Senate Standing Committee on Environment and Communications
Legislation Committee
Answers to questions on notice
Environment portfolio

Question No: 9

Hearing: Additional Estimates

Outcome: Outcome 1

Programme: Wildlife Heritage and Marine Division (WHM)

Topic: Australian Marine Mammal Grants Program

Hansard Page: 74

Question Date: 08 February 2016

Question Type: Spoken

Senator Singh asked:

Ms Schweizer: There are a number of clear areas where more research is warranted. When the IWC scientific committee investigated Japan's proposal for a successor scientific research program, after the International Court of Justice found that their previous program was not scientific and was not for the purposes of science, Japan did develop a follow-up proposal, which was subject to scrutiny by the scientific committee. At the committee's most recent meeting, which was in the middle of last year, in 2015, there was debate in the committee as to whether or not some of the research that Japan advised they needed to support with lethal take was warranted or not. Some of that relates to age to maturity and a number of issues. I think we can certainly provide that report from the scientific committee—it is in the public domain—which does identify the areas in dispute.

Senator SINGH: That would be handy.

Answer:

The report of the June 2015 International Whaling Commission Scientific Committee meeting is attached to this response.

A summary of the debate on Japan's proposal for a new research whaling programme in the Southern Ocean (known as NEWREP-A) is on pages 88-89.

Report of the

Scientific Committee

San Diego, CA, USA, 22 May-3 June 2015

This report is presented as it was at SC/66a.
There may be further editorial changes (e.g. updated references, tables and figures)
made before publication.

International Whaling Commission,

San Diego, CA, USA, 2015

Report of the Scientific Committee

2

The meeting (SC/66a) was held at the Marriott Marquis Marina Hotel, San Diego Marina from 19 May-3 June 2015 and was chaired by Toshihide Kitakado. The next meeting of the Commission (IWC/66) will take place during September 2016 and the next meeting of the Scientific Committee (SC/66b) will take place in Bled, Slovenia, from 5-19 June, in 2016. The list of participants is given as Annex A.

1. INTRODUCTORY ITEMS

1.1 Chair's welcome and opening remarks
Kitakado welcomed the participants to the meeting. He thanked the Government of the USA and City of San Diego for their invitation to this colourful and beautiful city. He thanked Ryan Wulff (Alternate US Commissioner), Melissa Garcia (IWC Coordinator for the USA), Debra Palka (Head of the US Scientific Committee delegation) and Mark Tandy (Secretariat) for all their help in organising the meeting.

Wulff welcomed participants to San Diego. He noted that the IWC is the premier body dealing with conservation and management of cetaceans, and its Scientific Committee is the key to its success. He hoped that participants would enjoy their time in San Diego.

The Committee then paused for a moment of silence, with great sorrow, for those colleagues who had passed away since the last meeting; Dorete Bloch, Natalie Goodall, Richard Laws and Peter Best.

Dorete Bloch worked closely with the IWC on the creation of the catch series for various North Atlantic whales. She was determined not to allow bureaucracy to interfere with the accuracy of her data and was generous in sharing her data with the IWC. She was a longstanding member of the IWC Scientific Committee and contributed to almost 80 Committee papers. She made a particularly notable contribution to the North Atlantic fin whale assessment. She was not only an authority on cetaceans, but of birds, plants and anything else you would wish to know about the Faroe Islands. She was also an accomplished artist and her enthusiasm for the Faroe Islands, and indeed life, was inspirational.

Natalie Prosser Goodall was a pioneer of marine mammal science in South America, especially in the Tierra del Fuego region. Most of her life was spent in this remote, and wild region where she lived on the margins of the Beagle Channel. She began collecting cetacean skulls as a hobby but this developed into one of the most important marine mammal collections in the world, including many rare species of beaked whales and may have more Commerson's dolphins than any other institution.

She attended several meetings of the IWC Scientific Committee and presented 57 documents during these meetings, the last being in Chile in 2008. She was a major contributor the IWC special issue on *Cephalorhynchus* (Brownell and Donovan, 1988). She was an inspiration to many in the marine mammal science community.

Richard Laws initially worked on elephant seals and his marine mammal reputation was enhanced by major work on fin whales in the late 1950s. At that time he was a regular member of the IWC Scientific Committee. He then turned his interest to African land mammals, but subsequently published on Antarctic Ecology and chaired the 1976 Bergen Marine Mammals of the Sea Conference. He later becoming the Director of the British Antarctic Survey. He pioneered the study of growth rings in seal teeth, which was applicable for other species, particularly sperm whales.

Peter Best was a giant within the IWC Scientific Committee, and indeed the world outside it. His contributions to the Committee's work spanned five decades. He chaired a number of sub-committees and was elected vice-Chair in 1982 but was unable to take up the position due to South Africa's withdrawal from whale science at that time. His value to the Committee was such that he was invited as a key participant since1983. He made major contributions to many aspects of cetacean conservation and management. One of the most lasting related to his role as an instigator of the IWC International Decade of Cetacean Research (IDCR) Antarctic whale marking and sightings programme which eventually became IWC-SOWER and lasted from 1978/79 until 2008/9; he contributed to almost 200 papers to the Committee – all important and directly relevant to our work. Right whales were one of his 'true loves' – he was co-editor of two IWC Special Issues on right whales in 1986 and 2001 - but it was the 36 years of annual surveys of Southern right whales off the South African coast, one of the world's longest time series for large whales, that represented perhaps his major achievement. This survey programme has documented the recovery of the population from near extinction and has extended to photogrammetry, genetics and satellite tracking studies. His reputation worldwide was as a leading international cetacean expert, with field work experience off the coast of South Africa, in the Antarctic and the West Indian Ocean; he made seminal contributions to studies of sperm and humpback whales, dolphins and fur seals, and even the mysterious pygmy right whale. His wisdom, sometimes gruff, often humorous, inspired everyone he met; he will be sorely missed by us all.

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
The Committee agreed to the meeting procedures and time schedule outlined by the Chair.

3

1.4 Establishment of sub-committees and Working Groups
The following pre-meetings were held:

(1) a joint meeting of the Commission's Standing Working Group on Whalewatching and the Scientific Committee's sub-committee Whalewatching met on Wednesday 20 May 2015;
(2) the 'Towards Ensemble Averaging of Cetacean Distribution Models, a Joint NMFS-IWC Preparatory Workshop' met on Thursday 21 May;
(3) the Standing Working Group on Environmental Concerns Cetacean Emerging and Resurging Diseases (CERD) Working Group met on Thursday 21 May.

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;

Annex E – Standing Working Group on an Aboriginal Whaling Management Procedure;

Annex F – Sub-Committee on Bowhead, Right and Gray Whales;

Annex G – Sub-Committee on In-Depth Assessments;

Annex H – Sub-Committee on Other Southern Hemisphere Whale Stocks;

Annex I – Working Group on Stock Definition;

Annex J – Working Group on Non-deliberate Human-Induced Mortality of Large Whales;

Annex K – Standing Working Group on Environmental Concerns;

Annex K1– Working Group to Address Multi-species and Ecosystem Modelling Approaches;

Annex L – Standing Sub-Committee on Small Cetaceans;

Annex M – Sub-Committee on Whalewatching

Annex N – Working Group on DNA;

Annex O – Working Group to Review Sanctuaries and Sanctuary Proposals.

Annex T provides a list of all of the intersessional groups established at this year's meeting.

1.5 Computing arrangements
Allison outlined the computing and printing facilities available for delegate use.

2. ADOPTION OF AGENDA

The adopted Agenda is given as Annex B. Statements on the Agenda are given as Annex U.

3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

3.1 Documents submitted
The documents available are listed in Annex C. As agreed at the 2012 Annual Meeting, primary papers were only available at the meeting in electronic format. (IWC, 2013b pp.78-9).

3.2 National Progress Reports on research
The National Progress Reports have their origin in Article VIII, Paragraph 3 of the Convention. All member nations are urged by the Commission to provide Progress Reports to the Scientific Committee following the most recent guidelines developed by the Scientific Committee and adopted by the Commission. The report is intended as a concise summary of information available in member countries and where to find more detailed information if required. In addition, the IWC holds a number of specialist databases (including, catches, sightings, ship strikes, images).

As agreed at the 2013 Annual Meeting (IWC, 2014d), all National Progress Reports were submitted electronically through the IWC National Progress Reports data portal. This year, as last, 16 countries provided National Progress Reports including data on bycatch, entanglement, ship strikes, direct and indirect takes, sampling, sightings tracking studies. These countries were: Argentina; Australia; Brazil; Croatia; Denmark; Germany; Japan; Korea; Mexico; Netherlands; New Zealand; Norway; Peru; Spain; United Kingdom; USA.

The Committee again **recommends** that all member states submit National Progress Reports to the IWC through the IWC data portal (http://portal.iwc.int); the present contributions represent only 20% of member nations.

3.3 Data collection, storage and manipulation
3.3.1 Catch data and other statistical material
Data received by the Secretariat since the 2014 meeting are listed in Table 1, including catch data from the 2014 season.

Table 1

List of data and programs received by the IWC Secretariat since the 2014 meeting.

Date	From	IWC ref.	Details
Catch data:			
17-06-14	Russia: V. Ilyashenko	E115 Cat2013	Individual data from the 2013 grey whale hunt in Chukotka.
27-01-15	Iceland: T. Gunnlaugsson	E123 Cat2014	Individual records of minke and fin whales caught by Iceland 2014.
	Greenland: N. Levermann	E115 Cat2013	Individual catch data from Greenland (all species) in 2013.
13-05-15	Norway: N. Øien	E123 Cat2014	Individual minke records from the Norwegian 2014 commercial catch. Access restricted (specified 14-11-00).
14-05-15	Russia: V. Ilyashenko	E123 Cat2014	Individual data from the 2014 grey whale hunt in Chukotka.
18-3- and 21-05-15	Greenland: N. Levermann	E123 Cat2010-14	Individual catch data from Greenland (all species) from 2010-2014.
21-05-15	Japan: N. Okazoe	E123 Cat2014	Individual data from Japan's catch in 2014 in the N. Pacific (JARPN II) & 2013/4 in the Antarctic.
24-05-15	USA: R. Suydam	E123 Cat2014	Individual data from the 2014 bowhead hunt in Alaska.
29-05-15	St Vincent: R. Ryan	E125 Cat2015	Information from St Vincent and the Grenadines on the 2015 catch and struck and lost in 2014.
10-12-14	D.Bloch	E119	Diary of Faroes catcher *Sumba* 1949 and 1951-58.
Sightings data:			
18-06-14	H. Brown		Miscellaneous sightings records.
26-12-14	Japan: K. Matsuoka	E120	JARPNII 2014 cruise sightings data forms (electronic) and reports.
05-01-15	Japan: K. Matsuoka	E121	POWER cruise sightings data – 2014 data forms (electronic and paper).
11-05-15	Japan: K. Matsuoka	E124	Japanese 2014-15 Antarctic dedicated sighting survey data: sightings, effort, weather and experiment.
20-2-15	Norway: N. Øien	E122	Sighting survey data submitted under the SC Guidelines and Requirements for use by SC members for the Committee's work for the RMP *Implementation Review of* North Atlantic common minke whales at the 2015 meeting.

3.3.2 Progress of data coding projects and computing tasks
Allison reported that work has continued on the entry of catch data into both the IWC individual and summary catch databases, including data received from the 2013 season.

The IWC summary catch database has been updated to include the pre-1940 coastal catches by Japan by year and area and to incorporate the new information and assumptions agreed for the catch series developed for the western North Pacific Bryde's whale and the western North Pacific common minke whale *Implementations* (Allison, 2011; IWC, 2008b; 2014e). A new version of the catch databases will be released shortly.

Validation of the data from the 2012 POWER sightings cruise has been completed and validation data from the 2013 and 2014 cruises has commenced. This and the DESS database is discussed further under 10.15.

Programming work during the past year has concentrated on the development of the programs and input data for the North Atlantic fin and minke whale *Implementation* trials (see Items 6.1 and 6.2). This and other work is described under the relevant sub-committee items.

4. COOPERATION WITH OTHER ORGANISATIONS

4.1 Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR)
The report of the IWC observer at the 33rd Meeting of the CCAMLR Scientific Committee (SC-CCAMLR), held in Hobart, Australia, from 20-24 October 2014 is given as IWC/66/4(2015)C. The main items considered at the CCAMLR meeting of relevance to the IWC included: (1) advances in statistics, assessments, modelling, acoustics and survey methods; (2)harvested species; (3) bycatch; (4) incidental mortality associated with fisheries; spatial management of impacts on the Antarctic ecosystem; (5) illegal fishing; (6) CCAMLR scheme of international scientific observation; and (7) cooperation with other organisations.

A joint IWC-CCAMLR workshop was held in 2008 (IWC and CCAMLR, 2010) to review data for Antarctic marine ecosystem models. Since then significant knowledge gaps in aspects such as spatial variability and trends in prey species have been identified. A further joint workshop is planned for prior to the 2016 IWC SC meeting and a correspondence group is continuing to plan for this.

WG-FSA discussed data availability from research relating to depredation and other opportunistic cetacean observations. The CCAMLR Scientific Observer Scheme Coordinator will contact the Southern Ocean Research Programme (SORP) Coordinator to determine how best to coordinate photo-ID catalogues of cetaceans used in CCAMLR and the IWC.

The results of analyses of depredation of fish by killer whales and sperm whales were discussed and were noted to be particularly high in one area (Subarea 58.6, near Crozet Islands). The committee recommended that similar analyses be conducted in other areas.

WG-EMM discussed research on Type C killer whales in the Ross Sea. It was suggested that toothfish are the only fish prey capable of meeting female killer whale energetic requirements during calving and lactation periods. Thus, a reduction in toothfish availability could reduce the reproductive success of these killer whales.

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

4.2 Conservation on the International Trade in Endangered Species of Wild Flora and Fauna (CITES)
The Conference of the Parties did not meet during the intersessional period.

4.3 Convention on the Conservation of Migratory Species (CMS)
4.3.1 Scientific Council
There was no meeting of the Scientific Council during the intersessional period.

4.3.2 Conference of Parties
The report of the observer at the 11th Conference of Parties held in Quito, Ecuador from 4-9 November 2914 is given as IWC/66/4(2015)E. Proposals adopted relevant to the work of the IWC included: (1) the listing of the Mediterranean population of Cuvier's beaked whale on CMS appendix II; (2) adoption of Resolution 11.10 on synergies and partnerships, and especially the reference to the IWC; (3) adoption of Resolution 11.29 on sustainable boat based wildlife watching; (4) adoption of Resolution 11.30 on marine debris; (5) adoption of Resolution 11.22 on live capture of small cetaceans; and (6) adoption of Resolution 11.23 on Cetacean Culture.

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

4.3.3 Agreement on Small Cetaceans of the Baltic and North Seas (ASCOBANS)
The report of the observer at the 21st meeting of the Advisory Committee (AC) held in Gothenburg, Sweden, 29 October – 1 November 2014 is given as IWC/66/4(2015)L. Currently ASCOBANS has three harbour porpoise action plans; the Jastarnia Plan for the Baltic Sea; and conservation plans for the 'gap' area (Western Baltic, Belt Sea and Kattegat) and the North Sea. Updates on these were given. The AC invited submission of draft conservation plans for common dolphins in the ACCOBAMS and ASCOBANS areas.

The importance of investigating the impacts of PCBs on small cetaceans was highlighted. ASCOBANS parties were encouraged to support research on the effects of PCBs in the agreement area.

The AC discussed ship strikes and agreed to seek collaboration with the IWC on this topic, along with the issue of marine debris.

The Committee thanked Scheidat for her report and **agrees** that she should represent the Committee as an observer at the next ASCOBANS Advisory Committee meeting.

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

No formal meetings of ACCOBAMS occurred during the intersessional period, but Donovan and Panigada attended a meeting at the ACCOBAMS Secretariat to discuss the ACCOBAMS Survey Initiative. Co-operation continues on a number of issues including ship strikes. Donovan agreed to continue to represent the Committee with respect to ACCOBAMS.

4.4 Food and Agricultural Organization of the United Nations (FAO)
No observer for the IWC attended the 2014 meeting of FAO.

4.5 Inter-American Tropical Tuna Commission (IATTC)
The reports of the IWC observer at the 87th and 88th meetings of the IATTC held in Lima, Peru 14-18 July 2014 and La Jolla, USA, 31 October–1 November 2014 respectively are given as IWC/66/4(2015)G. The primary focus of the IATTC remains on managing fisheries for tuna and billfish in the Convention area. However, the Antigua Convention also calls for an ecosystem approach to management including monitoring, management and conservation of non-target or associated or dependent species, and it mandates the application of the precautionary principle in managing under uncertainty.

During the 2014 Scientific Advisory Committee meeting ongoing work describing what is known about the direct impact of EPO fisheries upon various species and species groups of the ecosystem was summarised. The results of this and similar work may help inform future directions for managing fisheries and conserving dolphins.

There was considerable discussion of tuna conservation measures and these may have implications for dolphin conservation in the EPO. Fishing effort on dolphins may increase if, for example, future measures focus on further restricting the sector of the fishery that takes the greatest number of juveniles (i.e. vessels that set on floating objects). This could provide an incentive to fish on dolphins in order to remain active during closure periods for the floating object fishery and/or to not exceed catch limits. Striking a

6

balance in the trade-offs of various tuna fishing sectors and their respective environmental impacts, including impacts to dolphins, remains a difficult issue and one that will be the focus of discussions in 2015.

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

4.6 Agreement on the International Dolphin Conservation Programme (AIDCP)
The reports of the IWC observer at the 29th and 30th Meetings of the Parties to AIDCP held in Lima, Peru 8 July 2014 and La Jolla, USA, 26 October 2014 respectively are given as IWC/66/4(2015)G. AIDCP mandates 100% coverage by observers of fishing trips by purse seiners of carrying capacity greater than 363 metric tons in the Agreement Area (i.e. the eastern Pacific Ocean (EPO)). In 2014, 100% of trips by these vessels were sampled by independent observers, and 975 dolphins were reported killed. This reported dolphin mortality is the first since 2009 in which mortality did not decrease from the prior year.

The overall dolphin mortality limit (DML) for the international fleet in 2014 was 5,000 animals and the unreserved portion of 4,900 was allocated to 83 qualified vessels that requested DMLs. In 2014, no vessel exceeded its DML. The average individual-vessel DML (ADML) in 2014, based on 83 DML requests for vessels deemed qualified to receive one, was 59. The number of sets on dolphin-associated schools of tuna made by vessels over 363 t has been variable in recent years, reaching its highest point of 11,645 in 2010. During 2011/12 the number of dolphin-associated sets generally decreased; however, in 2014 dolphins sets rose again to 11,382. Reported dolphin deaths and mortality limits for 2014, presented by species and stock can be found in IWC/66/4(2015)G.

While the focus within the AIDCP has been on minimising the reported dolphin mortalities in the fishery, some Parties continue to express concern over the unobserved impacts of the fishery on affected dolphin stocks. The increasing trend in sets made on tuna in association with dolphins 2008-10 is cause for some concern at least among the Parties that believe this practice may have indirect negative effects on dolphin populations. While fewer dolphin sets are being made since 2010, this remains a frequent practice and the predominant method for catching yellowfin tuna by purse-seine in the EPO. In addition, the US National Marine Fisheries Service has had insufficient resources to conduct a dolphin and ecosystem assessment survey in the EPO since 2006, so it is unclear when updated abundance estimates for these cetaceans will be available.

The Parties to the AIDCP continued discussions on consideration of reducing observer coverage and on developing an 'Ecosystem Friendly' certification scheme for tuna caught in association with dolphins. The possibility of reducing observer coverage on large purse-seine vessels to something less than 100% was largely raised due to budgetary constraints, but to a lesser degree because of the perception that efforts to reduce all sources of incidental dolphin mortality in the fishery have achieved their objectives. However, practical questions such as how a dolphin-safe certification system for tuna could persist in the absence of 100% observer coverage remain unresolved.

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

4.7 International Committee on Marine Protected Areas (ICMMPA)
The report of the IWC observer documenting the activities of ICMMPA is given as IWC/66/4(2015)N. The ICMMPA was formed in 2006 to address common issues and challenges faced by scientists and managers using spatial management tools to manage and conserve important cetacean habitats or populations. The third conference was held 9-11 November 2014, in Adelaide, Australia. The theme of ICMMPA3 was: 'Important Marine Mammal Areas - A Sense of Place, A Question of Size' and it focused on developing and refining criteria for the identification of important marine mammal areas. The IWC technical advisor on Human Impact Reduction (Mattila) gave the closing keynote address at the conference. He noted that during his work building entanglement response capacity, MMPAs have frequently been the Government agencies taking the lead in requesting, organising and hosting the IWC training. The Government of Mexico has announced its intention to host the next ICMMPA4 in Mexico, in 2016.

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

4.8 International Council for the Exploration of the Sea (ICES)
The report of the IWC observer documenting the 2014 activities of ICES is given as IWC/66/4(2015)A. During the year, the ICES Working Group on Marine Mammal Ecology (WGMME) met from 10-13 March 2014 in Massachusetts, USA and a satellite meeting was held in Oban, Scotland simultaneously. A number of items discussed were of relevance to the IWC; (1) review of new information on population sizes and population/stock structure for marine mammals in European waters; (2) review of similar information as well as work on the incidental capture of marine mammals in the western North Atlantic; (3) review of the Bycatch Limit Algorithm framework for determining safe bycatch limits; (4) review of approaches to marine mammal survey design; (5) interactions between aquaculture and marine mammals; and (6) provision of technical and scientific advice on options for ways of setting targets for the OS PAR common MSFD indicators for marine mammals and to provide examples of the application of these options.

Building on earlier requests management units were further reviewed and delineated for cetaceans and seals. Boundaries were specified so that the management units can be populated with abundance and bycatch estimates, where appropriate.

The ICES Working Group on Bycatch of Protected Species (WGBYC) met in Copenhagen at the ICES HQ 4-7 February 2014. One significant aim of WGBYC continues to be the collation and review of recent annual information on the bycatch of protected species. A preliminary evaluation of estimated bycatch rates for North Sea harbour porpoise was conducted where expected bycatch rates were compared to four different thresholds to evaluate possible risk to this management unit. Without any measure of uncertainty, preliminary results of the bycatch risk approach (BRA) show that North Sea harbour porpoise may be near or above sustainable removal levels. WGBYC is still awaiting guidance from the EC on setting target removal levels for protected species so that impacts from fisheries interactions can be fully evaluated. WGBYC agreed to continue with the BRA focusing on how to incorporate uncertainty into the assessment where possible.

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

4.9 International Maritime Organisation
The report of the IWC observer documenting the 2014 activities of the International Maritime Organisation (IMO) is given as IWC/66/4(2015)J. The IWC has contributed to IMO discussions on addressing ship strikes and the impacts of underwater noise from shipping.

IMO has established measures to reduce risks to humpback whales off the Pacific Coast of Panama. A Traffic Separation Scheme to minimise overlap between shipping routes and humpback migration routes was adopted by IMO on 23 May 2014 and came into effect on 1 December 2014. The measures also include a reduction in vessel speed for four months every year during winter.

IMO adopted 'Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life' in 2014. In May 2015 the IMO Marine Environment Protection Committee (MEPC) considered a proposal from the Russian Federation for further work to evaluate the contribution of merchant ships and other sources to underwater noise levels. The MEPC decided that more information was needed before commencing such work and invited a revised proposal to a future session. The IWC would be in a good position to collaborate with IMO on any future work on underwater noise.

IMO also adopted a draft International Code for Ships Operating in Polar Waters at MEPC 68 in May 2015. The Polar Code will come into effect in 2017 for new ships and 2018 for existing vessels. The newly adopted environmental provisions cover measures for the prevention of pollution by oil, noxious liquids, sewage and garbage.

The Committee thanked Leaper for his report and agrees that he or the Secretariat should represent the Committee at the next IMO meeting.

4.10 International Union for the Conservation of Nature (IUCN)
Cooke reported on the considerable cooperation with IUCN that had occurred during the past year and this is given as IWC/66/4(2015)O. The Western Gray Whale Advisory Panel (WGWAP) met in October 2014 on Sakhalin Island, where *inter alia,* the population status and mitigation plans for a proposed seismic survey in summer 2015 were reviewed. Annex F, appendix 2 contains a report of WGWAP activities including a statement by the Panel calling for proposed seismic surveys in 2015 to be postponed. The Panel is scheduled to meet again in November 2015.

The last comprehensive assessment of cetacean species for the Red List was completed in 2008, and most cetacean species are due for re-assessment. As there has been no major revision to the listing criteria since the 2007 workshop, it has been decided not to hold another global workshop, but to organise smaller meetings as needed on species of problematic status. A workshop on the genera *Sousa, Orcaella* and *Neophocaena* was held in San Diego just prior to SC/66a. The current list of all cetacean species and populations that have been assessed for the Red List is maintained on the Cetacean Specialist Group site at *www.iucn-csg.org/index.php/status-of-the-worlds-cetaceans*.

Regarding the vaquita, IUCN welcomed the announcement in May 2015 by the President of Mexico of a set of measures that follow, to a large degree, the CIRVA (International Committee for the Recovery of the Vaquita) recommendations, and emphasises that the new fishing regulations need to be very strictly enforced if there is to be any hope of averting the extinction of the vaquita.

The Committee thanked Cooke for his report and agreed that he should continue to act as observer to IUCN for the IWC. Donovan will act as observer at the IUCN WGWAP.

4.11 North Atlantic Marine Mammal Commission (NAMMCO)
Scientific Committee
The report of the IWC observer at the 21st meeting of the NAMMCO Scientific Committee (SC) held in Bergen, Norway, 3-6 November 2014 is given as IWC/66/4(2015)M. An important topic this year was the lack of bycatch report from both the Icelandic and Norwegian fisheries. In both countries it is mandatory to report all bycatch of marine mammals, but very few reports are received by the authorities. In Norway the IMR receives bycatch data via research reference fleet. Extrapolation from these data indicate high bycatch numbers. A functioning bycatch recording system is of high priority. The SC recommended convening a bycatch Working Group.

Three ice-associated cetacean species reside year-round in the Arctic: the narwhal, the white whale and the bowhead whale. Sites of oil and gas exploration and development and routes used for commercial shipping in the Arctic are being compared with the distribution patterns of these species, with the aim of highlighting areas of special concern for conservation. Measures that should be considered to mitigate the impacts of human activities on these Arctic whales and the people who depend on them for subsistence, are now being discussed.

The distribution of fin whale catches in Iceland in 2014 was very different from any previous whaling season since the resumption of whaling in 1948. Whale densities appeared to be very low on the traditional whaling grounds east of Iceland and the bulk of the total catch of 137 fin whales were taken south of Iceland. Preliminary analysis of stomach contents suggests that this changed distribution may be due to a shortage of krill in the Irminger Sea. In 2013, a fin whale/blue whale hybrid was caught in the Irminger Sea west of Iceland. This is the fifth confirmed hybrid between these two species in Icelandic waters.

A 3-year research project on feeding behaviour, movements and acoustics of killer whales in Icelandic waters conducted by the MRI will be finalised in 2015. Photo-identification has revealed several instances of movement of killer whales between the Shetland Islands and Iceland.

There has been a notable increase in the numbers of blue whales seen in Svalbard over the last 2-3 years. This year there were also many sightings during the Norwegian sightings survey and the Arctic part of the Ecosystem survey.

Planning for a Global Review of Monodontids symposium has begun and it will likely be held in autumn 2016 in Russia. There are also plans for a Disturbance Symposium in October 2015 that will deal with the impacts of human disturbance on narwhal, white whales and walrus. Plans for a new T-NASS survey in summer 2015 were also discussed.

The Committee thanked Walløe for his report and **agrees** that he should represent the Committee at the next NAMMCO Scientific Committee meeting.

Council
The report of the IWC observer at the 23rd Annual Council meeting of NAMMCO held in Reykjavik, Iceland, 3-5 February 2015 is given as IWC/66/4(2015)B. NAMMCO has been examining the use of marine mammal products in the context of global food security and this is still ongoing. Three authoritative manuals on whale hunting have been completed: (1) large baleen whaling and the use of whaling cannons and the penthrite grenade; (2) the use of the spinal lance and hook in the pilot whale hunt; and (3) the hunting of small cetaceans in Greenland. These are available from the NAMMCO website.

The series of North Atlantic Sightings Surveys (NASS) has been the flagship of NAMMCO and is of vital importance for the sustainable management of cetacean stocks in the NAMMCO area. The sixth NASS will coordinate with other national surveys in the area and will take place in summer 2015. The area to be covered includes areas around West, Northeast and East Greenland, Jan Mayen Central Atlantic, north and south of Iceland and areas along and to the west of Norway encompassing the area around the Faroe Islands.

The Committee thanked Sakamoto for his report and **agrees** that Okazoe should represent the Committee at the next NAMMCO Council meeting.

4.12 North Pacific Marine Science Organisation (PICES)
The report of the IWC observers at the annual meeting of PICES held in Yeosu, Korea, 16-26 October 2014 is given as IWC/66/4(2015)F. A new Activity Plan titled 'Climate and Trophic Ecology of Marine Birds and Mammals' was discussed. The AP-MBM will synthesise new dietary information and estimate food consumption using bioenergetics models. It will also synthesise information on prey quality, quantity, composition and distribution to predict their impacts on MBMs. It is expected that the study will take five years to complete.

The Committee thanked Tamura for attending on its behalf and agrees that Tamura should represent the Committee as an observer at the next PICES meeting.

4.13 Protocol on Specially Protected Areas and Wildlife (SPAW) of the Cartagena Convention for the Wider Caribbean
The report of the IWC observer documenting the 2014 activities of SPAW is given as IWC/66/4(2015)K A joint SPAW/UNEP workshop to address collisions between marine mammals and ships with a focus on the Wider Caribbean took place in Panama, 18-20 June 2014 (see also Item 4.16). The workshop focused on ship strikes with whales in the Wider Caribbean Region, but also placed this local issue in a broader global context. It reviewed current knowledge of shipping and whale distribution, and identified data gaps. It reviewed mitigation measures that are currently in place, discussed potential new mitigation measures and made both regional and global recommendations for priority management actions.

The four-year Spain-UNEP LifeWeb project 'Broad-scale Marine Spatial Planning of Mammal Corridors and Protected Areas in Wider Caribbean and Southeast and Northeast Pacific' has been finalised and full reports can be found on the SPAW website.

The Committee thanked Carlson for attending on its behalf and **agrees** that she should represent the Committee as an observer at the next SPAW meeting.

9

4.14 Pacific Region Environment Programme (SPREP)
The report of the IWC observer documenting the 2014 activities of SPREP is given as IWC/66/4(2015)K. After the 2014 IWC Scientific Committee meeting, the IWC Secretariat continued to be actively engaged with the SPREP Secretariat. Together they organised, raised funds for and carried out an IWC entanglement response training 29-30 July 2014, in Neiafu, Vava'u, Tonga. Fourteen participants were trained, including two Fisheries officers from Tongatapu and 3 participants from Vanuatu. In addition, SPREP was an active participant in the IWC's Second Workshop on Marine Debris, which was held 5-7 August 2014 in Honolulu, Hawaii (IWC/65/CCRep04). IWC technical adviser Mattila represented the IWC at SPREP's Annual Meeting, 29 September-3 October 2014 in Majuro, Marshall Islands, where the IWC and SPREP co-hosted a side event about the status of Oceania humpback whales and the recent IWC-SPREP entanglement response training in Tonga. SPREP has declared 2016-17 as the 'year of the (humpback) whale', and the IWC will provide technical advice and participation as appropriate. The IWC observer will attend SPREP's upcoming (22-24 September 2015) annual meeting in Apia, Samoa.

The Committee thanked Mattila for his report and **agrees** that he should continue represent the Committee at future SPREP activities.

4.15 African States Bordering the Atlantic Ocean (ATLAFCO)
No meetings of ATLAFCO occurred during the intersessional period.

4.16 CBD North West Indian Ocean Region Ecologically or Biologically Significant Areas (EBSA)
The report of the IWC observer at the 2014 EBSA workshop is given as IWC/66/4(2015)D. In total 32 EBSAs were described by the workshop and marine mammals correlated strongly with most of those proposed. A detailed list of these is given in IWC/66/4(2015)D. The report will be made available to the IWC when completed.

The Committee thanked Notarbartolo di Sciara for his report and **agrees** that he should continue to represent the Committee at future meetings.

4.17 Permanent Commission of the South Pacific (CPPS)
The report of the IWC observer documenting the 2014 activities of CPPS is given as IWC/66/4(2015)I. At the 2014 IWC Scientific Committee meeting Mattila reported on the increased level of partnership between the IWC and CPPS. A joint IWC-UNEP-SPAW Ship Strike Workshop was held in Panama, 18-20 June 2014. The IWC CPPS representative, Fernando Felix, presented work on current efforts to understand and mitigate ship strikes in Ecuador. In addition, he identified a regional database of cetaceans and turtles that included 26 cases of ship strikes with humpback, fin and Southern right whales and indicated that these would be added to the IWC global ship strike database. In addition, the workshop inspired CPPS to plan a regional workshop on the issue for the CPPS member nations (i.e. Chile, Peru, Ecuador, Colombia and Panama). In addition to this joint work, CPPS invited the IWC to provide an expert on large whale bycatch to join a symposium panel on non-deliberate human impacts to whales, at the recent (1-5 December 2014) joint meeting of SOLAMAC-SOMEMA (the Latin American and Mexican Societies on aquatic mammals). IWC technical advisor, Mattila, presented an overview of the global large whale entanglement issue, and the IWC capacity building, data collection and mitigation initiative.

The Committee thanked Mattila for his report and **agrees** that he should continue to represent the Committee at future CPPS activities.

5. GENERAL ASSESSMENT ISSUES WITH A FOCUS ON THOSE RELATED TO THE REVISED MANAGEMENT PROCEDURE (RMP)

5.1 Relationship between MSYR$_{mat}$ and MSYR$_{1+}$
In 2013, the Committee recommended that MSYR$_{1+}$=1% be adopted as a pragmatic and precautionary lower bound for use in trials, and that MSYR$_{mat}$=7% be changed to the roughly equivalent MSYR$_{1+}$=4%. The Committee now further **agrees** that MSYR=4% would pertain to harvesting of the mature component of the population; this latter specification is consistent with how the trials used by the Committee in 1991 to evaluate the *CLA* were conducted (IWC, 1992a; 1992b).

The Committee has recognised that much remains to be learnt regarding MSYR and that the issue of the appropriate range for MSYR needs to be reviewed as new information becomes available (IWC, 2014d p.9). One issue is the relationship between MSYR$_{1+}$ and MSYR$_{mat}$. In 2013, de la Mare had introduced an energetics-based model (IBEM) to explore this issue and SC/66a/EM2 provided a progress report. The Committee welcomed the update, noting that development and parameterisation of the IBEM was the first step of a work plan established last year. Diagnostic statistics and plots will need to be developed to understand the behaviour of the model more fully. The Committee re-established the Steering Group under de la Mare (see Annex D Item 5.1) to coordinate intersessional work, including identification of diagnostic statistics and plots and development of a model that can mimic (emulate) the IBEM.

With the results detailed in Annex D Item 5.1, SC/66a/RMP1 outlined how density-dependence on natural mortality has been implemented for the trials to evaluate amendments of the *CLA*. It also explored the relationship between MSYR and MSYL and the parameters that define the density-dependence relationship when density-dependence operates on natural mortality.

10

In 2013, the Committee did not specify which population component MSYL and density-dependence should relate to when conducting simulation trials. Yield curves based on standard age-structured models (e.g. Cooke and de la Mare, 1994) indicate that the yield curve for the 1+ population is always to the right of that for the mature female component of the population (i.e. setting MSYL for the 1+ component to 0.6 will lead to MSY occurring at a female population size less than 0.6). Leaper *et al.* (2000) reviewed the then available information for baleen whales regarding the component of the population to which density-dependence applies and suggested for *Balaenoptera* that density-dependence should be a function of the mature component of the population. Given that (1) the difference in yield curves was minor for $MSYR_{1+}=1\%$ and not substantial even for $MSYR_{mat}=4\%$ and (2) the previous agreement of the Committee in relation to population component for density-dependence and MSYL for AWMP work, the Committee **agrees** that density-dependence and MSYL should relate to the 1+ component of the population for future trials.

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, completed in 2013 (IWC, 2014d); and (2) specification of additional trials for testing amendments to the *CLA*.

Last year (IWC, 2015f, p.8) the Committee had agreed that allowing natural mortality to be density-dependent would provide a more stringent test for the impacts of environmental change; further it had recommended that the common control program be extended to allow for density-dependence to act on natural mortality, and that results of tests of the *CLA* using trials in which density-dependence acts on natural mortality be presented this year. These recommendations had been implemented (SC/66a/RMP1, SC/66a/RMP10 and SC/66a/RMP12).

5.2.1 Approach for the Norwegian proposed amendment
The proposed Norwegian tuning of the *CLA* is based on achieving a desired median final depletion for a 'development' (initial depletion = 0.99K) trial of 0.69 when population projections are conducted for 300 years and MSYR is 1% when harvesting is on the total (1+) population. The decision to base the tuning on 300-year projections was made because simulations across multiple projection periods indicated that population size is not stable until approximately 300 years under *CLA* management (Aldrin *et al.*, 2008).

The Committee agreed that it was necessary to develop a protocol to compare the current tuning of the *CLA* with the alternative tuning proposed by Norway (and any future suggestions for amendments to the *CLA*). The Norwegian proposed ('Norwegian Tuning) and current tuning of the *CLA* ('IWC Tuning') differ in terms of the parameter modified to achieve a desired tuning as well as the final population size when a stock initially at 0.99K is managed for 100 (or 300) years. The Committee developed two additional *CLA* tunings to allow the impact of the choice of the median final population size and the choice of parameter to tune the *CLA* to be explored separately. This resulted in four *CLA* variants, where for each variant, the performance statistics are based on 400 replicates (Table 2).

Table 2

Four variants used to compare (all for the T1-D1 trial) the current *CLA* with that proposed by Norway (see text). NB these are referred to as '43', '51', '73' and '54' in Annex D – these will be updated in the Annex for publication.

Variant name	Tuning	MSYR	DD and MSYL	Period
IWC Tuning	0.723	Mature, 1%	Mature	100
Alternative Norwegian Tuning	0.723	Mature, 1%	Mature	100
Alternative IWC Tuning	0.681	1+, 1%	1+	300
Norwegian Tuning	0.681	1+, 1%	1+	300

The Committee conducted an initial comparison of the four *CLA* variants using the same approach that it used to select among the five candidate *CLA*s in 1991 (IWC, 1992a). This involved applying the four *CLA* variants to a set of three core trials conducted for (1) $MSYR_{mat}=1\%$ when density-dependence and MSYL act on the mature component of the population and (2) $MSYR_{1+}=1\%$ when density-dependence and MSYL act on the 1+ component of the population, with a projection-period of 100 years and 400 replicates. The results of these trials were used to compute the same set of comparison statistics that had been used by the Committee in 1991 (Annex D, fig. 3; table 2).

It was agreed that the evaluation process should occur in two stages:

(1) a review of performance for the original trials used to choose the 'C' procedure in 1991 (IWC, 1992a; 1992b; table 2); and
(2) if the results from (1) show that it has acceptable conservation performance (see below) and superior catch performance, then the procedure would be further evaluated against the set of additional trials for evaluation agreed in 2006 (IWC, 2007).

The Committee had recommended three tunings of the 'C' procedure to the Commission in 1991. Therefore it **agrees** that minimum requirement for any amendment to the *CLA* that can be recommended for possible adoption by the Commission is that its performance on conservation-related statistics is no poorer than the lowest of the three tunings of the 'C' procedure. Specifically, the Committee **agrees** that:

the lower 5th percentiles of the final and lowest depletion distributions for the T1-D1, T1-S1, and T1-R1 trials when $MSYR_{1+}$=1% should be no less than the values achieved by the 0.6 tuning of the 'C' procedure when it is applied to trials in which $MSYR_{mat}$=1% and the projection period is 100 years.

The trials for evaluating performance are based on $MSYR_{1+}$=1% rather than $MSYR_{mat}$=1%. A *CLA* variant that satisfies this conservation criterion will need further review before it could be presented for possible adoption by the Commission. In particular, trade-offs between conservation performance and catch will be considered, as well as the results of additional trials developed in IWC (2007b).

5.3 Complete evaluation of the Norwegian proposal for amending the *CLA*
The Committee then reviewed the Norwegian proposal for a *CLA* using the procedure outlined under Item 5.2.

The conservation performance of the 'Alternative IWC Tuning' (see Table 2) was markedly poorer than that of the 'Norwegian Tuning' even though these two variants were tuned to the same median final depletion for the T1-D1 trial (Annex D, fig. 4). This result was expected because the 'Alternative IWC Tuning' had a value for the posterior percentile parameter of 0.769 (Annex D, table 1). The Committee **agrees** that the conservation performance of the 'Alternative IWC Tuning' was unacceptable. It also **recommends** that variants of the *CLA* in which the posterior percentile parameter exceeds 0.5 should not be considered for possible adoption in the future.

The Committee then focused on the comparison between the 'IWC Tuning' and the 'Norwegian Tuning'. These variants achieve different performance metrics because they are tuned to different median final depletions. The Norwegian Tuning variant could in principle be chosen to be the *CLA*, as it has a posterior percentile larger than 0.5 (as, of course, does the IWC Tuning). Fig. 1 compares the catch and conservation performance of the 'IWC Tuning' and the 'Norwegian Tuning'. The figure confirms that the 'IWC Tuning' satisfies the criterion that conservation performance is no worse than that of the 0.6 tuning of the 'C' procedure. The 'Norwegian Tuning' achieves a median final depletion for the T1-D1 trial of 0.6. However, the lower 5th percentiles of the lowest and final depletion distributions for the 'Norwegian Tuning' are less than those of the 0.6 tuning of the *CLA*.

The Committee therefore **concludes** that the conservation performance of the 'Norwegian Tuning' whilst considerably better than the 'Alternative IWC Tuning', was insufficient for the Committee to recommend it for continued evaluation using the 2007 trials (see Item 5.2). It was also noted that the catch performance of the 'Norwegian Tuning' was superior to that of the 'IWC Tuning', but that this came at the expense of satisfactory conservation performance. Therefore, the Committee **recommends** continued use of the existing *CLA*.

The Committee speculated that the poorer conservation performance of the 'Norwegian Tuning' might be due to the parameter chosen to tune it (the slope parameter). Basing tuning on other parameters such as the maximum MSY rate parameter (perhaps in addition to the slope parameter) may lead to narrower distributions for final and lowest population size.

The Committee **agrees** that this concludes the review of the proposed Norwegian amendment to the *CLA*. It expressed considerable thanks to Kelli Johnson for running ever increasing numbers of trials and producing additional tables and figures, and acknowledged Cherry Allison whose immaculate record keeping made it possible to reconstruct the approaches used by the Committee to select a *CLA* in 1991.

5.4 Other computing matters related to the *CLA*
Allison noted that the Norwegian computer code implementing the *CLA* is included in the common control program. This was the version of the program used in the evaluation of the Norwegian proposal for an amendment to the *CLA*. The Committee **recommends** that any error messages encountered in simulations be communicated by the Secretariat to the Norwegian Computing Centre who developed this implementation of the *CLA* so that such problems can be resolved.

5.5 Requirements and Guidelines for conducting surveys and *Implementations*
The existing Requirements and Guidelines were written for design-based surveys only (IWC, 2012e). Recently, the Committee had recognised a need to consider what circumstances might require approval when the survey and analysis are conducted based on spatial modelling or quasi design-based approaches. The Committee had agreed in 2012 (IWC, 2013b) that a review of this issue should take place and initial work was presented in 2014 (SC/65b/RMP11; IWC, 2015f p.9). However, given the unavailability of contracted experts during the last intersessional period, it **agrees** that comprehensive discussion will be deferred to 2016.

The Committee was advised that Bravington would continue to be involved in conducting this review and developing a guidelines manual. The work is expected to be completed by the 2016 Annual Meeting. A demonstration of the software implementing the analysis method should occur, preferably during a Workshop held as a pre-meeting to SC66b. The Workshop will test the guidelines against several test cases of model-based abundance estimation.

