuals pooled; and (2) analyses conducted separately for J and O stocks, following the results of microsatellite analyses to assign individuals to stocks. The latter strategy followed previous recommendations from the Committee. The authors concluded that analyses of genetic and non-genetic markers strongly support the interpretation that there are two stocks (J and O) that mix seasonally with each other on the Pacific side of Japan and southern Okhotsk Sea. The authors considered evidence for the occurrence of a Y stock to be weak at this stage, and concluded that there is no direct evidence for subdivision of O and J stocks. Consequently, SC/63/RMP22 proposed the following assignments of plausibility for the three hypotheses on stock structure in the western North Pacific common minke whale: Hypothesis I: high, Hypothesis II: low and Hypothesis III: low.

Annex D1, Appendix 9 gives a draft form of the table mentioned above that illustrates how the Committee could summarise evidence relevant to evaluating plausibility of competing stock structure hypotheses.

The possibility that sub-area 2C, which, according to Hypothesis III, should represent pure JE stock actually includes a mixture of J and O individuals (as suggested by SC/62/NPM11 and Annex D1, Appendix 6), generated considerable discussion. The Committee noted that this could be problematic for specification of the trials, because sub-area 2C is considered the best proxy for a pure JE stock and also that estimation of mixing proportions led to inconsistencies with assumptions of Hypothesis III that could be related to the definition of pure JE. The proponents of Hypothesis III acknowledged the problem but noted that the same rigorous tests for internal consistency should be applied to each hypothesis in every sub-area. The Committee **agrees** that these tests need to be conducted.

Primarily because it had not been possible to complete the conditioning, the Committee was unable to assign plausibilities to the stock structure hypotheses. The implications of this are described below under Item 6.3.2.

MSYR

The Committee recalled that the previous *Implementation* had assigned $MSYR_{mat}=1\%$ 'medium' plausibility and $MSYR_{mat}=4\%$ 'high' plausibility. Reasons for assigning $MSYR_{mat}=1\%$ 'medium' rather than 'low' plausibility are reported in IWC (2004a). It was noted that the MSYR review may shed light on MSYR for western North Pacific minke whales, but this depends on the meta-analysis distribution for MSYR being representative of these whales.

6.3.1.5 SPECIFICATION OF OPERATIONAL FEATURE AND MANAGEMENT VARIANTS

On behalf of Japan, Hatanaka confirmed that the management variants proposed during the First Intersessional Workshop (SC/63/Rep3, item 5) should be included in trials. On behalf of Korea, An requested that management options in which sub-areas 5 and 6W are treated as a single *Small Area* should be considered.

6.3.1.6 SPECIFICATION AND CLASSIFICATION OF FINAL TRIALS
The specifications for the trials are given in Annex D1, Appendix 3.

FUTURE SURVEYS

The Committee was pleased to receive notice of several future surveys by Japan and Korea planned for 2011.

Details of these are given in Annex D1, item 8.2. To provide oversight on its behalf, the Committee appointed Matsuoka for the survey in sub-areas 8 and 9, An for the

survey in sub-area 6W, and Miyashita for the survey in the Okhotsk Sea and sub-area 7.

SELECTION OF SURVEYS AND CATCHES FOR USE IN THE *CLA*

Several issues need to be addressed to specify the surveys for use in the *CLA* when conducting *Implementation Simulation Trials*.

- (1) How (if at all) to use minimum estimates when applying the *CLA*.
- (2) How to treat JARPN surveys which did not have Committee oversight.
- (3) Whether certain surveys considered acceptable for use in conditioning trials had inadequate coverage to be considered when assessing performance under the RMP.
- (4) Whether estimates should be generated from surveys which have been conducted but the estimates were not available for the First Intersessional Workshop.

An intersessional working group has been established (Annex R4) to develop an initial list of abundance estimates for use in the *CLA* when conducting *Implementation Simulation Trials* and to specify commercial and incidental catches.

6.3.1.7 CONSIDERATION OF DATA/ANALYSES TO REDUCE HYPOTHESES IN FUTURE

There was insufficient time to discuss this item. The Committee noted recommendations from the First Intersessional Workshop (SC/63/Rep3, item 7). SC/63/RMP7 had responded to one of those recommendations and the analyses provided had proved helpful.

6.3.1.8 INPUTS FOR ACTUAL APPLICATION OF THE *CLA*

There was insufficient time available to select the catches and abundance estimates for use in actual applications of the *CLA*. The intersessional Working Group established under Item 6.3.1.6 will initiate discussion of this. One issue which needs to be considered in this respect is how to address cases in which the size of the area surveyed changes over time.

6.3.2 Work plan

Unfortunately, the Committee was unable to complete the tasks required at the First Annual Meeting this year. It had not been possible to assign plausibility to stock structure hypotheses, primarily because it had not been possible to complete conditioning of the trials. This meant that the 2-year schedule for the *Implementation Review* has been disrupted and it will not be possible to complete it at next year's meeting.

Previous *Implementations* under the Guidelines had been completed on schedule (IWC, 2008e; 2009b) but the *Implementation Review* for western North Pacific minke whales is complex and therefore considerably more time consuming. It includes simulating whaling operations during migration, which requires *Implementation Simulation Trials* to be structured temporally as well as spatially. The plausible stock structure hypotheses include those that are extremely complex. As a result, the *Implementation Simulation Trials* developed are far more complicated than any previously considered.

Given the delay to the *Implementation Review* schedule, next year's meeting effectively becomes a repeat of the First Annual Meeting with the same list of required tasks that had been initiated this year. The Committee discussed a workplan (including an intersessional workshop) that should guarantee completion of the necessary intersessional work so that all tasks would be completed at next year's meeting. The work on conditioning the trials that had been ongoing at

this meeting will continue intersessionally. Associated with this are a number of technical issues including revisiting, as appropriate, the specification of samples representing the best proxies for 'pure stocks', re-calculation of mixing proportions, and checking the values of the 'gamma coefficients'² to ensure consistency within the trials. In addition, it is important that the conditioning work and results are communicated in a readily understandable way. The results of conditioning are an important component of assigning plausibility to hypotheses and weights to trials. Given the complexity of the trials, the reliability of the conditioning algorithm also needs to be carefully checked.

The Committee discussed whether its work could be facilitated if additional trials were developed following the results of new analyses presented at this meeting relevant to Hypotheses III. It was noted that Hypothesis III was an inclusive hypothesis that incorporated the possibility of multiple J stocks, multiple O stocks and a Y stock. It was inappropriate to consider multiple combinations of the various stock structure aspects included in Hypothesis III but the Committee **agrees** that a version of Hypothesis III that did not assume multiple J stocks would be valuable to pursue. The possibility of excluding a Y stock from Hypothesis III was also raised; however, the Committee considered that this would likely involve more work than was possible in the time available.

The Committee **agrees** that modifying the way Hypothesis III was implemented by simplifying it did not violate the guideline that the structure of the trials should not be changed after the First Intersessional Meeting. The Committee noted that this did not involve any changes to the structure of the computer programs.

An *ad hoc* working group was established to draft a detailed work plan, including proposed membership of an intersessional working group (Annex R5) and plans for a technical intersessional workshop. Although it presented its work directly to Plenary, in addition to **endorsing** the work plan, the Committee **agrees** that it is appropriate to make it an appendix (Appendix 11) to Annex D.

The Committee **agrees** that the proposed analysis to explore evolutionary pathways of putative stocks (SC/63/Rep3, Annex N, item C) would be valuable to pursue intersessionally and **endorses** the research proposal given in Annex D1, Appendix 10.

6.4 North Atlantic minke whales

6.4.1 Review new abundance estimates

The Committee received information on a number of new surveys and abundance estimates for common minke whales in the North Atlantic. Discussion of these can be found in Annex D (item 3.3.1). There was insufficient time to review these estimates in any detail and the Committee noted that a full evaluation of them will occur in the forthcoming *Implementation Review*, planned for 2014.

6.5 Other business

The Committee noted that abundance estimates are used in three ways in the RMP and the AWMP: (1) for use when conditioning *Implementation Simulation Trials*, i.e. when estimating the parameters of the operating model; (2) when applying the RMP within *Implementation Simulation Trials*; and (3) when applying the RMP in actuality. There is a need for a single list of all abundance estimates for stocks for which management advice is needed that needs to be

²For an explanation see SC/63/Rep3, Annex J.

annotated by how they can be used (including 'do not use'). Donovan agreed to produce an initial list of abundance estimates considered in past RMP (and AWMP) discussions, including previous Committee evaluations of their status for consideration at next year's meeting. This is discussed further under Item 24.

The Committee did not have time to review a proposal to initiate a *pre-Implementation assessment* of North Atlantic sei whales (SC/63/RMP2).

6.6 Work plan

The Committee's discussions on the sub-committee's workplan (Annex D) are incorporated under Item 21.

The Committee was concerned over the feasibility of its future timetable of work, particularly given the delay in the western North Pacific common minke whale *Implementation Review*. It has previously noted that it was not possible to undertake two major *Implementations* or *Implementation Reviews* simultaneously (e.g. IWC, 2011e, p.65). This will be taken into account when discussing Items 1, 3, 4 and 5 next year.

7. ESTIMATION OF BYCATCH AND OTHER HUMAN-INDUCED MORTALITY

The report of the Working Group on Estimation of Bycatch and Other Human-induced Mortality is given as Annex J. This subject was introduced onto the Agenda in 2002 (IWC, 2003e) because under the RMP, recommended catch limits must take into account estimates of mortality due to *inter alia* bycatch, ship strikes and other human factors in accordance with Commission discussions at the 2000 Annual Meeting (IWC, 2001a), although of course such mortality can be of conservation and management importance to populations of large whales other than those to which the RMP might be applied. Subsequently, the issue of ship strikes has become of interest to the Commission's Conservation Committee (e.g. IWC, 2011c).

7.1 Collaboration with FAO on collation of relevant fisheries data

There has been an ongoing effort by the Secretariat and Sea Mammal Research Unit to consolidate data on entanglements submitted in the National Progress Reports into a single database to be shared with FAO. Data for the period 2004-10 have now been entered by the Secretariat.

7.2 Progress on joining the Fisheries Resource Monitoring System (FIRMS)

The IWC is currently an observer to the FIRMS partnership, a collaborative partnership organised by the FAO to enable fishery management bodies to share information. Full membership will be possible when the IWC entanglement database is completed and submitted to FAO.

7.3 Estimation of bycatch mortality of large whales

Entanglements of large whales reported in the Progress Reports are listed in Appendix 2 to Annex J. The Committee **recommends** that all countries submit Progress Reports including information on large whale mortality.

7.4 Estimation of risk and rates of entanglement

A workshop on welfare of entangled whales in 2010 developed a series of guidelines for collection and reporting of data on entanglements; these are listed in Annex J. The workshop also formulated a list of health assessment data items. A follow-up workshop is planned for October 2011.

7.5 Consider methods and data sources for establishing time series of bycatch

In an attempt to assist with information relevant to *Implementation Simulation Trials* for western North Pacific common minke whales, a way was sought to improve estimates of historical bycatch using a complex time series of reports of bycatch in fish traps. Although the complete time series was not used for the *Implementation Simulation Trials*, intersessional efforts continued to develop improved methods to estimate the time series of bycatches (SC/63/BC1); it was suggested that the resulting hierarchical Bayesian approach (described in Annex J) may be of value in future cases.

7.6 Review progress on including information in National Progress Reports

A system for online submission of information on bycatch and entanglements currently included in National Progress Reports is under development. A template has been drafted and a pilot system is under evaluation (see Item 3.2).

7.7 Ship strikes

7.7.1 IWC-ACCOBAMS workshop on ship strikes

The Joint IWC-ACCOBAMS Workshop on Reducing Risk of Collisions between Vessels was held last year (IWC/63/CC8). Emphasis was on mitigation, but some of the workings dealt with data collection and risk assessment. A number of recommendations were developed; these are listed in Annex J. The Committee **endorses** those recommendations relating to the remit to estimate mortality. The workshop recommended that a Joint IWC-ACCOBAMS Stranding Investigation Working Group be established to: (1) review existing protocols for determining from strandings whether ship strike has occurred; (2) identify, develop, review and validate tools and techniques; (3) develop and implement training; and (4) build capacity in states with no stranding programmes. The Committee **concurs** with this recommendation.

The Committee also **endorses** the holding of a further workshop for cetacean and shipping experts to agree on appropriate analytical and modelling techniques. An intersessional working group was established to develop a proposal for such a workshop (Annex R6).

7.7.2 Development of a global ship-strike database

The IWC has been developing a global database of collisions between ships and whales since 2007, with associated effort by IMO and ACCOBAMS. The Committee again **recommends** that development continue and that all collision events be reported to the database. The database has been up and running for two years, but submissions have been sparse. A more proactive approach is needed. The Committee **recommends** appointment of a dedicated IWC ship strike data coordinator. Tasks required include data gathering, communication with potential data providers and data management (see Annex J, Appendix 3).

7.7.3 Activities of the Conservation Committee

The Committee noted the overlap in scientific issues between it and the Ship Strikes Working Group of the Conservation Committee (IWC/62/Rep4) and noted the need for greater dialogue. The Conservation Committee may also be able to assist with outreach efforts to improve data reporting, including liaison with IMO. The issue of co-operation with the Conservation Committee is dealt with further under Item 24.

7.7.4 Experience in Hawaii with humpback whales

SC/63/BC2 reported efforts to assess the nature and importance of 'near-misses' in evaluating risk of collision between vessels and humpback whales in Hawaii. The Committee **agrees** that a consistent definition of 'near-miss' is needed in order to interpret such data; the criterion used in Hawaii is whether evasive action was needed in order to avoid a collision.

A major awareness campaign in Hawaii is probably responsible for an increase in ship-strike reports after 2003 (SC/63/E4). The quality of the data has also improved. However, it is not known what proportion of the collisions resulted in death of the whale. Encounters between whales and a high-speed ferry that operated in Hawaiian waters for 11 months in 2007 and 2008 were as frequent inside the whale sanctuary as outside. This may be due to decreased vigilance when leaving or approaching the harbour compared to when further at sea.

7.7.5 Estimating risk of ship strikes in the Mediterranean

Evaluation of population level effects of ship-strike mortality requires knowledge of whale abundance. SC/63/BC3 reported progress in surveying abundance of fin whales in the central Mediterranean. Comparison of recent estimates with those from the early 1990s suggests a possible decline in abundance in the Pelagos Sanctuary area. It was noted that an area of concentration of whales may have moved to the northwest of the survey area. Future surveys will take this into consideration.

7.7.6 Use of AIS data to estimate risk of ship strike

Data on shipping density and movements are required for assessing ship-strike risk. Automatic Identification System (AIS) transmissions from ships provide such data, and they have been made available through cooperation with the European Commission, IMO and UNEP. In the past, the utility of such data has been limited because they were collected by land-based stations with limited range. Newly available data collected by satellite are potentially much more useful; they are available for the globe by 1-degree block. AIS is presently mandatory for about 60,000 large commercial vessels, but in some areas, such as the EU, new regulations will cover some smaller vessels.

7.7.7 Estimating total ship-strike mortality

A recent study estimated ship-strike mortality for the North Atlantic right whale (Vanderlaan *et al.*, 2009), using estimators of three fractions of the mortality: that due to the observed rate of mortality due to collisions, that inferred from necropsies of strandings, and that fraction undetected. North Atlantic right whales are exceptionally well studied compared to other large whales, but carcass recovery rates for right whales could be used as informed priors in analyses for other species and populations, with appropriate caveats.

A qualitative comparison with ship-strike risk to North Atlantic fin whales was noted, and it was **agreed** that with recently available data on shipping traffic and data on whale abundance, it would be a useful case study to further explore the development of quantitative risk models. An intersessional working group was established to investigate this and provide an analysis for next year's meeting (Annex R7).

7.8 Other issues

7.8.1 Continue to consider methods for assessing mortality from acoustic sources

Information on acoustic impacts on small cetaceans was discussed in Annex K.

7.8.2 Continue to consider methods for assessing mortality from marine debris

Information on ingestion of plastics by small cetaceans was discussed in Annex K.

7.8.3 Estimating mortality rates from strandings

One issue that needs to be considered when making estimates of mortality from strandings is the proportion of carcasses that strand and are discovered and reported. Some reports of the environmental impacts of the recent major oil spill in the Gulf of Mexico suggested that impact was modest because of the small number of cetacean carcasses recovered. Williams *et al.* (2011) estimated however that recoveries on average represented only 2% of cetacean deaths that occur annually in the region. Thus the true death toll could be 50 times that inferred from strandings. The Committee **agrees** that tagged-carcass studies could yield appropriate multipliers for extrapolating stranding rate to mortality rate.

It was noted that the USA will organise a workshop in boreal winter 2012 to develop criteria for confirming whether ship strikes, entanglement or other human interactions were the cause of death or contributed to the stranding of cetaceans. In addition, the Committee was informed of the report³ of a workshop on observation schemes for bycatch of mammals and birds, jointly convened by NAMMCO and ICES in 2010, that was attended by participants worldwide and stakeholders. Guidelines on best practices in monitoring bycatch of marine mammals and seabirds will be published in the near future by ICES.

7.9 Work plan

The Committee's discussions on the sub-committee's work plan (Annex J) are incorporated under Item 21.

8. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995b). 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) *Implementation Review* of eastern gray whales with special emphasis on the PCFG⁴; (2) developing *SLAs* and providing management advice for Greenlandic hunts; and (3) review of management advice for the humpback whale fishery of St. Vincent and The Grenadines. This represented a significant workload. 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 La Jolla, California (SC/63/Rep2).

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

8.1 Sex ratio methods for common minke whales off West Greenland

The SWG has been examining whether the abundance of West Greenland minke whales could be estimated using

³http://www.nammco.no/Nammco/Mainpage/Publications/Miscellaneous/wkosbomb_report_2010.html.

⁴Pacific Coast Feeding Group.

time series data on the sex ratio of past catches since 2006. Last year, the Committee agreed that despite considerable effort, it was still not possible to confirm whether a sex-ratio-based method could be developed that was appropriate and effective. It agreed that it would no longer prioritise development of this technique unless a comprehensive final analysis could be endorsed at the 2011 Annual Meeting. It had also noted that the original motivation for the work, i.e. the need to obtain a satisfactory abundance estimate, had now been superseded by successful aerial surveys that produced an agreed abundance that was suitable for assessment (see Item 9.4).

Although a paper was received (SC/63/AWMP5) that began to address some of the difficulties identified last year, the SWG agreed that it was not the comprehensive final analysis sought and the Committee **concur**s. Although ultimately the effort had not proved to be successful, the Committee thanked Witting, Schweder, Brandão and Butterworth for their considerable effort over the last several years in developing a novel and scientifically interesting estimation approach.

8.2 Conduct *Implementation Review* of eastern North Pacific gray whales

At the 2010 Annual Meeting (IWC, 2011i), the Committee agreed that the information on stock structure and hunting presented, although some of it had not met the Data Availability Guideline requirements (IWC, 2004b) for the 2010 review, warranted the development of trials as part of an immediate new *Implementation Review* to evaluate the performance of *SLAs* for hunting in the Pacific Northwest, with a primary focus on the PCFG. It also agreed that the 2010 *Implementation Review* had shown that the population as a whole was in a healthy state, but that over the next few years, further work should be undertaken to investigate the possibility of structure on the northern feeding grounds, especially in the region of the Chukotkan hunts.

The SWG had begun the process of the new *Implementation Review* at an intersessional Workshop (SC/63/Rep2). At that Workshop, most of the effort centred on building on the work undertaken at the Annual Meeting and updating the available new information on stock structure, abundance, the nature of the hunt and the proposed management approach by the Makah, in order to developing an operating model and trial structure. The present meeting reviewed progress made since the Workshop and continued to work on developing a final set of trials. This summary here incorporates work from the intersessional Workshop and the present meeting.

8.2.1 *Areas and stocks considered*

The trials will consider three geographic regions:

- (1) the 'north' area (north of 52°N i.e. roughly northern Vancouver Island);
- (2) the PCFG area (between 41°N and 52°N); and
- (3) the 'south' area (south of 41°N).

The trials will also consider two stocks ('PCFG' and 'north'). PCFG whales are defined as gray whales observed (i.e. photographed) in multiple years between 1 June and 30 November in the PCFG area (IWC, 2011e, p.22). Not all whales seen within the PCFG area at this time will be PCFG whales and some PCFG whales will be found outside of the PCFG area at various times during the year. However, this is not problematic since the historical catches north of 52°N

occurred well north of 52°N and future catches will either occur in the Bering Sea or in the Makah U&A⁵.

8.2.2 *The hunt*

An overview of the Makah Tribe's proposed hunt is given in Annex D of SC/63/Rep2. The need envelope is 35 strikes per five-year block (seven strikes, three struck-and-lost or five landed annually, or 20 landed per five year block) throughout the 100-year simulation period. Unlike the *SLAs* for the B-C-B bowhead and the eastern gray whales, the *SLAs* to be evaluated for the hunt were not developed by the SWG but by the Makah Tribe. The strategy is somewhat complex and tries to minimise the catch of PCFG whales by a number of regulations including:

- (1) an allowable bycatch level (ABL) of PCFG whales (as defined above) based on the potential biological removal approach (Wade, 1998) using the minimum estimate of PCFG whales between Oregon and Southern Vancouver;
- (2) ceasing the hunt when the ABL is reached (all landed whales are compared with the photographic catalogue to determine whether they are PCFG whales and assumptions are made about whether struck-and-lost animals are PCFG whales or not depending on the time of the year that they are struck);
- (3) restricting the hunt to the period 1 December to 31 May to target migrating 'north' whales; and
- (4) prohibiting the hunt from Strait of Juan de Fuca due to the large portion of PCFG whales photographed in that area.

Modelling this process is relatively complex (see Annex D, Appendix 3 for the most recent trial specifications) and requires taking into account *inter alia* possible errors in photo-ID matching.

8.2.3 *Catch data*

The most recent catch data for the period of the trials i.e. 1930 onwards (updated and agreed in SC/63/Rep2) are incorporated into Annex E, Appendix 3. In addition, the workshop summarised bycatch/ship strike data (SC/63/Rep2, Annex D); the relevant average annual kills are 2 for the PCFG (December-May), 1.4 for the PCFG (June-November) and 3.4 for the 'south' (December-May).

8.2.3 *Abundance*

It is assumed that the abundance estimates from the southbound census incorporate both PCFG and 'north' whales (Laake *et al.*, In press). The abundance of PCFG whales is obtained from photo-identification mark-recapture analyses (SC/63/Rep2, Annex F). The abundance estimates that have been used to date are summarised in Tables 2 and 3. The Committee **strongly recommends** that the abundance estimates for the PCFG be updated to include data for 2009 and 2010 and a paper presenting all of the abundance estimates should be provided next year (Laake *et al.*, In press).

8.2.4 *Mixing*

Mixing relates to: (1) mixing of stocks in the three areas; and (2) the relative probability of whaling in the Makah U&A taking a PCFG whale given the number of PCFG and north whales. The latter can be estimated as the fraction of PCFG whales to total whales in photographs during March-May

⁵The Makah Tribe's 'usual and accustomed fishing grounds'. Although these include the Strait of Juan de Fuca, the hunt will be prohibited there due to the large portion of PCFG whales photographed in that area.

Table 2
Estimates of absolute abundance for eastern north Pacific gray whales from the southbound census.

Year	Estimate	CV	Year	Estimate	CV
1967/68	13,426	0.094	1979/80	19,763	0.083
1968/69	14,548	0.080	1984/85	23,499	0.089
1969/70	14,553	0.083	1985/86	22,921	0.081
1970/71	12,771	0.081	1987/88	26,916	0.058
1971/72	11,079	0.092	1992/93	15,762	0.067
1972/73	17,365	0.079	1993/94	20,103	0.055
1973/74	17,375	0.082	1995/96	20,944	0.061
1974/75	15,290	0.084	1997/98	21,135	0.068
1975/76	17,564	0.086	2000/01	16,369	0.061
1976/77	18,377	0.080	2001/02	16,033	0.069
1977/78	19,538	0.088	2006/07	19,126	0.071
1978/79	15,384	0.080			

Table 3
Estimates of absolute abundance from mark-recapture analyses.

Year	Estimate	CV	Year	Estimate	CV
41°-52°N					
1998	104	0.044	2004	206	0.058
1999	122	0.082	2005	205	0.087
2000	146	0.072	2006	188	0.083
2001	170	0.061	2007	186	0.106
2002	198	0.039	2008	194	0.087
2003	204	0.063			
Oregon to Southern Vancouver					
1998	65	0.061	2005	162	0.098
1999	78	0.113	2006	154	0.104
2000	90	0.130	2007	153	0.105
2001	113	0.071	2008	154	0.099
2002	137	0.104			
2003	153	0.085			

from the outer coast of northern Washington (20.3%; SC/63/Rep2, Annex E) but there are a number of uncertainties and assumptions surrounding such an analysis such that sensitivity tests (i.e. alternative trials spanning a range of values) need to be conducted. The Committee **agrees** that should data for 2009 and 2010 become available within the DAA, this estimate should be updated (and see Annex E, item 5.2.3).

8.2.5 Biological parameters and MSYR

These were discussed at the workshop (SC/63/Rep2) and the priors, based on the 2004 *Implementation* are given in the trial specifications (Annex E, Appendix 3). The most likely value for $MSYR_{1+}$ for the north stock was agreed to be 4.5% i.e. the posterior median from the most recent assessment of this stock (Punt and Wade, 2010). The *Evaluation Trials* will consider values for $MSYR_{1+}$ for north stock of 2% and 6% (rounded 90% posterior intervals from the Punt-Wade assessment). There are insufficient data to estimate MSYR for the PCFG and so the workshop agreed to consider two scenarios: (a) $MSYR_{1+}$ for the PCFG stock is the same as that for the north stock and there is no immigration (this is unlikely given the data but provides a conservative lower bound); and (b) a lower value of $MSYR_{1+}$ but with some immigration (and see below).

8.2.6 Trials

The trials specified during the workshop focussed on the performance of *SLAs* for the proposed hunt in the Makah Tribe's U&A (see SC/63/Rep2, tables 4 and 5). The major hypotheses considered included those related to:

- (1) MSYR;
- (2) levels of immigration;
- (3) the level of mixing between PCFG and northern whales when and where the Makah hunt is likely to take place; and
- (4) aspects of the hunt including struck and lost rates.

Consideration of trials at the present meeting was greatly informed by selected runs carried out during the intersessional period (SC/63/AWMP4) and during the meeting itself (by the indefatigable Punt). Details of the discussions can be found in Annex E, item 4.3.3.1. Particular attention was given to problems associated with implausible rates of increase for the PCFG.

During the SWG discussions it became clear that there was insufficient time to complete the *Implementation Review* at this meeting for the following reasons:

- (1) unresolved concerns with the trial structure;
- (2) lack of time to condition/run even the agreed trials; and
- (3) the computer programs used have yet to be verified.

The Committee **concurs** with this view.

Given this, the SWG focussed on trying to complete its deliberations on trial structure to the extent possible and to formulate a workplan that should allow it to complete the review at the next annual meeting. With respect to the rate of increase question, four broad base case models were identified to capture the trends in abundance (see Annex E, item 4.3.3.1) and a number of diagnostic plots and tables to facilitate understanding of the behaviour of the models and trials were developed, in order to narrow down the *SLA* testing framework. The present *Evaluation* and *Robustness Trials* are given in Annex E Appendix 3. However, the SWG emphasised the need to fully understand the results from additional runs before drawing any final conclusions about the relative merits of the four operating models or any further changes to the list of trials.

A steering group (Annex R9) was established to further review the trials structure before the proposed intersessional workshop (see Items 20 and 23). The Committee noted that the DAA deadlines incorporated under Item 8.6 apply.

8.2.7 Work plan

The Committee's discussions on the sub-committee's work plan (Annex E) are incorporated under Item 21.

8.2.8 Implications of new information on gray whale stock structure

Discussions in Annex F of information that western gray whales can cross to the eastern Pacific (including the PCFG area) can be summarised as:

- (1) there is now more uncertainty regarding Pacific gray whale stock structure;
- (2) there is no need to revise stock structure assumptions for Pacific gray whales at present; and
- (3) range-wide studies need to be undertaken to better understand the situation.

The Committee **agrees** that formally there was no need to modify the existing trials structure which had been designed to evaluate the *SLAs* for the northern and PCFG areas in the context of *eastern* gray whales. However, this structure does *not* incorporate conservation implications for western gray whales. Therefore, the Committee **stresses** the following items.

- (1) The new information on movements of gray whales highlights the importance of further clarification of the stock structure of North Pacific gray whales. In

particular, the matches of western gray whales with animals seen in the PCFG area and other areas along the west coast **emphasise** the need for efforts to estimate the probability of a western gray whale being taken in aboriginal hunts for Pacific gray whales (this does not require incorporation of western gray whales into the *Implementation Review*).

- (2) It **strongly endorses** the research programme developed in Annex F and summarised under Item 10.4 of this report that focuses on photo-identification, genetics and telemetry (Annex F, Appendix 7) incorporating both further analysis of existing data and collection of new data. The results of the research may require further trials for future *SLA* testing; this will certainly be a matter for the next *Implementation Review* if not before.
- (3) The Committee will continue to monitor the situation and is willing to respond to any guidance or requests for further information from the Commission.

8.3 Continue work on developing *SLAs* for the Greenlandic fisheries (Annex E, Item 3)

In Greenland, a multispecies hunt occurs and the expressed need for Greenland is for 670 tonnes of edible products from large whales for West Greenland; this involves catches of common minke, fin, humpback and bowhead whales. The flexibility among species is important to the hunters and satisfying subsistence need to the extent possible is a critical component of management. Last year, it was noted that the development of a combined approach to calculate strike limits for more than one species has not been previously attempted (IWC, 2011i). The Committee **endorses** the view (SC/63/Rep3) that this matter should be deferred until single-species management approaches had been developed further. These would provide the necessary basis to extend to multi-species considerations, such as need being expressed on a species-combined rather than a species-specific basis.

For a number of reasons, primarily related to stock structure issues, development of *SLAs* for Greenland aboriginal hunts (especially for common minke and fin whales) will be more complex than any previous *Implementation*. The Committee endorsed an interim safe approach to setting catch limits for the Greenland hunts in 2008 (IWC, 2009d), noting that this should be considered valid for two five-year blocks i.e. the target will be for agreed and validated *SLAs*, at least by species, for the 2017 Annual Meeting (assuming that the Commission sets 5-year block quotas in 2012 as scheduled). Given the complexity of the development process, this work is high priority and it will be necessary to hold intersessional workshops to expedite progress.

8.3.1 *Fin whales and common minke whales*

The first step toward *SLA* development for West Greenland fin whales and common minke whales will be to define the operating model(s) that are to be used to test the performance of candidate *SLAs*. Both of these species have been the focus of RMP *Implementations* and *Implementation Reviews*, even though the focus has not been on Greenland. Operating models used to develop *SLAs* for the Greenland hunts must be based on those used in the RMP *Implementations* (IWC, 1994d; 2005b; 2009c; 2010a). Given the SWG's focus on Greenland, it is clear that the review of the RMP operating models and specifications will probably identify refinements and modifications to the existing trials structure to properly account for the Greenlandic case, particularly with respect to stock structure; it is important that ultimately these

discussions are held in collaboration with the sub-committee on the RMP to ensure consistency with operating models to the extent possible. In addition, the *SLA* development process will have to take into account catches made under the RMP.

The Committee **endorses** the recommended intersessional workshop that will in part focus on the examination of the existing RMP operating models from a Greenland perspective.

8.3.2 *Humpback whales*

The Committee has previously agreed to provide management advice on the West Greenland feeding aggregation of humpback whales by treating this as an independent stock (IWC, 2008d, p.21) and it welcomed new work presented this year on the development of a stock assessment model for these whales (SC/63/AWMP2). The paper used recent abundance estimates, historical catches starting from 1664, and an age- and sex-structured population model to perform Bayesian assessments of West Greenland humpback whales. Detailed discussion of this paper can be found in Annex E item 3.3. Partly arising from discussion of this paper, the Committee **agrees** that the SWG should carefully monitor for signs of problems associated with over-fitting when conditioning operating models for *SLA* development and testing.

In conclusion, the Committee **recognises** that the development process of an *SLA* for Greenland humpback whales will focus on consideration of the West Greenland feeding aggregation as a management unit. This may allow less attention needing to be paid: (1) on the overall North Atlantic humpback whale stock structure; and (2) attempting to incorporate the long time series of catch data and the attendant catch allocation problems noted during the comprehensive assessment (e.g. IWC, 2002b; 2003c).

8.3.3 *Bowhead whales*

Discussion within the Committee in recent years has focussed on stock structure and associated abundance estimates. The present working hypothesis is that bowhead whales in eastern Canada - West Greenland comprise a single stock; the alternative hypothesis assumes two stocks: one in Hudson Bay - Foxe Basin and another in Baffin Bay - Davis Strait (and see Item 9.1).

SC/63/AWMP3 used recent abundance estimates, historical catches starting from 1719, and an age- and sex-structured population model to conduct Bayesian assessments of bowhead whales in eastern Canada - West Greenland. It also included a model for a Baffin Bay - Davis Strait stock, following the alternative two stock hypothesis. Detailed discussion of this paper can be found in Annex E item 3.4.

The Committee recalled the agreed abundance estimate for 2002 is 6,340 (CV: 0.38, IWC, 2009d). The need envelope will probably be around five strikes per year, to which a small number of additional strikes will need to be added to reflect strikes by native communities in Canada (Annex F, Appendix 3). Compared to the abundance estimate, therefore, this level of hunting would be expected to have little impact. Under these circumstances it should be possible to establish a simple *SLA*, noting that an *Implementation Review* could be triggered if the approach appeared inadequate or if the need envelope or level of Canadian strikes increased. Development of a simple method would require the determination of a need envelope, and the Committee **requests** the Chair of the SWG to discuss need envelopes with the Greenland hunters.

8.4 Aboriginal Whaling Management Scheme

8.4.1 Draft guidelines for Implementations and Implementation Reviews

The Committee did not have time to discuss this Item at the meeting. It **agrees** that the item should be referred to the AWMP intersessional workshop and the Chair of the SWG agreed to circulate a draft proposal at least one month before the workshop.

8.4.2 Scientific aspects of an aboriginal whaling scheme (AWS)

In 2002, the Committee strongly recommended that the Commission adopt the Aboriginal Subsistence Whaling Scheme (IWC, 2003b, pp.22-3). This covers a number of practical issues such as survey intervals, carryover, and guidelines for surveys. The Committee has stated in the past that the AWS provisions constitute an important and necessary component of safe management under AWMP *SLAs* and it **reaffirms** this view. It noted that discussions within the Commission of some aspects such as the 'grace period' are not yet complete.

8.5 Conversion factors for edible products for Greenland fisheries

For indigenous hunting of whales in West Greenland, need is expressed in terms of kg of edible product (across species), whereas for the development of *SLAs*, the SWG approach is to express need in terms of numbers of strikes (per species). Based on the recommendations in the report of the Commission's Small Working Group on Conversion Factors for use in Greenland Hunts (IWC, 2011b, pp. 48-51), the Committee had requested Greenland to provide information on its sampling scheme and data validation protocols to the present meeting. The focus of the recommendations concerned the fin, humpback and bowhead whales for which provisional conversion factors had been proposed; sufficient data had been available to develop a robust conversion factor for the common minke whale (IWC, 2011b, pp.48-51).

Greenland provided a response to this request (Annex E, Appendix 4). Data had been obtained for a small number of humpback, fin and bowhead whales using a new protocol and with the assistance of wildlife officers. The Greenland Institute of Natural Resources is planning to continue its efforts this year, targeting humpback and bowhead whales, with the effort extending to fin and minke whales in later years. The Greenland Ministry of Fisheries indicated that data collection will have to run for 'quite some years before an appropriate sampling size is reached'.

The Committee **welcomes** the provision of a report and appreciated and encouraged this work, recognising the logistical difficulty of collecting this kind of data in remote areas. However, it noted that considerably more detail is needed for it to evaluate the proposed programme; the authors of the original report had offered to assist in the development of a programme and the Committee **urges** Greenland to take advantage of this offer and it **requests** that a detailed report be presented for consideration at the next meeting.

In particular, the report should provide:

- (1) a description of the field protocols and sampling strategy, including effort and likely sample sizes;
- (2) a description of analysis methods and models; and
- (3) a presentation of results thus far, including preliminary analyses with the available data.

Such information will assist the Committee in addressing issues such as appropriate sample size.

8.6 Planning for a B-C-B bowhead whale Implementation Review

The purpose of an *Implementation Review* to examine whether any new information has become available which would indicate that the set of trials used to test the *Bowhead whale SLA* did not adequately address the range of plausible parameter space during the previous *Implementation Review* (IWC, 2003b; 2008d). No new information had been presented at the present meeting to suggest that this was the case (and see Annex F). The Committee **agrees** that an *Implementation Review* should be scheduled for the 2012 Annual Meeting. As part of the DAA, data used for providing management advice must be made accessible to Committee members no later than six months prior to the 2012 meeting. An extensive data set was made available for the previous *Implementation Review* in 2007. New data likely to be available for the *Implementation Review* in 2012 are summarised in Table 1 of Annex F.

Final dates for the 2012 meeting are not yet known but likely deadlines, assuming that the Committee meeting starts around the same time as this year, for the DAA process are:

- (1) final datasets available (6 months): 30 November 2011;
- (2) papers using novel methods (3 months): 28 February 2012;
- (3) papers using standard methods (2 months): 31 March 2012; and
- (4) papers responding to those above (1 month): 30 April 2012.

The Committee **recommends** that if any information is available on dive-time from the telemetry data, these data should be made available for analysis in the context of deriving availability correction factors for the abundance estimates. The Committee **recognises** that it is unlikely that a new abundance estimate will be available for the *Implementation Review*. It noted that this is not a required component of an *Implementation Review*. Once an agreed abundance estimate is received it will be incorporated routinely into the *SLA* for the provision of management advice.

9. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT ADVICE⁶

9.1 Eastern Canada and West Greenland bowhead whales

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

Historically, bowhead whales in the Eastern Arctic had been believed to comprise two separate stocks (IWC, 2009a). However, in 2009 the Committee received and reviewed a considerable amount of information from a number of data sources (including substantial telemetry data, mtDNA data, and demographic information) to clarify the stock structure (IWC, 2009a). The current working hypothesis of a single stock was established by the Committee on the basis of this information. However, the Committee agreed in 2010 that 'the degree of population structure still needs to be tested with additional molecular markers (nuclear loci) before any conclusion is finalised about the number of stocks in this region' and it encouraged the submission of such an analysis. The Committee received no new analyses this

⁶The Committee recognises the logistical difficulties in collecting samples in remote areas but in order to assist in its work, it **recommends** that biological information and material be collected from as many whales taken in subsistence hunts as possible (see guidelines in IWC, 2003a, pp.74-5).

year, but it notes that a large number (>30) of microsatellite loci have been developed and applied in analyses of population genetics and stock structure in Bering-Chukchi-Beaufort Seas bowhead whales. The Committee therefore **recommends** that an assessment of variability and population differentiation among bowhead whales from eastern Canada and West Greenland be completed using at least the above loci and all available samples from these regions and presented at the 2012 Annual Meeting. Such an analysis should also include a discussion of the limitations of the available data and the feasibility of obtaining samples from areas for which data are lacking. A clearer resolution of the stock structure question could become necessary if abundance estimates decreased substantially or strikes increased substantially. The Committee also recognises the complications arising out of the fact that existing data pertinent to the question of stock structure are held by a non-member nation, Canada.

SC/63/BRG18 presented a genetic mark-recapture estimate for bowhead whales in Disko Bay, West Greenland. Genotype and sex was determined for 342 individuals sampled between 2000 and 2010 and a resultant mark-recapture estimate of abundance of the spring aggregation in Disko Bay was 1,747 (SE=399, 95% CI: 966-2528).

Heide-Jørgensen presented a review of available winter and summer abundance estimates for different areas of eastern Canada and western Greenland (Annex F, Appendix 2).

9.1.2 Review recent catch information

In 2010, three bowhead whales were harvested in Disko Bay, West Greenland, and biological samples were obtained from all three animals (SC/63/ProgRepDenmark).

A compilation of catch data from Canadian sources for the period 1994-2010 is given in Annex F, Appendix 3. The Secretariat reported that the Canadian quota in 2011 was set at a maximum of 4 bowheads. The Committee was pleased to receive this information.

9.1.3 Management advice

In 2007, the Commission agreed to a quota for 2008 to 2012 of two bowhead whales struck annually (plus a carryover provision of two unused strikes from the previous year) off West Greenland, but the quota for each year shall only become operative when the Commission has received advice from the Scientific Committee that the strikes are unlikely to endanger the stock. In 2008, the Committee developed an agreed approach for determining interim management advice. The Committee again **agrees** that the current catch limit for Greenland 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 (Annex F, Appendix 3), this would not change the Committee's advice with respect to the strike limits agreed for West Greenland. Given the importance of this issue, the Committee **recommends** that the Secretariat of IWC should continue to contact Canada requesting information about catches and catch limits for bowhead whales.

9.2 Eastern North Pacific gray whales

9.2.1 Provide information to the SWG on AWMP for Implementation Review

SC/63/BRG7 summarised information about the counts of southbound whales migrating past Granite Canyon, California. A new counting approach consisting of a paired team of observers was employed, and appropriate correction

factors for the new counting approach are currently being estimated. Abundance indices have been developed for the four migration years covered. It is not possible to relate these indices to the true level of abundance until an appropriate assessment of the detection bias of recent counts has been completed. The Committee also noted that the thermal imaging component of the study sounded promising. The Committee **requests** a more detailed overview paper of the counts for discussion at the 2012 meeting.

SC/63/BRG25 presented results of the annual census of gray whales in breeding lagoons in Baja California, Mexico. Two of three lagoons (Ojo de Liebre and San Ignacio) were surveyed annually. There was a considerable increase in the number of whales using these lagoons in 2011 compared to 2010. The increased number of calves in the breeding lagoons and on the northward migration has previously been linked to the timing of sea ice retreat in the Bering Sea and the Arctic Ocean. Earlier ice retreat probably provides whales with a longer time period to feed in the summer, which may result in higher calf production.

SC/M11/AWMP3 provided an update of information from northbound eastern North Pacific gray whale calf counts by shore-based surveys for the period 1994-2010. Estimates for the total number of northbound calves were highly variable between years, with no sign of a positive or negative trend. The paper also showed that average ice cover in the Bering Sea explains roughly 70% of the inter-annual variability in estimates of northbound calves the following spring i.e. a late retreat of seasonal ice may limit access to prey for pregnant females and reduce the probability that pregnancies will be carried to term.

The Committee **thanks** the authors for the long time series of data on the numbers of eastern Pacific gray whales. The Committee **encourages** the undertaking of a more quantitative integrated analysis for the lagoon counts in Baja California, Mexico and the northbound calf counts in California, given the length of the time series. It was also suggested that correlations between calf production in western and eastern gray whales be examined.

Fraser *et al.* (2011) analysed information on stock structure within the eastern North Pacific, with a focus on understanding the relationship of the Pacific Coast Feeding Group (PCFG) to the rest of the eastern North Pacific population. Mitochondrial (mtDNA) sequence data from the PCFG animals was compared to published mtDNA sequence data (LeDuc *et al.*, 2002) from samples collected from stranded animals along the migratory route in the eastern North Pacific. Significant differentiation was found between the two groups, and analysis with MIGRATE provided estimates of θ ($N_e\mu$, the effective populations size times mutation rates, for mtDNA), which were significantly different between the PCFG and the other eastern North Pacific samples.

The Committee noted that the implications of dispersal rate estimates in Fraser *et al.* (2011) were unclear. It **agrees** that this information together with the population modelling of the PCFG (see Item 8.2 and Annex E) should be taken into account in reconsideration of the gray whale archetype.

Advice on stock structure issues (discussed under Item 10.4 below) was presented to the SWG on the AWMP (see Annex E, item 5.1) and was considered further under item 8.2.

9.2.2 Review of recent catch information

The Russian Federation reported that a total of 118 gray whales (57 males, 61 females) was landed in Chukotka, Russia, in 2010; no whales were struck and lost. One whale

was considered unfit for consumption (i.e. it was 'stinky'). Biological samples were collected from 51 gray whales (including from the 'stinky' whale).

9.2.3 Management advice

The Committee **agrees** that the *Gray Whale SLA* remains the appropriate tool to provide management advice for eastern North Pacific gray whales apart from the PCFG animals that are part of the ongoing work of the SWG on the AWMP for an *Implementation Review* (Item 8.2). It **agrees** that the *Implementation Review* undertaken last year had identified no reason to change the Committee's advice for the Chukotkan hunt, at least until the *Implementation Review* with an emphasis on the PCFG is completed.

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

9.3.1 Review catch information and new scientific information

9.3.1.1 STOCK STRUCTURE

The Committee was pleased to receive two papers on genetic studies for the B-C-B bowhead whales.

SC/63/BRG13 reported on mtDNA sequence data from 296 bowhead whales from the B-C-B, eastern Canadian Arctic and Sea of Okhotsk stock areas. Previously described methods were used to provide an estimate of mtDNA mutation rate in bowheads of 2.8% per million years, which is lower than most other whales. This study showed that bowheads have maintained a relatively high female effective population size. Calculations of F_{ST} (a measure of population subdivision) and migration estimates for whales from the three areas showed that those from Canada and the B-C-B stock area did not have a statistically significant F_{ST} while the Okhotsk whales had a significant F_{ST} with both B-C-B and Canada whales. Further details can be found in Annex F (item 2.1.1). The study provides examples of how mtDNA sequence data can provide improved resolution in a variety of evolutionary and population genetic applications.