A Steering Group was established under Butterworth (see Annex D, item 5.5) to co-ordinate intersessional work, develop an agenda and facilitate preparations for the Workshop.
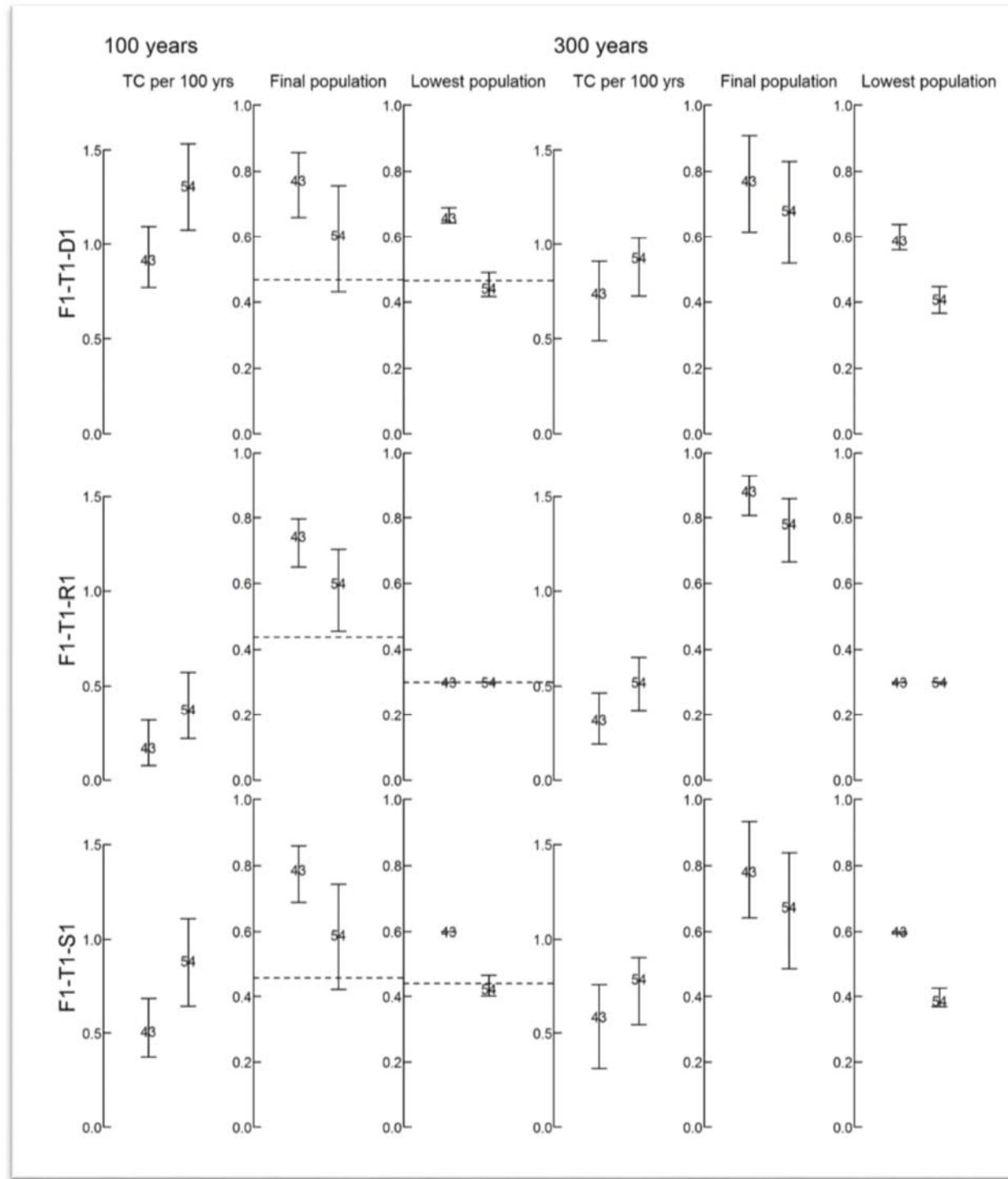
Fig. 1. Comparison of the performance of the 'Norwegian Tuning' ('43') and the 'IWC tuning' ('54') for total catch (TC), final population size and lowest population size for three trials (T1-D1, T1-R1, and T1-S1) when $MSYR_{1+}=1\%$ and density-dependence and MSYL pertain to the 1+ component of the population. Results are shown for 100- and 300-year projection periods. The horizontal dashed lines in the final and lowest population columns for the 100-year projection period indicate the performance of the 0.6 tuning of the 'C' procedure when $MSYR_{mat}=1\%$. Total catch and population size statistics are expressed relative to carrying capacity. [Note that '43' and '54' will be relabelled correctly in the published version].

5.6 Work plan

A detailed work plan, for actions before and during the 2016 Annual Meeting, is given in Annex D, item 5.6 and summarised in Table 3. Budgetary implications are considered under Item 26.

13

Table 3

Work plan for general assessment matters with a focus on the RMP.

		Intersessional	During the 2016 Annual Meeting
(1)	Evaluate energetics-based model	Continue evaluation: (a) produce a table of model outputs; (b) develop emulator models; (c) conduct simulations of the *CLA* for the energetics-based model; (d) conduct simulations of the *CLA* for the emulator models.	Review intersessional.
(1)	Model based abundance estimates	Develop simple-to-use diagnostic software that uses model-based analysis to assist in evaluating design based estimates.	Pre-meeting Workshop: to (1) test proposed new Guidelines against case studies; and (2) demonstrate and discuss proposed diagnostic software

6. RMP – IMPLEMENTATION-RELATED MATTERS

6.1 North Atlantic fin whales (*Implementation Review*)

6.1.1 Report of the intersessional workshop
The Committee was unable to complete the *Implementation Review* last year (IWC, 2014d p.10), but progress had been made through work by an intersessional steering group and an intersessional workshop, held at Copenhagen in February 2015. It was hoped to complete the *Implementation Review* this year.

Donovan reported on the intersessional workshop (SC/66a/Rep04). The objectives of the workshop were to: (a) review the conditioning of the trials; (b) update the specifications of the trials by defining a full set of sensitivity tests; and (c) discuss management variants to consider intersessionally. As noted in Annex D, item 6.1.1, the trials structure is complex and achieving satisfactory conditioning is a major task. After examining the data, it was agreed that conditioning should be based upon all of the data apart from the early (1967 and 1969) age-composition data and the 2007 abundance estimates for one sub-area as these were not comparable with the rest of the series.

Upon reviewing all of the available conditioning[1] results, the Workshop concluded that none of the fits were sufficiently poor for any of stock-structure hypotheses (see Fig. 2) to be rejected from further consideration at this stage. It noted that the quality of the fits to the data used for conditioning can be taken into account when plausibility ranks are assigned to individual trials. In this context, the Workshop stated that that the best fits were for the trials based on Hypotheses I, II, III, V and VII for $MSYR_{mat}$=4% and Hypothesis VI for both MSY rates. The Workshop agreed that these trials should form the focus for the sensitivity tests, but it was not possible to undertake the conditioning of these at the Workshop. The Workshop also agreed to drop the 'bridging' trials. In addition, it agreed that trials considering alternative starting years as well as those allowing for density-dependent and -independent dispersal between sub-areas were no longer needed. The final revised trials specifications are summarised in Annex D, appendix 3 and listed in table 3.

Given a change in the distribution of fin whale catches by Iceland (and the fin whales themselves) in 2014, Iceland wished consideration of at least one variant that allowed for catching in sub-area EI (east Iceland). A resulting revised list of management variants, based on calculating catch limits by *Small Area* and on applying catch cascading, is given in Annex D item 6.1.1.

The work plan established by the Workshop related to: (1) finalising any outstanding coding required (and updating associated datasets); (2) completing the conditioning; and (3) running the revised trials and presenting the results in the standard format. A Steering Group was established to facilitate progress.

The Committee thanked Donovan for chairing the Intersessional Workshop and the participants for their work during the Workshop and subsequently. It **endorses** the Workshop recommendations.

6.1.2 Intersessional progress
Allison noted that substantial changes had been made to the control program implementing the trials during the intersessional period. The Committee noted the updated specifications for the trials (Annex D, Appendix 3).

6.1.3 Implementation Review
SC/66a/RMP2 presented the distribution of Icelandic fin whale catches in 2014. Their distribution was unlike that in any previous season for which catch positions exist and was more in line with the distribution of earlier sei whale catches. Sighting surveys (1987 to 2007) had shown an increase in fin whale densities, in particular in the Irminger Sea. It is uncertain if the fin whales had moved to the southern area or into other areas. In general, a northward shift had been observed, so that the fin whales in the southern area might well have come from farther south.

Allison advised that given workload issues in trying to undertake two major *Implementation Reviews* simultaneously (see Item 6.2), it had been impossible to complete coding of the *Implementation Simulation Trials*. This precluded completion of the *Implementation Review* at the present meeting.

---

[1] Conditioning involves fitting the operating model to the available data to ensure that for each set of hypotheses (e.g. regarding stock structure, MSYR, etc.), the operating model used for projection purposes is consistent with the data.

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

Hypothesis (I). Base case: 4 breeding stocks with separate feeding sub-areas.
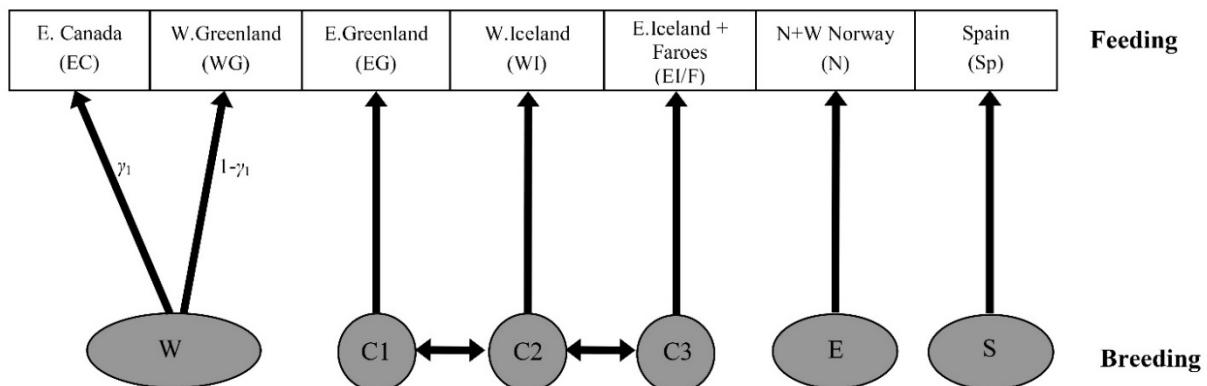
Hypothesis (II). 4 breeding stocks with the W and E stocks also feeding in the central sub-areas.
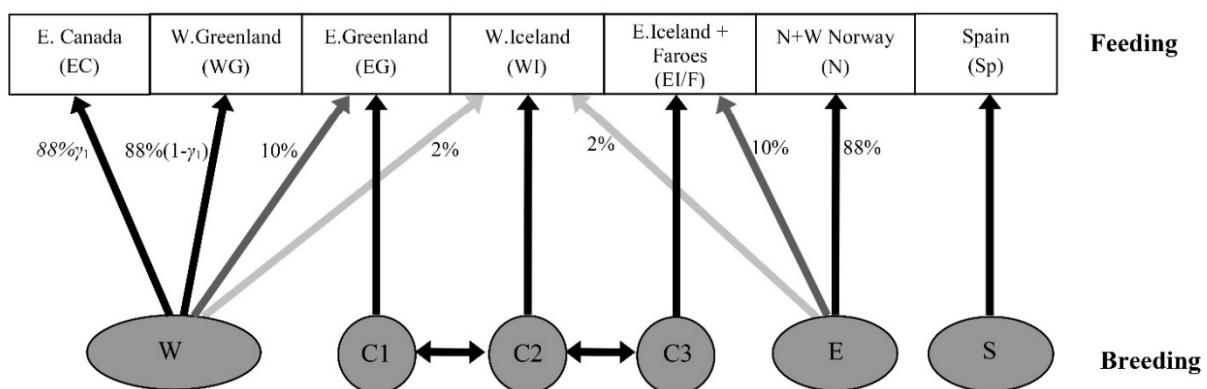
Hypothesis (III). 4 breeding stocks with the 3 C sub-stocks feeding in the adjacent sub-areas.
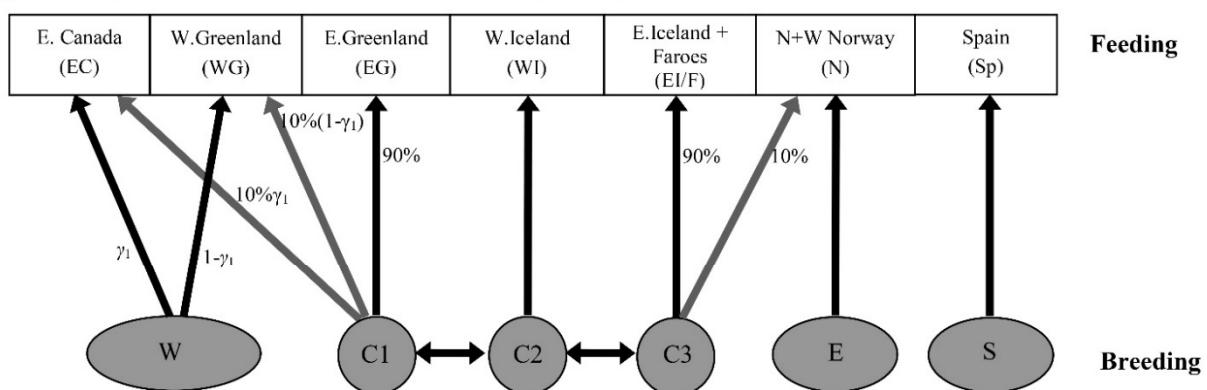
Hypothesis (IV). 4 breeding stocks but without dispersion between the C sub-stocks.

15
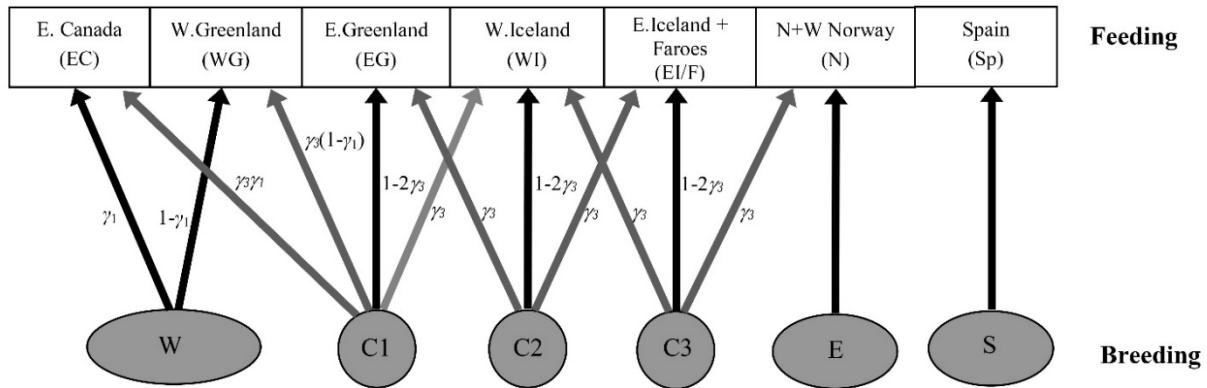
Hypothesis (V). 4 breeding stocks with the S stock feeding in the two adjacent sub-areas.
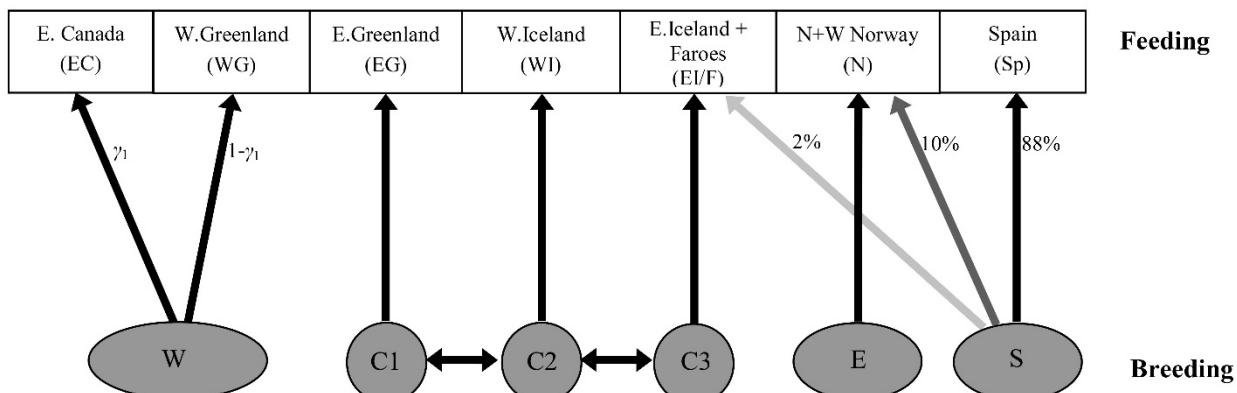
Hypothesis (VI). 3 breeding stocks.
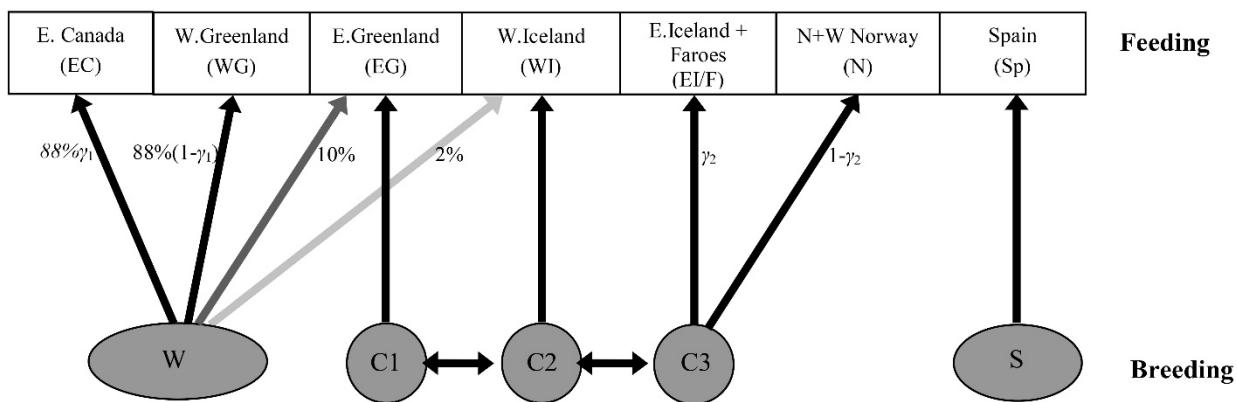
Hypothesis (VII). 4 breeding stocks with the 2 C sub-stocks feeding in the adjacent sub-areas. Sub-areas EG and WI are combined.
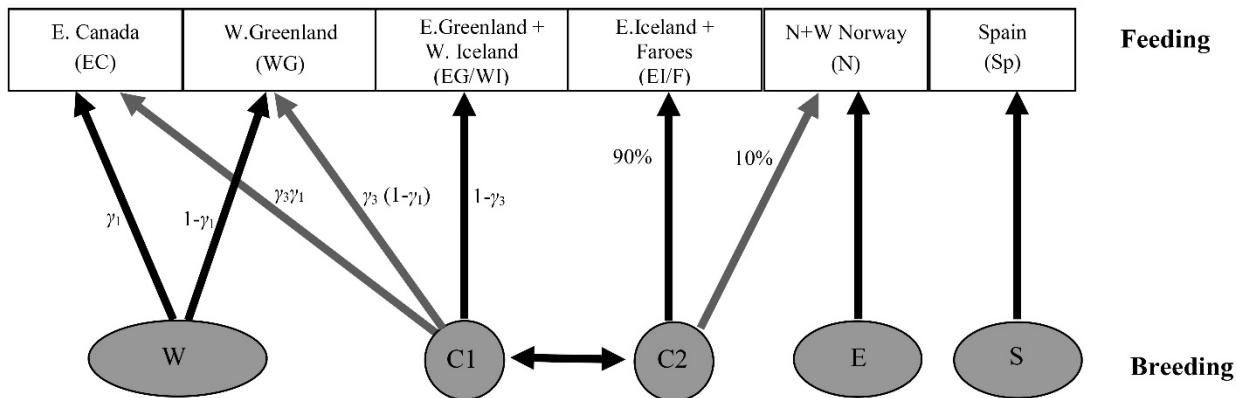
Hypothesis (VIII). 4 breeding stocks with the 2 C sub-stocks feeding in the adjacent sub-areas. Sub-areas EG and WI are combined.
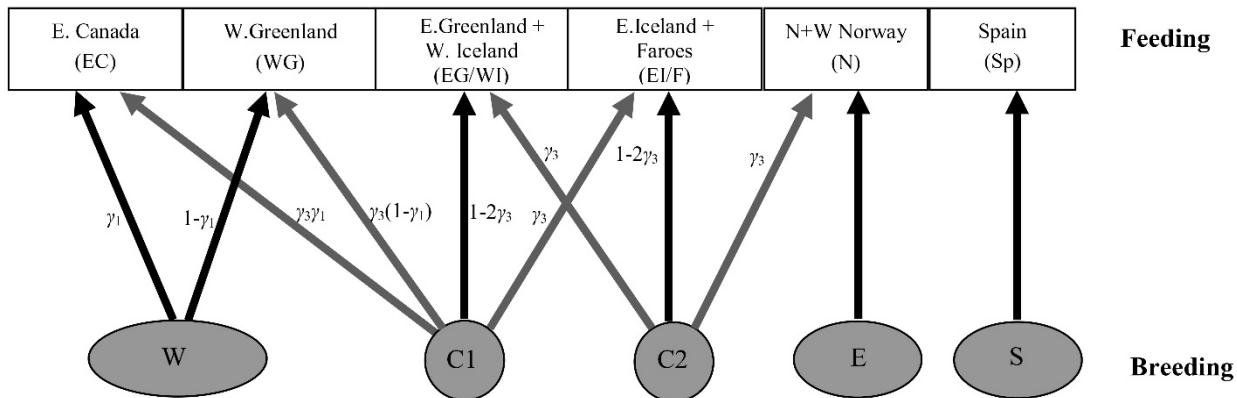
6.1.4 Recommendations
The Committee developed a work plan for the intersessional period, re-establishing the Steering Group under Elvarsson as detailed in Annex D, item 6.1.4.

6.2 North Atlantic common minke whales (*Implementation Review*)
6.2.1 Report of the intersessional workshop
Last year, the Committee had hoped it might be possible to complete the *Implementation Review* at the 2015 Annual Meeting. To that end an intersessional workshop had been held in Copenhagen in February 2015.

Donovan reported on the intersessional workshop, where the objectives were to: (a) review progress with the conditioning of trials; (b) finalise trial specifications; and (c) specify the management variants to consider intersessionally. Fits of the operating model to three data sources were examined: abundance estimates; sex-ratios by sub-area in the month when the surveys take place ('survey' sex-ratios), and sex-ratios by sub-area when the catches take place ('fishery' sex-ratios). After reviewing all of the available conditioning results, the Workshop concluded that the fits were acceptable.

The revised trials specifications are summarised in SC/66a/Rep04, table 2 and repeated in Annex D, appendix 4. Details of minor modifications are also given in SC/66a/Rep04.There were no suggested revisions to the list of management variants previously agreed (IWC, 2015f; 2015g).

The work plan established by the Workshop related to: (1) finalising any outstanding coding required (and updating associated datasets); (2) completing the conditioning; and (3) running the revised trials and presenting the results in the standard format. A Steering Group was established to facilitate progress.

The Committee thanked Donovan for chairing the intersessional Workshop and the participants for their work during it and subsequently. It **endorses** the Workshop recommendations.

6.2.2 Implementation Review
Allison reported that the trials specifications had been updated. The key changes to the trial specifications are detailed in Annex D, item 6.2.2. The final trial specifications are listed in Annex D, appendix 4 and the trials are summarised in Annex D, Table 4.

In the case of North Atlantic minke whales, the conditioning[2] involves fitting the operating model to three sources of data listed Annex D, Item 6.2.2

Conditioning results for 16 of the 20 *Implementation Simulation Trials* are discussed in Annex D, item 6.2.2. The Committee noted that fits of the operating models to the actual data were generally good. However, some of the plots identified concerns with the conditioning (Annex D, item 6.2.2). After further consideration it **agrees** that the inability to fit the abundance estimates for two sub-areas was not of major concern and that the truncated distribution for the operating model 'survey' sex-ratio for one sub-area was expected. However, addressing concerns over trends in abundance of mature females for one sub-stock and trends in abundance of 1+ animals in one sub-area appear to be caused by the 'entry' specifications of the mixing matrices. The Committee **recommends** that the mixing matrices be changed as detailed in Annex D, Item 6.2.2.

In conclusion, despite considerable work by Allison and de Moor, conditioning has not yet been successfully achieved. The Committee noted that the issues identified above could only be detected once the full set of 100 replicates had been conducted. It also **agrees** that Allison and de Moor should work with the Steering Group to refine the specifications of the trials and provide updated conditioning results to the proposed Intersessional Workshop (see item 6.7).

6.2.3 New information
SC/66a/RMP6 summarised a sighting survey conducted during the summer 2014 in the ES *Small Area* – Svalbard and Bear Island including the Greenland Sea. This was the first year in a new survey cycle 2014-2019, and ES was last surveyed in 2008. The Committee noted that the distribution of fin whales in *Small Area* ES was unusual during 2014. These whales are generally found on the slope off Spitzbergen. However, they were observed in high density in the north of *Small Area* ES in 2014.

SC/66a/RMP5 used the Markov modulated Poisson process to estimate variance in whale counts on individual transect legs. This model accounted for over-dispersion relative to the Poisson distribution, and constitutes a simpler alternative to the Neyman-Scott process that has been used in the past for Northeast Atlantic common minke whales. A second change in methodology was that the parametric bootstrap method had been replaced with a somewhat cruder 'delta-method' for calculating the variance of the line transect abundance estimator. The new approach was validated on the 1996-2001 surveys. The discrepancy was larger for individual survey blocks, and in particular the direct measure of over dispersion varied substantially between the old and new methods.

---

[2] Conditioning involves fitting the operating model to the available data to ensure that for each set of hypotheses (e.g. regarding stock structure, MSYR, etc.), the operating model used for projection purposes is consistent with the data.

The Committee **endorses** the new variance estimation method described in SC/66a/RMP5. In discussion it was noted that the over-dispersion parameter is probably not well estimated and that improved performance might be possible if this parameter was treated as a random effect.

SC/66a/RMP7 used a discrete approximation to model measurement error for the estimation of radial distance and angle during line transect surveys. The approach is based on a multiplicative errors model of Marques (2004).

The Committee **endorses** the approach to handling measurement error suggested. It noted that Cooke and Leaper (1998) had developed methods for analysing measurement errors when angles are rounded. The Committee **recommends** that the authors of SC/66a/RMP7 explore whether the method of Cooke and Leaper (1998) could be incorporated into that of SC/66a/RMP7.

SC/66a/RMP8 presented abundance estimates for common minke whales in RMP *Medium Area* E and *Small Area* CM using survey data collected over the period 2008-2013.

The Committee **endorses** the estimate of abundance for the entire survey area (the E *Medium Area* and *Small Area* CM) of 100,600 (CV=0.17) and the estimate for the E *Medium Area* of 89,600 (CV= 0.18) for use in the *CLA*. Annex D, table 5 lists the estimates of abundance by *Small Area* for the 2008-2013 surveys. The Committee noted that the estimates of abundance for the *Small Area* CM exhibit substantial between-period variation.

6.2.4 Recommendations
The Committee recognised that the nature of the process of conducting two major *Implementation Reviews* simultaneously (see Item 6.1), as well as the specific complexities of the computing precluded completion of the *Implementation Review* this year. It agreed on a work plan to ensure that the *Implementation Review* is completed during the 2016 Annual Meeting (or during an earlier pre-meeting). The work plan involves updating the mixing matrices in the trials' specifications, conditioning the trials, re-evaluating the conditioning, conducting an initial assignment of plausibility ranks to the trials, using the conditioned trials as a basis for projections under the agreed management variants, and applying the Committee's decision rules on how to evaluate RMP variants (IWC, 2012e) to the results of the trials.

The Committee re-established the Steering Group under Walløe (Convenor) with members as in Annex D, item 6.2.4, to guide the intersessional work.

6.3 North Atlantic sei whales
In 2014, the Correspondence Group on North Atlantic sei whales recommended genetic analysis of existing samples from different localities to aid in the development of stock structure hypotheses. An application for funding of these analyses from the IWC budget was unsuccessful in 2014, and no progress had been made during the intersessional period. Taking into account the present workload of the Committee related to RMP *Implementation Review*s, the Committee **recommends** postponing the *pre-Implementation review* for North Atlantic sei whales, at least until the *Implementation Reviews* for North Atlantic common minke and fin whales are completed, and **recommends** that a review of the RMP workload for 2017 and beyond should be undertaken next year and a medium-term work plan developed.

6.4 North Pacific common minke whales
There was no discussion under this item, but several items remain before the *Implementation* can be considered completed (IWC, 2015g, p.103). The Committee therefore re-established the Advisory Group under Butterworth, with membership and terms of reference as in Annex D, item 6.4.

6.5 Western North Pacific Bryde's whales
Last year, the Committee deferred the *Implementation Review* until 2017 because considerable new data should be available by then (IWC, 2015f). It further recommended that this *Implementation Review* be a 'full review' like those currently being undertaken for North Atlantic minke and fin whales, where all aspects of the *Implementation* are reviewed, rather than simply updating the abundance estimates and catches and determining whether new research suggests that the trial scenarios considered during the *Implementation* remain plausible.

6.6 Other
Annex D, appendix 6 lists the updated abundance estimates for North Atlantic whales.

6.7 Work plan and budget
A detailed Work Plan, for actions before and during the 2016 Annual Meeting, is given in Annex D, Item 6.7. It is summarised in Table 4. Budgetary implications can be found under Item 26.

Table 4

Summary of Work Plan for RMP *Implementation*-related work

	Intersessional period	During the 2016 Annual Meeting
North Atlantic fin whales	(1) finalise the code for the *Implementation Simulation Trial*s and complete conditioning; (b) hold Intersessional Workshop in Spring 2016	Complete the *Implementation Review* (Item 6.1.3).
North Atlantic common minke	(1) distribute suggested final trial specifications; (2) finalise code and condition trials; (3) hold Intersessional Workshop in Spring 2016	Complete the *Implementation Review* (Item 6.2.2).
Western North Pacific common minke	(1) receive research plan for possible variant with research if Japan wishes	(1) Review the results of proposed 'hybrid' versions of RMP variants to allow evaluation of 'variant with research' (2) review any research proposals related to a candidate 'variant with research'); and (3) agree the estimates of abundance for use in actual applications of the RMP.
Western North Pacific Bryde's		Continue to prepare for the 2017 *Implementation Review* (Item 6.5).

7. ESTIMATION OF BYCATCH AND OTHER NON-DELIBERATE HUMAN-INDUCED MORTALITY

The report of the Working Group on Non-deliberate Human-induced Mortality of Large Whales is given as Annex J. This work originally arose out of the need for mortality estimates for use in the RMP but it has now broadened in scope, providing advice to Commission working groups on mitigation of threats, e.g. entanglement and ship strikes.

7.1 Entanglement of large whales
7.1.1 Report from the Provincetown workshop
A third workshop to review progress on capacity building and provide advice on entanglement data and databases, was held in Provincetown, April, 2015 (IWC/66/WI-WKRep01). The workshop reviewed new information on e.g. entangling gear including pelagic FADs (fish aggregating devices) and aquaculture, the drag and energetic costs incurred by entangled whales, a comparison of the breaking strength of rope removed from entangled whales with wounds and outcomes, and case studies of post-entanglement survival. Since 2012, the IWC capacity building initiative has provided training to 336 individuals from 19 countries. All training is conducted with the endorsement, and frequently the direct support of the Governments involved. This work has led to formal networks in several countries who now report large whale entanglements and related science more regularly to the IWC.

The Committee reviewed the workshop's recommendations for the possible establishment of a global entanglement database, housed and maintained by the IWC. Requirements for such a database would need to: (1) take into consideration all potential sources of entanglement information beyond that collected by response networks; (2) work with member countries to ensure consistency and appropriate reporting, locally, regionally, nationally and internationally; and (3) interface smoothly with the National Progress Reports. With these considerations, the Committee **endorses** the goal, objectives and considerations outlined in the report and **recommends** that the proposals to advance this initiative go forward.

7.1.2 New information
The Committee considered a summary of large whale bycatch available through the annual National Progress Report portal. It was noted that only 16 countries had filled these out online with less than ten countries reporting large whale bycatch, the fewest number of reports in recent years. Currently, the large whale bycatch section still needs to be filled in to report zero bycatch.

An entangled Eastern South Pacific right whale was reported off Pichilemu, central Chile, in October 2014 (SC/66a/BRG15). The fact that there was a Conservation Management Plan (CMP) in place may have helped to facilitate the support of the Chilean Navy in efforts to find and assess the whale. It also noted the synergy between the CMP and the IWC entanglement expert advisory group, as they assisted the disentanglement effort by providing advice in real time. The Committee **recommends** that the proposed entanglement response training in Chile take place.

A North Pacific right whale was reported entangled in aquaculture gear off Korea in February 2015, the first sighting of this species in Korean waters since 1974 (SC/66a/HIM15). It was also the first disentanglement performed in aquaculture gear in Korea (previous entanglements have involved non-protected species). Following attempts to disentangle the whale it was not seen again and the whale was assumed to have escaped the remaining entanglement. The Committee noted the growing potential risk posed by the expansion of this type of aquaculture in this region and globally.

7.1.3 Progress on scientific aspects of mitigation measures
An approach to evaluate the effectiveness of management initiatives intended to reduce entanglements of large whales off the east coast of the USA used both the number of annual events reported and the time between events ('waiting time'). No significant changes occurred in waiting time in response to management measures implemented between 1998 and 2009 (Pace *et al.*, 2014). In

19

discussion, it was noted that simulations showed that rates of detected entanglement-related mortality would have had to be reduced substantially to allow a change to be detected. Management initiatives were incremental through the study period and rates of compliance were not identified. The Committee **welcomes** the approach described and hoped future monitoring and analyses may be able to detect an effect from more recent management initiatives.

An analysis of the frequency of line entanglement, and ship strike injuries on bowhead whales harvested by Alaska Natives between 1990 and 2012 (SC/66a/HIM15) revealed that of 515 whales examined for entanglement injuries, 59 (12%) had scars consistent with line entanglement. Scars associated with ship strikes were quite infrequent (around 2%). The frequency of entanglement scars is highly correlated with body length with larger animals showing more scars. There are now good baseline data on entanglement rates that should allow the detection of changes should they occur.

The Committee noted that some results related to age and risk appeared contradictory to findings in other areas with other species e.g. the suggestion that most of the entanglements may be in ghost gear (still fishing) or abandoned, lost or discarded fishing gear (ALDFG). Most entanglements in other areas are believed to be in actively fished gear (IWC/65/CCRep04) however, bowhead whale habitat overlaps an area with high gear loss due to sea ice and this may explain the difference. It was also noted that proposed shipping traffic lanes currently transect several hot spots for this population and that this development is of concern and should be monitored.

Last year (IWC, 2015f), the Committee had endorsed a proposal and seed funds for the IWC to convene a large whale entanglement prevention workshop. The Committee **reiterates** that this is an important workshop, looks forward to its results and **endorses** the terms of reference (Annex J, appendix 2).

7.2 Ship strikes
7.2.1 Progress on the global database
The database coordinators' contracts covers a two year term following the biennial Commission meeting schedule. Extensive outreach actions have been carried out in the past year. Following an overhaul to the database system there are around 250 new reported incidents that will be entered in the coming year, adding to the 1,156 existing records. All new entries will be verified by the IWC Ship Strike Data Review Group.

The Committee **commends** the database coordinators on the amount of outreach work that had been achieved and **recommends** that their work should be continued with the same work plan but that the priority for the work over the coming year should be on data entry and validation.

7.2.2 Estimating rates of ship strikes, risk of ship strikes and mortality
7.2.2.1 EASTERN NORTH PACIFIC BLUE WHALES
A USA National Marine Fisheries Service workshop held in September 2014 (NOAA, 2014) reviewed several different tools that have been developed to predict species distribution at various spatial and temporal scales. The aim was to improve understanding of the risk of vessel collisions with whales along the California coast and to inform management actions. Recommendations included exploring the development of carcass detection models. Modelling carcass drift has been attempted to identify the location of ship strikes but has proven difficult. The Committee noted that such work could assist in other areas and **encourages** papers to future meetings.

An approach to determine total potential ship strikes for eastern North Pacific blue whales (Monnahan *et al.*, 2014a) based on scaling up observed ship strikes using an estimate of the reporting rate suggested a plausible annual rate of ship strikes of between 10 and 35 in 2013 with reporting rates of 0.4-4.2%. The estimated upper bound on this ship strike rate was 93 assuming an annual survival of 0.907 and that all deaths are from ship strikes. This is incompatible with observed trends in population abundance estimates and other biological parameters. A range of 10-100 ship strikes per year was used as input into an assessment of population status of North Pacific blue whales (see Item 10.4).

The Committee **recognises** the difficulties of estimating mortality rates for ship strikes. Although some considered the upper bound was probably positively biased, the Committee expresses **concern** over the estimated mortality rates, although the population appeared to have recovered. It was also noted that the long-term data collected in this region on whale abundance, distribution and ship strike mortalities could help to determine ship strike rates for blue whales in other less well-studied areas. The Committee **recommends** that collection of relevant data on blue whales in this region continue.

Satellite tracking of 171 blue whales tagged along the Californian coast, USA (1993-2008) revealed that while whales generally occupied a wide region, most of the areas of highest concentration were close to large human population centres and busy ports; a subset of 53 tracks spanning the period 1998-2008 used to identify core areas of use suggest that risk for blue whales could be reduced by ship routing measures (Irvine *et al.*, 2014). These results contrast with another recent assessment of ship-strike risk which had concluded that routing measures would not reduce risk substantially for blue whales in the area because densities were similar throughout the area (Redfern *et al.*, 2013).

The value of overlaying ship traffic with telemetry results or other data was noted. This extensive telemetry data set could help inform the sample sizes required to address issues such as ship strike risk in other areas with fewer tag deployments. The Committee

20

agrees that in addition to co-occurrence, ship strike risk assessments should explicitly include the seasonality and annual variability in whale and shipping distribution.

7.2.2.2 GREAT BARRIER REEF, AUSTRALIA, AND ABROLHOS BANK, BRAZIL, HUMPBACK WHALES
Relative risk to humpback whales within shipping lanes on the Great Barrier Reef, Australia was estimated by examining the co-occurrence of whale distribution (from aerial surveys) and ship traffic (from AIS tracking) (SC/66a/HIM16). Collision risk was calculated using simple co-occurrence and also a probabilistic framework which incorporated considerations of vessel speed and type. The southern part of the surveyed area had the most dispersed shipping traffic and also an area of high whale density, precluding making clear routing recommendations to manage potential risk. It was noted that this approach, and other studies of co-occurrence, could only produce a measure of relative risk, and that without a known rate of collisions, the actual risk could not be estimated.

The Abrolhos Bank is the main breeding area of humpback whales in Brazil. In 2003, two shipping routes were established in the area. Based on observations conducted from these vessels the number of potential interactions between ships and whales was estimated from a simple collision risk model (Bezamat *et al.*, 2014). Results suggested that the three commercial vessels operating in coastal waters had the potential to collide with 25 humpback annually. In discussion it was noted that the risk model used did not take into consideration the possibility of avoidance behaviour on the part of either the whale or vessel. Similar calculations from other areas suggest that assuming no avoidance response by whales would substantially over estimate ship strikes. However, data on avoidance behaviour that could be used in such models are currently lacking.

7.2.2.3 NORTHERN INDIAN OCEAN BLUE WHALES
Measures to reduce ship strike risks often require data on the relative density of whales in localised high risk areas, but these may be remote or logistically difficult to survey. An evaluation of the potential for detecting blue whales from satellite imagery used images obtained during a period of concurrent boat surveys off southern Sri Lanka. A total of nine targets were classified as possible blue whales, close to the number that would have been expected to be visible. However, it was not possible to attribute possible to targets to blue whales with any degree of confidence, mainly due to confusion with waves.

In discussion, it was noted that this technology might be useful for determining whale densities under specific conditions of very calm waters, such as breeding lagoons (e.g. Fretwell *et al.*, 2014 for southern right whales) or for Antarctic minke whales in the ice. Whilst detecting whales was difficult, the images provided good information vessel distribution of all types.

The southern coast of Sri Lanka is an area with a high risk of ship strikes due to the overlap of high densities of blue whales and one of the world's busiest shipping routes. The apparently high level of risk was confirmed by a large number of reported ship strikes which is one of the highest for any large whale population (SC/66a/HIM13).

In response to recommendations from the Committee (IWC, 2015f), further surveys of blue whale distribution were conducted in 2015 together with an analysis of a year's AIS data to investigate shipping density. A collision risk analysis based on co-occurrence indicated a potential for over 1,000 interactions annually between blue whales and vessels within the study area (SC/66a/HIM09). Based on these results a 15nm southward shift in shipping would reduce this collision risk by 95%.

Surveys conducted in this region to date have occurred within around 50km of the coast. However, Soviet whaling records indicated the presence of blue whales over a broader area. de Vos emphasised the need to explore ship-strike risk in as large an area as possible and identified such an approach that also estimates potential costs of management actions to the shipping industry. This would include exploring the transferability of habitat models built in data-rich regions to the northern Indian Ocean to identify areas of likely highest whale density and using predictions from multiple models to conduct ship-strike risk assessments. Results of these analyses will be used to suggest approaches for minimising risk including estimates of economic effects of implementing ship traffic management measures.

The Committee thanked de Vos for this information about the approach and planned work. Given the estimate of a 95% reduction in risk of ship strike to blue whales if the current Traffic Separation Scheme (TSS) was moved further offshore there was some discussion about whether it was time to approach the appropriate authorities in Sri Lankan Government in order to suggest a proposal for the IMO. However, it was agreed that the most effective advice on routing options and estimates of the associated risk reduction could be achieved by combining the results of the two studies which provide complementary information that can be used to evaluate the implications of different potential routing schemes over a wide region, well beyond any specific TSS that might be established off the south coast. de Vos and Redfern indicated that they expected to have results from their analyses in October 2015. They will then work with the authors of SC/66a/HIM09 to integrate the two approaches. The Committee **recommends** that Brownell, de Vos and Leaper work with the Secretariat to maintain the dialogue with the relevant Sri Lankan authorities including those involved with IMO.

7.2.2.4 HELLENIC TRENCH, GREECE, SPERM WHALES
Ship strikes are recognised as a significant threat to the eastern sub-population of sperm whales in the Mediterranean which is considered as 'Endangered' under the IUCN Red List (IUCN, 2015). In 2014, the Committee considered an analysis of sperm whale and shipping distribution patterns in the Hellenic Trench, Greece (Frantzis *et al.*, 2014), which noted that the potential for small changes in shipping routes to dramatically reduce risk in these high risk areas suggested considerable scope for effective mitigation. Following this risk analysis and also considering the number of reported ship strike incidents, the Committee had recommended that a dialogue should be initiated with shipping regulators and interests in the area. However, the possibility that fin whales may

21

occur further offshore than the current shipping routes was raised and it was suggested that there should be further study of those deeper waters prior to recommending that shipping move offshore.

A review of available data on fin whale distribution around the Hellenic Trench provided no evidence that routing measures to take shipping offshore of areas of high sperm whale density would increase the risk of collisions to fin whales (SC\66a\HIM06). Further information on ship strike incidents was also presented: over 50% (12 out of 23) sperm whale strandings examined between 1992 and 2014 along the coast of Greece showed clear evidence of ship strikes.

The Committee welcomed the additional information which followed up on previous recommendations. Based on this new information, the Committee **agrees** that there is no reason to expect that routing measures designed to reduce risk to sperm whales would increase risk to fin whales. The Committee **recommends** that the Secretariat works with interested parties (including Greece, ACCOBAMS and the shipping industry) and now move forward with Greece in order to develop a proposal for routing measures in accordance with IMO guidelines.

7.2.2.5 BRYDE'S WHALES IN HAURAKI GULF, NEW ZEALAND
The entrance through the Hauraki Gulf to the Ports of Auckland, New Zealand holds a year-round population of Bryde's whales. Between 1996 and 2014, for 17 of 20 (85%) cases with known cause of mortality, injuries were consistent with vessel-strike; a mortality rate that is likely to be unsustainable (Constantine *et al.*, 2015). Whales are broadly distributed throughout the Gulf so re-routing traffic will not reduce risks. These findings resulted in a Transit Protocol for Shipping including voluntary speed restrictions and a monitoring plan. Ports of Auckland, the shipping industry, New Zealand's Department of Conservation (DOC), and Auckland University have collaborated on a protocol which outlines passage planning options to reduce risk. These include reduced speed when transiting the Hauraki Gulf.

The Committee **commends** this effort. It was noted that while voluntary speed recommendations had not produced immediate results, transit speeds had been decreasing towards the suggested (IWC/65/CCRep01) 10 knots over time. Willson noted that similar engagement with the Port Authorities of Duqum, Oman had produced similar results, which underscores the value of working with all stakeholders.

7.2.2.6 CANARY ISLANDS, SPERM WHALES
A passive acoustic survey was conducted to estimate the absolute abundance of sperm whales in the waters of the Canary Islands resulting in an estimate of 220 sperm whales in the survey area (Fais *et al.*, 2015). Many of the areas with higher whale density were consistent with those previously described. Some of these areas overlap with high shipping activity. Comparison of the minimum mortality rate based on known strandings of sperm whales showing signs of ship collisions in the Canary Islands (2 per year) suggested that mortalities due to ship-strikes probably exceed the reproduction rate.

The Committee has previously expressed concern about the ship strike rate in this region and welcomed this study. For the first time an abundance estimate for sperm whales is available which can be related to the number of stranded animals showing signs of collisions, indicating that the human-induced mortality rate may not be sustainable in the area. A Working Group for the Prevention of Ship-Strikes (WGPSS) comprising the three main inter-island ferry companies of the Archipelago, the Spanish national government and the Canary Islands regional governments, as well as cetacean scientists was established in 2014. The Committee **endorses** the mitigation measures suggested by the WGPSS (see Annex J) and noted a number of other initiatives that could help address the issue.

Web-tools developed to enhance data collection and sharing of distribution and identification of pelagic fauna in the Canary Islands were also presented (SC/66a/HIM12). Between 2012 and 2015 the CetAVist project had performed 416 surveys with more than 100 volunteer observers reporting more than 1,000 sightings. The Committee noted the need for further data and also **encourages** real-time reporting of sightings to and from ships within the local area as a possible mitigation tool. The Committee also **recommends** further studies: (1) to evaluate the amount of international and local shipping traffic within the Canary Islands PSSA to estimate the relative contribution by vessel type to overall ship strike risk and (2) to better describe sperm whale distribution and abundance in the archipelago to identify critical habitat, the range of the population, evaluate population level effects of ship strike related mortality and the overlap in distribution patterns of shipping with sperm whales and other cetaceans over a long period. It also highlights the importance of a continuation of the stakeholder dialogue and **encourages** a closer collaboration with the IWC, especially through the ship strike data coordinators and the Secretariat.

7.2.2.7 MEDITERRANEAN AND NORTH ATLANTIC, FIN WHALES
Satellite telemetry was used to identify critical habitats that might assist mitigation of ship strikes for Mediterranean fin whales (SC/66a/HIM14). Results from 13 fin whales tagged between 2012 and 2015 confirm that important fin whale habitat extends westward of the Pelagos Sanctuary area and also provide further evidence for the importance of the Strait of Sicily and the need for a designated action plan to address actual and potential threats in that area. The results demonstrate the use of telemetry data to assess fin whale critical habitats and the need for consideration of a comprehensive ship strike mitigation programme at a Mediterranean-wide scale rather than national or small regional scales. In discussion, it was noted that the whales' presence in the Strait of Sicily appears correlated with oceanographic features that have remained reasonably consistent over the past 20-30 years. Hence there is consideration of establishing a Marine Protected Area there under the auspices of the Barcelona Convention.

22

Three freshly dead, juvenile fin whales were brought into Rotterdam, Netherlands on the bows of large container ships between 2011 and 2013 (Ijsseldijk *et al.*, 2014). The assumed speed of the vessels ranged between 18 and 23 knots but none of the ship's crews were aware of the presence of the dead fin whales on the bows of their vessels. The study underlines the importance of performing a necropsy on bow-caught whales to try to determine if a collision was post-mortem or ante-mortem. In discussion, some members expressed surprise that, in general, so many whales stay caught on the bow of ships. It appears to be rorquals with long slender bodies, but the proportion of the overall number of collisions where whales get stuck on the bow is unknown.

7.3 Collaboration with the Commission's ship strikes working group including consideration of mitigation measures
7.3.1 General overview of mitigation options
The joint IWC and UNEP-CEP-SPAW Ship Strikes Workshop, hosted by Panama in June 2014 (IWC/65/CCRep01) reviewed progress on the recommendations from the previous IWC/ACCOBAMS workshop on ship strikes held in 2010 (IWC/63/CC8). As a priority action, the Workshop recommended that the IWC build a long-term working relationship with the IMO including the submission of a substantive document to the IMO Marine Environment Protection Committee. The Committee **agrees** that this would be a useful initiative. The Workshop examined a number of case studies and also reviewed currently used mitigation strategies. It agreed that currently the only proven, effective mitigation measures are to avoid areas with known concentrations of whales, or reduce speed while transiting those areas.

The Workshop recommendations of particular relevance to the Committee included building upon existing modelling approaches with a view to developing a broad simulation framework that could be used to examine the likely effectiveness of various mitigation strategies, and investigation of habitat modelling issues by 'censoring' datasets in various ways. This could allow comparisons of the reliability of the predictions against those from the full dataset and the exploration of the relationship between use of presence/absence data and presence-only data.

The Committee endorsed the Workshop's relevant recommendations and **recommends** that the censoring exercise go forward and that results be brought to future meetings. The Committee **welcomes** information on analyses surrounding IMMAs (Important Marine Mammal Areas) and **agrees** that an expert group on modelling could assist in such work and in formulating advice for the Commission and other relevant bodies. As an example, such a group might assist if the Committee were to offer its services to review proposals for new or modified TSSs, and other IMO actions, for any implications for whales.

A number of outreach documents on ship strike issues were considered including a ready-to-use PowerPoint presentation prepared as part of the work of the IWC ship strike data coordinators. It was suggested that this be distributed widely and be available through the IWC website. Ritter will work with the Secretariat to achieve this.

There was some discussion of whether there was a need to define what is meant by 'mitigation' in an IWC context. The Committee **agrees** that evaluation of the effectiveness of mitigation measures would be limited to direct actions like re-routing, changes in speed, or direct methods that alert mariners to enable manoeuvres to avoid strikes, and would not include evaluation of indirect actions like education and outreach.

Trials of an infrared blow detection system which consists of an actively stabilised thermal imaging device in combination with data acquisition and processing software showed that the system could detect humpback, minke and fin whales (Zitterbart *et al.*, 2013). Up to a range of 5km, the system detected 82% of all blows sighted by cue-counting observers. The system could potentially be used as a tool to alert ship's crews to whales in the path of a vessel. The system was not successful at detecting medium or small size cetaceans without a strong blow and produced a relatively high number of false positives which needed to be validated by an observer. Despite these limitations, the Committee **agrees** that the evolution of this technology may be promising in certain situations for detecting whales to avoid collisions.

Data collected using systematic line transect surveys completed at various speeds between 5 and 20 knots were used to examine the role of speed in close encounters between vessels and humpback whales. Below a critical speed threshold of 12.5 knots close encounters dropped by over 90%. The authors currently suggest a speed limit of 12.5 knots during the whale season and plan to expand on the model to include vessel traffic and whale behaviour. The Committee encouraged further updates from this ongoing work. It noted that this study represents a valuable approach for evaluating the role of speed in the risk of collision. The Committee also considered the need for a standard definition of 'near miss' or 'close encounter' and noted the potential for land-based observations to also provide information on whale reaction to approaching vessels.

Based on review papers presented, the Committee created a simple summary table of ship strike mitigation measures (Table 5). This table is intended for use by the Secretariat and ship strike data coordinators as a first response to general enquiries about mitigating ship strikes.

The Committee recognised that for most populations it is not yet in a position to provide time series of mortality estimates from entanglements and ship strikes with any reliability. An intersessional group will review existing literature, data and other resources in order to identify any quantitative (if possible) and qualitative estimates (e.g. reported numbers as minimum estimates) of non-deliberate, human induced mortality for the populations that are currently being assessed by the Scientific Committee. This information would be compiled and submitted to IWC SC66b in 2016. It was also agreed to develop a way of querying the ship strike database to be able to extract cases by population.

Table 5

Summary table of ship strike mitigation measures that have been implemented worldwide. Further details of the measures given as examples can be found in SC/65b/HIM05, with a bibliography of studies relating to these examples, including evaluations of effectiveness in SC/66a/HIM04.

Measure	Situation to which it might be applied	Implementation process (and observations)	Examples
Keeping vessels away from whales			
Permanent routing measures through TSS, ATBA or port approach routes	Long-term patterns of whale distribution are sufficiently predictable and well understood to enable a robust analysis of the risk reduction that might be achieved.	Implemented through IMO or national regulation if within territorial seas. Proposals should follow IMO process incl. data on the problem, the risk reduction achieved and implications for shipping. (Generally well respected by industry.)	Bay of Fundy, Canada Boston, USA California, USA Panama Cabo de Gata, Spain
Seasonal routing measures	Similar requirements to permanent routing but applicable where there are strong seasonal patterns in whale distribution	As above	Roseway Basin, Canada Great South Channel, USA
Recommended (voluntary) routes	Similar requirements to permanent routing through TSS or ABTA but not mandatory	Implemented by IMO or coastal state as a non-mandatory measure	Peninsula Valdez, Argentina Hauraki Gulf, New Zealand Glacier Bay, USA Ports on US east coast
Short-term (days – weeks) and Dynamic routing measures	Implemented in response to short-term observations of whale aggregations or known high risk areas. Need almost real-time reporting systems that can identify such aggregations	Voluntary measures that need to be communicated to mariners. (Can be difficult to encourage compliance.)	Dynamic management areas off the US east coast, Gibraltar Strait, Spain
Slowing vessels down			
Permanent speed restriction zones	Long-term patterns of whale distribution are predictable and well understood but routing measures are not practicable.	Can be voluntary or mandatory if implemented in national waters.	East coast of USA (mandatory) Glacier Bay, USA Hauraki Gulf, New Zealand
Seasonal speed restriction zones	As above but applicable where there are strong seasonal patterns in distribution	As above	Panama California, US Peninsula Valdez, Argentina
Dynamic Management Areas for speed restrictions	Implemented in response to short-term observations of whale aggregations or known high risk areas. Need reporting systems that can identify such aggregations	Voluntary measures that need to be communicated to mariners. (Can be difficult to encourage compliance.)	US east coast
Avoidance manoeuvres			
Real-time alerting tools to warn vessels of the presence of whales or aggregations that allow vessels to alter course or slow down	A rapid reporting network of whale sightings or acoustic detections alerts all vessels transiting an area to the locations of whales so that they can alter course or slow down	Individually designed and implemented reporting systems	REPCET, ACCOBAMS, Mediterranean Sea WhaleAlert, Boston USA
Observations from vessel allowing avoiding action	Only effective for vessels capable of rapid manoeuvres to avoid whale sightings (e.g. vessels of a few thousand GT or less)	Additional dedicated observers, education and outreach to mariners	Many initiatives

7.4 Work plan

The Work plan is summarised in Table 6. Budgetary implications are discussed under Item 26.

Table 6

Summary of the Work Plan for non-deliberate human induced mortality.

Item	Intersessional	2016 Annual Meeting
Review information from progress reports on entanglement and ship strikes	Encourage Governments to enter progress report data via the portal	Compile and review
Entanglement		
Estimate rates, risks and mortality	Intersessional group on time series for assessments	Review report and new information
Consider mitigation measures	Commission workshop, April 2016	Review results from workshop
Links with CMPs		Provide advice as needed
Database	Small design group meeting	Review results
Communications	Assist Secretariat as needed	Review website
Ship strikes		
Estimate rates, risks and mortality	Intersessional group on time series for assessments	Review report and new information
Consider mitigation measures	Follow-up on recommendations including modelling	Review progress and effectiveness
Links with CMPs		Provide advice as needed
Database	Coordinators' focus on data entry and outreach, intersessional group	Review results and progress
Communications	Assist Secretariat as needed	Review website

8. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE (AWMP)

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995a) which has been strengthened by Resolution 2014-1. The report of the Standing Working Group (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) developing *SLA*s (*Strike Limit Algorithms*) and providing management advice for Greenlandic hunts, with focus on bowhead and fin whales; (2) providing management advice for the Greenland hunts and the humpback whale hunt of St. Vincent and The Grenadines (see Item 9); and (3) additional work related to the AWS (aboriginal subsistence whaling management scheme). Considerable progress on items (1) and (3) was made as a result of an AWMP intersessional Workshop (SC/66a/Rep03) and the AWMP Developers' Fund.

The Committee **stresses** that the approach used by the SWG (and the sub-committee on the RMP) is of broad relevance to the work of the Committee when examining status and the effects of human-related mortality. The modelling framework and approach to dealing with uncertainty is of wide application, for example when assessing the effects of bycatch in fishing gear or ship strikes (see Item 7). This approach is now being used for North Pacific gray whales (SC/66a/Rep08).

8.1 Progress on SLA development for the Greenland hunts

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 greatest extent possible is an important component of management in the light of the agreed IWC objectives. For a number of reasons, primarily related to stock structure issues, development of *SLA*s for some Greenland aboriginal hunts (especially for common minke whales) is more complex than previous *Implementations* for stocks subject to aboriginal subsistence whaling. The Committee endorsed an interim safe approach to setting catch limits for the Greenland hunts in 2008 (IWC, 2009), noting that this should be considered valid for two blocks i.e. the target will be for agreed and validated *SLA*s, at least by species, for the 2018 Annual Meeting at the latest. This need to complete the work on *SLA*s has been reinforced by Resolution 2014-1. The Committee completed the first of these, for the West Greenland humpback whale hunt at last year's meeting (IWC, 2015f, p.19).

The Committee has recognised that in a multi-species fishery, hunters would like to have some flexibility across species in terms of meeting the overall need expressed in terms of edible products. It has agreed that the inclusion of such flexibility across a series of interlinked *SLA*s is complex (e.g. IWC, 2011a). The Committee has therefore agreed that this aspect only be considered after single species *SLA*s have been developed and adopted (IWC, 2012b, p.16)

8.1.1 Development of an SLA for the bowhead whale hunt off West Greenland
REPORT OF THE INTERSESSIONAL WORKSHOP

Considerable progress on the development of an *SLA* for the bowhead whale hunt had been reported last year (IWC, 2015h) Annex E). This continued intersessionally and at the February 2015 Intersessional Workshop (SC/66a/Rep03, item 2), the focus was on reviewing the performance statistics and plots for revised candidate *SLA*s. As for previous *SLA* selections, this process involved examining the results for the broad range of trials, determining which *SLA*s achieved acceptable conservation performance (the primary objective agreed by the Commission) and then identifying from those the *SLA*s that achieved the best need satisfaction within the set of such *SLA*s.

The Workshop received the results from two developing teams (Witting; Brandão and Butterworth) for several candidate *SLA*s. Based upon the different properties of these *SLA*s and their performance, the Workshop developed three new 'combined' *SLA*s that performed better than their individual components. Two of these met the Commission's conservation objectives and one of these slightly outperformed the other with respect to need satisfaction. Based upon these results[3], the Workshop recommended that *SLA* to the Committee as the '*WG-Bowhead SLA*'.

NEW INFORMATION AND ADDITIONAL WORK

At this meeting, new information was received about an increase in the quota for Canada (a non-member nation who sets limits independently of the IWC) in 2015 to seven (Annex E, appendix 2) that warranted further consideration; the catch off Canada during 2014 was two whales, against a quota of five. The trials conducted at the Workshop to evaluate *SLA*s had considered three scenarios regarding future Canadian catches (5 constant over 100 years; 2 to 8 over 100 years; 2 constant over 100 years).

The Committee focussed its work on determining that the *SLA* recommended at the February workshop is robust to reasonable assumptions made regarding future Canadian catches. In considering the Canadian catches when developing the original scenarios, the Committee (IWC, 2015c, pp.435-57) selected the initial value of two for some of the catch scenarios to be equivalent to the then current annual take of three because it was unrealistic to include all Canadian catches in the catch series whilst using only the abundance estimates for the West Greenland component of the stock. The rationale for this was that:

---

[3] The full set of results are available from the Secretariat. The full final trial specifications will be published as an Annex to SC/66a/Rep03.

(1) the abundance estimate from the Prince Regent area of Canada in 2002 (a best estimate of over 6,300) is appreciably larger than for West Greenland;

(2) whilst telemetry data have shown that some whales tagged off West Greenland do move to the east and west of Baffin Island (Heide-Jørgensen *et al.*, 2003; pers. comm.), none of the whales tagged in Canada (from settlements where whaling occurs) in summer have subsequently been seen in West Greenland in spring (Ferguson *et al.*, 2010); and

(3) the sex ratio in the Canadian catches has been close to equal whereas the percentage of females off West Greenland is 80%.

Thus, whilst the larger catch limit for Canada for 2015 of seven could lead to catches/strikes in excess of those in recent years, there is uncertainty concerning the relationship of those catches to the abundance estimate for West Greenland alone. The Committee evaluated two options for addressing this uncertainty. The first involved assuming the present simple and conservative assumption regarding the relationship between catches from Canada and the abundance estimate off West Greenland. The available trial results show that with a constant annual Canadian catch of 7, under these circumstances it would not be possible to meet Greenlandic need adequately and thus a new simulation framework accounting for the full eastern Arctic would be required. As noted in IWC (2015c, p.p. 436-7) this will be a major exercise given that as Canada is a non-member nation, determining plausible assumptions about the availability of abundance estimates as well as catches is problematic.

The second option considered was to conduct trials in which the proposed *WG-Bowhead SLA* is used to provide strike limits and the Canadian catch is seven annually and compare the conservation performance against the already tested constant annual catch of five for periods of 6, 12 and 18 years. This is a worst-case scenario for the reasons provided above and because following the approach agreed last year, a Canadian quota of 7 would be reduced to just under 5. The results are provided in Annex E, table 1. Under this worst case scenario, the Committee **agrees** that there is negligible conservation risk in using the proposed *WG-Bowhead SLA* for a period of 12 years (e.g. for the 2.5% MSYR trials, the lower 5th percentile of the 1+ population for constant catch 7 was never less than around 94% of the value for constant catch 5) or 18 years (the equivalent percentage was around 92%).

The Committee also noted that *Implementation Reviews* will occur every six years i.e. the next *Implementation Review* would take place in 2021 if the *WG-Bowhead SLA* is adopted. By this time there will have been (1) six more years of Canadian catch data, (2) further information on any Canadian abundance surveys and (3) further information on stock structure and movements. It was also noted that the West Greenland hunt had not taken bowhead whales since 2011. As part of the 2021 *Implementation Review*, the Committee should consider whether it appears likely that a full eastern Arctic framework for evaluating *SLA*s would need to be developed. If so, work should be initiated to do that, recognising that it will be a complex task and may take several years. If not, a similar instruction should be provided for the 2027 *Implementation Review*. It was also noted that the Committee undertakes an annual review of management advice each year and has the ability to call for an early *Implementation Review* should it so wish (e.g. as was the case for gray whales in 2010 (IWC, 2011a).

CONCLUSIONS AND RECOMMENDATIONS
Given the above, the Committee **recommends** the *WG-Bowhead SLA* to the Commission as the best approach to providing long-term management advice for the Greenland hunt. It also **recommends** that information on Canadian catches be an important component of the 2021 *Implementation Review*. The Committee thanked the SWG and the developers for their hard work during the process.

8.1.2 Development of an SLA for the Greenlandic fin whale hunt
REPORT OF THE INTERSESSIONAL WORKSHOP (SC/66A/REP03)
Based upon a careful review of the available stock structure and other information discussed during the development of trials for the RMP *Implementation Review* for fin whales (SC/66a/Rep03, item 3.1), the Workshop agreed that from a conservation perspective, it was acceptable to try to develop an *SLA* for this hunt on the conservative assumption that the animals off West Greenland comprised a single population represented by the abundance estimates from that area. In doing so, the Workshop recognised that this will make achieving need satisfaction more difficult. The Workshop agreed that this decision should be reviewed in light of initial results of candidate *SLA*s at the 2015 Committee meeting based on an agreed initial set of *Evaluation Trials* (see Table 7). Details of the trial structure agreed, including biological parameters, abundance estimates, need and all trials can be found in SC/66a/Rep03, item 3.2.

INITIAL EXPORATORY SLAS AND CONDITIONING
Thanks to the hard work of Punt in coding the program to implement the *Evaluation Trials,* two sets of developers presented results for a set of initial exploratory *SLA*s (Brandão and Butterworth - SC/66a/AWMP4; and Witting - SC/66a/AWMP3). The Committee **agrees** that the conditioning of the trials (Annex E, appendix 4) had been achieved satisfactorily. Details of the exploratory *SLA*s and their initial results can be found in Annex E, item 3.2 and in Annex E, appendix 5.

There was considerable discussion as to what was an appropriate lower bound for $MSYR_{1+}$ to use in the trials that initially arose out of a paper (SC/66a/AWMP1) which used Bayesian modelling to analyse density dependent growth of fin whales across four areas in the North Atlantic. The paper's conclusion was that there is an approximately a 95% probability that $MSYR_{1+}$ is higher than 2% for North Atlantic fin whales. There was considerable discussion as to whether the lower bound value used for the generic RMP (and being used in the current RMP North Atlantic fin whale *Implementation Review* (IWC, 2015, pp. 461-86) necessarily had to

Table 7

The *Evaluation Trials* for fin whales. Values given in **bold** type show differences from the base trial.

Trial	Description	$MSYR_{1+}$	Need Scenarios	Survey freq.	Historic Survey Bias	Conditioning Option
1A	$MSYR_{1+}$ = 4%	4%	A, B, C	12	1	Y
1B	$MSYR_{1+}$ = 2.5%	2.5%	A, B, C	12	1	Y
1C	$MSYR_{1+}$ = 1%	**1%**	A, B, C	12	1	Y
1D	$MSYR_{1+}$ = 7%	**7%**	A, B, C	12	1	Y
2A	6 year surveys	4%	A, B	**6**	1	1A
2B	6 year surveys; $MSYR_{1+}$ =2.5%	2.5%	A, B, C	**6**	1	1B
3A	18 year surveys	4%	A, B	**18**	1	1A
3B	18 year surveys; $MSYR_{1+}$ =2.5%	2.5%	A, B, C	**18**	1	1B
3C	18 year surveys; $MSYR_{1+}$ =1%	**1%**	A, B, C	**18**	1	1C
4A	Survey bias = 0.8	4%	A, B	12	**0.8**	Y
4B	Survey bias = 0.8; $MSYR_{1+}$ =2.5%	2.5%	A, B	12	**0.8**	Y
5A	Survey bias = 1.2	4%	A, B	12	**1.2**	Y
5B	Survey bias = 1.2; $MSYR_{1+}$ =2.5%	2.5%	A, B	12	**1.2**	Y
6A	3 episodic events	4%	A, B	12	1	1A
6B	3 episodic events; $MSYR_{1+}$ =2.5%	2.5%	A, B, C	12	1	1B
6C	3 episodic events; $MSYR_{1+}$ =1%	**1%**	A, B, C	12	1	1C
7A	Stochastic events every 5 years	4%	A, B	12	1	1A
7B	Stochastic events every 5 years; $MSYR_{1+}$ = 2.5%	2.5%	A,B	12	1	1B
8A	Asymmetric environmental stochasticity	4%	A, B	12	1	1A
8B	Asymmetric env. stochasticity; $MSYR_{1+}$ = 2.5%	2.5%	A, B, C	12	1	1B
8C	Asymmetric env. stochasticity; $MSYR_{1+}$ = 1%	**1%**	A, B, C	12	1	1C

be used in the case specific AWMP, particularly since *inter alia* the objectives of the RMP and AWMP differed. Although not all members of the Committee shared the same rationale, it **agrees** that:

(a) the available information for North Atlantic fin whales indicated that trials based on $MSYR_{1+}$ of 1% were of relatively low plausibility, but that there were insufficient data at present to choose a specific higher value;

(b) this is reflected in the *Evaluation Trial* structure in the balance of trials amongst MSY rates of 1%, 2.5%, 4% and 7%;

(c) as in previous *Implementations* and *SLA* development cases (IWC, 2002b, pp.,151-2) when reviewing the results of trials, there will be an integrated examination of the results of all trials, not simply the most challenging, taking into account plausibility.

CONCLUSIONS AND RECOMMENDATIONS

The Committee reviewed the initial results from the exploratory *SLA*s (see Annex E, appendix 5) to determine whether it was likely that an *SLA* that met both the Commission's conservation objective and user objectives could be developed under the conservative assumption that the animals off West Greenland comprised a single population represented by the abundance estimates from that area. Based upon these results, the Committee **agrees** that while further work is needed with *SLA* development, it is clear that it will be possible to develop an *SLA* that meets the Commission's objectives. Provided that sufficient resources are available and an intersessional workshop is held (see Item 26), the Committee **agrees** that it should be in a position to recommend a fin whale *SLA* for the Greenland hunt at next year's meeting.

8.1.3 Development of an SLA for the common minke whale hunt off Greenland

The complexity of the stock structure situation for common minke whales combined with the level of need (at present the annual strike limit is 164 – the highest allowed under the interim *SLA*) mean that the simple yet conservative approach adopted for fin whales (see Item 8.2.1) cannot be applied for the common minke whale hunt. As noted previously (IWC, 2014b, pp.447-9), testing of candidate *SLA*s for this hunt will require examination of the RMP *Implementation* process and adaptation of the code used. That *Implementation* process had involved joint AWMP/RMP work to consider stock structure hypotheses (IWC, 2015d, pp.545-57). This work was taken further at the present meeting (see item 6.2 and Annex D).

The intersessional workshop (SC/66a/Rep03) had noted that the code developed to implement the RMP trials structure now includes the facility to base catches of common minke whales off West Greenland on the outputs of an *SLA* or alternative *SLA*s. Depending on progress with the RMP *Implementation Review* at the present meeting, it may be possible to begin preliminary testing of initial candidate *SLA*s during the proposed forthcoming intersessional workshop (see Item 8). The Committee agrees to allocate highest priority to developing an *SLA* for this hunt in time for its recommendation to the Commission by 2018 at the latest.

8.2 Aboriginal Whaling Management Scheme

For more than a decade the Commission has been unable to agree on an *Aboriginal Whaling Scheme* (AWS). The 2003 AWS proposal (IWC, 2003, pp.161-6), includes provisions relating to survey intervals, carryover, a 'grace period' with a catch reduction in the event of no survey being available within the prescribed period and guidelines for surveys. In particular:

(1) new abundance information is expected at least once every 10 years;

(2) if abundance information is overdue, then a 'grace period' (see (3) below) is invoked for the first whole quota block that follows - this block may begin as early as the 11th year after the last estimate or as late as the 14th;

(3) during the grace period, the *SLA* block quota recommendation is reduced to 50% of the previous block and hunters are allowed flexibility as to how to allocate this throughout the block – a new *SLA* calculation can be carried out within the grace period if a new abundance estimate is accepted and a revised block quota set;

(4) the grace period is only for one block - without a new abundance estimate, the Committee would be unable to give scientific advice on strike limits after the grace period expired, and an *Implementation Review* would probably be initiated.

Further information on the proposed rules about the grace period and the carryover of strikes are given in IWC (2003, pp.161-6), along with examples of various scenarios.

The lack of acceptance by the Commission appears partly due to objections from hunters regarding strike limit reductions during the grace period when a recent whale abundance estimate has not been obtained due to factors outside their control (e.g. several years of bad weather, lack of funding, political paralysis).

REPORT OF THE INTERSESSIONAL WORKSHOP
Although the situations above would probably trigger an *Implementation Review*, given the lack of progress at Commission level with an AWS, it is clear that there is a need to develop further advice on how to proceed in such cases and the intersessional workshop (SC/66a/Rep03) focussed on the Alaskan bowhead whale hunt. It recognised the hunters' concern, but reiterated that it is important to consider aboriginal whaling quota reductions in the long term absence of data as well as when there is evidence of conservation risk. It was also noted that the status of the Bering-Chukchi-Beaufort (BCB) Seas stock of bowhead population has improved substantially since the *Bowhead SLA* was developed and tested (the estimated abundance is 60% larger and the rate of population increase has been revised upwards). There may thus now be more room to develop defensible, responsible management approaches for this stock that appeal to a wider range of stakeholders.

The new suggestion considered was that the grace period (with its 50% reduction) should be replaced by a grace period with an 'interim allowance' where the 'grace period' strike limit would be that produced by the *Bowhead SLA*, without reduction, for a single block. This proposal might be broadly applicable to other aboriginal hunts as well. The Workshop had agreed that such a process must be tested using the same general framework as was used to test the *Bowhead SLA* in 2003 to determine whether it meets the conservation and need satisfaction goals of the Commission. The Workshop had emphasised that the approach is intended only to be applied in the unlikely event that exceptional unforeseen circumstances delayed obtaining an agreed abundance estimate beyond the end of the second quota block. It should not be interpreted as a routine approach for extending quotas for a third block without a concerted effort to obtain a successful survey prior to then.

The Workshop had also stressed that as soon as it becomes apparent that there is a likelihood that an abundance estimate may not become available in time, researchers should immediately begin to develop alternative approaches to obtaining abundance estimates (or at least indices of abundance) that do not depend on the problematic conditions. It had noted that in the case of BCB bowhead whales, alternative methods of obtaining abundance estimates or indices of abundance are already being developed.

AWS SPECIFICATIONS AND TESTING
The Committee **endorses** the approach developed during the Workshop. Carrying this work forwards, the Committee has focussed on establishing the simulation testing framework to evaluate the conservation and need satisfaction performance of the new AWS proposal. This focussed on:

(1) adjusting the *Bowhead SLA* to account for 6-year blocks; and

(2) developing a sufficiently broad range of scenarios that takes into account timing of surveys, delays between surveys occurring and estimates being developed and accepted by the Committee, timing of blocks etc.

Developing the scenarios is complex, as discussed in Annex E, item 6.2 and table 3, where examples are given.

Since the Committee now intends to compare performance of two grace period policies (phase-out vs. interim allowance), the *SLA* and simulation testing framework must be elaborated to include grace period options. In most respects, the Committee agrees to apply the same general simulation testing framework used during the testing of the *Bowhead SLA* itself (IWC, 2003, p.156). Annex E, appendix 6 lists changes to the computer code for the *Bowhead SLA*, its component programs, the simulation testing software, trials and statistics that will be required to examine management performance under both AWS grace period proposals and with 6-year blocks. Some trials used for evaluation of the *Bowhead SLA* will not be needed for the present investigations; these are listed in Annex E, appendix 6. Each simulation trial chosen for analysis will be run three times: once with surveys every 10 years; once with overdue surveys and phase-out; and once with overdue surveys and an *SLA* interim allowance.

CONCLUSIONS AND RECOMMENDATIONS
The Committee **agrees** that it should be possible to fully test the above proposal and determine whether it can be recommended by the 2016 Scientific Committee meeting, resources permitting. To meet this goal, considerable work will be required to finish the necessary computer programming, to run the trials and to summarise results in advance of the proposed intersessional AWMP workshop in winter 2016. A steering group consisting of Allison, Brandão, Donovan, Givens (chair), Punt and Witting was formed to help guide development between meetings.

8.3 Work plan
The AWMP work plan is summarised in Table 8. Budgetary items are considered under Item 26.

Table 8

Summary of progress and work plan for aboriginal subsistence whaling management procedures

Topic	SC/66a	Intersessional (2015/16)	SC/66b (June 2016)
Validate *Humpback SLA*	Completed	No	No
Development of *SLA* for bowhead whales	Completed	Validate code for *WG-Bowhead SLA*	Review Canadian catch information
Development of *SLA* for common minke whales	Little progress, awaiting results of RMP *Implementation Review*	Workshop; begin to develop framework and trial structure	Review progress; developers' work
Development of *SLA* for fin whales	Agreed trial structure	Workshop; review results	Expect to finalise *SLA*
Aboriginal Whaling Scheme	Trial testing approach developed	Workshop; review results	Expect to complete
Annual review of catch limits	Completed	No	To be completed
Implementation Reviews	None scheduled	No	Prepare for gray whale *Implementation Review*

9. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT ADVICE

The Committee noted that the Commission had reached agreement on strike limits for Greenland at its 2014 Annual Meeting (*Ann. Rep. 2014*. Available at *archive.iwc.int*). The Committee has based its management advice this year on the same need requests considered last year. In providing this advice, the Committee noted that the Commission had endorsed the interim safe approach (based on the lower 5th percentile for the most recent estimate of abundance) for providing advice for the Greenland hunts developed by the Committee in 2008 (IWC, 2009, p.16); it was agreed that that this should be considered valid for two blocks i.e. up to the 2018 Annual Meeting. The Committee emphasises that the results of the simulation exercises undertaken as part of the development process for *SLA*s for the Greenland humpback, bowhead and fin whales **reconfirms** the Committee's original advice with respect to the interim safe approach.

The Committee notes that when providing management advice on subsistence whale hunts it provides advice in a specific way i.e. it comments only on whether the need request or present limits can be safely met from the perspective of the Commission's conservation objectives. If it or they cannot be safely met then the Committee provides advice on what strike limit is acceptable from a conservation perspective.

9.1 Eastern Canada and West Greenland bowhead whales
9.1.1 New information (including catch data)
No bowhead whales were taken in West Greenland in 2014 while two bowhead whales were taken in northeast Canada in 2014 (see Annex E, appendix 2). Samples were reported to have been collected from one of the whales taken in Canada and 45 biopsy samples had been collected from West Greenland bowhead whales in 2014. The Committee **welcomes** this information and **recommends** continuation of the work. It also **strongly encourages collaboration** with Canada on genetic work.

The Committee **recalls** that last year, it had agreed that the mark-recapture estimate of 1,274(CV=0.12) for 2012 provides the best estimate of abundance for the number of bowhead whales visiting West Greenland.

9.1.2 Management advice
Based on the agreed best 2012 estimates of abundance for bowhead whales (1,274 CV=0.12), and using the agreed interim approach, the Committee **repeats its advice** that an annual strike limit of two whales will not harm the stock.

The Committee **agrees** that the new *WG-Bowhead SLA* agreed above (see Item 8.2) should be used to confirm the strike limit, following completion of the validation/checking process at next year's meeting.

9.2 North Pacific gray whales
9.2.1 New information including report of the rangewide workshop
Donovan reported on the 2nd workshop on the rangewide review of the population structure and status of North Pacific gray whales (see SC/66a/Rep08). This Workshop was a technical follow-up to the 2014 workshop (IWC, 2015l, pp.489-528) that had thoroughly reviewed the available information on *inter alia* stock structure, abundance and biology with a view to developing an initial modelling framework for gray whales throughout the North Pacific. The 2015 Workshop reviewed progress made intersessionally on recommendations made at the 2014 workshop and annual meeting of the Scientific Committee (IWC, 2015f). These included additional work on the comparison of photographic and genetic catalogues, development of Single Nucleotide Polymorphisms (SNP) assays for use with gray whales to improve genetic analyses, additional work including a new research cruise to improve the sample sizes (genetic and photo-identification) for the feeding areas between northern California and Kodiak Island, with emphasis on the waters north of Washington, additional telemetry work, improved abundance estimates for PCFG (Pacific Coast Feeding Group) whales, improved early catch history data for the western North Pacific and better estimates of ship strikes and bycatches throughout the North Pacific. Focus within the Workshop was on how the additional information could feed into the modelling framework, now and in the future.

29

A key analysis identified at the 2014 workshop was to examine the existing data to see what bounds could be put on the proportion of whales that feed off Sakhalin and migrate to the eastern North Pacific. The Workshop's primary focus was to review the excellent intersessional work undertaken by Punt to produce initial specifications and runs for an age- and sex- structured population dynamics model. The importance of developing a plan to update the IUCN/IWC Conservation Management Plan at the 2015 meeting was also noted.

The Committee welcomes the continued progress to assess the population structure and status of North Pacific gray whales, thanked Donovan and the participants and **endorses** the recommendations. Substantial work had been completed in the short time between the workshop and SC66a, although additional data and analyses are still needed, including work to further quantify the bounds on the proportion of animals that feed off Sakhalin and breed in the western North Pacific.

Punt (SC/66a/BRG2) outlined a sex- and age-structured population dynamics model that can represent the stock hypotheses developed for North Pacific gray whales. The model allows for multiple breeding stocks, each of which may consist of several feeding aggregations, multiple feeding and wintering grounds, as well as migratory corridors. The values for the parameters of the model can be estimated by fitting it to data on trends in relative and absolute abundance, in addition to mixing proportions based on mark-resight data, bycatch rates, and estimates of numbers immigrating into the PCFG. The Committee thanked Punt for his efficiency and the speed at which he provided results. His initial efforts show that the model framework is working although additional data are still needed and the Committee reviewed progress with this work.

Weller, convenor of the intersessional matching group, reported progress on photographic and genetic matching and obtaining a full list of historical and recent records of gray whales off Japan. Work with respect to updated abundance estimates should be completed next year in the case of PCFG whales. Weller also reported on progress with respect to the planned NOAA ship survey in the North Pacific for gray whales. The Committee **welcomes** the news of this cruise and **encourages** NOAA to cover both North Pacific right whales and gray whales if possible.

SC/66a/BRG19 provided information about gray whales that washed ashore dead along the coast of Chukotka, Russia. The Committee thanked the authors for a similar report and was pleased to hear that stranded animals will continue to be examined. The Committee also **encourages** collection of genetic samples from stranded animals and comparisons between animals examined in Alaska and Chukotka.

Monitoring of gray whales in San Ignacio Lagoon and Magdalena Bay in Baja California, Sur, Mexico has been occurring for many years. Results from surveys in winter 2015 are provided in SC/66a/BRG21. Photos from 2006 to 2013 provided information about mean calving interval, which was 2.44 years (*n*=75 whales). This compares to a previous estimate of 2.25 years (*n*=60 whales) for 1977 to 1982. The Committee thanked Urbán and his collaborators and **recommends** continuation of this important long-term study of gray whales in the breeding lagoons of Baja California Sur, Mexico.

9.2.2 Review of recent catch information
SC/66a/BRG07 reported that in 2014, 124 gray whales were struck in the Chukotkan hunt resulting in 122 gray whales (42 males and 80 females) landed, none of which were 'stinky' (inedible). Two females had foetuses and no females were lactating. Information on hunting techniques was also provided. Body lengths of the landed whales ranged from 8-14.5m (mean 10.1m as in 2013). Samples were collected from a total of 49 whales.

SC/66a/BRG14 summarised catch data for the Chukotkan hunt from 2012 to 2014, when in total about 400 gray whales were landed. Just under half of the whales were landed in the village of Lorino in Mechigmensky Zaliv and scientists examined 95 gray whales caught in that bay over the period; 70% were sub-adults. Of the 95 whales, 66% were females (mean length 10.2m); the mean length of males was 10m. About 90% of the landed whales had complete or half-full stomachs and all whales were in good body condition. In 2012-13 eight 'stinky' whales were landed in Chukotka. It appears that the number of such gray whales landed in the hunt is decreasing and hunters have stated that the number of 'stinky' whales, seals, seabirds and fishes is at least stable. Hunters have learned to identify stinky whales from a distance and avoid hunting them.

In 2013-14, 43 live gray whales were photo-identified in Mechigmensky Zaliv and a preliminary comparison to gray whale catalogues from Kamchatka and Sakhalin waters showed no matches. Photos were also collected of harvested gray whales but could not be compared with the catalogues due to technical reasons. More than one hundred genetic samples were collected from harvested gray whales. Efforts will be made to continue collecting genetic and other biological samples, particularly from stinky whales.

The Committee thanked the authors for providing information about the harvested gray whales. The Committee **encourages** the additional collection of suitable photographs of living and dead whales and **recommends** comparison with the available catalogues from both the western and eastern sides of the Pacific, in accordance with the recommendations from the two rangewide workshops. Similarly, as also recommended at the workshops, it **recommends** prompt analysis of the genetic data from the harvest for comparison with other areas of the North Pacific. It also **stresses** the importance of archiving samples in a recognised facility.

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. It also **agrees** that the proposed Makah whaling management plan remains the appropriate tool to provide

management advice for hunts in Washington State, USA provided that a research programme monitors the relative probability of harvesting a PCFG whale in the Makah usual and accustomed fishing grounds (IWC, 2014d, p.24). The Committee **advises** that based upon the *SLA,* the present block quota will not harm the stock.

9.3 Bering-Chukchi-Beaufort (BCB) Seas stock of bowhead whale
9.3.1 New information
SC/66a/BRG03 presented an update on the 2011 bowhead whale aerial abundance spring (19 April to 6 June) survey photo analysis. A total of 2,123 uniquely identified bowhead whales were photographed. A new population abundance estimate may be presented at the 2016 meeting.

The Committee noted that the comparison of photographs taken in 2011 to photographs taken during surveys in 1985 and 1986 will provide important estimates of survival and growth rates. The authors hope to complete the comparison to 1985 and 1986 prior to the next annual meeting.

George *et al. (2015)* examined correlations between the body condition of BCB bowhead whales and summer sea ice conditions and upwelling-favourable wind in the Beaufort Sea. A long-term dataset from the hunt was used to estimate various body condition indices (BCI's) for individual whales but relied mainly on a bowhead girth/length metric to compute BCI. The results indicate an overall increase in bowhead whale body condition and a positive correlation with summer sea ice loss over the last 2.5 decades in the Pacific Arctic. The authors speculate that sea ice loss has had positive effects on secondary trophic production within the BCB bowhead whale's summer feeding region.

The Committee thanked the authors for presenting this paper, noting the increasing concern regarding the impacts of climate change and the loss of sea ice on bowhead whales and other Arctic species (IWC/65/Rep07 Rev1).

SC/66/BRG09 presented a new density-dependent population dynamics model with parameterisation based on fecundity variables that can be independently, empirically estimated. Using a baseline version of this model, the authors fitted a population growth trajectory for BCB bowhead whales using the available time series of abundance estimates. The 1914 abundance was estimated at about 1,100 whales and the model fitted the 2011 survey estimate of 16,892 whales (95% CI 15,704-18,928) well. Estimates of survival rates imply realistic age expectancies, with 11% of calves expected to survive to age 100. Estimates of fecundity parameters imply strong reproduction and a possible calving interval as short as two years. The Committee thanked the authors for this new analysis on the population dynamics of BCB bowhead whales.

The Committee **encourages** ongoing work on the population dynamics of BCB bowhead whales, including the use of alternative population dynamics models, and the continuation of body condition and ecosystem relevant studies, as reported in George *et al. (2015).*

9.3.2 New catch information
Catch data for the aboriginal hunt for bowhead whales in Alaska were presented in SC/66a/BRG06. In 2014, 53 bowhead whales were struck resulting in 38 animals landed. The total number landed for the hunt in 2014 was similar to the average over the past 10 years (2004-2013: mean landed = 41.6; SD = 8.6). Efficiency (landed/struck) in 2014 was 72% which was similar to the average for the past 10 years (mean = 76.5%; SD = 7%). Of the landed whales, 18 were females, 19 were males, and sex was not determined for one animal. Based on total length, four of the 18 females were presumed mature (>13.4m in length) and at least one was pregnant.

SC/66a/BRG07 reported that the Russian Federation had no bowhead whale landings or struck and lost in 2014.

The Committee thanked the authors of both papers for providing this information.

9.3.3 Management advice
The Committee **reiterates** that the *Bowhead Whale SLA* continues to be the most appropriate way for the Committee to provide management advice for this population. The Commission adopted catch limits for a six-year block in 2012, i.e. 2013-18. The total number of whales landed shall not exceed 336 and the number of annual strikes shall not exceed 67; there is a carryover provision that allows for any unused portion of a strike quota from past years to be carried forward to future years provided that no more than 15 strikes be added for any one year. The Committee **advises** that based upon the *Bowhead* SLA, these limits will not harm the stock.

9.4 Common minke whales off West Greenland
9.4.1 New information (including catch data)
In the 2014 season, 144 common minke whales were landed in West Greenland and 2 were struck and lost. Of the landed whales, there were 115 females, 27 males and two were of unknown sex. Genetic samples were obtained from 118 of these animals in 2014, and the Committee is pleased to note that samples from the West Greenland hunt are included in ongoing genetic analyses of common minke whales in the North Atlantic. The Committee **encourages** the continued collection, archiving and analysis of samples.

31

9.4.2 Management advice
In 2009, the Committee was able to provide management advice for this stock for the first time (IWC, 2010b). This year, using the agreed interim approach and last year's revised estimate of abundance (16,100 CV=0.43), the Committee **advises** that an annual strike limit of 164 will not harm the stock.

9.5 Common minke whales off East Greenland
9.5.1 New information (including catch data)
In the 2014 season, 11 common minke whales were landed in East Greenland, and none were struck and lost. Of the landed whales, there were nine females, one male and one of unknown sex. The Committee is pleased to note that samples were collected from eight landed whales, and that samples from the East Greenland hunt are included in ongoing genetic analyses of common minke whales in the North Atlantic. The Committee **encourages** the continued collection, archiving and analysis of samples.

9.5.2 Management advice
Catches of minke whales off East Greenland are believed to come from the large Central stock of minke whales. The most recent strike limit of 12 represents a very small proportion of the Central stock (see Annex E, table 3) The Committee **advises** that the strike limit of 12 will not harm the stock.

9.6 Fin whales off West Greenland
9.6.1 New information (including catch data)
A total of 11 fin whales (five females and six males) were landed, and one was struck and lost, off West Greenland during 2014. The Committee is pleased to note that genetic samples were obtained from nine of these, and that the genetic samples of fin whales off West Greenland are being analysed together with the genetic samples from the hunt in Iceland. It **encourages** the continued collection, archiving and analyses of samples.

9.6.2 Management advice
Based on the agreed 2007 estimate of abundance for fin whales (4,500 95% CI 1,900-10,100), and using the agreed interim approach, the Committee **advises** that an annual strike limit of 19 whales will not harm the stock.

9.7 Humpback whales off West Greenland
9.7.1 New information (including catch data)
A total of six (two males and four females) humpback whales were landed, and one was struck and lost, in West Greenland during 2014. The Committee is pleased to learn that genetic samples were obtained from six of these whales and that Greenland is contributing fluke photographs to the North Atlantic catalogue, both from captured whales and other field studies. The Committee again **emphasises** the importance of collecting genetic samples and photographs of the flukes from these whales.

9.7.2 Management advice
Based on the *Humpback SLA* that was agreed by the Commission last year (IWC, 2015f), the Committee **agrees** that an annual strike limit of 10 whales will not harm the stock.

9.8 Humpback whales off St. Vincent and the Grenadines
9.8.1 New information (including catch data)
No humpback whales were landed in St Vincent and the Grenadines in 2014, but two whales were struck and lost. One male humpback whale, 35.8 feet long, was caught on 4 April 2015. Samples of skin and blubber were collected from this whale, and they will be analysed in collaboration with the USA.

The Committee **welcomes** this information from St Vincent and the Grenadines and **strongly encourages** continued tissue sampling and collection of fluke photographs where possible. Data should be shared with the appropriate databases and catalogues for the North Atlantic and archived.

9.8.2 Management advice
The Committee has agreed that the animals found off St Vincent and The Grenadines are part of the large West Indies breeding population (abundance estimate 11,570 95%CI 10,290-13,390). The Commission adopted a total block catch limit of 24 for the period 2013-18 for Bequians of St Vincent and The Grenadines. The Committee **advises** that this block catch limit will not harm the stock. The Committee **agrees** to add the question of the abundance estimate to be used to provide advice at its next meeting, noting the likelihood that a new abundance estimate may shortly be forthcoming.