The Committee **welcomes** this study and provided suggestions for further analyses noting that a more accurate and extended data set is now available and analyses are planned to re-investigate this issue (see Annex F, item 9).

SC/63/BRG14 examined nucleotide sequence data from the X and Y chromosomes of bowhead whales. Much less variation than expected was observed in the Y chromosome based on theoretical mutation rates and from previous studies on human Y chromosome variation. It was concluded that bowhead whales have experienced a Y-chromosome selective 'sweep' (fixation of certain chromosome variants) in the recent evolutionary past. These data show a distinct difference exists in the population biology of male and female bowhead whales, consistent with male reproductive success being highly variable.

The Committee noted that this low level of variation on the Y chromosome was consistent with estimates from other species of cetaceans. The 'super-male' hypothesis of non-random male mating success was also noted for bowhead whales, and in this context the methods presented in SC/63/BRG14 may hold promise for better understanding of reproductive patterns in this and other species, contingent on sufficient sample sizes.

The Committee noted that during the previous *Implementation Review*, it had concluded that B-C-B bowhead whales represented a single stock and that there was no new information presented at this meeting to alter this conclusion for the forthcoming *Implementation Review*.

9.3.1.2 ABUNDANCE

The Committee was pleased to receive two papers dealing with dedicated ice-based surveys for abundance estimation of the B-C-B bowhead whales. Details can be found in Annex F, item 2.1.2.

SC/63/BRG3 provided a summary of the 2010 ice-based census of bowhead whales migrating past Barrow, Alaska. Two observation perches were used, and each location had both a primary perch and a second independent observer (IO) perch. A method for post hoc matching of whale sightings between perches was developed. A total of 759 matches were made from 3,188 whale sightings. The 2010 survey season began with an unusual pulse of bowhead whales in late March (never been recorded before) and substantial portions of the bowhead whale migration occurred during times when sighting was impossible due to ice and weather conditions; therefore, the results were not used to obtain an abundance estimate. However, the survey yielded a large quantity of IO data from which estimates of detection probabilities can be made (see below).

SC/63/BRG1 developed a novel capture-recapture method to use these data to update the old detection probability estimate (used since 1986); 'recaptures' occurred when the same group was sighted by the other perch. The mean estimated detection probability was 0.468 although detailed detection probability estimates depended on the effects of visibility, distance, group size, lead condition, whale passage rate, and some two-way interactions of these factors. The resultant detection probability estimates were somewhat lower than those of Zeh and Punt (2005) from 26-year-old data obtained using a different experimental method. This could be attributed to changes in the environment, the abundance and migration of the whales and the survey method. The authors plan to apply their detection probability estimates in conjunction with 2011 survey counts to produce an overall estimate of absolute abundance for this bowhead population.

The Committee **welcomes** this study which makes an important contribution to the development of a new estimate of abundance.

There was some discussion of observer effects. While the observer crews were different between 2010 and 2011, the authors believed it was worthwhile to further investigate the causes of observer effects and their implications for analysis. It was also noted that it was not necessarily appropriate to assume that those correction factors should be applied to earlier abundance estimates, because it is known that there have been changes in the population and environmental conditions over that time.

An update was provided on efforts in 2011 for collecting data for estimating the population size of B-C-B bowhead whales. Two efforts were attempted: (1) an on-ice census with visual and acoustic monitoring; and (2) an aerial survey to obtain individual identification photographs to estimate population size. Both efforts have been successful. Data from both efforts will be used to estimate the 2011 population size of B-C-B bowhead whales. All these data will be made available as soon as possible, but it unlikely that their provision for the 2012 *Implementation Review* of B-C-B bowhead whales can be achieved. The last estimate of population size for B-C-B bowhead whales was from 2004 and under the draft Aboriginal Management Scheme (IWC, 2003a, pp.74-5), a new estimate is not needed until 2014.

The Committee **thanks** the authors for these updates and for the considerable time and effort necessary to complete

both the ice based and aerial surveys and it **commends** the work of the field crews who endured considerable hardship and personal risk to complete the surveys successfully.

9.3.1.3 AGE ESTIMATION

SC/63/BRG5 reported results from an ageing study of B-C-B bowhead whales, based on the analysis of eye globes using aspartic acid racemisation. Using the update racemisation rate would increase by 1.2 times the ages reported in George *et al.* (1999).

In discussion it was noted that the average age at sexual maturity was very high compared to other baleen whales. It was also noted that the maximum age in George *et al.* (1999) was over 200yrs, which is higher than the maximum ages reported in SC/63/BRG5. Given the apparent high survival rate of B-C-B bowhead whales, and their history of commercial exploitation, the high age estimates were considered consistent with a population recovering to its equilibrium age structure. The Committee **recommends** that these techniques should be applied to other species of whales in future studies.

9.3.2 Management advice

SC/63/BRG2 provided information on the 2010 Alaskan hunt. A total of 71 bowhead whales were struck resulting in 45 animals landed. Challenging sea ice conditions, weather and equipment malfunctions contributed to a poor hunt during the spring. Of the landed whales, 20 were males, 23 were females, and sex was not determined for two animals. Two females were pregnant, one with a 1.2m foetus and one with a 4.2m male foetus. Further details are given in Annex F, item 4.1.2. Two males were taken in Chukotkan waters in 2010.

Discussion of the planned *Implementation Review* for B-C-B bowhead whales in 2012 is given under Item 8.6. 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 and catch limits are acceptable.

9.4 Common minke whales off West Greenland

9.4.1 New information

In the 2010 season, 179 minke whales were landed in West Greenland and 7 were struck and lost (SC/63/ProgRepDenmark). Of the landed whales, there were 122 females, 53 males, and four whales of unreported sex. Witting noted that there are plans to tag minke whales in the coming years to establish correction factors to be applied to future aerial surveys.

9.4.2 Management advice

In 2007, the Commission agreed that the number of common minke whales struck from this stock shall not exceed 200 in each of the years 2008-12, except that up to 15 strikes can be carried forward. In 2009, the Committee was for the first time ever able provide management advice for this stock based on a negatively biased estimate of abundance of 17,307 (95% CI 7,628-39,270) and the method for providing interim management advice which was confirmed by the Commission. Such advice can be used for up to two five-year blocks whilst *SLAs* are being developed (IWC, 2009a, p.16). Last year, the Commission agreed to replace the number 200 with 178 as recommended by the Committee. Based on the application of the agreed approach, and the lower 5th percentile for the 2007 estimate of abundance, the Committee repeats its advice of last year that an annual strike limit of 178 will not harm the stock.

9.5 Common minke whales off East Greenland

9.5.1 New information

Nine common minke whales were struck (and landed) off East Greenland in 2010 (no animals were struck and lost) (SC/63/ProgRepDenmark). Of the landed whales, there were two females, four males, and three whales of unreported sex. Catches of minke whales off East Greenland are believed to come from the large Central stock of minke whales.

9.5.2 Management advice

In 2007, the Commission agreed to an annual quota of 12 minke whales from the stock off East Greenland for 2008-12, which the Committee stated was acceptable in 2007. The present strike limit represents a very small proportion of the Central Stock (see Table 4). The Committee **agrees** that the present strike limit will not harm the stock.

9.6 Fin whales off West Greenland

9.6.1 New information

A total of four fin whales (all females) were landed, and one additional animal was struck and lost, in West Greenland during 2010 (SC/63/ProgRepDenmark). An acoustic study on fin whales in Davis Strait between Greenland and Canada found that call frequencies peaked in November-December, and continued until the area was covered by ice in January (Simon *et al.*, 2010).

9.6.2 Management advice

In 2007, the Commission agreed to a catch limit (for the years 2008-12) of 19 fin whales struck off West Greenland. At last year's Commission meeting, it was agreed that this should be reduced to 16 animals with a note that this will be voluntarily limited to 10 by Greenland (IWC, 2011a). The Committee agreed an approach for providing interim management advice in 2008 and this was confirmed by the Commission. It had agreed that such advice could be used for up to two five-year blocks whilst *SLAs* were being developed (IWC, 2009a). The most recent agreed abundance estimate is 4,359 (95%CI 1,897-10,114). Based on the application of

Table 4

Most recent abundance estimates for minke whales in the Central North Atlantic (see Fig. 2 for the location of the *Small Areas*).

<i>Small Area</i> (s)	Year(s)	Abundance and CV
CM	2005	26,739 (CV=0.39)
CIC	2007	10,680 (CV=0.29)
CG	2007	1,048 (CV=0.60)
CIP	2007	1,350 (CV=0.38)

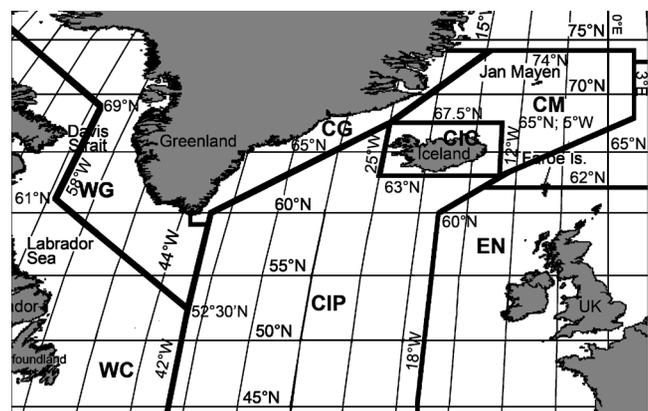


Fig. 1. *Small Area* specifications (see Table 4).

the agreed approach in 2008 (IWC, 2009a), the Committee **agrees** that an annual strike limit of 16 (and therefore also 10) whales will not harm the stock.

9.7 Humpback whales off West Greenland

9.7.1 New information

A total of nine (three males; five females; one unreported sex) humpback whales was landed (none were struck and lost) in West Greenland during 2010 (SC/63/ProgRepDenmark). Genetic samples were obtained from five of these whales.

9.7.2 Management advice

In 2007, the Committee agreed an approach for providing interim management advice and this was confirmed by the Commission (IWC, 2008a). It had agreed that such advice could be used for up to two five year blocks whilst *SLAs* were being developed (IWC, 2009a, p.16). Last year the Commission established an annual strike limit of nine whales for the years 2010-12 with an annual review by the Scientific Committee. The most recent agreed abundance estimate is 3,039 (CV=0.45; annual rate of increase 0.0917 SE 0.0124). Using this approach, the Committee **agrees** that an annual strike limit of nine whales will not harm the stock.

9.8 Humpback whales off St. Vincent and The Grenadines

9.8.1 New information

No information was provided on 2010-11 catches by St. Vincent and The Grenadines. The Committee **strongly recommends** that catch data, including the length of harvested animals, be provided to the Scientific Committee. It also **strongly recommends** that genetic samples be obtained for any harvested animals as well as fluke photographs, and that this information be submitted to appropriate catalogues and collections.

9.8.2 Management advice

In recent years, the Committee has agreed that the animals found off St. Vincent and The Grenadines are part of the large West Indies breeding population. The Commission adopted a total block catch limit of 20 for the period 2008-12. The Committee **agrees** that this block catch limit will not harm the stock.

10. WHALE STOCKS

10.1 Antarctic minke whales

The Committee is in the process of undertaking an in-depth assessment of the Antarctic minke whale. The report of the sub-committee on In-depth Assessments is given in Annex G. The primary abundance data are those collected from the 1978/79 to 2003/04 IWC-IDCR/SOWER cruises (e.g. Matsuoka *et al.*, 2003) that had been divided into three circumpolar series (CPI, CPII and CPIII). Two different methods for estimating Antarctic minke whale abundance from these data have been developed in recent years (see below) and although they gave different estimates of abundance, both were consistent in showing an appreciable decline in estimated circumpolar abundance between CPII and CPIII. The Committee has been working to resolve the differences between the estimates for some time and last year believed that it would be possible to present an agreed abundance estimate at this year's meeting (IWC, 2011j, p. 195).

10.1.1 Progress towards producing agreed abundance estimates of Antarctic minke whales

The Committee reviewed progress made on the work plan developed last year to facilitate it agreeing abundance estimates of Antarctic minke whales from the IDCR/

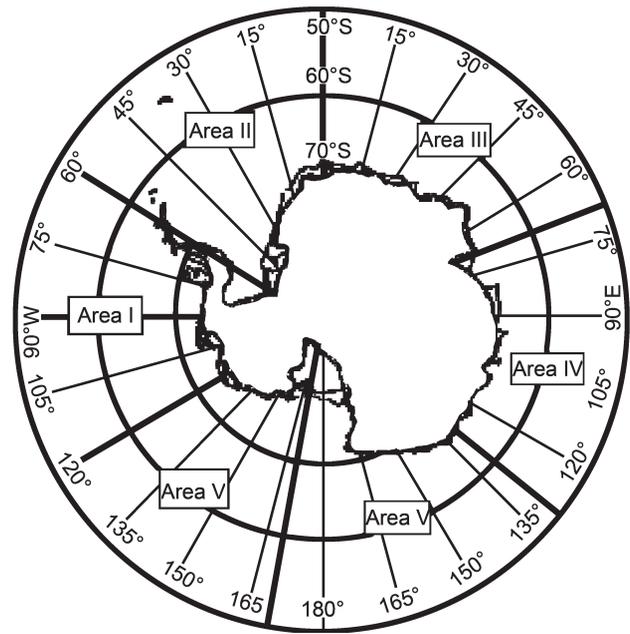


Fig. 2. Antarctic management Areas I-VI (see Donovan, 1991 and Matsuoka *et al.*, 2003).

SOWER surveys, with a focus on resolving the substantial differences between estimates from the hazard-probability stratified estimator (the 'OK' model, Okamura and Kitakado, 2010) and those from the trackline conditional independence spatial estimator (the 'SPLINTR' model, Bravington and Hedley, 2010). As part of the intersessional process, a workshop was held in January 2011 in Bergen, Norway; deliberations continued here in Tromsø.

Extensive new analyses for both methods were carried out and factor adjustments to each set of estimates were agreed. While these adjustments brought the estimates from the two methods much closer together, they remained different (Table 5). However, given the existing constructive collaboration and progress, the Committee believes that it is realistic to expect that the estimates will be reconciled by next year's meeting if an intersessional workshop is held. The reason for this is that the direction of future model development appears clear and achievable. A hazard-probability formulation of the SPLINTR model has been developed based on a very similar hazard-probability model to that used in the OK model. The preliminary results from this model have been extremely useful to the process of understanding the difference between the OK and SPLINTR estimates, and in identifying the path forward. The Committee therefore **recommends** that the Working Group on abundance estimation methods be re-established Annex R12.

In conclusion, while the Committee regrets that it has not been able to provide reliable final estimates for the Antarctic minke populations this year, it should be possible next year. From preliminary calculations, the Committee agrees that the final estimates for each Area (see Fig. 2) will most likely lie between the numbers given by the two methods in Table 5 and be probably closer to the OK estimates.

It is clear from Table 5 that while circumpolar Antarctic minke whale abundance estimates have declined during the period from CPII to CPIII, there are substantial differences in relative changes between Areas, with only

Table 5

Comparison of 'survey-once' estimates of abundance, by Management Area, from the adjusted OK and SPLINTR models. Estimates shown are rounded and in thousands. CVs (not incorporating additional variance) are given in parentheses.

Area I	Area II	Area III	Area IV	Area V	Area VI	Total
CPII - OK						
126 (0.20)	185 (0.16)	131 (0.21)	80 (0.18)	459 (0.17)	82 (0.27)	1,062 (0.12)
CPII - SPLINTR						
82 (0.23)	118 (0.23)	68 (0.51)	47 (0.18)	254 (0.14)	43 (0.25)	612 (0.13)
CPIII - OK						
47 (0.12)	70 (0.19)	111 (0.15)	72 (0.32)	215 (0.12)	96 (0.15)	612 (0.09)
CPIII - SPLINTR						
42 (0.16)	56 (0.16)	70 (0.12)	36 (0.23)	152 (0.13)	66 (0.17)	421 (0.09)

Table 6

Ratio of CPIII to CPII 'survey-once' estimates of abundance (95% CI), by Area, from the adjusted OK and SPLINTR models.

Area I	Area II	Area III	Area IV	Area V	Area VI	Total
CPIII:CPII - OK						
0.37 (0.23-0.58)	0.38 (0.23-0.62)	0.85 (0.51-1.41)	0.90 (0.44-1.85)	0.47 (0.31-0.71)	1.18 (0.64-2.16)	0.58 (0.43-0.78)
CPIII:CPII - SPLINTR						
0.51 (0.29-0.88)	0.47 (0.27-0.81)	1.02 (0.37-2.85)	0.77 (0.43-1.36)	0.60 (0.41-0.87)	1.55 (0.86-2.80)	0.69 (0.51-0.94)

relatively moderate increases or declines in some Areas, but appreciable declines in others (Table 6). No significant decline is seen in Areas III, IV and VI, whilst estimated abundance is substantially lower in CPIII for Areas I, II and V. Areas II and V encompass the Weddell and Ross Seas respectively; the ice configuration in both of these Areas is particularly complex and highly variable from year to year.

10.1.2 Reasons for differences between estimates from CPII and CPIII

As noted above, large declines in estimates of Antarctic minke whale abundance occurred in Areas I, II and V (there were no statistically significant changes in the other three Areas). The Committee **agrees** that these declines do indeed reflect genuine changes in abundance in the open-water areas surveyed that need to be explained. Such changes may be due to changes in distribution or reflect a true decline (or some combination of both).

The IDCR/SOWER cruises could only survey a small part of the Antarctic in any one year, and even within that they could not cover the entire range of potential minke whale habitat (e.g. the vessels could not go into the pack ice). If the decline in estimated abundance was due to whales being in unsurveyed regions during CPIII but not during CPII, then there are four possible (not mutually exclusive) explanations:

- (1) a much higher proportion of whales in the pack ice or in open-water areas (polynyas) within the pack ice in CPIII;
- (2) extensive east-west movements of whales from year to year, such that CPII, by chance had higher abundance than CPIII in certain areas;

- (3) a much higher proportion of animals were north of 60°S in CPIII; and
- (4) within-year movements of whales in open water within the surveyed areas.

While precise retrospective evaluation of each of these possibilities is difficult if not impossible, the Committee **agrees** that probably no analyses would be able to conclusively exclude the hypotheses that a true decline in abundance occurred in some Areas.

There are two classes of explanation for possible true declines in abundance. The first, quantitative approach involves the population dynamics statistical catch-at-age analyses (SCAA) from Area III East to VI West, which can potentially account for the changes in overall abundance in terms of variations over time in mortality and recruitment (note that this may explain how but not why changes occurred). The second, less quantitative approach involves attempts to identify mechanisms whereby mortality and recruitment may have changed (e.g. ecosystem effects, inter-species competition, climate changes, etc.).

In attempting to investigate reasons for the change in abundance, a better understanding of the relationship between Antarctic minke whale distribution and sea ice is important and a number of ice-related papers were presented this year (Annex G, item 5.1.3).

As part of the discussion of these papers, a technical issue arose with respect to the use of (and interpretation of) information from passive microwave sensors for assessing ice cover. The Committee noted that expert advice should be sought on this and that a paper or papers based on that advice would be welcomed next year.

It is also valuable to obtain information on present whale distribution in pack ice regions. The Committee therefore **welcomes** the information presented this year and expresses its gratitude to the Governments of Australia and Germany for conducting the relevant aerial surveys. The potential value of a system to detect whales in the pack ice using aerial photographs (without the need for observers) is clear and the Committee welcomed information on a trial project to record the presence of whales beneath the aircraft and to provide information on local sea ice conditions. The Committee **welcomes** this new attempt to record whale sightings data in the vicinity of sea ice and **encourages** further exploration of this technique.

An important limitation when examining the relationship between minke whale abundance by Area in CPII and CPIII and ice conditions is that for most Areas there are only two data points. The Committee noted that at least for some regions (Areas IV and V and more latterly adjacent parts of Areas III and VI), abundance estimates from JARPA and JARPA II provide a longer (up to 25 years) time series of estimates with which to examine these effects. Although there are some issues to be resolved with the JARPA and JARPA II estimates (e.g. IWC, 2008c), the Committee nonetheless **recommends** that exploratory analyses to investigate the relationship between estimates of abundance of Antarctic minke whales from JARPA/JARPA II data and environmental conditions be conducted and presented next year.

10.1.3 Continue development of the catch-at-age models

Population dynamics modelling provides a way to explore possible changes in abundance and carrying capacity within Areas IV and V. The data inputs are catch, length, age and sex data from the commercial harvests and both JARPA programmes, as well as abundance estimates from IDCR/

Table 7

BSB assessment results for the reference single and two stock models. Posterior median values are given with 90% probability intervals.

	Single (Model 0)		Two-stock (Model IIa)			
	B		B1		B2	
r^B	0.045*	0.006, 0.081	0.053*	0.010, 0.097	0.043*	0.005, 0.078
K^B	24,072	19,686, 40,980	18,732	1,3595, 36,551	4,293	224, 6,627
N_{min}	1,921	603, 7,822	1,532	367, 6,604	69	25,172
N_{2005}	9,484	7,581, 11,849	9,310	7540, 11,730	324	117, 471
N_{2010}/K	0.467	0.229, 0.711	0.607	0.252, 0.893	0.106	0.033, 0.980
N_{2040}/K	0.93	0.272, 0.999	0.982	0.346, 1.000	0.4	0.039, 1.000

*The models used an uninformative prior on r and there was minimal updating during the model fitting process. In the absence of updating, a uniform prior would lead to an estimate of r of 0.05. For details, see SC/63/Rep6, item 2.4.

SOWER and both JARPA programmes. Results of a further SCAA analysis developed for Antarctic minke whales were presented to the Committee this year (SC/63/IA1). The Committee noted that the qualitative results on trends were now consistent across all the most plausible scenarios considered. The Committee **agrees** that both sets of adjusted IDCR/SOWER abundance estimates (Table 5), which show similar trends although different absolute levels, should be used in intersessional work on SCAA. In addition, as recommended last year, the Committee **agrees** that the most recent catch-at-age data from JARPA II should be included in the SCAA; at least preliminary data from 2006 and perhaps 2007 are available; the Committee **recommends** that such data be provided under Data Availability Agreement Procedure B, as previously.

The Committee **agrees** that the SCAA development phase is now complete (it has **resolved** the issues related to: (a) apparent differences between growth rates estimated from the JARPA and commercial data sets; and (b) the consistency of age readings amongst readers) and as part of the analyses presented by the Working Group (Annex R13) next year the Committee **agrees** that the paper should *inter alia* include:

- (1) detailed technical specifications of the analytical techniques;
- (2) a 'lay' summary of the model and its assumptions;
- (3) a graphical representation of results for key parameters; and
- (4) clear specifications for the 'base case' and the related sensitivity tests.

10.2 Southern Hemisphere humpback whales

The report of the sub-committee on other Southern Hemisphere whale stocks is given in Annex H. The humpback whale assessment has been on the agenda of the Scientific Committee since 1992. The Committee currently recognises seven breeding stocks (BS) in the Southern Hemisphere (labelled A to G, IWC, 1998b), which are connected to feeding grounds in the Antarctic. An additional population is found only in the Arabian Sea. Preliminary population modelling of these stocks was initiated in 2000 (IWC, 2001e) and in 2006 (IWC, 2007c), the Scientific Committee completed the assessment of BSA (eastern South America), BSD (western Australia) and BSG (western South America), although it was agreed that BSD might be re-examined with BSE and BSF, in light of mixing on the feeding grounds. The assessment of BSC (eastern Africa) was completed in 2009 (IWC, 2010g). Since then, the assessments of BSB (western

Africa), BSE (western South Pacific) and BSF (central South Pacific) have been considered a priority by the Committee (IWC, 2009a, p.66; 2010g, p.234).

10.2.1 Complete assessment of Breeding Stock B

Breeding Stock B corresponds to whales inhabiting the western coast of Africa, from Guinea to western South Africa. The available data comes primarily from Gabon (a breeding ground) and west South Africa (WSA, a feeding ground/migratory corridor). Analyses to date suggest that Gabon and WSA are part of two different sub-stocks (B1 and B2, respectively), but the boundary between them is unknown.

SC/63/Rep6 reported on the pre-meeting held in Tromsø to complete the assessment of this breeding stock. An intersessional e-mail group had been convened last year to facilitate this work and new information was also provided in SC/63/SH17, SH20 and SH21. The pre-meeting evaluated preliminary assessment results (SC/63/SH26) and selected two reference case models: a single stock model (Model 0, SC/63/Rep6, Appendix B) and a two stock model (Model IIa, SC/63/Rep6, Appendix B). While neither adequately captured the complexity of the BSB population structure, the Committee **agrees** that they are both useful for making inferences about the current status of the stock. Sensitivity analyses were developed to assess how changes in stock structure hypotheses and input data would impact the model outputs. Details of the specification of reference cases and sensitivities are given in SC/63/Rep6, item 2.3.

The results of reference case models are shown in Table 7 and Fig. 3. Discussion of the model outputs for reference cases and sensitivity analyses is presented in SC/63/Rep6, item 2.4. On the basis of these results, the Committee **agrees** that BSB has probably recovered to about half of its pre-exploitation level, but noted that the probability interval around this estimate is wide. While the two-stock model suggests that B2 is appreciably more depleted than B1, it was not possible to determine whether this is real or reflects the fact that the data do not represent B2 due to incomplete sampling coverage.

The Committee **agrees** that the current assessment of BSB has been completed to the degree possible given the available data. Future assessments will require additional information on population abundance, trends and structure. Recommendations to address these gaps were given under SC/63/Rep6, Item 2.6. One recommendation has financial implications for the Committee (Annex H, item 5.1). The Committee **thanks** Zerbini for his hard work in ensuring that the BSB assessment has been completed this year.

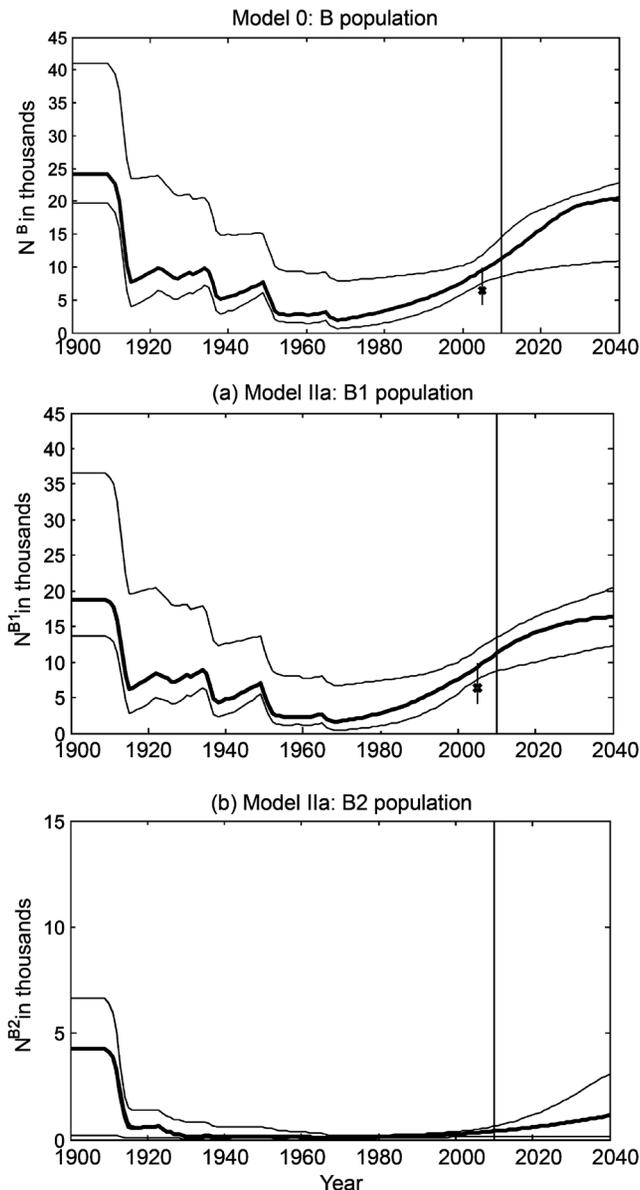


Fig. 3. Median trajectory (solid line) and 90% probability interval (long dashed lines) for the Model 0 reference case (top) and IIa reference case (B1 stock: middle, B2 stock, bottom). The trajectories to the right of the vertical dashed line are projections into the future under the assumption of zero catch. A MARK generated sighting-resighting abundance estimate (x) and 95% confidence interval (vertical line) for Gabon is presented for comparison. See SC/63/Rep6 for details.

10.2.2 New information on other breeding stocks

10.2.2.1 BREEDING STOCKS E AND F

10.2.2.1.1 NEW INFORMATION

SC/63/SH9 reported the results of a genetic mixed stock analysis based on mtDNA from 575 humpback whales sampled in the Antarctic (from approximately 35°E to 120°W) and 768 whales sampled at low latitude localities of the South Pacific and eastern Indian Ocean. The results suggested that:

- (1) BSD whales are found mainly between ~80°E and 125°E (Area IV);
- (2) French Polynesia whales do not occur in the Antarctic areas examined;
- (3) New Caledonia whales occur from approximately 150°E and 120°W (VE and VI); and

- (4) Tonga and Cook Island whales may occur mainly in Area VI.

The Committee **welcomes** this analysis and made recommendations for future work. It particularly noted the importance of adding samples from BSE(1), which had not been available to this analysis. The relative advantages of a microsatellite-based mixed stock analysis were also discussed.

SC/63/SH10 and SC/63/SH16 examined migratory connections between Area V and Southern Hemisphere breeding grounds based on microsatellite and photo-ID matching, respectively. In these studies, successful matches were made between Area V and East Australia, New Zealand (genotype match) or New Caledonia (photo-ID match). This research was coordinated by the SORP (SC/63/O12) and the results provide further support for known migratory connections.

The Committee received an update on research efforts in 2010 at New Caledonia, Cook Islands, French Polynesia, Samoa, American Samoa, New Zealand, Hervey Bay, Norfolk Island and Niue (SC/63/SH24).

SC/63/SH11 presented an opportunistic photo-ID match between BSD and BSE(1). The mixing of individuals from BSD and BSE on breeding and feeding grounds should be considered in upcoming assessments, particularly in the context of the allocation of Antarctic catches. This issue is further discussed in Annex H, item 2.3.4.

SC/63/SH22 described a land-based survey at Point Lookout on the east coast of Australia. Population growth was estimated at 10.9% per annum (95% CI 10.5-11.3%) and the 2010 absolute abundance was estimated at 14,522 whales (95% CI 12,777-16,504). However, this may be an underestimate if females do not always migrate past this location (e.g. Brown *et al.*, 1995). The Committee **recommends** that the sex ratio of migrating whales be re-examined using an unbiased sampling design and encourages calving rate analyses to clarify the continued high rate of increase.

The Committee also received a report of mid-migration feeding off Eden, Australia (SC/63/SH12). Further detail can be found in Annex H, item 2.3.

10.2.2.1.2 PREPARATION FOR THE ASSESSMENT OF BREEDING STOCKS E/F

The Committee **agrees** that its next priority for assessment will be BSE/F. The assessment will take into account mixing of BSD and BSE on the feeding grounds (see above).

The Committee **welcomes** the progress of an intersessional e-mail group to identify data available for assessment modelling. It notes that progress had already been achieved toward the assessments of BSD and BSE (Johnston and Butterworth, 2005) as well as BSE and BSF (Jackson, 2009).

The following steps were **agreed** to complete the work:

- (1) consider previously proposed stock structure scenarios (IWC, 2006);
- (2) consider new data sets;
- (3) evaluate the need for new scenarios based on new data;
- (4) evaluate data gaps; and
- (5) select one or more biologically plausible scenarios that are supported by data.

The Committee selected two stock structure scenarios for priority consideration in assessment modelling:

Scenario A: 2 stocks: (1) East Australia; and (2) New Caledonia +Tonga+French Polynesia.

Scenario B: 4 stocks: (1) East Australia; (2) New Caledonia; (3) Tonga; and (4) French Polynesia.

In both scenarios, exchange with BSD would be considered as a sensitivity test. Justification of these selections, including discussions of available data and notable data gaps, are provided in Annex H, item 2.3.4.

Work to evaluate and agree on the input data set to be used during the assessment modelling was begun but not completed. An intersessional e-mail group has been established to identify available data sets, to select the best available for assessment purposes, to provide data intersessionally to the modellers by 1 December 2011 and to present results to the Committee next year (Annex R15). The terms of reference and timeline of that work is discussed under Annex H, item 5.1.

The Committee **agrees** that modelling should begin intersessionally, but that new data can be added until the start of SC/64. A completed assessment is planned for no later than the end of the 2013 Annual Meeting. Further detail can be found in Annex H, item 5.1.

10.2.2.2 ARABIAN SEA

Humpback whales in the Arabian Sea constitute a small ($N=82$, 95% CI=60-111), isolated population that is vulnerable to human activities (Minton *et al.*, 2011; Pomilla *et al.*, 2010). The Committee has previously expressed concern about this population and made recommendations for continued and new research (IWC, 2011k, p. 214).

An update on photo-ID, acoustic and behavioural research performed in 2011 was provided in SC/63/SH27. The Committee **agrees** that sufficient data exist on Arabian Sea humpback whales and possible anthropogenic threats to begin the process for the development of a Conservation Management Plan (Annex H, Appendix 3). Following the model for western gray whales, the Committee **agrees** that progress would best be achieved through engagement of scientists, marine stakeholders and range states at a dedicated intersessional workshop between to be held prior to next year's meeting. The workshop should engage relevant range state government departments responsible for marine conservation in the Arabian Sea. Their willingness to be involved in the process should be determined and they should be familiarised with and provide feedback on their capacity for CMP implementation. An intersessional e-mail group has been established to evaluate the possibilities for such a workshop (Annex R16).

The Committee **recommends** that any draft CMP should include the priority research actions recommended at SC/62 (IWC, 2011k, p. 214), and photo-identification studies. The Committee **agrees** the following: (1) although humpback whales are the priority, other less-well studied large whale species should also be considered; (2) collaborative research should be undertaken in cooperation with range state partners, with a view to increasing awareness and capacity and to reducing dependence on external expertise; and (3) research priorities would ultimately be best determined via the CMP process.

Finally, the Committee **recommends** that stranding networks be established in this region to better determine the frequency of strandings, as well as the species involved and causes of death, in order to address anthropogenic effects.

10.2.2.3 BREEDING STOCK A

SC/63/SH1 reported on an unusual peak in recorded humpback whale mortalities off Rio de Janeiro, south-eastern Brazil, during 2010. The Committee discussed

this paper relative to the larger unusual mortality event at Brazil, and in the context of similar events in recent years off Western Australia (Coughran and Gales, 2010) and Argentina (SC/62/ProgRep Argentina). The Committee **encourages** international collaboration to better understand these events. It also **recommends**:

- (1) consultation with CCAMLR's Ecosystem Modelling Programme to evaluate potential links with changes in the marine ecosystem, especially on the feeding grounds;
- (2) necropsies whenever feasible during unusual mortality events; and
- (3) concurrent studies of the health of the free-ranging population.

Three papers were received on the distribution and movements of BSA humpback whales. SC/63/SH4 reported the first inter-oceanic photo-identification match of a humpback whale between Ecuador and Brazil. SC/63/SH14 provided information on sightings of humpback whales at Trindade Island, off the southeast coast of Brazil. SC/63/SH23 described the migratory routes and destinations of 13 humpback whales satellite tagged off Brazil. The latter were largely consistent across years and followed the migration corridor originally described for this population. However, one individual spent 20 days (probably foraging) at middle latitudes (45°S) before heading southwest towards the South Sandwich Islands. Foraging at this latitude has not been previously described.

In its discussion of these papers, the Committee **recommends** expanded research effort in Brazil to include offshore islands to more fully encompass breeding populations. It also **recommends** multi-year tagging programmes to better understand humpback whale migration patterns.

10.2.2.4 BREEDING STOCK C

SC/63/SH28 described the first systematic photographic comparison of humpback whales at Réunion (BSC4, $n=320$) to another sub-stock of the south-western Indian Ocean. Three photographic matches were made to Madagascar (BSC3, $n=812$), confirming individual movements between BSC3 and BSC4. Further discussion of these results and recommendations for regional collaborations are presented in Annex H, item 2.4.2.

10.2.2.5 BREEDING STOCK D

Hedley *et al.* (2011) provided a re-analysis of aerial line transect surveys along the Western Australian coast. A spatio-temporal model gave relative abundance estimates of 5,130 (95% CI 3,380-8,750) in 1999, 6,070 (95% CI 4,420-11,020) in 2005 and 11,820 (95% CI 9,720-16,400) in 2008. The annual rate of increase from 1999-2008 was 9.7% (CV=0.25) and the estimated absolute abundance in 2008 was 28,830 (95% CI 23,710-40,100) whales. The authors cautioned that although the rate of increase information from these analyses is reliable, the extrapolation to an absolute abundance estimate is not yet satisfactory. The Committee **agrees** that these abundance estimates are the best currently available for the assessment process. Discussion of these estimates is provided in Annex H, item 2.4.3.

10.2.2.6 BREEDING STOCK G

The Committee received two papers relating to BSG. SC/63/SH4 reported the first inter-oceanic photographic match between Ecuador to Brazil, as noted in Item 10.2.2.3, above. SC/63/SH19 reported on photographic comparisons between Ecuador ($n=1,470$), Peru ($n=96$) and American

Samoa (BSE/F, $n=168$). Two matches were made between Ecuador and Peru in that study, extending the southern limit of BSG to approximately 700km south of Ecuador.

10.2.2.7 FEEDING GROUNDS

Migratory connections between Antarctic feeding grounds and breeding stocks were studied in SC/63/SH9, SC/63/SH10 and SC/63/SH16 (see Item 10.2.2.1.1 above). Systematic sighting survey data, photo-ID and biopsy samples for humpback whales have also been collected in the Antarctic since the 2005/06 season and results will be reported to the JARPA II review meeting. Mid-latitude feeding was also described off Eden, East Australia (SC/63/SH12) as noted in Item 10.2.2.1.1 above.

10.2.2.8 ANTARCTIC HUMPBACK WHALE CATALOGUE

(AHWC)

SC/63/SH5 provided an update on the Antarctic Humpback Whale Catalogue (AHWC), maintained by the College of the Atlantic. During the contract period, 924 photo-ID images were catalogued, representing 740 individual humpback whales from Southern Hemisphere waters. Images were submitted by 53 individuals and research organisations. These submissions bring the total number of catalogued whales identified by fluke, right dorsal fin/flank and left dorsal fin/flank photographs to 4,277, 414 and 407, respectively. Matches made during the contract period included two re-sightings between BSG and the Antarctic Peninsula, and one between BSG and BSA. Within-region re-sightings occurred at the Antarctic Peninsula ($n=4$), BSA ($n=6$), BSC3 ($n=1$), BSE ($n=2$), BSE3 ($n=2$) and BSG ($n=4$). Progress continues to stimulate submission of opportunistic data from eco-tourism cruise ships in the Southern Ocean and from research organisations and expeditions working throughout the Southern Hemisphere.

The Committee **recommends** that the AHWC continue, particularly given the importance of its Antarctic and sub-Antarctic holdings. Financial implications are discussed under Item 23.

10.2.3 Work plan

The Committee **agrees** that the priority for next year's meeting is the assessment of BSE/F and a detailed work plan is given under Item 10.2.2.1.2. The Committee **agrees** that the assessment will be finalised no later than the end of the 2013 Annual Meeting.

An intersessional e-mail group to work collaboratively with the Conservation Committee towards an intersessional workshop on Arabian Sea humpback whales has also been established (Annex R16).

Items with financial implications are dealt with under Item 23.

10.3 Southern Hemisphere blue whales

The progress report on the assessment of Southern Hemisphere blue whales is given in Annex H. In 2002, the Committee recommended that the assessment of blue whales be started in 2005, after the completion of the IDCR/SOWER review (IWC, 2003b, p. 41). In 2008, the Scientific Committee completed a circumpolar assessment of Antarctic blue whales (IWC, 2009e) and recommended that area-specific analysis be examined to evaluate whether separate assessments can be done by Area (IWC, 2009e). The Committee also recommended gathering data relevant for the assessment of non-Antarctic (pygmy-type) blue whales.

10.3.1 New information

SC/63/SH6 presented results of the Alfaguara (Chilean blue whale) Project conducted by the Centro de Conservacion Cetacea from 2004 to 2010. Information on group size, behaviour, distribution, relative abundance, photo-ID and site fidelity was presented. The authors reported high overall annual return and sighting rates, as well as concerns about overlap with large vessels in the mouth of the Chacao Channel (along the north side of the island of Chiloé). Further details can be found in Annex H, item 3.1.

The Committee recognises the value of such long-term datasets for understanding blue whale populations and **recommends** that they continue.

10.3.2 Photo-identification catalogues

The Committee received updates on the Southern Hemisphere Blue Whale Catalogue (SHBWC, SC/63/SH8) and the Antarctic Blue Whale Photo-ID Catalogue (ABWPC). The ABWPC is the reference dataset for blue whale photo-ID data from the Antarctic IDCR/SOWER cruises, and now contains 228 individual whales. These holdings will ultimately be included within the SHBWC, a collaborative Southern Hemisphere catalogue that has been developed with the financial support of the IWC. The SHBWC currently holds nine photo-ID catalogues from Chile, Eastern Tropical Pacific, Ecuador-Galapagos, southeastern Australia, western Australia, Timor Leste and Sri Lanka. As described in SC/63/SH8, this catalogue has recently facilitated a ten-year re-sighting between two catalogues from Chilean waters. This was the first long-term match of that magnitude for blue whales for the eastern South Pacific. Further details on the technical aspects, holdings and achievements of these catalogues are detailed in Annex H, item 3.1.1. The managers of these datasets are congratulated on their efforts and the Committee **recommends** continuation of these important initiatives. The financial implications are discussed under Item 23.

Blue whale photo-ID data collected by the Japanese Whale Research Program under special permit in the Antarctic (JARPA 1987/88-2004/05 seasons) had been submitted to the Secretariat (IWC, 2011k). The Committee **reiterates** its recommendation that these images be compared to the Antarctic Blue Whale Photo-ID Catalogue and **recommends** that results be provided at next year's meeting. The financial implications are discussed under Item 23.

10.3.3 Abundance estimates

The Committee received the report of an intersessional group on blue whale abundance estimates from Chile and west Australia (IWC, 2011m). Two relevant papers were provided to SC/63. The first was an updated line transect estimate based on the 1997/1998 SOWER surveys off Chile. The revised result (303 whales, 95% CI: 176-625, Williams *et al.* (2010) was considered a minimum estimate of whales in this area because the survey did not span the range of the population. SC/63/SH7 provided the first mark-recapture estimates for Chilean blue whales, based on 334 individuals photo-identified between 2004 and 2010. Abundance estimates ranged from 691 (95% CI: 598-817) to 917 whales (95% CI: 682-1151), depending on the assumptions made in the analysis. The authors concluded that despite the high concentration of blue whales off Isla de Chiloé, the Chilean blue whale population appears to be smaller than blue whale populations around Antarctica and off western Australia.

The authors of Williams *et al.* (2010) and SC/63/SH7 are thanked for providing this new information and

recommendations were made for future mark-recapture analyses, as described in Annex H, item 3.1.2.

No new information had been received on pygmy blue whales off west Australia. The Committee expresses continued interest in acoustic information and analytical approaches to improve understanding of pygmy blue whales in the east Indian Ocean and **recommends** that studies be presented next year. Further details of these discussions can be found in Annex H, item 3.1.2.

SC/63/SH3 evaluated possible strategies for obtaining a new, reasonably precise abundance estimate for Antarctic blue whales. Further Committee discussion of this is incorporated under Item 19.

10.3.4 Molecular genetic studies

SC/63/SH13 reported progress using mtDNA and microsatellite genotypes to census maternal lineages of Antarctic blue whales surviving the exploitation 'bottleneck'. The resulting minimum census of 53 haplotypes more than doubles the previous estimate (LeDuc *et al.*, 2007) and can be used to revise the current estimate of N_{\min} ⁷ (Branch and Jackson, 2008). The Committee **welcomes** this study and noted that the estimate of N_{\min} for Antarctic blue whales requires further consideration.

Attard *et al.* (2010) reported a genetic study of pygmy blue whales at the two known Australian feeding aggregations in the Perth Canyon and the Bonney Upwelling. Their results indicated no evidence of significant genetic differentiation within or between the two feeding aggregations. The Committee **agrees** that further research to elucidate the degree of continuity of Australian feeding aggregations with blue whales in surrounding areas would be extremely important to future blue whale management and conservation.

Additional, ongoing collaborative genetic studies of blue whales in the Southern Hemisphere are detailed in Annex H, item 3.1.3, and updates will be presented at next year's meeting.

10.4 Western North Pacific gray whales

10.4.1 New scientific information

The Committee received numerous papers on stock structure and movements of North Pacific gray whales. Generally, those papers occurred within three categories: satellite tagging, genetics and photographic studies. Details can be found in Annex F, item 4.1.