10. WHALE STOCKS

10.1 Antarctic minke whales
10.1.1 Consideration of factors that may drive Antarctic minke whale distribution and abundance
No papers were received for this item this year. However, given the importance of the topic to the work of the Commission, the Committee **agrees** that this item shall remain on the agenda, with the expectation that updated research on aerial surveys for Antarctic minke whales will be presented next year.

10.1.2 Continue in-depth assessment
Last year, after many years, the in-depth assessment of Antarctic minke whales in the Indo-Pacific Antarctic region was completed. At that time it was suggested all of the components and results of the assessment that had been concluded over the years be brought together in one document. Intersessional discussions will continue to determine the best way to document all of this work.

Now that the in-depth assessment of Antarctic minke whales in the Indo-Pacific region has been completed, attention turned toward the South Atlantic and Antarctic Peninsula, and whether there are sufficient data to initiate an in-depth assessment for those Antarctic minke whales. The Committee collated a list of potential input data (Annex G, appendix 2) and **agrees**, in principle, that a statistical catch-at-age-type analysis could be undertaken, if given priority.

10.2 Southern Hemisphere humpback whales
The report of the IWC Scientific Committee on the assessment of Southern Hemisphere humpback whales is given in Annex H. The Committee currently recognises seven humpback whale breeding stocks (BS) in the Southern Hemisphere (Fig.3, IWC, 2011a), which are connected to feeding grounds in the Antarctic. Breeding stocks in Oceania (E2, E3, F1 and F2) have been collectively called 'BSO'. Assessments of Southern Hemisphere breeding stocks were completed in 2014 (IWC, 2015f) and a primary focus of this year's meeting was to synthesise the results (see Item 10.2.2).

A list of agreed Southern Hemisphere humpback abundance estimates is provided in Annex H, table 2. Apart from removal of the BSD estimate that is no longer considered valid (see IWC, 2015), this corresponds to the list provided in IWC (2014, appendix 6).
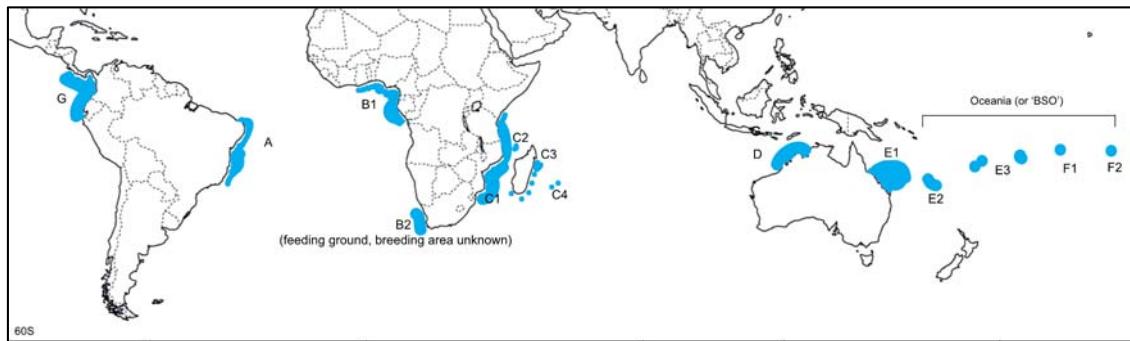
Fig. 3. Southern Hemisphere Breeding Stocks and Sub-stocks (see text)

10.2.1 Review new information
The Committee received a number of papers providing new information on Southern Hemisphere humpback whales. These are only briefly summarised here and details can be found in Annex H; the information will be particularly valuable when the Committee decides to undertake a further in-depth assessment to that completed last year and synthesised under Item 10.2.2.

BREEDING STOCK B
SC/66a/SH30 presented the results of a dedicated dual-vessel cetacean survey cruise targeting humpback whales off the western coast of South Africa (28 October to 8 November 2014). The cruise provided information on the distribution of humpback whales between Dassen Island (33°25'S, 18°5'E) and Groenriviermond (30°51'S, 17°34'E) and also placed satellite tags on eight adults. Over three months, the whales moved locally amongst upwelling areas of the southern Benguela Current system, before migrating southward towards Bouvet Island, from where they dispersed widely between 15°W and 35°E.

This study connects these humpback whales from the west South Africa feeding ground (BSB2) with high latitude feeding ground areas to the west and east, which have been associated with breeding grounds BSA and BSC respectively.

BREEDING STOCKS D/E/F
SC/66a/SH02 examined the distribution of humpback whales in Hervey Bay (Australia, BSE1) in relation to depth and distance from shore. Understanding humpback whale habitat preference and patterns of use of Hervey Bay is important for effective management of this critical habitat and tourism operations (including recent swim-with-whale trials).

33

The Committee welcomed SC/66a/SH01 that described a website 'Match My Whale' (MMW), incorporating South Pacific humpback whale photo-IDs. It uses 'crowdsourcing' to match flukes, that can assist scientists to manage catalogues, and facilitates comparisons across large photo-ID catalogues.

BREEDING STOCK G

A comparison between the Ecuadorian Humpback Whale Identification Catalogue (*n*=2131) and a catalogue of the Instituto Baleia Jubarte, Brazil for waters between 54°-59°S and 26°-38°W (n=23), resulted in one match between 56°16'S, 27°32'W and the Machalilla National Park in Ecuador (SC/66a/SH27). Whales from Ecuador (BSG) feed typically off the Antarctic Peninsula and this match to the feeding area associated with BSA constitutes the easternmost known feeding ground linkage for BSG, indicating some overlap between the feeding areas of these two stocks.

It is not yet clear whether such movements are common or extreme outliers, but the results underscore the great value of comparing photo-ID catalogues, even when areas not thought to be connected.

The Committee was pleased to receive information (SC/66a/SH13) on a large collaborative study that compared mtDNA for whales from the West Antarctic Peninsula (WAP, *n*=118) to Oceania (*n*=1,009), Colombia (BSG, *n*=95) and Brazil (BSA, *n*=103). The results suggested that the WAP is composed of 97.5% (CI 93-99%) whales from Colombia and 1.5%, CI 0.0-6.5% whales from French Polynesia/Samoa (Oceania). No temporal or geographic differentiation across the WAP was found. One match (microsatellite) was found connecting French Polynesia with the WAP. Results also suggested that group-feeding behaviours or associations were not based exclusively on maternal kin.

Connectivity between the feeding grounds associated with BSA and BSG were discussed. While significant genetic differentiation has been detected, the BSG connection with the waters around the islands found between 56°20'-59°30'S and 26°20'-28°10'W suggests the potential for eastward movement of BSG whales on their feeding grounds. Satellite telemetry conducted off the WAP suggests the potential for eastward movement at the end of the feeding season; the Committee **encourages** further telemetry work in the northern Antarctic Peninsula area to better investigate these movements. The Committee also **encourages** further collaboration among scientists working within the range of BSG to expand the geographic coverage of genetic samples used in this work, particularly to include genetic samples from Panama and the Magellan Straits as there is some photo-identification evidence for breeding and feeding ground sub-structuring among these regions (Acevedo *et al.*, 2007).

In view of the substantial Southern Hemisphere mtDNA datasets now collected, the Committee **encourages** the compilation of all available mtDNA data, to standardise nomenclature and provide a reference database (held at the IWC Secretariat) for future work.

SC/66a/SH16 reports on the most recent of a series of winter surveys conducted in the Gulf of Chiriquí in Western Panama (~8°N). Data suggest that since 2012, more whales are visiting the Gulf of Chiriquí. They also suggest that the Gulf of Chiriquí is an important nursery area for BSG, despite the unusually long migration. The photo-identification discovery curve suggests that the majority of this population has not yet been sampled.

The Committee noted that other photo-identification data have been collected off Panama (Guzman *et al.*, 2014; Rasmussen *et al.*, 2012) and **recommends** that these catalogues be compared. Additional comparisons with catalogues collected in Costa Rica, the Magellan Straits and the Antarctic Peninsula was also suggested in order to identify connections among regions within BSG.

FEEDING GROUNDS

SC/66a/SH20 summarised visual and acoustic data gathered during the 2015 Southern Ocean Research Programme survey on board the Argentinian vessel *Tango SB-15* in Antarctic and sub-Antarctic waters. Humpback whales were the most frequently seen species followed by fin whales. A number of odontocete species were detected acoustically.

Curtice *et al., (In press)* applied a novel method to test the hypothesis that humpback whale distribution around the Western Antarctic Peninsula reflects that of krill. The study involved five satellite tagged humpback whales. The study presents a baseline for future observations of the seasonal changes in the movement patterns and foraging behaviour of humpback whales in that marine ecosystem.

10.2.2 Review intersessional work

The assessment of the breeding stocks D, E and F was completed last year (IWC, 2015f). However, two elements remained outstanding: (1) obtaining a minimum bound on the abundance of BSD, as the present value is considered tentative (Annex H, item 3.2.1.2); and (2) resolving a disparity between the assessment high latitude catch allocations and the high latitude stock mixing proportions suggested by genetic data (Annex H, item 3.2.1.1). These analyses will be concluded intersessionally (see Item 10.2.3).

SC/66a/SH05 applied a three-stock modelling approach with mixing on feeding grounds to breeding stocks BSE1, BSO and BSG, using the same model framework as that used in 2014 for the BSD, BSE1 and BSO assessment. The intent was to investigate whether assessment outcomes for BSE1 and BSO were similar to those estimated during the 2014 assessment (IWC, 2015a). Appreciable differences were observed between the two models; pre-exploitation levels were higher for BSE1 and lower for BSO, with BSE1 estimates as less and BSO more recovered relative to pre-exploitation levels.

The model was considered biologically unlikely as it estimates that 65% of Oceania whales feed in Antarctic Area I (west Antarctic Peninsula), with only 35% feeding in Antarctic Areas V and VI directly to the south of their breeding grounds. The work highlighted the importance of integrating additional biological data to better inform catch allocations on the feeding grounds.

Table 9

Predicted abundance, recovery and population growth estimates for all Southern Hemisphere humpback populations projected to 2015, with 2015 recovery levels calculated relative to pre-exploitation abundance in 1900. Values rounded (precise values can be found in Annex H).

Breeding stock	Median K	Median N_{min}	Baseline year of estimate[2]	Projected abundance 2015	Recovery N2015/K	Reference
BSA	24,600 (22,800-31,100)	500 (200-4,000)	2005[4]	11,700 (6,600-16,900)	0.47 (0.22-0.73)	IWC (2007a)
BSB1	18,300 (13,400-36,500)	1,500 (400-6,400)	2006[5]	13,000 (9,700-15,100)	0.74 (0.29-0.97)	IWC (2012a)
BSB2	4,400 (200-6,600)	70 (20-200)	2007[5]	500 (130-900)	0.13 (0.03-0.88)	IWC (2012a)
BSC1	8,400 (7,000-14,600)	700 (300-4,600)	2003[4]	8,000 (6,800-9,700)	0.97 (0.58-0.97)	IWC (2010a)
BSC3	8,900 (6,900-16,100)	1,900 (500-6,100)	2006[5]	8,000 (6,400-10,200)	0.96 (0.48-1.00)	IWC (2010a)
BSD	21,700 (19,000-29,400)	800 (500-4,000)	2008[3,4]	20,300 (18,400-25,000)	0.95 (0.80-0.99)	IWC (2015a)
BSE1	26,100 (21,600-29,000)	240 (200-300)	2010[4]	19,600 (17,600-21,500)	0.76 (0.69-0.84)	IWC (2015a
BSO	14,100 (10,200-19,600)	130 (100-250)	2004[5]	6,400 (5,500-7,600)	0.47 (0.29-0.66)	IWC (2015a)
BSG	11,600 (10,600-14,900)	700 (240-3,000)	2006[4]	9,700 (8,500-10,200)	0.93 (0.74-0.98)	IWC (2007a)
Total[1]	138,000 (111,900-198,000)			97,000 (78,000-117,500)	0.70	

[1]Note: Totals are the sums of medians and 95% probability intervals calculated for individual breeding stocks.
[2]Model projections are based on abundance estimates summarised in Annex H, table 2 'Updated list of accepted abundance estimates'
[3]Tentative minimum bound on 2008 abundance imposed, this assessment will be updated at the 2016 Annual Meeting.
[4]Abundance derived from sightings surveys
[5]Abundance derived from mark recapture data fitted into the population assessment model.

10.2.3 Synthesis of the Comprehensive Assessment of Southern Hemisphere humpback whales

The Committee's Comprehensive Assessment of humpback whales was concluded in 2014 (IWC, 2015f) and it was agreed that an intersessional correspondence group should work to synthesise the results of the assessment. SC/66a/SH03 summarises the results of the assessment, comments on the methodological developments that occurred and identifies a number of unresolved questions for future assessments. The assessments suggested that around 140,000 humpback whales were present in the Southern Hemisphere prior to modern whaling, and they reveal contrasting patterns of population recovery across the oceans. All models were re-run with the goal of providing projected abundance estimates for 2015 for comparison among all breeding stocks (Table 9, Fig. 4). Some of the model projections are based on estimates of abundance that are more than ten years old (Annex H, table 3).

SC/66a/SH09 summarised new information relevant to assessments for each breeding stock and sub-stock since the assessments were undertaken. Only BSG has sufficient new information (abundance and sub-structure) to enable a more in-depth assessment than previously attempted, as additional information has become available since the last assessment. SC/66a/SH09 has been updated to incorporate new information received at SC66a and is provided as Annex H, appendix 2.

A working group was established during the present meeting to discuss how to prioritise data gaps identified by the synthesis review and to identify modelling needs for future humpback whale assessments. The work was not completed and so an intersessional email group has been formed to develop a prioritisation process for agreement at the 2016 Annual Meeting. The Committee noted that no trend data are yet available from BSB, BSC3, Oceania and BSG, a key component for population assessment. Furthermore, the abundance indices for BSA in the breeding grounds span a short period and are relatively uninformative. During the assessments, the posterior distributions on growth rate for these stocks were not substantially updated from the uniform priors (Annex H, fig. 2); since data collection for trend requires long-term surveys, the Committee **recommends** that such work towards estimating trends for these stocks continues in order to inform future humpback whale assessments.

The Committee also recognised that future assessments will probably be conducted with multi-stock models, which require understanding of regional population structuring to inform catch allocation. It therefore **recommends:**

(1) additional sampling (e.g. of genetic data) to improve understanding of Southern Hemisphere population connectivity, across breeding grounds and between breeding and feeding grounds; and
(2) further development of mixed stock assignment approaches to identify breeding-feeding ground connections for allocating high latitude catches.
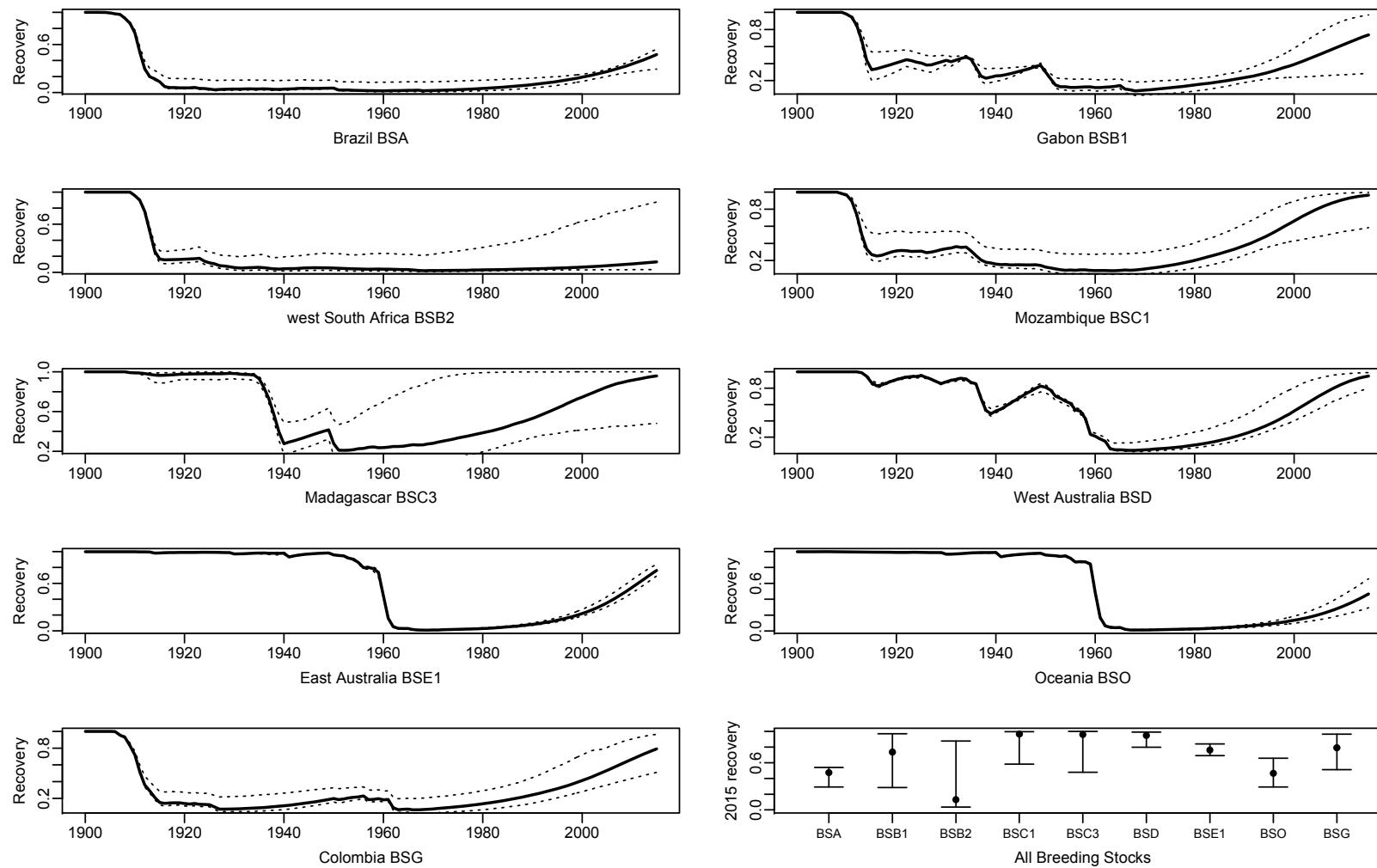
Fig. 4. A-C Southern Hemisphere humpback whale recovery levels (relative to 1900 abundance) plotted by Breeding Stock and year from 1900 to 2015.

10.2.4 Antarctic Humpback Whale Catalogue
SC/66a/SH14 presented the interim report on the IWC supported Antarctic Humpback Whale Catalogue (AHWC). During the contract period, the AHWC catalogued 668 photo-ID images representing 541 individuals submitted by 27 individuals and research organisations. Matches made include re-sightings between BSG and the WAP (*n*=3). Within-region re-sightings were identified in BSC3 (*n*=4), BSG (*n*=22) and the WAP (*n*=7). The database now contains records of 343 individuals re-sighted over multiple years (maximum span 28 years), with 78 sighted in three or more different years. There were 174 individuals identified in multiple regions. The total numbers of whales photo-identified by fluke, right dorsal fin/flank and left dorsal fin/flank are now 6460, 414 and 409 respectively.

The Committee has supported the valuable work of the AHWC in the past and **strongly endorses** its continuation.

10.2.5 Future work
SC/66a/SH04 used the model developed for the assessment of BSD, BSE1 and BSO to simulate future data which might be collected for these stocks and ascertain which data types have the best potential to improve estimates of precision for key quantities associated with the population dynamics. Additional mark recapture data for BSO, and an absolute abundance estimate for BSD, showed good potential for improving precision in parameter estimates. The three-stock model was also used to generate ranges of future observations that are likely to be observed, given the model assumptions, so that in future these can be compared against field data to test the biological plausibility of the present model.

The Committee **recommends** investigation of the feasibility of using sightings data collected by duFresne *et al.,* (2014) to obtain a new abundance estimate for BSD (Annex H, item 3.1.3.2).

Carroll *et al. (In press)* used mark-recapture simulations to investigate the power of future survey designs to estimate abundance and trend in Oceania. Part of this study has been discussed previously (IWC, 2014a). This work proposes a future survey design that should be able to: (1) estimate population size with a CV of <20%; (2) reject a population growth rate of zero, if the true growth rate is over 5%; and (3) reject a population growth rate of 11%, if the true growth rate is less than 5% (this is the mean growth rate estimated for East Australia). Region specific simulations also suggest scope to test for differences in population growth between principal breeding sites within Oceania.

10.2.6 Work plan
The work plan for Southern Hemisphere humpback whales based upon the recommendations above is summarised in Table 10. Budgetary implications are discussed under Item 26.

Table 10

Work plan on Southern Hemisphere humpback whales.

Item	Intersessional period	SC66b
BSD/BSE1/BSO	Continue work to improve mixing proportions in Antarctic	Review results
BSD abundances	(1) Develop minimum abundance estimate	Review results /progress
	(2) Re-analyse sightings data reported by duFresne *et al.,* (2014) to determine future survey method	
BSG	Examine sub-structuring by reconciling existing Central American catalogues especially those for Panama	Review progress
Catalogue	Continued support for Antarctic catalogue and matching	Receive results
Genetics	Form single database for all mtDNA haplotypes from IDCR/SOWER and breeding grounds	Review results/progress
Future priorities	Examine existing models and data and identify priority work for future assessments	Develop long-term plan

10.3 Southern Hemisphere Blue Whales
10.3.1 Review new information
10.3.1.1 SOUTHERN HEMISPHERE POPULATION STRUCTURE
Information was provided on a new collaborative initiative to match the biological data from the hundreds of baleen plates collected from Antarctic blue whales during the 1946/47 Japanese Antarctic season (now held in the Smithsonian Institution, Washington DC, USA) with the original Japanese whaling records. A pilot DNA sequencing project from these plates is planned by Southwest Fisheries Science Center, USA. More details are given in Annex H, appendix 4.

The Committee **welcomes** this study, which will provide valuable information on genetic diversity and blue whale population structure from a time-period when the population was still around 50,000 animals. It **strongly encourages** continued collaboration between Japan and the USA.

10.3.1.1.1 GENETIC STUDIES
SC/66a/SH19 and SC/66a/SH06 describe the population identity, population structure and habitat use of blue whales feeding in the South Taranaki Bight, on the New Zealand west coast. Genetic comparisons reveal no differentiation from southwest Australia and significant differentiation from Chile and the Southern Ocean. Blue whale foraging sites are often related to oceanographic features; for example South Taranaki blue whales are associated with an upwelling point. Recent marine mammal observer data from seismic

surveys off New Zealand may be informative about other such hotspots. The Committee **agrees** that these sightings should be examined in that context and encourages this work.

The Committee noted that while genetic differences were not detected between pygmy-type blue whales sampled in New Zealand and those considered to represent the Indonesian/Australian stock (SC/66a/SH19), acoustic studies have recorded distinct call types from blue whales in New Zealand waters and those off western Australia. Blue whale call types, which are highly stereotypical and have been shown to remain stable over decades, have been used as a proxy for population structure. These results raise the question of what type of data (acoustic or genetic) are most appropriate to delineate stocks of pygmy blue whales prior to assessment. An intersessional group was formed to further assess this question (see Item 10.3.2).

Attard *et al.,* (2015) describe low genetic diversity in southwest Australian pygmy blue whales and use a combined genetic dataset from Australia, Chile and the Antarctic to investigate the population origin of Australian blue whales. They suggest that low genetic diversity is due to a founder event from Antarctic blue whales which occurred after the Last Glacial Maximum.

This work contributes to a growing genetic dataset for blue whales which is being developed by multiple research groups. The Committee therefore **recommends** the establishment of a common nomenclature for pygmy blue whale mtDNA haplotypes. As IDCR/SOWER blue whale samples have been loaned from the IWC's archive at the Southwest Fisheries Science Center to multiple researchers, it is possible that replicate sequence submissions from the same individual have been submitted to Genbank; if present, such duplicates must be identified.

10.3.1.1.2 SOUTHERN HEMISPHERE BLUE WHALE CATALOGUE (SHBWC)
The Southern Hemisphere blue whale catalogue was formed in 2008 and contains the Antarctic blue whale catalogue, as well as multiple regional catalogues for pygmy blue whales.

SC/66a/SH28 summarises progress on catalogue matching made by the SHBWC intersessionally. This catalogue currently totals 1,101 Antarctic and pygmy blue whales. Australian catalogues have been uploaded. New catalogues from South Africa, New Zealand and Sri Lanka are expected to be submitted within the next year. Results from comparisons are provided in Annex H, appendix 5. No re-sightings between regions have been detected. SC/66a/SH25 provides a compilation of suggestions to address problems that have arisen in relation to the development of the SHBWC.

The Committee **welcomes** this information and recommends the continuance of the SHBWC. The catalogue is an important data source for capture-recapture analysis for the upcoming assessment, but accurate sightings histories associated within each ID are needed. In order to enable this, a working group has been established to discuss this with regional catalogue holders, beginning with the central eastern and south eastern Pacific catalogue holders as a priority. The Committee also **recommends** a change in the terms of reference for SHBWC submitters, in order that date and location data are provided with future photo-ID uploads, to facilitate the upcoming assessment. An intersessional group was established to address technical issues related to the SHBWC (Annex H, item 7.2).

10.3.1.2 ANTARCTIC BLUE WHALES
The last Antarctic blue whale abundance estimate was produced for 1997, the mid-point of the IDCR/SOWER circumpolar CPIII abundance surveys (Branch, 2007). Following CPIII, some additional surveys were conducted south of Africa and in the Indian Ocean. The Committee **recommends** a systematic review of the available photo-ID and line transect sighting data collected during IDCR/SOWER surveys since CPIII, and photo-ID data collected during recent IWC-SORP Antarctic Blue Whale Project voyages; an intersessional working group has been formed to conduct this review.

SC/66a/SH07 reported sightings from a cruise organised by the SORP Antarctic blue whale project and SC/66a/SH15 describes the open-source PAMGuard acoustic technology used to analyse DiFAR sonobuoy data. SC/66a/SH26 presents a comparison of the photo-identifications from this cruise with the Antarctic blue whale catalogue. The New Zealand-Australia Antarctic Ecosystems Voyage was a 42-day research expedition to the Ross Sea area. During the voyage there were two detection phases (8-14 February and 24 February-2 March) where the ship was guided to whales by triangulations from the sonobuoys. Once located, sightings (*n*=81), photo-ID (*n*=46) and biopsies were obtained. The whales were strongly aggregated in a region centred on 69°S, 178°W, including two ice-edge hotspots. A match was made to a sighting two years previously in the Ross Sea in the Antarctic Blue Whale Catalogue (ABWC), a regional catalogue of the SHBWC.

The Committee **recognises** the importance of the DiFAR technology for finding whales and noted that this voyage has increased the size of the ABWC by 25%. It **recommends** that future surveys are supported by national governments. A proof of concept survey for estimating blue whale abundance from Area III using mark-recapture is upcoming (Olsen and Kinzey, In press).

SC/66a/SH11 and SC/66a/SH12 reported results of sighting surveys following distance sampling methodology conducted from *R/V Polarstern* between December 2014 and February 2015. The survey used shipboard and on-board helicopters as survey platforms along the 0° meridian on a return track from Cape Town to *Neumayer Station III*. Minke, fin, humpback and blue whales were seen. An area of high blue whale density was found between 8°W and the Greenwich meridian.

SC/66a/SH18 deployed a passive acoustic recorder to document cetacean presence off Elephant Island, Antarctica, from March to July 2014. Fin whale acoustic activity persisted at very high levels although decreasing in early June. If blue whale signals were also present, these were masked by fin whale activity and only detectable from mid-June. Three different beaked whale frequency

38

modulated pulse types were classifiable. There was no sea ice cover throughout the recording period, and the sea ice edge was still ~100km away in July. Further acoustic recording will be conducted in 2015/16.

10.3.1.3 PYGMY-TYPE BLUE WHALES
SC/66a/SH21 reviewed available information on pygmy-type blue whales in the Southern Hemisphere in preparation for a preliminary assessment. Call types were used as a proxy for identifying populations, and (unless otherwise noted) catch records were derived from the IWC database. The objectives are to; (1) provide an updated catch series split by sub-species and call type/area; (2) collate positional data from sightings, catch, acoustic sources and satellite tags; and (3) identify important feeding areas for pygmy-type blue whales in the Southern Hemisphere. Positional information on blue whale distribution from acoustic recordings is shown in Annex H, fig. 2.

The Committee noted that further information on how available acoustics and genetics relate to pygmy blue whale stock structure will be important for delineating stocks for pre-assessment. A joint SD/SH session will be held at next year's meeting to assess pygmy blue whale stock structure. Stock delineations by call type can provide a useful starting point for considering stocks to assess.

Two key elements that will be considered next year are whether sufficient regional data are available to proceed to assessments, and an examination of the level of threats faced by each stock. It appears that most data are available for the Chile/Peru and Indonesian/Australian regions. Whilst few data are available for the Northern Indian Ocean, this is considered an urgent priority for further information gathering, as Soviet whaling took almost 1,300 whales. Therefore the Committee **agrees** to begin compiling data for Chile/Peru and Indonesia/Australia assessments at the 2016 Annual Meeting and **encourages** collection of pre-assessment related data from the Northern Indian Ocean (particularly photo-ID data and genetic samples).

10.3.1.3.1 CHILEAN BLUE WHALES
SC/66a/SH10 provided mark-recapture abundance estimates from photo-identifications collected off Isla de Chiloé (~42°S, 2004-11), and Isla Chañaral (~26°S, 2012), southern Chile. Estimates for Isla Chiloé were 711 (95% CI 574-848) and 549 (95% CI 442-656) for left and right sides respectively. Substantial fluctuation in abundance between years was found, peaking in 2009. The data suggest strong inter-annual fidelity to this feeding ground. When 2012 photo-ID data from Isla Chañaral are included, higher estimates of 1,353 (SE=453) and 1,040 (SE=283) are obtained from left and right sides respectively. These latter estimates may be more representative of blue whales feeding more broadly along the Chilean coast.

Noting the relevance of this abundance and trend information for the upcoming blue whale assessment, the Committee **recommends** the continuation of this work and also advises the collection of genetic material alongside photo-identifications, if resources allow.

Torres-Florez *et al.,* (In press) reports the first direct evidence of a migratory link between the south-eastern Pacific blue whale feeding ground and the Galapagos Islands. A female photo-identified west of the Galapagos Islands in 1998 (in November) was re-sighted in Corcovado Gulf, southern Chile in 2006 and 2008 (in February). This migratory connection is supported by other lines of evidence, including acoustics and genetics.

The Committee noted that there is a photo-ID re-sighting linking the Galapagos Islands to the Costa Rica Dome, an area which is strongly connected to the eastern North Pacific stock feeding off California with ~26% of photo-identified Californian whales re-sighted there. In view of this possible inter-hemisphere connection, the Committee **strongly encourages** continued photo-ID matching between catalogues from the Costa Rica Dome and Galapagos with those held in the southeastern Pacific.

10.3.2 Work plan
The work plan for blue whales based upon the recommendations above is summarised in Table 11. Budgetary implications are discussed under Item 26.

Table 11

Work plan on blue whales.

Item	Intersessional period/groups	SC66b
Antarctic blue whale assessment		
Catalogue and photo-ID	Continued support for the Antarctic blue whale catalogue and matching	Evaluate the results and develop future strategy with respect to assessment
Abundance and trends	Review all photo-ID data and post-CPIII IWC-SOWER data for possible updated analyses of abundance and trends	
Genetics	Match baleen plate collection numbers with biological data for the 1946/47 catch	
Pygmy blue whale assessment:		
Catalogue and photo-identification	Continued support and work on Southern Hemisphere blue whale catalogue, including: updated ToR and addressing technical issues; comparison with eastern North Pacific catalogues; engagement of regional catalogue holders from Chile and Peru in the assessment process; search for pygmy blue whale photo-IDs collected by researchers in the 1980s off Sri Lanka. This work will be undertaken by intersessional groups.	Review progress and develop future work plan strategy with respect to assessment – this applies to all of the items below as well.
Genetics	Establish common nomenclature for mtDNA haplotypes and identify where duplicate sequences have been obtained from the same individual and published on Genbank	Joint session between the SD, DNA and SH sub-groups next year
Acoustics	Establish number of blue whale call types and their distribution in the Southern Hemisphere and Northern Indian Ocean	
Modelling	Investigate utility of Chilean abundance data for habitat modelling; Investigate relationship between sightings and upwellings off New Zealand and consider use of seismic survey marine mammal observer data	Review progress

39

| New data | Collect genetic samples from Sri Lanka | Review progress |

10.4 Eastern North Pacific blue whales

The Committee last conducted an assessment of North Pacific blue whales in 1972 (IWC, 1973). This year, the Committee reviewed a recent assessment of eastern North Pacific (ENP) blue whales (Monnahan *et al.*, 2015) that involved allocating historical catches by population using extant calling patterns across the North Pacific (Monnahan *et al.*, 2014b) and a population dynamics model that estimated trends in abundance and status. In addition, the Committee reviewed additional information that potentially could be used in an updated assessment or inform the current assessment.

In general, the ENP blue whales range from the Gulf of Alaska to the Costa Rica Dome off Mexico and Central America. They feed off California from May to November and migrate to waters off Mexico and Central America in winter and spring.

10.4.1 Stock structure

Whilst the IWC has formally considered only a single population of blue whales in the North Pacific (Donovan, 1991), there is evidence for at least two populations, an eastern (ENP) and western (WNP) populations (Reeves *et al.*, 1998). SC/66a/SD5 provided an update on the progress of genetic analyses that are underway to evaluate the population structure and taxonomy of blue whales globally. A further update on these analyses will be provided next year.

10.4.2 Distribution and abundance

There are numerous research groups working on a variety of methods that seek to characterise large whale movement and distribution and population-level information along the US west coast, and a US West Coast large whale distribution and occurrence workshop was convened in September 2014 (DeAngelis, 2015). This topic was discussed further in the ecosystem monitoring (EM) group (Annex K1, item X).

Irvine *et al.* (2014) described a study of satellite-monitored radio tags which were attached to 171 blue whales in the ENP from 1993 to 2008. While the whales in this study generally occupied a wide region, most of the areas of highest concentration were close to large human population centres and busy port terminals. Several animals moved as far north as the Gulf of Alaska and as far west as almost Hawaii.

Recent trends in ENP abundance estimates (Calambokidis and Barlow, 2004; Calambokidis *et al.*, 2009; 2007), have been flat or only slightly increasing at 2.0% per year, with a 90% probability of increase (Monnahan *et al.*, 2015). This is despite cessation of whaling over four decades ago. These authors hypothesised the following possible explanations: (1) the population is now approaching K (carrying capacity); (2) ship strikes are a key risk; or (3) there is immigration/emigration.

A total of 17 schools (17 individual) blue whale sightings have been made during various IWC-POWER cruises, between 2010 and 2014 (see Annex G, appendix 5; SC/66a/Rep01) and the Committee **welcomes** the fact that the resultant catalogue has been compared with the Cascadia collection. No matches were found, although it was noted that the IWC-POWER photographs came from more central North Pacific locations than might be expected for animals distributed in inshore eastern North Pacific areas. Photographs of blue whales from IWC-POWER cruises are available to be shared following the agreed protocols[4].

10.4.3 Historical catches

Monnahan *et al.* (2014b) allocated past historical catches to the eastern population based on information on different song call types associated with the two populations, and acoustic data from hydrophones. A key assumption was that present day geographic separation of the two populations could be applied to split the historical catches. The authors estimated that ENP blue whale catches totalled over 3,400 (95% range 2,593 to 4,114) from 1905–71, representing 35% (95% range 27% to 42%) of total North Pacific catches. The uncertainty in the acoustic data (from bootstrapping) was the largest source of uncertainty. SC/66a/IA1 provided details of 17 previously unreported catches of blue whales by the USSR in 1972. These catches bring the total Soviet catch of North Pacific blue whales since 1948 to 1,638. It is thought to be unlikely that additional unknown Soviet catches of blue whales occurred.

10.4.4 Life history parameters

SC/66a/IA17 presented data on progesterone concentrations to estimate a crude pregnancy rate of blue whale non-calf females of 0.28. Based on a preliminary analysis of age structure, the resulting pregnancy rate for mature females is consistent with a reproductive interval of between 2–3 years. The primary author noted that she was interested in working with collaborators who have additional tissue samples (around 125ml of blubber is required).

The Committee noted that pregnancy rate estimates as low as 0.28 would greatly constrain the range of possible rates of increase; caution is needed when interpreting such information in the absence of population trajectories.

---

[4] https://iwc.int/index.php?cID=64&cType=Document

10.4.5 Assessment
Taking the inferred historical catches for the ENP described above, Monnahan *et al.* (2015) developed a population dynamics model using mark-recapture estimates from Calambokidis and Barlow (2004) and Calambokidis *et al.* (Calambokidis *et al.*, 2009; 2007) to provide a first assessment of the eastern population and to test the hypothesis that ship strikes may be preventing its recovery. The framework consists of three distinct models: (1) vessel movement and density; (2) ship strikes; and (3) population dynamics. Under the base case scenario it was estimated that the population did not drop below 460 individuals, is at 97% of carrying capacity (95% interval 62%–99%), and the population in 2013 was around 2,140 (95% interval 1,774-2,584). The authors suggest density dependence, not ship strikes, is the key reason for the observed lack of increase, and that ship strikes are not likely to significantly threaten the population in the future. These conclusions were qualitatively the same regardless of the prior used for annual rate of increase (*r*), the total catches, the observed number of ship strikes in 2013, future mitigation scenarios for ship strikes, and the assumed value of the parameter which controls density dependence.

In discussion, four key sources of uncertainty were identified: (1) reporting rates for ship strikes; (2) underreporting of historical catches; (3) geographic shifts in population boundaries over time (indicated by acoustics data); and (4) alternative assumptions that involve *K* changing over time. Ship strike related issues were discussed in more detail in Annex J, item X. These were considered in Monnahan *et al.* (2015). SC/66a/IA15 and during the meeting (Annex G, Appendix 6) and sensitivity tests were undertaken. In no cases did the results affect the broad overall conclusions of the original assessment. The smallest probability that the population had not recovered (i.e. relative abundance greater than 0.6) was 0.963 for when 25% of the catches were missing, as compared to 0.981 for the base case. The addition of the 1979 and 1991 density estimates provided valuable information about historical trends if the model start value is 1960 but they had a negligible impact under the baseline case described above,

Assuming that ship strikes do not have a significant impact, the Committee discussed other potential drivers for the observed flattening of the rate of increase in the ENP blue whales. With respect to possible changes in distribution over time for the two populations, the limited available information support the idea that both ENP and WNP populations have occurred in the Gulf of Alaska from the 1950s to present day, as assumed in Monnahan *et al.* (2014b).

The Committee noted that the photo-ID catalogues upon which the ENP mark-recapture abundance estimates are based are sampled mostly from the Californian coast. Abundance estimates will be biased if missing some proportion of the population, if the population is shifting over some time scale, or if they are more susceptible to process error than originally thought. These possibilities are discussed in Annex G, item 5.5.

As the usual summer feeding circumstances may to be changing due to longer-term trends in environmental characteristics, the Committee **encourages** research focussing on the movements of blue whales (surveys, satellite tagging and behavioural studies) in response to environmental variables. Tagging blue whales on the Costa Rica Dome would help discover other places where whales using that area during the winter breeding season may be going to feed in the northern summer.

10.4.6 Conclusions and work plan
The Committee **commends** the authors of Monnahan and colleagues for their extensive work. It **endorses** the conclusions of Monnahan *et al.* (2015) that the population of eastern North Pacific blue whales is now near carrying capacity, *K*, and has 'recovered' as defined by the authors (the population is above 60% of carrying capacity). Although there is evidence of a flattening of the rate of change of the population size, this is probably because the population is at or near *K* rather than due to mortalities from ship strikes.

However, the Committee also **recognises** the uncertainties in these analyses that could not be reduced given the available data. Four key sources of uncertainty identified by the Committee are: (1) rates for ship strikes (i.e. the risk extends into the high seas); (2) underreporting of historical catches (current information indicates this source is negligible); (3) geographic shifts in population boundaries over time (indicated by acoustics data); and (4) alternative assumptions that involve *K* changing over time (related to decadal-scale shifts in productivity influenced by processes like the Pacific Decadal Oscillation). The Committee looks forward to future refinement of the assessment when additional data become available, particularly related to reductions in the uncertainty of their abundance, definitions of the eastern North Pacific blue whales perhaps being a distinct stock, and the impact of ship strikes on their population.

The Committee **recommends** future mark-recapture survey work across a broader geographical region than that already covered and for cross-matching of all available North Pacific catalogues. Finally, the Committee **proposes** that a broader assessment of blue whales in the North Pacific be undertaken.

10.5 Distribution of baleen and toothed whales in the Antarctic relative to spatial and environmental covariates
No papers were received for this item for the SC66a meeting. A paper relating the distribution of baleen whales during CPII and CPIII of IWC IDCR/SOWER, with spatial and environmental covariates, is currently being prepared for the IWC IDCR/SOWER Special Volume (see Annex G, item 7.1), and the Committee looks forward to reviewing this study during SC66b.

10.6 North Pacific sei whale
The Committee has started an in-depth assessment of North Pacific sei whales. This year the datasets were identified and the initial assumptions that will be used in the assessment were decided upon. During the intersessional period, these data will be used in initial conditioning trials with the results being considered at the 2016 Annual Meeting.

10.6.1 Abundance and distribution
SC/66a/IA12 presented estimates of abundance for sei whales derived from sighting data obtained during the 2010-12 POWER cruises. Data from the 2013 and 2014 cruises, which covered areas south of those covered in 2010-12 and generally south of the expected sei whale distribution at that time of the year, were not used because they resulted in only one sei whale sighting. The best estimate was an Akaike-weighted average of 29,632 (CV=0.242; 95% CI 18,576 – 47,267).

In discussion, after considering alternative model averages, the Committee **endorses** the Akaike-weighted average abundance estimate for use in the in-depth assessment.

SC/66a/IA14 presented an analysis of results of *Discovery* marking conducted in the 1970s and earlier. A total of 111 sei whales were marked during or after 1972. Estimates of historical abundance (1972-75) were presented based on marks placed during 1972-75.

The Committee **agrees** that these data are potentially informative about abundance and migration, particularly in view of the substantial differences in recapture rates between marks placed in different areas and the mark recapture data should be incorporated in full into the conditioning of stock assessment models.

A full list of abundance data to be considered for the assessment is given in Annex G Appendix 3.

For the assessment, the disaggregated data of both marks placed and marks recaptures are required. The Committee **recommends** that the Secretariat enter these data (about 5,000 records for all species) as a matter of priority. Allison, Mizroch and Ivashchenko offered to try to locate records from the smaller US, Canadian and Soviet marking programmes.

10.6.2 Catch history
Allison reported on progress with the compilation of the North Pacific sei whale catch history. The Japanese coastal catch data in the IWC summary catch database has been updated to separate sei and Bryde's whales as agreed for the catch series developed for the western North Pacific Bryde's whale. Catches of sei whales by the Japanese pelagic fleets are presumed to be correct as reported. The Committee **recommends** that the individual data in the IWC catch database be amended in due course to incorporate new individual data which differentiates sei and Bryde's whales in the 1955-62 period, but that in view of other data entry priorities, it does not regard this task as a prerequisite for the present assessment

Allison received from Ivashchenko corrected Soviet catch data, which in the case of sei whales involved some net reduction in numbers relative to the official figures submitted to BIWS at the time. The Committee **recommends** that the revised data for all species be entered into the IWC Catch Database as a matter of priority and that the false data originally submitted to BIWS for these expeditions be removed.

10.6.3 Stock structure
Papers relating to stock structure (SC/66a/IA 3, SC/66a/IA4, SC/66a/IA8, SC/66a/IAIA9, and SC/66a/IA14) were discussed primarily in the Working Group on Stock Definition and are summarised in Annex I, item 11. SC/66a/IA9 proposed one sei whale stock whilst SC/66a/IA14 proposed five sei whale stocks. The Committee **agrees** that discriminating between these two hypotheses is difficult in the absence of genetic data from the potentially extirpated stocks, and thus both hypotheses are plausible. The importance of obtaining samples from additional areas of the North Pacific in addressing this issue was stressed. The Committee noted that all data collected under JARPN II during 2002-13 will be collated for the JARPN II final review to be conducted in March 2016.

The Committee thus **agrees** to proceed with two initial alternative stock structure hypotheses (Annex G, appendix 4): (1) a single stock in the entire North Pacific, as proposed in SC/66a/IA8 and SC/66a/IA9; and (2) a five-stock hypothesis proposed in SC/66a/IA14, with modifications: Japan coastal; North Pacific pelagic; Aleutian Islands and Gulf of Alaska; eastern North Pacific migratory; Southern North American coastal stock (coastal California).

Stock boundaries for these will be developed following initial exploratory conditioning of the hypotheses using the available data during development of the stock assessment model. The Committee **recommends** that the assessment model accommodates the shifts in distribution probably due to habitat shifts that are reflected in the data.

10.6.4 Stock assessment model formulation
The model will be similar to those used by the Committee to evaluate RMP variants (e.g. for fin and minke whales in the North Atlantic). Detailed specifications for a population dynamics model of North Pacific sei whales have yet to be developed, but the structure of the model will be tailored to the available data, including tagging and recovery data, and catches and sightings. The catches and sightings should be compiled by year, month and 5° square, but the final choice of spatial and temporal resolution of

the model will be based on initial exploration of the data. The model will be age-structured, with spatially and temporally structuring to the extent necessary to utilize the available data and to represent the two stock structure hypotheses described above. Choices of stock boundaries and possible mixing areas will be made following initial exploration of the data.

The Committee **recommends** that Punt be contracted to develop the model, and that an intersessional steering group consisting of Allison, Cooke (convenor), Punt, Mizroch, Pastene and Kishiro be appointed to:

(1) review the proposed model structure to be developed by Punt and advise on model choices including stock boundaries and ranges for input parameters; and

(2) collate the available data sources and develop a 'data document' which summarises the details of each data source to be used as input to the model.

10.6.5 Work plan
The work plan for North Pacific sei whales based upon the recommendations above is summarised in Table 12. Budgetary implications are discussed under Item 26.

Table 12

Work plan on North Pacific sei whales.

Item	Intersessional period/groups	SC66b
In-depth assessment	Entry of corrected Soviet catch data	Review results of
	Entry of Japanese Discovery mark data	intersessional work and
	Collation of available data sources	finalise assessment or develop
	Development of modelling framework	plan to complete it

10.7 North Pacific gray whales
10.7.1 Review report of intersessional workshop
The discussion of the rangewide workshop is given under item 9.2.1. That workshop incorporated information from all parts of the North Pacific, including some of the information provided below.

10.7.2 Review new information
SC/66a/BRG10 presents the results of hormone (progesterone) and stable isotope ($\delta^{13}C$ and $\delta^{15}N$) analyses using biopsies taken near Sakhalin Island in 2011, 2012 and 2013. Tissue samples from stranded eastern gray whales were used to optimise progesterone assays for determining reproductive fitness and pregnancy and the analysis of C and N stable isotopes to assess chemical feeding ecology. The females were probably not pregnant. Further work planned includes measuring progesterone levels in adult females of known reproductive status.

The paper also reported on isotopic ratios of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) from 10 Sakhalin biopsy samples (epidermis). The patterns of $\delta^{13}C$ and $\delta^{15}N$ (higher $\delta^{13}C$ with moderate to low $\delta^{15}N$) for the Sakhalin whales was substantially different from those from the east (higher $\delta^{15}N$ with moderate to low $\delta^{13}C$) values. The results suggested lower trophic level feeding for the Sakhalin animals. However, caution is needed in interpreting the results given that the Sakhalin samples were from free ranging animals, while those from the east came from carcasses of stranded animals.

The Committee welcomed this study, made a number of suggestions for improvements and **encourages** that, where quantity of sample allowed, the biopsy samples also be used for other analyses (e.g., contaminants, stress hormones, etc.).

The current migratory routes and wintering areas of gray whales in the western North Pacific are enigmatic. Historical evidence indicates that coastal waters off Japan were an important part of the migratory route but modern day observations of gray whales off Japan are uncommon. Fewer than 20 sightings or strandings of gray whales in Japanese waters have been documented between 1990 and 2015. SC/66a/BRG17 reported on gray whale sightings between March and May 2015 in two areas off the Pacific coast of Japan. Comparison of photographs and videos collected during these sightings with each other and with the 1994-2014 Russia-U.S. photo-identification catalogue from Sakhalin Island, Russia (Weller and Burdin, 2015) revealed that: (1) all of these sightings off Japan were of the same whale; and (2) this same whale had been first identified as a calf with its mother off Sakhalin Island in the summer of 2014.

The occurrence of gray whales off the Izu Islands has been previously reported (Darling, 1994). Similarly, there are a number of relatively recent records of gray whales from the Pacific coast of Honshu (Kato *et al.*, 2014). This includes a female yearling entrapped in a set net in January 2007 that was matched to earlier photographs of it as a calf (with its mother) while on the Sakhalin feeding ground in July and August 2006 (Weller *et al.*, 2008). This match from 2006 (Sakhalin) and 2007 (Japan) along with the new matches from 2015 provide evidence of a migratory link between the summer feeding ground off Sakhalin Island, suggesting an unknown wintering location which may be somewhere along the coast of Asia.

SC/66a/BRG18 reported a POP sighting off Teradomari, Niigata prefecture, Japan in addition to the gray whale sightings reported in SC/66a/BRG17. To avoid entanglement or ship strikes of those whales sighted, the Fisheries Agency of Japan requested the local governments to take preventative actions, which was acknowledged by the Committee. Japan received no reports of strandings or entanglements in the last year.

43

The Committee **welcomes** this new information about the sightings.

Mate *et al.* (2015) reported on the results from three satellite tagged gray whales at Sakhalin Island. They moved from Sakhalin across the Bering Sea and Gulf of Alaska at high speeds (~6.5km/h) into the traditional south-bound winter migration path of the gray whales that migrate along the west coast of the USA and Canada. One of the tagged whales was a 10-year old female that travelled down the West Coast of the United States to nearly the southern tip of Baja, Mexico, passing by all three major Baja breeding areas while off Baja for 42 days. She returned to Russia after 5.5 months, taking a different return route and traveling 22,500 km in the round-trip. The ability of these animals to navigate across open water over long distances is novel for gray whales, previously assumed to be coastal in their migration.

The Committee **welcomes** publication of this information that has been presented at earlier meetings and noted that this tagging programme was carried out under the auspices of the IWC and been a key factor in the decision to begin the rangewide review and to undertake the major comparison of photographic and genetic data from both sides of the Pacific (e,g, IWC, 2015f)

The Committee recognised the value of these tagging studies and **reiterates** the value of additional telemetry effort off Sakhalin and Kamchatka (e,g, IWC, 2014d), noting the discussion of this in SC/66a/Rep08.

A collaborative Russia-U.S. research programme on the gray whales summering off Sakhalin Island has been ongoing since 1995. SC/66a/BRG16 reviewed findings from 2014 research activities and combined these with data from previous years, in some cases ranging back to an opportunistic survey in 1994. Photo-identification research conducted off Sakhalin Island in 2014 resulted in the identification of 79 whales, including nine calves. Three previously unidentified non-calves were observed. When combined with data from 1994-2012, a catalogue of 235 photo-identified individuals has been compiled, although not all of these can be assumed to be alive today.

The Committee **welcomes** the information from the Russia-U.S. collaborative research programme. The Committee also noted that it had in the past appreciated receiving annual information about the other gray whale studies near Sakhalin that are conducted jointly by Exxon and Sakhalin Energy. The Committee **encourages** scientists from the Exxon and Sakhalin Energy programme to provide an update on their work at the 2016 annual meeting.

10.7.3 Conservation advice
As indicated last year (IWC, 2015f), oil and gas activities continue to increase near Sakhalin. The annual progress report (Annex F, appendix 2) from the Western Gray Whale Advisory Panel (WGWAP), which is convened by the International Union for Conservation of Nature (IUCN), summarised efforts made over the past year to develop plans to mitigate a large-scale seismic survey by Sakhalin Energy scheduled to begin in early July 2015. In addition to that survey, a much larger survey by Exxon Neftegas Ltd (ENL) is planned to begin in early June and other seismic work is expected continue off NE Sakhalin throughout the summer and until well into September 2015, with few (if any) periods when there is no seismic ensonification of some areas on or near the gray whale feeding areas. This situation is unprecedented in this area and gives cause for considerable concern. The Committee **concurs** with the advice of the WGWAP (Annex F, appendix 2).

In light of these developments, the Committee **stresses** the importance of agreeing a co-operative approach amongst companies, regulators and other stakeholders to consider cumulative and synergistic effects of activities on Sakhalin gray whales and the development of joint and consistent mitigation measures. It noted the guidelines for responsible seismic surveys (Nowacek *et al.*, 2013) endorsed by the Committee and Commission last year in this regard. It **recommends** that all operators become involved in studies and monitoring of Sakhalin gray whales and follow the best mitigation practices to ensure protection of these whales and their habitats off Sakhalin Island.

The Committee noted that new public information provided by the company has shown that ENL's pier and causeway construction project in Piltun Lagoon, discussed in some detail in last year's report (IWC, 2015f), will become particularly intensive in the open-water seasons of 2016 and 2017. The Committee **reiterates** its concern of last year about this project (IWC, 2015f, p.32) and its possible impacts, including cumulative ones, on Sakhalin gray whales and their prey. It again **urges** the authorities to take steps to protect the Piltun lagoon area.

The Committee again acknowledges and welcomes the important work of the IUCN WGWAP as reflected in the updated report provided to this meeting and **encourages** its continuation. It noted that the work of the WGWAP and the IWC Scientific Committee are important components of the Memorandum of Co-operation signed by three gray whale range states last year (Japan, Russian Federation, USA). It **welcomes** this memorandum and encourages the other range states to sign. The Committee also **recognises** the importance of updating the IUCN/IWC Conservation Management Plan for western gray whales in light of the new information discussed *inter alia* at the two rangewide workshops. This is discussed further under Work plan.

With respect to activities on the Sakhalin shelf, it is clear that that the companies have decided to proceed with major seismic surveys, on an unprecedented aggregate scale, in the vicinity of the Sakhalin gray whale feeding grounds in 2015. It appears likely that this will be followed by two successive seasons of major disturbance in and near Piltun Lagoon in connection with the ENL construction project.

The Committee appreciates the efforts made by Sakhalin Energy to respond to many of the WGWAP recommendations concerning mitigation of the potential impacts of its seismic survey on the whales and to ensure a credible monitoring and mitigation programme (MMP) is in place (Annex F, appendix X). It also **welcomes** Sakhalin Energy's decision to include accommodation of an independent observer. It also notes that ENL has stated that it will follow the 'IUCN guidelines'. However, the details of its MMP have not been made available or reviewed.

The Committee **welcomes** the adoption of these guidelines (the guidelines for responsible seismic practices included in (Nowacek *et al.*, 2013) that have also been endorsed by the IWC), **urges** their adoption by all companies and **recommends** that they have their MMPs reviewed by outside experts (e.g. the WGWAP or IWC Scientific Committee). However, the Committee retained strong concerns over the aggregate scale of disturbance this year (mainly by seismic surveys but this is also expected to be a relatively strong year for salmon runs, bringing potential associated risk of entanglement) and over the next two years (mainly by the ENL project). Therefore, the Committee **recommends** that greater effort be made by all concerned – companies and authorities – to ensure that industrial (and other) activities are coordinated, cumulative disturbance is minimised and credible mitigation and monitoring programmes are in place. The Committee also **urges** a collaborative analysis of the scientific results of the monitoring programmes of the two companies being undertaken in 2015, including input from the WGWAP and other experts outside the companies themselves.

10.7.4 Work plan
The work plan for North Pacific gray whales based upon the recommendations above and in Annex F is summarised in Table 13. Budgetary implications are discussed under Item 26.

Table 13

Work plan on North Pacific gray whales.

Item	Intersessional period/groups	SC66b
Rangewide assessment:		
(1) Preparations for workshop	Updated data on abundance incl. variance co-variance matrices	Review results of intersessional work and finalise assessment or develop plan to complete it
	Additional photographic matching	
	Obtain fishing effort data to improve bycatch estimation	
	Update modelling framework	
(2) Workshop	Hold workshop in April 2016 taking in to account new information	
	Develop sensitivity testing to address uncertainty	
	Finalise modelling framework	
Management advice:		Review new information and provide advice
CMP:	Drafting group meeting to update scientific aspects of the plan	Review draft
	Begin work to prepare for a stakeholder workshop probably between 2016 and 2018 including development of a Steering Group including: Scientific Committee, Conservation Committee, IUCN, MoC coordinator and representatives of the range states to develop formal terms of reference, participants, timing and venue for a stakeholder workshop to update the IWC/IUCN CMP in light *inter alia* of the Memorandum of Co-operation.	Review progress

10.8 Southern Hemisphere right whales
10.8.1 Review of new information
SOUTH ATLANTIC
SC/66a/Rep9 reported on the workshop held at the Centro Nacional Patagónico (CENPAT) in Puerto Madryn from 5-6 August 2014. The goal of the workshop was to update the information available on the mortality of southern right whales around Península Valdés, Argentina. During discussions the five main hypotheses for the high calf mortality identified by the first IWC workshop were reviewed in the light of any new information. After discussion, the Workshop concluded that good progress has been made since the 2010 IWC workshop in a number of areas. The Workshop also supported the strong recommendations made by the IWC Scientific Committee that research and long-term monitoring of this stock should continue without interruption. The Workshop agreed to focus on three main issues:

(1) kelp gull and southern right whale interactions and effects on whale behaviour and health;

(2) density-dependent processes and effects on right whale population dynamics;

(3) a decline in food availability and effects on right whale body condition and health.

Whilst recognising the progress made, the report stressed that further commitment is required to develop long-term actions to ensure the effective conservation of southern right whales and their habitat, in accordance with the objectives of the IWC's Conservation Management Plan.

The Committee **endorses** the scientific and management recommendations in the Workshop report. It noted that while some priority actions have been taken, significant progress remains to be made on a number of key recommendations (SC/66a/Rep9, item 11). The Committee **encourages** that the priority actions listed in Item 11 be implemented as soon as possible, and that progress be reported at next year's meeting.

SC/66a/BRG5 described aerial surveys and some vessel surveys for southern right whales carried out from 1999 to 2014 in Peninsula Valdes. The population was estimated to have increased at a mean rate of 3.2% annually and the number of calves increased by 5.5%, although the mean annual rate of increase declined from 6.2% (1999-2007) to 3.2% (1999-2014). The estimated number of whales in the coastal area in 2014 was 1,556 and the number of calves born in 2014 was 466. Data of live and dead calves were examined for the period 1971-1973, 1981-1982 and 2003-2014; mortality rates are variable amongst years with maximum observed rates from 2007-2009.

SC/66a/BRG 23 presented photo-identification data collected during 1970-2012 on southern right whales in their winter calving grounds at Península Valdés, Argentina. These data were analysed using an updated version of the stage structured model that allows for birth intervals to depend on survival or mortality of the previous calf. A steep rise in observable calf mortality since 2000 is consistent with the trend in recorded strandings in the gulfs of Nuevo and San José during this period. No change in the annual population growth rate of 6.5 ±0.2 % had been detected, but it is important that recent data be processed and that the population continue to be monitored in the coming years.

In SC/66a/BRG1, a mathematical model of right-whale population dynamics was used to assess potential short- and longer-term effects of a sustained increase in calf deaths and the observed increase in the number of 2-year calving intervals such as that observed in Peninsula Valdes. If elevated rates of calf mortality continue for another decade or two, the population's growth is expected to slow substantially. In discussion, it was noted that food limitation may explain the apparently high stranding rates observed in this population. Nutritional data were presented in SC/66a/Rep9 that will be supplemented by ongoing analyses of blubber thickness of stranded calves which may show differences in the nutritional status of these whales.

SC/66a/BRG22 reports on the first attempt to deploy satellite tags on Southern right whales in the west South Atlantic. This study was motivated by recommendations of the Scientific Committee in regards to the need to assess migratory movements and feeding destinations in light of the hypotheses put forward to explain the high mortality observed for this species in Península Valdés, Argentina. Satellite transmitters were attached to seven individuals in their breeding grounds in Golfo Nuevo, PV in October 2014. Five fully implanted tags, deployed in two mothers and three juveniles, transmitted for a to-date average of 93 days (range: 23-212 days), with one tag still transmitting by the time this paper was completed. The Committee **looks forward** to a full report at next year's meeting.

In summary, the Committee **welcomes** the analyses provided in SC/66a/BRG1, BRG5, and BRG23 which elucidated demographic issues associated with recent observations of calf mortality, and SC/66a/BRG 22 which demonstrated movements of animals to putative feeding grounds. The Committee **recommends** this work continues with the aim of better understanding both the causes and consequences of the temporal variations in observed mortality.

While it is not yet clear whether gull attacks play a significant role in the observed mortalities (see SC/66a/Rep09), the Committee **reiterates** its concern over the extent of the gull attacks, which is clearly changing the behaviour of right whales in the area with likely energetic consequences. The Committee **recommends** that the priority actions outlined SC/66a/Rep9 be undertaken to the address the gull harassment problem.

SOUTHEAST PACIFIC
Information on an entangled animal in the Southeast Pacific is given under Item 7.1.2.

SOUTH AFRICA
SC/66a/BRG4 reported on the 2014 annual southern right whale survey flown coastwise by helicopter in early October between Nature's Valley and Muizenberg, South Africa following the same survey design as previous years. These long-term monitoring surveys were the inspiration of the late Peter Best. Totals of 461 cow and calf pairs of southern right whales (922 animals), 87 unaccompanied adult southern right whales, 18 humpback whales (four cow and calf pairs and 10 adult animals), one Bryde's whale and six groups of bottlenose dolphins and five groups of humpback dolphins were sighted during the survey. Drones will be employed to survey this region but only to expand the temporal rather than the spatial coverage of the survey. The methods of the long-term aerial survey will remain constant to ensure all years remain comparable.

AUSTRALIA
Bannister outlined the results of the 22nd annual survey for right whales flown off coastal southern Australia in late August 2014. The 2014 cow/calf count (232) was not as high as the record 2013 count of 246, or as those for 2011 (236) and 2009 (244, the highest count prior to 2013). The exponential 'cow/calf pair' rate of increase for 1993-2014 was 0.0704 (95% CI 0.0462-0.0945) equivalent to an annual rate of 7.29% (4.73-9.91).

ANTARCTIC
SC/66a/IA7 reported that twenty seven schools of southern right whales (43 individuals, including 5 mother and calf pairs) were sighted between 90°E - 115°E, south of 60°S, by the 2014/15 Japanese dedicated line transect whale sighting survey in the Antarctic

Area IV. A total of 39 individuals were photographed and biopsy samples collected from these individuals (including both of 4 mother and calf pairs).

GENERAL

The Committee **recognises** the great value of annual surveys and long-term datasets such as those reported above for Argentina, South Africa and Australia and **recommends** they continue. It also **welcomes** the long-term collection of photo-identification and sightings survey data on right whales from the Antarctic.

The Committee also welcomed information (SC/66a/BRG4) on the Australasian Right Whale Photo-Identification Catalogue (ARWPIC). It **recognises** that this important development could be adopted for other species/areas.

CONSERVATION ISSUES

The Committee **welcomes** information on progress with the two southern right whale Conservation Management Plans (Annex F, item 4.4) and recommends that they continue. These are also discussed under Item 21.1.

10.9 North Atlantic right whales

SC/66a/BRG11 reports updates on the status of the North Atlantic right whale population which has been categorised as critically endangered or on the brink of extinction. Recent analyses and reports have demonstrated that, although the western North Atlantic stock has far from fully recovered from a precipitous population decline likely caused by early commercial whaling, the small population that was extant in the 1960s has undergone a slow but relatively constant increase in abundance. Based on the records of photographically recaptured individually identifiable whales recorded in the North Atlantic Right whale catalogue, there has been a 2.8% per annum increase in the minimum number alive during the period 1990-12.

The Committee was informed that a proposal for an IWC Workshop on the assessment of North Atlantic right whales will be submitted next year.

10.10 North Pacific right whales

The Committee received a progress report on the US National Marine Mammal Laboratory's studies of North Pacific right whales using acoustic data. Because of the loss of sea ice and the likelihood of greatly increased trans-polar ship traffic through the Bering Sea, there is an urgent need to better understand the existing range and habitat use of right whales in this region. Acoustic monitoring has suggested that right whales occur in the Bering Sea in most months of the year, and historical records indicate they were found throughout this area as well as in the Aleutian Islands. It was also noted that the US has recently proposed shipping lanes through the Bering Sea and Bering Strait, and these lanes pass through the western margin of the federally designated Critical Habitat area for right whales and there is an ongoing effort to implement mitigation measures. Ship traffic is expected to increase rapidly in this region and the Committee **recognises** the importance of describing the seasonal distribution of this endangered population of right whales and urges mitigation

10.11 North Atlantic bowhead whales

Boertmann *et al*. (In press) reported on a systematic aerial survey for walrus in the Northeast Water Polynya off Northeast Greenland that revealed several observations of bowhead whales that resulted in a corrected abundance estimate of 102 whales (95% CI 32-329) - the largest abundance of bowhead whales reported from the Greenland Sea since the days of whaling in the sixteenth to seventeenth centuries. This provides renewed hope for the Spitsbergen stock of bowhead whales that until now has shown only inconclusive signs of recovery despite more than 100 years of protection from whaling.

SC/66a/BRG20 reported on the Spitsbergen population of bowhead whales in the waters around Franz-Josef Land Archipelago (FJLA), Russia. New observations suggest that total numbers in the area might exceed 100 animals. These new data, together with the report from NE Greenland (Boertmann *et al.*, In press), suggest that the existing overall Spitsbergen bowhead population estimate (Christensen *et al.*, 1992; Zeh *et al.*, 1993) may be an underestimate and should be re-evaluated.

All commercial activity is prohibited within the protected area of the FJLA, including commercial fishing, shipping, oil and gas development and mining. However, there are a number of threats from outside the refuge that are increasing with the most important one being oil and gas development and the associated seismic surveys in the surrounding shelf areas. Other important activities that are on the increase include military operations in the waters in and around the FJLA, transport of petroleum products from west Siberia, and increase ship traffic, including a new anchorage site in FJLA. Therefore, all these human activities, especially seismic surveys in the nearby waters require increased monitoring and research on the bowheads using the waters of the FJLA.

In light of these developments, the Committee **draws the attention** of the range states to the potential threats to this small population and **stresses** the following needs:

(1) to continue and intensify monitoring of this population throughout its range, ideally in a co-ordinated manner between all range states; and

(2) for range states to develop a cooperative approach among the companies, regulators and other stakeholder to consider the cumulative and synergistic effects of activities on these bowhead whales and to recommend following the guidelines for responsible seismic surveys (Nowacek *et al.*, 2013) that were endorsed by the Committee and the Commission in 2014.

10.12 Arabian Sea humpback whales
10.12.1 Review new information
Mahanty *et al.,* (2015) reported the detection of humpback whale calls in the south-eastern Arabian Sea from mid-January to mid-March 2011, peaking in February. No presence was recorded after mid-March. These detections suggest that humpback whales may use this area as a winter breeding habitat.

SC/66a/SH17 collated humpback whale observations from visual and acoustic surveys and local interviews with fishermen and cargo vessel crews operating off the Indian coast. Interviews indicate that humpback whales are most regularly observed along the Saurashtra and Kachchh coasts of northern Gujarat, with most stranding reports from Maharashta. Sightings in northern Gujarat are concentrated from November to March. Fishermen sightings in Maharashtra are correlated with the presence of sardine shoals. SC/66a/SH17 recommends development of an organised database of all records in a shared standard format to make the data available among range countries. Stock identity of these whales is unknown, and the authors propose that current constraints on the collection of samples for further analyses, particularly for genetics be rectified as soon as possible.

The Committee therefore **encourages** collaboration with Indian government scientists on future work in this region, to facilitate acquisition of genetic samples, collection of which is crucial for identifying this poorly known stock.

SC/66a/SH22 described whale movements off the southern coast of Oman during March 2015 from three adult males equipped with satellite tags. The animals remained in the vicinity of Hallaniyats Bay until the end of March, moved north towards the Gulf of Masirah by the beginning of April and remained there into May. A similar pattern of movement was presented in 2014 (Willson *et al.*, 2014). This confirms the importance of Hallaniyats Bay and the Gulf of Masirah. The whales did not leave Omani waters during the transmission period.

Satellite tracks suggest that humpbacks off Oman inhabit a small geographic area compared to other breeding stocks, and therefore that they may be demographically independent from the humpback whales observed in the south eastern Arabian Sea. The Committee **reiterates** the importance of collecting genetic samples off the west coast of India to investigate whether the humpbacks off the coasts of Oman and India are separate populations.

Pomilla *et al.,* (2014) compared humpback whales from the Arabian Sea (*n*=67) from those in the Southern Hemisphere and North Pacific, using mtDNA and microsatellite genotypes. The Arabian Sea population was significantly differentiated from all other stocks, and the analyses suggest that it has been isolated for 70,000 years. Genetic diversity within the Arabian Sea is low and genetic signatures are consistent with both ancient and recent bottlenecks in this population. These finding suggest that this is the world's most isolated humpback whale population.

10.12.2 Progress toward the development of a Conservation Management Plan and other conservation initiatives
Minton *et al.,* (2015) summarised proceedings from an intersessional Arabian Sea Humpback Whale Workshop, which was intended to develop a unified, collaborative research and conservation strategy for communication to governments, NGOs, IGOs, donors and research colleagues. The workshop made a series of recommendations to improve conservation management of this population (Annex H, appendix 3).

The Committee **endorses** the recommendations made by the workshop. The workshop covered a variety of issues related to the status of the population and noted that shortage of information on the population's full range and population size outside of Oman is one of the most significant impediments to the pursuit of a regional conservation strategy.

SC/66a/SH23 reported on progress with a partnership amongst industry, consultancy and NGOs in the Gulf of Masirah, Oman, to develop mitigation measures related to port operations and hydrocarbon exploration in the area. This included development of a 'Whale Management and Mitigation Programme' to be implemented by the Port of Duqm Company as well as seismic survey mitigation measures.

The Committee **agrees** that more work on humpback whale occurrence and habitat use in the Gulf of Masirah is required to identify at what time of year seismic surveys may have the least impact, and therefore to provide the best possible management and mitigation advice (see Nowacek *et al.*, 2013).

The Committee **reiterates** its serious concerns about the threats faced by the endangered Arabian Sea humpback whale sub-population. These include: (1) small population abundance and genetic isolation; (2) a high rate of recent strandings; (3) evidence of an increasing trend in tattoo-like skin disease (22% of catalogued whales; see Item 12.3.1); (4) high entanglement rates with 30-40% showing scarring from possible entanglement; (5) critical habitats in the Gulf of Masirah and Hallaniyats Bay under rapid development with seismic surveys, well drilling, port development, expansion of a city, fisheries, fast ferry routes and the whale watching industry; and (6) whales use areas coincident with offshore shipping routes (Annex H, Item 4.2).

10.12.3 Work plan
The work plan for Arabian Sea humpback whales is given in Table 14. Budgetary implications are discussed under item 26.

10.13 Sperm whales
There is an on-going effort to compile information useful for future assessments of sperm whales, related to: (1) population structure within oceans; (2) population size within ocean basins and abundance in smaller areas; (3) catch history and (4) development of new assessment models.

10.13.1 Review new information
Moore and Barlow (2014) provide abundance and trend estimates for sperm whales in the California Current, using sightings from line transect surveys conducted between 1991 and 2008 and employing Bayesian hierarchical models. The main trend parameter was estimated too imprecisely to make inference about overall abundance trend, but there is strong evidence that the abundance of adult males has increased since the early 1990s and ~2,000 whales are estimated to use the study area.

Table 14

Work plan on Arabian Sea humpback whales.

Sightings	Continuance of the collection and analysis of sightings reports off the coast of Oman and India, along with other range states (the United Arab Emirates, Iran, Pakistan, Maldives and Sri Lanka)	Review progress
Stock structure	Analysis of genetic material collected off Oman and increased efforts to collect genetic material elsewhere in the region	Review progress
Health	Increased efforts to monitor health including investigation of strandings, with assistance being provided by the CDoC (possibly in conjunction with entanglement training, see below)	Review progress
Entanglement	Provision of IWC entanglement response training	Review report
General	(1) Continuance of the intersessional Arabian Sea working group (2) Consideration of the formation of an independent advisory panel along the lines of that developed for the western gray whale (see Item 10.7), to focus on key areas where threats are occurring concurrently and provide expert advice on conservation management and research	Review progress and consider next steps

The Committee **welcomes** presentation of this method, which may be applicable to other time series of sightings surveys. Further discussion of the application of this method is covered in Annex H, item 6. Given that similar sightings data are available from the Eastern Tropical Pacific, the Committee **encourages** the analysis of these data to generate a time series of sperm whale abundance and trend for this region. Acoustic surveys using towed hydrophones have effectively provided absolute estimates of sperm whale density in a number of areas and such surveys were considered a more realistic option for some regions. Estimating group size from acoustic data alone can be challenging for large group sizes. Hence survey design may need to consider additional methods to estimate group size.

Alexander *et al.,* (In prep) describes the global population structure of sperm whales using mtDNA and microsatellite genotypes obtained from 1,587 samples worldwide and including previously published genetic information. Findings provide further evidence that: (1) mtDNA diversity of sperm whales is low; (2) strong differences in haplotype frequencies between oceans and between many regions within oceans; and (3) geographic fidelity and social philopatry appear to explain much of the genetic structure within the sperm whale, but the relative influence of these forces differs amongst oceans.

The Committee noted that levels of population differentiation differ markedly between males and females. It was suggested that matrilines are a useful indicator of stock structure for use in assessments, given the strongly matrilineal social structuring of this species. The Committee **agrees** to initiate intersessional discussion of data related to stock structure and catches of sperm whales in order to discuss these during a joint session of the Working Group on Stock Definition and the sub-committee on Other Southern Hemisphere Whales at the 2016 Annual Meeting.

10.13.2 North Pacific sperm whales catch history
SC/66a/RMP9 used data of known reliability from Soviet whaling industry reports to show that body lengths reported to the IWC by Japanese factory fleets for female sperm whales caught in the North Pacific are not credible. Adjusting for effort, catches of legal sized females were up to 9.1 times higher for Japan compared to the USSR, and even higher for very large females. The paper concluded that the Japanese length data reflect systematic falsification of catch statistics submitted to the IWC.

Moronuki pointed out the absence of such falsified data in the Japanese Government records and questioned the appropriateness of making an estimation by such analogy. Kato questioned whether the corrected Soviet length data could be assumed to be reliable and noted that there were no records available that could be used to replace the official statistics. Ivashchenko noted that the Soviet North Pacific data are identical in nature to the true Soviet data from the Southern Hemisphere which have been accepted by the IWC.

There was discussion as to whether it was plausible that female sperm whales exceed 38ft as commonly as the reported data suggest. Cooke *et al.* (1983) that showed that the recorded length distributions from the Japanese coastal male sperm whale catches were also not plausible during 1952-71. It was suggested that looking at oil yields could assess whether a larger number of smaller whales could have been recorded as fewer large whales.

The Committee **concludes** that this year it is not in a position to make any recommendations as to how these data could be adjusted in the IWC catch data base, but **recommends** that the documentation of the database include a note that this issue is pending. The Committee **encourages** suggestions next year for addressing this matter.

10.13.3 Work plan
The work plan for sperm whales based upon the recommendations above is summarised in Table 15.

Table 15

Work plan on sperm whales.

Item	Intersessional period/groups	SC66b
Feasibility of stock assessment:		Review results of intersessional work and joint SD/SH session to consider feasibility of undertaking a sperm whale assessment and if yes, a work plan and timetable
(1) Stock structure	Intersessional group on stock structure	
(2) Other	Intersessional group on (1) population size within ocean basins and abundance in smaller areas; (2) catch history; and (3) consideration of the development of a new assessment model	
North Pacific catch history	Add note to IWC catch database of possible issues with respect to body lengths for Japanese factory ship catches; Consider ways to resolve this issue.	Review progress with a view to finalising the issue.

10.14 Omura's whales

SC/66a/SH29 presents the first genetic and biological description of Omura's whales off northwest Madagascar. Biopsy samples from 23 whales all shared the same mtDNA haplotype and were 1-3 base-pairs different from all previously sequenced Omura's whales. Sightings indicated a preference for shallow-water shelf habitat with frequent observations of lunge feeding. Observations of five mothers with young calves and recordings of song-like vocalisations indicated reproductive behaviour. Reports of continual presence at least from April to December suggest a resident population, with one whale photo-identified between years.

The Committee **welcomes** this substantial new information on a poorly known Southern Hemisphere species and noted that SC/66a/SD01 also provides a record of an Omura's whale stranding off West Africa.

10.15 Southern Hemisphere fin whales

The Committee **agrees** to initiate discussion of Southern Hemisphere fin whales at the 2016 Annual Meeting along the lines of the assessment process currently being progressed for blue whales. It therefore **recommends** that the post CPIII survey data be inspected for fin whale sightings with a view to examining whether these data are suitable for estimating abundance or trend. This work will be conducted alongside that recommended for Antarctic blue whales (Item 10.3.1.2).

10.16 IWC photo-identification catalogue guidelines

This year, the Committee initiated a discussion about the status of current photo-identification catalogues in relation to future needs for assessment.

SC/66a/BRG13 describes the newly launched Australasian Right Whale Photo-Identification Catalogue (ARWPIC), an open-access, centralised data repository for Australian southern right whales accessed via an online portal. SC/66a/BRG13 was presented as a possible model to consider for future IWC supported catalogues.

The Committee **welcomes** this news. It noted that the database software developed for this catalogue could potentially be used to develop other whale matching catalogues.

Inter alia, the IWC requires that photo-identification catalogues it supports are useable for population assessment processes, including mark-recapture and population connectivity investigations. The Committee therefore **recommends** development of a set of IWC guidelines for photo-ID catalogues that takes into account the need for them to be able to contribute to IWC population assessments (Annex H, item 7.5). Where catalogues are supported by IWC funds, these guidelines may be imposed as conditions for IWC support (e.g. see Item 10.3.1.1).

10.17 IWC cruise programmes
10.17.1 The IWC-POWER (North Pacific Whale Ecosystem Research) programme
The IWC-POWER programme has been through a thorough planning process by the Committee and it has developed short-, medium- and long-term goals over a number of years based upon a thorough review of data available throughout the North Pacific. The short-term part of the programme is to cover all of the poorly-covered areas of the North Pacific with sufficient coverage to

50

allow the necessary information on distribution, density and abundance (as well as biopsy samples and photo-identification data) to enable the design of a robust medium- and long- term programme that meets the objectives of the IWC-POWER programme. Although the research programme is designed by the Committee, the Committee acknowledges the tremendous support of the Government of Japan who provide a vessel and crew for 60-days each year – this is tremendous in-kind support without which the programme could not take place.

10.17.1.1 MID- AND LONG-TERM RECOMMENDATIONS FOR THE IWC-POWER CRUISES

SC/66a/Rep01 presented the report of the TAG (Technical Advisory Group) to the IWC-POWER. The TAG focused on eight issues and a number of recommendations for further analyses, improvements to procedures, validation and archiving of catalogues, improved databased and information requests were made. The Committee thanked the Government of Japan for hosting the meeting. The Committee **endorses** these recommendations.

The Committee received information on progress with the development of photo-identification catalogues from the POWER Surveys in the North Pacific. In 2014, photo-identification data of all 5 years of POWER surveys since 2011 were integrated across years, for blue, humpback and killer whales. Integration is nearly complete for the fin and Bryde's whale catalogues, and underway for sei whales.

The Committee **welcomes** this progress and **recommends** the photo-ID catalogues continue to be populated and disseminated to other researchers through the IWC Secretariat to facilitate finding matches. These catalogues should be archived at the IWC Secretariat and validated in accordance with the **recommendation** in SC/66a/Rep01, item 7.3.2.

10.17.1.2 REVIEW OF 2014 CRUISE

SC/66a/IA05 presented results from the 5th annual IWC-POWER cruise which was successfully conducted from 2 July to 30 August 2014 in the central North Pacific (north of 30°N, south of 40°N, between 170°E and 160°W) using the Japanese Research Vessel *Yushin-Maru No.3*. Researchers from Japan, USA and UK participated in the survey. The cruise had five main objectives (see Annex G, item 6.1). Survey plans had been endorsed by the Committee (IWC, 2015f, p.35). The Committee **agrees** that it was duly conducted following the guidelines of the Committee (IWC, 2012d, pp.509-17).

Further details of the cruise, including summaries of the sightings made, may be found in Annex G, item 6.1. The Committee thanked the Cruise Leader, researchers, Captain and crew, and the Steering Committee for completing the cruise and the Government of the USA who granted permission for the vessel to survey in their waters, without which this survey would not have been possible. In addition, the Committee thanked the Government of Japan who generously provided the vessel and crew and thanked the IWC Secretariat for providing support. The Committee **recognises** the value of the data contributed by this and the other POWER cruises which cover many regions not surveyed in recent decades, and address an important information gap for several large whale species. The Committee looks forward to receiving abundance estimates arising from these data.

10.17.1.3 RECOMMENDATIONS FOR 2015 AND 2016 CRUISES

SC/66a/Rep02 presented the report of the Planning meeting for the 2015 IWC-POWER cruise, the sixth cruise under the successful international IWC-POWER programme. This cruise is to be held from 2 July – 30 August 2015 including transit from and to Japan, using a research vessel, which will be the same type as in the previous cruises (e.g. the *Yushin-Maru No. 3*), kindly provided by Japan. The proposed plan will cover waters from 170°E to 160°W between 30°N and 20°N; some 42 days will be available in the research area.

SC/66a/IA10 outlined the line transect sighting survey cruise plan for the 2016 IWC-POWER as one of the short term research program. It is assumed that the research vessel, *Yushin-Maru No.3*, will be available. It is proposed that this cruise should be conducted in the central North Pacific between 160°W and 135°W, from 20°N to 30°N, where the IWC-POWER cruise has not yet been conducted, in approximately 60 days involving 18 day-transit and 42 days in the research area. Photo-identification and biopsy experiments are also planned. Information collected from the survey will contribute to provide essential information for the *Implementation Review* for Bryde's whale which is scheduled in 2017. The outcome of the survey will also contribute to the intersessional workshop to plan for a medium-long term IWC-POWER international programme in the North Pacific. The data and report of this survey will be submitted to the Committee soon after the cruise. Thanks to cooperation between USA and Japan, it will also be possible to take biopsy samples in the US EEZ.

The Committee **endorses** the plan and thanked the Government of Japan for its generous offer of providing a vessel for this survey. Matsuoka was assigned responsibility for IWC oversight. The Steering Group for IWC North Pacific Planning appointed last year was re-established, convened by Kato; this group will meet in Tokyo 7-10 October 2015. A small group convened by Matsuoka was formed to summarise the recommendations made in POWER cruise reports in preparation for the next planning meeting. The Committee also **recommends** that the IWC-POWER TAG be reconvened and meet at the same time as the IWC-POWER meeting in Tokyo. The primary objective of the TAG meeting is to review the available information from the previous cruises and to develop further the plan to design a medium-term programme to meet the Commission's agreed long-term objectives relating to status, trends and causes of any trends.

Finally, the Committee **recommends** that negotiations with the Russian Federation about required permits for surveying in the Bering Seas during the upcoming surveys start as soon as possible. It **urges** the co-operation of the Russian Federation in this matter to support these IWC cruises.

10.17.2 Other IWC cruise related matters
10.17.2.1 REVIEW PROGRESS ON THE IWC IDCR/SOWER VOLUME
Preparation of the volume is still in progress. The contents will include an introduction to SOWER and the fieldwork; distribution and movement of species encountered; their taxonomy and population structure; acoustics; species abundance; conclusions and lessons for the future. Given concerns over possible duplication with a proposal for an Antarctic minke whale Special Volume (see item 10.1.2) the Committee **agrees** that priority should be given to completing the IDCR/SOWER Commemorative Volume first. The Committee thanked Bannister and the Editorial Board, and looks forward to an update next year (and see Item 29).

10.17.2.2 UPDATE OF IWC-DESS DATABASE
Hughes reported on the current status of DESS (Database - Estimation Software System) and the IWC-POWER cruise data validation process. DESS was developed many years ago for the storage, easy extraction and analysis of data from the IDCR cruises. The base programs are now not widely used and would be better replaced by more modern alternatives. This would also enable other data such as natural marking and biopsy samples to be linked to the sightings in the database. This is in accord with the recent recommendations from the IWC-POWER Technical Advisory Group, most recently in SC/66a/Rep01.

Hughes was thanked for her work on DESS. In order to progress the work of developing a more modern system, a small steering group was established under Palka (convenor) that will include a professional database developer. In particular, this will involve: (1) review of database needs, across the broad range of scientific and management data collected by the IWC; (2) documentation of the issues with the current system; (3) whether options for estimating abundance within a database framework is appropriate; and (4) use of the first three points to help develop scope for a tender for a comprehensive database system designed for the Committee's needs. This small steering group will work intersessionally via email, and hold at least one meeting. The small steering group will also consider incorporating the ability to combine mapping and data from the catch database. After development, the broad database system will be made available to other scientists/management bodies.

10.17.2.3 UPDATE ON PROGRESS WITH IWC PHOTOGRAPHIC DATABASE
Donovan reported that the IWC (Jess Taylor and Donovan) has been continuing to enter and code image data into the Secretariat's *Lightroom* database. This archival database now contains over 111,000 images from 35 cruises, including IWC-IDCR, SOWER and POWER. An important component of last year's work was to begin to scan the negatives from the early cruises and this work should be completed this year. Photographic coding includes categorising photographs by quality, potential use (e.g. photo-identification, ship strikes and entanglement), geocoding, cross-referencing with original data sheets and comprehensive keywording using a standard list. Natural marking and biopsy record datasheets converted into text files can be linked to the database. A demonstration version of the database was available at the meeting.

The Committee **recognises** the great benefit of the photographic database and the enormous effort taken to build it to its current extent, and thanked Taylor and Donovan for their hard work. It **recommends** continuation of this work.

10.18 Review of cruise information and plans
The Committee has developed guidelines to aid in the process of obtaining estimates of abundance for use in the Revised Management Procedure, RMP (IWC, 2012d, pp. 509-517).

10.18.1 The Antarctic
10.18.1.1 REVIEW OF 2014/15 JAPANESE CRUISE
SC/66a/IA7 reports on the results of the 2014/15 Japanese dedicated whale sighting survey in the Antarctic (south of 60°S). Two dedicated sighting vessels were engaged and successfully conducted research from 1 February to 4 March 2015 in Area IV (70°E - 115°E, 75% of the total Area) using two survey modes, based on IWC/IDCR-SOWER survey procedures. Details of the collected data can be found in Annex G, item 7.2.

The Committee **expresses** appreciation for the successful completion of this sighting survey and looks forward to receiving abundance estimates arising from these data. The Committee also thanked Matsuoka for overseeing this survey on behalf of the IWC.

In discussion it was noted that encounter rates for Antarctic minke whales were within the ranges observed during previous IWC-SOWER surveys in same Area. It was also noted that the number of humpback whales was about 10 times higher than that of Antarctic minke whales, and that there was an unexpectedly large number of fin whales encountered relatively far south.

10.18.1.2 REVIEW PLANNING OF FUTURE JAPANESE CRUISE
Annex 2 of SC/66a/SP8 presents a research plan for the NEWREP-A's dedicated sighting survey in the 2015/16 austral summer season. The research plan was prepared taking into account suggestions and recommendations from the NEWREP-A Review Panel (SC/66a/Rep06). The survey is planned to be conducted in Area V (130°E-170°W), which includes the Ross Sea, for 115 days (65 days in the research area) using two vessels, the *Yushin-Maru No. 3* and an as yet undetermined but similar vessel. In addition to the standard IO abundance survey, a krill survey will be conducted with the aim of providing a krill index of relative abundance. The feasibility and practicability of biopsy sampling and telemetry deployment will be evaluated in a systematic manner. A cruise report will be prepared which will include a list of the samples and data collected and will be presented to the 2016 Annual Meeting.

The Committee **welcomes** the proposed multi-disciplinary survey and thanked the Government of Japan for the use of two dedicated vessels for this research project. Since the study area is so large and the weather is often unfavourable for a sighting survey, the Committee **endorses** the view that two vessels are necessary to collect sufficient levels of representative data.

In discussion, the Committee **recommends** the value of being able to deploy small boats for biopsy sampling and especially satellite tagging of whales (and see Item 17.4.2). In addition, the Committee **recommends** that in parallel with conducting the current field data collection study, the authors, develop the ecosystem and spatial density models and revised the analytical methods used to estimate abundance in an effort to more explicitly define the field design and procedures.

The Committee **endorses** this proposal and Matsuoka was appointed to provide IWC oversight.

10.18.1.3 OTHER
SC/66a/SH11 and SC/66a/SH12 presented the results of dedicated cetacean sighting surveys from two platforms (crow's nest and helicopter on R/V *Polarstern* during 2 Dec 2014 – 1 February 2015. This was on a return track from Cape Town, South Africa to Neumayer Station III (70°40'S, 008°16'W) along the 0° meridian (see Annex H, item 5.2.1 for more details).

The results of the successful multinational blue whale cruise under the SORP programme (SC/66a/SH07) are discussed under Item 10.3.1.

10.18.2 North Pacific
10.18.2.1 JAPANESE CRUISES
SC/66a/IA06 reported on a systematic large-scale vessel-based sighting survey that was conducted in 2014 by Japan to examine distribution and abundance of large whales in the western North Pacific. The survey was conducted during 5 August – September 2014 using the research vessels *Yushin-Maru* and *Yushin-Maru No.2*.

The Committee thanked the US government for granting a research permit and thanked Matsuoka for overseeing the survey on behalf of IWC. The Committee **recognises** the value of this series of surveys and looks forward to receiving abundance estimates arising from these data.

SC/66a/RMP4 presented the results of sighting surveys for common minke whales in the Japanese waters using two research vessels (*Shonan-maru No.2* in the 7CN and *Shunyo-maru* in the 10E and 11) in the sub-area 7CN (Pacific coast off Hokkaido, northern Japan), 10E (coastal waters off Hokkaido in the Sea of Japan), and 11(coastal waters off Hokkaido in the Okhotsk Sea) during 28 August – 12 September 2014. Due to a logistical problem, the surveys were conducted in place of the plan for the Okhotsk Sea including the Russian EEZ (sub-area 12NE) presented last year (Kishiro *et al.*, 2014). These results provide information on the migration and abundance of the whales in those waters in summer season, and will contribute to the future assessment of the North Pacific common minke whales.

The Committee **welcomes** this information, and **expresses** its admiration to the researchers for developing a survey in this important area in such short time after logical problems developed. It hopes that biopsy samples will be able to be collected during a future survey. The Committee thanked Miyashita for his role as oversight on behalf of the Committee and looked forward to the analyses of these data as they will contribute to the assessment of North Pacific common minke whales.