SATELLITE TAGGING

The Committee received a number of papers (SC/63/BRG20, SC/63/BRG23 and SC/63/BRG26) reporting on the international collaborative telemetry study on western gray whales (with some additional biopsy sampling and photo-ID work) undertaken under the auspices of the IWC⁸, following guidelines developed by the IWC Scientific Committee and IUCN (e.g. IUCN, 2010; Weller *et al.*, 2008). Details of the work and the contributions by the various institutes can be found in Annex F, item 4.1. The primary objective of the project was to deploy tags on 12 western gray whales to discover migration routes and wintering areas in order to inform conservation actions for this critically endangered population.

In the event, primarily for logistical reasons and poor weather, only one whale was tagged on 4 October 2010. This whale was a 13-year-old male (given the nickname 'Flex' by the researcher team that initially photo-identified the animal) tagged off Piltun Lagoon, northeastern Sakhalin Island. For some 68 days the tagged whale remained in a small area within 45km of the tagging site. On 11 December, it departed Sakhalin and began migrating across the Okhotsk Sea, Bering Sea, and Gulf of Alaska. By 5 February 2011, when transmissions stopped, the whale was within 20km of the central Oregon coast. The implications of this are considered later in the report.

The Committee **thanks** the Russian and US scientists involved in this important field effort. It also **thanks** the funding bodies and Donovan (IWC) and Larsen (IUCN) for considerable logistical and administrative assistance.

With respect to continued field work in 2011, discussion focussed on possible revisions to the field protocols, primarily in terms of 'candidate' whales for tagging. The 2010 protocol limited tagging to healthy males but it was agreed to revisit this condition based on the potential scientific and conservation gains from being also able to tag healthy females.

To inform that discussion, considerable attention was paid to follow up studies on eastern gray whales that had been tagged earlier, particularly 18 animals tagged off the Oregon and California coast of the US from September to December 2009 and subsequently photographed. Details of those discussions and the deliberations of a working group established to review the field protocols can be found in Annex F. That working group focussed on six areas and its conclusions can be summarised as follows.

- (1) Health risk assessment: The risk is sufficiently low and the conservation benefits sufficiently high that the main focus of determining candidates to tag should be the scientific importance of the data that might be obtained.
- (2) Design: The aim should be to tag 12 animals which are broadly representative of the non-calf, non-juvenile population of gray whales off Sakhalin Island in the 2011 open-water season.
- (3) Candidate whales: The previous requirement that only whales judged to be healthy and in good body condition should be candidates for tagging is maintained. In addition the following cannot be candidate whales: 'small' animals (calves, yearlings, juveniles), females accompanied by calves and (to the extent that it is possible to determine) females that have weaned their calves in 2011; and finally efforts should be made to avoid retagging 'Flex', the animal tagged in 2010.
- (4) Participation by Amanda Bradford: The field work will benefit greatly by the presence of Amanda Bradford for her unparalleled expertise in the identification and visual assessment of body condition of individual whales in this population and every effort should be made to ensure her participation.
- (5) Biopsies: Biopsy sampling is an integral element of the tagging effort, for determining the sex of animals for which the sex is not already known and, for tagged females, to provide valuable information on reproductive status using hormone analyses as long as the sample is preserved frozen (details will be incorporated into a final protocol).
- (6) Follow-up studies: In addition to assessing the potential effects of tagging, a special effort should be made to follow the reproductive performance of females that may be tagged.

⁷In the future, the Committee will refer to the hard-bound estimate of minimum population size as N_{floor} (see Annex I for discussion).

⁸This project represents a major international collaboration between IWC, IUCN, the A.N. Severtsov Institute of Ecology and Evolution Russian Academy of Sciences and Oregon State University's Marine Mammal Institute. Funding for the work was provided by Exxon Neftegas Ltd. (ENL) and Sakhalin Energy Investment Company (Sakhalin Energy).

Recognising some continued concern among some members about risks of tagging females, especially reproductive females, for the reasons given above the Committee **endorses** the full revised guidelines found in Annex F and summarised above and **strongly recommends** that the tagging study on western gray whales continues this summer, following the agreed protocols (as specified in Annex F).

Furthermore, the Committee **encourages** the additional tagging of animals from the eastern population, including whales from the PCFG. As stressed below, additional information concerning movements of all components of the population of North Pacific gray whales would be helpful for determining stock structure.

GENETIC STUDIES

SC/63/BRG10 presented an updated analysis of genetic differentiation between gray whales in the eastern North Pacific (north of Aleutians and migration area between California and southeastern Alaska) and western North Pacific (Sakhalin feeding ground). Significant levels of differentiation were found between western and eastern North Pacific gray whales using both mitochondrial and nuclear markers while no significant differentiation was detected between the two strata compared in the eastern North Pacific. Two genetic matches were also identified between Sakhalin and southern California.

The Committee discussed the conception date of gray whales and whether western and eastern whales would be in the same location when breeding occurred. The timing of breeding relates to genetic distinctness of eastern and western gray whales. Maintaining genetic distinctness at the nuclear DNA levels indicates some segregation of eastern and western whales during breeding. More information is needed in the timing of breeding and conceptions of gray whales and it was suggested that a re-analysis of foetal growth using a large data set may provide some additional insights into the timing and variability of conception dates.

The Committee **encourages** additional genetic comparisons between Sakhalin and Baja California, Mexico. The genetic comparisons between western gray whales and gray whales off Mexico would be valuable because Mexico may represent a more random sample than any individual feeding region, and such a comparison might provide additional information on the overlap between eastern and western gray whales. It was also noted that the archetype for gray whales may need reconsideration and that the current concept of movements and distribution of gray whales may be wrong.

PHOTO-IDENTIFICATION

SC/63/BRG6 provided results from a comparison of long-term photographic studies on western North Pacific gray whales off Sakhalin Island with eastern North Pacific gray whales to detect possible population mixing. The comparison resulted in six matches. All six whales were sighted off Sakhalin prior to their sighting off southern Vancouver Island, BC, and five were observed off Sakhalin subsequent to being sighted in the eastern North Pacific.

In addition, Weller and Urban reported on an *ad hoc* effort to expand upon work reported in SC/63/BRG6. To this end, a preliminary inspection of the 2006-10 photo-catalogues from Laguna San Ignacio in Baja California, Mexico was conducted to look for matches to the Russia-US catalogue of western gray whales from Sakhalin Island. This comparison produced four matches.

INTEGRATION OF DIFFERENT DATA TYPES

As a whole, a total of 12 western gray whales first identified off Sakhalin Island have been matched to three locations in the eastern North Pacific (Vancouver Island, Southern California and Laguna San Ignacio).

The Committee **commends** the authors on the new information linking whales sighted near Sakhalin Island with animals sighted off the west coast of North America. Comprehensive photo-matching effort of western and eastern North Pacific gray whales is planned under the international collaboration programme envisaged below (see Annex F, Appendix 7). It is hoped that information will be available by the 2012 meeting. Photos and samples from the different nations and areas should be integrated.

The Committee **agrees** that it is important to integrate existing data and collect new data to clarify the stock structure of North Pacific gray whales, noting the important potential implications for conservation and management. It **strongly endorses** the plan to develop an international collaborative programme under the auspices of the IWC involving all range states (Annex F, Appendix 7).

Recognising the logistical difficulties, the Committee **strongly recommends** that photos and tissue samples for genetic analyses be collected from harvested whales in Chukotka and the photos be compared with the western gray whale catalogue.

Brownell reported that between 1955 and 2009, Kato *et al.* (2010) reported 23 records of the western North Pacific gray whales from Japanese waters, including at least 11 records from 1968 to 2007. Brownell noted that there are only ten known records of western North Pacific gray whales in China from 1922 to 1996 (Wang, 1999), and these are represented by only six specimens from 1933 and 1996. High priority needs to be given to analysing available samples from Japan and China as soon as possible as called for by the Committee since 2005. The Committee was reminded that last year a mtDNA analysis was presented to the Committee based in part on stranded and by-caught gray whales in Japan. The study was carried out in a collaboration between Russian and Japanese scientists. Given recent evidence that the Sakhalin feeding area may represent a mix of individuals overwintering in the eastern North Pacific and individuals overwintering in the western North Pacific, analysis of samples from areas in the North Pacific whales used for migrating and/or breeding, such as Japan and China, will greatly contribute to our understanding of gray whale population structure.

The Committee agreed that as it continues to consider new information on stock structure and movements of North Pacific gray whales, a working definition of terms and more consistent usage would be helpful. All of these terms are descriptions of groups below the species level, and the inconsistency in usage reflects the difficulty associated with the fact that such subdivisions attempt to divide the continuum of genetic relatedness into [more-or-less] discrete subunits. The working group on stock definition has been considering such issues (see Item 11 and Annex I). Given the complexity of gray whale stock structure, the Committee **encourages** participation of those involved in analysis of North Pacific gray whale population structure in the review of terminology to be conducted next year.

The Committee also received a number of papers on western North Pacific gray whales. A number of points of interest were raised by these papers including the following items (details are given in Annex F):

- (1) updated information from 2010 collaborative Russia-US research conducted off Sakhalin Island on photo-ID and findings based on combined data from previous years (SC/63/BRG8);
- (2) updated information on photo-identification of the western gray whale population conducted off the northeast Sakhalin Island since 2002 to study the migration and biology (SC/63/BRG12);
- (3) discussion of the hypothesis that eastern gray whales are re-occupying the species' historic range including the Far East Sea of the Pacific Ocean (SC/63/BRG24);
- (4) consideration of anthropogenic sound levels associated with onshore pile installation on northeastern Sakhalin Island was studied (SC/63/BRG4), and the need for an improved and more comprehensive analysis and improved understanding of impacts on gray whales from pulsed and more constant sounds was identified;
- (5) results of shore- and vessel-based distribution surveys conducted offshore northeast Sakhalin, in August-September 2010 were shown (SC/63/BRG21);
- (6) updated information on the western gray whales food supply distribution patterns in two feeding grounds off the Northeast coast of Sakhalin in 2002-10 (SC/63/BRG15) that led the Committee to **recommend**: (i) that faecal samples be collected from gray whales in Sakhalin to confirm prey items; and (ii) that a more quantitative analysis of prey items of gray whales off Sakhalin for understanding the distribution of whales off Sakhalin be conducted and presented; and
- (7) updated information on research and conservation in Japan including information on morphological analysis of gray whale skeletons, educational programme for fishermen and soft tissues lost due to the earthquake and tsunami in March 2011 (SC/63/O8).

The Committee noted the considerable information collected off Sakhalin Island in recent years by oil companies and others. It **requests** that results from a more quantitative analysis of anthropogenic impacts on gray whales using a comprehensive data set be presented at the 2012 meeting and encourages the participation of non-industry experts in the analytical process. The Committee also discussed the complication of multiple seismic surveys occurring in 2010. The Committee **urges** that analyses of impacts consider all the anthropogenic activities that occurred during the season. Reeves advised the Committee of reports indicating that at least three seismic surveys may take place off northeastern Sakhalin again in summer 2011.

In conclusion, the Committee **welcomes** all of the new information on this critically endangered population. It strongly **encourages** further work and as in previous years, **re-emphasises** the importance of continued long-term monitoring.

10.4.2 Conservation advice

The Committee again **recognises** that the problem of net entrapment of western gray whales is a rangewide issue. It **welcomes** the efforts of Japan to reduce mortality, and notes that net entrapments could occur in other range states, including Canada, US and Mexico.

As in previous years, the Committee **acknowledges** the important work of the IUCN Western Gray Whales Advisory Panel (WGWAP). This year's update on the panel's activities is given in Appendix 6 of Annex F. The Committee **re-emphasises** its view that its work is important and **strongly recommends** continuation of the Panel.

Furthermore, the Committee **recommends** that appropriate monitoring and mitigation plans be implemented for oil and gas activities that occur in the range of western gray whales. The Committee also **encourages** oil and gas companies to work together as well as with non-industry scientists in sharing environmental data, including information about gray whales, and to develop a plan to coordinate seismic surveys and other noise producing activities (see Item 12.4 and Annex K) to minimise the impact on gray whales.

In 2009, the Committee welcomed the report of the IUCN range wide workshop. An important aspect of the results from that workshop was the object of developing a conservation plan for western gray whales. It **repeats its strong endorsement** of the draft Conservation Plan for Western North Pacific Gray Whales (Brownell *et al.*, 2010).

10.5 Southern Hemisphere right whales

10.5.1 Review any new information

The Committee agreed last year that only important or urgent papers on southern right whales would be considered this year and all other southern right whales papers would be referred to the forthcoming Workshop for the Southern Right Whale Assessment at Puerto Madryn, Argentina, in September 2011. Brownell reported on progress in preparing the workshop and introduced its draft agenda (see Annex F, Appendix 5). The Committee looks forward to the report of workshop next year. In accord with that, only brief summaries are presented here. More details can be found in Annex F.

SC/63/BRG19 reported on progress with establishing the Southern Ocean right whale catalogue, approved last year by the Commission (IWC, 2011e, p.36). The catalogue aims to be a depository of right whale photographs south of 40°S that researchers can use to compare to coastal catalogues. To date 206 photographs (from 1974 -2008) have been received from a variety of sources. The Committee **thanks** the authors for their work on this important study, and **recommends** that the catalogue be expanded to include photographs from other databases (e.g. SOWER and platforms of opportunity such as cruise ships), and **endorses** the proposal for continued work on the southern right whale photo-ID catalogue. Funding implications are discussed under Item 23.

The Committee also received information on:

- (1) the first southern right whale helicopter surveys since 2007 in Golfo San Jorge, Santa Cruz, Argentina (SC/63/BRG11);
- (2) the first record of a southern right whale becoming entangled in a kayak rope off Argentina (SC/63/BRG17);
- (3) a study of stock structure among coastal calving grounds of Australia and New Zealand that provides some evidence that some individuals from the NZ subantarctic may be slowly recolonising Mainland NZ, where a former calving ground was extirpated (Carroll *et al.*, In press);
- (4) an updated estimate of the annual percentage increase rate (around 6.8%) during 1993-2010, for right whales surveyed along the southern coast of Australia with a total Australian population of around 3,500 animals (SC/63/ProgRep Australia) and an analysis showing that any reduction in survey frequency would significantly detract from the value of the data for monitoring (Bannister *et al.*, 2011);
- (5) modelling of the historical decline (from perhaps 27,000- 40,000 animals to near extinction in the late 19th-early 20thcenturies) and slow recovery (now around 4.6%) of the 'nationally endangered' southern right whale (Jackson *et al.*, In press).

In discussion of (5) it was noted that the history of these right whales in this area was consistent with matrilineal fidelity to breeding areas acting as a limiting factor in re-colonisation (Clapham *et al.*, 2008) and that re-colonisation was also occurring around Namibia. The Committee also noted that the 'high catch' scenario of around 52,000 modelled was considerably higher than that reported by Dawbin (1986) of '26,000 or more' and this was the primary reason for the much greater estimate for the pristine population size in this region.

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

An update was provided on North Atlantic right whales for the period November 2009 - October 2010, reflecting the work of North Atlantic Right Whale Consortium. The most recent stock assessment reported a minimum of 345 individuals alive in 2005 (Waring *et al.*, 2009), while examination of the collaborative photographic catalogue suggested with some caveats that there may be some 473 in 2009. Five right whale deaths were documented during the reporting period as well as four new entanglement cases.

No new information was provided for North Pacific right whales or bowhead whales from the Sea of Okhotsk or Spitsbergen.

In conclusion, the Committee continues to **reiterate its grave concern** over these small stocks, noting that it is a **matter of urgency** that every effort be made to reduce anthropogenic mortality to zero.

10.7 Cruises

10.7.1 Reports on sighting survey cruises in the North Pacific

10.7.1.1 IWC/JAPAN JOINT CETACEAN SIGHTING SURVEY CRUISE

The first of what is hoped to be a long series of cruises under this programme (to be called IWC-POWER⁹) in the North Pacific (see Item 10.7.4) was conducted from 2 July to 31 August, 2010 in the central North Pacific (see Fig. 5) using the Japanese Research Vessel, *Kaiko-Maru* (SC/63/O5). The cruise plan was developed under the auspices of the IWC. The cruise was primarily a line-transect cruise incorporating photo-ID and biopsy sampling. Details of the cruise can be found in Annex G (item 6.1). Some 375 schools (4,242 individuals) of 12 cetacean species were recorded. Sei and sperm whales were the most frequently sighted species and there were also sightings of fin, blue, common minke and killer whales.

The Committee **welcomes** the report of this cruise, noting a similar cruise will take place in summer 2011, and it looks forward to receiving the results of the analyses from the data collected at next year's meeting. Future cruises under the programme are discussed under Item 10.7.4. In particular, the Committee would like to thank the governments of Japan, USA and the Republic of Korea, along with the IWC, for their contributions in providing the vessel, associated funding and research permits.

10.7.1.2 JAPANESE NATIONAL CRUISE

Japan reported on the systematic sighting survey undertaken in summer 2010 to examine the distribution and abundance of sei and Bryde's whales in parts of the western and central North Pacific, that had been endorsed by the Scientific Committee (IWC, 2010d). In addition to the line transect

survey, photo-ID of blue whales and biopsy sampling of sei and Bryde's whales was undertaken. The Committee **welcomes** the new information presented and noted that the sighting and genetic information also provides a useful contribution to the planning of the IWC-POWER programme of cruises.

10.7.2 Report on Japanese sighting surveys in the Antarctic
Last year, the Committee had approved plans for a cetacean sighting survey in the Antarctic in 2010/11. Matsuoka reported to the Committee that, regrettably, the dedicated sighting survey had to be cancelled from the beginning of the survey, owing to violent action by an anti-whaling non-governmental organisation in the research area. This was a great loss in terms of the time and effort of the survey personnel, but moreover, of a valuable scientific research opportunity for cetacean management in the Antarctic.

The Committee **expresses** regret that such actions had prevented the sighting survey from being conducted as planned. Following the end of the IDCR/SOWER programme in 2009, these surveys now provide the only dedicated cetacean sighting data in this region and are extremely valuable to the work of the Committee.

10.7.3 Plans for cetacean sighting surveys in the Antarctic in the 2011/12 season

A systematic cetacean sighting survey for abundance estimation using two vessels is planned in the Antarctic in the 2011/12 season (SC/63/O18) as a part of the Japanese Whale Research Programme under Special Permit in the Antarctic (JARPA II). The research area is south of 60°S between 35°E and 175°E from December 2011 to March 2012. The survey procedures are based on those for the IWC-SOWER programme. The primary objective is the estimation of abundance of Antarctic minke whales. Opportunistic biopsy and photo-ID studies of large whales will be undertaken, focussing on blue, southern right, and humpback whales and a cruise report will be submitted to the next meeting.

The Committee reviewed and **endorses** the plans for the proposed sightings survey, noting that the data from the survey will contribute to the work of the Committee, particularly in assessing the status of Antarctic minke whales, but also for providing information on other baleen whales.

10.7.4 Medium-long term planning for the IWC-POWER programme (SC/63/Rep5)

As recommended last year, a major component of the planning meeting for North Pacific cruises held in Tokyo (SC/63/Rep5) was dedicated to the development of a medium-long term plan for the IWC-POWER cruises.

The Committee has stressed that for the North Pacific surveys to be of maximum value, they should be part of a well-designed medium-long term programme, rather than a series of *ad hoc* cruises. The broad objective agreed by the Committee last year (IWC, 2011e) stated that the North Pacific survey programme should 'primarily contribute information on abundance and trends in abundance of large whales and try to identify the causes of any trends should these occur'.

The objectives for the Workshop were to:

- (1) review the Scientific Committee's past discussions and identified research needs in the North Pacific;
- (2) review the past and ongoing survey activities and available data from range states; and
- (3) use these to begin to develop a medium-long term programme for consideration by the Committee.

⁹Pacific Ocean Whale and Ecosystem Research.

Table 8
 Priorities for the medium-long term IWC-POWER programme.

Initial priority	Rationale
Blue whale Low direct, high opportunistic	Depletion level suggests high priority, but feasibility of addressing outstanding issues in short term is low. Continued photo-id work part of US national programme.
Bryde's whale Low direct, high opportunistic	Depletion levels suggest low priority. Management on western side already dealt with under RMP where a national programme exists. Telemetry not well served given available vessel. Suggest separate study.
Common minke whale Low direct, high opportunistic	Depletion levels suggest low priority on east. Management on western side already dealt with under RMP where a national programme exists. However, if Okhotsk Sea covered for other priority species (e.g. right whales) then would provide valuable information incl. biopsy. Telemetry studies priority for stock structure but not part of this programme with this vessel. Suggest separate study. Weather/g(0) a problem if multi-species surveys.
Fin whale High direct, moderate opportunistic	Depletion levels suggest high priority. Given major genetic analysis on east then biopsy sampling on offshore east and west high priority to improve overall understanding of stock structure. Co-ordination with US national work in Bering Sea. Examination of existing data and coverage of uncovered areas needed to determine survey strategies.
Humpback whale Low direct, high opportunistic	Good information already available from SPLASH. Existing programmes sufficient. Opportunistic sightings during cruises may identify new 'SPLASH' areas. Feasibility of collecting biopsy and photo-id data opportunistically high.
Right whale Moderate-high direct, high opportunistic	Depletion level suggests high priority, but feasibility of addressing outstanding issues in short term is low. Continued photo-id work part of US national programme. Feasibility of collecting biopsy and photo-id data opportunistically high. New survey in Sea of Okhotsk has high feasibility to get good abundance data provided appropriate permits can be obtained from the Russian Federation. Targeted surveys required.
Sei whale High direct, high opportunistic	High priority for in-depth assessment. High feasibility of obtaining abundance estimates and biopsy samples in well-designed surveys. Cover new areas based on available information.
Sperm whale High direct, moderate opportunistic	High priority given lack of good information on status but high historic catches. Obtaining abundance estimates for sperm whales can be problematic due to g(0) issues but combined acoustic/visual surveys have been successful. Feasibility depends on equipment.

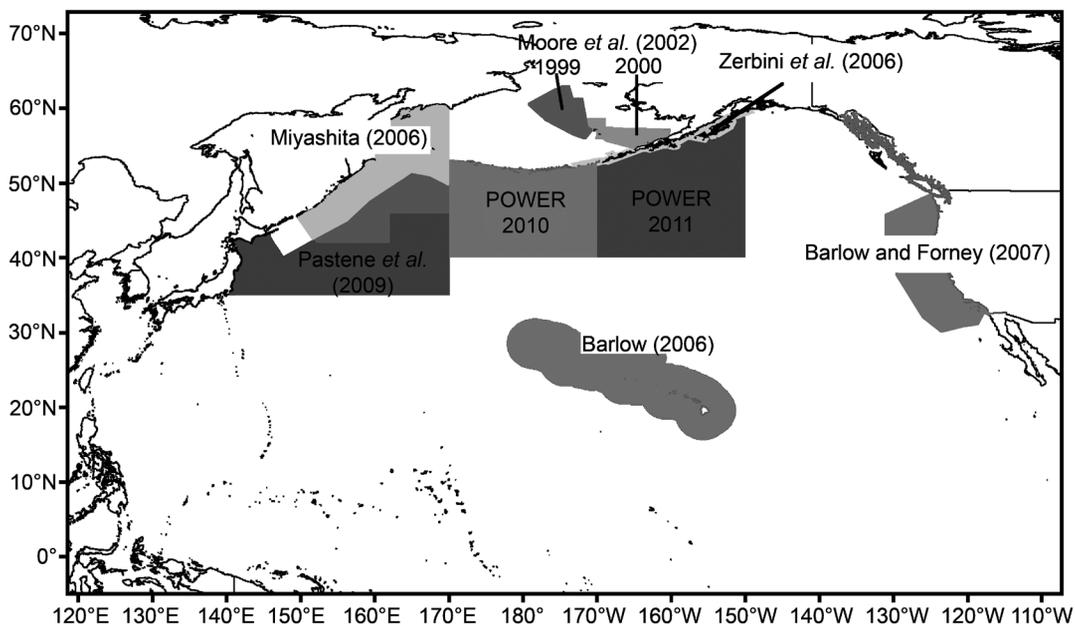


Fig. 4. Recent surveys in the North Pacific. The 2010 and 2011 IWC/Japan Joint Cetacean Sighting Survey research areas are shown in mid and dark gray, respectively. These areas have not been surveyed previously. Other shaded areas represent surveys conducted in the North Pacific in relatively recent years: in 1999 and 2000 by Moore *et al.* (2002), in 2001-03 by Zerbini *et al.* (2006), in 2001 and 2005 by Barlow and Forney (2007), in 2005 by Miyashita (2006). Sighting surveys have been conducted in the area since 1994 as a part of JARPN II (Pastene *et al.*, 2009).

Planning a large scale programme such as this required data on stock structure and abundance, prioritisation of species and areas, and appropriate tools (which may vary by species). It noted, therefore, that basic line transect surveys were not always appropriate, especially for rare species.

Prior to and during the workshop, the participants produced extremely valuable summaries of surveys and data within the North Pacific and species summaries of available information (SC/63/Rep5, items 8 and 9) in the context of developing a broad qualitative overview to be used to inform discussions on research needs and priorities for medium-long term planning.

A list of priority species and topics was developed (Table 8). A technical advisory group was established to take the priorities and information collated at the workshop and integrate these to develop short (~5 years), middle (5-10) and long (10+) term objectives, and in particular to use the existing data plus environmental data to develop better options (including visual, acoustics, biopsy, photo-ID methods etc.) for strata coverage incorporating likely power to detect trends for the species. This was a major task and it was not possible for the group to achieve it before the present Annual Meeting.

The Committee expressed its thanks to Donovan for his major contribution to the workshop. It noted the important contribution the IWC-POWER programme can make to understanding the status of North Pacific whale populations, many of which have not been assessed for decades. It **endorses** the conclusions of the workshop and **recommends** that the technical advisory group be re-established and meet prior to the planning meeting for the 2012 cruise (Annex R19). It **encourages** other range states to contribute to and collaborate with the programme.

10.7.4.2 PLANNING FOR THE 2011 CRUISE

During the second part of the meeting, it was agreed that the forthcoming 2011 cruise would have the following three primary objectives:

- (1) estimation of sei whale abundance (and other species where possible, especially fin whales);
- (2) collection of information on stock structure, particularly biopsy samples, with priority given to sei, fin and sperm whales; and
- (3) collection of photo-ID data and biopsy samples¹⁰ for rare species encountered, especially North Pacific right whales and blue whales.

The Workshop also addressed a number of logistical and technical aspects of the cruise.

10.7.5 Plans for cetacean sighting surveys in the North Pacific in 2012

A research plan for what will be the third cruise in the IWC-POWER programme was drawn up following general guidelines agreed in SC/63/Rep5. The research area (150°W -135°W; see Fig. 5) was chosen because the area had previously had poor survey coverage, with no coverage in recent decades, thus representing an important information gap for several large whale species. The cruise will collect line transect data, to estimate abundance, and biopsy/photo-ID data contributing to the work of the Scientific Committee on the management and conservation of populations of large

¹⁰Biopsy samples for the 2011 cruise will be collected only in the high seas after the research vessel exits from the US EEZ because appropriate CITES permits/certificates cannot be issued due to the discrepancies on the positions on this matter between the Governments of Japan and the USA; see Item 10.7.5.

whales in the North Pacific. Biopsy sampling/photo-ID work will also be undertaken on priority species (sei, common minke, right, blue, humpback, fin, gray and bowhead whales, with higher priority given to the first two species). The Committee **thanks** the Government of Japan for its intention to provide a vessel for this survey. The Steering Group for IWC North Pacific planning appointed last year was re-established (Annex R18).

While **endorsing** the cruise, the Committee nonetheless noted that there had as yet been no resolution of the issue of obtaining appropriate CITES permits/certificates, including 'institutional permits', for biopsy samples collected outside Japanese waters (e.g. IWC, 2011e, p.9), and the positions of the Governments of Japan and the USA concerning CITES permits have not changed. Brownell and Uoya will continue to try to resolve the problem. Given that the assessment of stock structure in the North Pacific is one of the primary objectives of the IWC-POWER programme, the Committee **strongly recommends** that concerted efforts to resolve these difficulties be continued expeditiously.

10.8 Progress towards an in-depth assessment of North Pacific sei whales

A summary of available information on North Pacific sei whales was given in 2009 (IWC, 2010f, pp.196-7) and see SC/63/Rep5, item 8.7. Since then, field work in the North Pacific has continued under the JARPN II programme, Japanese sightings surveys, and most recently, surveys under the IWC-POWER programme. The Committee was pleased to receive two new analyses this year, one aimed at assessing stock structure of sei whales in the North Pacific by genetic methods, and the other providing preliminary abundance estimates from the 2010 IWC-POWER survey (for details see Annex G).

As last year, the Committee discussed the most appropriate timing for an in-depth assessment (IDA) of North Pacific sei whales. Unless new genetic analyses suggest a more complex situation, the simple stock structure of this population suggests that an IDA should be relatively straightforward. By 2013, new abundance estimates from the first three IWC-POWER cruises should be available, together with further genetic information for elucidating stock structure. For an IDA, all available information - including the historical catch series - needs to be assembled. The Committee therefore **recommends** that the Secretariat be requested to review and update the catch series interessionally, with the aim of conducting an IDA in 2013. A Working Group was established to co-ordinate the process (Annex R20).

10.9 Workplan and budget requests

The Committee's discussions on the sub-committee's workplan (Annex D) are incorporated under Item 21.

Items for which financial support are recommended are dealt with under Item 23.

10.10 Other

The precise taxonomic relationships and species delineations within the Bryde's/Eden's whale complex are currently uncertain. SC/63/O19 described a genetic study of *Balaenoptera brydei* ('ordinary' form) and *B. edeni* ('small' form). The objectives of this study were: (1) to determine the putative taxonomic units of each region and their relationship to one another through preliminary phylogenetic analyses; and (2) undertake a population-level analysis to provide updated management recommendations. The

results supported the recognition of two species of Bryde's whales in the Indo-Western Pacific, as well as designation of provisional multiple management units across and within ocean regions for each species.

The Committee welcomes this new information and **recommends** that genetic studies continue. A collaborative effort that analyses merged datasets from the Indo-Western Pacific and South Africa, as well as other available datasets is also **recommended**.

Two papers provided accounts of Bryde's whales in the Southern Hemisphere. SC/63/O9 provided new information on strandings along the southeastern Brazilian coast, while SC/63/O20 reported at-sea sightings made during a vessel transit from the Mediterranean Sea to West Australia.

SC/63/SH2 described the first strandings of fin, sei and a possible blue or fin whale on the northern Brazilian coast. Further information can be found in Annex H, item 4.

11. STOCK DEFINITION

This agenda item was established in 2000, and has been handled since then by a Working Group; see IWC (IWC, 1999c, p.83) for the original Terms of Reference. The term 'stock' has been used with different meanings in different contexts at different times, both within IWC and in other management and conservation contexts. These multiple meanings have sometimes hindered the Committee's ability to provide management advice. The Working Group was set up to clarify the issue of 'stocks' in a management context (see Item 11.3), to create a bridge between IWC and the expertise of the wider population genetics community (see Item 11.2 and 11.3), to develop software that evaluates the management utility of various population genetic analyses (see Item 11.2), and to develop guidelines for preparation and analysis of genetic data within an IWC context (see Item 11.1). These issues are of fundamental importance to the Committee's discussions on assessments and to the development of management advice. The Report of the Working Group is given as Annex I.

11.1 Guidelines for DNA data quality and genetic analyses

The Committee has previously endorsed a general set of guidelines¹¹ for ensuring sufficient quality in genetic (DNA) data used for management advice (IWC, 2009f, p.248). These guidelines constitute a 'living document' that is to be updated as necessary. Work is continuing on developing suggested guidelines for the difficult issue of numerical standards for quality, which was first raised in 2008.

In parallel with the development of data quality guidelines, the Committee is developing guidelines for some of the more common types of statistical analyses of genetic data that are employed in IWC management contexts. These guidelines, which are being developed through an intersessional working group, are at an earlier stage of development than the DNA data quality guidelines. The proposed structure of the document, including a motivating example, was shown in IWC (2009g), and several modifications were suggested in IWC (2010b, p. 228).

The two sets of guidelines are central to many of the Committee's current activities, but for a variety of reasons, including workload and availability of IPs, their completion¹² has taken longer than anticipated and little progress was made this year. The Committee **agrees** that the most efficient and

cost-effective approach to complete this work is to gather the contributing authors together at a short intersessional workshop, hosted at the IWC Secretariat; it **recommends** that this be carried out during the intersessional period (and see Item 23). The guidelines have and will entail a great deal of effort, but should be of lasting importance. They deserve to be published, both online via IWC (so that they are freely available and can be easily updated) and in peer-reviewed literature.

11.2 Statistical and genetic issues related to stock definition

The Committee reviewed issues connected with ' N_{\min} ', the historical minimum population size, which does or could feature in several current assessments of bowhead, humpback, right, and gray whale stocks that were once reduced to very low abundances. The idea is to use the current number of distinct maternal genetic lineages to set such a lower bound¹³. To alleviate terminological confusion, the term ' N_{floor} ' was agreed instead for a 'hard' lower bound calculated from haplotype counts; the term ' N_{\min} ' should be reserved for the true (albeit unknown) minimum population size, and N_{floor} is just a lower bound for N_{\min} - it is not an attempt to estimate it.

Even with this definition, N_{floor} could still be computed several different ways¹⁴. The unadjusted current haplotype count is a rather weak bound, since fails to account for males or non-reproductive females in the population. It was agreed that multiplying the current haplotype count by 3 (see Annex I for justification) could safely be used as a default N_{floor} , which might require modification if depletion is known to have been strongly size- or sex-structured.

The true N_{\min} would likely be considerably above N_{floor} , because N_{\min} ignores some important biasing factors (multiple females per lineage at the bottleneck; loss of haplotypes after the bottleneck due to drift; current sample may not include all haplotypes in the population). Therefore, any reconstructed population trajectory which comes close to N_{floor} should immediately attract suspicion; careful consideration should be given to the appropriateness of the model and/or its input data.

It may in future be possible to develop more sophisticated corrections for these factors and to allow direct estimation of N_{\min} itself, as opposed to the use of N_{floor} . While in principle this would be a more efficient way to use current genetic data, it would be complicated, and substantial methodological development is required; it would be advisable beforehand to consider how much information might actually be gained that would be truly useful for conservation and management. For several of the species where N_{\min} might in principle be valuable, there is also the possibility of significant immigration after the bottleneck; this would be a major and non-ignorable complication in the estimation of N_{\min} (or indeed the use of N_{floor}).

11.3 Progress on the TOSSM project (Testing of Spatial Structure Models)

The aim of TOSSM is to facilitate comparative performance testing of population structure methods intended for use in conservation planning. From an IWC perspective, the

¹¹http://www.iwcoffice.org/sci_com/handbook.htm#ten.

¹²Of course, both the DNA Data Quality and the Genetic Analysis guidelines will be updated as appropriate in future; the word 'complete' here means that neither of them yet has a complete first draft.

¹³The creation of new maternal lineages via mutation is exceedingly rare over timescales of a few generations, so all the maternal lineages seen now must have been present at the bottleneck (barring immigration), and there can be no more than one lineage per female.

¹⁴Provided it is safe to assume there has been negligible immigration since the bottleneck; if not, new haplotypes could have been introduced.

TOSSM software package allows evaluation of methods for detection of genetic structure, in terms of how well the methods can be used to set spatial boundaries for management. As noted last year, the framework is now complete and the software is available for all to use; simulated datasets exist for three of the five stock-structure Archetypes previously proposed by the Committee (see IWC, 2010d, p.51). To date, ten methods have been tested on datasets from the two simplest Archetypes: single-stock panmixia; and two populations with limited migration sampled and harvested on the breeding grounds) (see IWC, 2010, p.228).

This year, the Committee noted that the TOSSM framework can be used for more than just the testing of particular boundary-setting rules. It is also a flexible simulation tool for investigating how certain observed genetic phenomena might arise, among animals such as whales whose life histories are not well-covered in classical genetic theory. A practical example of this is provided by the Pacific Coast Feeding Group of eastern gray whales (see Annex E), which appears to be genetically different to the rest of the population, yet also to receive substantial immigration from it (which would be expected to erase the genetic differentiation). A steering group was established to coordinate the use of TOSSM simulations in exploring possible mechanisms for this (Annex R21). Results will be valuable for the next *Implementation Review* of gray whales.

The convener of the SDWG will liaise with other sub-committee convenors interessionally, to develop a list of stock-related issues within the Committee where similar TOSSM-based exercises (or existing results from TOSSM) might prove useful.

11.3 Terminology and unit-to-serve

As noted earlier, there is still considerable divergence within the Committee in the terminology used to discuss 'stock issues'. In the past, the SDWG has discussed extensively the definition of such terms as 'population', 'subpopulation', 'stock', 'substock', 'feeding group', etc., and has had a long-standing objective of developing a suite of possible definitions for the all-embracing concept of 'unit-to-serve'. While there are good reasons why some of the usual terms are not susceptible to rigid definition - many are inevitably subjective attempts to divide the continuum of genetic relatedness into units that are discrete. The Committee **agrees** that it is timely to revisit the question of terminology and to try to develop a simplified set of terms and usage across the Committee. With this in mind, the SDWG next year will:

- (1) explain why it is difficult to provide strict definitions for some terms used within various IWC (and other) contexts;
- (2) review past discussions and conclusions on use of stock-related terms within the SDWG;
- (3) review terminology used outside the IWC for describing subdivisions below species level; and
- (4) taking into account the above, attempt nevertheless to provide working definitions for terms already in use in various management and conservation contexts (e.g. RFMOs), pointing out their relationships with similar terms and to assessment/conditioning models being used in the Committee.

11.4 Work plan

A single intersessional email group on both sets of guidelines has been established to replace the two previous groups (Annex R21). The terms of reference combine the two sets

from last year, and the primary task is to prepare for the intersessional workshop. The proposed agenda for 2012 is:

- (1) review draft guidelines for genetic analysis and DNA Data Quality;
- (2) statistical and genetic issues concerning stock definition;
- (3) TOSSM; and
- (4) terminology review and unit-to-serve.

12. ENVIRONMENTAL CONCERNS

The Commission and the Scientific Committee have increasingly taken an interest in the possible environmental threats to cetaceans. In 1993, the Commission adopted resolutions on research on the environment and whale stocks and on the preservation of the marine environment (IWC, 1994a; 1994b). A number of resolutions on this topic have been passed subsequently (e.g. IWC, 1996; 1997a; 1998a; 1999a; 1999b; 2001b). As a result, the Scientific Committee formalised its work on environmental threats in 1997 by establishing a standing working group that has met every year since then. Its report this year is given as Annex K.

12.1 State of the Cetacean Environment Report (SOCER)

SOCER provides an annual update, requested by the Commission, on: (1) environmental matters that potentially affect cetaceans; and (2) developments in cetacean science that reflect environmental issues. It is tailored for a non-scientific audience. The 2011 SOCER (SC/63/E1; see Annex K, Appendix 6) is based on peer-reviewed literature between 2009 and 2011 and contains a total of 58 entries, 21 dealing with this year's regional focus on the Antarctic region/Southern Ocean, as well as 37 articles reporting on global issues. This year, the SOCER reports on useful developments with regards to chemical pollution research and its impacts on cetacean health, in particular the effects of exposure to pollutant mixtures. There have been advances in studying the nature of beaked whale responses to military sonar, and several studies indicate that biologically significant effects occur at sound levels orders of magnitude lower than several nation's guidelines or statutory limits for sound exposure. Marine environmental trends of concern include widespread global declines in marine biodiversity and the poor conservation status of marine species and fish stocks. In addition, the effects of climate change and ocean acidification (in combination with the compounding stressors of over-fishing and marine habitat degradation) on krill stocks, primary productivity and habitat quality, in particular in coastal zones and the Southern Ocean, have major implications for the health and status of global cetacean stocks.

Next year the focus of the SOCER will be on the Indian Ocean, and the SOCER editors request Committee members provide input, preferably in the form of pdf files, of papers published between 2010 and 2012.

12.2 POLLUTION

12.2.1 Update on POLLUTION 2000+ Phase II

Three goals were identified at the IWC Intersessional POLLUTION 2000+ Phase II Workshop (IWC, 2011d):

- (1) develop integrated modelling approaches and risk assessment framework for evaluating the cause and effect relationship between pollutant exposures and cetacean populations;
- (2) identify data needs and available datasets or case studies that would be appropriate for the models that are exposure driven, source driven or effects driven; and

- (3) develop a prioritisation framework to evaluate the broad number of environmental pollutants.

The first year of a 2-year modelling project funded by the Commission addressed the first two goals. An individual-based population (IBM) framework (Hall *et al.*, 2006b) was chosen as the approach for this activity and the first iteration of the model was to investigate the impact of polychlorinated biphenyls (PCBs) on calf survival probability and how this may ultimately affect potential population growth rate. The specific aims of the project were to:

- (1) improve the existing concentration-response functions for PCB-related reproductive effects in cetaceans;
- (2) derive additional concentration response functions for other toxicological endpoints;
- (3) integrate improved concentration response components into a population risk model for two case studies (bottlenose dolphins and humpback whales); and
- (4) implement a concentration response component for at least one additional contaminant of concern, as determined by the prioritisation scheme.

Population-level consequences of pollutant exposure in cetaceans are extremely difficult to determine directly. A comprehensive approach is needed to try and estimate at what level of exposure impacts on individuals translate into detrimental effects on populations. The ultimate goal of the project is to develop the existing model framework into a more robust and flexible format, using open source software with a user friendly interface with the aim of allowing researchers and managers to investigate potential impact of pollutants on cetaceans using their own simulated scenarios.

Further work is needed to determine which concentration-response function to use in the model and whether to allow this to vary depending on which risk management measures are considered 'best' for a given scenario. The next steps will include incorporating additional sources of variation, other toxicological endpoints and refining the concentration response uncertainties. The Committee **commends** the authors for the progress this year.

With respect to the third POLLUTION 2000+ objective (to develop a prioritisation hazard identification framework to assess the contaminants that pose the greatest risk to cetaceans), the Committee had agreed (IWC, 2011e) to develop a web-based chemical hazard survey to be filled out by subject matter experts, including marine mammal biologists, toxicologists and analytical chemists, which is now available¹⁵. A report of the survey findings will be presented next year and provided to the modelling team. Appropriate members of the Committee are encouraged to complete the survey.

The Committee **commends** the work completed to date on Phase II of POLLUTION 2000+ and **strongly supports** the proposal for the 2nd year of this study (see Item 23). The Steering Group (Annex R26) will continue to guide the project.

The SWG had received four papers on current research being conducted using biopsy samples from living animals incorporating biomarker research (e.g. CYP1A and B) and the assessment of contaminant levels on cetaceans, including the provision of information on polycyclic aromatic hydrocarbon (PAHs) exposure in cetaceans for which few data are available. The Committee commends the authors for obtaining as much information as possible from these biopsy samples and it **encourages** further work

on biomarkers (both exposure and effect biomarkers) and pollutant loads using biopsy samples from living animals of well-studied cetacean populations.

12.2.2 Update on Deepwater Horizon (DWH) oil spill

Rowles and Ylitalo provided an update on the Deepwater Horizon (DWH) oil spill in the Gulf of Mexico. Since the DWH drilling platform collapsed on 22 April 2010, more than 4.9 million barrels of crude oil have been released into the waters of the Gulf of Mexico approximately 5,000ft (1,525m) below the surface. In addition to petroleum-related compounds, more than 1.9 million gallons of dispersant were applied aerially or directly into the wellhead from mid-April through mid-July 2010. This is the largest oil spill in US history and cetaceans in the Gulf of Mexico may have been exposed to various oil-spill related chemicals as a result.

The marine mammal stranding network in the Gulf of Mexico was activated in response to the spill and animals were examined from 20 April - 2 November 2010. The discovery of an externally oiled dolphin re-activated the stranding response network in central and eastern Louisiana on 3 December 2010¹⁶. As of 22 May 2011, a total of 186 cetaceans have been reported as part of the oil spill response, with the majority being bottlenose dolphins. Other species include sperm whales, melon headed whales and spinner dolphins. Of the stranded dolphins, 14 were live and 172 were dead. Twelve animals were reported with externally visible oil and 148 animals were reported as not having externally visible oil. Forty five full and 11 partial necropsies have been performed with 27 carcasses awaiting necropsy. In plenary discussion, it was noted that the number of animals reported on the beach is an underestimate of total mortality. Estimating total mortality from strandings is complex and was discussed in Annex J, item 13.1.

Simultaneous with the stranding response, the Natural Resource Damage Assessment (NRDA) process was initiated, which includes the assessment of injury and restoration planning for marine mammals. Projects for coastal bottlenose dolphins and offshore cetaceans have been underway since May 2010¹⁷. Photo-ID and biopsy sampling were focussed on areas where the greatest impacts from oil were predicted to occur: Mississippi Sound, MS, Chandeleur Sound LA and Barataria Bay, LA. Vessel surveys were conducted as part of the NRDA and Bryde's whales were sighted, tagged (1 whale) and biopsied. In addition, Mate noted that 12 sperm whales were tagged two months after the oil spill began and before it was under control - further details on the tracks of the sperm whales relative to oil is anticipated next year.

In addition to petroleum-related compounds, cetaceans in the Gulf of Mexico may have been exposed to dispersants. The US Environmental Protection Agency released a list of the major components¹⁸ comprising the two primary dispersants; analytical methods to measure dispersants in tissues are now available. For example, as part of the DWH seafood safety response effort, Food and Drugs Administration and NOAA worked collaboratively to develop and validate a rapid method to measure dioctyl sodium sulfosuccinate (DOSS) in edible seafood. Thus, DOSS concentration data in potential prey of Gulf cetaceans are available, but no information exists on exposure levels in cetaceans from the region, nor on the potential toxic effects of dispersants on cetaceans.