SC/66a/IA11 presented a plan for a systematic vessel-based dedicated sighting survey in the North Pacific 2015 by Japan as a part of the Japanese Whale Research Programme under Special Permit in the western North (JARPNII). The main objective of this cruise is to examine the distribution and estimate the abundance of sei whales for management and conservation purposes.

The Committee **endorses** this proposal and Matsuoka was appointed to provide IWC oversight.

10.18.2.2 JOINT RUSSIAN-JAPANESE CRUISE
SC/66a/RMP11 proposed a cetacean sighting survey in the northern part of the Sea of Okhotsk conducted by the Russian research vessel during 7 August 2015 to 10 September 2015 where the main research area is north of $57°$N, $137°$E-$157°$E, which has not been covered for over 25 years. The objective of the survey is to obtain the information on distribution and abundance of whales and dolphins using the normal closing mode. All information will be recorded following the IWC-POWER cruise procedures. Photo-identification of cetaceans such as northern right whales and gray whales will also be trialled.

The Committee **commends** Russia and Japan for undertaking the planned survey, notably given the lack of information from much of the Okhotsk Sea in recent years, the known data gap that had to be dealt with in the recent North Pacific common minke whale assessment, and because this was a historically important area for north Pacific gray whales, bowheads and right whales.

The Committee **recommends** this survey be conducted and offers some suggestions to consider that should improve the survey. It was suggested that the survey be expanded to include some key areas not currently covered, including the western side of Kamchatka, Shelikov Bay and the Shantar Archipelago. These are known to be important for several species, including bowhead whales. For the latter species, there are indications in whaling data that some degree of age or maturational segregation exists between Shantar and Shelikov Bay, with larger animals being found in the latter. Observations of right whales, preferably with photo-identification and biopsy sampling, would be of great importance given the unknown status of this stock.

The Committee **stresses** the importance of using experienced observers in such a survey, especially since it is not known when this region will be surveyed again and therefore **encourages** sufficient training be provided to individuals with little or no cetacean experience. To help with the training, the Committee appointed Miyashita to provide oversight on behalf of the Committee.

10.18.3 North Atlantic cruises
10.18.3.1 WEST AFRICA
SC/66a/IA2 proposed a cetacean sighting survey conducted by COMHAFAT in coastal waters of western North Africa in winter 2015/16. The study area is set in the coastal waters from Mauritania to Guinea-Bissau, except for shallow waters less than 20 m for safe sailing during a 15-days survey period within the November 2015 to February 2016 time period.

The Committee welcomes a survey in these waters since few previous surveys for this area are available and **recommends** that data from the proposed survey, along with the previous two similar surveys be analysed, perhaps together, to estimate abundance for as many species as the data allow and these results be submitted to the Committee. The Committee **recommends** the authors collaborate with other Committee scientists to provide all of the needed information and then submit this to the TAG (see Item 10.17.1) who can provide oversight and make suggestions or recommendations before the proposed survey starts in December 2015.

10.18.3.2 NASS-2015 (NORTH ATLANTIC SIGHTINGS SURVEYS)
SC/66a/RMP3 provided details of the proposed Icelandic and Faroese parts of NASS-2015 abundance surveys. The last NASS survey was conducted eight years ago. NASS-2015 has been in the planning by NAMMCO with IWC oversight for several years and was delayed to 2015 in the hope of a wider synoptic coverage in the North Atlantic by more parties, but that has been in vain. The aerial survey in Icelandic coastal waters (CIC *Small Area*) will be similar to earlier surveys. The shipboard surveys will be conducted by one dedicated vessel from the Faroe Islands and one from Iceland and one fisheries/oceanographic survey vessel doing combined cetacean, redfish and mackerel surveys in the middle area west of Iceland (10 June to 10 August 2015).

The Committee was informed that it is intended that the results from these surveys will be used in the RMP. In the absence of a Faroese scientist, the Committee focussed on the Icelandic proposed survey. The Committee **recommends** considering the use of spatial modelling analysis techniques if all tracklines are to be used and notes the potential challenges of collecting line transect cetacean data from a survey which is primarily designed for another purpose, in this case fish surveys. The Committee also noted that IWC oversight on the planning aspects of the NASS-2015 project has been provide via Hammond and Donovan and several knowledgeable Committee past and present members (for example, Víkingsson, Gunnlaugsson, and Pike) who will be on shipboard and aerial surveys, so the Committee **concludes** there is sufficient IWC oversight.

10.19 Other
10.19.1 North Pacific humpback whale assessment
SC/66a/IA16 discussed issues pertaining to an assessment of North Pacific humpback whales. In part because of uncertainty in the catch record relating to illegal Soviet whaling, the IWC has not undertaken a Comprehensive Assessment of this population. With the recent correction of this catch record, such an assessment can now be considered. The authors presented a summary of existing data on catches, population structure, abundance, and trends of North Pacific humpback whales in order to generate a discussion about future approaches to assess the status of this population. They used a single-population logistic model. Not surprisingly given the simplistic approach, the model did not match observed growth rates.

The Committee **commends** the authors for beginning to address this complex assessment, with its multiple feeding and breeding grounds. Suggestions were made in Annex G, item 10.1 on what else could be explored to improve the model fit.

11. STOCK DEFINITION

This agenda item was established in 2000, and has been handled since then by a Working Group (hereafter SDWG). In 2012, the Terms of Reference for the SDWG were changed to reflect the evolving needs of the Committee. During this meeting, the SDWG continued to develop guidelines for the preparation and analysis of genetic data within an IWC context (see Item 11.1), provided the Committee with feedback and recommendations concerning stock structure related methods and analyses presented to other sub-committees (see Item 11.2), and continued work on a draft reference glossary of stock related terms, to aid consistent definition of 'stocks' in a management context for the Committee (see Item 11.4). The Report of the Working Group is given as Annex I.

11.1 Guidelines for DNA data quality and genetic analyses
Two sets of reference guidelines have been developed and endorsed by the Committee (IWC 2009, p248) and form 'living documents' that can be updated as necessary[5]. The first set addresses DNA validation and systematic quality control in genetic studies. The second set provides guidelines for some of the more common types of statistical analyses of genetic data used in IWC

---

[5] DNA data quality guidelines are available https://iwc.int/scientific-committee-handbook#ten- the genetic data analysis guidelines are anticipated to become available before the 2015 Annual Meeting.

contexts, and contains examples of management problems that are regularly faced by the Committee. One section of the data quality guidelines will be updated intersessionally, and the genetic analysis guidelines will be completed intersessionally (see Item 11.5).

The Committee discussed two papers that have relevance for the genetic data analysis guidelines. These included: (1) the application of Random Forests, a classification algorithm, to identify diagnosable groups as well as to assign samples of unknown origin to their source (Brieman, 2001), as applied to fin whale products in Japanese and Korean markets (SC/66a/SD2); and (2) a guide to distinguishing between possible causes for departure from Hardy Weinberg proportions (Waples, 2015). Technical comments on these papers are given in Annex I.

11.2 Statistical and genetic issues related to stock definition
The SDWG discussed a number of papers relevant to stock structure discussions in other Committee sub-groups and comments were submitted to the following sub-committees: Aboriginal Subsistence Whaling Management Procedure (Annex E), In-Depth Assessments (Annex G), and Other Southern Hemisphere Whale Stocks (Annex H). Technical comments on these papers are given in Annex I.

Several papers relevant to the stock structure of sei whales in the North Pacific were presented and these are discussed under Item 10.6.3.

In addition, two papers (SC/66a/IA3 and SC/66a/IA4) that presented the results of a re-analysis of the likely geographic origin of sei whale market products obtained in Japan (n=71) and South Korea (n=4) between 1997 and 2009 were discussed. This re-analysis used an expanded set of mtDNA reference sequences obtained through a reciprocal data exchange between the proponents of each study under the Committee's Data Availability Agreement Procedure B data sharing protocol. Twenty-one of the market products could not be assigned to a known permitted source and showed a phylogenetic affinity to the Southern Hemisphere. The authors of SC/66a/IA3 noted that these 21 products, which were obtained from a single shop, could have been stored from the end of commercial whaling in the Southern Hemisphere, and suggested that this could be investigated further if the name and address of the shop were provided. While the results suggest that these market samples would not need to be considered in the context of the in-depth assessment of North Pacific sei whales (Item 10.6), the authors of SC/66a/IA4 noted that additional reference samples would be needed to exclude the possibility of an origin from the North Atlantic or a coastal stock in the western North Pacific.

The discussions of stock structure of pygmy-type blue whales in the Southern Hemisphere can be found under Item 10.3.1.1.

11.3 Testing of Spatial Structure Models (TOSSM)
TOSSM (IWC, 2004, pp.27-8; 2010b, p.51) was developed to facilitate comparative performance testing of population structure methods intended for use in conservation planning (e.g. Martien *et al.*, 2009). More recently, the TOSSM dataset generation model has been used to create simulated datasets that allow the plausibility of stock structure hypotheses to be tested. No progress on Testing of Spatial Structure Models was reported this year, although a project is underway to integrate some of the functionality of TOSSM into a package intended to facilitate the use of simulation-based approaches in population genetics. The Committee expressed appreciation for this effort, which may allow the TOSSM framework to be utilised by a wider audience. The Committee further noted that a wide range of simulation-based software is currently available that may have utility to the Committee and it **agrees** that this item should be expanded to include review of a broader range of simulation tools.

11.4 Terminology and unit-to-conserve
Defining and standardising the terminology used to discuss 'stock issues' remains a long standing objective to help the Committee report on these issues according to a common reference of terms (see Appendix 5, IWC, 2014g, pp.287-8). This year, further progress was made on efforts initiated last year to align the terms generally used with those currently being used by the sub-committee on small cetaceans. In recognition of the difficulty of this task, given the differences in behaviour and life history of baleen whales and small cetaceans, an intersessional email group has been formed to: (1) provide a list of stock structure related terms used by the different sub-committees and working groups of the Committee as well as by relevant outside groups (e.g. IUCN); and (2) identify 'equivalencies' between terms in order to highlight where changes in terminology might be made to improve consistency of usage (see Item 11.5).

11.5 Work plan
The work plan on general issues related to stock definition is given as Table 16.

Table 16

Work plan on stock definition (excluding those covered under specific species/areas).

Item	Intersessional period/groups	SC66b
Guidelines and terminology:		
(1) Data quality and analyses	Work on updates and finalisations	Review results of intersessional work and update for inclusion on IWC website
(2) Terminology	Intersessional group on (1) terminology used by various groups; (2) identification of 'equivalencies' and suggestions for consistency	

55

Simulation tools	Encourage presentation of papers on simulation-based approaches including TOSSM	Review use of TOSSM and other simulation-based approaches; consider how TOSSM can assist in developing decision rules for stock 'boundaries'
General		Review relevant papers and provide advice as requested

12. ENVIRONMENTAL CONCERNS

The Commission and the Scientific Committee have increasingly taken an interest in the 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 (e.g. IWC, 1996; IWC, 1997a; 1998; 1999a; 1999b; 2001; 2013a). As a result, the Committee formalised its work by establishing a Standing Working Group that has met every year since.

12.1 State of the Cetacean Environment Report (SOCER)

The SOCER provides an annual update, as requested by Commission Resolutions 1997-7 (IWC, 1998) and 1998-5 (IWC, 1999a), on: (1) environmental matters that potentially affect cetaceans; and (2) developments in cetacean populations/species that reflect environmental issues. The 2015 SOCER (Annex K, Appendix 4) focused on the Pacific Ocean. Details of this year's SOCER can be found in Annex K, item 6. The Committee thanked the SOCER editors for compiling another thorough and informative summary. The focus of the SOCER at SC/66b will be on the polar seas. The Committee **encourages** Committee members who work in polar ecosystems to submit materials for the next update.

12.2 Pollution

12.2.1 Pollution 2020

An individual based pollution model, the Effects of Pollutants on Cetacean Populations (SPOC), to investigate the risks to cetacean populations and their potential growth rates was developed under the IWC Pollution 2020 initiative (Hall *et al.*, 2013). This model was translated into a web-based application for members of the Committee to test (SC/66a/E01). The web interface was demonstrated and SC/66a/E02 presented a further example of its application using historical, published parameters and vital rates to prepare a simulated, baseline population for Northern and Southern Resident Killer Whale (NRKW and SRKW) populations from the eastern North Pacific. The model then simulated the population growth over 100 years and investigated the potential impact of exposure to polychlorinated biphenyls (PCBs) at different accumulation rates and their subsequent effects on reproduction and immunity. For the SRKW population, the model simulations estimated they were experiencing an accumulation of 5 mg/kg total PCBs per year and suggested that PCB exposure could result in a declining population following the introduction of a novel pathogen.

In discussion, it was noted that this model may be precautionary because the survival of calves is based on studies in mink, which are known to be very susceptible to these pollutants. While the program was not developed to model males, sperm quality may be affected by these contaminants, and so there may be an effort to include males in future. More details can be found in Annex K, item 7.1. The model also provides an excellent visual tool to engage government officials and policy makers on a range of contaminant issues. The Committee thanked Hall for the extensive work that has gone into developing this model as part of an IWC funded project.

12.2.2 Oil spill response and impacts

12.2.2.1 OIL SPILL RESPONSE AND PREPAREDNESS

Suggestions for engagement in international oil spill response based on experiences during the joint United Nations/Government of Bangladesh Sundarbans oil spill response were presented jointly by Ziccardi and Smith. The oil spill occurred on 9 December 2014, when an oil tanker collision spilled an estimated 350,000 litres of furnace oil into the waterways of the world's largest mangrove forest in the Sundarbans, Bangladesh. A response was mounted several weeks later by local and international experts. Favourable tidal variations and oil collection efforts conducted by local communities and the Forest Department helped limit exposure of plants and animals to the spilled oil. The immediate environmental impacts to the mangrove and aquatic ecosystems appeared relatively mild and initial acute impacts to wildlife, including freshwater dolphins, appeared limited in scope. The safe removal and disposal of oiled debris remains a challenge and monitoring is required to assess the long-term effects of remobilisation of residual oil on the ecosystem and fishing livelihoods.

Based on the experience before, during, and after the spill several suggestions were made that could be applied to improve future international responses and assessments. These are listed in Annex K, item 7.2.

The Committee thanked those members who participated in this spill response for presenting their perspective on this incident and their insights for international oil spill response based on the response to this spill. The Committee **recognises** the difficulties of international oil spill coordination in areas that have limited resources.

Ziccardi presented information on past and current international oiled wildlife response planning and preparedness. IPIECA, the global oil and gas industry association for environmental and social issues, had developed Guidelines for Oiled Wildlife Response

Planning in 2004 which were updated in 2014[6]. The Joint Industry Project along with wildlife response experts are developing Global Oiled Wildlife Response System in 2015-16. The Committee noted that this system will be valuable for future spill preparedness that involves marine mammals and their habitat and in planning for areas (e.g., marine mammal protected areas) and species of concern for conservation. The Committee **recommends** collaboration with this international planning effort to provide cetacean expertise and information as the international response system is developed.

12.2.2.2 IMPACT ASSESSMENT OF CETACEANS FROM THE DEEPWATER HORIZON OIL SPILL

Three studies were presented on common bottlenose dolphins following the Deepwater Horizon (DWH) oil spill in 2010. The disaster released millions of barrels of oil into the Northern Gulf of Mexico (GoM). Natural and experimental exposure to oil has been linked to adverse health conditions in humans and animals.

The first study (Schwacke *et al.*, 2014) evaluated the potential health effects on bottlenose dolphins using capture-release health assessments conducted during the summer of 2011 in Barataria Bay, Louisiana, an area that received heavy and prolonged oiling, and in a reference site, Sarasota Bay, Florida, where oil was not observed. Dolphins sampled in Barataria Bay had abnormally low measures of adrenal hormones and were five times more likely to have moderate to severe lung disease. Furthermore, the adrenal and pulmonary disease states observed in Barataria Bay dolphins were consistent with petroleum hydrocarbon exposure and toxicity.

The second study identified demographic clusters of bottlenose dolphin strandings within the Northern Gulf unusual mortality event (UME) from January 2010-June 2013 (Venn-Watson *et al.*, 2015b). The location and magnitude of dolphin strandings during the 2010 DWH oil spill and the year following, including the Barataria Bay cluster from August 2010 to December 2011, overlap in time and space with locations that received heavy and prolonged oiling. Following the DWH oil spill, dolphin stranding numbers in Barataria Bay were high and elevated incidences of strandings did not commence until after the spill (August 2010), lasting through November 2011. These were the highest, most sustained dolphin stranding rates (>1,300 animals) on record for the state of Louisiana.

A third study was presented on adrenal gland and lung lesions in stranded bottlenose dolphins in the GoM found dead following the DWH oil spill (Venn-Watson *et al.*, 2015a). Lung and adrenal gland tissues were evaluated from fresh dead non-perinatal carcasses that stranded in Louisiana, Mississippi, and Alabama from June 2010 to December 2012. Results were compared to fresh dead stranded dolphins from outside the UME area or prior to the DWH spill. UME dolphins were more likely to have primary bacterial pneumonia and thin adrenal cortices. The rare, life-threatening, and chronic adrenal gland and lung diseases identified in stranded UME dolphins are consistent with exposure to petroleum compounds as seen in other mammals, and consistent with the findings from the 2011 Barataria Bay live animal health assessments. Therefore, exposure of dolphins to elevated petroleum compounds present in coastal GoM waters during and after the DWH oil spill is proposed as a cause of adrenal and lung disease and as a contributor to increased dolphin deaths. Further details and discussion can be found in Annex K, Item 7.2.

The Committee thanked the authors for these studies and look forward to further information on the impacts of the spill on bottlenose dolphins.

Mate presented an update on a tagging study of sperm whales in Gulf of Mexico. An estimated, relative measure of whale foraging effort was highly variable, as sperm whales covered large areas, suggesting sparsely distributed prey with occasional high density aggregations. Tagged whale movements in 2011 depict a ~4,000km^2 oblong area of low use habitat, including the DWH site. Observed whale behaviour suggests poor prey availability in this area. One hypothesis is that benthic oil-contamination reduced bottom-dwelling fish and thus the squid that prey on them. If true, sperm whales represent the apex of a trophic cascade originating from bottom sediment fouling by oil.

The Committee thanked Mate for the update and **recommends** that Gulf of Mexico sperm whales in the vicinity of the DWH oil spill should be monitored to document the extent and duration of possible localised effects as an evaluation process to better understand cumulative effects and possible long-term population consequences.

Overall, the Committee **expresses concern** for the impacts that the Deepwater Horizon oil spill had and may still be having on cetaceans in the Gulf of Mexico. The Committee **agrees** that prevention efforts for oil spills should be maximised. The Committee **reiterates** its recommendations from last year (IWC, 2015f, p.40) that studies to determine long-term impacts on cetaceans in the Gulf of Mexico be continued, that baseline data be collected from other populations at risk, that knowledge about exposure and impacts be maximised, and that analytical methods for oil spill-related compounds be standardised. Finally based on the concern of impacts to cetaceans, the Committee **recommends** that planning begin for a workshop on oil spills and their impact to cetacean populations and habitats.

12.2.3 Contaminant threat assessment

A questionnaire was used to poll subject matter experts about the contaminant issues that should be prioritised for future research. The results of the 'Prioritisation of Chemical Contaminants of Concern to Cetaceans' survey were discussed. Legacy persistent organic pollutants (POPs) remain of concern, along with the flame retardants and polycyclic aromatic hydrocarbons; coastal habitats are the regions of highest priority. Reproduction, reproductive success and survivorship are thought most likely to be affected

---

[6] http://oilspillresponseproject.org/completed-products

through acute and chronic biological effects with the endocrine, immune, and neurological systems most likely to be affected. The Committee **recommends** further evaluation of these body systems, geographic regions and compounds of concern.

12.2.4 Data integration and mapping
The Committee agreed last year (IWC, 2015f, p.45) to hold a focus session on regional trends and status of POPs in cetaceans. A number of experts were invited from Australia, Japan, the UK and the USA and asked to provide the group with information and data for the major contaminant groups, in key cetacean species, across their regions. In some regions and for some cetacean species, monitoring POP concentrations in blubber samples has been carried out since the 1980s. However, the pattern of trends in these POPs, and therefore the current threat that these legacy contaminants may still pose, has not been investigated and the global extent of these surveillance efforts is not known. Some of these datasets now span more than 30 years, enabling regional trends to be investigated. Trends in POP concentrations in cetaceans from five main regions; the North Atlantic, the Mediterranean, the Northeast and Northwest Pacific, the Arctic and the Southern Ocean were discussed and the datasets available shown in Annex K, table 1.

12.2.4.1 NORTH ATLANTIC AND THE MEDITERRANEAN SEA
New research was presented by Jepson on PCBs in European cetaceans, including a European meta-analysis of new and existing blubber PCB concentration data for four cetacean species, which included samples from over one thousand individuals (Jepson *et al.*). Current threats to cetaceans from POPs in Europe appear to be restricted solely to PCBs, with mean concentrations in striped dolphins, common bottlenose dolphins and killer whales around the Iberian Peninsula and western Mediterranean Sea among the highest levels recorded in cetaceans and exceed all marine mammal PCB toxicity thresholds by almost an order of magnitude. These excessively high and temporally stable PCB exposures were associated with small populations, population declines, or range contraction in several dolphin species in both the NE Atlantic and Mediterranean Sea. Marked and ongoing declines in tissue concentrations of organochlorine pesticides have occurred in the UK and western Mediterranean small cetaceans. This study concluded that legacy PCB pollution continues to pose the major health and conservation threat to the top cetacean predators in Europe and will continue to impact these populations without significant mitigation to limit bioaccumulation through marine food webs.

Discussion on the presentation can be found in Annex K, item 7.4. Females may be more susceptible to these types of contaminants, due to contaminant recirculating when the lipid is mobilised to produce milk during lactation. High concentrations of POPs are also problematic for young calves that ingest contaminated milk. Due to their small mass, the dose to calves may be very large, making them more vulnerable. The Committee **agrees** that this issue of continued sources of PCBs is of concern in certain areas and **recommends** exploring ways to further reduce PCB inputs into marine systems, such as mitigating the release of contaminants during sediment dredging operations, as well as considering methods to sequester PCBs that are already released into the environment. The Committee thanked Jepson for compiling and presenting these data.

12.2.4.2 NORTHWEST PACIFIC
Isobe presented information on accumulation levels and temporal trends of POPs in striped dolphins, melon-headed whales and finless porpoises from Japan. There was a significant decreasing trend in PCBs and DDTs in striped dolphins and melon-headed whales, which may be a result of the global decreased use of these chemicals since the 1970s. In contrast, there was a significant increase of the flame retardants, PBDEs (polybrominated diphenyl ethers) and HBCDs (hexabromocyclododecanes), in those species, which may be due to the increased use of these pollutants since the mid-1980s. No clear trends were observed in any other compounds. The Committee thanked Isobe for presenting these findings.

12.2.4.3 SOUTHERN OCEAN
A literature review of POP burdens in marine mammals in Antarctica, Australia, and New Zealand was presented by Bengtson Nash. This review covered 30 papers (Annex K, appendix 3) that targeted 26 species over the past 50 years. A review of the available data for delphinidae species highlighted that there are great regional differences in contaminant burdens. It was evident that levels of organochlorine contaminants appeared to have plateaued in the Southern Ocean over the past two decades and no decline had occurred since implementation of the Stockholm Convention in 2004. Considerable trophic biomagnification was evident when baleen whale data were compared to killer whale data from animals sampled in the region in 2005.

During discussion, it was noted that there were significant gaps surrounding levels and health effects in species dependent upon known contamination 'hot-spot' foraging grounds. In addition, it was suggested that model/regional representative species should be included under the Global Monitoring Plan of the Stockholm Convention. Despite the perceived pristine Antarctic conditions, the Committee noted that cetacean contaminant burdens are not insignificant in this region. The Committee noted the importance of monitoring polar species and **strongly encourages** long-term, comparable data sets to progress the field in this region; a focus on resident and vulnerable species would be ideal. The Committee thanked Bengtson Nash for presenting the Southern Ocean data.

12.2.4.4 NORTHEAST PACIFIC INCLUDING THE ARCTIC
Kucklick presented POP concentration data in white whales from an Arctic region and common bottlenose dolphins from a subtropical region, to demonstrate rates of change of POPs in these two species from two very different temperature regimes - details can be found in Annex K, item 7.4. The study showed that, while concentrations of POPs are generally lower in cetaceans from the Arctic versus those inhabiting more southern locations, changes reflected in the population differ, as warmer geographical locations generally mobilise POPs out of food webs faster than colder regions.

A summary presentation of concentrations of POPs in tissues of North American cetaceans was presented by Ylitalo. Decreasing levels of PCBs, DDTs and organochlorine pesticides were found for several populations; but this trend was not found for certain POP classes determined in Cook Inlet white whales or juvenile gray whales. Concentrations of the PBDE flame retardants, generally, have been increasing since the 1990s. Overall, the highest contemporary concentrations of POPs were measured in blubber of fish- and marine mammal-eating cetaceans that reside near heavily populated areas of North America, such as eastern North Pacific transient killer whales and bottlenose dolphins from Georgia and South Carolina, as well as dolphins sampled off the coast of southern California. More details can be found in Annex K, item 7.4.

The Committee thanked Kucklick and Ylitalo for presenting these data and **recommends** that additional research be conducted in this area. Discussion followed on the Alaska Marine Mammal Archival Tissue Project (AMMTAP). The Committee noted the value of this type of collection protocol and **encourages** development of programmes such as this at an international level, possibly with the International Society of Biological and Environmental Repositories.

12.2.4.5 OTHER INFORMATION
Yasunaga *et al*. (2014) presented data on contaminant concentrations in Antarctic minke whales which were much lower than those in common minke whales from the Northern Hemisphere. Organochlorine levels in Antarctic Area IV were significantly higher than those in Area V, except that DDT levels in both areas were similar. PCBs, DDTs, HCBs (hexachlorobenzenes) and CHLs (chlordanes) levels did not vary or slightly decreased in Areas IV and V during the study period. However, HCH (hexachlorocyclohexane) levels clearly decreased. More details can be found in Annex K, item 7.4.

General discussion of persistent organic pollutant trends can be found in Annex K, item 7.4.

The Committee **expresses concern** about the continued persistence of PCBs, especially in the Northern Hemisphere, despite the overall decline in their use and manufacture. It recommends that research efforts continue to better understand this persistence in the environment. The Committee also **recommends** the continuation of the effort to collect and collate additional contaminant data for cetaceans and the development of a cetacean POPs mapping tool.

The Committee identified the need to better quantify the environmental impacts of PCB contamination, to determine PCB sources and to identify mechanisms to reduce further PCB input into the marine environment. An intersessional working group on PCB sources, exposure data gaps, and options to reduce PCB exposure has been formed.

The POP trend data provided by these experts will be collated by the Pollution 2020 steering group intersessionally for inclusion in a mapping initiative. The trends and status data will be available through a web application that could display potential 'hotspots' or regions where POPs are still of concern and in which species. More detail is provided in Annex K, item 7.4.

A summary of the POP trend data is given in Annex K, item 7.4, table 1. The Committee thanked Hall for her efforts and **agrees** that making this database more broadly available, as well as incorporating information collected via SOCER, or other mechanisms, to the database, would be of value.

Kucklick presented information on the activities of the Arctic Monitoring and Assessment Programme (AMAP) that summarised data on POPs in the Arctic. Several types of environmental sample data were summarised, including those related to humans, air, fish and marine mammals. A major task of the working group was to decide how to report POP data that often is reported differently by different groups (Wilson *et al.*, 2014). The second activity of the AMAP POP Expert Group was to prepare a summary on chemicals of emerging concern that is relevant to the Arctic which will be available in 2016. These contaminants of concern are listed and discussed in Annex K, item 7.4.

The Committee thanked Kucklick for providing this valuable summary.

12.3. Cetacean Diseases of Concern (CDoC)[7] and mortality events
12.3.1 CDoC
Information on the prevalence of the ectoparasite cyamid, *Cyamus ceti*, on Bering-Chukchi-Beaufort Seas (BCB) bowhead whales harvested for subsistence purposes from 1973 to 2014 was presented in SC/66a/E07. The bowhead cyamid study was motivated by previous work on North Atlantic right whales. In those studies, visual health assessment analyses indicated that the spatial distribution and abundance of cyamids was strongly correlated with host health and body condition. This study found that cyamids were at low numbers and that older whales had a higher probability of cyamid presence. In some cases, heavy infestation of cyamids appears to be related to whales in compromised health. Variability in the prevalence and intensity of cyamids may serve as a bio-indicator of change in bowhead whale health and environmental conditions. The authors noted that the cyamid assessment in bowhead whales is still a work in progress, and that conclusions may change. The Committee thanked the authors for presenting these interesting findings.

Information on the natural morbidity and mortality rates of BCB bowhead whales was presented in SC/66a/E08. General knowledge about diseases and natural causes of morbidity and mortality of bowhead whales and other large whales, in general, is limited. The

---

[7] This topic and working group were known as 'CERD' – 'cetacean emerging and resurgent diseases' prior to this meeting when the Committee agreed to change its name to 'CDoC' – 'cetacean diseases of concern'.

data provides important baseline information for BCB bowhead whales under changing Arctic conditions. The future health assessment work outlined in the paper will provide unprecedented retrospective health information for an ice-adapted large cetacean during the Arctic Anthropocene.

The Committee thanked the authors for bringing this information forward, noting that this is the longest health assessment data record for a large whale. The Committee **encourages** collaborative efforts among researchers to standardise health status parameters for assessments on bowhead whales and white whales.

As part of a long-term cetacean study, during regular whalewatching trips off the Canary Island of La Gomera, small cetacean sightings were documented photographically from 1996 to 2014, and anomalies of different types were analysed in Ritter *et al.* (2015). A number of causations for each category of anomaly were considered including: (1) ship strikes and entanglement; (2) skin diseases such as infections and scars from predators/parasites; and (3) food shortage or internal diseases. Documenting anomalies, even if conducted in a less systematic way from platforms of opportunity, can contribute to assessing the health status of small cetacean populations. In multi-species habitats like the Canary Islands, the comparison of levels of affliction can help understand the impact of anthropogenic threats to different cetacean species sharing the same environment.

The Committee thanked the authors for presenting these interesting findings, and **encourages** inclusion of the skin disease photographs presented in the paper on the CDoC website.

Van Bressem *et al.* (2014b) presented information on the first documented case from a balaenopterid of a tattoo-like skin disease; lesions on Arabian Sea humpback whales (found from a review of a photo identification dataset generated from small vessel surveys conducted in Oman between 2000 and 2011). The paper noted an increased prevalence from 2000-02 to 2010-11. It was hypothesised that this condition may be more widely distributed than existing records document, suggesting that further studies should investigate the distribution, epidemiology, trends and potential health impacts of the disease.

In discussion, it was noted that Soviet whale catch data indicated that this population had high level of hepatic pathology. In consideration of its isolation, low genetic diversity, low abundance estimates from Oman, emerging threats, and five mortalities over a 5-month period in 2015 (Annex H, item 4), the Committee **reiterates** its concern about the future and continued health of this population (and see Item 10.12). It therefore **recommends** that further efforts be initiated to evaluate the health of this population through health studies and increased information on conditions and causes of morbidity and mortality from strandings. The Committee **recommends** that technical support be offered and extended to stranding responders in Oman through the CDoC, to assist with this effort. The Committee also noted that the Ministry of Environment and Climate Affairs in Oman has requested IWC entanglement response training and stranding response training. The members of CDoC might coordinate with this effort to provide appropriate expertise on the health assessments of this population (see Item 10.12.3).

In Van Bressem *et al.* (2014a), the authors summarise how significant progress in our understanding of the epidemiology, molecular biology and pathogenesis of cetacean morbilliviruses has been made since the first strains were detected in 1988. Cetacean morbillivirus is a distinct species within the morbillivirus genus that has caused epidemics with high mortality in odontocetes in Europe and the USA, individual cases of disease in numerous countries, and has also caused disease in mysticetes. The paper made several recommendations for future research focus which can be found in Annex K, item 8.1.

The Committee **welcomes** this international collaboration on a disease of concern to cetacean populations worldwide and **recommends** that CDoC consider these suggestions.

Rowles provided an update on the US mid-Atlantic coast morbillivirus unusual mortality event, noting that the peak of morbillivirus cases in common bottlenose dolphins occurred in autumn 2013 off the coast of Virginia and northern North Carolina and that cases spanned from New York to the Florida Keys. In previous morbillivirus outbreaks, it was noted that PCB exposure in marine mammals has been associated with immune suppression; thus, animals with high levels of these contaminants may be more susceptible to epizootics.

The Committee noted that this investigation and the follow up work on phylogeny of cetacean morbilliviruses was also a collaborative effort with experts from other countries (e.g. Canada, Australia, Costa Rica). However, often during epidemics or die-offs, information between countries may not be rapidly disseminated as there is no single venue to communicate the information to other researchers in nearby regions. The Committee **recognises** the importance of global understanding of the impacts of viruses such as this on cetaceans and strongly **encourages** continued research in this study area. The Committee noted that the newly established disease section of the IWC website and other communication tools may serve as a communication site for these international outbreaks.

Early studies assessing metabolite content in dolphin breath were presented (Aksenov *et al.*, 2014). Initial results support that breath condensate may be a valuable indicator of ill dolphins.

The Committee **welcomes** this paper and expected future work, and **encourages** the further development of this technique to assess the health of wild populations of cetaceans. The Committee also **encourages** its use to study 'stinky' gray whales, noting the unresolved questions surrounding this issue.

Rosa presented information discussed at a pre-meeting with the objective of prioritising the likely needs of the international community with regards to emerging and resurging diseases of cetaceans (including infectious and non-infectious disease), and to identify the most effective role that the Committee might play with regards to disease surveillance, diagnosis, and risk management. The Committee reviewed the database and discussed recommendations for further development.

The Committee **recommends:**

(a) increased focus on website finalisation and maintenance, especially for implementation of 'Phase 2' (the reporting function of the website);
(b) improved outreach and capacity building to/between veterinarians and biologists, as well as between the Commission and non-Commission participants through a variety of mechanisms, such as listserves, sharing resource lists and web sites;
(c) development and maintenance of a list of cetacean reference or diagnostic laboratories that would be available as a resource on the Commission website for cetacean biologists and veterinarians - the information on this list will be obtained through other bodies or requests to member countries;
(d) expansion of the extended expert list and maintain the quarterly CDoC updates.

The Committee thanked the steering group for the work they have done on the website. It was suggested that the CDoC intersessional steering group should also consider using skin biopsies as a means of monitoring disease and changes in skin microflora ('microbiomics') associated with physiological changes, and appropriate protocols to store biopsy samples to aid such studies.

12.3.2 Strandings and mortality events
Information was presented from SC/66a/Rep09[8], the report of the 2nd workshop on mortality of southern right whales at Península Valdés, Argentina. Difficulties in both response and investigations when large numbers of whales die and strand during a short period of time was discussed. The response and investigation has involved cooperation among technical experts from many countries and relied heavily on established in-country programmes, such as the Southern Right Whale Health Monitoring Programme (established by a consortium of NGOs in Península Valdés in 2003) and the Red de Fauna Costera from Chubut province. As noted under Item 10.8.1, the Committee **welcomes** this update on the southern right whale mortality in Península Valdés and **encourages** continued investigations and cooperation among research groups to monitor the population's health and determine the causes of the mortalities.

The Committee received an update the Marine Mammal HealthMAP project[9]. Information on the occurrence of elevated California sea lion pup mortalities together with oceanographic data (e.g., sea surface temperature) was shown as an example of how the mapping system could be used. The Committee noted that HealthMAP can provide information on marine mammal health and disease to help determine the potential impacts on populations. It **encourages** further development of this dynamic tool. The Committee thanked all of the presenters for their hard work and encourages continued work on disease and cetaceans.

The Committee noted that a lack of baseline data collection was a major area of concern and **recommends** evaluation of the stranding progress reports to determine the utility of the current fields, consideration of adoption of potential new fields, or expansion of the reports in a way that would provide more value to member countries (e.g. with a mapping function of strandings, or reporting mass stranding events). Noting that the progress reports are primarily an information tool stating where data can be found than a database *per se* (see Item 3.2), the Committee tasks the CDoC intersessional working group under Simeone with consideration of these items, as well as evaluating the 2011 Stranding Network List, to determine the most appropriate way to gather more information.

Further discussions on events in several regions highlighted the need to identify ways to improve stranding response capacity and identify the manner in which the IWC might assist in improving stranding response and investigations with member countries and non-member countries. Suggestions for improvement are found in Annex K, item 8.2. The Committee **strongly encourages** governments to support the maintenance of stranding networks as an important source of data and, where possible, expand capacities. The standardised collection of data using appropriately elaborated necropsy protocols is also **recommended**.

Finally, the Committee **agrees** to the terms of reference and draft agenda for the workshop on 'Investigations of large mortality events and mass strandings' (Annex K, Appendix 2).

12.4 Effects of anthropogenic sound on cetaceans and approaches to mitigate effects
12.4.1 Update on soundscape mapping
Although no update on the soundscape mapping was presented, the CetSOUND website[10], which was presented to the Committee last year, provides information on soundscape mapping.

12.4.2 Masking
The Committee has considered underwater sound since 2004 (IWC, 2005b, p.268) and the Committee focussed upon 'masking sound' from low-frequency noise in 2010 (IWC, 2011a, p.41). Since then, there have been a number of advances in the mathematical

---

[8] This report is also discussed in Annex F.
[9] http://www.sccoos.org/projects/marine-mammal-health-map/
[10] http://cetsound.noaa.gov/cetsound

and statistical techniques used to model population consequences of disturbance (PCoD), including the incorporation of underwater sound (New *et al.*, 2013a; 2013b)

The Committee **recommends** a focal-topic session be held at the 2016 Annual Meeting to: (1) update the Committee on progress made on 'masking sound' with a particular emphasis on noise from commercial shipping; (2) provide an overview of the PCoD framework; and (3) explore ways that the PCoD and similar frameworks could be modified to predict population consequences of acoustic masking. The Committee **recommends** that an intersessional correspondence group **encourages** participants to attend and identify subject matter experts to present at this focal-topic session, especially researchers that have expertise in drawing linkages among acoustics, foraging ecology, physiology, demography, statistics and modelling dynamics of marine mammal populations.

12.4.3 Evaluation of stress and sound
Atkinson *et al.* (2015) reviewed current scientific knowledge of the physiology of the stress response in marine mammals and additional information was provided by Houser on the relationship between noise exposure and stress hormone levels - this information is summarised in Annex K, item 9. In discussion, concern was noted for situations in which the animals are unable to respond appropriately (with either too much or too little hormone response) or when they are chronically stressed, as all three situations may negatively affect cetacean health. The Committee also **recommends** that researchers attempt standardisation of hormone analysis whenever possible, including comparing trends and patterns as well as focusing on absolute numbers. The Committee **recommends** that plans for a future workshop be developed next year for 2017 or 2018.

12.4.4 Other sound related issues
Houser presented information on auditory evoked potentials (AEP), a method that is non-invasive and frequently used in hearing-impaired human infants. The use of AEP has rapidly increased the rate at which information on hearing capabilities in marine mammals is obtained and is used routinely in live cetacean stranding situations in the USA for evaluation of hearing.

A number of issues hamper the use of AEP-acquired thresholds in establishing species-specific baseline hearing capabilities. One critical issue is the use of different methods for determining the hearing threshold in odontocetes. Methods vary across researchers and laboratories and can result in large differences in threshold estimates for the same species, or even the same individual. The Committee thanked Houser for this presentation. The Committee **agrees** with the need for standardisation of scientific methods and analyses.

The Committee noted that ACCOBAMS has a resolution that reaffirms that anthropogenic marine noise is a form of pollution which can have adverse effects on marine life (Resolution 5.15). ACCOBAMS plans to: (1) identify anthropogenic noise/cetaceans interactions hot spots within its area; and (2) map and develop a monitoring of sea ambient noise, particularly in cetaceans critical habitats. The Committee **encourages** presentation on a report of this work at next year's meeting.

To conclude the topic of underwater noise, it was highlighted that discussion on the effectiveness of Marine Mammal Observers (MMOs) as a mitigation measure for underwater sound was a topic of interest that has been included in the Committee's work plan. The Committee **encourages** submission of papers on MMO effectiveness at next year's meeting. ACCOBAMS is also addressing the issue of MMOs and a working document will be presented at the next ACCOBAMS Scientific Committee meeting.

The Committee **encourages** continuation of this international collaboration on issues of sound and marine mammals.

12.5 Effects of climate change on cetaceans
Simmonds presented an overview of the history of the Climate Change issue within the Commission (see Annex K, item 10.1) then gave the report of the 2014 Climate Change Steering Group. The Steering Group considered that progress on the topic may have been hindered, in part, by misconceptions regarding climate change as a subject area, and this could be partially resolved by clarifying and defining separate individual threats and issues currently falling under the blanket term of 'climate change'. There might also be an underlying belief that work cannot be successfully progressed because of a lack of data and poor predictive power of available climate tools, which have in fact now improved.

Modelling methods predicting species- and ecosystem-level responses to climate change are being developed, and existing terrestrial models such as the bioclimatic envelope model have been refined to include demographic parameters and population dynamics, and applied to the marine environment. Understanding of the physiology, behaviour and trophodynamics of oceanic top predators in response to climate change has also improved in recent years. The Climate Change Steering Group, noting some progress made by the Committee, recommended the following steps:

(1) The Committee should hold a joint session of all its relevant sub-committees to consider this topic and agree a two-year work programme. This should include a review of existing work streams to consider where climate change related matters might best fit. The matters that should be considered in this work programme are identified in section 2 below; and

(2) Every effort should be made to work expeditiously and in concert with other international multilateral bodies that are also trying to progress this topic including *inter alia* the Convention for Migratory Species (which has a comprehensive work

programme on climate change), the Convention for Biological Diversity and the IUCN Species Survival Commission's Cetacean Specialist Group and Red List sub-group.

The Committee **agrees** that the joint session in item (1) was achieved with the joint session between EM and E, as well as representation from SM. However, the two-year work programme will need to be developed by the intersessional working group on climate change. The Committee **endorses** the recommendation for international collaboration and integration of datasets described in (2) and referenced additional potential collaborations that aim to provide an integrated ecosystem approach.

The Climate Change Steering Group also considered recommendations for future research and reiterated, in particular, the importance of maintaining long-term studies and giving consideration to defining and identifying restricted habitat. It made recommendations to:

(1) review and identify mathematical and statistical models that can integrate the demographic consequences of climate change;
(2) enhance ongoing liaison between sub-committees;
(3) further consider existing data sets to investigate plausible climate change scenarios (and see report of the second workshop on climate change – (IWC, 2010c, pp.451-80)
(4) consider ecological refugia;
(5) liaise with other relevant international initiatives; and
(6) facilitate the development of unpublished relevant datasets and unanalysed biological materials.

The Committee **agrees** that a review of mathematical and statistical models, particularly those used in fisheries, is desirable, and that by further clarifying optimal models and a more defined focus and scope, this work will be more manageable. The Committee **recommends** that the intersessional working group refine their TOR to include clarification about the scope of this work, a more explicit definition of the recommendations for research with actions for the intersessional group to achieve. In addition, because the Committee's recommendations encompass the work of several sub-committees, the Committee **recommends** expanding the intersessional working group to include members from other sub-groups. The intersessional working group will refine its terms of reference to encompass the above recommendations and report back to all relevant sub-committees during the 2016 Annual Meeting.

In order to provide effective evaluation of available observations and modelling tools, the Committee **agrees** to focus work on actionable activities that support the work of other sub-committees and the Commission. With reference to SC/66a/Rep07 and to discussions on the Arctic, the following foci (and links to other sub-groups) are encouraged:

(1) riverine/freshwater and coastal small cetaceans (connection with SM);
(2) large whales in polar habitats – ecosystem focus (LTER & DBO), and relationship to emerging issues of ship strike, entanglement and underwater noise (connection with EM & HIM); and
(3) the development of further links with appropriate international bodies.

It was noted that the tools in development by the Pollution 2020 and CDoC activities would support all three foci.

The Committee also **recommends** that efforts be made to develop plans for a special volume on cetaceans and climate change.

12.6 Arctic issues
George *et al*. (In press) examined correlations between summer sea ice conditions and upwelling-favourable wind in the Beaufort Sea on the body condition of Bering-Chukchi-Beaufort (BCB) sea bowhead whales. A summary can be found in Annex F. The Committee welcomed this study and encourages further work in this area.

In March 2014, the IWC held a workshop on the impacts of increased marine activities on cetaceans in the Arctic (IWC/65/Rep07 Rev1). Four priority recommendations from the workshop report provided a framework for discussion of the development of a plan for climate change work focused in the Arctic region. Provisional responses to the four priority recommendations are provided below, followed by potential cooperative actions, as discussed by the Committee.

(1) Increased cooperation with the Arctic Council
The Conservation of Arctic Flora and Fauna (CAFF) is the biodiversity working group of the Arctic Council. Two activities where members of the Committee have, or are, contributing expertise include: (a) the Arctic Biological Assessment (ABA; see Laidre *et al.*, 2015) and (b) the Circumpolar Biodiversity Monitoring Programme (CBMP). The CBMP includes a Marine Mammal Expert Network. The mandate of the Protection of the Arctic Marine Environment (PAME) working group is to address policy and non-emergency pollution prevention related to the protection of the Arctic marine environment. Two areas where the Committee could contribute expertise include (a) the Arctic Marine Shipping Assessment (AMSA), and (b) developing a framework for a Pan-Arctic Network of Marine Protected Areas. It was noted that development of a MPA Network is one (of 13) initiatives identified for action during the US Chairmanship (2015-2017) of the Arctic Council. For more specific items of collaboration see Annex K, item 11.