¹⁶<http://www.nmfs.noaa.gov/pr/health/oilspill/mammals.htm>.

¹⁷<http://www.gulfspillrestoration.noaa.gov/oil-spill/gulf-spill-data/>.

¹⁸<http://www.epa.gov/bpspill/dispersants-qanda.html#list>.

¹⁵<https://www.surveymonkey.com/s/NHLYLSL>.

The Committee **thanks** Rowles and Ylitalo for providing the most current information available and commended the oil spill work that their programmes have conducted over the past year. It **encourages** additional research on the impacts from oil and dispersants on cetaceans and looks forward to reports at future meetings.

12.2.3 Capacity building regarding oil impacts on cetaceans

The Committee recognised the need for capacity building regarding oil spill impacts on cetaceans in critical areas including oil interest areas. The training should include protocols for obtaining baseline and research data such as how to collect and store samples and carcasses; example protocols should be brought to next year's meeting. The Committee **agrees** that there is significant need and interest in cross-training between the oil spill and marine mammal response communities. An intersessional e-mail group has been established to evaluate the possibilities and report back next year (Annex R23).

12.2.4 Other pollution related issues

Thirty one species of marine mammals have been reported to have ingested marine debris and plastic debris. This is well established as a problem for some marine wildlife (e.g. turtles and seabirds). Plastic ingestion has been found to cause morbidity and mortality in cetaceans, including two sperm whales that stranded in California in 2008. A related topic of growing concern is 'microplastics' (pieces in the size range of 0.3-5mm), which may be absorbed by cells. Along with other impacts in the marine environment, microplastics may also facilitate contaminant transfer. The Committee **expresses concern** at the increasing problems associated with marine debris. An intersessional email group has been established to gather more data on plastics, including microplastics and its potential effects on cetaceans (Annex R24).

12.3 Cetacean emerging and resurging disease (CERD)

In 2007, the Committee recognised the need for increased research and standardised reporting in a wide range of disciplines dealing with cetacean health (IWC, 2008g, pp.247-9), which led to the creation of the Cetacean Emerging and Resurging Disease Working Group¹⁹ (CERD WG). Although progress has been made by the CERD WG on several initial tasks identified in 2007 (e.g. skin diseases specific to South America, stranding capacity building workshops), progress has recently slowed. Some of the impediments to progress of the CERD WG include:

- (1) lack of funding;
- (2) insufficient dedicated staff/work time to address CERD issues; and
- (3) the absence (in many cases) of appropriate subject matter experts from member countries at the meeting.

The Committee recognised the need to enhance participation and communication through targeted programmes, along with development of a strategy to effectively achieve goals relevant to the IWC. A CERD workplan (Annex K, Appendix 3) has been developed that includes:

- (1) expansion of the steering group (Annex R27) to identify regional and national points of contact;
- (2) creation of a listserv (i.e. electronic mailing list of people interested in CERD) that will link interested

parties and the creation of a CERD website housed on the IWC homepage;

- (3) creation of a framework document to outline the purpose, goals and future directions of the CERD WG; and
- (4) identification of and contact with organisations with interests synergistic to the goals of CERD (e.g. Arctic Council).

The Committee **endorses** the CERD workplan and **agrees** that CERD-related items remain as a standing agenda item.

12.4 Anthropogenic sound

12.4.1 Sound from pile installation – review of available information on methods and mitigation techniques

In recent years, the Committee's SWG has considered marine renewable energy development, most notably in the use of pile installation during construction of offshore wind farms and the potential for sounds produced by these developments to affect marine mammals. Pile installation onshore and very near shore for harbour construction and non-renewable energy development can also be a source of loud underwater sounds potentially harmful to coastal cetaceans. The most common technique of pile installation is impact hammer pile, followed by vibratory pile driving and press-in or push pile driving. While both vibratory and press-in driving emit lower levels of noise than impact pile driving, there is a cost increase associated with these methods and certain situations prevent their use. A variety of techniques exist to reduce or mitigate impacts from the high levels of sound produced during pile installation, including:

- (1) bubble curtains;
- (2) ramp-up/soft start;
- (3) cushion blocks;
- (4) coffer dams; and
- (5) temporary noise attenuation pile design.

Several studies report the potential effects of pile driving sounds on cetaceans, but few have empirically measured sound levels or behavioural responses. The Committee **stresses** the importance of properly assessing the effectiveness of mitigation measures; sound levels at the source and receiver should be measured and reported in all such experiments. The Committee's SWG has discussed various means to mitigate the negative effects of anthropogenic noise on cetaceans at three recent meetings (IWC, 2005c; 2007d; 2011f). The Committee **agrees** that a review of recommendations made during those meetings is appropriate and timely.

In addition, the Committee noted that the Fourth Meeting of Parties of ACCOBAMS²⁰ has adopted guidelines to address the impact of anthropogenic noise on cetaceans within its area and **commends** this effort.

12.4.2 Other anthropogenic sound related issues

The Committee was informed that an underwater detonation by the US Navy was associated with the mortality of up to five long-beaked common dolphins: three were killed immediately, one found dead a few days later with similar pathological findings and a fifth too decomposed to determine. Modelling and assessment is underway to better determine the circumstances and the injuries and historic stranding data for the region are being reviewed. The Navy has suspended time-delay undersea detonation training while

¹⁹CERD Terms of Reference are found in IWC (2008h).

²⁰see <http://www.accobams.net>.

a review of protective procedures is conducted in concert with the NMFS. Information was also received about a mass stranding of 26 short-beaked common dolphins in Cornwall, UK on 9 June 2008 (Deaville and Jepson, 2008).

The Committee welcomed information on a number of industry-supported studies²¹ related to anthropogenic noise effects on cetaceans, including:

- (1) a study to model baleen whale hearing;
- (2) a comparative assessment of techniques for conducting marine seismic surveys;
- (3) an assessment of airgun soft-start operations;
- (4) an experiment to examine the behavioural responses of humpback whales to seismic surveys off Australia; and
- (5) temporary threshold shift in odontocetes in response to airgun sounds.

12.5 Climate change

12.5.1 Workshop on Small Cetaceans and Climate Change

The Small Cetaceans and Climate Change Workshop (SC/63/Rep1) was held in November 2010, largely as a result of the 2nd Climate Change Workshop (IWC, 2010j). Presentations focussed on: cetaceans in the Arctic; white-beaked dolphins in the Barents Sea; freshwater-dependent species; the Mediterranean, Black and Red seas; submarine canyons; current and future patterns of marine mammal biodiversity; and the distribution of common dolphins in the Northeast Atlantic. The Workshop also focussed on health issues. A series of recommendations was generated, with particular emphasis on the importance of long term datasets (Annex K). The Committee **endorses** the Workshop's recommendations, many of which were in accord with previous Committee recommendations on the general subject of the impact of climate change on cetaceans (e.g. IWC, 2010j). An intersessional correspondence group has been established to develop a global review of restricted habitats for small cetaceans (Annex R25).

12.5.2 Progress on recommendations from 2nd Climate Change Workshop

The 2nd Climate Change workshop (IWC, 2010j) resulted in a series of recommendations summarised under three headings corresponding to working groups established at the workshop: small cetaceans (see Item 12.5.1), Southern Ocean; and Arctic. With regard to the Southern Ocean, the Southern Ocean Research Project (SORP) has undertaken to address several of the recommendations. To date, no progress has been made on the recommendation to examine how variable environmental conditions may affect southern right whale calving rates, and possibly body condition and stranding events. The Committee **suggests** that the topic of climate drivers of southern right whale population demographics and body condition be further considered at the Southern Right Whale Workshop (see Annex F), with the goal of developing a research plan that might be included in the SORP. No progress has been made towards Arctic research themes over the past year, but there is an opportunity to use the recently completed Arctic Council Circumpolar Biodiversity Monitoring Plan (CBMP) as a framework for developing study plans that focus on white whales and bowhead whales. The Committee notes the importance of dialogue between cetacean researchers and climate modellers and **recommends** that cetacean

researchers integrate their data into existing Arctic climate models.

12.5.3 Planning for a Workshop on Anthropogenic Impacts on Arctic Cetaceans

Last year, the Commission agreed that the Committee should convene a workshop on anthropogenic impacts on cetaceans in the Arctic. A provisional agenda for a 3-day workshop was developed (see Annex K, Appendix 4). The Committee **suggests** that this workshop is held after next year's annual meeting when products from other ongoing efforts to assess anthropogenic impacts on cetaceans in the Arctic will be available, including work of the:

- (1) Arctic Council;
- (2) IUCN;
- (3) Audubon/Oceana;
- (4) World Wildlife Fund;
- (5) PEW Trusts;
- (6) US-NOAA/Fisheries; and
- (7) US-DOI/USGS.

An intersessional working group (Annex R28) was established to guide development of the workshop, and a progress report will be considered at next year's meeting.

The Committee received information on a report (document 62/11/6) submitted to the 62nd session of the MEPC²² on 6 May 2011. The report 'proposed that the MEPC consider and recommend suitable provisions for the mandatory code for ships operating in polar waters (the 'Polar Code') regarding vessel voyage planning and operations in order to avoid interactions, especially ship strikes on cetaceans and other marine mammals, or disruption of native subsistence hunting dependent on cetaceans'. The Committee **endorses** the development of a 'Polar Code' and noted that it follows-on recent endorsements of actions recommended by both the IMO-MEPC, and the Arctic Council Arctic Marine Shipping Assessment, with regard to reducing the impact of commercial shipping activities on cetaceans (IWC, 2010i, item 9.4).

12.6 Other habitat related issues

The Committee received information on cetaceans in the Dutch Caribbean, noting that the principal concerns were lethal interactions with fisheries, naval exercises and disturbances from unregulated whalewatching. It also **welcomes** the updates provided on: (1) the REMMOA surveys, which are being conducted across the French EEZ with the aim of identifying hot-spots of abundance and diversity of cetaceans and other pelagic megafauna and establishing a monitoring scheme; and (2) the systematic monitoring of density and abundance, conducted through aerial surveys of the most common cetacean species of the Pelagos Sanctuary and the seas surrounding Italy. The Committee **commends** these survey programmes and urges their continuation.

12.6.1 Marine Renewable Energy Development

The Committee received a review on the status of marine renewable energy developments and potential impacts these developments may have on cetaceans, which include:

- (1) increased noise during construction, operation and decommissioning;
- (2) physical interactions such as entrapment or entanglement;

²¹Studies commissioned by the International Association of Oil and Gas Producers Sound and Marine Life Joint Industry Programme, with reports available at <http://www.soundandmarinelife.org>; and at <http://www.ogp.org.uk>.

²²The International Maritime Organization's Marine Environment Protection Committee.

- (3) habitat changes due to turbidity and artificial reef effects;
- (4) increase of contamination from leaks or spills from attendant ships; and
- (5) effects on prey, such as changes in food webs.

There are some 484 marine wind farms in various stages of development in the Northern Hemisphere, with a concentration in European seas. However, there are a larger number of sites in early planning and submission stages outside Europe, especially in China and Chile. The Committee received information on a very large wind farm project in southern Chile near Isla de Chiloé; associated with this is the development of an associated port to support the project. The Committee **strongly recommends** the urgent development of a full environmental impact assessment of this proposed development.

Relatively little is known about the potential impacts of renewable energy development on cetaceans. Given growing concerns about the rapid expansion of the industry, its expansion into important cetacean habitat areas and reoccurring concerns on the lack of adequate baseline studies, the Committee **endorses** an outline proposal for a workshop on interactions between marine renewable developments and cetaceans (Annex K, Appendix 5). A Steering Group (Annex R29) has been established to plan for the workshop.

12.7 Work plan

The Committee's work plan on environmental concerns is given under Item 21, while budgetary implications are considered under Item 23.

13. ECOSYSTEM MODELLING

The Ecosystem Modelling Working Group was first convened in 2007 (IWC, 2008f). It is tasked with informing the Committee on relevant aspects of the nature and extent of the ecological relationships between whales and the ecosystems in which they live. This advice is important to other responsibilities of the Committee: it can be used to simulate an ecosystem framework in which to evaluate management strategies; it can provide a biophysical context within which to try to understand spatial or temporal (e.g. interannual, interdecadal, or long-term climate-driven) variability in cetacean population dynamics, distribution, behaviour and health; it can provide insight into interactions between whales and fisheries; and it can inform the prioritisation and design of future IWC research projects by identifying critical information gaps and offering recommendations of when, where and how field efforts should be conducted to successfully collect new data that are necessary for providing insight into key questions. The Commission has stated their interest in such work in a number of resolutions (IWC, 1999a; 2001b; 2002a). The Working Group's primary issues at this year's meeting were threefold:

- (1) review recent work in ecosystem modelling;
- (2) discuss how ecosystem models can be used in the work of the Committee; and
- (3) review issues relating to ecosystem modelling.

The Working Group's report is given as Annex K1.

13.1 Review of recent work in ecosystem modelling

13.1.1 Ecosystem modelling in the North Pacific

13.1.1.1 RESEARCH ONGOING WITHIN NOAA/NMFS

Aydin presented a summary of ecosystem modelling research ongoing within NMFS, explicitly in reference

to: (1) advances in statistical fitting procedures using Ecosim models; and (2) recent developments in end-to-end ecosystem models, focusing on biological models built within the Regional Oceanographic Models (ROMS) framework. SC/63/EM1 described a set of model results for the Bering Sea and the Gulf of Alaska, which were produced using Ecosim algorithms implemented independently from the software package Ecopath with Ecosim (EwE²³). The results presented demonstrated the sensitivities of the models, particularly for whales, to the formulation of the terms governing 'other' mortality and growth efficiency. He recommended that the sensitivity of the models to the full range of parameters should be considered in evaluating the results and predictions of Ecosim models, although this is a data-intensive exercise. He also described the Forage/Euphausiid Abundance in Space and Time (FEAST) model for the Bering Sea and Aleutian Islands currently under development as a biological extension to the ROMS as part of the North Pacific Research Board's Bering Sea Integrated Research Program (BSIERP²⁴). While marine mammals are not explicitly modelled in FEAST, the model can be used to predict forage concentrations in areas critical to these species, and marine mammals can be built into the model at a future time. The primary current challenge of FEAST is its runtime: it takes 20-30 real-time days on a 'moderate' computing cluster (~200 processing cores) to produce a single 50-year simulation; this runtime currently precludes iterative running or fitting procedures. Its primary use in a management setting is anticipated to be as an operating (baseline truth) model for management strategy evaluations (MSEs); an ongoing part of this project is to develop an MSE to test single-species, multi-species minimum-realistic, and Ecosim-style models for use in management scenarios.

13.1.2 Atlantis and In Vitro modelling frameworks

Fulton presented the *Atlantis*²⁵ and *In Vitro* modelling frameworks as examples of a growing list of 'end-to-end' models that include ecological, biogeochemical, climatic and socioeconomic processes, and which are aimed at informing strategic management decisions. The fields covered by *Atlantis* and *In Vitro* span processes from biogeochemistry and water column transports through food webs and into the dynamics of human industries such as fisheries, tourism and oil and gas. Both model frameworks are intended for use in management strategy evaluation studies of marine and coastal resource use and associated industries. These modelling frameworks have no set form *per se*, as each includes many alternative model formulations for each major process and model component included. In each implementation the user sets the complexity to the level desired given the question and information in hand. The major uses of the models to date have been to: integrate a wide range of system information; gain understanding of marine ecosystem dynamics (including identifying major processes, drivers and responses); highlight major gaps in data and empirical knowledge; and provide a mechanism to 'road test' management strategies before implementing them in reality. With more than a decade of use, she drew attention to the following common lessons learned from the implementation of these approaches:

- (1) multiple factors should be considered if unintended consequences are to be avoided;

²³<http://www.ecopath.org/>.

²⁴<http://bsierp.nprb.org/>.

²⁵<http://atlantis.cmar.csiro.au/>.

- (2) no single management lever can successfully address the many trade-offs associated with ecosystem-based management - instead, the mix of measures needed will differ between systems and will change through time;
- (3) all management decisions have costs, which can lead tension between conservation and economic objectives;
- (4) system-specific dynamics and responses mean that reference points and even reference directions for indicators used in monitoring may not be usefully universally employed - while a suite of widely useful indicators exists, their reference points will need to be conditioned on system-specific information and knowledge;
- (5) in a number of cases, full enforcement of existing management rules would go a long way to meeting sustainable management objectives without the requirement to introduce any new management rules.

Experience with the models has also identified weaknesses and points of caution that must always be kept in mind when applying these approaches. Most importantly:

- (1) fast growth species such as squid and shrimp are very difficult to model, as are top predators, which have very sophisticated behaviour - agent-based models show promise (especially for central-place foragers and species with small population sizes);
- (2) model complexity and uncertainty must be carefully handled, which means the models should ONLY be used for strategic management questions.

The Committee welcomed this information, noting the comprehensive coverage of *Atlantis* and *In Vitro*, which can incorporate many more types of processes than most ecosystem models normally handle.

13.1.3 US National Ecosystem Modelling Workshops

A summary of the two US National Ecosystem Modelling Workshops held by NMFS was presented (Link *et al.*, 2010; Townsend *et al.*, 2008). The workshops derived several conclusions, including:

- (1) standards and guidelines for ecosystem modelling should be established;
- (2) a diversity of modelling approaches should be encouraged to allow for adaptation to meet local requirements;
- (3) the most important information gaps in ecosystem modelling are lack of data (spatially explicit, in particular) relating to trophic ecology, non-target species and socioeconomics;
- (4) establishing and refining a list of best practices to address ecosystem model uncertainty should be continually re-evaluated; and
- (5) it is important to engage stakeholders in terms of communicating, interacting and discussing ecosystem model rationales, uses, applications, and benefits.

13.1.4 Comparative Analysis of Marine Ecosystem Organisation (CAMEO) Workshop on End-to-End Modelling of Marine Ecosystems

The conclusions from this workshop undertaken by CAMEO²⁶ echo common current themes in ecosystem modelling, including:

- (1) the encouragement of diversity in end-to-end modelling approaches;

- (2) the importance of stakeholder participation, which may require funding for specialist help or instruction in model use or interpretation; and
- (3) the complexity of, and requirement for research into, end-to-end model skill assessment and risk analysis.

13.1.5 Update on NAMMCO ecosystem modelling efforts

The NAMMCO Council requested that their Scientific Committee should investigate dynamic changes in the spatial distribution of species in all areas of interest to NAMMCO due to ecosystem changes and functional responses. Multi-species modelling was considered appropriate for a general understanding of the ecological relations between species, but its present development does not allow for providing quantitative management advice, which is presently given by single-species management. Additional research is required to develop ecosystem models to a point where it may become possible to use them to provide quantitative management advice. The NAMMCO Scientific Committee recommended that the best way forward was to carry out a modelling exercise for comparing the results of different models on the same ecosystem(s) using a common dataset. Four modelling approaches were identified. The primary objective of this exercise is to investigate if a variety of models presents robust predictions regarding the direction of the impact on major commercial fish species of reducing marine mammal numbers. The Committee **welcomes** these plans and looks forward to receiving updates on progress.

13.2 Discussion of how ecosystem models can be used in the work of the Scientific Committee

The Working Group's discussions on this issue can be summarised by the following key points.

- (1) Ecosystem modelling is important to the assessment and management of cetaceans because, *inter alia*, it may help explain trends that cannot be explained by single-species models, and it may reveal a range of possible alternative scenarios that would not be predicted by those models.
- (2) The utility of ecosystem modelling efforts to date lies primarily in their strategic value.
- (3) It is important to identify which inputs or assumptions drive the behaviour of specific ecosystem models.
- (4) At this time, it is not appropriate for the Committee to develop its own modelling approaches in addition to those being developed elsewhere; rather, focus should be on developing ways for the Committee to make use of the modelling work being conducted worldwide.
- (5) Ecosystem and multi-species models have the potential for generating more explicit and realistic scenarios that could be used as operating models for whale populations to be used in simulation testing of the RMP.
- (6) The approach followed in the development of the RMP to date, of striving for robustness across a broad range of scenarios rather than placing too much faith in any single scenario, should be continued - however, in the future the selection of scenarios may be guided by the results of multi-species and ecosystem models.
- (7) Due to the complexity of ecosystem models and the limits of existing computing power, technical challenges exist to directly linking ecosystem models or components of them into management simulations. Ecosystem modelling frameworks should be used to develop a range of alternative scenarios for the dynamics of whale populations of interest. After which, the key features of the behaviour of these scenarios should be

²⁶<http://cameo.noaa.gov/>.

extracted and encapsulated in simpler, self-contained models. The latter can be designed more along the lines of the tactical, minimal realistic models. These could then be linked into management simulations.

13.3 Review of issues relating to ecosystem modelling

13.3.1 Role of baleen whales in iron fertilisation of the Southern Ocean

Nicol *et al.* (2010) examined a hypothesis concerning the recycling of iron in surface waters of the Southern Ocean through whale faeces. The study estimated iron content of the faeces of four baleen whale species and the tissues of seven krill species. It was estimated that krill contain approximately 24% of the total iron present in Antarctic surface waters. The study concluded that pre-exploitation levels of baleen whale populations would have resulted in more iron present in surface waters, which may have elevated productivity. Therefore, the depletion and recovery of baleen whales may involve positive feedbacks, in contrast to the usual assumptions of negative feedbacks driving whale and krill dynamics. The Committee considered that processes of the kind examined by Nicol *et al.* (2010) were potentially of great importance for ecosystem modelling because they can generate dynamics that are qualitatively different from those assumed in conventional whale population models. The Committee **encourages** experimental studies to assess whether the proposed mechanism is actually a significant driving factor.

13.3.2 Analysis of trends in blubber thickness of Antarctic minke whales

The Working Group on Ecosystem Modelling spent considerable time discussing the significant decline (of about 0.2mm per year) in mean blubber thickness of Antarctic minke whales over the 18-year JARPA period in Areas IV and V as published in Konishi *et al.* (2008). An agreed, but limited range of mixed effects models was applied to the data. As predicted, the estimated variance of the estimated trend in blubber thickness was much greater when these additional components of variance were included. However, the estimated trend remained negative in all models examined, and was significantly different from zero in all but one. For the best-fitting model (based on the AIC criterion) the estimated trend was -0.19 mm/yr (SE 0.07, $t=-2.724$). Details of those discussions can be found in Annex K1 and focussed on questions related to potential biases and additional components of variance. The Committee noted the potential importance of body condition indices to its work. It **agrees** that further analysis of the data was warranted to determine: (1) whether the models fitted so far captured all the main features of the data; and (2) whether the estimate of trend (whose confidence limits using the best fitting model ranged from near zero to values that could be of appreciable biological significance) could be made more precise. *Inter alia*, revised analyses should consider the two sexes separately and consider latitudinal band as a random effect. The Committee **recommends** that further analyses are presented next year. To facilitate this it **suggests** that the authors of SC/63/O16 and of Konishi *et al.* (2008) as appropriate apply for access to the data under Procedure B of the Data Availability Agreement; it **requests** the data holders to consider such requests favourably.

13.3.3 Definition and estimation of MSYR in a multi-species context

SC/63/RMP25 examined some implications of estimating maximum sustainable yield rate (MSYR) from the recovery

trajectories of competing populations in a multi-species context. The Committee **agrees** that multi-species effects can be important both for the definition and estimation of MSYR and related parameters, but referred detailed consideration of the issue to the sub-committee on the RMP.

13.3.4 Ecosystem modelling under the JARPN II programme

The Working Group was reminded of the emphasis on improved ecosystem modelling for the western North Pacific that arose out of the expert review of the JARPN II programme (IWC, 2010c) and subsequent comments made by the ecosystem modelling group (IWC, 2010h).

13.4 Work plan

The work plan is considered under Item 21.

14. SMALL CETACEANS

The Committee has been discussing issues related to small cetaceans since the mid-1970s (IWC, 1976). Despite the differences of views over competency (IWC, 1993a, p.31), the Commission has agreed that the Committee should continue to consider this item (IWC, 1995a). The report of the sub-committee on small cetaceans is given as Annex L.

14.1 Review taxonomy, population structure and status of North Atlantic and the Mediterranean Ziphiidae (beaked and bottlenose whales)

The last assessment on the status of ziphiids was in 1988 (IWC, 1989b, pp. 120-1). Fig. 1 in Annex L shows the relevant geographic locations for the current ziphiid assessment i.e. the North Atlantic (including the Caribbean Sea) and the Mediterranean Sea. A tremendous amount of information was submitted for the review and details can be found in Annex L. This summary here is intended only to provide a general overview.

14.1.1 Cuvier's beaked whale (*Ziphius cavirostris*)

SC/63/SM17 reviewed available information on Cuvier's beaked whale, the most widely distributed beaked whale, which occurs in deep waters worldwide and ranges from equatorial tropical to cold-temperate waters. There is no global abundance estimate although IUCN indicated that there are probably >100,000 worldwide (Taylor *et al.*, 2008).

Several studies suggest that small, discrete sub-populations of Cuvier's beaked whales exist although seasonal movements are largely unknown (see table 1, Annex L); (Aguilar de Soto, 2006; Aparicio *et al.*, 2009; Claridge, 2006; Falcone *et al.*, 2009; Revelli *et al.*, 2008; Rosso *et al.*, 2009; Smith, 2010). It was suggested that management plans for this species should be at the sub-population level.

An earlier review of the status of Cuvier's beaked whale in the Mediterranean Sea (Reeves and Notarbartolo di Sciara, 2006) was updated in SC/63/SM8. Cuvier's beaked whales inhabit oceanic waters of the western and eastern basins of the Mediterranean. They are associated with steep slope habitats and show a marked preference for submarine canyons and escarpments.

14.1.1.1 TAXONOMY AND POPULATION STRUCTURE

The genus *Ziphius* is monotypic (Dalebout *et al.*, 2005). Although sample sizes are small, mtDNA analyses suggest a strong differentiation between the Mediterranean (at least the Ionian Sea) and eastern North Atlantic (Dalebout *et al.*, 2005). It remains unclear whether such a difference exists between animals from the Alborán Sea and the Atlantic.

However, current genetic evidence and the lack of sightings from 13 years of intense survey effort in the Straits of Gibraltar (SC/63/SM8), strongly supports the idea that this species in the Mediterranean constitutes a sub-population (*sensu* IUCN Red List sense).

14.1.1.2 DISTRIBUTION AND ABUNDANCE

Table 1 of Annex L summarises the information on density and abundance of this species in the region. There are relatively few estimates of absolute abundance. In several cases, especially large-scale surveys (e.g. Waring *et al.*, 2009 for the western North Atlantic and SC/63/SM13 for the eastern North Atlantic) these are only at the level of 'beaked whales'. Common issues relating to abundance estimation of beaked whales are discussed under item 14.1.4.1.

Records of strandings were received from several parts of the region including Ireland (mainly the west coast; SC/63/SM19); the UK (mainly the west coasts e.g. MacLeod *et al.*, 2004), France (mainly the Atlantic coast but the only beaked whale species recorded stranded in the Mediterranean; SC/63/SM11) and Italy (SC/63/SM5). Except in the Mediterranean, there appears to be a general seasonal pattern with more strandings in winter (December-March). In the French records, two unusual mortality periods were noted, 1979-82 and 2007-08, when there were 6-7 events per year compared to the average of 0-4. The latter was coincident with atypical beaked whale strandings in the British Isles and was also associated with a higher stranding incidence for Sowerby's beaked whales (Dolman *et al.*, 2008).

The majority of *Ziphius* sightings from recent large-scale surveys in the eastern North Atlantic were concentrated in the Bay of Biscay (SC/63/SM12, SM13) in depths greater than 2000m, and typically further offshore and in deeper waters than sightings of northern bottlenose whales (SC/63/SM12). Density estimates from studies within the Bay of Biscay (SC/63/SM7) were broadly consistent with those from the larger-scale survey (SC/63/SM13).

In the Mediterranean Sea, sightings data from a number of sources were integrated into a habitat modelling exercise (SC/63/SM10) that highlighted three areas with relatively high densities of beaked whales: the Alborán Sea; the northern Ligurian Sea; and the Hellenic Trench and north of Crete. Other areas with relatively high predicted densities were the Tyrrhenian Sea, the southern Adriatic Sea and some areas north of the Balearic Islands and east of Sicily (Ionian Sea). The strengths and limitations of such modelling were discussed. The Committee stresses the value of effective large-scale collaboration.

From SC/63/SM10 and Azzelino *et al.* (2011), it is clear that the Alborán Sea supports one of the highest densities of Cuvier's beaked whales in the world.

14.1.1.3 LIFE HISTORY AND ECOLOGY, INCLUDING HABITAT

Cuvier's beaked whales feed primarily on oceanic cephalopods, although some fish and crustaceans have also been found in stomachs (SC/63/SM17, MacLeod *et al.*, 2003; Santos *et al.*, 2007).

Tagging studies in the Ligurian Sea and waters off the Canary Islands suggest that Cuvier's beaked whales forage at depth using echolocation to find prey (Johnson *et al.*, 2004; Madsen *et al.*, 2005; Tyack *et al.*, 2006). Maximum recorded dive depth and dive duration were 1,888m and 85 min, respectively, with echolocation foraging in waters between 222 and 1,885m (Tyack *et al.*, 2006). Average foraging dives were to a depth of 1070m and lasted 58 min, with approximately 30 attempts to capture prey each dive (Tyack *et al.*, 2006). There was no indication of foraging

during the series of shallower dives that typically followed deep foraging dives, and no vocalisations were detected from whales when they were within 200m of the surface (Johnson *et al.*, 2004; Tyack *et al.*, 2006).

14.1.1.4 DIRECT AND INCIDENTAL TAKES

There is no commercial hunt for this species. Small numbers of directed takes of Cuvier's beaked whale have been documented in the Lesser Antilles (Reeves, 1988).

Incidental takes of Cuvier's beaked whales occurred in commercial fisheries off the Atlantic coast of the US as well as in the Mediterranean Sea, primarily in drift net fisheries (Di Natale and Notarbartolo di Sciarra, 1994; Heyning, 1989). Two separate reports of live-stranded animals from the coast of South Carolina (USA) showed signs of interaction with fisheries (SC/63/SM17).

14.1.1.5 CONCLUSIONS AND CONSIDERATION OF STATUS

Cuvier's beaked whales have been listed globally by the IUCN as 'least concern' although it was previously classified as 'Data Deficient' (Taylor *et al.*, 2008). Military sonars and high-energy sounds from other anthropogenic sources have often resulted in the stranding and death of Cuvier's beaked whales, particularly in the Mediterranean (SC/63/SM8), although the population level implications are unknown. Two other concerns are bycatch in drift gillnets and the ingestion of plastic debris (see also Annex L, item 12.2.4 and Annex K). An important conservation measure for this species is to minimise noise in areas of high density; it has been suggested that beaked whales should not be exposed to received levels greater than SPL 140 dB re 1 μ Pa @ 1m (ACCOBAMS, 2011).

More systematic effort is needed to assess the status of Cuvier's beaked whales (as well as other Mediterranean cetacean species, especially in southern and south-eastern parts of the basin). The Committee **commends** the analysis presented in SC/63/SM10, **recognises** the challenges inherent in collaborative projects of this kind and thanks ACCOBAMS for providing the umbrella that facilitated the work.

The Committee **agrees** that the Cuvier's beaked whale population in the Mediterranean is a population for which a relatively large amount of quantitative information is available and for which serious threats have been identified.

14.1.2 Northern bottlenose whale (*Hyperoodon ampullatus*) SC/63/SM4 reviewed available information on northern bottlenose whales throughout the species range but with emphasis on the western North Atlantic. They occur primarily in waters >500m deep. They are strongly attracted to some vessels in some circumstances. Most biological data comes from scientists working with whalers and detailed studies of photo-identified animals in the Gully, a canyon on the edge of the Scotian Shelf (Canada). Whaling was concentrated in the Scotian Shelf; northern Labrador and southern Baffin Bay; around Iceland, east Greenland and the Faeroes; Andenes, Norway; Møre, Norway; and Svalbard (catch data for the eastern Atlantic are summarised in SC/63/SM1; whaling ceased in 1973). These centres of abundance may contain distinct populations but there are few data available apart from evidence that the Scotian Shelf and Baffin-Labrador populations are distinct and that the animals in Iceland and Baffin-Labrador are linked. The northern bottlenose whales on the Scotian Shelf do not seem to migrate seasonally, but evidence from sightings, strandings and whaling suggest some seasonal movements in the northeastern Atlantic.

In addition to information on catches, SC/63/SM1 provided information on sightings in the northeastern Atlantic as follows: 66 primary sightings from dedicated minke whale surveys (1984-present; mostly in July); 199 opportunistic sightings (1967-2010) in deep waters of the Norwegian Sea from April to June, essentially matching the old whaling ground, and 16 strandings (1979-2010). The incidental sightings include some observations along the Norwegian coast and in the relatively shallow Barents Sea. Although whalers believed that bottlenose whales migrate south in the winter, there are records of occurrence in all months, suggesting some degree of year-round residency in Norwegian waters. No abundance estimates are available.

14.1.2.1 TAXONOMY AND POPULATION STRUCTURE

It was suggested that collection of biopsies in areas other than the Scotian Shelf (e.g. Labrador-Baffin, Iceland and Faeroes, Norwegian Sea) as well as the use of museum materials from whaling and strandings should be a priority data source for the investigation of population structure.

14.1.2.2 DISTRIBUTION AND ABUNDANCE

These whales are seen occasionally in the Canary Islands and regularly in the Azores, where a photo-ID catalogue is being developed.

Northern bottlenose whales were the most commonly stranded beaked whales in Ireland, usually as single animals on the west coast in August (SC/63/SM19). On seven occasions the animals live-stranded. The UK stranding network recorded 36 northern bottlenose whales from 1991-2009 and there were nine stranding events in France between 1970-2010 (SC/63/SM11).

SC/63/SM13 provided estimates of abundance for the eastern North Atlantic using data from three large-scale surveys: SCANS-II 2005, CODA 2007 and the Faroes block of TNASS 2007. The adjusted design-based estimate of abundance for northern bottlenose whales was 20,456 (CV=0.35) and for all ziphiids, 29,154 (CV=0.27, 95% CI=17,478-48,629). These estimates were uncorrected for both perception bias and availability bias. The model prediction for ziphiids in the European Atlantic in summer highlights two high-density areas: the Bay of Biscay (probably reflecting the prevalence of Cuvier's) and the most northwestern section of the study area (where Sowerby's and northern bottlenose whales were more abundant). There was considerable discussion as to the effect of possible ship-seeking behaviour on the reliability of the estimates although the data collected during the survey showed no evidence of responsive movement (see Annex L for details).

Photo-ID mark-recapture studies indicate that the Scotian Shelf population consists of about 160 animals and it has been fairly stable since 1988. The sizes of the remaining populations are unknown. Sightings are fairly frequent off Iceland, the Faeroes and Svalbard, but relatively few sightings have been reported in the two population centres that the whalers used off mainland Norway and in the Baffin-Labrador area. There are strong indications that catches totalling about 65,000 northern bottlenose whales (principally between 1872-1972), depleted the populations (SC/63/SM13).

In the Scotian Shelf habitat, clicks of bottlenose whales can be recorded at distances of about a kilometre. These clicks are sufficiently different to be readily distinguishable from those of other cetaceans in this region but it was cautioned that in areas where other ziphiids (besides *M. bidens*) are present, the ability to discriminate clicks to species level is less certain.

14.1.2.3 DIRECT AND INCIDENTAL TAKES

SC/63/SM2 provided approximate numbers of bottlenose whales caught by different hunts in different population centres of the North Atlantic (see Table 2, Annex L).

Incidental catches have been recorded in a number of areas, including Ireland, Iceland, Greenland, Scotian Shelf area and Newfoundland/Labrador especially in pelagic longlines set for swordfish (*Xiphius gladius*), silver hake (*Merluccius bilinearis*), halibut and squid (SC/63/SM2; SM4; SM19).

14.1.2.6 CONCLUSIONS AND CONSIDERATION OF STATUS

The species was classified as a Protection Stock by the IWC from the 1978 coastal season (IWC, 1978), when it was understood that intensive whaling had seriously reduced populations. Given that there is a recent estimate of abundance for at least a part of the North Atlantic, the feasibility of a reassessment needs further consideration. Although there are regions of relatively high densities, further effort is required in most parts of the range to determine abundance and trends. The principal threats are interactions with fisheries and anthropogenic noise, perhaps especially from seismic exploration.

14.1.3 *Mesoplodon spp.*

Information on the mesoplodonts - Sowerby's beaked whale (*M. bidens*), Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*) and True's beaked whale (*M. mirus*) - is mostly based on information from strandings (e.g. SC/63/SM16, SC/63/SM19, SC/63/SM20). In the past decade, tagging and photo-identification studies have been carried out on Blainville's beaked whale, one of the most well-known mesoplodonts (SC/63/SM16). See Annex L, items 6.3-6.6.

14.1.3.1 TAXONOMY, POPULATION STRUCTURE AND DISTRIBUTION

Analysis of mtDNA suggests that Sowerby's beaked whale is most closely related to True's beaked whale, with which it is sympatric in the southern portion of its range. These two species form a grouping separated from the majority of other *Mesoplodon* species (Dalebout *et al.*, 2002).

Studies around the Bahamas and Canary Islands support the concept that small, discrete populations of Blainville's beaked whales exist in some areas. However, no new information was presented on either taxonomy or population structure of this species. No research has been published on population structure for Sowerby's, Gervais' and True's beaked whales in the North Atlantic.

14.1.3.2 DISTRIBUTION AND ABUNDANCE

The distribution of these four species of mesoplodonts partially overlaps.

Sowerby's beaked whales are endemic to the North Atlantic and occur in waters of the continental shelf edge and slope (MacLeod, In press). It has been recorded in the Norwegian Sea, the Faroes, Iceland and Double Mer, Labrador, Canada (MacLeod, In press) and there are reliable records are from the Azores and Madeira. Most strandings are from northern Europe including the UK and France (MacLeod, In press; SC/63/SM11, SM19). In the western North Atlantic, most strandings have occurred between Labrador and New England although the species may also occur in waters south of New England. A steady increase in sightings of Sowerby's beaked whales in the Scotian Shelf study area has been reported, where the sighting rate for this species now exceeds that for northern bottlenose whales. There is some debate as to whether Sowerby's

beaked whales occur in the Mediterranean Sea (Mead, 1989; Pouloupoulos, 1989).

Blainville's beaked whale is one of the most cosmopolitan ziphiids, and has the most extensive range of any mesoplodont. It is found in deep tropical to warm-temperate waters, mainly offshore or near insular coasts. In the western North Atlantic, Blainville's beaked whales have been reported from the Caribbean Sea, the Gulf of Mexico, and warm offshore Gulf Stream waters to as far north as Nova Scotia. In the eastern North Atlantic, sightings and strandings of Blainville's beaked whales have occurred in the UK, Netherlands, Portugal, France, Azores and Canary Islands. These whales are not believed to be common in the Mediterranean Sea. In the Atlantic they are reliably found (and studied) in the Bahamas (Claridge, 2006) and the Canaries (Aguilar de Soto, 2006; Johnson *et al.*, 2004).

Gervais' beaked whale is a warm water species (Norman and Mead, 2001). Strandings records suggest it is rare in northwestern Atlantic. It is more commonly sighted in the Azores and its distribution is believed to extend to Mauritania and Ascension Island, and it has been confirmed in many areas of the Caribbean. Strandings are more common in the western Atlantic, particularly in the southeastern United States.

True's beaked whale is unusual in that it is found in the North Atlantic (both sides), as well as around Australia and South Africa. It is the only ziphiid with a truly anti-tropical distribution. North Atlantic records are mainly from warm-temperate waters. In the western North Atlantic, the southernmost records are from Florida and the Bahamas and the northernmost record is from Nova Scotia while in the east, there are records from the Hebrides, west of Ireland, the Bay of Biscay, the Canaries and the Azores (Fraser, 1934; Herman, 1992; MacLeod, 2000). There are no records from the Gulf of Mexico, the Caribbean, the Mediterranean Sea or farther south in the eastern North Atlantic (MacLeod and Mitchell, 2006a). The limited evidence available suggests that it may be the least common beaked whale in the North Atlantic.

Quantitative information on these species was scarce and sparse; often the estimates cannot be differentiated to species (e.g. Mullin, 2007; Waring *et al.*, 2009). SC/63/SM13 provided an uncorrected estimate of 4,227 (CV=0.48) Sowerby's beaked whales in the study area of CODA+SCANS-II+T-NASS Faroese block, mainly the northwestern part of the study area.

14.1.3.3 LIFE HISTORY AND ECOLOGY, INCLUDING HABITAT

The little information that exists comes from stranded animals and generally suggests that these whales eat squid and fish (see Annex L for more details).

There is evidence that Sowerby's beaked whales are capable of deep diving and they have been recorded in deep waters close to the shelf edge off Nova Scotia (Hooker and Baird, 1999) and the Atlantic Frontier and Faroes-Shetland channel to the west and north of Scotland respectively (Pollock *et al.*, 2000).

Blainville's beaked whales perform long, deep dives, with foraging dives sometimes lasting over an hour to depths well over 1,000m (Baird *et al.*, 2006; Johnson *et al.*, 2004), separated by periods of about 1.5h during which they have shorter, relatively shallow dives (Aguilar de Soto, 2006). They echolocate during deep foraging dives (Johnson *et al.*, 2006; Johnson *et al.*, 2004; Madsen *et al.*, 2005). Tyack *et al.* (2011) found evidence that anthropogenic sound led to a disruption of foraging and avoidance behaviour (i.e. moving away from the sound source).

14.1.3.4 DIRECT AND INCIDENTAL TAKES

There are no hunts in the region. Incidental takes of mesoplodonts, including Blainville's beaked whales, occur worldwide, primarily in drift net and longline fisheries, although records are poor. There are records of incidental catches in US waters (SC/63/SM20, Waring *et al.*, 2009) and in the eastern North Atlantic, and True's beaked whales may be taken in albacore tuna driftnet fisheries operated by various European countries.

One stranded Sowerby's beaked whale in Ireland had wounds consistent with a ship strike (Hurley and Murphy, 2005).

14.1.3.5 CONCLUSIONS AND OTHER CONSIDERATIONS ON STATUS

IUCN lists all mesoplodont species as Data Deficient. The new available information was not sufficient for the Committee to assess the status of these four species.

14.1.4 Common issues and threats

14.1.4.1 ABUNDANCE ESTIMATION

Methods suitable for estimating abundance of ziphiids were discussed. Mark-recapture (MR) using photo-ID is an effective technique for relatively small populations with restricted ranges but care must be taken to ensure that assumptions are either met or accounted for in analyses.

MR is not practical for large populations and/or large areas and/or evasive species but there are also logistical and other difficulties associated with other methods (such as line transect surveys using visual or acoustic cues), primarily associated with the fact that Ziphiids dive to great depths for long periods and as such spend relatively little time at the surface, which means the number of detections tends to be small.

For visual line transect surveys, long dive times and possible responsive movement make correcting for availability and perception bias challenging. If data are analysed for all ziphiids combined, species differences in behaviour may introduce heterogeneity to the sampling process. Data from DTAGs can be useful for estimating availability bias for the different species. Fixed-wing aerial surveys can be effective in certain areas (the problem of responsive movement is removed) but corrections for availability and perception bias can still be problematic. Recent work using helicopters in the Antarctic (Scheidat, pers. comm.) allowed researchers to take photographs and video of ziphiids to assist in species identification and confirm school sizes; responsive movement only occurred after the appropriate distance measurements had been taken.

In many surveys a high proportion of ziphiids sightings are unidentified to species as a result it is difficult to generate credible species-specific abundance estimates.

Passive acoustics (SC/63/SM2) are a promising area for ziphiid detection and potentially for estimating abundance (to date they have been primarily used for detection) but there are a number of challenges including the largely untestable assumption that factors relating cue detection to density remain constant (beaked whales do not vocalise throughout their dive cycle and therefore are not continuously available for acoustic detection).

A brief summary of Sea Glider™ developments at the Applied Physics Laboratory (APL) of the University of Washington was provided. Hydrophones have been added to the glider unit for the detection of cetaceans and specifically beaked whales. The system has been tested and there is good correspondence in detections. It was noted that the Canadian Navy was using a different glider to study Scotian

Shelf beaked whales. There are a number of other ‘acoustic-capable’ sea gliders in development.

In summary, although some methods for estimating abundance are appropriate for beaked whales, these species are particularly challenging because of the many sources of potential bias and methods deployed need to be carefully considered and applied.

14.1.4.2 NOISE

There is considerable evidence that anthropogenic noise can affect beaked whales. Atypical mass strandings consisting of multiple individuals that do not strand in the same location and often of multiple species, including Cuvier’s and Blainville’s beaked whales, have occurred associated with the use of mid-frequency sonars and seismic exploration (Anon., 2001; Cox *et al.*, 2006; Fernández *et al.*, 2004; Fernández *et al.*, 2005; Frantzis, 2004; Frantzis and Cebrian, 1998; Jepson *et al.*, 2003; Malakoff, 2001). In addition, evidence from the Tyack *et al.* (2011) study described earlier supports the growing consensus that exposure to military sonar can trigger a behavioural response that results in lethal strandings (Cox *et al.*, 2006; Tyack *et al.*, 2011).