(2) Increased cooperation with the International Maritime Organisation (IMO)
In November 2014, the IMO adopted the mandatory International Code for Ships Operating in Polar Waters (Polar Code) - details can be found in Annex K, Item 11. There are two IMO Resolutions relevant to this Committee's activities: (a) voyage planning in

remote areas (adopted in November 2007); and (b) ship reporting in the Arctic region (adopted November 2012). Currently, the mandatory ship reporting system applies only to ships in the Barents Sea Area.

It was noted in discussion that a recent evaluation and relevance of a Particularly Sensitive Sea Area (PSSA) for the Bering Strait is now available (Hillmer-Pegram and Robards, 2015). This may be another avenue for consideration/cooperation between the IMO and the IWC. For more specific items of collaboration with IMO see Annex K, item 11.

(3) Increased-cooperation with stakeholders
Several actions were recommended for the Secretariat with regard to fostering increased interactions with stakeholders. The overarching goal is to express the interest of the IWC in cooperating with and providing advice on issues of mutual interest. The Secretariat is ready to take action on this recommendation, via formal letter to specific stakeholders, once co-operative partners and actions are identified. The Committee **encourages** Committee members to begin to identify cooperative partners and actions.

(4) Scientific matters
The Workshop report listed four recommendations for this Committee. With regard to the first recommendation, it was noted that Laidre *et al.* (2015) provides a summary of Arctic cetacean population status and Moore and Gulland (Moore and Gulland, 2014) provide a framework for the development of a Marine Mammal Health Map to support the evaluation of non-direct threats to cetaceans. An intersessional Steering Group was formed to review and prioritise the remaining science-related recommendations, and report to the 2016 Annual Meeting.

12.7 Habitat

12.7.1 Marine Debris
12.7.1.1 REPORT FROM 2ND WORKSHOP
There have been two recent workshops held under the auspices of the Commission related to marine debris. The first workshop was focused on an evaluation of known effects of marine debris on cetaceans (IWC, 2014c, pp.521-41). The workshop made many recommendations, and highlighted the importance of trying to distinguish whether or not entangling gear was active or derelict at the time of entanglement. It also called for improved data-sharing and recommended that marine debris interactions should be reported by Commission Members in National Progress Reports. It also recommended that: debris sampling should be conducted during cetacean field studies; there should be improved efforts to work with industry and fishermen; and that the Scientific Committee should work to further evaluate the risks of ingestion. Finally, the desirability of working in collaboration with other intergovernmental bodies on this issue was highlighted.

The second workshop (IWC/65/CC Rep04) was held in August 2014 in Hawaii. The primary objectives were to explore how the Commission can engage with the existing international and regional mitigation efforts concerning the management of marine debris, determine how best to ensure that these efforts are updated on cetacean-specific impacts of marine debris, and advise on how best the Commission can lead and engage in regions where marine debris has the greatest potential impacts on cetacean populations.

Topics that were discussed included fishing gear marking, potential gear modifications, methods for identifying debris hotspots, modelling approaches, and work conducted on other species, such as seabirds and turtles. In addition, debris ingestion, the role and responsibilities of the International Maritime Organisation's (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL), fishing gear recycling programmes, and governmental and non-governmental marine debris programmes were also discussed. The Workshop agreed that the Commission's primary contribution should be to ensure that cetacean-related issues are adequately represented within existing initiatives, and that its strong scientific and other expertise is made available in collaborative efforts.

The workshop also made specific recommendations for collaboration with the IMO and the South Pacific Regional Environment Programme (SPREP), the incorporation of data on marine debris into National Progress Reports in a standard format, and development of a global Commission entanglement database.

Further workshop recommendations can be found in Annex K, item 12, and the workshop also strongly recommended that the Secretariat work with the secretariats of other intergovernmental organisations and Regional Fisheries Management Organisations (RFMOs) to ensure consistency of approach, synergy of effort and exchange of information to develop appropriate mitigation strategies that recognise that prevention is the ultimate solution, but that removal is important until that ideal is realised. The workshop also recommended that individual Commission Members collaborate with such initiatives and that the Commission continues to highlight issues surrounding marine debris and cetaceans.

12.7.1.2 OTHER MARINE DEBRIS INFORMATION
SC/66a/E5 provided an update on recent published research into marine debris and the impacts on cetaceans. Without improvements in waste management, the cumulative quantity of plastics available to enter the ocean from land is predicted to increase by an order of magnitude by 2025 (Jambeck *et al.*, 2015). The review contained information on microplastics in many ecosystems and prey species and marine debris ingestion in several cetacean species. Work by ACCOBAMS on marine debris was also discussed (see Annex K, item 12.1.2 for details). SC/66a/E4 provided an overview of at least some of the current international initiatives that are focused on marine debris - details are provided in Annex K, item 12.1.2. It was suggested that the Committee should explore ways

of combining estimates of oceanic debris and information on cetaceans to identify priorities for mitigating and managing the impacts of marine debris on cetaceans, and that marine debris might be considered as a topic for a 'Conservation Management Plan' (CMP).

The Committee **recommends** that instead of a CMP on marine debris, the possibility of a broader threats-based CMP should be considered at the Joint Meeting of the Conservation and Scientific Committees that follows SC/66a. Consideration could be given to bycatch and other entanglement as a focus.

In recognising the need to provide robust advice to the Commission on the emerging threat to cetaceans of marine debris and in light of existing activities already underway in other IGOs, the Committee **agrees** that the focus of effort on this topic should:

(1) address key gaps in our understanding of the extent and significance of marine debris impacts on cetaceans;

(2) disseminate the outcomes of the IWC Marine Debris workshops and, in particular, promoting the standardised collection of ingestion and entanglement data during necropsies of stranded and bycaught cetaceans, including through the development of a standardised data collection forms and the dissemination of the necropsy guidance to strandings networks;

(3) facilitate the collation of relevant data, including via information requests to, for example, listserves such as 'MARMAM' and directly to strandings networks requesting submission of information/analyses to the Committee on:

    (a) occurrences and rates of debris ingestion and entanglement and pathology observed;

    (b) potential methods that may be used to help distinguish entanglement in active fishing gear as opposed to 'ghost' [lost/discarded] gear;

    (c) entanglement between vulnerable cetacean populations/species and marine debris may be of particular concern e.g., deep sea habitats; and

    (d) possible improvements to existing data collection/monitoring activities or modelling/mapping techniques that could improve the provision of scientific advice.

(4) give consideration to whether more can be done to facilitate the collation and analysis of available data to investigate the impacts of debris ingestion and entanglement at an individual and population level, including that of microplastics i.e. through the creation of specific databases or by improving interoperability between existing database initiatives;

(5) identify relevant information that IWC member nations should include in national progress reports to the Scientific Committee and Conservation Committee; and

(6) develop and maintain a directory of researchers involved in investigating interactions between cetaceans and marine debris.

The Committee **agrees** that an intersessional correspondence group on marine debris under Simmonds will be established to assist in these endeavours.

In terms of the development of suitable liaison with other IGOs (as previously recommended and elaborated in papers SC/66a/E04 and E05) - and noting that the Commission may need to interact with some of them on a number of topics (e.g., IMO on noise, ship-strikes and perhaps ship-originated wastes) – the Committee **recommends** that the Secretariat liaise with members of the SWG's intersessional working group on marine debris to identify appropriate opportunities.

SC/66a/E6 presented the results of an analysis of stranding data from the German stranding database. Between 1990 and 2014, nine cases of marine debris-porpoise interaction were recorded out of 533 harbour porpoise carcasses that were collected along the coast of Germany. Findings included external attachments of netting and fishing lines, as well as ingestion of plastic items and fishing lines. While comparably few cases (1.7%) were documented in the database, it is assumed that not all marine debris-porpoise interactions were detected and/or documented.

The Committee **agrees** that marine debris interactions may not have been found or recorded in historical data, especially if the cause of death was not fully attributable to marine debris. However, entanglement or ingestion of marine debris may contribute to the cause of death, as it may weaken the animal and make it more susceptible to other threats. Additionally, it was noted that the issue of microplastics is still emerging and methods to test for microplastics have only recently been (Besseling *et al.*, 2015; Lusher *et al.*, 2015); therefore, it is very unlikely that microscopic marine debris would have been found and recorded in stranding data even when present.

12.7.2 Other habitat issues
SC/66a/E9 summarised a spatial analysis of critical habitats for coastal cetaceans in Golfo Dulce, Costa Rica with consideration for a marina construction project. Golfo Dulce harbours critical habitats for coastal cetaceans, specifically critical foraging habitats for inshore common bottlenose dolphins and humpback whale nursing and calving habitat. Golfo Dulce is also affected by major coastal development projects, in particular the construction of a new marina. The increase in maritime traffic will potentially increase the likelihood of collision between ships and humpback whale calves and juveniles, as well as adding to acoustic pollution which could disrupt their breeding behaviour.

The Committee welcomed this paper. While this study has been presented to the Costa Rican authorities, the fate of the marina project remains unclear. The Committee **expresses concern** over proposed coastal development in Golfo Dulce in light of the presence of critical habitat for humpback whales and bottlenose dolphins. It **urges** the government of Costa Rica, paying due regard to the need for precautionary action, to ensure rigorous impact assessments are undertaken, that potential negative impacts are fully mitigated, and that appropriate pre- and post-development monitoring is carried out. Further, the Committee **recommends** that the

Secretariat transmits these concerns to the Ministry of the Environment and the Interinstitutional Commission of Marinas (Ministry of Tourism) of the Government of Costa Rica[11].

12.8 Consideration of environmental concerns in light of Resolution 2014-4
Last year the Commission passed resolution 2014-4 directing the work, finances and rules of procedure of the Scientific Committee and some sections were particularly relevant to the work of the SWG on environmental concerns. The Committee **recommends** that these sections be considered under its deliberations, the work plan, and the budget. The Committee **agrees** that conservation-related Committee recommendations may be relevant to the wider international community and should be highlighted and compiled by the Secretariat.

In discussion, it was noted that there is a need to continue to communicate critical conservation issues to the broader scientific community. Therefore the Committee **recommends** that, in addition to the non-contracting governments, IGOs, and agencies, the Secretariat should circulate relevant Committee recommendations to the wider marine mammal and scientific community (via outreach such as the MARMAM listserv).

12.9. Work plan
A two year overview of the Committee's work plan in matters relating to environmental concerns is given in Annex K, Item 14, table 2 and item 12. The Committee also **recommends** that, as part of their work plan, the CDoC Intersessional Working Group also consider and identify new techniques such as biopsies to assess the health of wild populations of cetaceans.

The work plan on general issues related to environmental concerns is given as Table 1.

Table 17

Work plan on matters related to environmental concerns.

Item	Intersessional period/groups	SC66b
SOCER	Collate report with focus on Polar regions	Receive report
Pollution 2020 and related matters	(1) Continue to refine consequence model – focus on PAHs; (2) *In utero* transfer analyses and modelling; (3) Intersessional group on risk and mitigation for PCBs.	Review progress
Oil spill impacts	(1) Plan for workshop; (2) Co-ordinate with development of Global Oiled Wildlife System.	Finalise workshop proposal; Discuss other related matters
Data integration and mapping of POPs and trends	Intersessional group to determine format and develop maps.	Receive report and consider future actions
CDoC	(1) Increase focus on website finalisation and maintenance; (2) Improve outreach and capacity building including listserves etc.; (3) Expand expert list and maintain quarterly updates.	Review progress
Strandings and mortality events	(1) Plan and host workshop (in conjunction with SMM conference); (2) Consider stranding reporting including evaluating 2011 stranding network list and encouraging their support and development.	Receive report of workshop and intersessional group and determine future actions
Effects of anthropogenic sound	(1) Develop plans for focal topic on 'masking' at 2016 meeting; (2) Develop plans for workshop on stress; (3) Support ACCOBAMS work on noise; (4) Encourage papers on MMO effectiveness.	(1) Focal session on 'masking'; (2) Finalise proposal for stress workshop; (3) Receive report of ACCOBAMS work; (4) Focal session on MMO effectiveness.
Climate change	(1) Steering Group to focus on several factors listed under Item 12.5; (2) Plan for special issue on climate change and cetaceans.	Receive recommendations from Steering Group and develop work plan
Arctic issues	Intersessional group to review and prioritise scientific work	Receive report and develop work plan
Marine debris	Intersessional group to assist with focusing efforts on this topic including assisting Secretariat	Receive report and develop work plan
Other matters	Secretariat to: (1) send copy of recommendation on marine development in Golfo Dulce, Costa Rica; (2) Transmit recommendations to wider scientific community	Review progress.

13. ECOSYSTEM MODELLING

The report of the Working Group on Ecosystem Modelling is given as Annex K1. This group was first convened in 2007 (IWC, 2008a). 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.

Each year, the Working Group reviews new work on a variety of issues falling under three areas:

---

[11] http://www.tourism.co.cr/traveling-to-costa-rica/costa-rica-tourism/inter-institutional-commission-of-tourist-marinas-and-wharves.html

(1) reviewing ecosystem modelling efforts undertaken outside the IWC;

(2) exploring how ecosystem models can contribute to developing scenarios for simulation testing of the RMP; and

(3) reviewing other issues relevant to ecosystem modelling within the Committee.

13.1 Review ecosystem modelling efforts undertaken outside the IWC
13.1.1 Update from CCAMLR's Ecosystem Monitoring and Management Programme (WG-EMM) on krill and its dependent predators
Currey presented the relevant items of the Observer's Report from CCAMLR (Annex C of SC/COMM/1) focussing upon (and see Item 4.1):

(1) A proposed joint CCAMLR-IWC workshop on the development and application of multi-species models to the Antarctic marine ecosystem;
(2) Coordination of photo-identification libraries;
(3) Fish losses (primarily *Dissostichus* spp.) due to depredation by cetaceans, in particular killer whales and sperm whales;
(4) Ecosystem interactions, particularly in relation to Type C killer whales in the Ross Sea (SC/65b/SM6; Eisert *et al.*, 2014)
(5) Baleen whale sightings associated with surveys between 2010 and 2014 near the South Orkney Islands (Krafft *et al.*, 2014; Orgeira *et al.*, 2014).

13.1.2 Update on planning for joint IWC-CCAMLR activities in 2016 and beyond
The background and rationale for a joint IWC-CCAMLR Workshop in 2016 are detailed in item 2.2 of Annex K1. This workshop is part of an initiative by the Committee to foster collaboration between the two organisations, with particular focus on the development and application of multi-species models to the Antarctic marine ecosystem. Currey reported on his presentation of the workshop proposal to CCAMLR in October 2014. They recommended that the objectives of the joint workshop be broadened to include other activities of mutual interest (e.g. (1)-(4) under Item 13.1.1) and endorsed the formation of a Steering Group to progress the proposal.

The Committee **agrees** with this recommendation by CCAMLR and further **encourages** the use of the joint workshop as an opportunity to increase knowledge on specific species and/or management areas, possibly focusing on the Antarctic Peninsula is high-priority area for both CCAMLR and IWC. A joint Steering Group was formed with members from both organisations (Annex K1, table 2), which will develop terms of reference for the joint workshop intersessionally, and consider participation and contributions to the workshop against these, and confirm timing.

13.2 Explore how ecosystem models contribute to developing scenarios for simulation testing of the RMP
The Committee welcomed SC/66a/EM02 that reports on progress on using the individual-based energetics model (IBEM) in the exploration of the relationship between $MSYR_{1+}$ and $MSYR_{mat}$. This work is now primarily directed towards the work on the RMP (see Annex D, item 5.1 for further discussion).

13.3 Review other issues relevant to ecosystem modelling within the Committee
13.3.1 Update on Antarctic minke whale body condition
For the last five years the Committee has discussed apparent declining trends in blubber thickness and body condition in Antarctic minke whales (Konishi *et al.*, 2008) over the 18 years (1987/88-2004/05) of the JARPA special permit programme (IWC, 2011a; 2012b; 2013b; 2014d; 2015f). This item is relevant to ecosystem modelling because the findings have implications for energetics, reproductive fitness, foraging success, and the prey base itself, all of which are important as input in models. A number of concerns have been raised and addressed on the statistical methods that were used to derive these trends.

Konishi and Walløe (In press) provided an updated version of the work conducted during the meeting last year (IWC, 2015i, pp.284-89) based upon which the Committee had concluded that: '*In discussion of these further analyses, the Committee agrees that the analyses which it had requested last year, and those requested by the Review Panel, had been satisfactorily completed.*' At this year's meeting, these analyses were presented in more detail and with a number of diagnostic plots, together with results which were similar to those obtained during the meeting last year. These results indicated that important changes took place in the Antarctic ecosystem during the 1990s. The authors argued that the most important cause of the changes was most likely to have been the simultaneous increase in numbers of other krill feeders, especially humpback whales.

De la Mare and McKinlay held the view that the real issue was the heterogeneous manner in which the data were collected, and disagreed with last year's statement from the Committee that the analyses requested in IWC (IWC, 2015i, pp.279-281) and later by the expert panel had been satisfactorily completed (Annex K1, appendix 2 in Annex K1 provides a compilation of these past recommendations). In particular, they considered that the following points had not been fully addressed:

(1) Develop a conceptual model of the system under consideration.
(2) Use the conceptual model to identify a set of covariates to consider in the modelling.
(3) Start with a 'full model' and base selection of which factors to include and of which of their interactions to treat as random effects on a reduction process.

67

(4) Apply both Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) as model selection criteria to simplify models and examine the sensitivity of results to the different models selected.

Further, in SC/66a/EM01, McKinlay and de la Mare discussed the relative merits of using AIC or BIC in the process of statistical model selection, considering that this choice had been a matter of contention in the analyses of Antarctic minke whale nutritive condition. The authors, drawing on both the statistical literature and results from a simulation experiment, provided recommendations on appropriate practice in the development and presentation of statistical analyses that use model selection. They concluded that the choice of which information criterion to use depends on the purpose of the analysis, the sample size, and the specifics of the realised experimental design. In the specific case of analyses of Antarctic minke whale nutritive condition, simulation results conditioned on the realised spatial and temporal sampling patterns of data collected during JARPA indicated that, based on the actual sample sizes, it was likely that models selected using BIC underestimated the complexity necessary to adequately capture the main features of the data.

In response, Konishi and Walløe argued that BIC should be preferred over AIC to be able to select the best model out of a number of possible models in a complex situation with many potential explanatory variables, interaction terms and random effect terms, and a large number of data points. AIC has a positive probability of overestimating the true dimension, even asymptotically, and in practical statistical work AIC tends to overestimate the number of parameters needed. As an illustration, Konishi and Walløe repeated the model selection procedure used in (Konishi and Walløe, in press) for the dependent variable FatWeight, but using AIC as a selection criterion instead of BIC, which was used in the paper. Three new terms were included in the final AIC model, two random effect terms and one ordinary categorical variable, and the degrees of freedom increased from 7 to 21. However, for the AIC-based model, the fat weight declined over the JARPA years by 9.1 (SE=2.6) kg/year, which was not very different from the 8.3 (SE=1.4) kg/year obtained from the much simpler model using BIC.

Konishi and Walløe also stated that the 'full model' presented by McKinley and de la Mare in SC/66a/EM01 was far too complex to be a reasonable 'full model', but even so they had tried to reduce this model with FatWeight as the dependent variable using both BIC and AIC. Despite issues with singularities in the solution of this complex model, Konishi and Walløe concluded that both BIC and AIC showed a statistically significant decline in fat weight (by 9% and 2%, respectively, over the JARPA years), but they recognised that there was additional geographical and temporal heterogeneity.

Walløe considered that the matter of the presence or otherwise of a declining trend remained an important issue in understanding the behaviour of the Antarctic ecosystem. De la Mare explained his view was that while the possibility of such a decline was not excluded, the analyses by himself and his colleagues had indicated that the data were also open to different interpretations.

There was not sufficient support in the Working Group to modify its conclusion (subsequently endorsed by the Committee) from last year that 'a decline in blubber thickness and in fat weight that was statistically significant at the 5% level had occurred'. De la Mare and McKinlay considered that last year's conclusion was premature because in their view it was not based on the full analyses recommended by the JARPA II Expert Review Panel (IWC, 2015e, pp.393-4). The Committee expressed nevertheless appreciation to all those who provided analyses to the meeting for their substantial contributions.

Given earlier recommendations by the Committee and the continuing debate of how best to model the data, the Committee **recommends** that additional analyses be undertaken on both the blubber thickness and body fat data. It **encourages** the various scientists involved in these analyses **to collaborate** to develop a set of models that best capture the Committee's previous recommendations, taking into account the structure of the underlying processes giving rise to the data. To facilitate this, the Committee **suggests** that the interested scientists apply for access to the data under Procedure B of the Data Availability Agreement. It **requests** the data holders to consider such requests favourably.

13.3.2 Case studies of the effects of long-term environmental variability on whale populations
This topic was initially addressed during a joint session of the E and EM sub-committees, as the identification and compilation of long time series of cetacean demographic parameters and environmental variables is a cross-cutting theme within the Committee. As well, the Committee **notes** that this compilation would also be relevant to the objectives of the proposed joint IWC-CCAMLR workshop in 2016 (see item 13.1.2).

13.3.2.1 COMPILATION OF LONG TIME SERIES OF CETACEAN DEMOGRAPHIC PARAMETERS AND/OR ABUNDANCE AND POTENTIALLY RELEVANT ENVIRONMENTAL VARIABLES
The intersessional Correspondence Group reported progress on modelling of two populations with respect to detection of environmental effects: Southwest Atlantic right whales and North Pacific gray whales (under items 3.1 and 4.1 of Annex F). In the case of Southwest Atlantic right whales, calf survival rate was found to be the parameter most affected, when cryptic mortality (calf dies without being seen) is included. Potentially relevant environmental indices have been compiled, and the next step is to investigate correlations. Data sets on other baleen whale species, as identified in IWC (IWC, 2015i, pp.251), will also be examined for their potential to reveal effects of environmental variability. The Committee encourages continuation of this work.

13.3.2.2 REVIEW THE 'REPORT OF THE IWC CLIMATE CHANGE STEERING GROUP MEETING'
The report of the meeting of this Steering Group (SC/66a/Rep07) is discussed under Item 12.5.

13.3.3 Competition among baleen whales: how can we measure and model it?
This subject had been an area of emphasis at last year's meeting, both from a modelling and empirical perspective. The Committee had agreed the need: (1) for species-specific, fine-scale data on cetacean feeding and prey to provide parameters for individual-based models of competition between baleen whales; (2) to develop the analytical and modelling tools to scale from individual-based whale foraging scales to broad spatial scales across species and ecosystems, using information about baleen whale energetics and feeding functional forms, as well as existing satellite tag, spatial and temporal data; and (3) to develop competition models in parallel with data collection because the models can inform data collection and experimental design, and *vice versa.*

SC/66a/EM/4 reported results from the first year of an IWC-supported project to use tag data to inform ecosystem models of competition, which focused on producing quantitative information that can be used at a range of spatial scales and across species. New data were presented on the feeding rates and energetic costs of feeding for all rorquals, and how these change for each species as a function of prey density, which will be used to parameterise individual-based energetics models (IBEMs) in year 2 of the study. The authors also presented results from a state-space switching model (SSM) applied to satellite-tag data from humpback and minke whales in the Antarctic, which can be used to provide estimates of the proportion of time spent in different behavioural states across broad spatio-temporal scales. These results will be used to generate ecological niche models to estimate the amount of overlap and the potential of competition between these sympatric baleen whale species. In this context, de la Mare reported that the next development of the IBEM will be to model Antarctic minke whales (see Item 13.2 above).

The Committee notes that direct measurement of feeding rates and the derivation of functional relationships between foraging effort and prey concentration using energetic models opens new possibilities for generating ecosystem-level information and welcomes this progress.

13.3.4 Applications of species distribution models (SDMs)
13.3.4.1 PRELIMINARY REVIEW OF SDMs APPLIED TO BALEEN WHALES
Last year the Committee had agreed to review the application of species distribution modelling and associated techniques as they pertain to the goals of the Committee, and established an intersessional Correspondence Group to develop guidelines and recommendations for best modelling practices. SC/66a/EM03 provided an overview of SDM methods and conducted a preliminary review of applications of SDMs to baleen whales based on 36 papers published from December 1997 to March 2015. The review concluded that although these studies have significantly contributed to knowledge of baleen whale ecology, a general lack of detailed descriptions of construction and evaluation methods hampers further consideration of the outputs. The authors recommended that future studies should conduct comparisons among different SDM techniques as well as consider ensemble-modelling approaches. They also identified a need for further guidelines regarding approaches for parameter settings and evaluation methods.

The Committee welcomes this work and **recommends** that the review be expanded to consider guidelines for model diagnostics, including residual examination. The Committee also **recommends** the review to consider simulation approaches as an alternative to empirical model validation. Intersessional work by the Correspondence Group will include a review of machine-learning techniques.

13.3.4.2 REVIEW THE REPORT OF THE JOINT NMFS-IWC PREPARATORY WORKSHOP 'TOWARDS ENSEMBLE AVERAGING OF CETACEAN DISTRIBUTION MODELS'
A joint IWC-National Marine Fisheries (US NMFS) Preparatory Workshop titled 'Towards Ensemble Averaging of Cetacean Distribution Models' was held immediately prior to the Committee's meeting. Considering that a number of independent SDMs had been developed for Eastern North Pacific blue whales, SC/66a/Rep10 presented the rationale for a collaborative effort to develop formal methods to compare and combine predictions from these models through a preparatory workshop which would lay the groundwork for a future workshop where the ensemble averaging would be completed. Researchers with relevant models were invited to present on the pertinent aspects of their approaches, including information on the characteristics of the models and of the data sets. The Workshop recommended that a review of literature on model averaging and similar approaches from other fields should be undertaken with the objective of assisting discussions of the appropriate approach for use within the present blue whale case study. The Workshop also stressed that, similar to multi-model inference with AIC weights, the composition of the candidate set of models can be influential on the resulting ensemble and the outputs which it provides, and determined that the candidate models should be chosen carefully and with transparency about the degree of similarity between them. The Workshop further agreed that the development of a meta-data collection for each candidate model for an ensemble was necessary. The metadata would contain information on key management questions; spatial and temporal scales; how error was estimated and propagated, and whether correlation structure of errors had been taken into account for details about source datasets, modelling assumptions, etc. Finally, the Workshop agreed that further review and consultation on methods for model validation should be undertaken as part of the preparatory requirements to conduct an ensemble averaging exercise at a future workshop.

In recognition of the need to develop methods to average different model types, the Committee **recommends** a review of scientific fields such as climate change research for methods to combine disparate model types. The Committee thanked the participants and organisers of the Workshop for this valuable contribution to species distribution modelling for cetaceans. The Steering Group was re-appointed to continue to advance the agenda and objectives set out for a following workshop (see Annex K1, item 5).

13.3.5 Other
SC/66a/EM/5 described preliminary analyses to characterise the foraging grounds of the Antarctic blue whale during a recent joint New Zealand-Australia Antarctic Ecosystems Voyage (see SC/66a/SH/7 for further details). A combination of active (echosounders) and passive (sonobuoys) acoustics provided the ability to find aggregations of blue whales and measure the characteristics of krill swarms, both within the blue whale aggregations and in the surroundings. These two complementary technologies provided insights into sub meso-scale Antarctic blue whale foraging behaviour. The Committee welcomes the work to date and encourages further analyses of the data from this study.

13.4 Work plan and budget requests
The work plan on general issues related to ecosystem modelling is given as Table 18 (for details see Annex K1, item 5). Budget implications are discussed under Item 26.

Table 18

Work plan on matters related to ecosystem modelling.

Item	Intersessional period/groups	SC66b
Planning for 2016 Annual Meeting	Intersessional group	Forms basis of agenda and discussions
Joint IWC-CCAMLR work	(1) Continue to develop working relationship (2) Begin planning for Workshop	Review progress
Effects of long-term environmental variability	(1) Identify long-term datasets for whales (2) Identify relevant environmental variable datasets.	Review progress and identify work plan
Application of species distribution models	Develop guidelines and recommendations for best practice in modelling steps	Receive report and consider future actions

14. SMALL CETACEANS

14.1 Review of taxonomy and population structure of bottlenose dolphins (*Tursiops* spp.) in the wider Indo-Pacific region
It has been agreed that the priority topic for small cetaceans for the next three Scientific Committee meetings (2015-17) would be a review of the genus *Tursiops*. As bottlenose dolphins are among the most widely distributed cetacean species, with complex taxonomy and population structure, it was agreed that the review would be completed in stages, the first being to develop an assessment framework and to conduct general reviews of the available information in relatively well-studied regions.

This year the subcommittee on small cetaceans (Annex L) reviewed taxonomy and population structure of bottlenose dolphins (*Tursiops* spp.) in the Indo-western Pacific region including China-Japan-Taiwan, Australian waters, New Zealand and Oceania, the eastern Bay of Bengal, Bangladesh and the east coast of Africa from the Red Sea to South Africa. Specific objectives of the review were to clarify:

- Taxonomic status of *Tursiops* spp. (*T. truncatus*, *T. aduncus*, [*T. catalania*][12] and *T. australis*) around Australia;
- Taxonomic status of *T. aduncus* in the core Indo-Pacific region as compared to Bangladesh, the Red Sea (type location) and eastern Africa;

Additional information on the distribution and conservation status of Indo-Pacific *Tursiops* populations, (including Australia, Japan and Taiwan) and the Occurrence and distribution of island-associated *Tursiops* populations in the western Pacific (Oceania) and New Zealand was also discussed.

14.1.1 Overview of published taxonomy and population studies in the greater Indo-Pacific, from 1999 through 2011
Relationships among members of the entire family Delphinidae are taxonomically complex and the taxonomy of these species and genera is still unclear (Perrin and Brownell, 2013). More than 20 different *Tursiops* species have been described historically, but only two (*T. truncatus* Montagu 1821 and *T. aduncus* Ehrenberg 1832) are widely recognised. *T. truncatus* has a worldwide distribution from temperate to tropical waters in both hemispheres, whereas *T. aduncus* is confined to the Indo-Pacific region and is principally found in nearshore waters with a few notable exceptions (SC/66a/SM18). In addition, *T. truncatus* does not appear to occupy inshore areas in the range of *T. aduncus,* although there are areas where they can be considered to be generally sympatric. Among the *T. truncatus* forms in the Atlantic and Pacific, two morphotypes have been described – 'coastal'/'inshore' and 'oceanic'/'offshore' - that differ morphologically and genetically. However, the morphotype distinction is not consistent across regions, e.g., in the eastern North Pacific the coastal form is larger than the offshore form, whereas in the Atlantic the coastal form animals are smaller than oceanic animals. Strong population structure among coastal *T. truncatus* has been observed in areas where intensive analyses have been conducted (e.g. Florida, Gulf of Mexico, western North Atlantic, Mediterranean). See Annex L, item 6.1.1 for details.

---

[12] Now considered a junior synonym of *T. aduncus*, see discussion in Annex L, section 6.6.1.

In discussion, it was pointed out that some of these studies - largely based only on genetic analyses - were preliminary (e.g. few markers, primarily mtDNA loci were used). Such an approach may be adequate for identifying genetically discrete 'management units' but is not appropriate for making taxonomic distinctions. It is nevertheless clear from these studies that more than one species of *Tursiops* is present in the Indo-West Pacific.

14.1.2 Overview of published studies of taxonomic placement of Australian bottlenose dolphins
Summaries of published studies on evidence for and against a new species of bottlenose dolphins in the southern Australia were presented. Details can be found in Annex L, item 6.2.

14.1.3 Overview of published studies and observations of bottlenose dolphins around the islands of Oceania
Additional details on the overview of published and new studies on taxonomy and population studies on the Australian bottlenose dolphins, as well as on studies and observations around the islands of Oceania (including Micronesia, Polynesia and Melanesia), are given in Annex L items 6.3.1, 6.3.2, 6.3.3. Discussion centred on methodological and analytical considerations.

14.1.4 Additional information on Philippines and South Australia
Some information on distribution of bottlenose dolphins the Philippines (Annex L, item 6.4) and on biology and threats in South Australia (Annex L, item 6.5) was presented. Following a brief discussion on the latter region the Committee **recommends** that:

(1) a workshop be held to assess the distribution and abundance of, and threats to *T. aduncus* around Australia; and
(2) efforts be made throughout Australia to improve the consistency and transparency of entanglement monitoring (i.e. detection, investigation and reporting) - this would require that the fishing and aquaculture industries cooperate in securing and delivering carcasses of animals taken incidentally and that funding is made available to perform necropsies.

14.1.5 New information and analyses from taxonomic studies in the Indo-Pacific and Melanesia
A number of interesting studies on genetics and morphology of *Tursiops* spp. carried out in Australia (Annex L, item 6.6.1), New Caledonia (Annex L, item 6.6.2) and Bangladesh (Annex L, item 6.6.3) were presented.

During discussions it was suggested that an updated worldwide comparison of *Tursiops* spp. is needed; the importance of including both morphometrics and genetics in such comparisons, given the localised and complex differences observed in many studies, was stressed.

Overall, Krützen and colleagues' analyses indicate that in South and South-Western Australia, genetic patterns are more complex than previously assumed. There are three genetically identified groups of bottlenose dolphins in this area (none clearly defined geographically) differing with respect to nuclear, mtDNA and Y genetic makeup compared to the unambiguously well-resolved *T. aduncus* and *T. truncatus* clades in eastern, western and northern parts of Australia.

Discussion focused on results, methodological details including types of genetic markers used and sample sizes, 'coverage' of the mitogenome sequencing, analytical methods, alternative explanations for the results and details of the calibration methods used to infer branching order and times of divergence. See Annex L, item 6.6.1 for details.

Oremus *et al.* (2015*)* present data for bottlenose dolphins in New Caledonia (*n*=88) and the Solomon Islands (*n*=19). Two distinct morphological forms occur in these areas, one with all the characteristics of *T. aduncus* (small size, speckles on ventrum, coastal habitat) and the other more similar to *T. truncatus* (larger body size, shorter beak).

The discussion on New Caledonian studies clarified details of the methodology used and analysis results. See Annex L, item 6.6.2 for details.

SC/66a/SM18 reported on the phylogeographic affinity of *T. aduncus* in the northern Bay of Bengal, Bangladesh. The haplotype network, level of differentiation and number of fixed nucleotide substitutions all suggest significant reproductive isolation and different phylogenetic units, as previously suggested for African and Pacific *Tursiops* (Natoli *et al.*, 2004; Sarnblad *et al.*, 2011) and other polytypic dolphin species within the Indo-Pacific. Details on this study can be found in Annex L, item 6.6.3.

Discussion on SC/66a/SM18 centred on explanations for the relatively high divergence between *T. aduncus* in this region relative to others, the need for additional samples and the analyses needed to clarify relationships and the mechanisms involved. Despite the need for a larger sample size, the Committee acknowledged that this new information provided considerable support for considering the bottlenose dolphin population in Bangladesh a discrete conservation unit.

14.1.6 General discussion of older data in relation to new information
The purpose of this review of bottlenose dolphins in the Indo-Pacific was to clarify understanding of *Tursiops* taxonomy across the region in general and in particular the relationship of '*T. australis*' to other taxa. *T. aduncus* and *T. truncatus* are clearly distinguishable and the distinction is consistent across many different areas, studies and marker types analysed. The *aduncus*-type dolphins, however, exhibit considerable regional variability, suggesting that the morphological characters used for diagnosis are subject to convergence, perhaps related to independent adaptation to particular coastal habitats. In particular, reported analyses are

distinguishing new *T. aduncus* lineages off Pakistan and India, and off Bangladesh. Coordinated analyses will be required to determine the distinction between populations in different regions.

The taxonomic status of '*T. australis*' has become less clear as more samples have been analysed and more markers have been used. This is exemplified by the discordance in results using different genetic markers, such as the Y-chromosome sequences and mitogenomes analysed by Krützen and colleagues. Microsatellite data distinguished *T. australis* from other local southern Australian samples, but 5 Y-chromosome SNPs could not distinguish *T. australis* from *T. truncatus*, although that shared lineage was distinguished from *T. aduncus* with this marker. A relatively ancient split represented by divergent mitochondrial lineages should be paralleled by concordant results in nuclear markers, but that was not strongly supported by the Krützen and colleagues data, nor by morphological analysis by Jedensö. Both Moura and colleagues and Krützen and colleagues extending that work found *T. australis* to diverge from the basal node 1-3 Ma based on mitogenome phylogenies. Gray and Hoelzel reported support for this same topology when mtDNA was combined with congruent nuclear intronic sequences. Although the recent, well-conceived and carefully conducted morphometric analyses by Jedensjö and Kemper did not show a difference between putative *T. australis* specimens and *T. truncatus*, the lack of morphological distinctiveness relative to *T. truncatus* could conceivably be related to convergence. It is well-recognised that morphology has both a genetic and environmental component, with the potential for synergisms between those influences. Morphological convergence blurring the distinctions between species and cryptic speciation are both commonly observed, given different combinations of evolutionary history and selective pressures.

Guidance from Reeves *et al.* (2004*)* suggests that concordance between at least two independent forms of evidence, such as genetic markers and morphology, is a useful criterion for distinguishing and delineating cetacean species. IWC taxonomy generally accords with that used by the Taxonomy Committee of the Society for Marine Mammalogy (IWC, 2015f, p.69) and both seek to use objective criteria for making consistent taxonomic distinctions. The Committee **agrees** that an important role for the IWC is to pull together many data points and analyses in reviews, such as this one, and to promote the consistent use of genetic, morphological and behavioural characters across regions and laboratories to facilitate better and more informative comparisons.

Recognition and delineation of 'units to conserve' that require independent management may be less problematic, and sometimes easier, than resolved taxonomy in practical situations when data are unambiguous, even if all criteria for taxonomic resolution are not met. Justification for conservation decisions, e.g. assignment to an endangered species list or the IUCN Red List, provision of special protection measures, determination of the boundaries of a protected area, may be needed while the taxonomic status of the animals is still being resolved. From a conservation perspective, prioritisation of actions can be informed by, but may not depend on, taxonomic usage and 'Red List' designation. Conservation issues should not be allowed to drive, or force, taxonomic decisions. Although it is known that extreme philopatry can cause high levels of divergence, it would be inappropriate, and possibly counter-productive, to make species distinctions based on such divergence alone and therefore, more nuclear data should be a priority to further assess the taxonomy of the putative *T. australis*.

Given the remaining uncertainties and the difficulties of making progress towards understanding the relationships within and between bottlenose dolphin populations in different parts of the world, the Committee **urges** consistency in approaches used and in morphological, genetic and behavioural characters employed to allow direct comparisons between areas and study groups. Use of additional, independent nuclear markers (such as multi-locus genotyping using SNP analysis) and keeping open minds in the search for a better understanding of the patterns observed, will be critical. The value of morphological and morphometric analyses as part of the task should not be forgotten or overlooked.

14.1.7. Plans for the next stage of the review of Tursiops *taxonomy and population structure*
Considering the discussion of the taxonomical issue of the genus *Tursiops*, the Committee **recommends** that to facilitate the progress of the revision work for the next two years on this subject, a diagnostic strategy should be identified that can be utilised across groups working on this genus. An intersessional working group was formed to assess the value/strengths of the different genetic markers and analytical methods currently in use as evidence for/against making species/sub-species level distinction for *Tursiops* with the following terms of reference:

(1) to discuss the application of different markers and analytical tools used for species/subspecies/Unit to Conserve delineation in *Tursiops;*
(2) to formulate a strategy to engage different groups to collaborate and share information to address the taxonomical/ conservation issues in *Tursiops*.

14.2 Report on the Voluntary Fund for Small Cetacean Conservation Research
The new and improved IWC website page for the Voluntary Fund for Small Cetacean Conservation Research (https://iwc.int/sm_fund) was presented. This page contains information on the purposes of the fund, a list of donors (the most recent being The Netherlands Government and Whale and Dolphin Conservation) and descriptions of projects funded to date. Separate pages for each project contain information on the Principal Investigators, project goals and main outcomes, maps, illustrations and photographs and links to reports and publications. Fortuna thanked the Secretariat and Collins for their assistance in updating the website and encouraged Committee members to disseminate information about the fund and the website to encourage greater donor participation and interest from investigators.

Current plans include a new call for proposals in January 2016, with proposals to be evaluated at SC66b in June 2016 and approved by the Commission in September 2016.

A number of scientists who had received project support from the Voluntary Fund were present. They briefly described their research and explained how this funding had enabled them to achieve conservation-related outcomes. The fund recipients noted repeatedly that in addition to meeting the specific goals of their projects, the IWC funding had helped them leverage other funds and influence broader research and conservation efforts in the countries concerned.

The Committee **welcomes** the new donations and thanked Governments and NGOs for their continued support to the Voluntary Fund for Small Cetacean Conservation Research.

14.3 Progress on previous recommendations
14.3.1 Vaquita
Great concern over the status of this species has been expressed for 25 years by the Committee (IWC, 1991, p.79). This year, the Committee received alarming new information on the status of this critically endangered species (SM/66a/SM25), in which an estimated 67% decline in vaquita acoustic activity in the passive acoustic study area from 2011 to 2014 was found by a panel of acoustic experts. The average estimated annual rate of decline of 31% (95% Bayesian Credible Interval -51% to -10% per year) over that period is considerably greater than the previously estimated (18.5%; 95% Bayesian Credible Interval -46% to +19% per year) for the 2011-2013 sampling period. The panel had concluded that acoustic activity had declined between 2011 and 2014 with very high probability (0.996) at a rate of more than 10% per year (0.976). For further details Annex L, item 8.1 and SM/66a/SM25.

The Committee also received new information on management measures (see Annex L, appendix 2). In May 2015, following a series of regulatory notices and consultations, the President of Mexico announced a set of measures that followed, to a large degree, the recommendations of the fifth report of the International Committee for the Recovery of the Vaquita (CIRVA-5[13]). These included:

(1) implementation of an emergency two-year gillnet ban throughout the vaquita's distribution;
(2) making major new commitments to enforcement by strengthening the team of agencies involved and building coordination across them, providing new high-speed patrol boats and committing to a greater overall enforcement presence in the region;
(3) establishing a comprehensive programme to compensate fishermen and associated workers; and
(4) deciding to fund a new survey to estimate vaquita abundance planned for 2015.

The Sixth Meeting of CIRVA (CIRVA-6) was convened in San Diego on 22 May 2015 (see Annex L, appendix 2 for further details). The CIRVA-6 report commends the Government of Mexico for taking the four major measures detailed above, noting that 'in an economically challenging time, the President of Mexico demonstrated unprecedented high-level commitment and support for saving Mexico's porpoise when he visited San Felipe in April 2015 to initiate these measures.'

CIRVA-6 concluded that the acoustic monitoring programme continues to provide strong evidence of a dramatic decline in vaquita abundance. It found the rates of decline alarming, particularly the apparent 42% decline from 2013 to 2014. 'This rapid decline underscores the need for Mexico's strong recent actions to ban gillnets and increase enforcement to save the species.'

After reviewing and revising its previous recommendations in light of new information and bearing in mind that it had repeatedly emphasized that gillnets must be removed permanently from the range of the vaquita, CIRVA made the following recommendations at its 6th meeting.

(1) 'that the Government of Mexico follow up on its enactment of emergency regulations establishing a gillnet exclusion zone by immediately initiating the process of making the ban permanent'.
(2) 'that the Government of Mexico maintain its strong commitment to interagency enforcement'.
(3) 'the Government of Mexico increase enforcement, including night-time surveillance, to ensure that all gillnet fishing is eliminated within the exclusion zone. Possession and transportation of gillnets should be prohibited both at sea and on land'.
(4) 'that the efficacy of the enforcement efforts for the current ban be monitored and commends the Government of Mexico for having entered into a collaboration that involves third-party monitoring'.
(5) 'that all available enforcement tools, both within and outside Mexico, be applied to stopping illegal fishing, especially the capture of totoaba and trade in their products'.
(6) 'that increased efforts be made to develop and introduce alternatives to gillnet fishing in communities affected by enforcement of the exclusion zone'.
(7) 'that in accordance with Mexican Standard 002 published in June 2013 mandating the stepwise substitution of alternative gear for shrimp gillnets, the Government of Mexico announce that shrimp gillnets are now permanently banned'.
(8) 'that issuance of permits for legal non-gillnet fishing be expedited'.
(9) 'that the acoustic monitoring program continue indefinitely, with adequate financial support, to determine whether mitigation efforts are working'.

The Committee **continues** to be **gravely concerned** about the survival of the vaquita. In light of the new information and bearing in mind that it had repeatedly emphasised that gillnets must be removed permanently from the range of the vaquita, the Committee **endorses the CIRVA-6 recommendations** and **strongly reiterates** that the only measure that will save the vaquita from extinction is to make the current two-year ban on gillnets permanent throughout the species' range.

The Committee **stresses** that a major driver of the vaquita decline is the illegal fishery for totoaba and the illegal trade of totoaba swim bladders. In light of the apparent high demand from international markets (primarily in China), the Committee **re-iterates** its recommendation that the Governments of Mexico and the United States consult on the continuing illegal international trade in CITES Appendix I totoaba. It notes the opportunity afforded by the CITES Conference of Parties in 2016 to further highlight the effect of this trade in causing additional losses of the critically endangered vaquita, with the goal of enhancing enforcement efforts and awareness. The Committee further **requests** that the IWC Secretary send letters expressing the Commission's strong concern about the impact of the illegal totoaba trade on the vaquita to the CITES Secretariat and the Chair of the Standing Committee, and to the appropriate Chinese authorities.

The Committee **commends** the Government of Mexico for the major actions taken to address the conservation of the vaquita through a two-year gillnet ban and associated enforcement, compensation and acoustic monitoring and visual surveys and respectfully requests that it provide a report on the progress of vaquita conservation efforts to the next annual meeting. The Committee also looks forward a report from the CIRVA meeting planned for early 2016, to review the estimates of abundance from this year's survey and the results of acoustic monitoring through 2015.