In a review of historical occurrence of ‘mass’ strandings of beaked whales (two or more animals) using unclassified data, D’Amico *et al.* (2009) found that 126 of the 136 mass stranding events occurred after the introduction and implementation of modern, high-power mid-frequency active sonar (MFAS). Only 2 reports contained details on the use, timing and location of sonar relative to stranding location, 10 coincided spatially and temporally with exercises that may have involved MFAS, 27 occurred near a naval base or ship with no evidence of sonar use and the remaining 87 events had no evidence for a link with any naval activity (D’Amico *et al.*, 2009). Of the 126 beaked whale mass stranding events, 118 events involved a single species and 8 were mixed species events, all of which included Cuvier’s beaked whale with at least one other ziphiid species (D’Amico *et al.*, 2009). Almost half of the single species mass strandings involved Cuvier’s beaked whale, and almost half of those were from the Mediterranean Sea (D’Amico *et al.*, 2009; Podestá *et al.*, 2006). However it was noted that Cuvier’s is the only beaked whale in the Mediterranean. All beaked whale mass stranding events reported as being associated with naval activities involved Cuvier’s solely or with *Mesoplodon* spp. or northern bottlenose whales (D’Amico *et al.*, 2009).

14.1.4.3 PLASTIC INGESTION

It has been suggested that beaked whales are especially vulnerable to ingestion of plastic debris because of their reliance on suction-feeding (MacLeod, 2009). The significance of this issue may be underestimated given that not all dead animals strand and are necropsied.

SC/63/E3 (see also Item 12.2.4 and Annex K) summarised reports of plastic ingestion by five beaked whale species, four of them occurring in the North Atlantic: Blainville’s, Cuvier’s and Gervais’ beaked whales and northern bottlenose whales. Most of these reports involved stranded animals with varying quantities of plastic bags, threads, sheets and other items in their stomachs. In some instances the animals were emaciated and there was clear evidence of blockages.

14.1.4.4 GAS EMBOLISM

Bernaldo de Quirós Miranda provided a summary of her work on gas embolism that was first described in stranded beaked whales linked to military sonar (Fernandez *et al.*, 2005; Jepson *et al.*, 2003) and in particular her development

of a gas analysis technique (Bernaldo de Quiros *et al.*, 2010). Although it does not provide a conclusive diagnosis for decompression-like sickness in stranded cetaceans, it may be used in combination with other data to reach a definitive diagnosis of decompression disease. Details can be found in Annex L, item 6.7.4.

14.1.4.5 CLIMATE CHANGE

MacLeod (2009) hypothesised changes in range and conservation status of cetaceans in response to increased water temperatures resulting from global climate change. He cited as examples declines in occurrence of northern bottlenose whales and Sowerby’s beaked whales off northwestern Scotland and a decline in sighting rate for bottlenose whales along with an increase in sighting rate and northward range expansion for Cuvier’s beaked whales in the Bay of Biscay.

15.1.5 General recommendations

In general, the Committee **recommends** that for all North Atlantic ziphiid species, efforts be made to define population structure, obtain estimates of abundance and identify (and prioritise) threats. Particular attention should be given to populations known or suspected to be small. The available evidence suggests that most ziphiid species occur as numerous local, largely isolated groups, which should be regarded as putative subpopulations (*sensu* IUCN Red List).

As discussed above (Item 14.1.4.1), estimating abundance is challenging. Therefore, the Committee **recommends** that more effort be made to investigate and validate methods of estimating population size for ziphiids, including those that incorporate passive acoustics for application in areas where the local species are acoustically distinguishable. Among other things, more data are needed to adjust density estimates from line transect surveys to account for availability and visibility bias (given that these deep-diving whales spend relatively little time at the surface and species are difficult to distinguish) and for responsive movement, with special attention to the possible bias caused by ship attraction in bottlenose whales. Consideration should also be given to interrupting line-transect surveys (closing mode) in order to obtain photographs and biopsies as a way of reducing the ‘unidentified ziphiid’ component of abundance estimates.

Initial efforts have been made to map high-use areas for ziphiids on a global scale (MacLeod and Mitchell, 2006b) and in the Mediterranean Sea (SC/63/SM10), with the objective of providing guidance for mitigation measures specifically to reduce the recognised risks to these whales from naval sonar and seismic survey operations. This includes habitat characterisation and predictive habitat modelling. The Committee **recommends** that collaborative efforts (c.f. SC/63/SM10) be made by the relevant scientists and research groups in other parts of the North Atlantic.

Like other cetaceans, ziphiids are vulnerable to entanglement in nets (especially pelagic driftnets) and to hooking or entanglement by longline gear. The Committee **recommends** that methods be developed and applied to estimate fishery-related mortality, giving special attention to areas where direct evidence of incidental mortality exists (e.g. Labrador for northern bottlenose whales, Mediterranean for Cuvier’s beaked whales) as well as to areas where driftnetting and longlining operations overlap known concentrations of ziphiids (e.g. driftnetting in the Alborán Sea).

The Committee **recommends** the continuation and expansion of studies of how anthropogenic noise, especially that from naval sonar and seismic survey airguns, affects

ziphiids. These should include efforts to determine if and how vulnerability differs among species, habitat types, animal activities (e.g. travelling, foraging) etc. The Committee further **recommends** that collaborative arrangements be made with military and industry authorities to ensure researchers have advance notice of sonar exercises, seismic surveys and other activities so that the possibility of beaked whale stranding events can be anticipated with enhanced beach surveillance etc.

To improve understanding of the status of northern bottlenose whales, the Committee **recommends**:

- (1) focus field efforts on the populations off Baffin-Labrador and mainland Norway;
- (2) use a suite of data (genetic, contaminant etc.) to describe population structure and examine potential links between bottlenose whale population centres;
- (3) collect and analyse data on seasonal migration, especially in the northeastern Atlantic and the Baffin-Labrador area; and
- (4) develop a comprehensive model of how whaling affected the populations.

With respect to Cuvier's beaked whales in the northeastern Atlantic and the Mediterranean Sea, the Committee **recommends**:

- (1) use existing (in museums and tissue banks) and new genetic samples (from strandings and biopsies) to examine population structure, including connectivity or lack thereof between putative populations;
- (2) review and/or collect data on habitat use, with an emphasis on site fidelity and movements of the animals that may be resident to specific areas;
- (3) refine or obtain abundance estimates for the Bay of Biscay and key areas in the Mediterranean such as the Ionian Sea (especially off the western coast of Greece; SC/63/SM10) and around the Macaronesian islands;
- (4) review and try to quantify known and possible threats for putative populations; and
- (5) use the above information to determine the status of populations.

The Committee further **recommends** that researchers and research groups establish broad-scale collaborations to allow integrated analyses of genetic material, photograph collections and survey data.

With regard to *Mesoplodon* species and Cuvier's beaked whales, the Committee **recommends** that field researchers collect voucher material (skin or other tissue sample, skull) whenever possible from stranded or bycaught animals; biopsies should be obtained from live animals in order to verify species identification. Collection of such material is especially important to confirm species identification of females and young males. Efforts are also needed to validate acoustic signatures from *Mesoplodon* species by collecting biopsies along with acoustic recordings at sea.

Finally, the Committee **concludes** that the evidence for one or more discrete populations of Cuvier's beaked whales in the Mediterranean Sea is sufficient to merit 'subpopulation' assessment for the IUCN Red List. Recognising that Cañadas has already prepared most of the documentation for such an assessment, it **recommends** that this be submitted for consideration to the Cetacean Red List Authority.

14.2 Review report from the Workshop on climate change and small cetaceans

This item was addressed in a joint session with the Working Group on Environmental Concerns (see Item 12.5.1, SC/63/Rep1).

14.3 Voluntary Fund for Small Cetacean Conservation Research

In 2009, the Government of Australia made a generous donation towards the IWC Voluntary Fund for Small Cetaceans Conservation Research of about £250,000 (\$500,000 AUS). One project endorsed by the Scientific Committee last year has already been supported (*Threatened Franciscanas: Improving Estimates of Abundance to Guide Conservation Actions*; see SC/63/SM9 for preliminary results).

Table 9

List of projects recommended for funding in alphabetic order by principle investigator's surname.

Project title (<i>principal investigator; project duration; total amount</i>)	Species	Geographic area (Country)
Ecology, status, fisheries interactions and conservation of coastal Indo-Pacific humpback and bottlenose dolphins on the West Coast of Madagascar (<i>Cerchio; 3 years; £33,900</i>).	<i>Sousa chinensis</i>	Africa (<i>Madagascar</i>)
Abundance and distribution of the Atlantic humpback dolphin in Gabon and Congo, with a focus on improving field-survey methods and monitoring protocols (<i>Collins; 1 year; £27,900</i>).	<i>Sousa teuszii</i>	Africa (<i>Gabon, Congo</i>)
Estimating abundance of an isolated population of the threatened franciscana: moving towards conservation actions. (<i>Danilewicz; 1 year; £30,950</i>).	<i>Pontoporia blainvillei</i>	South America (<i>Brazil</i>)
Monitoring and threat assessment of coastal cetacean populations in Sarawak, Malaysia (<i>Minton; 1 year; £20,440</i>).	<i>Orcaella brevirostris</i> , <i>Neophocaena phocaenoides</i> , <i>S. chinensis</i> , <i>Tursiops aduncus</i>	Asia (<i>Malaysia</i>)
Genetic and demographic assessment of dolphins taken in live-capture and traditional drive-hunt in the Solomon Islands (<i>Oremus; 1 year; £28,250</i>).	<i>Tursiops aduncus</i>	Oceania (<i>Solomon Islands</i>)
Supporting the assessment of alternative fishing gears for replacing gillnets that cause bycatch of vaquita in the Upper Gulf of California, Mexico (<i>Aguilar-Ramirez; 1 year; £33,270</i>).	<i>Phocoena sinus</i>	North America (<i>Mexico</i>)
Investigation on the population identity of Indo-Pacific humpback dolphins in the northern Bay of Bengal, Bangladesh and implications for population-level conservation and taxonomy of the species (<i>Smith; 2 year; £31,700</i>).	<i>S. chinensis</i>	Asia (<i>Bangladesh</i>)
Identifying conservation solutions for the Yangtze finless porpoise through community research (<i>Turvey; 1 year; £33,600</i>).	<i>Neophocaena phocaenoides</i> <i>asiaorientalis</i>	Asia (<i>Yangtze</i>)
Photo-id monitoring of the eastern Taiwan strait population of Indo-Pacific humpback dolphins (<i>Sousa chinensis</i>) (<i>Wang; 2 years; £32,500</i>).	<i>S. chinensis</i>	Asia (<i>Eastern Taiwan</i>)

A framework to guide the awarding of the grants from the research fund was agreed by the Scientific Committee and the Commission in 2010 (IWC, 2011a). The first call for proposals under the agreed framework was launched last March. Details can be found at http://www.iwcoffice.org/sci_com/sm_fund.htm.

The Secretariat received 26 proposals (24 different proponents) for research projects based in six continents on a number of different species living in a variety of habitats (some highly degraded). Projects ranged from 'research only' to 'research, capacity building and public awareness'. A variety of scientific approaches were included in the proposals concerning taxonomy, population structure, abundance estimation and anthropogenic threats.

The Review Group (Björge, Donovan, Fortuna, Gales, Palka, Reeves and Rojas-Bracho), selected by the Chair of the Scientific Committee and the Chair of the sub-committee on small cetaceans, worked intersessionally and during the Scientific Committee meeting. Details of the review process can be found in Annex L.

Taking into account the above, the Committee **recommends** nine proposals for funding (Table 9). Summaries of the recommended proposals are provided in Appendix 1 of Annex L.

The Committee **endorses** these proposals and funding for the first year of the multi-year projects. The Committee thanks Australia for its contribution to this fund, which support research related to conservation issues.

Insufficient funds (about £45,000) are available to completely fund the proposals that require more than one year's funding and the Committee **strongly recommends** that member countries seriously consider making donations to the fund. Should sufficient funds be made available, the Committee **agrees** that the next call for proposals should occur in 2013.

Grant contracts, which do not exceed £34,000 each, incorporating any suggested modifications and a specification of deliverables, will be developed by the Review Group and the Secretariat after formal approval of the projects by the Commission at its Plenary meeting in July 2011.

14.4 Review progress on previous recommendations

14.4.1 Vaquita (*Phocoena sinus*)

The Committee has expressed its serious concern at the critical state of the vaquita on many occasions. Gerrodette *et al.* (2011) estimate the 2008 abundance of vaquitas as 245 (log-normal CI 68-884) implying an average rate of decline of 7.6% yr⁻¹ since 1997. The 'vaquita refuge' (a nominally enforced no-gillnet zone) contains, on average, about half of the total population at any one time.

Gerrodette and Rojas-Bracho (2011) assessed three alternatives for protected areas delineated under the national recovery plan PACE Vaquita but only the option of providing full protection throughout the entire range of the species had an acceptable value and a probability of success near one (99.5%). To date fishing operations are still permitted outside the vaquita refuge,

Last year, the Committee was informed of planned work to implement an acoustic monitoring scheme to track future changes in vaquita abundance (Rojas-Bracho *et al.*, 2010) and SC/63/SM22 provided some details of the design, trials and pilot phases of this five-year monitoring programme funded by the Ocean Foundation, Cousteau Society and Mexican Government. Plans for representative coverage of the entire refuge during the pilot test were impeded by the loss of 60% of the subsurface moorings, possibly due

to illegal fishing operations, vandalism, bad winter weather conditions or a combination of these. Despite this there were 108 confirmed acoustic encounters of vaquitas. Statistical theory and simulation modelling indicate that the CV of average detection rate can meet the required precision for analysis and efforts are being made to achieve this in practice. A strategy to sample outside the refuge to detect possible shifts in vaquita distribution is under study.

To implement PACE Vaquita, the Government of Mexico spent a total of almost US\$34m on measures to reduce fishing effort from 2008-11. The number of small fishing boats (pangas) in the northern Gulf of California has been reduced from 1,200 to 670, although there is some evidence that fishermen who have received compensation not to fish in the refuge have not complied. Observer overflights show a decline in fishing vessels inside the reserve, but illegal fishing continues, affecting the success of monitoring and recovery efforts. Efforts to develop alternatives for gillnets continue, but testing of gear for blue shrimp has been hampered by spatial conflicts with gillnet fishermen in areas surrounding the reserve during the shrimping season.

The Committee **recognises** that in reducing gillnet use by almost half, Mexico's vaquita recovery programme may have slowed the decline of the species. Nonetheless, it was acknowledged that the vaquita will continue to decline towards extinction unless bycatch is eliminated. The Committee **reiterates its extreme concern** for the status of the species. Robust analyses indicate that current conservation actions have only an 8% probability of success. Eliminating all gillnets throughout the entire range of the species has a 99% probability of success (Gerrodette and Rojas-Bracho, 2011). Therefore, the only reliable approach for saving the species is to eliminate vaquita bycatch by removing entangling gear from areas where the animals occur. It **strongly recommends** that, if extinction is to be avoided, all gillnets should be removed from the upper Gulf of California immediately. This is in accord with its strong recommendation made in 2009 (IWC, 2010, p.66) that:

'if extinction is to be avoided, all gillnets should be removed from the upper Gulf of California immediately, and certainly within the three year schedule, started in 2008'.

It appears unlikely that this will be achieved unless alternative gear is made available for catching shrimp and finfish. In this regard, the Committee **expresses concern** that proper experimental design and trials of alternative fishing gear had not yet taken place; these are urgently needed actions to avoid the extinction of vaquita. The Committee **recommends** that all efforts be made to support this research and ensure that trials of alternative gear are given spatial priority over small-boat gillnet fishing during some periods of the shrimping season. In addition, a sufficient number of trial boats must be under the control of the researchers. This is necessary to complete statistical validation and an economic viability assessment of proposed gear alternatives. The Committee **expresses its extreme concern** that gill and other entangling nets continue to be used throughout the vaquita's range and it once again **strongly encourages** the international community and NGOs to assist the Government of Mexico in taking urgent actions to avoid the extinction of the vaquita.

14.4.2 Harbour porpoise (*Phocoena phocoena*)

Throughout their range, harbour porpoises are vulnerable to incidental mortality in gillnets. SC/63/SM18 described studies to characterise and quantify bycatch from the fleet of small coastal gillnetters targeting anglerfish (*Lophius*

piscatorius) and cod (*Gadus morhua*) in Norwegian waters. Details of the analyses and models used to estimate bycatch are summarised in Annex L. The paper estimates a total annual bycatch of 6,900 harbour porpoises in the anglerfish and cod fisheries combined. This must be an underestimate as not all gillnet fishing effort is covered by the analysis, although it is assumed to be close to the true bycatch level in Norway. The next step of this project is to develop mitigation measures in close collaboration with the fishermen who provided data for the bycatch estimate. The Committee noted that one small area (Lofoten-Vestfjorden) had by far the highest bycatches and it was asked if this area could be closed for gillnet fisheries. Bjørge explained that this area is the spawning ground for the largest population of cod in the world and it is politically and economically infeasible to eliminate bycatch by simply closing this area to fishing.

The Committee acknowledges that the approach in SC/63/SM18 is a useful alternative for estimating bycatch when vessels are too small to carry observers, and **welcomes** the results. The Committee **recommends** that this monitoring effort continue. The Committee also **recommends** that efforts be made to use contracted vessels in combination with placement of observers on the larger of the small vessels in order to further improve the data and reduce the CV of the estimate.

Population structure and abundance estimates for harbour porpoises are required to assess the sustainability of the predicted level of bycatch. The Committee **notes with concern** that there are no abundance estimates for the complex Norwegian coastal and fjord waters, and **recommends** that at least the areas with the highest estimated bycatch be monitored to provide abundance estimates.

The Committee noted that ASCOBANS is striving to address serious harbour porpoise bycatch problems in the Baltic, Kattegat/Belt and North Sea areas through its two conservation plans and its bycatch Working Group (also see Item 14.5). The bycatch Working Group is focussed on developing practical liaisons with stakeholders, particularly fishermen. The Committee **encourages** further action on these pressing issues, noting especially the critically endangered status of the porpoise population in the Baltic proper, and **recommends** greater exchange of information and collaborations among researchers all over the Baltic.

14.4.3 *Franciscana* (*Pontoporia blainvillei*)

Four franciscana management stocks have been defined: three in Brazil (FMA I-III), one of which extends into Uruguay (FMA III), and one in Argentina (FMA IV) (Secchi, 1999). Systematic aerial surveys to estimate franciscana abundance have been conducted in FMA II and III in Brazil and IV in Argentina. Last year, in response to Zerbini *et al.* (2010), the Committee recommended further studies to:

- (1) improve estimates of visibility bias;
- (2) evaluate potential biases in the estimation of group sizes; and
- (3) estimate franciscana diving parameters.

Aerial surveys are the most appropriate survey method to estimate abundance of franciscanas (e.g. Crespo *et al.*, 2002; Secchi *et al.*, 2001) but most estimates to date have suffered from the lack of correction for visibility and group size bias. SC/63/SM9 described an experiment using concurrent independent boat and aerial line transect surveys concurrently sampled a known aggregation of franciscanas in Babitonga Bay, southern Brazil. A preliminary correction factor was computed and work is underway to refine the

analysis. The importance of the financial support received from the IWC was recognised as it stimulated the local government to support this conservation-oriented research and provided valuable training and experience to local scientists.

The Committee **welcomes** this new information noting:

- (1) that the research responded directly to its recommendations;
- (2) it was the first project completed under the Voluntary Fund for Small Cetacean Conservation Research; and
- (3) the generous additional support from the Government of Brazil.

The Committee **encourages** researchers to apply the developed bias correction methods to future franciscana assessment studies, including planned surveys of FMA I later this year, and if feasible, to do retrospective analyses of previous franciscana survey results from FMA II. Although they may need to be adapted for each particular study, the methods developed in this study to address issues of bias should be useful for aerial surveys of other cetacean species.

Mendez *et al.* (2010a) studied franciscana populations in FMA IV off northern and central Argentina. The authors showed that potentially reproductive pairs of unrelated franciscanas establish at least temporary bonds and these pairs as well as related mother-calf pairs are often entangled simultaneously. The implication is that bycatch may have a disproportionate impact on individuals (and associations) with the highest reproductive value to the population. The effect of differential bycatch is exacerbated by local population structure. Previous assessments of franciscana population structure (Mendez *et al.*, 2008; 2010b) suggested that franciscana populations depleted by bycatch are not 'supplemented' by immigration from neighbouring populations.

The Committee **thanks** the authors for presenting this new information that follows up on previous studies and recommendations concerning population structure and impacts of bycatch. The Committee **recommends** that studies using this approach continue.

A first workshop to develop a national plan of action to reduce interaction between marine mammals and fisheries is being held in Argentina in June 2011.

14.4.4 *Indo-Pacific humpback dolphin*

Mendez *et al.* (2011) combined genetic data from humpback dolphins (*Sousa spp.*) throughout the western Indian Ocean (Oman, Tanzania, Mozambique, and South Africa) with 13 years of remote-sensing oceanographic information from the region to evaluate the influence of oceanographic variables on the structure of dolphin populations. The concordance between environmental and genetic boundaries suggests that a suite of environmental features could be driving, at least in part, the genetic patterns observed. Mendez *et al.* (2011) concluded that the use of molecular tools in combination with environmental data can help address questions pertaining to population structure, and also help in understanding the influence of ecological processes. Such research is of use in identifying and justifying scientifically defensible and spatially explicit conservation measures. The Committee thanks the authors for this new information as it follows-up on previous recommendations concerning population structure and habitat of humpback dolphins. The Committee **recommends** that approaches of this nature continue and **welcomes** updates as they are produced.

14.4.5 White whales and narwhals

Bjørge summarised the work on planning a proposed global review of monodontids (involving, at a minimum, IWC, NAMMCO and JCMB - the Canada-Greenland Joint Commission on Narwhal and Beluga). The United States, Russia and Norway have expressed interest in participating. Additional preparatory work is needed and a proposal is being developed for consideration by the Scientific Committee for a workshop to be held in the autumn of 2013.

The Committee was informed about a sustainability assessment programme for live-capture removals of white whales in the Okhotsk Sea carried out by an independent panel of experts convened by IUCN in March 2011 (Reeves *et al.*, 2011). The panel concluded after reviewing the first four years of research under this programme that the removal of 29 white whales per year would be sustainable at current population levels. It was noted that the analysis was unable to take account of the potential social consequences of removals. The Committee **commends** the use of a panel of independent experts to review and help inform proposals for removals and appreciated the substantial investment made in both the extensive assessment-related field research and the independent evaluation of results. It was noted that such investments are rarely made by live-display facilities and this was seen as a valuable approach that should be replicated more widely.

There was considerable discussion over the deposition rate of growth layer groups in white whales (Brodie *et al.*, Submitted) and details can be found in Annex L. The Committee noted that NAMMCO is convening three workshops addressing monodontid age estimation at the request of the Joint Scientific Working Group (JWG) of NAMMCO and the JCMB. It is anticipated that the outcome from all three workshops will form the basis of an authoritative scientific publication by NAMMCO on age estimation in monodontids.

14.4.6 Killer whale (*Orcinus orca*)

Lauriano *et al.* (2010) describes a study carried out in January and February 2004 in the western Ross Sea, Antarctica. Data on the presence and distribution of killer whales and other cetaceans were collected during coastal helicopter surveys in an area that typically remains ice-free in summer. Both B- ($n=2$) and C-type killer whales ($n=23$) were recorded. The authors noted that this area is designated as an Antarctic Specially Protected Area and expressed hope that the Italian Antarctic programme will be resumed soon so that more data can be collected.

A progress report on a collaborative project on the distribution, relative abundance, migration patterns and foraging ecology of three ecotypes of killer whales in the Southern Ocean funded under the Southern Ocean Research Partnership (SORP) was provided in SC/63/O13. Potential additional collaborators were invited to contact the SORP or the principal investigators concerning the project.

14.4.7 Boto (*Inia geoffrensis*)

Da Silva *et al.* (2011) contained information on the use of botos as bait in fisheries for the piracatinga (*Calophysus macropterus*), especially in the Brazilian Amazon. The Committee was concerned that this fishery appears to have expanded since it was last discussed by the Committee in 2008 but available information remains sparse. It was informed that the Government of Brazil is investigating this matter and that there is a possibility of bringing more information in the future.

The Committee **expresses its ongoing concern** with the conservation status of botos given the continuation and apparent acceleration of directed killing. The Committee **reiterates its previous recommendation** (IWC, 2007a; 2008d; 2009a) that immediate steps should be taken by range countries (Brazil, Colombia, Peru and Venezuela) to stop this hunting, and asks that scientists in the region cooperate by providing information to next year's meeting on the extent of the use of botos as bait, the implications of international trade for the persistence and spread of this practice, and progress in addressing the problem.

14.4.8 Small cetaceans of the Caribbean and western tropical Atlantic

The Caribbean Sea and western tropical Atlantic south to northern Brazil is a region characterised by high biological productivity and a diverse cetacean fauna (Siciliano *et al.*, 2008; Van Canneyt *et al.*, 2010; Ward *et al.*, 2001; SC/63/E9). SC/63/E9 compiled incidental records of cetaceans from the Dutch Caribbean and indicated broad faunal differences in the two different sectors of the EEZ. Concern was expressed about anthropogenic sources of mortality. Van Canneyt *et al.* (2010) highlighted results of extensive aerial surveys of the French Caribbean and Guiana, including sightings of beaked whales.

The Committee learned of four recent large projects that exemplify international research cooperation and coordination in the region. The completion of the 2008 Action Plan for the Conservation of Marine Mammals for the Wider Caribbean Region under the SPAW Protocol has been followed by regional strandings workshops focusing marine mammal research and management. In 2010 the AGOA Marine Mammal Sanctuary was designated in the French Caribbean; REMMOA surveys provided density estimates of cetaceans in the area. A stranding network was recently implemented on the north coast of Brazil by the Aquatic Mammal Center/ICMBio.

The Committee noted that more work is needed on the distribution and abundance of cetaceans in the Caribbean and **recommends** continued and expanded cooperation on large-scale directed surveys and other cetacean assessment and conservation research among the countries and territories of the region, including those of north-eastern South America (Brazil, Guyana, Suriname, French Guiana) whose waters adjoin this region.

14.4.9 Other

The Committee discussed the list of potentially vulnerable populations of small cetaceans forwarded from the Vienna Climate Change Workshop (SC/63/Rep1), discussed in detail in Annex K. The Committee **recommends** that scientists interested in and knowledgeable on particular taxa should consider submitting draft assessments that take into account climate change to the Cetacean Red List Authority. It was stressed, however, that such assessments should be prepared only if there is reason to believe that concerns about climate change would change the listing status of the taxon (see <http://www.redlist.org> for categories and criteria).

14.5 Review takes of small cetaceans

SC/63/SM21 that summarised recent information from European Union member states on the extent to which required cetacean bycatch mitigation measures and monitoring are being implemented and enforced under Council Regulation 812/2004. It briefly reviewed EU member states' obligations with respect to the monitoring and mitigation of cetacean bycatch based on the work of the

ICES expert group on bycatch (WGBYC) and a workshop held by ICES in September 2010 (all reports available on the ICES website). In general, ICES experts concluded that bycatch rates for most cetacean species remain very poorly documented in European fisheries as a whole, and it is impossible to provide credible estimates of total takes on a regional basis. Importantly, there are no recent estimates of bycatch in the Baltic Sea, where harbour porpoises are critically endangered and no bycatch should be allowed.

Particularly with regard to the Baltic harbour porpoise population, the Committee recalled its previous discussion and comments on the ASCOBANS Recovery Plan for Harbour Porpoise in the Baltic (the Jastarnia Plan, 2002). It was reported that ASCOBANS is advocating a switch to other gear (e.g. Koningson, 2011), especially for the Baltic Sea where angling, trap and line fisheries can replace gillnets. In discussion, it was noted that the establishment of gillnet-free zones and fishery closures are difficult in areas where fisheries are the main source of income.

The Committee **re-endorse**s the Jastarnia plan and **reiterates** the comments made in 2002 on the draft of that plan, especially points 6, 7, and 8 (IWC, 2003d) on the use of pingers (see Annex L).

In view of the critical status of harbour porpoises in the Baltic Sea, the Committee **encourages** all the relevant nations to give their full support to the implementation of the Jastarnia plan (2009). Further the Committee **encourages** the range countries to move ahead with implementation.

The Committee was informed that a bycatch mitigation workshop is planned to take place in Woods Hole (USA) in autumn 2011, organised by the Bycatch Consortium at the New England Aquarium, Boston. It was also noted that a document called 'Review on the effectiveness of acoustic devices and depredation mitigation as demonstrated in field studies to date' was prepared for ACCOBAMS in 2010 (available at <http://www.accobams.net>).

The Committee received an update of the records of Japanese directed catches and associated quotas for small cetaceans from 1997-2009 (Source: Japanese National Research Institute of Far Seas Fisheries website; see Annex L, Appendix 3).

The Committee also examined the summary of catches of small cetaceans in 2009-10 extracted from this year's National Progress Reports. There was discussion of the limitations and usefulness of this information. The Committee **expresses concern** that data in general on small cetacean bycatch in the National Progress Reports are incomplete and thus likely to give a misleading impression of the scale of bycatch in some countries. The Committee **reiterates** the importance of having complete and accurate catch information, and it **encourages** all countries to submit catch data, appropriately qualified and annotated. The Committee also noted that the hunting of small cetaceans has long been and remains a common and well-known practice at Lamalera, Indonesia. This is an example of an area (one of many, e.g. eastern Caribbean) where direct takes are known to occur regularly but are largely undocumented and unreported.

14.6 Work plan

The sub-committee reviewed its schedule of priority topics which currently includes:

- (1) status of ziphiids in the North Pacific and Southern Hemisphere;
- (2) systematics and population structure of Tursiops; and
- (3) fishery depredation by small cetaceans.

After a brief discussion, given that the priority topic at this meeting was limited to ziphiids of the North Atlantic, and in view of plans to hold the 2012 Annual Meeting in Panama, the sub-committee **agreed** that ziphiids of the North Pacific should be the priority topic. The Committee **endorses** this view.

The subject of 'marine bushmeat' had been suggested at the last meeting as a future priority topic and an intersessional e-mail discussion was held to consider this further. Details of progress can be found in Annex L and the e-mail group (Annex R31) will continue its intersessional work in the expectation of further discussion next year when a decision will be made on whether to put the issue on the list of Small Cetaceans sub-committee's priority topics for SC/65.

15. WHALEWATCHING

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

15.1 Assess the impacts of whalewatching on cetaceans

SC/63/WW1 summarised and reviewed several recent whalewatching research projects. Matsuda *et al.* (2011) observed behavioural effects of dolphin-watching boat traffic on Indo-Pacific bottlenose dolphins off Amakusa-Shinoshima, Japan; Visser *et al.* (2010) used a land-based vantage point to document that an increase in whalewatching vessels correlated with a decrease in resting and an increase in social behaviour of Risso's dolphins in the Azores; Seuront and Cribb (2011) investigated the diving behaviour of Indo-Pacific bottlenose dolphins from a land-based site overlooking the Port Adelaide River-Baker Inlet Estuary; Tseng *et al.* (2011) analysed behaviour of cetaceans in response to whalewatching activity in Taiwan; Donaldson *et al.* (2010) investigated the scope of anthropogenic injury to dolphins, behaviour of dolphins during feeding interactions and the correlation between rates of entanglement and boat strikes with provisioned dolphins; and Lachmuth *et al.* (2011) investigated the potential impacts of exhaust gases from whalewatching vessels on the population of southern resident killer whales in British Columbia, Canada and Washington State, USA. Detailed summaries are presented in Annex M, item 5.

SC/63/WW2 compared the behaviour of common minke whales in the presence and absence of whalewatching boats in Faxaflói, Iceland. Individual focal follows were conducted from a land site (control) and from commercial whalewatching boats (impact). The presence of boats influenced the interaction between dive interval and directness index. A relative increase in respiration rate in relation to directness index in the presence of whalewatching boats could reflect an increased energetic expenditure caused by avoidance behaviour. In addition, the long and relatively sinuous dives observed during control foraging behaviour were absent during interactions with whalewatching boats. The authors concluded that this foraging disruption could be of biological importance.

The authors also used photogrammetry to estimate the position of whales in relation to the whalewatching boat. This showed that results were not sensitive to field sampling errors and offers the possibility to have clear quality control and assurance procedures to ensure the reliability of data collected. Discussions and concerns expressed by some members of the sub-committee are detailed in Annex M, item 5.

SC/63/WW5 tested whether killer whales' tactics to avoid boats were mediated by the difference in risk factors different platforms might present. The authors compared variation in activity state disruption in killer whales during control conditions and three kinds of whale/boat interactions. The authors determined that the effect of boat presence on activity state transition probabilities changed depending on the type of boat present and that the observed avoidance strategies have different energetic consequences. Results and discussion are detailed in Annex M, item 5.

SC/63/WW7 reported on a study underway to assess the influence of whalewatching interactions on the behaviour of blue whales in Sri Lanka. The Committee noted that:

- (1) this paper had relevant information for the sub-committee on Southern Hemisphere whales;
- (2) welcomes studies on blue whales; and
- (3) encouraged the presentation of additional information from this study at future meetings.

SC/63/E9 raised concerns about the situation in the Dutch Caribbean, where there has been a rapid increase in marine tourism and recreational use of the coast with potential detrimental effects on cetaceans, including unregulated whalewatching. The authors urged the development of guidelines for interacting with marine mammals for the region. Discussion is detailed in Annex M, item 5.

15.2 Review whalewatching off Norway

Norway has among the most significant whalewatching industries in Europe, with an annual average growth of approximately 5% over the last 10 years. Table 2 of Annex M, Appendix 2 represents a web-based search of whalewatching operations in Norway. Although it covers the more established operations in mainland Norway, it may not include some of the smaller, more opportunistic operators that offer a variety of nature and fjord tours. In discussion of the importance of impact studies, it was reported that in Andenes, a study is being designed to do a before/after land-based exposure experiment, work that could become a component of the LaWE (see Item 15.3.1). The Committee **welcomes** this proposed experiment and **recommends** additional similar Norwegian research, especially as there may be increased development of whalewatching. Discussions on this issue are noted in Annex M, item 6.

15.3 Review reports from intersessional working groups

15.3.1 Large-scale whalewatching experiment (LaWE) steering group

SC/63/WW4 reported that thirty-five research groups holding data relevant to the LaWE proposal were willing to participate in the LaWE project. The steering group (Annex R32) is now in a good position to start power analyses as well as re-initiate some of the previously attempted meta-analyses. The next step will be to ensure that quality assurance/quality control protocols are in place which will require building a database with the data from various data holders. Given other commitments, this task cannot currently be carried out by the Secretariat. The Committee **agrees** that an interim option is to make use of time of an available research assistant to initiate data sharing under the auspices of the LaWE steering group, following procedures that will protect data holders' rights.

Most initial respondents were academic researchers (some contracted by government agencies) but there were fewer government-affiliated respondents than was desired. The Committee **recommends** that Commissioners encourage

their relevant government agencies to participate in the LaWE. The Committee **welcomes** news that ACCOBAMS is discussing whalewatching and that ACCOBAMS members may be able to provide data to the LaWE from the Pelagos Sanctuary; it **encourages** further collaboration with other relevant intergovernmental bodies on this topic.

15.3.2 LaWE budget development group

The importance of this intersessional e-mail group was noted, as the LaWE will require significant funding. Unfortunately the group's progress was delayed due to illness; a co-convenor was appointed to continue its work intersessionally and the group (see Annex R33) will report back to the Committee next year.

15.3.3 Online database for world-wide tracking of commercial whalewatching and associated data collection

An intersessional e-mail group was convened to guide the development of a database of whalewatching operations and associated data collection. A beta version of the database is now accessible on a private server and was made available to the sub-committee at the meeting for the first round of review and further development. Robbins will continue discussions with the programmer to provide feedback to ensure that the database contains information that is useful to the Committee (see Annex R34). The Committee **thanks** Robbins for this work.

It was also reported that an overview and preliminary inventory of currently existing whalewatching activities in the ACCOBAMS agreement area was presented at the meeting of parties (<http://www.accobams.net>). These data can contribute to the IWC's future online database.

15.3.4 Swim-with-whale operations

The Pacific Whale Foundation offered travel funds for beta testing the swim-with-whale questionnaire presented in Rose *et al.*, (2007); the Committee **welcomes** this news. The testing did not occur in the 2010/11 season but is set to occur in the 2011/12 season in the Dominican Republic, which has several swim-with-whale operators. Results will be presented next year.

In addition to the report, Scheer (2010) was considered. It reviewed 26 scientific publications on free-ranging swim-with-cetacean or provisioning encounters, including those involving 'lone sociable' dolphins. During discussion (detailed in Annex M, item 10), examples were provided of potentially dangerous behaviour by cetaceans. The Committee noted that sequences of behaviours might be used to predict if an injury will occur in encounters with cetaceans. An intersessional e-mail group has been established to work further on this topic (see Annex R35).

15.4 Other issues

15.4.1 Review scientific aspects of the report from the Commission's intersessional whalewatching workshop

IWC/63/CC6 reported on the conclusions of the IWC whalewatching workshop held in Puerto Madryn, Argentina from 3-5 November 2010. The workshop recommended that the Conservation Committee's Working Group on Whalewatching consider, as one of the primary methods for achieving the objectives of the Strategic Plan, the development of a web-based 'living' handbook on whalewatching. The handbook would provide advice on governance, capacity building, monitoring, compliance, business, community and education/training/communication. The Scientific Committee will be an important source for some of this information. IWC/63/CC3 reported the conclusions

of the Conservation Committee's Working Group on Whalewatching (CCWGW), which met in Paris in March 2011 to finalise a proposal for a 5-year strategic plan for whalewatching, taking into account the results of the whalewatching workshop. The proposal seeks Commission endorsement of the strategic plan and of establishing an ongoing role for the CCWGW over the life of the plan. Draft revised terms of reference for the future of the CCWGW are also attached in the report. It also proposed that the Working Group's membership be expanded to include two members of the Scientific Committee. Discussions of these two reports are detailed in Annex M, item 8.1.

In response to these reports, the Committee thanked the CCWGW for the opportunity to consider its report. As the proposal in IWC/63/CC3 has not yet been considered by the Conservation Committee, or the Commission, the Committee offered general, overarching comments to assist the Conservation Committee in its deliberations. A more formal and comprehensive review can be conducted at the next Scientific Committee meeting if requested.

The Scientific Committee has recognised the importance of rigorous science to underpin management of responsible whalewatching. In this regard, it welcomed the approach of establishing a joint Working Group on Whalewatching and the development of a Strategic Plan to guide the work on whalewatching in both the Scientific Committee and the Conservation Committee. The Scientific Committee believes that it is important that it is adequately represented in these discussions of a strategic plan to ensure that any specified scientific components are achievable. In accord with the discussions under Item 24 on co-operation with the Conservation Committee, it therefore **nominates** the chair and co-chair (who is also a member of the LaWE steering group) of the sub-committee on whalewatching to serve on this joint Working Group, along with one of the Chair of the Committee, the Vice-Chair or the Head of Science.

The Committee noted, but did not review, the extremely ambitious scale of the current, science-related work programme proposed in the draft strategic plan. After the Conservation Committee has reviewed this document from its own perspective, the Committee **looks forward** to providing review, revision, and scientific guidance on the nature and scale of priorities in the Strategic Plan, *inter alia* through the joint Working Group and during any future review processes. The Committee also **looks forward** to reviewing the terms of reference for the joint Working Group once the Conservation Committee has conducted its review.

15.4.2 Consider information from platforms of opportunity of potential value to the Scientific Committee

SC/63/WW3 presented the Pacific Whale Foundation's 'Whale and Dolphin Tracker' (WDT) software²⁷, a novel web-based data management system that provides real-time relative cetacean abundance and distribution data. The Committee **welcomes** the development of this software, especially its ability to be customised and the fact that it is free. The system can easily be disseminated to non-governmental organisations (NGOs) and the operator community; however, it was considered a challenge to distribute the software to governmental management agencies. The Committee **recommends** making this software available on the IWC website.

Ritter *et al.* (2011) presented results of a study using platforms of opportunity in the waters of La Gomera (Canary

Islands), where 23 cetacean species have been documented. Through collaboration between the NGO MEER and local whalewatching operators, a long-term sighting scheme covering 1995-2010 has collected data on relative cetacean abundance year-round from whalewatching vessels. Results and discussion are detailed in Annex M, item 8.2.

15.4.3 Review whalewatching guidelines and regulations

Carlson reported that the updated worldwide compendium of whalewatching guidelines and regulations will soon be online²⁸. The Committee recognised the value of the compendium, for example, in assisting countries, regional agreements (e.g. ACCOBAMS) and others to develop their own guidelines. The Committee **thanks** Carlson for her work and **agrees** that the Commission should continue to host the compendium on the website. It also **agrees** that next year it should review the guidelines²⁹ it developed several years ago (IWC, 1997b), with a view to updating them if necessary. Discussion is detailed in Annex M, item 8.3.

SC/63/WW1 summarised studies published over the preceding year relevant to the effectiveness of whalewatching guidelines: Schaffar *et al.* (2010) collected data on vessel interactions with humpback whales and resultant whale behaviour from a land-based vantage point in New Caledonia; and Kessler and Harcourt (2010) presented a review of swim-with-whale tourism in Tonga. The authors also conducted a survey of swim-with-whale tourists and gauged tourist support for various potential regulations for whalewatching trips. Further information on these studies is detailed in Annex M, item 8.3.

15.4.4 Review of collision risks to cetaceans from whalewatching vessels

SC/63/E4 reported on an extensive awareness campaign initiated in 2003-11 to address vessel collisions with whales. This campaign has resulted in an increase in the number of and accuracy of collision reports. Due to the awareness and concern for this issue, whalewatching vessels in the area have been very helpful to official efforts to respond in real time to ship strike reports, and this had resulted in the ability to gather useful *in situ* data from ship-struck animals. Discussion is detailed in Annex M, item 8.4.

SC/63/BC2 reported on a modelling exercise to determine the number of 'surprise encounters' and 'near misses' of humpback whales based on data collected systematically from a fleet of whalewatching vessels in Maui, Hawaii during the 2011 humpback breeding season. Further investigation is needed to determine if there is a whale age class or sex bias, or if certain individual whales are more likely to approach vessels and become involved in surprise encounters or near misses. Results and discussion are detailed in Annex M, item 8.4.

15.5 Work plan

There was considerable discussion within the Committee as to the focus of work for the sub-committee next year. The work plan prioritised the following primary item.

- (1) Assess the impacts of whalewatching on cetaceans (methods and results of changes in behaviour and movement patterns; methods and results of physiological changes to individuals; and methods and results of demographic and distributional changes).

Agent-based models (ABM) of cetacean behaviour are an emerging tool to simulate and test population

²⁷<http://www.pacificwhale.org/content/whale-and-dolphin-sightings>.

²⁸<http://www.iwcoffice.org/conservation/whalewatching.htm>.

²⁹<http://www.iwcoffice.org/conservation/wwguidelines.htm>.

consequences of disturbances. The sub-committee will: (a) review specific case studies of agent-based simulations used in assessing population consequences of disturbances, inviting participants that have implemented such models; (b) assess their suitability for its tasks; and (c) ascertain data requirements for such models to be implemented in case studies, as well as interacting with other sub-groups that have an interest in ABS (e.g. EM).

In addition, it will consider the following items.

- (2) Review reports from Intersessional Working Groups:
 - (a) Large-Scale Whalewatching Experiment (LaWE) steering group;
 - (b) LaWE budget development group;
 - (c) online database for world-wide tracking of commercial whalewatching and associated data collection;
 - (d) swim-with-whale operations; and
 - (e) in-water interactions.
- (3) Review the scientific aspects of the report from the Conservation Committee.
- (4) Review whalewatching in the region of the next meeting (Central America, in particular Bocas del Toro, Panama, was identified as a location of concern regarding whalewatching impacts on cetaceans and will be a subject of special attention for next year's sub-committee, with appropriate invited participants).
- (5) Consider information from platforms of opportunity of potential value to the Scientific Committee.
- (6) Review of and where appropriate recommend revision of the IWC whalewatching guidelines (IWC, 1997b) in conjunction with invited experts examining the efficacy of guidelines and regulations).
- (7) Review of collision risks to cetaceans from whalewatching vessels.

15.6 Other matters

Carlson presented the observer's report for the Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean (SPAW). One activity was related to the work of the Committee. A Marine Mammal Watching Workshop, a priority activity of the Marine Mammal Action Plan, will be held in Panama on 26-29 October 2011. Details of the workshop are in Annex M, item 10.

16. DNA TESTING

The report of the Working Group on DNA is given as Annex N. This particular agenda item has been considered since 2000 (IWC, 2001c; 2001d; 2001f) in response to a Commission Resolution (IWC, 2000).

16.1 Review genetic methods for species, stock and individual identification

SC/63/SD1 provided a comprehensive review of the Norwegian minke whale DNA register, including its logistics (sample collection on boats to DNA analysis), technical analyses (types of markers and analytical methods included) and uses of the data (scientific and management/monitoring). During discussion, emphasis was given to the technical aspects of the register. In addition to its well-demonstrated primary objective as a control organ to track and monitor legal trade of minke whale meat in Norway, the register has been used for a wide range of scientific purposes. These include among others species and hybrid identification of migrating whales (Glover *et al.*, 2010).

The Committee **welcomes** this comprehensive and clear review of the Norwegian DNA register. It was noted that although tedious, the double DNA isolation and analyses of each individual sample is important and useful for crosschecking and quality control.

SC/63/SD2 presented a brief summary of some simple experiments testing new materials for PCR amplification, which may be useful in streamlining identification analysis of whale products. Pre-aliquoted and dried 'AccuPower® PCR PreMix', amplification reagents (Bioneer, Inc., Alameda, California) were tested in side-by-side comparisons with standard materials for amplifying market products using a portable laboratory. More products were successfully amplified using AccuPower PreMix tubes (17/20 attempted) compared to PCR using standard methods (14/20 attempted) in two separate paired-sample experiments.

The Committee noted that the AccuPower products are stable at room temperature for at least two months and for a year in the freezer. This is a big advantage when shipping material.

16.2 Review results of the amendments of sequences deposited in *GenBank*

During the first round of sequence assessment (IWC, 2009h, p.347) some inconsistencies were found for some sequences assigned to right and minke whales but these appear to be due to a lag in the taxonomy recognised by *GenBank* or uncertainty in taxonomic distinctions currently under investigation (e.g. the number of species and appropriate names for recently recognised species of 'Bryde's whales').

In 2009, the Committee noted that the original submitter should be notified of the inconsistencies and a suggestion made that an amendment be made to the entry and Pastene was nominated to carry out this work. He duly contacted the relevant submitters encouraging them to make the relevant amendments. As a result, the notification regarding Bryde's whale taxonomy was made for four cases (out of nine cases) and the amendment in the case of minke whales only for one case (out of 23 cases). No amendments were made in the case of the right whale (ten cases).

In view of this lack of response, the Committee **requests** that an official letter is sent from the IWC Secretariat requesting the submitters to make the amendments in *GenBank*. Pastene will draft a letter for consideration by the Secretariat. In addition, the Committee **suggests** the addition of a field in *GenBank* where comments on taxonomy updates of the entries can be made. Cipriano will initially make an informal request to *GenBank* via a contact at NCBI but he will inform the Secretariat if a more formal request is required. The Committee **endorses** this approach.

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 2010. A total of 466 whales were landed in 2010 (see Annex N, Appendix 2).

The collection of samples in Japan is from scientific whaling in the Antarctic (JARPA II) and North Pacific (JARPNI II), bycatches and strandings. The collection includes coverage for 2010 throughout the 2010/11 Antarctic season. The Committee was informed that a total of 170 genetic samples of the Antarctic minke whale and two of the fin whale were collected from the 2010/11 austral summer survey of JARPA II. From JARPNI II in the western North Pacific (NP) samples stored in 2010 were: NP

common minke whale, $n=119$; NP Bryde's whale, $n=50$; NP sei whale, $n=100$; and NP sperm whale, $n=3$. The samples from bycatch stored in 2010 were: NP common minke whale, $n=124$; NP humpback whale, $n=9$; NP sei whale, $n=1$ and NP sperm whale, $n=1$. Genetic samples were stored for the following stranded whales in 2010: NP common minke whale, $n=9$; NP fin whale, $n=3$; NP humpback whale, $n=4$ and NP sperm whale, $n=11$ (see Annex N, Appendix 3).

The Committee was informed that some samples have been lost after the 11 March 2011 earthquake and tsunami and that there is a plan in Japan to keep genetic samples, DNA samples and data stored in more than one place in the future.

The collection of samples from Iceland in 2010 was from commercial catches: North Atlantic (NA) common minke whale, $n=59$; NA fin whale, $n=142$. Samples are currently in hand for all whales taken in 2003-10 (see Annex N, Appendix 4).

The Committee **welcomes** this information from Norway, Japan and Iceland.

16.4 Reference databases and standards for diagnostic registries

Genetic analyses have been completed and data on mtDNA, microsatellites and sex entered in the Norwegian register for all years through 2010 (see Annex N, Appendix 2).

For the Japanese register, the genetic analyses based on microsatellites have been completed for North Pacific common minke, Bryde's and sei whales taken by JARPN II through 2010. Laboratory work on mtDNA for these samples is being re-conducted after the tsunami. The genetic samples of Antarctic minke and fin whales sampled by JARPA II have not yet been analysed, except for sex and for microsatellites of 190 Antarctic minke whale samples taken in 2006/07 (six loci) and 551 taken in 2007/08 (six loci). For bycatch samples, genetic analyses based on mtDNA and microsatellites have been completed for all samples through 2010. Laboratory work is ongoing for stranded animals in 2010 for mtDNA, STR (short tandem repeats) and sex determination (see Annex N, Appendix 3).

For the Icelandic register, genetic analyses (mtDNA and microsatellites) were completed for common minke whales taken by scientific whaling from 2003-07. Laboratory work of samples taken under commercial whaling in 2006, 2007, 2008 and 2010 is underway. Genetic analyses have been completed for eleven minke whales taken in 2009. Genetic analyses have also been completed for fin whale commercial samples collected in 2006, 2009 and 2010 (see Annex N, Appendix 4).

Last year, the Committee recommended the adoption of a standard format for the updates of national DNA register to assist with the review of such updates in the future (IWC, 2011e, p.55). In addition, the Committee noted that the addition of a percent completed column for genetic analysis of tissue samples would assist in the annual review. Pastene worked intersessionally with colleagues from Norway, Japan and Iceland to produce a standard format.

The Committee **endorses** the format shown in Annex N, Appendix 5.

16.5 Work plan

Members of the Committee were encouraged to submit papers in response to requirements placed on the Committee by the IWC Resolution 1999-8 (IWC, 2000). Results of the 'amendments' work on sequences deposited in *GenBank* will be reported next year.

The following issues are high priority topics:

- (1) review genetic methods for species, stock and individual identification;
- (2) review of results of the 'amendments' work on sequences deposited in *GenBank*;
- (3) collection and archiving of tissue samples from catches and bycatches; and
- (4) reference databases and standard for diagnostic DNA registries.

Issues related to the work plan are dealt with under Item 22.

17. SCIENTIFIC PERMITS

This Agenda Item was discussed by the Working Group on Special Permits in two late afternoon sessions to enable all Committee members who wished to do so to attend. Bjørge was elected Chair of the Working Group. Reeves acted as Rapporteur, and the Working Group report has been directly incorporated here.

17.1 Review of results from existing permits

As in previous years, the Committee received short reports on activities undertaken but spent relatively little time on discussion of the details. For long-term programmes the Committee has agreed that regular periodic detailed reviews (following the guidelines in 'Annex P' – see below) were more appropriate. It was noted that this does not imply the Committee's support or disagreement with these programmes. General views on the permits from some members can be found in Annex P2 and a response to that annex by other members can be found in Annex P3 (and see Item 17.2.3).

17.1.1 JARPN II

AUTHORS' SUMMARIES

SC/63/O2 summarised results of the ninth cruise of the full-scale Second Phase of the Japanese Whale Research Programme under Special Permit in the western North Pacific (JARPN II) - offshore component - conducted from 9 June to 22 August 2010 in sub-areas 7, 8 and 9 of the western North Pacific. The objectives of the JARPNII are: (1) feeding ecology and ecosystem studies; (2) monitoring environmental pollutants in cetaceans and the marine ecosystem; and (3) elucidation of stock structure. Target species in the whale component of JARPN II are the common minke, sei, Bryde's and sperm whales. A total of five research vessels were used: one trawl survey vessel equipped with scientific echo sounder (TSV), one dedicated sighting vessel (SV), two sighting/sampling vessels (SSVs) and one research base vessel. The SSV's surveyed a total of 3,749 n. miles in a period of 75 days. A total of 15 common minke, 333 sei, 136 Bryde's, 193 sperm, 36 fin and 10 blue whales were sighted and a total of 14 common minke, 100 sei, 50 Bryde's and three sperm whales were sampled. All whales sampled were examined on board the research base vessel. Common minke whales fed mainly on Pacific saury (*Cololabis saira*), Bryde's whales on Japanese anchovy (*Engraulis japonicus*) and sei whales on copepods and Japanese anchovy. Dominant prey in the stomachs of the three sperm whales were various squid species that inhabit the mid-depth and deep waters. The 2010 survey was completed successfully and the data obtained will be used in the development of ecosystem modelling.

SC/63/O3 outlined results of the seventh survey of the JARPN II coastal component off Sanriku (southern part of sub-area 7) conducted from 22 April to 7 June in 2010 using four small-type whaling catcher boats and one echo

sounder trawl survey vessel. Sampling of common minke whales was conducted in coastal waters within 50 n. miles of Ayukawa port in the Sanriku district, and all animals sampled were landed at the research station established for biological examination. During the 47 days survey, a total of 8,957 n. miles was surveyed and 62 schools (62 individuals) of common minke whales were sighted. A total of 45 whales were sampled. Average body length was 6.02m (SD: 1.15, $n=18$) for males and 5.12m (SD: 0.99, $n=27$) for females. Dominant prey species found in forestomachs of the animals were Japanese sand lance (*Ammodytes personatus*) followed by krill (*Euphausia pacifica*). Japanese anchovy (*Engraulis japonicus*) were observed in only one of the animals sampled. The density of sand lance, as detected by echo sounder, was lower than in previous years, which could have affected the distribution pattern of common minke whales.

SC/63/O4 outlined results of the eighth survey of the JARPN II coastal component conducted off Kushiro, north-eastern Japan (middle part of sub-area 7CN). The survey was carried out from 7 September to 6 October 2010, using four small sampling vessels. Sampling of common minke whales was made in coastal waters within 50 n.miles of Kushiro port, and all animals sampled were landed at the JARPN II research station for biological examination. During the survey, a total of 4,152 n.miles (385.0 hours) was searched, 125 schools (126 animals) of common minke whales were encountered, and 60 animals were sampled. Average body length of males was 5.80m (SD=1.06, range=4.05-7.70m, $n=41$) and 5.44m (SD=0.63, range=4.49-6.86m, $n=19$) for females. Nine of the 41 males were sexually mature, but no mature animals were found among the 19 females. The dominant prey species detected from whale forestomachs was walleye pollock (*Theragra chalcogramma*, 60.0%), followed by Japanese anchovy (*Engraulis japonicus*, 36.7%) and unidentified fishes (3.3%). No other prey species were observed. The ratio of whales feeding on walleye pollock was highest in the present survey, in comparison with the previous surveys in 2002-09 (3.4-58.0%). Immature and mature whales fed on different prey species, even if they were collected in close proximity: immature animals took walleye pollock while mature animals tended to take Japanese anchovy. These results indicate a difference in feeding habits between immature and mature common minke whales off Kushiro in autumn as had been suggested by the results of previous surveys.

DISCUSSION

With respect to the intention of taking up to ten sperm whales, it was questioned why only three were taken, all within a day of each other in the same general location, when there were 96 sightings of sperm whales or sperm whale groups across a wide area. It was suggested that this could not be regarded as representative. It was noted that, in contrast, the full target number of sei and Bryde's whales had been taken.

Hatanaka explained that the sampling design was different for the three species and that for sperm whales the objective was qualitative rather than quantitative data. The target number for the sperm whale sample was given as ten or fewer and it was recognised that it would not be possible to sample across the whole study area every year. The area chosen for sampling in 2010 was one that had been rarely sampled in previous years. Hatanaka added that large sperm whales can be difficult to catch and handle; this may have played some role in the limited sampling in 2010.

It was noted that one of the three objectives of the JARPN II programme is to monitor environmental pollutants in cetaceans and the marine ecosystem. It was suggested that

concentrations of radionuclides, especially caesium-137, should be included under this objective and also that radionuclides may be useful for stock elucidation.

It was further noted that monitoring was needed because sand lance is an important food item of common minke whales off Sanriku and a fishery for these fish had been closed southeast of the Fukushima Daiichi Power Plant because caesium-137 levels exceeded the public health standard. However, it was recognised that to understand radionuclides in the waters off Japan, other cetaceans (e.g. finless porpoises and Baird's beaked whales) and other elements of the marine ecosystem would need to be monitored.

Japan explained that the spring Kushiro minke whale samples were being screened for radioactive contaminants on a regular basis and that a few whales had been found with traces of radioactivity at levels well under the provisional regulation value for food safety established by the Ministry of Health, Labour and Welfare. As to the potential for a long-term and extensive marine ecosystem study involving radioactivity, Japan expressed its willingness to consider this possibility.

17.1.2 JARPA II

AUTHORS' SUMMARIES

The 2010/11 Second Phase of the Japanese Whale Research Program under the Special Permit in the Antarctic (JARPA II) was conducted during the austral summer season (SC/63/O1). A dedicated sighting vessel (SV), two sighting and sampling vessels (SSVs) and one research base ship engaged in the research. Although the original plan was to conduct research in Area V (130°E-170°W) and Area VI West (170°W-145°W), the research activity was interrupted several times by violent actions of an anti-whaling group. The Government of Japan decided to withdraw the research vessels in the middle of the planned research period for the sake of crew safety, thus shortening the research period and resulting in cancellation of the research in the western part of Area V. The SV and one of the SSVs had to dedicate considerable time to the security task of dealing with obstructive activity of the anti-whaling group; therefore research was conducted on only 31 of 52 days from 29 December 2010 to 18 February 2011. A total of 170 Antarctic minke whales and two fin whales were caught. All whales caught were examined onboard the research base vessel. The number of Antarctic minke whales sighted greatly exceeded those of other species. The next most frequently sighted whales were humpback whales and fin whales. Most of the sightings of Antarctic minke whales were in the Ross Sea, where the extent of ice-free waters was much greater than in previous surveys. In contrast, humpback whales were seen north of the Ross Sea and concentrated at the ice edge in the mouth of the Ross Sea. Fin whales were found off the ice edge north of the Ross Sea. Distribution of these three rorquals around the Ross Sea was clearly separated. Biological samples from Antarctic minke whales showed that immature animals and mature males were found north of the Ross Sea whereas pregnant females were concentrated in the Ross Sea. These results showed that Antarctic minke whales are segregated by sex and maturity status in and outside the Ross Sea. It seems that early and geographically widespread melting of sea ice this season produced a large ice-free area in the Ross Sea and most mature female Antarctic minke whales entered the Ross Sea earlier than usual.

DISCUSSION

A question was raised concerning the representativeness of the lethal sampling of minke whales, considering that it

covered only two parts of the region where minke whales were observed. In response it was noted that the sampling was influenced by the activities of an anti-whaling organisation.

When asked to clarify the secondary killing methods for fin and minke whales, it was explained that for minke whales, use of an explosive harpoon was the primary method and a rifle was used as a secondary method. Nothing about the killing methods in 2010/11 differed from previous years.

17.1.3 Planning for a final review of results from Iceland – North Atlantic common minke whales

Víkingsson recalled that some delays in completion of the work had been reported at the last meeting but he was optimistic, at the time, that despite Iceland's economic difficulties, it would be possible to adhere to the original reporting time schedule. This would have meant that three months following this meeting, Iceland would submit reports for review by an expert Panel. However, there has been a serious setback in the work process because one of the main contributors has moved, causing an unavoidable delay in the completion schedule.

Some members expressed serious concern about this delay. Whilst the Government of Iceland had proposed its research whaling programme on the understanding that lethal sampling was needed to obtain vital information for management of marine resources, and having undertaken the work, it now appeared as though it had not set aside sufficient resources to complete the analyses and reporting on schedule. Víkingsson explained that it was not a matter of inadequate resources. The funds were available but it simply had not been feasible to hire appropriate replacement personnel as quickly as would have been necessary to meet the original schedule. The problem has now been addressed and it must be understood that the delay was for a practical reason - unforeseen and unavoidable.

Iceland proposed that under the circumstances, the process should be delayed by one year so that the Committee can consider the final report of the review Panel at its 2013 annual meeting. This would mean the document on likely methods to be used in the documents to the Workshop from Iceland is due by September 2012, at which time the Panel review process (IWC, 2009i) should begin. The Committee **agrees** with this proposal.

17.1.4 Planning for a periodic review of results from JARPA II

Japan reported that the first 6-year phase had been completed (2005/06 through 2010/11) and therefore the first periodic review is due to begin. Considerable laboratory and analysis work will be needed and it is anticipated that the review will occur in the same timeframe as that indicated above for the Iceland review. After a brief discussion it was agreed that undertaking two reviews in parallel is impractical and therefore the JARPA II review will be postponed to begin in September 2013.

17.2 Review of new or continuing proposals

The 11 March 2011 earthquake and tsunami had severe impacts on JARPA II/JARPN II data and samples. Japan provided a summary of these effects and this is given as Annex P1.

17.2.1 JARPA II

Japan reported that there was no plan to change the JARPA II programme.

17.2.2 JARPN II

Under the research plan for the Second Phase of the Japanese Whale Research Programme under Special Permit in the

Western North Pacific (JARPN II), which was submitted to the 56th IWC/Scientific Committee (Government of Japan, 2004), its coastal component has been conducted, since 2005, in two localities: spring survey off Sanriku (Miyagi Pref.) and autumn survey off Kushiro (Hokkaido Pref.). Annually a maximum of 120 common minke whales are sampled, up to 60 samples in each of the localities.

For the 2011 spring survey off Sanriku, which was originally scheduled to start in early April, logistical preparation had been in progress as in normal years. However, the situation completely changed after the earthquake and subsequent tsunami hit the northeastern part of Japan on 11 March 2011. There was no choice but to abandon plans of conducting the spring survey off Sanriku, at least in this year, since Sanriku region, including related infrastructure of Ayukawa port, was catastrophically damaged by the disaster. On the other hand, most of the other capabilities to conduct that survey (i.e. small type whale catcher boats, their crew members, land station workers, and researchers/scientists) were unaffected by the catastrophe.

Given this situation, Japan decided to carry out the spring survey off Kushiro, where survey infrastructure was not damaged by the earthquake and tsunami. The spring survey off Kushiro started on 25 April 2011 (and had not yet been completed as of 31 May 2011).

Sampling in spring off Kushiro has been a subject of interest under the objectives of JARPN II. That is, a combination of data sets obtained through sampling of common minke whales off Kushiro during their spring feeding/migration season as well as autumn feeding/migration season would improve understanding of the feeding ecology and migration pattern of this species in the western North Pacific.

The temporary change described above does not require an 'Annex P' Procedure because the shift of survey area in spring does not involve revision of the research plan for JARPN II (Government of Japan, 2004): (1) the objectives of the shifted spring survey remain the same; (2) the coastal component of JARPN II is to cover 'the coastal region (off the Pacific coast of northern Japan) in a part of sub-area 7', with no more detailed specification; and (3) there is no change in the sample size and species.

Separate from the change above, Japan also indicated that it was considering an improvement of the JARPN II research design by adding sub-area 11 to its research area without any change in species sampled or total sample size. It is expected that research in sub-area 11 would provide a 'window' to the Sea of Okhotsk ecosystem as well as important information on the stock structure of the western North Pacific minke whales. Japan requested clarification of whether an Annex P (IWC, 2009i) Procedure should be applied to such a modification of the research plan, showing its intention to follow the decision by the Committee. After some discussion, the Committee **agrees** that the proposed change would trigger the Annex P Procedure and Japan confirmed that it would submit a proposal for change in accordance with Annex P.

17.3 Procedure for reviewing scientific permit proposals and results

The Chair recalled that the Annex P Procedure (see IWC, 2009i) had been used only once so far, in the January 2009 review of JARPN II (IWC, 2010c). Following the expert workshop in 2009, two aspects of the Procedure were controversial, namely the admission of observers and the selection of experts to the review panel. As explained in the

report of last year's meeting (IWC, 2011e, pp.56-8), these issues had to do with how the Procedure was implemented, not the Procedure itself. Therefore the emphasis at this meeting was to discuss the two outstanding matters related to implementation but not to consider changing the Procedure as a whole.

17.3.1 Admission of observers

A fundamental principle underlying the Annex P Procedure is that reviews should be independent and objective.

At the first intersessional expert Workshop, held in January 2009 (IWC, 2010c), the procedure was as follows. In open sessions, Japanese scientists (hereafter the 'Proponents') presented papers on particular agenda items. The expert panel (hereafter the Panel) then asked questions of clarification and substance regarding the work that had been undertaken or further work expected to be undertaken. Following this, the Panel met in closed session to discuss its conclusions and begin drafting its report on individual items. At the end of the Workshop, the Proponents returned in open sessions for any further questions and to correct any misunderstandings. In addition, the draft report was shown to the Proponents following the Workshop so that they could comment on any technical misunderstandings in the text.

In discussions within the Committee at this meeting, there was general agreement that the inclusion of observers in the process can help provide transparency for stakeholders (although the view was expressed by one member that this might serve to increase polarisation within the Committee rather than decrease it as was one objective of Annex P).

However, there were a number of different views expressed on the role of the observers, including: (1) the selection of observers, including whether they should be limited to Committee members and whether 'balanced' representation should be sought; (2) whether or not they should be allowed to make interventions when recognised by the Chair; and (3) the need or otherwise for a limit on numbers. It was noted that it is a longstanding convention within the Committee that all members are entitled to attend intersessional meetings.

The general question of written submissions by observers and others was also discussed (in fact the rules already provide for any member to make a written submission and be able to request data under Procedure B of the DAA).

There was general agreement that Observers would be limited to Scientific Committee members and that written submissions (which should be scientific, relevant and suitable for consideration by the Panel) would have to be received by a deadline set by the Scientific Committee Chair, Vice-chair and Head of Science. Such submissions would be presented at the beginning of the Workshop.

17.3.2 Selection of members of the Expert Panel

Discussion of this item was much shorter than that of Observers. The selection of experts for the first review followed the Procedure closely but there was nonetheless dissatisfaction expressed by some members after the review (IWC, 2010d, pp.78-80) with the final Panel composition although much of this was also related to the availability of proposed invitees. Bjørge stated that the comments on this topic received from several members had been duly noted and he assured the Committee that those comments would be taken into account by the Chair, Vice-chair and Head of Science when they select the next review Panel.

In the specific case of the 2008 review, some of the problems arose because the venue was some distance away from the primary workplace of the Proponents (Institute of

Cetacean Research, Tokyo). This meant Proponents had to spend considerable time 'in the corridors' during closed sessions whereas they could have gone back to their offices if the workshop had taken place at their home institute. In the future, the Committee **agrees** that more thought should be given to where the review Workshop is held and how best to facilitate participation of Proponents in the open sessions.

The Chair clarified membership of the Standing Steering Group tasked with selecting the review Panel, as specified in Annex P (IWC, 2009i). The Standing Steering Group consists of the current Committee Chair and Vice-chair, the IWC Head of Science and the four most recent ex-Chairs of the Committee (i.e. Bjørge, DeMaster, Zeh and Bannister).

17.3.3 Conclusions

The Committee **agrees** that Annex P (IWC, 2009i) would continue to be used as the template for the next review and that the Steering Group would make every effort to take account of lessons learned from the first application of the new procedure.

The Committee requested the Scientific Committee Chair, Scientific Committee Vice-chair and Head of Science to develop draft guidelines specifying the terms under which Observers would be allowed to participate and characterising the types of individuals to be selected as experts (see Annex P4). The Committee **adopts** these guidelines as detailed below.

OBSERVERS

- (1) Committee members (hereafter referred to as observers) are allowed to attend the same sessions as the Proponents. They will not normally participate in discussions unless invited to do so by the Chair under special circumstances (c.f. the rule for observers to the Scientific Committee meeting).
- (2) Given the alternating open and closed sessions, Workshops shall be held in a venue convenient for the Proponents.
- (3) Any Committee member (whether or not an observer at the workshop) may submit reviews or analyses relevant to the review for consideration of the Panel following the agreed time frame outlined in Annex P4.
- (4) Admittance of observers has logistical implications for the hosting of the Workshop and deadlines for registering interest in attendance as an observer will be established and communicated as soon as practicable to the full Committee by email and on the website.

CHOICE OF PANEL MEMBERS

In addition to the guidance already provided in Annex P (IWC, 2009i), the Committee Chair, Vice-chair, Head of Science and the SSG (which is composed of the last four Committee Chairs) shall take into account the comments made in IWC (2010d, pp.78-80), recognising that some of the difficulties referred to reflected availability of proposed Panel members. The goal is to obtain a full, fair, independent, balanced and objective review, so careful efforts will be made to avoid any potential conflicts of interest (e.g. via directly relevant collaborations and/or publications). Emphasis will be given to including outside experts (non-Committee members) where appropriate but the precise balance will depend on the subject matter of any particular review. The Panel membership will include experts in the relevant field and/or analytical methods used in the Permit activities which may include those that are not specialists in whales.

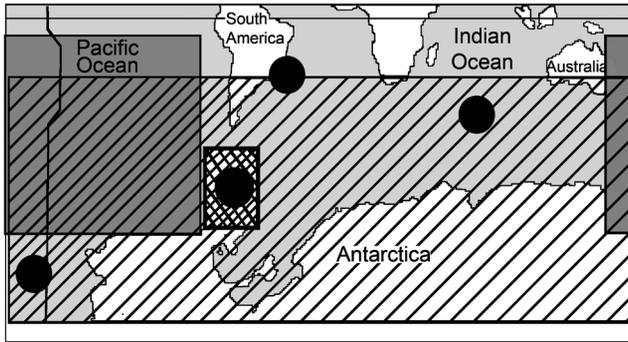


Fig. 5. Map showing approximate (existing and proposed) coverage of Southern Ocean Research Partnership (SORP) research projects. It should be noted that these locations are indicative only and these collaborative projects will draw on relevant non-lethal research from across the Southern Ocean and Antarctic waters. Legend: Diagonal lines - Antarctic Blue Whale Project and blue and fin whale acoustics project. Diamonds - Foraging ecology of minke and humpback whales. Black - Ecology of Antarctic killer whales (core areas shown but data included from all SO). Grey shades - Oceania humpback whales stock mixing.

18. WHALE SANCTUARIES

The Committee received no new documents under this Item relevant to proposals for IWC Sanctuaries. Papers on research within existing IWC Sanctuaries and papers dealing with other marine protected areas were considered by the relevant sub-committees and working groups.

19. SOUTHERN OCEAN RESEARCH PARTNERSHIP

The Southern Ocean Research Partnership (SORP) was proposed by the Australian Government to the IWC in 2008 (IWC, 2008b) with the aim of developing a multi-lateral, non-lethal scientific research programme that will improve the coordinated and cooperative delivery of relevant scientific information to the IWC. A framework and set of objectives for SORP were presented, discussed and endorsed last year (IWC, 2011e).

A single Plenary session was held to allow members who wished to attend to be able to do so without conflict with other sub-group meetings. The plenary session was chaired by Gales and rapporteured by Childerhouse. It was agreed that the report of those discussions would be incorporated directly into the Plenary report.

19.1 Intersessional progress

SC/63/O12 reported on the intersessional progress on SORP. Progress was made on the following major items:

- (1) further develop the SORP Antarctic Blue Whale Project (formerly known as the SORP Year of the Whale Project), including holding two technical workshops and the development of paper SC/63/SH3;
- (2) finalise development of the SORP projects and respond to comments received from SC/62 (SC/63/O13) – a workshop was held in Paris in March 2011 generously supported by the Government of France (the full report is available as Annex 2 in SC/63/O12);
- (3) provide interim funding – funding provided for three of the SORP projects to support research during 2010/11;
- (4) planning for future collaborative SORP Antarctic Whale Expeditions – an expedition led by Australia is planned for the austral summer of 2011/12 to support the development of the SORP Antarctic Blue Whale Project; and

- (5) progress reports from the SORP projects – available in SC/63/O12 for the 2010/11 period.

In addition, SORP was pleased to welcome Norway to the partnership.

These items are covered in more detail below. It was noted that a full discussion of the SORP Antarctic Blue Whale Project (SC/63/O12) had taken place in the sub-committee on Southern Hemisphere whales and is reported in more detail in its report (Annex H) and under Item 19.2.5 below. It was also noted that SORP has now moved into a period of implementation from a period of planning and that future work will be focussed around supporting the delivery of results from these projects.

19.2 SORP projects (SC/63/O13)

The existing SORP projects were revised following comments and feedback received from Scientific Committee last year. A summary of revisions made to the project proposals are included below with further details available in the report of the SORP Paris Workshop (Annex 2 in SC/63/O12). An approximate geographic distribution of the projects is provided in Fig. 5.

19.2.1 Killer whales in the Southern Ocean

More detail of the analytical and conceptual framework was requested last year and this has now been added to the project description. In addition, the project investigators provided a broad description of the framework that underpins that collaborative work and outlined how different research groups will work together to undertake large analyses of data from the different regions. The investigators have also been in contact with other killer whale researchers in the Southern Ocean, including from South Africa and Italy, with a view to including them in the collaboration.

19.2.2 Foraging ecology and predator prey interactions of whales and krill

Comments last year related to the feasibility of scaling up this research from the small scale to the medium/large scale and also on the reliability of estimating gulp volume. The investigators provided additional details in response to these issues in the revised project description. With respect to scaling up the study to a larger scale, they agreed that this will require complex modelling but that the primary aim of the project was to provide robust data at a small scale in the first instance. They also noted that they would undertake sensitivity studies of parameters in estimating gulp volume to assess reliability of the estimation procedure. Gales provided some additional detail of revisions to the project including a new component added to the project of satellite tagging of minke whales and humpback whales in April/May 2012, which will include the collection of summary dive data and surface intervals. This research will also integrate with a large scale, long term ecosystem study (LTER) which is collecting information about other predators and prey within the region. The research areas for this work will be Margarite Bay in the south and the Guerlache Strait in the north. There was a question about how diet and consumption rates will be estimated from this study and a detailed description of these techniques is provided in Appendix 2 in SC/63/O13. It was noted that biopsy samples will be collected from all whales tagged and instrumented.

19.2.3 Oceania humpback mixing

Last year comments included a discussion that tagging should be focused on feeding rather than breeding grounds. The investigators agreed that while this would be helpful

they noted that the area to the south of Australia and the South Pacific was difficult for logistic operations and, while they were hopeful of future tagging opportunities on the feeding grounds, these were uncertain and so had focussed efforts on breeding grounds which were considerably more accessible. There was a call for additional collaborators on this project, reflected in papers presented at this meeting (e.g. SC/63/SH10, SH16). In discussion, it was noted that this work would benefit from a broader geographic coverage (e.g. extending out to the Antarctic Peninsula) and the integration of such data would strengthen the work. This work should also take into account existing analyses that have been presented at this meeting (e.g. SC/63/SH9). The Committee **recommends** that future biopsy sampling of individuals on feeding grounds should focus on Area V East and Area VI, both of which only have a limited number of samples available. While there are few vessels, operating in the area, it would be a good idea to make the most of vessels that are operating in the area. With respect to the genetic analysis, it is important to note that there is a gap in most analyses from East Australia and this should be considered and rectified if possible. One output from this project, SC/63/SH10, includes some data from Eastern Australia but this needs to be expanded to include more Antarctic samples.

19.2.4 *Fin and blue whale acoustics*

The first year of this project was delayed until 2011/12 as key personnel were unavailable. However, substantial progress has been made in the intervening period which has allowed for considerable additional development and planning to be completed. A range of issues were raised last year in relation to this project.

The investigators have revised the project in response to these issues in the following ways. The data sets to be included in this work have been expanded to include more geographical and temporal coverage. Additional details of analytical methods have been provided in the revised proposal, including references to existing and closely related research. There has also been a careful consideration of potential deployment sites for the acoustic loggers that take account of both whale distribution and density and also areas where logistical support is likely to be available over the long term (e.g. well-travelled vessel routes for supply of Antarctic bases). The collection of other environmental and oceanographic data from these loggers was encouraged as it would aid in the interpretation of the acoustic data but also allow collaborative research and cost sharing with other research programmes. It was noted that the Australian Antarctic Division was continuing development of low cost, robust acoustic loggers that could be readily deployed and retrieved (e.g. without a need for specialised, technical personnel) allowing their widespread use around the Antarctic.

The first year of this project will involve analyses of continuous Comprehensive Test Ban Treaty Organisation (CTBTO) data set from Cape Leeuwin, Western Australia over the last 8 years. It was noted that this work will not focus on exploring the sensitivity of acoustic data in detecting relative trends but that this site will only provide information about blue whales in the vicinity of the recording station. The project will focus on the southern Indian Ocean and associated Antarctic waters due to substantial existing data sets and access to the region. It was noted that there is considerable acoustic data available from the IDCR/SOWER surveys that could be incorporated in this research. In the first instance, this project will focus on analysis of

long term data sets that can be used to assess trend but as this project matures, other data sets will be incorporated as appropriate.

19.2.5 *SORP Antarctic Blue Whale Project*

This project was previously referred to as the Year of the Whale Project but as it has developed, the focus has shifted to Antarctic blue whales. It was noted that a full discussion of the SORP Antarctic Blue Whale Project had taken place in the sub-committee on Southern Hemisphere whales and is reported in more detail there (see SC/63/SH3 and Annex H). The specific objectives of this initiative are to:

- (1) provide a circumpolar abundance estimate for Antarctic blue whales;
- (2) improve understanding of Antarctic blue whale population structure;
- (3) improve understanding of connectivity between blue whale feeding and breeding grounds; and
- (4) characterise foraging habitat of blue whales.

During the intersessional period, and relying heavily on the previous work of Trevor Branch, the group explored how much effort would be required to estimate circumpolar abundance of Antarctic blue whales with a reasonable CV, both for line transect and mark-recapture methods and the feasibility of achieving the required effort. These analyses are described in SC/63/SH3.

Given the low encounter rate of Antarctic blue whales, there was some discussion over use of mark-recapture methods in preference to a line-transect approach, particularly before the feasibility of the acoustic-assisted mark recapture methodologies had been established. The comparability of mark-recapture estimates with those derived from IDCR/SOWER was also considered. The development of new methods, in particular determining how acoustics can augment encounter rates to enable the targeting of 'hot spots' of high density blue whale areas to support this work, is critical in ensuring the successful completion of this project. It was noted that whereas line transect techniques sample space, mark recapture techniques sample animals and that the latter can be efficient if methods to locate concentrations of whales are effective. Both approaches can generate robust estimates if implemented appropriately. Furthermore, one of the benefits of this project relates to the legacy of the data collected from it, and in particular, the biopsy samples and photographs for individual identification.

There was general agreement that while this is an ambitious project, progress in developing the project has been excellent. It was noted that there was considerable support for this project from many countries within the partnership and it is expected to receive firm practical support once the developed proposal is available.

In conclusion, assuming that feasibility studies prove successful, the Committee **endorses** the following general conclusions based on the analyses provided in SC/63/SH3 (see Annex H):

- (1) a circumpolar abundance estimate for Antarctic blue whales was an appropriate primary objective of a large-scale project of the SORP;
- (2) any effort will involve a diversity of research vessels and countries and so the prescriptive protocols of a line-transect (LT) approach would be logistically very difficult to implement;
- (3) a mark-recapture approach, using photo-ID and genetics - augmented with the use of acoustics to increase encounter rate and by the targeting of identified blue whale hot spots - was the most appropriate approach

Table 10
Proposed funding for SORP projects (GBP).

Description	Amount	Totals
Blue and fin whale acoustics		
Coordinator	32,500	
Steering Group meeting	7,800	40,300
Oceania humpbacks		
Coordinator	3,900	3,900
Humpback and minke foraging ecology		
Coordinator	11,700	11,700
Killer whale ecology		
Coordinator	11,700	11,700
Living whales symposium		
Chilean organisation team	5,200	
Scientific programme coordinator's time	6,500	
Meeting costs	11,700	23,400
Antarctic Blue Whale Project		
Coordinator	11,700	
Technical meeting	9,750	21,450
SORP Steering Committee		
Support of travel to Annual Meeting	9,750	9,750
TOTAL		122,200

to achieve the stated objectives given the likely nature of a cooperative effort through the SORP i.e. the surveys will be undertaken by a wide range of vessels for varying amounts of time, over a number of years, putatively starting around the 2013/14 summer season;

- (4) a dedicated paid coordinator will be essential for the success of this initiative given the magnitude of the logistical challenges.

Future work will focus on: (1) fieldwork to develop acoustic methods to help increase blue whale encounter rates; and (2) developing the specifics of where and when effort will be required within a mark-recapture framework, in order to better assess the logistical and financial practicalities of undertaking the research, especially in term of the feasibility of being able to obtain the required number of vessels. This will allow the Committee to determine whether it is feasible to proceed.

19.2.6 Non-lethal research techniques symposium

Planning for this symposium is well advanced and a programme has been developed that will cover significant advances in non-lethal research techniques and their application to key research questions in the Southern Hemisphere. The draft programme consists of four sessions covering:

- (1) molecular techniques;
- (2) biologging;
- (3) remote sensing; and
- (4) long term data sets.

For each component there will be a key note speaker, some detailed case studies, followed by a panel discussion. The symposium will be followed by four workshops covering:

- (1) health assessment of live whales;
- (2) advances in tagging attachment techniques;
- (3) ageing techniques; and
- (4) the estimation of diet and consumption rates.

For operational reasons, the symposium will take place from 27-29 March 2012 in Puerto Varas, Chile. It will be supported by the Chilean Ministry of Foreign Affairs and the Chilean Navy. The target audience will include Committee members (who will be able to provide updated information to Commissioners) and Southern Hemisphere cetacean researchers who will have the opportunity to learn about these research techniques and their application to specific Southern Hemisphere research and conservation issues. The associated workshops will provide an opportunity for experts from around the world to provide direct advice and support in the development and implementation of new research projects in the Southern Hemisphere. The question of sample sizes required for the SORP projects is considered in the project plans themselves (SC/63/O13). The IDCR/SOWER programme has been added to the programme in recognition of its outstanding contribution to the work of the Committee for three decades.

19.2.7 Research priorities

The SORP projects developed over the last two years have been the subject of considerable discussion in Scientific Committee and also in several intersessional meetings. Throughout this time, there has been regular review of the research priorities of the projects, and each project proposal contains specific reference to previous Committee recommendations. It was suggested that when considering priorities for SORP projects, there should be higher priority given to projects that have the potential to provide data that will be useful in assessments carried out by the Committee. In discussion, it was recognised that a range of criteria can be used to establish the priority for the projects and these will be considered if projects need to be reviewed.

19.3 Budget

The IWC has a budget specifically related to the work of SORP established with a contribution from Australia in 2008. The Committee **endorses** the budget given in Table 10 to support coordination and planning for SORP projects.

Table 11
Intersessional workshops and meetings.

Subject	Agenda Item	Venue	Dates
WNP common minke whales <i>Implementation Review</i>	6.3.2	Tokyo, Japan	12-16 December 2011
AWMP gray whale <i>Implementation Review</i> and Greenland hunt <i>SLA</i> development	8.2-8.4	La Jolla (USA) or Copenhagen (Denmark)	Last two weeks in March 2012
Antarctic minke whale abundance	10.1.1	Bergen, Norway	February 2012
Arabian Sea humpback whales	10.2.2.2	In the region	Not yet decided
Southern Hemisphere right whales	10.5.1	Puerto Madryn, Argentina	13-16 September 2011
IWC-POWER	10.7.4	Tokyo, Japan	26-30 September
Marine Renewable Energy Developments and Cetaceans	12.6	Panama City, Panama	Pre-meeting
SORP non-lethal research techniques	19.2.6	Puerto Mundt, Chile	March 2012
Genetic guidelines	11.1	Cambridge, UK	Spring 2012
JARPN II Expert Panel (if required)	17.2.2	Tokyo	February 2012

19.4 Work plan

Work plan items include:

- (1) specific work plans for individual SORP projects are listed in each project plan (SC/63/O13);
- (2) intersessional work and a technical meeting for planning the SORP Antarctic blue whale project and developing a comprehensive project proposal for the next annual meeting; and
- (3) work of the intersessional email group (Annex R37) for developing and running the non-lethal techniques workshop.

20. RESEARCH AND WORKSHOP PROPOSALS AND RESULTS

Table 11 lists the proposed intersessional meetings and workshops. Financial implications and further details are dealt with under Item 23.

20.1 Review results from previously funded research proposals

Research results from previously funded proposals are dealt with under the relevant agenda items.

20.2 Review proposals for 2011/12

No unsolicited research proposals were received this year. Proposals for the voluntary fund for small cetaceans were discussed under Item 14.3 and those relating to SORP are discussed under Item 19.

21. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2012 MEETING

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 (IWC, 2004a, p.51) and this was based on the recommended workplans developed by sub-committees and the general discussion of these within the Committee. The Committee recognises that priorities may have to be reviewed in light of decisions made by the Commission. 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. This information should be included on the website when the information about document submission is published next year.

Revised Management Procedure (RMP)

The following issues are high priority topics:

GENERAL ISSUES

- (1) refine the data and assumptions on which the meta-analyses of environmental impacts on growth rate and of increase rates at low population size are based;
- (2) complete the MSYR review;
- (3) specify and run additional trials for testing amendments to the *CLA*;
- (4) finalise the approach for evaluating proposed amendments to the *CLA*;
- (5) evaluate the Norwegian proposal for amending the RMP;
- (6) modify the Norwegian 'CatchLimit' program to allow variance-covariance matrices to be specified for the abundance estimates. Compare the results from the modified program with those from the 'accurate' version of the Cooke program for some cases; and

- (7) run the full set of revised results for the North Atlantic fin whales, the Western North Pacific Bryde's whales, and the North Atlantic minke whales using the Norwegian 'CatchLimit' program and place the results on the IWC website (carry over from the 2010 work plan).

PREPARATIONS FOR IMPLEMENTATIONS

The Committee is concerned over the feasibility of its future timetable of work, particularly given the delay in the western North Pacific common minke whale *Implementation Review*. It has previously noted that it was not possible to undertake two major *Implementations* or *Implementation Reviews* simultaneously (IWC, 2011e, p.65). This will be taken into account when discussing Items 1, 3, 4 and 5 below next year.

- (1) prepare for the 2013 *Implementation Review* for the western North Pacific Bryde's whales;
- (2) examine whether and when the optimisation method used when conditioning trials fails to find the actual minimum of the objective function and any implications of this for previous results of *Implementation Simulation Trials*;
- (3) review a revised research proposal for North Atlantic fin whales for the 'variant with research' to be submitted to the 2012 meeting;
- (4) prepare for the 2014 *Implementation Review* for North Atlantic minke whales³⁰;
- (5) prepare for the 2014 *Implementation Review* for North Atlantic fin whales; and
- (6) review a proposal for a *pre-Implementation assessment* of North Atlantic sei whales.

IMPLEMENTATION FOR THE WESTERN NORTH PACIFIC MINKE WHALES

- (1) review results of intersessional workshop; and
- (2) complete the work assigned to the 'First Annual Meeting' in accordance with our guidelines.

Aboriginal Whaling Management Procedure (AWMP)

The following issues are high priority topics:

- (1) continue work on the development of *SLAs* for the Greenlandic hunts with a focus on common minke whales and fin whales;
- (2) complete the *Implementation Review* for eastern gray whales with a focus on the PCFG;
- (3) complete an *Implementation Review* for B-C-B bowhead whales;
- (4) develop guidelines for *Implementations* and *Implementation Reviews*;
- (5) provide management advice for the appropriate subsistence hunts; and
- (6) review the Greenlandic programme to provide information on conversion factors.

Bowhead, Right and Gray whales (BRG)

The following issues are high priority topics:

- (1) review any new information on North Pacific gray whale stock structure and movements, and if necessary, provide information to the SWG of AWMP relevant to the *Implementation Review*;
- (2) review stock structure and abundance in more comprehensive manner for Eastern Canada and West Greenland bowhead whales, if appropriate data and analyses are provided;

³⁰As the original *Implementation* was undertaken in 1993 before the Requirements and Guidelines for *Implementations* were developed, a fuller *Implementation Review* is appropriate.

- (3) review the report of southern right whale workshop to be held in Argentina during September 2011; and
- (4) review new information on all stocks of right whales, western North Pacific gray whales, and small stocks of bowhead whales.

In-depth assessment (IA)

The following issues are high priority topics:

- (1) to further resolve the reasons for the differences between estimates of abundance of Antarctic minke whales between the OK and (hazard-probability and trackline conditional independence) SPLINTR models, and thus provide agreed estimates of abundance at next year's meeting;
- (2) to apply the statistical catch-at-age models using the full suite of available data so that the results may be considered at next year's meeting; and
- (3) to continue the examination of the differences between minke whale abundance in CPII and CPIII, by further investigation of the relationship between sea ice and minke whale abundance.

Bycatch and other human-induced mortality (BC)

The following issues are high priority topics:

- (1) collaboration with FAO on collation of relevant fisheries data and joining FIRMS;
- (2) progress in including information in National Progress Reports;
- (3) estimating risk and rates of bycatch and entanglement;
- (4) development of methods to estimate mortality from ship strikes;
- (5) continuing development and use of the international database of ship strikes; and
- (6) review of information on other sources of mortality.

Stock Definition (SD)

The following issues are high priority topics:

- (1) review draft guidelines for genetic analyses and DNA data quality;
- (2) statistical and genetic issues concerning stock definition;
- (3) TOSSM; and
- (4) terminology review and unit-to-convert.

DNA (DNA)

The following issues were high priority topics:

- (1) review genetic methods for species, stocks and individual identifications;
- (2) review of results of the 'amendments' work on sequences deposited in GenBank;
- (3) collection and archiving of tissue samples from catches and bycatches; and
- (4) reference databases and standard for diagnostic DNA registries.

Environmental Concerns (E)

The following issues were high priority topics:

- (1) SOCER;
- (2) review progress on POLLUTON 2000+ Phase II;
- (3) review progress of CERD working group;
- (4) review new information on effects of anthropogenic sound on cetaceans and approaches to mitigate these effects;
- (5) review progress on recommendations from Climate Change Workshops;
- (6) update plans for an Arctic Anthropogenic Impacts on Cetaceans Workshop; and

- (7) review marine renewable energy development pre-meeting.

Ecosystem modelling (EM)

The following issues are high priority topics:

- (1) explore how ecosystem models might contribute to developing scenarios for simulation testing of the RMP;
- (2) review other issues relevant to ecosystem modelling within the Committee;
- (3) review ecosystem modelling efforts undertaken outside the IWC; and
- (4) review any new information on ecosystem model skill assessment.

Southern Hemisphere whales other than Antarctic minke whales (SH)

The following issues are high priority topics:

- (1) Southern Hemisphere humpback whales:
 - (a) begin assessment of breeding stocks E and F;
 - (b) review new information from the Arabian Sea;
 - (c) review new information from other breeding stocks; and
- (2) review new information on Southern Hemisphere blue whales in preparation for assessment.

Small cetaceans (SM)

The following issues are high priority topics:

- (1) status of Ziphiids in the North Pacific;
- (2) voluntary funds for small cetacean conservation research;
- (3) review progress on previous recommendations; and
- (4) review takes of small cetaceans.

Whalewatching (WW)

The following issues are high priority topics:

- (1) assess the impacts of whalewatching on cetaceans.

Additional items:

- (2) review reports from intersessional Working Groups:
 - (i) Large-Scale Whalewatching Experiment (LaWE) steering group;
 - (ii) LaWE budget development group;
 - (iii) online database for world-wide tracking of commercial whalewatching and associated data collection;
 - (iv) swim-with-whale operations; and
 - (v) in-water interactions;
- (3) review the scientific aspects of the report from the Conservation Commission;
- (4) review whalewatching in the region of the next meeting;
- (5) consider information from platforms of opportunity of potential value to the Scientific Committee;
- (6) review of whalewatching guidelines and regulations; and
- (7) review of collision risks to cetaceans from whalewatching vessels.

Scientific Permits

The following issues are high-priority topics:

- (1) review of activities under existing permits;
- (2) review of new or continuing proposals;
- (3) review results of specialist meeting to review the modified JARPN II special permit, if submitted; and
- (4) plan for final review of results from Iceland's scientific take of North Atlantic common minke whales.

Table 12
Computing tasks/needs for 2011/12.

RMP – general issues

Specify and run additional trials for testing amendments to the *CLA* (in conjunction with the working group) (Item 5.2).

Collaborate with Norwegian Computing Center to modify the ‘CatchLimit’ program to allow variance-covariance matrices to be specified for the abundance estimates and compare results with those from the ‘accurate’ version of the Cooke program for some cases (Item 5.5).

Examine whether and when the optimisation method used when conditioning trials fails to find the actual minimum of the objective function and any implications of this for previous results of *Implementation Simulation Trials* (Item 5.7).

Complete runs of the full set of trials using the Norwegian ‘CatchLimit’ program for North Atlantic fin whales, Western North Pacific Bryde’s whales; and North Atlantic minke whales and place the results on the IWC website (IWC, 2011e, p.7).

RMP – preparations for Implementation

Refine input data, diagnostics and control program for running WNP common minke whale trials and complete conditioning (Item 6.3).

AWMP

Validate the control program and the code for implementing the PCFG hunt, condition all of the trials and conduct all of the projections (Item 8.2).

In-depth assessment

Validate data from the 2010 Japan/IWC Joint Cetacean Sighting Survey in the North Pacific for incorporation into the DESS database (Item 10.7.1.1).

Complete validation of the 1995-97 blue whale cruise data and incorporate into the DESS database.

Prepare a catch series for North Pacific sei whales (see Item 10.8).

Southern Hemisphere whale stocks

Documentation of the catch data available for Antarctic minke whales in preparation for the *pre-Implementation assessment*.

Bycatch

Input bycatch data from the last season (2010) and for previous seasons into the bycatch database.

22. DATA PROCESSING AND COMPUTING NEEDS

The Committee identified and agreed the requests for intersessional work by the Secretariat given in Table 12.

23. FUNDING REQUIREMENTS FOR 2011/12

Table 13 summarises the complete list of recommendations for funding made by the Committee. The total required to meet its preferred budget is £424,000. The Committee **recommends** all of these proposed expenditures to the Commission.

However, it understands that the projected amount available for funding is about £325,000. Following some initial suggestions produced by the Convenors group, the Committee therefore carefully reviewed the proposed 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-groups in its priority topics. Progress will not be possible in some important areas, as outlined below and the Committee **strongly 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 £328,700.

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 Table 13.

Aboriginal Whaling Management Procedure

(1) WORKSHOP ON GREENLANDIC HUNTS AND COMPLETION OF THE GRAY WHALE IMPLEMENTATION REVIEW WITH AN EMPHASIS ON THE PCFG

The Committee has a number of priority areas related to the Greenlandic hunts and an intersessional Workshop is required ensure adequate progress to allow the highest priority work (development of *SLAs*) to be achieved prior to the 2017 meeting, particularly for the complex cases of common minke whales and fin whales. The objectives of the Workshop are to:

- (1) begin the process of developing operating models to allow the development of *SLAs* for West Greenland fin and common minke whales by investigating the current structure for RMP *Implementations*;
- (2) review the conditioning for the gray whale *Implementation Review*, review the initial results of trials and develop a final set to allow completion of the review at the 2012 Annual Meeting; and
- (3) given the major development and review work scheduled for the next 5 years, develop guidelines for *Implementations* and *Implementation Reviews* for adoption at the 2012 Annual Meeting.

(2) AWMP DEVELOPERS FUND

The developers fund has been invaluable in the work of *SLA* development and related essential tasks of the SWG. It has been agreed as a standing fund by the Commission. The primary development tasks facing the SWG are for the Greenlandic fisheries. These tasks are of high priority to the Committee and the Commission. The fund is essential to allow progress to be made and it has already been reduced from the initial target level of £15,000.

Bycatch and other human-induced mortality

(3) SHIP STRIKE DATA COORDINATOR

Data on collision incidents are required for assessing the conservation implications for whale populations including understanding how different factors affect collision risk. The IWC has been developing a global ship strike database since 2007 to contribute to better assessment of ship strike incidents. In 2010, the Committee recommended that consideration be given to the appointment of a dedicated coordinator for the IWC ship strike database, noting this is the practice for other similar successful databases of this scale. A data entry system has been available on the web for two years but utilisation has been limited. A dedicated coordinator could improve outreach to potential data holders to encourage data entry. The ongoing development of the database requires data gathering, communication with potential data providers and data management. This proposal is for a part-time post initially for 3 months a year with the tasks described in detail in Annex J, Appendix 3, travel and miscellaneous expenses. The reduced budget will slow down progress considerably as the work will need to continue on a voluntary basis as at present. Focus will need to be on member governments with existing data working to find ways to incorporate this satisfactorily in the database.

Bowhead, right and gray whales

(4) CONTINUATION OF FUNDING FOR SOUTHERN OCEAN RIGHT WHALE CATALOGUE

In 2010, the Commission approved funding to establish the Southern Ocean right whale catalogue. The catalogue aims to be a depository of right whale sightings south of 40°S for comparison with coastal catalogues. SC/63/BRG19 summarises the progress to date on the development of the

catalogue. Data will be shared with users of the catalogue as per conditions set by the provider of the photographs following the protocol used by the administrators for the Antarctic Humpback Whale Catalogue (Allen *et al.*, 2010). The catalogue is not complete. This year, right whale photographs taken during IDCR/SOWER cruises will be included, while efforts continue to expand the scope of the catalogue by including data collected opportunistically e.g. through the British Antarctic Survey, the Japan/IWC blue whale cruise (1995/96) and Antarctic eco-tourism cruise ships. This proposal seeks funds to continue the sourcing and cataloguing of right whale photographs and maintenance of the database. A trial version of the catalogue should be available for demonstration at the proposed right whale workshop in September 2011. The reduced funding will allow the catalogue development to continue but will slow development considerably.

(5) SOUTHERN RIGHT WHALE ASSESSMENT WORKSHOP

This Workshop has been planned for over two years and is scheduled for 13-16 September 2011 in Puerto Madryn, Argentina. The objectives of the Workshop are:

- (1) the examination of current understanding of distribution and population structure in the Southern Hemisphere;
- (2) the examination of current stock size and recent population trends;
- (3) biological parameters;
- (4) update and review threats to SRW populations and status;
- (5) identification of feeding grounds and links with nursery/breeding grounds;
- (6) food, feeding and links with productivity/survival;
- (7) update on historical catches and estimates of original population size;
- (8) future research needs and conservation plans by region; and
- (9) review progress on establishment of Southern Ocean Right Whale Photo-Identification Catalogue.

(6) PACIFIC WIDE STUDY ON POPULATION STRUCTURE AND MOVEMENTS PATTERNS

Results regarding mixing of western and eastern gray whales illustrate the great conservation and management importance of a more comprehensive examination of gray whale movement patterns and population structure in the North Pacific. For such an effort to be successful it must be international and collaborative. To facilitate this, and noting the existing safeguards for collaborators provided under the Committee's Data Availability Agreement, it recommended that a collaborative Pacific-wide study be developed under the auspices of the IWC, recognising that *inter alia* this will contribute to the Committee-endorsed Conservation Plan for Western North Pacific Gray Whales and incorporate previous recommendations made by the Committee. Such a study will involve collaborative analysis and sharing of existing data as well as the collection of new data. To facilitate development of the programme and ensure that work on some sub-projects begins as soon as possible, these funds are required to compile a list of existing photo-identification and genetic samples (and research groups holding these samples) and to compare the western gray whale catalogues to Mexican gray whale catalogue and to compare the PCFG catalogue to the Mexican gray whale catalogue. The reduced budget will allow for the first objective to be met during the forthcoming year.

Environment

(7) CONTRIBUTION TO THE PRODUCTION OF THE STATE OF THE CETACEAN ENVIRONMENT REPORT (SOCER)

SOCER is a long-standing effort to provide information to Commissioners and Committee members on environmental matters that affect cetaceans in response to several Commission resolutions. The focus for 2012 will be on the Indian Ocean. Funds are for salaries, library services and printing. The reduced budget may mean delay of the SOCER for one year.

(8) POLLUTION – RISK ASSESSMENT MODELLING – 2ND YEAR OF A 2-YEAR PROJECT

This funding request is for Year Two of the modelling project for Pollution 2000+. SC/63/E5 reported the progress of the modelling exercise for the first 6 months of work. The completion of the Year One and of Year Two will result in allow the Committee to make substantial progress on a better understanding of the impacts of pollutants on cetacean populations. Year Two will finish items 1-4 outlined below. Progress will be reported at SC/64 with the final report presented at SC/65. Over this first 6 months, the project has begun the development and implementation of two demonstration projects, using the risk assessment framework (based on an individual based model approach) outlined by Hall and Schwacke (Hall *et al.*, 2006a) and will provide the community with a tool that can be used for other populations at the end of the 2 year project period. Specifically the 2-year project will:

- (1) improve the existing concentration-response (CR) function for PCB-related reproductive effects in cetaceans;
- (2) derive additional CR functions to address other endpoints (i.e. survival) in relation to PCB exposure;
- (3) integrate improved concentration-response components into a population risk model (i.e. individual-based model) for two case study species: bottlenose dolphin and humpback whale; and
- (4) implement a CR component for at least one additional contaminant of concern (COC).

Completion is expected in August 2012. Funds include an annual meeting of the modellers and the steering committee. The reduced budget is sufficient for the project to continue but will result in some delay of the final product.

(9) DEVELOPMENT OF A WEBSITE AND LISTSERVE AND COMMUNICATION TOOL FOR THE COORDINATION OF THE CETACEAN EMERGING AND RESURGING DISEASES (CERD)

The Committee has recognised the importance of the CERD to the IWC and has identified mechanisms to enhance participation and communication as essential to effectively reaching the goals relevant to the IWC. This would entail seeking broader participation from partners in various regions and establishing new partnerships with international organisations that are also addressing diseases in wildlife. The CERD workplan includes expansion of the steering group to identify regional and national points of contact, the creation of a listserv through the Secretariat that will link interested parties, and the creation of a CERD website housed either on the IWC homepage or on an extranet page linked to the IWC. As part of this effort, the development of a consultation section of the extranet site will include an ability to review and comment on photos including archival of comments relative to these photos (skin lesions, shipstrike lesions, entanglements) These activities will be coordinated with the shipstrikes review team. The work should be completed by August 2012. Funds are requested for the

extranet, a listserv, and communication tool with purchased software (the development of which may also be useful for other applications such as shipstrikes and entanglements).

(10) SC/64 PRE-MEETING: MARINE RENEWABLE ENERGY DEVELOPMENTS AND CETACEANS (MREDS & CETACEANS): PARTIAL SUPPORT

The topic of marine renewable developments (MREDS) has been considered by the Committee for several years and the rapid increase in developments across the world has been highlighted. Wind farms have greatly increased in size and are moving further offshore with considerable associated infrastructural development, including ports, service vessels and cable laying. Interactions with cetaceans are inevitable but in many respects poorly characterised. Typically adequate baseline data have not been obtained prior to developments. The Workshop will provide a forum for scientist/industry interactions on mitigation and issues of mutual concern with a focus on wind farms.

The pre-meeting workshop will consider the potential effects on cetaceans (e.g. injuries; masking; behavioural changes) available information (including modelling approaches) and mitigation measures and adaptive management to address this. The workshop will seek to develop procedures to coordinate and collate standardised effect measurements of marine renewable developments on cetaceans and it will identify research needs. Finally the workshop will formulate recommendations for research, monitoring, conservation and management.

The funds are for the IWC contribution to the workshop in terms of three invited participants and room hire should it be needed. The reduced funds will limit the attendance of IPs.

In-depth assessments

(11) PROCESS FOR RESOLVING DIFFERENCES IN MINKE WHALE ABUNDANCE, INCLUDING A WORKSHOP

Over the past three years, OK and SPLINTR have presented estimates of Antarctic minke whale abundance from the CPII and CPIII IDCR/SOWER cruise data. Considerable work has eliminated several possible sources of difference between the two methods. However, some items remain to be dealt with. This can only be achieved by intersessional work prior to a workshop (no later than the end of February 2012) followed by work prior to the annual meeting. The reduced budget will mean fewer invited participants and delay to the preparation of the proposed simulated datasets that may ultimately delay completion of the work.

(12) PREPARATORY WORK FOR CONSIDERING SURVEY COVERAGE ISSUES RELATIVE TO CHANGES IN MINKE WHALE ABUNDANCE ESTIMATE BETWEEN CPII AND CPIII

The reasons for the difference of abundance estimates of Antarctic minke whales have been investigated by the Committee since 2001, but a final conclusion has not been reached. Now that problems with the abundance estimates themselves have largely been resolved, attention has turned *inter alia* to the possibility of changing proportions of whales in unsurveyed regions between the two CP series. Examination of the effect of ice is important and preparation for estimating number of Antarctic minke whales south of ice edge should begin intersessionally. Specifically, this proposal will entail: (1) consideration of technical aspects of sea ice coverage data and time since ice melt, which may be used in attempts to bound or estimate the number of Antarctic minke whales south of the ice edge; and (2) preliminary consideration of the appropriateness of various

possible analyses with that goal. Datasets resulting from step (1) will be made available intersessionally to the working group on sea ice issues relevant to Antarctic minke whale distribution, which will also act as a steering group for this proposal. The work will ensure that analyses to be presented next year are based on an agreed common ground. The reduced budget will allow progress to be made but will delay the date the agreed information can be circulated and thus the Committee's overall consideration of this problem.

(13) PROPOSAL TO EXPLORE ASPECTS OF STATISTICAL CATCH-AT-AGE ESTIMATORS FOR ANTARCTIC MINKE WHALES

Following on from the above, several of these reasons for the apparent large declines in abundance can be explored by population dynamics modelling. The Committee has been funding an integrated statistical catch-at-age (SCAA) modelling framework that allows for errors in catch-at-age data, more than a single stock, time-varying growth, multiple areas, environmental covariates, fleet-specific vulnerabilities, and changes over time in vulnerability. The SCAA model is ready to be applied so the Committee can reach final conclusions with respect to declines and also enable a model-based assessment of population status and trends for Southern Hemisphere minke whales to be undertaken over a lengthy period. This proposal will allow the Committee to use the SCAA method at the 2012 Annual Meeting.

(14) 2012 IWC NORTH PACIFIC SIGHTING CRUISE AS PART OF THE 'IWC-POWER' PROGRAMME

The Committee has strongly advocated the development of an international medium- to long-term research programme involving sighting surveys to provide information for assessment, conservation and management of cetaceans in the North Pacific, including areas that have not been surveyed for decades. The finalisation of the integrated mid-long-term programme (IWC-POWER; the Pacific Ocean Whales and Ecosystem Research programme) that will provide information on stock structure, abundance and ultimately trends is almost completed and the analytical work will be completed at an intersessional workshop. The 2012 is focussed on another poorly-covered area (and includes both the high seas and waters within the USA EEZ). The cruise will last approximately 60 days between July and August 2012. By far the most important component of the cost is the provision of a research vessel, crew and fuel (up to US\$1m) and that is generously being provided by Japan. The IWC funding will provide for international researchers, equipment and a meeting to finalise the mid-long-term plan and the details of the 2012 cruise.

North Pacific minke whales

(15) WORKSHOP FOR IMPLEMENTATION REVIEW FOR WESTERN NORTH PACIFIC COMMON MINKE WHALES

The *Implementation Review* for western North Pacific minke whales is more complex than any previous *Implementation* and therefore the data processing has been time consuming. Because of this the Committee was unable to complete the tasks required at the First Annual Meeting. The Committee discussed a detailed work plan that should guaranteed completion of the necessary intersessional work so that all tasks would be completed at next year's meeting. Without the holding of an intersessional workshop, it will be impossible to complete this high priority *Implementation Review* by 2013. The funds are required to hold the workshop.

(16) POSSIBLE EVOLUTIONARY PATHWAYS FOR THE GENERATION OF STOCK STRUCTURE AS PROPOSED IN THE DEFINED NORTH PACIFIC COMMON MINKE WHALE HYPOTHESES

The objective is to consider putative populations in the context of possible evolutionary pathways that may help with the interpretation of relative plausibility with respect to the issues surrounding possible subdivision of J or O stocks. The proposed analyses will require one postdoctoral researcher working full time for 4 months, and one meeting of collaborators. Results will be available in time for the Intersessional Workshop in December 2011. The Committee notes that if this project is not funded then it will be unable to inform discussions on relative plausibility during the present *Implementation Review*. If this cannot be done it recommends that the project is funded in time for the next scheduled *Implementation Review*.

Revised Management Procedure

(17) ESSENTIAL COMPUTING FOR RMP/NPM

The approach used to evaluate RMP variants during *Implementations* as well as candidate *SLAs* involves two main steps: (1) specification and conditioning of trials; and (2) projecting simulated populations forward under alternative RMP variants/*SLAs*. The first of these steps is by far the most computationally intensive. Moreover, the complexity of the operating models on which simulation evaluations are conducted has increased in recent years. Unfortunately, the relatively simple optimisation method included in current control programs (which was more than adequate in the past), combined with a complicated objective function, has led to problems producing conditioned trials quickly. This proposal will provide the Secretariat with the essential support required to investigate and address this issue during the intersessional period. It will also continue the arrangement of recent years by which essential support is provided to the Secretariat, particularly in the key area of estimating stock mixing proportions for input to the trials, both intersessionally, and during meetings. Without this support it will be impossible for the Committee to undertake its present work on RMP *Implementations*.

Stock definition

(18) WORKSHOP TO FINALISE THE 'GUIDELINES FOR THE ANALYSIS OF POPULATION GENETIC DATA' AND 'GUIDELINES FOR GENETIC DATA QUALITY CONTROL'

These two Guideline documents have been a priority item identified by the Committee for several years. Their importance to assessments, especially, but not only related to the RMP and AWMP is vital. It has become clear that the only way this work can be done is to hold a small, focussed, intersessional workshop that will also allow dialogue with those at the science/management interface who are familiar with the range of management problems facing the Committee. The reduced costs will limit the number of IPs but will still allow progress to be made.

Other Southern Hemisphere whale stocks

(19) MODELLING OF SOUTHERN HEMISPHERE HUMPBACK WHALE POPULATIONS: EI, EII, EIII AND F

This proposal consists of two projects. The first project involves data from Oceania that are already combined into two large synoptic datasets spanning 1999-2005, covering four main survey regions and two types of mark recapture data (Photo-ID and microsatellite genotype). The aim is to estimate rates of interchange between East Australia, New Caledonia, Tonga (with and without the Cook Islands)

and French. The results of this interchange analysis will be available both to the intersessional email working group prior to the data deadline. The second project is to develop a Bayesian population assessment model of Ei, Eii, Eiii and F. This will incorporate the input data agreed by the intersessional working group and will explore catch allocation scenarios in advance of deciding final sensitivities for this parameter. The reduced funding will allow the work to continue but may delay the final assessment of BSE and F by the Committee.

(20) MODELLING OF SOUTHERN HEMISPHERE HUMPBACK WHALE POPULATIONS

This project will focus on a combined assessment of humpback breeding stocks D and E, with the possibility to extend to D+E+F, based on methods previously used in humpback assessments recently completed. Initial results will utilise the data agreed to by the intersessional working group appointed to advise thereon, and results will be presented at the 2012 Scientific Committee meeting. Further model developments and refinements in association with the final set of agreed data (and their sensitivities) would be presented at the 2013 Scientific Committee meeting. The reduced funding will allow the work to continue but may delay the final assessment.

(21) ANTARCTIC HUMPBACK WHALE CATALOGUE

The IWC has supported the College of the Atlantic's work on the international Antarctic catalogue since 1998. The collection spans more than two decades continuing to yield important results from early contributions. It has been expanded to IWC members with the aim to substantially improve the accessibility and organisation of the database and is the primary holding for IDCR-SOWER humpback whale photographs (and for opportunistic photographs that otherwise would have little value on their own, $n=788$). Holdings from the Antarctic alone total 3,157 fluke photographs of 1,799 individual humpback whales. The availability of these data has broadened our understanding of the exchange between areas and in some cases provided information that was previously not available. These funds are for the management of the project and database and to continue comparing the photographs. The reduced funding will allow the catalogue to continue but will slow down the rate of matching with the potential to mean that information valuable to the Committee's humpback whale assessments may be delayed.

(22) EXPANSION OF SAMPLING EFFORT FOR HUMPBACK WHALES IN NAMIBIA

During the assessment of Breeding Stock B humpback whales (those that visit breeding grounds on the west coast of southern Africa in winter) it was noted the poor geographical coverage of genetic and photo-ID sampling. Currently information is largely available only from Gabon (at 2-7°S) and the west coast of South Africa (at 33°S), with a very small contribution from northern Angola. Although comparison of samples from these areas has suggested some stock structure, there are too few biopsies and photographs from intervening areas (such as the rest of Angola and Namibia) to determine where any stock boundaries might lie and how animals from other aggregations relate to animals from Gabon or the west coast of South Africa. More extensive and co-ordinated range-wide sampling for genetics and photo-identification has been recommended. This proposal is seeking funds for a more dedicated effort to collecting samples and photographs from humpback

whales off Namibia including the collection of biopsies and photo-ID images and their analysis. Funds requested are for equipment, travel and analyses. The reduced funding will not allow this work to occur. Although the Committee commends this work, its decision took into account the fact that it has just completed the BSB assessment and will not undertake revisions in the near future.

(23) SOUTHERN HEMISPHERE BLUE WHALE CATALOGUE 2011/2012

The Southern Hemisphere Blue Whale Catalogue is an international collaborative effort to facilitate cross-regional comparison of blue whale photo-identifications catalogues. This initiative has been supported by IWC since 2008 when the development of specially designed software was developed to host several blue whale catalogues and to allow inter-regional comparisons. For the period 2010/11, IWC funding allowed considerable progress. To date, a majority of blue whale catalogues currently are being contributed to this collaborative effort. During 2011-12 expected work includes: (1) comparisons between Australian, Southeast Pacific and Antarctica; (2) improvements of the software to speed up searching; and (3) an online wiki system to improve communication among blue whale researchers. Funding is for hosting, technical assistance and matching. The reduced funding will allow the catalogue to continue but will slow down the comparison work.

Special Permits

(24) REVIEW OF MODIFIED RESEARCH PLANS FOR JARPN II
Japan has indicated that it was considering an improvement of the JARPN II research design by adding sub-area 11 to its research area without any change in species sampled or total sample size. It is expected that research in sub-area 11 would provide a 'window' to the Sea of Okhotsk ecosystem as well as important information on the stock structure of the western North Pacific minke whales. The proposed change will trigger the Annex P Procedure (see Item 17.3) and Japan confirmed that, if it decides to go ahead, it will submit a proposal for change in accordance with Annex P. Thus a budget will be needed for a review workshop 100 days prior to the next Annual Meeting of the Scientific Committee.

Plenary

(25) CO-SPONSORSHIP OF SECOND INTERNATIONAL CONFERENCE ON MARINE MAMMAL PROTECTED AREAS
In November 2011, the French national MPA agency, along with several international partners, will host the second International Conference on Marine Mammal Protected Areas (ICMMPA II). Topics for the invited presentations and workshops include: scientific criteria for determining marine mammal critical habitat and managing threats to marine mammals (including bycatch, ship strikes, climate change and noise). 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 Conference. The Committee also co-funded the successful first ICMMPA in March 2009. The Committee agrees that while it would like to co-sponsor the conference, given the present funding climate this would not be accorded high priority compared to other more immediate tasks.

All

(26) 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 role 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.

24. WORKING METHODS OF THE COMMITTEE

24.1 Consistency of abundance estimates

Annex M draws attention to the matter of consistency in the way in which abundance estimates are dealt with within the Committee. While recognising that the required 'quality' of an abundance estimate depends on the use to which it is being put, the authors suggested that: (1) there appeared to be rather variable levels of scrutiny across, and even within, sub-groups; and (2) often a lack of clarity as to whether reported estimates had been evaluated and approved, and if the latter approved for what purpose within the Committee's work.

The Committee recognised the need to examine this issue carefully. It **agrees**:

- (1) That an intersessional group comprising Butterworth, Bravington, Donovan, Hammond and Palka will produce a review document identifying the issues and proposing possible mechanisms to address them. This will include consideration of general principles for considering abundance estimates (*cf* SC/63/Rep3) and guidelines to authors as to what information should be provided.
- (2) In addition to its commitment to compile a list of all abundance estimates used in connection with RMP *Implementations*, together with the statuses accorded to those estimates, the Secretariat would also compile a list of all abundance estimates considered by the Committee since ~2000 (staff resources permitting), with a summary of any 'status' accorded at the time by the Scientific Committee.

With the benefit of the above, the Committee will allocate time to address this issue more fully at the 2012 Annual Meeting.

24.2 Collaboration between the Scientific Committee and the Conservation Committee

The effective conservation of cetaceans requires scientific and management input. Over the past few years a range of issues of direct relevance to both the Scientific Committee and Conservation Committee have been discussed, including whalewatching, conservation management plans, ship strikes, climate change and ocean noise.

An important consideration for the Commission is the development of mechanisms that allow effective communication and joint roles for these two committees. One possible mechanism to achieve this, at least in some circumstances, is joint steering groups with appropriate scientific and conservation management representation (such joint groups have been proposed by sub-groups of the Conservation Committee for whalewatching and conservation management plans).

The Committee **recognises** that joint steering groups are likely to be one important mechanism for interaction between the Scientific Committee and the Conservation Committee on appropriate conservation issues. Scientific Committee representation on these joint groups will vary with the issue, but in addition to relevant sub-committee convenors and members with special expertise, the Committee **recommends** that (at least initially) joint groups

Table 13

Budget requests (see text). Note that in addition, the budget requests for the two separate funds (small cetaceans and SORP) are given in Tables 9 and 10.

Title	Agenda Item	Full (£)	Reduced (£)
(1) AWMP Workshop	8. AWMP	12,000	12,000
(2) Developer funds for AWMP	8. AWMP	8,000	6,000
(3) Ship strike data coordination	7.7 Ship strikes	10,000	0
(4) Continuation of funding for Southern Ocean Right Whale Catalogue	10.5 SH right whales	4,000	3,000
(5) Southern Right Whale Assessment Workshop	10.5 SH right whales	24,000	24,000
(6) Pacific-wide study on population structure and movements patterns	10.4 WNP gray whales	15,600	6,200
(7) Production of the state of the cetacean environment report (SOCER)	12.1 SOCER	3,000	0
(8) POLLUTION 2000+ Phase II - Risk Assessment Modelling	12.2 POLLUTION	65,700	45,000
(9) Website and Listserve and communication tool for the coordination of the Cetacean Emerging and Resurging Diseases	12.3 Review report from CERD working group	3,500	3,500
(10) Pre-meeting: marine renewable energy developments and cetaceans	12.8 Other habitat issues	4,900	3,000
(11) Intersessional process for resolving differences in minke whale abundance (including a Workshop proposal)	10.1 Antarctic minke whales	17,600	9,000
(12) Preparatory work for considering survey coverage issues relative to changes in minke whale abundance estimates between CPII and CPIII	10.1 Antarctic minke whales	6,000	4,000
(13) Proposal to explore aspects of statistical catch-at-age estimators for Antarctic minke whales	10.1 Antarctic minke whales	4,000	4,000
(14) 2011 IWC North Pacific sighting cruise and medium to long-term planning	10.8 North Pacific cruise	60,200	57,000
(15) Workshop for <i>Implementation Review</i> for western North Pacific common minke whales	6.3.2 North Pacific common minke whales	20,000	15,000
(16) Possible evolutionary pathway for the generation of stock structure as proposed in defined hypotheses	6.3.2 North Pacific common minke whales	10,000	0
(17) Funds to enable essential computing work to continue in RMP and NPM	22. Data processing and computing needs	26,000	26,000
(18) Intersessional Workshop proposal: Finalisation of 'Guidelines for the analysis of population genetic data' and 'Guidelines for genetic data quality control'	11.1 Guidelines for genetic studies and DNA data quality	7,500	5,000
(19) Modelling of Southern Hemisphere humpback whale populations Ei, Eii, Eiii and F	10.2 SH humpback whales	5,000	4,000
(20) Modelling of Southern Hemisphere humpback whale populations	10.2 SH humpback whales	2,500	2,000
(21) Antarctic Humpback Whale Catalogue	10.2 SH humpback whales	15,000	11,000
(22) Expansion of sampling effort for humpback whales in Namibia	10.2 SH humpback whales	7,500	0
(23) Southern Hemisphere Blue Whale Catalogue 2011/12	10.3 SH blue whales	13,000	10,000
(24) Review Panel: modified JARPN II proposal		15,000	15,000
(25) Participation in the Second International Conference on Marine Mammal Protected Areas	20. Research and workshop proposals and results	15,000	0
(26) IPs	All	64,000	64,000
TOTAL		439,000	328,700

should also include at least one of the Chair of the Scientific Committee, the Vice-Chair or the Head of Science.

The Committee is happy to assist the Commission to develop practical guidance on how best to facilitate interactions between the two Committees including the formation and functioning of issue-specific joint groups.

24.3 Pre-meetings

The Committee **agrees** to formalise for the Scientific Committee Handbook, an improved practice for pre-meetings that has been evolving over recent years, i.e.

- (1) Pre-meetings (which are open to all members of the Committee) shall normally:
 - (a) be identified at the preceding Annual Meeting;
 - (b) address discrete topics and produce reports for full review by the relevant sub-groups.
- (2) Where an intersessional workshop is unable to complete its work and determines the need for a pre-meeting (in conjunction with the Chair of the Committee, the Vice-Chair and the Head of Science), the Secretariat shall send out a circular communication to this effect as soon as possible with the word 'Pre-Meeting' in the subject line, in addition to placing the information on the Scientific Committee website and including the information in the notes to the draft agenda.

24.4 Role of Convenors

The present role of the Convenors (and co-convenors) is described in the Scientific Committee Handbook and especially under Item 4.1.1³¹ In summary, Convenors tasks are:

- (1) to facilitate intersessional progress on identified tasks including providing advice to the Chair as appropriate;
- (2) to identify potential invited participants;
- (3) to draw up the draft agenda for the sub-group's³² work for discussion and agreement at an organisational meeting of the sub-group;
- (4) if elected chair (as is normally the case) by the sub-group at its opening meeting:
 - (a) to meet in the Convenors' group to determine the business and timetable for the day
 - (b) to provide advice to the Chair on other meeting-related matters should they arise;
 - (c) to chair the sub-groups meetings efficiently and fairly and if necessary establish small expert groups;
 - (d) to authorise working papers should they be deemed necessary;
 - (e) to appoint rapporteurs and ensure the sub-group's report follows the guidelines for reports, to present the sub-group report to the full Plenary and to provide an initial draft for the relevant sections of the Plenary report;
 - (f) to ensure that the final version of the sub-group report is completed by the end of the day after the Scientific Committee meeting; and
 - (g) to meet in the Convenors' group the day after the Scientific Committee meeting to finalise the draft work plan for the coming year to be submitted to the Commission, based on those agreed by the sub-groups.

³¹http://www.iwcoffice.org/sci_com/handbook.htm#four.

³²'sub-group' is a generic term for sub-committees, working groups, etc.

Choosing Convenors from among the full membership is the responsibility of the Chair, who takes advice from the existing convenors and other members of the Committee. The handbook at present summarises this process as:

'it is the Chair's responsibility to appoint Convenors for each of the sub-groups; this requires a balance of a number of features including experience, geographical spread, and a balance of the need for new blood with the need for continuity (more important in some groups than others)'.

It was recognised that the primary function of the Committee is to provide the best scientific advice possible to the Commission. Accepting that the present system works well, after some discussion, the Committee **agrees** that the Chair of the Committee should develop a review document for consideration next year that considers whether or not there is a need to expand on the above guidelines with respect to further details about the roles of Convenors and co-convenors, timeframes of service etc. as well as the roles of Heads of Delegation, and if so provide proposed text.

25. ELECTION OF OFFICERS

This is the second year in the terms of the Chair and Vice-Chair and so no elections are required.

26. PUBLICATIONS

Donovan reported on progress with publications this year. Congratulations were given to Jemma Jones who is on maternity leave. After further problems with printers, the *Journal* should now be in good hands as it is being printed by Cambridge University Press. As reported last year, the Secretariat has been working hard to develop and then transfer to an online system all of the editorial process from submission to reviewing to decision making. The prototype is now being tested and is expected to come into effect within the next three months. The system being developed also allows:

- (1) for online access to the *Journal* for subscribers and Committee members; and
- (2) ultimately the ability for purchasing individual items and subscriptions online.

The Southern Hemisphere humpback whale special issue is now complete and will be published by the end of the year. The Committee **recommends** that highest priority is given to the completion of the special issue on the Revised Management Procedure which should be published before the next Annual Meeting. The Committee also **re-establishes** the intersessional email group to plan for a special issue dedicated to the IDCR/SOWER cruises (Annex R38).

Work is continuing to digitise all of the Scientific Committee papers with the ultimate aim of making these available as an online resource.

Finally, the Committee **reiterates** the great importance of the *Journal* to its work, welcomed the online developments and thanked the Secretariat and the Editorial Board for their hard work during the year.

27. OTHER BUSINESS

This was the last meeting for two members of the Secretariat who were retiring after many years of service, Bernard Lynch (meeting logistics and, among many talents, saving fried computers) and Fiona Wright (data processing and, during meetings, keeping delegates supplied with copious drafts). The meeting rose in appreciation of their outstanding

service and the Chair presented both with cards and gifts on behalf of the Scientific Committee.

28. ADOPTION OF REPORT

The report was adopted at 17.30 on 11 June 2011. As is usual final editing was carried out by the convenors after the meeting. In closing the meeting the Chair thanked the Secretariat for carrying out its duties in its customary friendly and efficient manner, as well as once again thanking the Government of Norway and the city of Tromsø for its magnificent hosting of the meeting³³.

REFERENCES

- ACCOBAMS. 2011. Report of the 7th Meeting of the ACCOBAMS Scientific Committee. Available online at <http://www.accobams.net>.
- Aguilar de Soto, N. 2006. Acoustic and diving behaviour of Blainville's beaked whales and short finned pilot whales in the Canary Island. PhD thesis. University of La Laguna, Tenerife, Canary Islands.
- Allen, J.M., Carlson, C. and Stevick, P.T. 2010. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Paper SC/62/SH17 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 8pp. [Paper available from the Office of this Journal].
- Anonymous. 2001. Effects of extraction of marine sediments on the marine ecosystem. *Int. Coun. Explor. Sea. Coop. Res. Rep.* 247(December 2001).
- Aparicio, C., Aguilar de Soto, N. and Crespo, A. 2009. Should beaked whales be protected or 'data deficient'? a population approach to their status of conservation. *Eur. Res. Cet. (Proc. Annu. Conf. Eur. Cet. Soc.)*. Turkey.
- Attard, C.R.M., Beheregaray, L.B., Jenner, C., Gill, P., Jenner, M., Morrice, M., Bannister, J., LeDuc, R. and Moller, L. 2010. Genetic diversity and structure of blue whales (*Balaenoptera musculus*) in Australian feeding aggregations. *Conserv. Genet.* 11: 2437-441.
- Azzellino, A., Lanfredi, C., D'Amico, A., Pavan, G., Podesta, M. and Haun, J. 2011. Risk mapping for sensitive species to underwater anthropogenic sound emissions: Model development and validation in two Mediterranean areas. *Mar. Poll. Bull.* 63: 56-70.
- Baird, R.W., Webster, D.L., McSweeney, D.J., Ligon, A.D., Schorr, G.S. and Barlow, J. 2006. Diving behaviour of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales in Hawaii. *Canadian Journal of Zoology* 84: 1120-28.
- Bannister, J.L., Hedley, S.L., Bravington, M.V. and Burnell, S.R. 2011. Monitoring population dynamics of right whales off southern Australia. Project 2009/41: Final Report to the Australian Marine Mammal Centre.
- Barlow, J. and Forney, K. 2007. Abundance and population density of cetaceans in the California Current ecosystem. *Fish. Bull.* 105: 509-26.
- Bernaldo de Quiros, Y., Gonzalez-Diaz, O., Saavedra, P., Arbelo, M., Sierra, E., Mendez, M. and Fernandez, A. 2010. Methodology for field-gas sampling, transport and analysis in the laboratory of gas embolism found in stranded cetaceans. Abstract presented to the European Cetacean Society, 2010.
- Branch, T.A. and Jackson, J.A. 2008. Minimum bottleneck abundance of Antarctic blue whales based on current mtDNA diversity. Paper SC/60/SH10 presented to the IWC Scientific Committee, June 2008, Santiago, Chile (unpublished). 7pp. [Paper available from the Office of this Journal].
- Bravington, M.V. and Hedley, S. 2010. Antarctic minke whale abundance from the SPLINTR model: some 'reference' dataset results and 'preferred' estimates from the second and third circumpolar IDCR/SOWER surveys. Paper SC/62/IA12 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 15pp plus revised. [Paper available from the Office of this Journal].
- Brodie, P., Ramirez, K. and Haulena, M. Submitted. Growth and maturity of beluga (*Delphinapterus leucas*) in Cumberland Sound, Canada, compared to those raised in captivity: evidence for GLG/2. *J. Cetacean Res. Manage.*: 21pp.
- Brown, M.R., Corkeron, P.J., Hale, P.T., Schultz, K.W. and Bryden, M.M. 1995. Evidence for a sex-segregated migration in the humpback whale (*Megaptera novaeangliae*). *Proc. R. Soc. Lond. Ser. B.* 259: 229-34.
- Brownell, R.L., Donovan, G.P., Kato, H., Larsen, F., Mattila, D.K., Reeves, R.R., Rock, Y., Vladimirov, V.A., Weller, D.W. and Zhu, Q. 2010. Draft Conservation plan for Western North Pacific gray whales (*Eschrichtius robustus*). Paper SC/62/BRG24 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 61pp. [Paper available from the Office of this Journal].

³³ and finally, congratulations to Manchester City football club for winning their first trophy in 35 years..... The blue moon is rising.....

- Carroll, E., Patenaude, N., Alexander, A., Steel, D., Harcourt, R., Childerhouse, S., Smith, S., Bannister, J., Constantine, R. and Baker, C.S. In press. Population structure and individual movement of southern right whales around New Zealand and Australia. *Mar. Ecol. Prog. Ser.*
- Clapham, P.J., Aguilar, A. and Hatch, L.T. 2008. Determining spatial and temporal scales for management: lessons from whaling. *Mar. Mammal Sci.* 24(1): 183-201.
- Claridge, D. 2006. Fine-scale distribution and habitat selection of beaked whales, MSc. Thesis. Aberdeen University, Scotland.
- Cooke, J.G. 2007. The influence of environmental variability on baleen whale sustainable yield curves. Paper SC/N07/MSYR1 presented to the MSYR Workshop, Seattle, USA, 16-19 November 2007 (unpublished). 19pp. [Paper available from the Office of this Journal].
- Coughran, D. and Gales, N. 2010. An unusual peak in recorded mortalities of humpback whales in Western Australia: normal stochastic variability or a regional indication of carrying capacity? Paper SC/62/SH24 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 7pp. [Paper available from the Office of this Journal].
- Cox, T.M., Ragen, T.J., Read, A.J., Vos, E., Baird, R.W., Balcomb, K., Barlow, J., Caldwell, J., Cranford, T., Crum, L., D'Amico, A., D'Spain, G., Fernández, A., Finneran, J., Gentry, R., Gerth, W., Gulland, F., Hildebrand, J., Houser, D., Hullar, T., Jepson, P.D., Ketten, D., MacLeod, C.D., Miller, P., Moore, S., Mountain, D., Palka, D., Ponganis, P., Rommel, S., Rowles, T., Taylor, B., Tyack, P., Wartzok, D., Gisiner, R., Mead, J. and Benner, L. 2006. Understanding the impacts of anthropogenic sound on beaked whales. *J. Cetacean Res. Manage.* 7(3): 177-87.
- Crespo, E.A., Secchi, E.R., Dalla Rosa, L., Kinas, P.G., Danilewicz, D. and Bordino, P. 2002. Report of the working group on abundance estimates. *The Latin American Journal of Aquatic Mammals* 1(1 - Special Issue on the Biology and Conservation of the Franciscana): 65-66.
- D'Amico, A., Gisiner, R.C., Ketten, D.R., Hammock, J.A. and Johnson, C. 2009. Beaked whale strandings and naval exercises. *Aquat. Mamm.* 34: 452-72.
- da Silva, V.M.F., Martin, A.R. and do Carmo, N.A.S. 2011. Boto Bait. *IUCN Species Magazine of the Species Survival Commission*(53): 10-11.
- Dalebout, M.L., Mead, J.G., Baker, C.S., Baker, A.N. and van Helden, A.L. 2002. A new species of beaked whale *Mesoplodon perrini* sp. N. (Cetacea: Ziphiidae) discovered through phylogenetic analyses of mitochondrial DNA sequences. *Mar. Mammal Sci.* 18(3): 577-608.
- Dalebout, M.L., Robertson, K.M., Frantzi, A., Englehaupt, D., Mignucci-Giannoni, R., Rosario-Delestre, J. and Baker, C.S. 2005. Worldwide structure of mtDNA diversity among Cuvier's beaked whales (*Ziphius cavirostris*): implications for threatened populations. *Mol. Ecol.* 14: 3353-71.
- Dawbin, W.H. 1986. Right whales caught in waters around south eastern Australia and New Zealand during the nineteenth and early twentieth centuries. *Rep. int. Whal. Commn (special issue)* 10: 261-67.
- Deaville, R. and Jepson, P.J. 2008. *Report on the UK Strandings Investigation Programme*. Report to the Department for Food, Environmental and Rural Affairs, Bristol. 52pp.
- Di Natale, A. and Notarbartolo di Sciara, G. 1994. A review of the passive fishing nets and trap fisheries in the Mediterranean Sea and of the cetacean bycatch. *Rep. int. Whal. Commn (special issue)* 15: 189-202.
- Dolman, S.J., Reid, R.J., Barley, J.P., Deaville, R., Jepson, P.D., O'Connell, M., Berrow, S., Penrose, R.S., Pinn, E., Stevick, P.T., Calderan, S., Robinson, K.P., Doyle, T.K., Brownell, R.L. and Simmonds, M.P. 2008. A preliminary note on the unprecedented strandings of 45 deep-diving odontocetes along the UK and Irish coast between January and April 2008. Paper SC/60/E5 presented to the IWC Scientific Committee, June 2008, Santiago, Chile (unpublished). 9pp. [Paper available from the Office of this Journal].
- Donaldson, R., Finn, H. and Calver, M. 2010. Illegal feeding increases risk of boat-strike and entanglement in Bottlenose Dolphins in Perth, Western Australia. *Pac. Conservat. Biol.* 16: 157-61.
- Donovan, G.P. 1991. A review of IWC stock boundaries. *Rep. int. Whal. Commn (special issue)* 13: 39-68.
- Falcone, E.A., Schorr, G.S., Douglas, A.B., Calambokidis, J., Henderson, E.W., McKenna, M.F., Hildebrand, J. and Moretti, D. 2009. Sighting characteristics and photo-identification of Cuvier's beaked whales (*Ziphius cavirostris*) near San Clemente Island, California: a key area for beaked whales and the military? *Mar. Biol.* 156: 2631-40.
- Fernández, A., Arbelo, M., Deaville, R., Patterson, I.A.P., Castro, P., Baker, J.R., Degollada, E., Ross, H.M., Herraes, P., Pocknell, A.M., Rodríguez, E., Howie, R.E., Espinoza, A., Reid, R.J., Jaber, R., Martín, V., Cunningham, A.A. and Jepson, P.D. 2004. Whales, sonar and decompression sickness. *Nature* 428: Brief communication. doi: 10.1038/nature02528.
- Fernández, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herraes, P., Castro, P., Jaber, J.R., Martín, V. and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Vet. Pathol.* 42: 446-57.
- Fernandez, A., Edwards, J.F., Rodríguez, F., Espinosa de los Monteros, A., Herraes, P., Castro, P., Jaber, J.R., Martín, V. and Arbelo, M. 2005. 'Gas and fat embolic syndrome' involving a mass stranding of beaked whales (family Ziphiidae) exposed to anthropogenic sonar signals. *Vet. Pathol.* 42: 446-57.
- Frantzi, A. 2004. The first mass stranding that was associated with the use of active sonar (Kyparissiakos Gulf, Greece, 1996). *ECS Newsletter* 42(Special Issue): 14-20. Proceedings of the Workshop on Active Sonar and Cetaceans held at the European Cetacean Society's 17th Annual Conference, Auditorio Alfredo Kraus, Las Palmas, Gran Canaria, 8th March 2003.
- Frantzi, A. and Cebrian, D. 1998. A rare, atypical mass stranding of Cuvier's beaked whales: cause and implications for the species' biology. *Eur. Res. Cet.* 12: 332-35.
- Fraser, F.C. 1934. Report on Cetacea stranded on the British coasts from 1927 to 1932. *Br. Mus. (Nat. Hist.) Publ.* 11: 3-14. London.
- Frasier, T.R., Koroscil, S.M., White, B.N. and Darling, J.D. 2011. Assessment of population substructure in relation to summer feeding ground use in the eastern North Pacific gray whale. *Endangered Species Research* 14: 39-48.
- George, J.C., Bada, J., Zeh, J., Scott, L., Brown, S.E., O'Hara, T. and Suydam, R. 1999. Age and growth estimates of bowhead whales (*Balaena mysticetus*) via aspartic acid racemization. *Can. J. Zool.* 77: 571-80.
- Gerrodette, T. and Rojas-Bracho, L. 2011. Estimating the success of protected areas for the vaquita, *Phocoena sinus*. *Mar. Mammal Sci.* 27(2): E101-E25.
- Gerrodette, T., Taylor, B.L., Swift, R., Rankin, S., Jaramillo-Legorreta, A.M. and Rojas-Bracho, L. 2011. A combined visual and acoustic estimate of 2008 abundance, and change in abundance since 1997, for the vaquita, *Phocoena sinus*. *Mar. Mammal Sci.* 27(2): E79-E100.
- Glover, K.A., Kanda, N., Haug, T., Pastene, L.A., Oien, N., Goto, M., Seliussen, B.B. and Skaug, H.J. 2010. Migration of Antarctic minke whales to the Arctic. *PLoS ONE* 5(12).
- Government of Japan. 2004. Revised research plan for cetacean studies in the western North Pacific under Special Permit (JARPNI). 14pp. Paper SC/56/O1 presented to the IWC Scientific Committee, July 2004, Sorrento, Italy (unpublished). 14pp. [Paper available from the Office of this Journal].
- Gunnlaugsson, T., Vikingsson, G.A., Pampoulie, C. and Elvarsson, B.T. 2010. Research programme on North Atlantic fin whales in relation to RMP Variant 2 and stock structure hypothesis IV. Paper SC/62/RMP1 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 22pp. [Paper available from the Office of this Journal].
- Hall, A., McConnell, B., Rowles, T., Aguilar, A., Borrell, A., Schwacke, L., Reijnders, P. and Wells, R. 2006a. Population consequences of polychlorinated biphenyl exposure in bottlenose dolphins - an individual based model approach. *Environ. Health Perspect.* 114(1): 60-64.
- Hall, A.J., Hugunin, K., Deaville, R., Law, R.J., Allchin, C.R. and Jepson, P.D. 2006b. The risk of infection from polychlorinated biphenyl exposure in the harbour porpoise (*beta*): a case-control approach. *Environ. Health Perspect.* 114(5): 704-11.
- Hedley, S.L., Dunlop, R.A. and Bannister, J.L. 2011. Evaluation of WA Humpback surveys 1999, 2005, 2008: Where to from here? Report to the Australian Marine Mammal Centre. Project 2009/23.
- Herman, J.S. 1992. *Cetacean species in the National Museums of Scotland*. 1st ed. Vol. 13. National Museums of Scotland, Edinburgh, Scotland. 67pp.
- Heyning, J.E. 1989. Cuvier's beaked whale *Ziphius cavirostris* G. Cuvier, 1823. pp.289-308. In: Ridgway, S.H. and Harrison, R. (eds). *River Dolphins and the Larger Toothed Whales*. Academic Press, London and San Diego. i-xix+442pp.
- Hooker, S.K. and Baird, R.W. 1999. Observations of Sowerby's beaked whales, (*Mesoplodon bidens*), in the Gully, Nova Scotia. *Can. Field-Nat.* 113(2): 273-77.
- Hurley, J. and Murphy, S. 2005. Sowerby's beaked whale, *Mesoplodon bidens* Sowerby, in Co. Wexford. *The Irish Naturalists Journal* 28(1): 41.
- IUCN. 2010. Report from the 9th Meeting of the western Gray Whale Advisory Panel, December 4-6 2010, Geneva, Switzerland. 69pp. [Available from http://www.iucn.org/wgap/wgap/meetings/wgway_9/].
- International Whaling Commission. 1976. Report of the Scientific Committee, June 1975. *Rep. int. Whal. Commn* 26(2):1-59.
- International Whaling Commission. 1978. Chairman's Report of the Twenty-Ninth Meeting. *Rep. int. Whal. Commn* 28:18-37.
- International Whaling Commission. 1989a. Report of the Comprehensive Assessment Workshop on Catch Per Unit Effort (CPUE), Reykjavik, 16-20 March 1987. *Rep. int. Whal. Commn (special issue)* 11:15-20.
- International Whaling Commission. 1989b. Report of the Scientific Committee, Annex H. Report of the sub-committee on small cetaceans. *Rep. int. Whal. Commn* 39:117-29.
- International Whaling Commission. 1993a. Chairman's Report of the Forty-Fourth Annual Meeting. *Rep. int. Whal. Commn* 43:11-53.

- International Whaling Commission. 1993b. Report of the Scientific Committee. *Rep. int. Whal. Commn* 43:55-92.
- International Whaling Commission. 1993c. Report of the Scientific Committee. Annex D. Report of the sub-committee on management procedures. *Rep. int. Whal. Commn* 43:93-103.
- International Whaling Commission. 1994a. Chairman's Report of the Forty-Fifth Annual Meeting, Appendix 12. Resolution on research on the environment and whale stocks. *Rep. int. Whal. Commn* 44:35.
- International Whaling Commission. 1994b. Chairman's Report of the Forty-Fifth Annual Meeting, Appendix 13. Resolution on the preservation of the marine environment. *Rep. int. Whal. Commn* 44:36.
- International Whaling Commission. 1994c. Report of the Scientific Committee. *Rep. int. Whal. Commn* 44:41-67.
- International Whaling Commission. 1994d. Report of the Scientific Committee, Annex D. Report of the Sub-Committee on Management Procedures. *Rep. int. Whal. Commn* 44:74-92.
- International Whaling Commission. 1995a. Chairman's Report of the Forty-Sixth Annual Meeting. *Rep. int. Whal. Commn* 45:15-52.
- International Whaling Commission. 1995b. Chairman's Report of the Forty-Sixth Annual Meeting, Appendix 4. IWC Resolution 1994-4. Resolution on a Review of Aboriginal Subsistence Management Procedures. *Rep. int. Whal. Commn* 45:42-43.
- International Whaling Commission. 1995c. Chairman's Report of the Forty-Sixth Annual Meeting, Appendix 15. IWC Resolution 1994-14. Resolution on whalewatching. *Rep. int. Whal. Commn* 45:49-50.
- International Whaling Commission. 1996. Chairman's Report of the Forty-Seventh Annual Meeting, Appendix 11. IWC Resolution 1995-10. Resolution on the environment and whale stocks. *Rep. int. Whal. Commn* 46:47-48.
- International Whaling Commission. 1997a. Chairman's Report of the Forty-Eighth Annual Meeting, Appendix 8. IWC Resolution 1996-8. Resolution on environmental change and cetaceans. *Rep. int. Whal. Commn* 47:52.
- International Whaling Commission. 1997b. Report of the Scientific Committee, Annex Q. Report of the whalewatching working group. *Rep. int. Whal. Commn* 47:250-56.
- International Whaling Commission. 1998a. Chairman's Report of the Forty-Ninth Annual Meeting, Appendix 7. IWC Resolution 1997-7. Resolution on environmental change and cetaceans. *Rep. int. Whal. Commn* 48:48-49.
- International Whaling Commission. 1998b. Report of the Scientific Committee, Annex G. Report of the sub-committee on Comprehensive Assessment of Southern Hemisphere humpback whales. *Rep. int. Whal. Commn* 48:170-82.
- International Whaling Commission. 1999a. Chairman's Report of the Fiftieth Annual Meeting, Appendix 6. IWC Resolution 1998-5. Resolution on environmental changes and cetaceans. *Ann. Rep. Int. Whaling Comm.* 1998:43-44.
- International Whaling Commission. 1999b. Chairman's Report of the Fiftieth Annual Meeting, Appendix 7. IWC Resolution 1998-6. Resolution for the funding of work on environmental concerns. *Ann. Rep. Int. Whaling Comm.* 1998:44-45.
- International Whaling Commission. 1999c. Report of the Scientific Committee, Annex D. Appendix 4. A recommendation by the RMP Working Group on Stock Identification to establish a working group of the Scientific Committee on stock definition. *J. Cetacean Res. Manage. (Suppl.)* 1:82-83.
- International Whaling Commission. 2000. Chairman's Report of the Fifty-First Annual Meeting, Appendix 9. IWC Resolution 1999-8. Resolution on DNA testing. *Ann. Rep. Int. Whaling Comm.* 1999:55.
- International Whaling Commission. 2001a. Chairman's Report of the 52nd Annual Meeting. *Ann. Rep. Int. Whaling Comm.* 2000:11-63.
- International Whaling Commission. 2001b. Chairman's Report of the Fifty-Second Annual Meeting, Appendix 1. Resolutions adopted during the 52nd annual meeting. IWC Resolution 2000-7. Resolution on environmental change and cetaceans. *Ann. Rep. Int. Whaling Comm.* 2000:56-57.
- International Whaling Commission. 2001c. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 3:1-76.
- International Whaling Commission. 2001d. Report of the Scientific Committee, Annex O. Report of the working group on DNA identification and tracking of whale products. Appendix 1. Terms of reference of working group on DNA identification and tracking of whale products. *J. Cetacean Res. Manage. (Suppl.)* 3:319-20.
- International Whaling Commission. 2001e. Report of the Scientific Committee, Annex G. Report of the Sub-Committee on the Comprehensive Assessment of Whale Stocks - In-depth Assessments. *J. Cetacean Res. Manage. (Suppl.)* 3:177-208.
- International Whaling Commission. 2001f. Report of the Scientific Committee, Annex I. Report of the Working Group on Stock Definition. *J. Cetacean Res. Manage. (Suppl.)* 3:229-38.
- International Whaling Commission. 2002a. Chair's Report of the 53rd Annual Meeting, Annex C. Resolutions Adopted During the 53rd Annual Meeting. Resolution 2001-9. Proposed resolution on interactions between whales and fish stocks. *Ann. Rep. Int. Whaling Comm.* 2001:58.
- International Whaling Commission. 2002b. Report of the Scientific Committee, Annex E. Report of the Standing Working Group (SWG) on the Development of an Aboriginal Subsistence Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage. (Suppl.)* 4:148-77.
- International Whaling Commission. 2003a. Chair's Report of the Fifty-Fourth Annual Meeting, Annex C. Report of the aboriginal subsistence whaling sub-committee. *Ann. Rep. Int. Whaling Comm.* 2002:62-75.
- International Whaling Commission. 2003b. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 5:1-92.
- International Whaling Commission. 2003c. Report of the Scientific Committee, Annex E. Report of the Standing Working Group on the Development of an Aboriginal Subsistence Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage. (Suppl.)* 5:154-255.
- International Whaling Commission. 2003d. Report of the Scientific Committee, Annex L. Report of the Sub-Committee on whalewatching. *J. Cetacean Res. Manage. (Suppl.)* 5:382-91.
- International Whaling Commission. 2003e. Report of the Scientific Committee, Annex L. Report of the Sub-Committee on whalewatching, Appendix 3. Examples of scientific studies showing changes in cetacean behaviour and habitat use as a result of the presence of whalewatching vessels. *J. Cetacean Res. Manage. (Suppl.)* 5:391.
- International Whaling Commission. 2004a. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 6:1-60.
- International Whaling Commission. 2004b. Report of the Scientific Committee, Annex E. Report of the Standing Working Group (SWG) on the Development of an Aboriginal Subsistence Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage. (Suppl.)* 6:185-210.
- International Whaling Commission. 2005a. Report of the Scientific Committee, Annex D. Report of the sub-committee on the Revised Management Procedure, Appendix 2. Requirements and Guidelines for Implementation. *J. Cetacean Res. Manage. (Suppl.)* 7:84-92.
- International Whaling Commission. 2005b. Report of the Scientific Committee, Annex E. Report of the Standing Working Group (SWG) on the Development of an Aboriginal Subsistence Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage. (Suppl.)* 7:115-24.
- International Whaling Commission. 2005c. Report of the Scientific Committee, Annex K. Report of the Standing Working Group on Environmental Concerns. *J. Cetacean Res. Manage. (Suppl.)* 7:267-81.
- International Whaling Commission. 2006. Report of the Scientific Committee, Annex H. Report of the Sub-Committee on the Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage. (Suppl.)* 8:151-70.
- International Whaling Commission. 2007a. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 9:1-73.
- International Whaling Commission. 2007b. Report of the Scientific Committee, Annex D. Report of the Sub-Committee on the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 9:88-128.
- International Whaling Commission. 2007c. Report of the Scientific Committee, Annex H. Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage. (Suppl.)* 9:188-209.
- International Whaling Commission. 2007d. Report of the Scientific Committee, Annex K. Report of the Standing Working Group on Environmental Concerns. *J. Cetacean Res. Manage. (Suppl.)* 9:227-96.
- International Whaling Commission. 2008a. Chair's Report of the Fifty-ninth Annual Meeting. *Ann. Rep. Int. Whaling Comm.* 2007:7-62.
- International Whaling Commission. 2008b. Regional non-lethal research partnerships: a proposal for the Southern Ocean (submitted by Australia). Paper IWC/60/16 presented to the 60th Annual Meeting of the IWC, March 2008, Santiago, Chile. 3pp. [Paper available from the Office of this Journal].
- International Whaling Commission. 2008c. Report of the Intersessional Workshop to Review Data and Results from Special Permit Research on Minke Whales in the Antarctic, Tokyo, 4-8 December 2006. *J. Cetacean Res. Manage. (Suppl.)* 10:411-45.
- International Whaling Commission. 2008d. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 10:1-74.
- International Whaling Commission. 2008e. Report of the Scientific Committee, Annex D. Report of the sub-committee on the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 10:90-120.
- International Whaling Commission. 2008f. Report of the Scientific Committee, Annex K1. Report of the working group on ecosystem modelling. *J. Cetacean Res. Manage. (Suppl.)* 10:293-301.
- International Whaling Commission. 2008g. Report of the Scientific Committee, Annex K. Report of the standing working group on environmental concerns. *J. Cetacean Res. Manage. (Suppl.)* 10:247-92.
- International Whaling Commission. 2008h. Report of the Scientific Committee, Annex K. Report of the standing working group on environmental concerns, Appendix 2. Report of the workshop on infectious and non-infectious diseases of marine mammals. *J. Cetacean Res. Manage. (Suppl.)* 10:259-76.
- International Whaling Commission. 2009a. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 11:1-74.

- International Whaling Commission. 2009b. Report of the Scientific Committee. Annex D. Report of the sub-committee on the Revised Management Procedure (RMP). *J. Cetacean Res. Manage. (Suppl.)* 11:91-144.
- International Whaling Commission. 2009c. Report of the Scientific Committee. Annex D. Report of the sub-committee on the Revised Management Procedure (RMP). Appendix 7. Report of the working group on the North Atlantic minke whales RMP *Implementation Review*. *J. Cetacean Res. Manage. (Suppl.)* 11:132-40.
- International Whaling Commission. 2009d. Report of the Scientific Committee. Annex E. Report of the standing working group on the Aboriginal Whaling Management Procedures. *J. Cetacean Res. Manage. (Suppl.)* 11:145-68.
- International Whaling Commission. 2009e. Report of the Scientific Committee. Annex H. Report of the sub-committee on other Southern Hemisphere whale stocks. *J. Cetacean Res. Manage. (Suppl.)* 11:220-47.
- International Whaling Commission. 2009f. Report of the Scientific Committee. Annex I. Report of the working group on stock definition. *J. Cetacean Res. Manage. (Suppl.)* 11:248-57.
- International Whaling Commission. 2009g. Report of the Scientific Committee. Annex I. Report of the working group on stock definition. Appendix 2. Guidelines for DNA data quality control for genetic studies relevant to IWC management advice. *J. Cetacean Res. Manage. (Suppl.)* 11:252-56.
- International Whaling Commission. 2009h. Report of the Scientific Committee. Annex N. Report of the working group on DNA. *J. Cetacean Res. Manage. (Suppl.)* 11:344-49.
- International Whaling Commission. 2009i. Report of the Scientific Committee. Annex P. Process for the review of special permit proposals and research results from existing and completed permits. *J. Cetacean Res. Manage. (Suppl.)* 11:398-401.
- International Whaling Commission. 2010a. Report of the 2nd Intersessional Workshop of the North Atlantic Fin Whale *Implementation*, 19-22 March 2009, Greenland Representation, Denmark. *J. Cetacean Res. Manage. (Suppl.)* 11(2):587-627.
- International Whaling Commission. 2010b. Report of the 2nd Intersessional Workshop of the North Atlantic Fin Whale *Implementation*, 19-22 March 2009, Greenland Representation, Denmark. Annex B. The specifications for the *Implementation Simulation Trials* for North Atlantic fin whales. *J. Cetacean Res. Manage. (Suppl.)* 11(2):598-618.
- International Whaling Commission. 2010c. Report of the Expert Workshop to Review the Ongoing JARPEN II Programme, 26-30 January 2009, Yokohama, Japan. *J. Cetacean Res. Manage. (Suppl.)* 11(2):405-50.
- International Whaling Commission. 2010d. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 11(2):1-98.
- International Whaling Commission. 2010e. Report of the Scientific Committee. Annex D. Report of the sub-committee on the Revised Management Procedure (RMP). *J. Cetacean Res. Manage. (Suppl.)* 11(2):114-34.
- International Whaling Commission. 2010f. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-Depth Assessments. Appendix 4. Data sources and work plan for the in-depth assessment of North Pacific sei whales. *J. Cetacean Res. Manage. (Suppl.)* 11(2):196-97.
- International Whaling Commission. 2010g. Report of the Scientific Committee. Annex H. Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage. (Suppl.)* 11(2):218-51.
- International Whaling Commission. 2010h. Report of the Scientific Committee. Annex K1. Report of the Sub-Committee on Ecosystem Modelling. *J. Cetacean Res. Manage. (Suppl.)* 11(2):300-05.
- International Whaling Commission. 2010i. Report of the Scientific Committee. Annex K. Report of the Standing Working Group on Environmental Concerns. *J. Cetacean Res. Manage. (Suppl.)* 11(2):267-99.
- International Whaling Commission. 2010j. Report of the Workshop on Cetaceans and Climate Change, 21-25 February 2009, Siena, Italy. *J. Cetacean Res. Manage. (Suppl.)* 11(2):451-80.
- International Whaling Commission. 2011a. Chair's Report of the Sixty-Second Annual Meeting. *Ann. Rep. Int. Whaling Comm.* 2010:5-39.
- International Whaling Commission. 2011b. Chair's Report of the Sixty-Second Annual Meeting. Annex D. Chair's report of the intersessional meeting of the Commission. *Ann. Rep. Int. Whaling Comm.* 2010:48-55.
- International Whaling Commission. 2011c. Chair's Report of the Sixty-Second Annual Meeting. Annex I. Report of the Conservation Committee. *Ann. Rep. Int. Whaling Comm.* 2010:89-99.
- International Whaling Commission. 2011d. Report of the POLLUTION 2000+ Phase II Workshop, 22-24 February 2010, The Marine Mammal Center, Sausalito, CA, USA. *J. Cetacean Res. Manage.* 12(Suppl.):421-36.
- International Whaling Commission. 2011e. Report of the Scientific Committee. *J. Cetacean Res. Manage.* 12(Suppl.):1-75.
- International Whaling Commission. 2011f. Report of the Scientific Committee. Annex D1. Report of the Working Group on the *Pre-Implementation Assessment* of Western North Pacific Common Minke Whales. *J. Cetacean Res. Manage.* 12(Suppl.):117-42.
- International Whaling Commission. 2011g. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. *J. Cetacean Res. Manage.* 12(Suppl.):89-116.
- International Whaling Commission. 2011h. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. Appendix 5. Updates to the RMP specifications and annotations. *J. Cetacean Res. Manage.* 12(Suppl.):102-03.
- International Whaling Commission. 2011i. Report of the Scientific Committee. Annex E. Report of the Standing Working Group on the Aboriginal Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage.* 12(Suppl.):143-67.
- International Whaling Commission. 2011j. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-Depth Assessments. *J. Cetacean Res. Manage.* 12(Suppl.):185-202.
- International Whaling Commission. 2011k. Report of the Scientific Committee. Annex H. Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage.* 12(Suppl.):203-26.
- International Whaling Commission. 2011l. Report of the Scientific Committee. Annex K. Report of the Standing Working Group on Environmental Concerns. *J. Cetacean Res. Manage.* 12(Suppl.):238-66.
- International Whaling Commission. 2011m. Report of the Scientific Committee. Annex Q. E-mail Correspondence Groups and Terms of Reference. *J. Cetacean Res. Manage.* 12(Suppl.):351-52.
- International Whaling Commission. 2011n. Report of the Third Intersessional Workshop on the Review of MSYR for Baleen Whales, Seattle, 20-24 April 2010. *J. Cetacean Res. Manage.* 12(Suppl.):399-411.
- Jackson, J. 2009. Southern Hemisphere humpback whale Comprehensive Assessment workshop, Seattle, February 2009: Summary table for BS Ei, Eii, Eiii, American and Independent Samoa, Fi and Fii (revised table from SC/58/Rep5). Paper SC/F09/SH7 presented to the Intersessional Meeting on Southern Hemisphere Humpback Whale Assessment Methodology, 3-5 February 2009, Seattle, USA (unpublished). 7pp. [Paper available from the Office of this Journal].
- Jackson, J.A., Carroll, E., Smith, T.D., Patenaude, N. and Baker, C.S. In press. Taking stock: the historical demography of the New Zealand right whale (the Tohora). Progress report to the New Zealand National Institute of Water and the Atmosphere, MS12 Part C: ZBD200505. 36pp.
- Jepson, P., Arbelo, M., Deaville, R., Patterson, I.A.P., Castro, P., Baker, J.R., Degollada, E., Ross, H.M., Herraes, P. and Pocknell, A.M. 2003. Whales, sonar and decompression sickness. *Nature* 425: 575-76.
- Johnson, M., Madsen, P.T., Zimmer, W.M.X., Aguilar de Soto, N. and Tyack, P. 2006. Foraging Blainville's beaked whales (*Mesoplodon densirostris*) produce distinct click types matched to different phases of echolocation. *J. Exp. Biol.* 209: 5038-50.
- Johnson, M., Madsen, P.T., Zimmer, W.M.X., Aguilar de Soto, N. and Tyack, P.L. 2004. Beaked whales echolocate on prey. *Proc. R. Soc. Lond. Ser. B. Supplement* 6(271(S6)): 383-86.
- Johnston, S.J. and Butterworth, D.S. 2005. A Bayesian assessment of the west and east Australian breeding populations (stocks D and E) of Southern Hemisphere humpback whales. Paper SC/57/SH15 presented to the IWC Scientific Committee, June 2005, Ulsan, Korea (unpublished). 25pp. [Paper available from the Office of this Journal].
- Kato, H., Miyashita, T., Kanda, N., Ishikawa, H., Furukawa, H. and Uoya, T. 2010. Status report of conservation and researches on the western gray whales in Japan, May 2009-April 2010. Paper SC/62/O7 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 6pp. [Paper available from the Office of this Journal].
- Kessler, M. and Harcourt, R. 2010. Aligning tourist, industry and government expectations: A case study from the swim with whales industry in Tonga. *Mar. Policy* 34: 1350-56.
- Koningson, S. 2011. Seals and Fisheries. A study of the conflict and some possible solutions, PhD. Thesis. University of Gothenburg, Sweden.
- Konishi, K., Tamura, T., Zenitani, R., Bando, T., Kato, H. and Walloe, L. 2008. Decline in energy storage in the Antarctic minke whale (*Balaenoptera bonaerensis*) in the Southern Ocean. *Polar Biol.* 31: 1509-20.
- Laake, J.L., Punt, A.E., Hobbs, R., Ferguson, M., Rugh, D. and Breiwick, J. In press. Gray whale southbound migration surveys 1967-2006: an integrated re-analysis. *J. Cetacean Res. Manage.* 12(3): In press.
- Lachmuth, C., Barrett-Lennard, L.G., Styen, D. and Milsom, W. 2011. Estimation of southern resident killer whale exposure to exhaust emissions from whalewatching vessels and potential adverse health effects and toxicity thresholds. *Mar Pollut Bull* 62: 792-805.
- Lauriano, G., Fortuna, C.M. and Vacchi, M. 2010. Occurrence of killer whales (*Orcinus orca*) and other cetaceans in Terra Nova Bay, Ross Sea, Antarctica. *Antarct. Sci.* 23(2): 139-43.
- LeDuc, R.G., Dizon, A.E., Goto, M., Pastene, L.A., Kato, H., Nishiwaki, S., LeDuc, C.A. and Brownell, R.L. 2007. Patterns of genetic variation in Southern Hemisphere blue whales, and the use of assignment test to detect mixing on the feeding grounds. *J. Cetacean Res. Manage.* 9(1): 73-80.

- LeDuc, R.G., Weller, D.W., Hyde, J., Burdin, A.M., Rosel, P.E., Brownell, R.L., Jr., Würsig, B. and Dizon, A.E. 2002. Genetic differences between western and eastern North Pacific gray whales (*Eschrichtius robustus*). *J. Cetacean Res. Manage.* 4(1): 1-5.
- Link, J.S., Ihde, T.F., Townsend, H.M., Osgood, K.E., Schirripa, M.J., Kobayashi, D.R., Gaichas, S., Field, J.C., Levin, P.S., Aydin, K.Y. and Harvey, C.J. 2010. Report of the 2nd National Ecosystem Modeling Workshop (NEMoW II); Bridging the Credibility Gap - Dealing with Uncertainty in Ecosystem Models. *NOAA Tech. Mem. NMFS-F/SPO-102*: 72pp.
- MacLeod, C. 2009. Understanding the impacts of human activities on beaked whales: from individuals to species and from local to global. In: Dolman, S., MacLeod, C. and Evans, P. (eds). *Proceedings of ECS Workshop on Beaked Whale Research, San Sebastian, Spain, 26th April 2007*. ECS Special Publication Series No. 51, Feb. 2009.
- MacLeod, C.D. 2000. Review of the distribution of beaked whales of the genus *Mesoplodon* in the North Atlantic (Order: Cetacea, Family: Ziphiidae). *Mammal Rev.* 30: 1-8.
- MacLeod, C.D. In press. *Mesoplodon bidens*. *Mamm. Species*. To be published by the American Society of Mammalogists.
- MacLeod, C.D. and Mitchell, G. 2006a. Key areas for beaked whales worldwide. *J. Cetacean Res. Manage.* 7(3): 309-22.
- MacLeod, C.D. and Mitchell, G. 2006b. Known key areas for beaked whales around the world. *J. Cetacean Res. Manage.* 7(3): 309-22.
- MacLeod, C.D., Pierce, G.J. and Begona Santos, M. 2004. Geographic and temporal variations in strandings of beaked whales (Ziphiidae) on the coasts of the UK and Republic of Ireland from 1800-2002. *J. Cetacean Res. Manage.* 6(1): 79-86.
- MacLeod, C.D., Santos, M.B. and Pierce, G.J. 2003. A review of data on diets of beaked whales: Evidence of niche separation and geographic segregation between three genera. *J. Mar. Biol. Assoc. UK* 83: 651-55.
- Madsen, P.T., Johnson, M., Aguilar de Soto, N., Zimmer, W.M.X. and Tyack, P. 2005. Biosonar performance of foraging beaked whales (*Mesoplodon densirostris*). *J. Exp. Biol.* 208: 181-94.
- Malakoff, D. 2001. Scientists use strandings to bring species to life. *Science* 293: 1754-57.
- Matsuda, N., Shirakihara, M. and Shirakihara, K. 2011. Effect of dolphin watching boats on the behaviour of Indo-Pacific bottlenose dolphins off Amakusa-Shinoshima Island, Japan. *Nippon Suisan Gakkaishi - Bulletin of the Japanese Society of Scientific Fisheries* 77: 8-14. [In Japanese].
- Matsuoka, K., Ensor, P., Hakamada, T., Shimada, H., Nishiwaki, S., Kasamatsu, F. and Kato, H. 2003. Overview of minke whale sightings surveys conducted on IWC/IDCR and SOWER Antarctic cruises from 1978/79 to 2000/01. *J. Cetacean Res. Manage.* 5(2): 173-201.
- Mead, J.G. 1989. Beaked whales of the genus *Mesoplodon*. pp.349-430. In: Ridgway, S.H. and Harrison, R. (eds). *Handbook of Marine Mammals. Vol. 4. River Dolphins and the Larger Toothed Whales*. Academic Press Inc., London and San Diego. i-xix+442pp.
- Mendez, M., Rosenbaum, H.C. and Bordino, P. 2008. Conservation genetics of the franciscana dolphin in northern Argentina: population structure, by-catch impacts, and management implications. *Conserv. Genet.* 9(2): 419-35.
- Mendez, M., Rosenbaum, H.C., Subramaniam, A., Yackulic, C. and Bordino, P. 2010a. Isolation by environmental distance in mobile marine species: molecular ecology of franciscana dolphins at their southern range. *Mol. Ecol.*: 17pp.
- Mendez, M., Rosenbaum, H.C., Wells, R.S., Stamper, A. and Bordino, P. 2010b. Genetic evidence highlights potential impacts of by-catch to cetaceans. *PLoS ONE* 5(12): 1-7.
- Mendez, M., Subramaniam, A., Collins, T., Minton, G., Baldwin, R., Berggren, P., Sarnblad, A., Amir, O.A., Peddemors, V.M., Karczmarski, L., Guissamulo, A. and Rosenbaum, H. 2011. Molecular ecology meets remote sensing: environmental drivers to population structure of humpback dolphins in the Western Indian Ocean. *Heredity* 2011: 1-13.
- Minton, G., Collins, T., Findlay, K., Baldwin, R., Ersts, P.J., Rosenbaum, H., Berggren, P. and Baldwin, R.M. 2011. Seasonal distribution, abundance, habitat use and population identity of humpback whales in Oman. *J. Cetacean Res. Manage. (special issue 3)*: 183-98.
- Miyashita, T. 2006. Cruise report of the sighting survey in the waters west of the Kuril Islands and the Kamchatka Peninsula in 2005. Paper SC/58/NPM5 presented to the IWC Scientific Committee, May 2006, St. Kitts and Nevis, West Indies (unpublished). 9pp. [Paper available from the Office of this Journal].
- Mullin, K. 2007. Abundance of cetaceans in the oceanic Gulf of Mexico based on 2003-2004 ship surveys. Available from: NMFS, Southeast Fisheries Science Center, PO Drawer 1207, Pascagoula, MS 39568. 26pp.
- Nicol, S., Bowie, A., Jarman, S., Lannuzel, D., Meiners, K.M. and van der Merwe, P. 2010. Southern Ocean iron fertilization by baleen whales and Antarctic krill. *Fish and Fisheries* 11: 203-09.
- Norman, S.A. and Mead, J.G. 2001. *Mesoplodon europaeus*. *Mamm. Species* 688: 1-5.
- Okamura, H. and Kitakado, T. 2010. Abundance estimates of Antarctic minke whales from the historical IDCR/SOWER survey data using the OK method. Paper SC/62/IA3 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 35pp. [Paper available from the Office of this Journal].
- Pastene, L.A., Hatanaka, H., Fujise, Y., Kanda, N., Murase, H., Tamura, T., Miyashita, T. and Kato, H. 2009. The Japanese Whale Research Program under Special Permit in the western North Pacific Phase-II (JARPN II): origin, objectives and research progress made in the period 2002-2007, including scientific considerations for the next research period. Paper SC/J09/JR1 presented to the Expert Workshop to Review Results of JARPN II, 26-30 January 2009, Tokyo, Japan (unpublished). 73pp. [Paper available from the Office of this Journal].
- Pastene, L.A., Kitakado, T. and Hatanaka, H. 2008. Research proposal accompanying management variant 2 of the RMP Implementation for western North Pacific Bryde's whale. Paper SC/60/PF19 presented to the IWC Scientific Committee, June 2008, Santiago, Chile (unpublished). 10pp. [Paper available from the Office of this Journal].
- Podestá, M., D'Amico, A., Pavan, G., Drougas, A., Komnenou, A. and Portunato, N. 2006. A review of Cuvier's beaked whale strandings in the Mediterranean Sea. *J. Cetacean Res. Manage.* 7(3): 251-61.
- Pollock, C.M., Mavor, R., Weir, C.R., Reid, A., White, R.W., Tasker, M.L., Webb, A. and Reid, J.B. 2000. *The Distribution of Seabirds and Marine Mammals in the Atlantic Frontier, North and West of Scotland*. Joint Nature Conservation Committee, Aberdeen. 92pp.
- Pomilla, C., Collins, T., Minton, G., Findlay, K.P., Leslie, M.S., Ponnampalam, L., Baldwin, R. and Rosenbaum, H.C. 2010. Genetic distinctiveness and decline of a small population of humpback whales (*Megaptera novaeangliae*) in the Arabian Sea (Region X). Paper SC/62/SH6 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 15pp. [Paper available from the Office of this Journal].
- Pouloupoulos, J. 1989. A Sowerby's whale discovered in the Greek Seas. *Nature, Bull. Hell. Soc. Protect. Nature* 44/45: 7-9. [In Greek with English abstract].
- Punt, A.E. 2010. Further analyses related to the estimation of the rate of increase for an unknown stock using a Bayesian meta-analysis. Paper SC/62/RMP3 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 14pp. [Paper available from the Office of this Journal].
- Punt, A.E. and Wade, P.R. 2010. Population status of the eastern North Pacific stock of gray whales in 2009. Paper SC/62/AWMP2 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 24pp. [Paper available from the Office of this Journal].
- Reeves, R., Brownell, R.L., Burkanov, V.N., Kingsley, M.C.S., Lowry, L.F. and Taylor, B.L. 2011. Sustainability assessment of beluga (*Delphinapterus leucas*) live-capture removals in the Sakhalin-Amur region, Okhotsk Sea, Russia. Report of an independent scientific review panel. *Occasional Papers of the Species Survival Commission* 44. IUCN, Gland, Switzerland. 34pp.
- Reeves, R. and Notarbartolo di Sciara, G. 2006. *The status and distribution of cetaceans in the Black Sea and Mediterranean Sea - Workshop report - Monaco 5-7 March 2006*. IUCN Centre for Mediterranean Cooperation, Malaga, Spain. 137pp.
- Reeves, R.R. 1988. Exploitation of cetaceans in St. Lucia, Lesser Antilles, January 1987. *Rep. int. Whal. Commn* 38: 445-47.
- Revelli, E., Pusser, T., Bocconcelli, A., Ballardini, M., Sturlese, A. and Johnson, M.P. 2008. Photoidentification catalog of Cuvier's beaked whale (*Ziphius cavirostris*) in the Ligurian Sea Report to the Woods Hole Oceanographic Institution. [Available online at <http://darchive.mblwhoilibrary.org/handle/1912/2165>.]
- Ritter, F., Ernert, A. and Smit, V. 2011. A long-term cetacean sighting data set from whale watching operations as a reflection of the environmental dynamics in a multi-species cetacean habitat. Poster presented at the Annual Conference of the European Cetacean Society (ECS) in Cadiz (Spain), 21-23 March 2011.
- Rojas-Bracho, L., Jaramillo-Legorreta, A.M., Taylor, B., Barlow, J., Gerodette, T., Tregenza, N., Swift, R. and Akamatsu, T. 2010. Assessing trends in abundance for vaquita using acoustic monitoring: within refuge plan and outside refuge research needs. Paper SC/62/SM5 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 11pp. [Paper available from the Office of this Journal].
- Rose, N.A., Parsons, E.C.M. and Sellares, R. 2007. Swim-with-whale tourism: an update on development of a questionnaire. Paper SC/59/WW6 presented to the IWC Scientific Committee, May 2007, Anchorage, USA (unpublished). 4pp. [Paper available from the Office of this Journal].
- Rosso, M., Aurelie, M. and Wurtz, M. 2009. Population size and residence patterns of Cuvier's beaked whale (*Ziphius cavirostris*) in the Genoa Canyon, north-western Mediterranean Sea. 18th Biennial Conference on the Biology of Marine Mammals, Quebec City, 12-16 October 2009.

- Santos, M.B., Martin, V., Arbelo, M., Fernandez, A. and Pierce, G.J. 2007. Insights into the diet of beaked whales from the atypical mass stranding in the Canary Islands in September 2002. *J. Mar. Biol. Assoc. U.K.* 87: 243-51.
- Schaffar, A., Garrigue, C. and Constantine, R. 2010. Exposure of humpback whales to unregulated whalewatching activities in their main reproductive area in New Caledonia. *J. Cetacean Res. Manage.* 11(2): 147-52.
- Scheer, M. 2010. Review of self-initiated behaviors of free-ranging cetaceans directed towards human swimmers and waders during open water encounters. *Interactions Studies* 11(3): 442-46.
- Secchi, E.R. 1999. Taxa de crescimento potencial intrínseco de um estoque de franciscanas, (*Pontoporia blainvillei*) (Gervais & D'Orbigny, 1844) (Cetacea, Pontoporiidae) sob o impacto da pesca costeira de emalhe, Fundação Universidade Federal do Rio Grande, Rio Grande, Brasil. 152pp. [In Portuguese].
- Secchi, E.R., Ott, P.H., Crespo, E.A., Kinas, P.G., Pedraza, S.N. and Bordino, P. 2001. A first estimate of franciscana (*Pontoporia blainvillei*) abundance off southern Brazil. *J. Cetacean Res. Manage.* 3(1): 95-100.
- Seuront, L. and Cribb, N. 2011. Fractal analysis reveals pernicious stress levels related to boat presence and type in the Indo-Pacific bottlenose dolphin, *Tursiops aduncus*. *Physica A* 390: 2333-39.
- Siciliano, S., Van Bresse, M.F., Moreno, I.B., Ott, P.H., Tavares, M., Flores, P.A.C., Flach, L., Cesar Reyes, J., Echegaray, M., De Oliveira Santos, M.C., Viddi, F., Crespo, E., Klaich, J.M., Félix, F., Sanino, G.P. and Van Waerebeek, K. 2008. Review of lobomycosis and lobomycosis-like disease (LLD) in cetacea from South America. Paper SC/60/DW13 presented to the IWC Scientific Committee, June 2008, Santiago, Chile (unpublished). 6pp. [Paper available from the Office of this Journal].
- Simon, M., Stafford, K., Beedholm, K., Lee, C. and Madsen, P. 2010. Singing behavior of fin whales in the Davis Strait with implications for mating, migration and foraging. *J. Acoustic. Soc. Am.* 128(5): 3200-10.
- Smith, J.A. 2010. The ecology of Cuvier's beaked whale, *Ziphius cavirostris* (Cetacea: Ziphiidae) in the Bay of Biscay. Thesis, University of Southampton. 229pp.
- Taylor, B.L., Baird, R., Barlow, J., Dawson, S.M., Ford, J., Mead, J.G., Notarbartolo de Sciara, G., Wade, P. and Pitman, R.L. 2008. *Ziphius cavirostris*. IUCN 2010 Red List of Threatened Species. Version 2010.4.
- Townsend, H.M., Link, J.S., Osgood, K.E., Gedamke, T., Watters, G.M., Polovina, J.J., Levin, P.S., Cyr, N. and Aydin, K.Y. 2008. Report of the National Ecosystem Modeling Workshop (NEMoW). *NOAA Technical Memorandum NMFS SPO-87*: 93pp.
- Tseng, Y., Huang, Y., Kyle, G. and Yang, M. 2011. Modeling the impacts of cetacean-focused tourism in Taiwan: Observations from cetacean watching boats: 2002-2005. *Environ. Manage.* 47: 56-66.
- Tyack, P.L., Johnson, M., Aguilar Soto, N., Sturlese, A. and Madsen, P.T. 2006. Extreme diving of beaked whales. *J. Exp. Biol.* 209: 4238-53.
- Tyack, P.L., Zimmer, W.M.X., Moretti, D., Southall, B.L., Claridge, D.E., Durban, J.W., Clark, C.W., D'Amico, A., DiMarzio, N.A., Jarvis, S., McCarthy, E., Morrissey, R., Ward, J. and Boyd, I.L. 2011. Beaked whales respond to simulated and actual navy sonar. *PLoS ONE* 6(3): 1-15.
- Van Canneyt, O., Certain, G., Doremus, G., Laran, S.G., Ridoux, V., Bolanos, J., Jeremie, S. and Watremez, P. 2010. Distribution and abundance of marine megafauna in French Guiana. REMMOA Campaign - Guiana. Final report for the Agency for Marine Protected Areas. 43pp. [Available from: <http://www.cep.unep.org>].
- Vanderlaan, A.S.M., Corbett, J.J., Green, S.L., Callahan, J.A., Wang, C., Kenney, R.D., Taggart, C.T. and Firestone, J. 2009. Probability and mitigation of vessel encounters with North Atlantic right whales. *Endangered Species Research* 6: 273-85.
- Visser, F., Hartman, K., Rodd, E., Hendriks, A.J.E., Zuur, D., Wolff, W., Huisman, J. and Pierce, G. 2010. Risso's dolphin alter daily resting pattern in response to whale watching at the Azores. *Mar. Mammal Sci.* 27: 366-81.
- Wade, P.R. 1998. Calculating limits to the allowable human-caused mortality of cetaceans and pinnipeds. *Mar. Mammal Sci.* 14(1): 1-37.
- Wang, P. 1999. *Chinese Cetaceans*. Ocean Enterprises Ltd. 325pp. [In Chinese].
- Ward, N., Moscrop, A. and Carlson, C. 2001. Elements for the Development of a Marine Mammal Action Plan for the Wider Caribbean: A Review of Marine Mammal Distribution UNEP(DEC)/CAR IG.20/INF.3. First Meeting of the Contracting Parties (COP) to the Protocol Concerning Specially Protected Areas and Wildlife (SPA) in the Wider Caribbean Region, Havana, Cuba, 24-25 September 2001. [Available from: <http://www.cep.unep.org/pubs>].
- Waring, G.T., Josephson, E., Fairfield-Walsh, C.P. and Maze-Foley, K. 2009. US Atlantic and Gulf of Mexico marine mammal stock assessments 2008. *NOAA Tech. Mem. NMFS NE-210*: 440pp. [Available at: <http://www.nefsc.noaa.gov/publications/tm/tm210/>].
- Weller, D.W., Bradford, A.L., Kato, H., Bando, T., Otani, S., Burdin, A.M. and Brownell Jr, R.L. 2008. Photographic match of a western gray whale between Sakhalin Island, Russia and Honshu, Japan: first link between the feeding ground and a migratory corridor. *J. Cetacean Res. Manage.* 10(1): 89-91.
- Williams, R., Gero, S., Bejder, L., Calambokidis, J., Kraus, S., Lusseau, D., Read, A. and Robbins, J. 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the *Deepwater Horizon*/BP incident. *Conservation Letters* 4: 228-33.
- Williams, R., Hedley, S., Branch, T.A., Bravington, M., Zerbini, A.N. and Findlay, K. 2011. Chilean blue whales as a case study to illustrate methods to estimate abundance and evaluate conservation status of rare species. *Conservation Biology* 25: 526-535.
- Zeh, J.E. and Punt, A.E. 2005. Updated 1978-2001 abundance estimates and their correlations for the Bering-Chukchi-Beaufort Seas stock of bowhead whales. *J. Cetacean Res. Manage.* 7(2): 169-75.
- Zerbini, A.N., Secchi, E.R., Danilewicz, D., Andriolo, A., Laake, J.L. and Azevedo, A. 2010. Abundance and distribution of the franciscana (*Pontoporia blainvillei*) in the Franciscana Management Area II (southeastern and southern Brazil). Paper SC/62/SM7 presented to the IWC Scientific Committee, June 2010, Agadir, Morocco (unpublished). 14pp. [Paper available from the Office of this Journal].
- Zerbini, A.N., Waite, J.M., Laake, J.L. and Wade, P.R. 2006. Abundance, trends and distribution of baleen whales off Western Alaska and the central Aleutian Islands. *Deep-Sea Res. I* 53: 1772-90.