14.3.2 Yangtze finless porpoise
SC/66a/SM23 summarises progress on conservation of the Yangtze River finless porpoise which numbers only around 1,000 animals. The Institute of Hydrobiology of the Chinese Academy of Sciences and WWF have conducted awareness campaigns and promoted the Yangtze River finless porpoise as a flagship species and as an indicator of the health status of the Yangtze River ecosystem. This has been successful in building stronger support from both the government and the general public, as demonstrated by the Ministry of Environmental Protection's (MEP) rejection of two shipping channel projects which were proposed in the Zhenjiang Provincial Cetacean Reserve and in the Anqing Municipal Cetacean Reserve. Further, in October 2014 the Ministry of Agriculture (MOA) released a 'Notice on Further Strengthening the Protection and Management of Yangtze Finless Porpoise' which stipulates that this subspecies must be protected and managed according to the standards of a National First Grade Key Protected Wild Animal. In addition, the MOA is planning to transform the 'Action Plan of the Conservation of the Yangtze Finless Porpoise' from a National Strategy to a National Project, which means that permission for any activity that might have an impact on finless porpoise must be sought from the Central Government rather than from a province-level agency. Two new reserves, one *in situ* and one *ex situ* (oxbow lake), have been established. Four porpoises caught in Poyang Lake were translocated to the new He-Wang-Miao reserve and an additional four animals were relocated from Poyang Lake to the existing Tian-E-Zhou reserve.

This Committee **commends** the Chinese government for elevating the Yangtze River finless porpoise to a "National First Grade Key Protected Wild Animal". It also **congratulates** the MOA for elevating the Action Plan of the Conservation of the Yangtze Finless Porpoise (APCYFP) to a National Project which will provide stronger management support, greater financial support and national recognition of this subspecies.

Discussion within the Committee focused on the *in situ* management. The continued overall decline in the porpoise population is due to a combination of factors, the three most significant of which are: (1) interaction with fisheries, both competition for prey resources and entanglement in gear; (2) the heavy vessel traffic on the river and (3) large-scale sand mining in much of the animals' riverine and lacustrine habitat. Further details are in section 8.2 of Annex L.

While the Committee **welcomes** the establishment of two new reserves in the last year, it also **reiterates** its previous recommendations that every possible effort be made to protect Yangtze River finless porpoise in their main river habitat. Further, the Committee **recommends** steps be taken to:

(1) identify river and lake segments with the highest porpoise concentrations and enforce appropriate, year-round protection measures (including fishing bans);
(2) vigorously enforce a basin-wide prohibition of electro-fishing and other fishing activities known to threaten porpoises;
(3) vigorously enforce regional and seasonal closures of sand-mining;
(4) strengthen pollution control measures and;
(5) ensure that before any further modification of the natural flow regime (or other natural features) of the Yangtze ecosystem are allowed to take place, the implications for finless porpoise are investigated and taken into account.

The Committee **recommends** that the IWC Secretary send a follow-up letter to the Chinese Government, commending the efforts to date, highlighting the recommendations made by the Committee and offering to provide advice to the Government in refining or implementing management measures.

14.3.3 Hector's dolphin
14.3.3.1 HECTOR'S DOLPHIN SURVEYS
Last year, the sub-committee on small cetaceans had a short discussion of the survey design and analysis in Mackenzie and Clement (2014) and agreed that this matter deserved closer scrutiny (IWC, 2015j, pp.297-8). In the light of this and taking into account concerns expressed in SC/66a/SM15, the Chair proposed the following approach which recognises, *inter alia,* that besides this specific issue with respect to Hector's dolphin, there is additional value in establishing this as a case study should similar instances occur in future. The Committee **agrees** to:

(1) establish a steering group (Scheidat, Donovan, Fortuna and Palka) to ensure that the following work is carried out intersessionally and reported to SC66b;
(2) recognising the complexities of obtaining abundance estimates in this area, an expert group (the Steering Group plus, *inter alia*, Currey, Lundquist, Slooten, Mackenzie, Clement and Hammond) will undertake a thorough review of the estimates produced by Mackenzie and Clement (2014) and try to reach a consensus view of the appropriate estimate or range of estimates that will be of value to the Zealand Government in developing appropriate conservation and management actions;
(3) This review will include consideration of issues related to:
(4) availability and perception bias (including use of circle-back, consideration of environmental conditions);
(5) appropriate truncation;
(6) model fit and associated implications for the estimate.
(7) It is clear that to investigate these issues it will almost certainly be necessary to carry out additional analyses and a request to the New Zealand Government for access to the relevant data will be submitted by the IWC Secretariat.
(8) The operating procedures of the expert group will be left to the group itself, but may require a face-to-face meeting in addition to email correspondence and teleconferences.

Potential costs related to this activity will be considered under the Voluntary Fund for Small Cetaceans.

14.3.3.2 MĀUI DOLPHIN
In previous years the Committee has expressed serious concerns on the status of the Māui dolphins, given that the most recent abundance estimate was of only 55 individuals (95% confidence interval = 48–69) over 1 year of age in 2010–11 (Hamner *et al.*, 2012). This year the Committee received four lines of new information:

(1) an update from the Government of New Zealand in response to last year's Committee request (see Annex L, item 8.3.3.1and SC/66a/SM3);
(2) results of a model on population decline and effectiveness of protection measures (see Annex L, item 8.3.3.2 and SC/66a/SM12);
(3) information on an NGO Initiative regarding opportunistic sightings (see Annex L, item 8.3.3.3); and
(4) new information on genetic monitoring on Māui dolphins (see Annex L, item 8.3.3.4).

Further details of these presentations and following discussion can be found in their respective sections. Here are highlighted the main new facts and conclusions.

Concerning the update from the New Zealand Government (see Annex L, item 8.3.3.1 and SC/66a/SM3):

(1) a programme of data collection and research is underway ahead of the next review of the Māui Dolphin Threat Management Plan (TMP) in 2018;
(2) in the 12-month reporting period, no reports were received of captures in commercial fisheries, beach-cast dolphins or ship strikes and, as a result, no necropsies were conducted;
(3) a Māui dolphin Research Advisory Group was established by the New Zealand Government in 2014.

SC/66a/SM12 (see also Annex L, item 8.3.3.2) compared the effectiveness of current protection measures for Māui's dolphins that are applied in approximately 19% of their assumed total range with the projected effectiveness of protection measures, as recommended by the Committee in 2014 (IWC, 2015f). According to SC/66a/SM12, the current management framework is expected to result in continued population decline, with none of the (1000) model runs resulting in population growth.

The Committee thanked Slooten for this analysis and Currey for his willingness to provide constructive comments. It **encourages** further discussion and exchanges of data and expertise between Slooten and the New Zealand Government. It **stresses** the importance of ensuring that data are made available for a rigorous analysis of the various management options for conserving this critically endangered population of dolphins.

In the course of discussion three points were raised on issues that had been considered by the 2012 review of the Māui dolphin threat management plan. The first concerned the need to assess the offshore distribution of Māui dolphins. The second concerned the need to increase trawler observer coverage in order to better assess Māui/Hector's dolphin bycatch rates. The third issue was whether C-Pod type passive acoustic monitoring devices could be deployed to assess Māui dolphin habitat use. See Annex L, item 8.3.3.2 for all details on these points.

On the NGO Initiative regarding opportunistic sightings, Leslie reported on a new mobile phone 'app' developed to receive 'public sightings' of Māui dolphins. Reports generated from this and other channels are forwarded to an independent marine mammal

scientist for verification and assignment of validation scores. This information is collated by WWF and then shared with the New Zealand Department of Conservation, other government agencies and scientists as part of a programme to advocate for enhanced protection of Māui dolphins throughout their range. The benefits and limitations of such public reporting schemes were briefly discussed (Annex L, item 8.3.3.3).

The Committee received a preliminary report on the 2-year genetic sampling programme begun in 2015 to obtain a new genetic mark-recapture abundance estimate (details can be found in Annex L, item 8.3.3.4). Baker and his collaborators hope to evaluate the effectiveness of current protection measures. The Committee **welcomes** this work on genetic monitoring of Māui dolphins and **looks** forward to the presentation of an updated abundance estimate at next year's meeting.

Given the information presented this year, the Committee **concludes**, again, that existing management measures in relation to bycatch mitigation fall short of its previous recommendations and **expresses grave concern** over the status of this small population. The human-caused death of even one individual would increase the extinction risk for this subspecies. It **reiterates** its previous recommendation that highest priority should be assigned to immediate management actions to eliminate bycatch of Māui dolphins. This includes closures of any fisheries within the range of Māui dolphins that are known to pose a risk of bycatch to dolphins (i.e. set net and trawl fisheries). It **re-emphasises** that the critically endangered status of this population and the inherent and irresolvable uncertainty surrounding information on small populations point to the need for precautionary measures.

Ensuring full protection of Māui dolphins throughout their known range, together with an ample buffer zone, would minimise the risk of bycatch and maximise the chances of population increase. The Committee **notes** that the confirmed current range extends from Maunganui Bluff in the north to Whanganui in the south, offshore to 20 n.miles and included harbours. Within this defined area, fishing methods other than set nets and trawling should be used.

The Committee again **urges** the New Zealand Government to commit to specific population increase targets and timelines, and again, **respectfully requests** that reports be provided annually on progress towards conservation goals.

14.3.4 Amazon river dolphin and tucuxi

SC/66a/SM2 describes the actions of the Brazilian Government to combat the use of the Amazon River dolphins (*Inia geoffrensis* and *Sotalia fluviatilis*) as bait for fishing the catfish, known as piracatinga (*Calophysus macropterus*) in the Amazon Basin. In July 2014, the Federal Government published a normative (Normative Interministerial nº 6/2014) establishing a five year moratorium on the fishing and marketing of the piracatinga in Brazilian waters starting January 2015. The Ministry of Environment (MMA) is responsible for evaluating the contribution of the moratorium to the recovery of the two dolphin species. A working group (WG) was established for the MMA (Decree n° 318/2014) to define procedures and monitor the fishing and marketing of piracatinga during the moratorium period. The WG will be effective until January 2020 when protection measures will be revaluated.

The Committee **commends** Brazilian authorities for the new restrictions placed on the piracatinga fishery as a means of reducing pressure on river dolphins and other fauna that have been heavily exploited to provide bait for the fishery. This issue has been great concern for a number of years and the Committee is pleased that Brazil has responded forcefully to address both the science and conservation elements of this problem.

The Committee **notes** the progress represented by publication of the WWF South American river dolphin conservation strategy (Trujillo *et al.*, 2010). See Annex L, item 8.4 for further details.

The Committee respectfully **requests** that Brazil continue to provide it with progress reports on this issue. Brazil and the other range states, including those where there is a strong market demand for piracatinga (e.g. Colombia), are **encouraged** not only to ensure that the regulations are tightly enforced but also to monitor the dolphin populations and assess effectiveness of the control measures.

14.3.5 White whales

SC/66a/SM14 reviewed information on the status of white whale (beluga) populations, last reviewed by the Committee in 1999 (IWC, 2000b). The review highlighted the fact that many populations face threats from multiple types of human activity including shipping, subsistence hunting, offshore oil and natural gas development, fishery interactions, coastal industrialisation, pollution and, in one case, live capture for the international aquarium trade. Global climate change is already having a significant impact on the Arctic marine environment with changes in sea ice extent and phenology (Laidre *et al.*, 2015). The authors highlighted the need for up-to-date status assessments of beluga populations, identification of critical habitat areas and migratory routes, and programmes to monitor and mitigate anthropogenic impacts. SC/66a/SM14 also highlighted the relevance and importance of the recommendations from the 2014 IWC Workshop on Impacts of Increased Marine Activities on Cetaceans in the Arctic (IWC/65/Rep07 Rev1), especially the need for enhanced collaboration between the IWC and the International Maritime Organization (IMO) to support implementation and enhancement of the Polar Code and engagement with the Arctic Council, particularly in its development of a framework for a pan-Arctic marine protected area network. Further details can be found in Annex L, item 8.5 and in SC/66a/SM14.

The Committee **welcomes** this review, noting that climate change and increased industrial development are affecting, and will continue to affect, the Arctic environment and therefore, also, the living conditions for white whales.

It was noted that after several years of consultations, planning is finally underway for a global review of monodontids in 2016, to be led by NAMMCO with active participation by scientists from Canada and Russia (neither a member of NAMMCO) as well as various members of the IWC Scientific Committee.

The Committee also refers to its the discussions under Item 12.6 regarding the need to implement the recommendations from the 2014 IWC Workshop on Impacts of Increased Marine Activities on Cetaceans in the Arctic (IWC/65/Rep01 Rev1) and their relevance to enhancing conservation of white whales in the changing Arctic environment.

14.3.6 Franciscana

SC/66a/SM06 and SC/66a/SM07 described acoustic studies undertaken since 2011 on franciscana in the Rio Negro Estuary, Argentina. A female neonate that stranded alive was found to produce very distinct echolocation clicks compared to adults, the main difference being their bandwidth of about 120kHz as opposed to 20kHz in adults. This striking difference allowed the development of an acoustic detector (*Pontoporia* Acoustic Detector)[14] that can detect and distinguish vocalisations of both calves and adults.

The Committee **welcomes** this initiative and **notes** that it could be very useful for other research teams working on this species and may prove to be a useful tool for studying population structure and abundance.

14.3.7 Sousa spp.

14.3.7.1 NEW INFORMATION ON TAXONOMY OF HUMPBACK DOLPHINS, SOUSA SPP.

Four species of humpback dolphins are recognised: *Sousa teuszii* in the eastern Atlantic Ocean; *S. plumbea* in the western Indian Ocean; *S. chinensis* in the eastern Indian and western Pacific Oceans and *S. sahulensis* in northern Australia (Jefferson and Rosenbaum, 2014)

New information was provided in SC/66a/SM24 on the genetic identity of humpback dolphins in the area of the northern Bay of Bengal, Bangladesh, which is presumed to represent the distributional 'dividing line' between *S. plumbea* and *S. chinensis*. A number of other markers analysed supported the suggestion that humpback dolphins in this region are distinct from those in all other regions studied to date. A sole exception is an animal sampled in far southern Bangladesh that was closely related to *S. chinensis* in Thailand, interpreted by the authors as implying that the range of the phylogenetically unique humpback dolphin population in Bangladesh may be limited to areas affected by freshwater input from the Ganges-Brahmaputra-Meghna River. Further details can be found in Annex L, item 8.7.1.

The Committee **acknowledges** that there is no information on the genetics of humpback dolphins along the east coast of India and in Sri Lanka and briefly discussed the initiation of new field studies, including genetic sampling, on humpback dolphins in Malaysia with plans to expand into the southern Philippines and Borneo. It therefore **recommends** that further investigation of the genetic identity of humpback dolphins in Asia be made to test the hypothesis of a clinal progression from Bangladesh into the range of *S. sahulensis*. This will require more samples from previously unsampled areas and the analysis of additional genetic markers.

The Committee notes that the Bangladesh dolphins might be the same as the earlier described *S. lentiginosa* (Iredale and Troughton, 1934) with the type specimen obtained from Indian waters and housed at the Natural History Museum, London. It suggests that a sample be obtained from this skull to compare its genetic characteristics with humpback dolphins in Bangladesh and to examine and extract DNA from the holotype of *S. borenensis* (Lydekker, 1901), collected from Sarawak (Malaysia) and housed in the Natural History Museum, London.

14.3.7.2 NEW INFORMATION ON STATUS

SC/66a/SM24 reported new information on population demography, habitat selection and bycatch risk of humpback dolphins in the northern Bay of Bengal, Bangladesh. A robust mark-resight analysis of 468 photo-identified humpback dolphins generated winter abundance estimates of 132 (SE=10, 95% CI = 115-153) in 2010-11, 131 (SE=3, 95% CI = 124-137) in 2011-12 and 636 (SE=58, 95% CI = 531-761) in 2012-13, with the substantial jump in the third year explained by a single group with 205 different individuals photo-identified. The sampled population is almost certainly part of a larger population that extends west across the border with India, further extending east towards the mouth of the Meghna River. More than 15% of photo-identified humpback dolphins exhibited injuries related to entanglements in fishing gear, implying a strong potential for fatal interactions in the 'Swatch-of-No-Ground' area. During 15 trips in which large-mesh (18-20cm) gillnets were deployed between June 2013 and December 2015, one fatal entanglement of a humpback dolphin was observed.

Although the taxonomic identity of humpback dolphins in Bangladesh still needs clarification, the Committee **recognises** them as a priority for conservation. Although the estimated abundance in the portion of the surveyed area was fairly high, bycatch is a known threat. Therefore, the Committee **recommends** continued monitoring and further photo-identification work to refine survival estimates. The Committee also **notes** the importance of efforts to investigate and establish protective measures for humpback dolphins on the Indian side of the upper Bay of Bengal.

---

[14] http://www.internationalwhalewhisperer.com/projects/

14.3.8 Lagenorhynchus
SC/66a/SM20 provided an overview of research on the demography of Pacific white-sided dolphins in Canada and described a proposed workshop on *Lagenorhynchus* at the 2015 Biennial Conference of the Society for Marine Mammalogy. This genus generally falls low on the list of conservation and management priorities. It was last considered as a priority topic by the Committee in 1996 (IWC, 1997b). Since then, a number of projects and publications have presented genetic, morphological and acoustic evidence which suggest that the entire genus needs to be reviewed and probably given a taxonomic overhaul (see Annex L, item 8.8 for details).

The Committee welcomed this useful information and **encourages** further efforts to improve understanding of population structure, status, and taxonomy of the genus *Lagenorhynchus*. The Committee also **supports** the idea of the proposed workshop and **encourages** members of the Scientific Committee to provide details of it to those people who would be appropriate to participate.

14.3.9 Killer whales
The Committee welcomed new information on killer whales movements from the Ross Sea, Antarctica, to New Zealand were brought to the attention of the sub-committee (SC/66b/SM9, SC/66b/SM11). Details can be found in Annex L, item 8.9.

Annex 2 of SC/66a/SH8Rev summarised the progress of the IWC-SORP project on distribution, relative abundance, migration patterns and foraging ecology of three ecotypes of killer whales in the Southern Ocean, additional to SC/66a/SM9 and SC/66a/SM11. This is a collaborative project between Australia, Italy, New Zealand and the United States of America. Since SC/65b researchers have deployed satellite tags on 46 killer whales and collected biopsy samples from 91 killer whales, and thousands of images for photo-identification have been catalogued. Fieldwork has been undertaken in McMurdo Sound, Terra Nova Bay, the Ross Sea, the western Antarctic Peninsula and Weddell Sea, and off Marion Island in the sub-Antarctic.

The Committee **notes** that the IWC-SORP killer whale project is a good example of international collaboration and facilitates sharing of existing Antarctic killer whale image catalogues. The Committee also **notes** links established between IWC-SORP and CCAMLR to facilitate sharing of images of killer whales and other species between organisations; Currey was thanked for his intersessional facilitation of this effort.

14.3.10 Baltic harbour porpoise
Leslie provided an update on the Baltic harbour porpoise (*Phocoena phocoena*). The porpoise population in the Baltic Sea proper has been estimated at 447 animals (95% CI = 90-997) based on two years of passive acoustic monitoring, as part of the SAMBAH project (Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise, http://www.sambah.org/). The estimate tends to confirm that this population is critically endangered. Spatial modelling revealed a previously unknown breeding area. In 2013, Hel Marine Station and WWF Poland combined efforts to deliver a conservation programme on the Baltic harbour porpoise to the Ministry of Environment in Poland. To date, the Ministry has not yet adopted the conservation programme. A reliable bycatch monitoring system is needed as fishery bycatch is considered the most serious threat to the population.

The Committee **commends** the work of SAMBAH and **stresses** the importance of applying the results to stimulate both conservation action and further research and monitoring. The Committee **encourages** the project's representatives to present their results in more detail at next year's meeting.

The Committee also **recommends** that Poland adopt the aforementioned conservation programme and that the Baltic countries maintain efforts to monitor abundance and bycatch levels.

14.4 Takes of small cetaceans
14.4.1. New information on takes
The summary of takes of small cetaceans in 2014 extracted from this year's online national Progress Reports and prepared by the Secretariat can be found in Annex L, appendix 3, tables 1-3.

14.4.1.1 DIRECT TAKES
In regards to direct takes, the only information received was that contained in the USA report on white whale hunts. The Committee thanked the Alaska Beluga Whale Committee for providing information about the harvest of white whales in Alaska.

Funahashi summarised the content of the Japan Progress Report on Small Cetaceans, a public document that can be freely downloaded from the website of the Fishery Agency of the Government of Japan[15]. This document reports on small cetacean fisheries in 2013.

The Committee **reiterates** its long standing recommendation that no small cetacean removals (live capture or directed harvest) should be authorised until a full and complete assessment has been made of their sustainability.

---

[15] http://www.jfa.maff.go.jp/j/whale/w_document/pdf/h25.pdf

14.4.1.2 ACCIDENTAL TAKES
Last year, the Committee noted that the bycatch of finless porpoises in South Korean waters was still high. However, it was also pleased to hear of efforts by the South Korean Government to start a monitoring and mitigation programme on the stow net fisheries[16] which are responsible for 95% of the bycatch. This was partly in response to the Committee's recommendations. The South Korean progress report for 2014 showed continued substantial finless porpoise bycatch, but no new information on efforts to reduce bycatch was received this year. Therefore, the Committee respectfully **requests** that the Government of South Korea provide an update on its finless porpoise bycatch monitoring and mitigation efforts next year.

14.4.2 Follow up on the Workshop on 'poorly documented hunts of small cetaceans for food, bait or cash'
The Committee received an update on the progress made by the marine bushmeat steering group on the series of workshops proposed in 2014 and recent progress in better documenting takes of small cetaceans in Southeast Asia. Porter presented the work plan for the forthcoming year in Southeast Asia for which independent funding has recently been obtained. It is anticipated that the results of this work will be presented in 2016.

It was generally agreed that a global workshop of the scale originally proposed in 2013 should still be held, possibly within two years, provided sufficient data are available. The option to apply for funding for small projects through the Small Cetacean Voluntary Fund was also discussed. The scope and extent of potential funding will be considered intersessionally.

An intersessional group was proposed to develop more focused terms of reference for the global workshop. It was further proposed that the Society of Conservation Biology annual meeting in Singapore, mid-2016, would be an ideal venue to hold a workshop on marine bushmeat. This workshop could focus on developing a 'toolbox' of techniques which could be used by groups throughout the areas of concern to investigate the issue. Further, such a workshop would be an opportunity to explore cooperation with other entities working on terrestrial bushmeat (e.g., CMS, CBD and CITES) and on non-cetacean marine bushmeat species.

The Committee **endorses** the following work plan:

(1) to continue development of a detailed terms of reference intersessionally through a small working group;
(2) to develop a 'toolbox' of investigative techniques to assist in documenting more clearly takes of small cetaceans; and
(3) to hold a workshop comprising a multi-disciplinary group of biologists, social scientists, managers and NGO's with a global scope.

The Committee also **notes** that sufficient new data from more than one region would be a pre-requisite for such a workshop.

14.5 Other
14.5.1 Task team and Conservation Management Plans for small cetaceans
Last year (IWC 2015, p. 56), the Committee agreed to trial a new intersessional approach for situations that are considered high priority from a conservation perspective at the species or population level, especially where the indications are that time is short and no effective mitigation actions are in place. For these situations, the Committee would establish an intersessional 'small cetacean task team' (SCTT) of appropriate experts from its membership.

SC/66a/SM22 provided a preliminary list of small cetacean populations that might require special attention and high priority in the Small Cetaceans sub-committee and might be addressed by a SCTT. This non-exhaustive list included populations listed as 'Endangered' or 'Critically Endangered' by the IUCN, as well as populations of 'Least Concern' and 'Data Deficient' species that may be suffering high and/or unregulated exploitation.

During this meeting a working group was established to refine the list and work further on a draft Terms of Reference for such SCTTs. See Annex L, appendix 4 for full details on the Terms of Reference and Annex L item 10.1 for Task Team Steering Group membership.

The primary aim of the initiative is to assist the Committee in providing timely and effective advice on situations where a population of cetaceans is or suspected to be in danger of a significant decline that may eventually lead to its extinction; the ultimate aim being to ensure that extinction does not occur. The terms of reference describes the role of a Task Team Steering Group and the work of SCTT's.

Iniguez presented information on franciscana dolphins as a possible candidate for an SCTT effort. These dolphins are distributed from Itaunas, (18º25'S), Brazil to Golfo San Matias (42º10'S), Argentina. The species range is divided in four 'Franciscana Management Areas' (FMAs, Secchi *et al.*, 2003) which have been proposed to improve management of the species. The IUCN listed the species as *Vulnerable*. The government of Argentina has included franciscana in their Red List as Endangered since 2011 and the Brazilian government has considered the species as Critically Endangered since 2014. This species is considered the most threatened small cetacean species in the SW Atlantic, primarily due to high levels of accidental mortality in fisheries activities. The distribution of the franciscana is not continuous; with the northern population (FMA1) being isolated and likely fragmented (Cunha *et al.*, 2014). The IWC completed a review of the franciscana more than 10 years ago (IWC, 2004). Since this review new studies have shown evidence that populations of the franciscana are more localised, with significant genetic differentiation detected within

---

[16] http://www.fao.org/fishery/fishtech/1024/en

the broader FMAs (e.g. Cunha *et al.*, 2014; Mendez *et al.*, 2010a). Furthermore, in parts of the range, levels of simultaneous bycatch of mother-offspring pairs potentially put populations at further risk (Mendez *et al.*, 2010b).

It was proposed that the franciscana would be a good initial case study to test this approach. In particular, Franciscana Management Area 1 in Brazil, which is geographically disjunct from all other franciscana populations, has gaps in distribution within its range, and is presumed to be subject to high rates of bycatch would be amenable to the approach of gathering and reviewing information and consultation with experts and managers in its range country. The Committee agrees to the process and to establish a Small Cetacean Task Team on franciscana (see Annex L, item 10.1) for additional details.

The franciscana is also a good potential candidate for a CMP along the lines of the one already implemented for the Southern Right Whale in the west South Atlantic (see Item 21). It is proposed that a discussion of the creation of the CMP for this species will be started with the regional community at a meeting of the Consortium of Franciscana that will be hosted in Santa Catarina, Brazil, in October 2015. A report with a summary of these discussions will be presented next year.

14.5.2 Resolution 2014-4
Resolution 2014-4 establishes Terms of Reference for the sub-committee on Small Cetaceans, largely consolidating the existing work plan of the sub-committee. In addition, it calls for more integration of the work of the sub-committee with that of other sub-committees (e.g. AWMP, RMP, HIM, E) and clarifies that this sub-committee can now have access to the general Research Fund.

The Committee **welcomes** this new development, which provides additional recognition of the work of the sub-committee, and notes the value of further integration of work across different sub-committees. While noting the increased opportunity for funding as part of the overall research budget, the Committee **emphasises** the continued importance of the Voluntary Fund for Small Cetaceans and hopes that Governments and NGOs will continue supporting it. It also **recommends** the continued use of the Voluntary Fund in supporting important research and conservation projects. In this regard, the Committee **suggests** that the funding of collaborative projects with other sub-committees and working groups and of Invited Participants should be dealt with jointly, i.e. in coordination with the Research Fund, while the Voluntary Fund for Small Cetaceans should continue to be directed primarily at conservation-oriented activities, inter alia, the work of the future Small Cetacean Task Teams and new research projects.

During the discussion, it was also noted that the adopted changes to the RoP introduced a new concept i.e. maintaining cetacean populations at 'viable levels'. The Committee **agrees** that it would discuss this concept further intersessionally with a view to developing a working definition at the 2016 Annual Meeting.

14.5.3 Other scientific information
The Committee welcomed new information on the occurrence of inshore and offshore common bottlenose dolphins in Costa Rica was presented (SC/66a/SM16) and on small cetaceans present in Dubai, United Arab Emirates (UAE), Arabian/Persian Gulf. All details can be found in Annex L items 10.3.1 and 10.3.2. The Committee **encourages** further work.

14.5.4 Work plan
The work plan on general issues related to small cetaceans is given as Table 19 (for details see Annex L). Budget implications are discussed under Item 26.

Table 19

Work plan on matters related to small cetaceans.

Item	Intersessional period/groups	SC66b
Ongoing review of *Tursiops*	(1) Determine IPs and encourage papers on taxonomy and population structure for the North Atlantic (including the Mediterranean, Black and Caribbean seas and the Gulf of Mexico) and South Atlantic; (2) Develop diagnostic strategy with respect to markers and tools appropriate for various taxonomic and management levels	Primary topic
Voluntary Fund for Small Cetaceans	Develop call for new proposals and steering group develop recommended list for next meeting	Finalise list of new proposals for Commission and review progress with ongoing proposals
Definition of 'viable'	Develop discussion papers and examine concept of target population level	Discuss and finalise definition in conjunction with relevant sub-groups of Committee
Takes of small cetaceans	Encourage submission of data via web portal for national progress reports	Review information
Review progress on past recommendations:		
Vaquita	Secretariat to send letters of concern to CITES (totoaba), China	Review progress including results of new survey
Yangtze finless porpoise	Secretariat to send letter to China including offer to provide advice	Review progress
Hector's and Māui's dolphin	(1) Review and develop consensus abundance estimates from aerial surveys	Receive reports on progress including new mark-recapture estimate and report from New Zealand on monitoring and management plans and develop work plan
Amazon river dolphins		Receive reports from Brazil on monitoring and management plans

White whales		Receive update on NAMMCO workshop
Lagenorhynchus	Members attend workshop at 2015 SMM Biennial Conference	Receive report
Other		Review progress as received
Franciscana	(1) SCTT (Task Team) on FMA1; (2) Discussion of CMP by 'Consortium of Franciscana'	Receive reports and develop work plan
'Bushmeat' workshop	Develop detailed ToR, 'toolbox' of techniques to assist documenting takes and continue to plan for workshop	Review progress and develop plan for workshop

15. WHALEWATCHING

The report of the 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, 1995b). The Commission also has a Standing Working Group on Whalewatching that reports to the Conservation Committee (see Item 15.3).

15.1 Assess the impacts of whalewatching on cetaceans
15.1.1 Panama
In 2012 (IWC, 2013b), the Committee strongly recommended more research and monitoring on the impacts of tourism on common bottlenose dolphins in Bocas del Toro, Panama. In 2014 (IWC, 2015f); it also recommended the pursuit of social science research in Bocas del Toro in relation to the human dimensions of dolphin-watching tourism.

SC/66a/WW05 evaluated the effect of noise levels on dolphin whistle acoustic structure by analysing recordings obtained under various boat interaction conditions. Changes in noise levels only explained a small percentage of the variation in dolphin whistle structure, suggesting that other cues (e.g. mode of approach) and other sensory modalities (e.g. vision) associated with boat-dolphin interactions may be more important contributors to changing dolphin acoustic behaviour.

SC/66a/WW06 examined dolphin whistle structure in the presence of transport boats (no approach, short exposure), research boats (controlled approach, long exposure) and dolphin-watching boats (uncontrolled approach, long exposure). Dolphins emitted similar whistles in the presence of the research and transport boats. In contrast, dolphins in the presence of tour boats emitted whistles that were highly modulated, longer, lower in ending and peak frequency, and wider in frequency range (delta frequency) than those emitted in the presence of the research/transport boats.

SC/66a/WW07 described 15 dead dolphins found in Bocas del Toro from 2009-2014. Some of these dolphins had injuries caused by boat propellers, while others had been entangled in fishing nets. Necropsies of five of seven dolphins found dead over four months in 2012 revealed injuries from propellers. During 2014, a number of live dolphins were seen with fresh and healed propeller wounds and cuts. In 2016, samples will be collected to assess the dolphins' microbial fauna and stress hormones.

The Committee noted that there is no stranding network in the region, so much of the information on dead dolphins is collected opportunistically. There may be many carcasses that are missed or not reported by locals who find them. The Committee **recommends** that research in the area should increase effort outside the archipelago, to better assess whether or not strandings are in fact concentrated there. It was noted that the carcasses that are found represent a large percentage of the population of 72-87 dolphins (see SC/66a/WW10).

SC/66a/WW11 analysed dolphin behavioural transitions in Bocas del Toro using transition matrix models and the effect of tour boat activities on dolphin behavioural transition probabilities in both control and impact scenarios using first-order, time discrete Markov chain models. A Generalised Log Linear Mixed Model (GLMM) was fitted to data containing only females with dependent calves to assess this vulnerable age-sex class. In the presence of tour boats, dolphins were less likely to stay in a socialising state and were more likely to begin travelling, and were less likely to begin foraging while in a travelling state, while females with dependent calves were less likely to forage and more likely to travel.

SC/66a/WW10 presented preliminary estimations of population size and residency patterns for Bocas del Toro's dolphin population, using capture-recapture data from 2004-2013. Preliminary analysis suggests that this dolphin group ranges from 72 to 87 dolphins. This group is divided into two 'communities', a larger community with a wider distribution within the archipelago and a smaller community, which is restricted to Dolphin Bay and has an estimated 37 animals. Communities differed in their levels of associations, with the larger community showing loose associations while the smaller community had several regular, long-term associations.

SC/66a/WW12 described dolphin behavioural changes in relation to tour boat exposure in Bocas del Toro. Observations of dolphins outside the archipelago with no tour boats present served as a control. An Akaike Information Criterion (AIC) reduction process that eliminates variables to best fit the model indicated that both foraging and socialising decreased with boat presence. Sexual behaviour, resting and long dives were also less likely to occur with increasing boat numbers. Social behaviour was more likely to be observed when boat numbers decreased.

Given the information above, the Committee **recommends** that those areas in the archipelago, particularly in Dolphin Bay, that are important to dolphin foraging and resting be designated as refuges.

SC/66a/SM13 assessed the degree of genetic isolation of the dolphin in Bocas del Toro. Microsatellite data were used to compare the Bocas population to a neighbouring population in Costa Rica and to other populations in the Caribbean. Bocas dolphins are isolated but, despite the absence of photo-identification evidence, DNA evidence shows there is some genetic flow from Panama to Costa Rica.

The Committee commended the authors of these papers for the impressive body of evidence – including genetic, behavioural, and acoustic – that has been amassed to demonstrate the significant negative impact the dolphin-watching situation in Bocas del Toro is having on the local dolphin population. The Committee **agrees** that this evidence continues to support its previous recommendations (IWC, 2013b, p.61; 2014d, p.56; 2015f, p.57) and it **reiterates its extreme concern** and its **recommendation** that the Panamanian authorities enforce the relevant dolphin-watching regulation (ADM/ARAP No.01) and in particular promote adherence to requirements regarding boat number and approach speed and distances (see also Item 15.7).

15.1.2 Argentina
SC/66a/WW13 summarised the current status of southern right whales *in* San Matías Gulf, Argentina, from data on distribution, abundance and social structure, and described an emerging whalewatching industry. In 2012, law N°4,066 authorised whalewatching under an experimental framework. This experimental programme authorised four tourism companies to develop whalewatching in a marine protected area and requested scientists to monitor whalewatching activity and assess its environmental, social and economic impact. Spatial distribution of whales showed high monthly and inter-annual variability. In 2014, there were a total of 145 whalewatching trips.

The Committee noted that this work is acquiring baseline data from which changes in distribution and habitat use can be measured. It was further noted that recovering whale populations are reoccupying coastal areas throughout South America, which represents an excellent opportunity to acquire such baseline data and to begin long-term studies before whalewatching expands into these regions (see Item 15.2.1 for possible application to the Modelling and Assessment of Whalewatching Impacts project). The Committee **recommends** that the Commission take advantage of this opportunity and that research projects are supported in these areas.

15.1.3 Arabian Sea
SC/66a/SH23 reported on recent research relevant to port operations and hydrocarbon exploration activities operating in the Gulf of Masirah, an area of known importance to the Arabian Sea humpback whale. The development of port and supporting transport infrastructure presents an opportunity for tourism to start in the area. Seismic surveys conducted in the Gulf during 2014 implemented stringent mitigation measures; even so, one whale was non-fatally struck. Re-sightings of whales within the survey area provide initial indications that whales did not leave the area despite the survey. This would be an issue of potential concern if whalewatching tours move into the area.

The Arabian Sea humpback whale is being subjected to increasing tourism pressures. As recently as 20 years ago, the Gulf of Masirah, Oman, was essentially wilderness. Now there are roads, fishing is increasing, port numbers are growing, and seismic surveys are occurring with greater frequency. Whalewatching from the new city of Duqm will likely become established soon. It is not yet known how far beyond the currently studied area the whales range, but while important habitats are known in Oman, whales are also seen in Pakistan and whaling records show an historic concentration of animals off the coast of India.

The Committee **refers to its serious concerns** over this population expressed under Item 10.12 and the discussion of whalewatching regulations under Item 15.7

15.1.4 Other
SC/66a/WW08 is the 12th in a series of summaries of whalewatching research published since SC/65b. See Annex M, item 5, and table 1 for more details of recent research on whalewatching impacts. SC/66a/WW04 briefly discussed an innovative proposal to use drones and underwater remotely operated vehicles to investigate whalewatching impacts.

Further details and discussion are in Annex M, item 5.

15.2 Review reports from intersessional working groups
15.2.1 Modelling and Assessment of Whalewatching Impacts (MAWI) steering group
SC/66a/WW03 discussed progress on the MAWI initiative. In August 2014, a MAWI symposium and workshop were held at the International Marine Conservation Congress in Glasgow, UK. The symposium discussed a history of and behavioural and physiological responses to whalewatching, modelling techniques for assessing whalewatching's impact, and the role of industry as platforms of opportunity. A subsequent workshop discussed the research questions and hypotheses that would most benefit scientific understanding of whalewatching impacts on large cetaceans.

The outputs of the symposium and workshop resulted in a publication, New *et al.* (2015), which concluded that there are six factors to consider when building a strong scientific platform from which to assess the potential effects of whalewatching. The intersessional group proposed a scientific workshop, which would focus on the first three of the six factors: (1) standardising data collection; (2) defining key research questions; and (3) identifying the role of whalewatching in the broader suite of disturbances and stressors

affecting cetaceans to better assess their combined impacts. Once the key research questions and data standards are defined, it will be necessary to work with stakeholders at existing study sites, or develop new ones, to implement the beginnings of the unified platform. The intersessional group prepared a table (Annex M, table 2) which describes several potential sites where MAWI's initial work could be undertaken. Other locations can be added to this table as they are identified. See Annex M, item 6.1 for more details.

15.2.2 Swim-with-whale operations
No information was presented. Updated information will be presented at the 2016 annual meeting.

15.2.3 In-water interactions
No information was presented.

15.2.4 Populating the Commission's web-based handbook on whalewatching
This is addressed in under Item 15.3.

15.2.5 Guiding principles for data collection forms from platforms of opportunity
No information was presented, but a document will be presented at the 2016 annual meeting.

15.3 Review progress on Five-Year Strategic Plan for Whalewatching
One of the guiding principles of the Commission's Five-Year Strategic Plan on Whalewatching[17] discourages whalewatching on endangered and critically endangered species. SC/66a/WW09 presented an initial list of endangered and critically endangered cetaceans (under the IUCN system), whether they were subject to whalewatching, and if regulations existed. In total, 34 such populations were identified, 18 critically endangered and 16 endangered.

The Committee **agrees** that this list should eventually be included in the Online Handbook for Whalewatching after further review.

At IWC/65, the Commission endorsed a joint meeting of the Scientific Committee's sub-committee on whalewatching and the Conservation Committee's Standing Working Group on Whalewatching (Working Group) to discuss implementation of the Five-Year Strategic Plan for Whalewatching (Plan). This joint meeting was held on 20 May 2015.

The overall goals of the meeting were to discuss the development of a beta version of the Online Handbook for Whalewatching, the process needed to achieve a version by the next Commission meeting in 2016, and how to move forward with the capacity building components of the Plan. As reported at SC/65a, a 'level' approach will generally be followed for each topic or theme: Level 1 (short, simple); Level 2 (for people who wish more detail after reading Level 1); and Level 3 (for specialists who wish to explore the topic thoroughly).

It was decided that in order to develop the beta website efficiently, two team members from the Committee and two from the Working Group will spend a week working directly with the Secretariat in Cambridge. Funding for this meeting will be made available through the existing voluntary contributions to the Working Group. The goal is to have a draft version ready to submit to the Committee and the Working Group by the end of April 2016. Suggested edits from those bodies would be incorporated before SC/66b, where additional comments would be taken and incorporated into the version presented to the Conservation Committee and Commission at IWC/66. See Annex M, item 7 for more details.

The Committee **agrees** that the collaboration involving the Handbook has been an excellent example of coordination between the Scientific Committee and the Conservation Committee.

15.4 Review whalewatching on the Pacific coast of the USA
Annex M, table 3 summarises the number of whalewatching operations along the western coast of the USA.

It was noted that more tourism companies are now advertising whalewatching from novel, individual platforms such as paddleboards. In further discussion, two emerging issues of concern were identified: (1) recently developed or new technology, such as drones, selfie sticks, Go-Pros, social media, and smart phone video, being used by whalewatching operators or passengers in ways that can result in reckless human behaviour (which can be dangerous for people and animals); and (2) changes in species distributions in certain areas, most probably due to changing prey distribution and other climate change-related habitat changes, leading to previously infrequently or never observed species being targeted by established whalewatchers. Whalewatchers encountering never-before-seen species may travel into new areas (sometimes outside of established whalewatching areas) and may be faced with behaviours different from those of established target species, which would require the operators to have a better understanding of the new species' ecology and natural history.

The Committee **recommends** that researchers, naturalists and other relevant individuals using or working on-board platforms of opportunity report back to the Committee regarding prevalence of these new technologies, potential or observed impacts, and any other relevant information related to the use of these technologies during whalewatching activities (including via National Progress

---

[17] https://iwc.int/whalewatching

Reports). The Committee also **recommends** that relevant authorities conduct operator training programmes that address newly observed species' ecology, behaviour, and requirements for best-practise whalewatching. In addition, there needs to be better outreach to tourists, recreational whalewatchers and others active on the water, offering education about these new species.

It was noted that the South Pacific Regional Environment Programme (SPREP) has designated 2016-17 as 'The Year of the Whale' for the Pacific. Given that SPREP and the Commission have recently established a cooperative programme, and that whalewatching has great potential for many Pacific nations, the Committee **agrees** that the South Pacific should be the focus of this item at the 2016 annual meeting and **requests** the Secretariat to invite SPREP to submit a report to that meeting on whalewatching in SPREP member nations (see Annex M, Item 13).

15.5 Consider information from platforms of opportunity of potential value to the Scientific Committee
Ritter *et al.*(2015) presented data from a long-term cetacean study where, during regular whalewatching trips from La Gomera, Canary Islands, physical anomalies were detected in cetaceans and analysed from photographs. These anomalies were categorised as: (1) skin lesions and injuries; (2) skin anomalies (e.g. distinct blotches, patchy scars, dents, bumps); and (3) deformed and emaciated animals. Anomalies were found in the following species: bottlenose dolphin, pilot whale, Atlantic spotted dolphin, rough-toothed dolphin and common dolphin. Documenting anomalies, even if conducted in a non-systematic way from platforms of opportunity, can significantly contribute to assessing the health status of small cetacean populations.

In discussion, the qualitative value of these data was noted, but it was also noted that, in areas with larger numbers of whalewatching vessels, such data can cover more area, be systematic and have quantitative value. See Annex M, item 9 for more details.

15.6 Review whalewatching guidelines and regulations
See Annex M, Item 10 and Table 2 for details from SC/66a/WW08 regarding research on compliance with whalewatching guidelines and regulations.

SC/66a/WW18 described a new regulation on whalewatching in Ecuador. In 2008, the Constitution of Ecuador guaranteed the Rights of Nature. In 2014, the Ministries of Environment, Tourism, Public Works, and National Defense signed Inter-ministerial Agreement No. 20140004, for the Regulation of Whalewatching Tourism in Ecuador, to replace the 2002 Whalewatching Regulation.

ROMM (2014) is a mariner's guide to whales in the Northwest Atlantic. Some of its advice was considered relevant to whalewatching vessels, especially larger commercial boats. The guide alerts mariners to the need to be especially vigilant against collisions with whales when there are adverse weather conditions, when the vessel is travelling at higher speed, and when the vessel is in areas of known high occurrence of whales. See also Annex J, Item 7.3(i).

During discussion, it was noted that the main problem in the context of whalewatching was smaller rather than larger vessels. In addition, all vessels that may slow to view whales must be considered when addressing collision risk, not just commercial whalewatching boats. The Committee **encourages** additional research on collision risk in the context of whalewatching and agrees that regulations and guidelines meant to minimise collision risk should apply to all vessels around whales.

Carlson noted that the IWC compendium of whalewatching guidelines and regulations was not updated last year, but an update will be available this year. The Committee **recognises** the important contribution this compendium has made to its work and the work of the Commission with respect to whalewatching. This has been the result of a major voluntary commitment by Carlson over two decades. The Committee **wishes to place on record its great appreciation** for the tremendous work of Carlson in supporting the work of the sub-committee on whalewatching as well as her long-term contribution to the work of the Committee with respect to the North Atlantic and Antarctic humpback whale catalogues.

A study to identify best practises in Pacific whalewatching, as reflected in US and Canadian whalewatching guidelines, was conducted from December 2014 to May 2015. The study noted a 60% rate of noncompliance with the ≤30 min viewing guideline during the first pursuit of a baleen whale. After the first pursuit, any subsequent pursuits showed greater rates of compliance with this guideline. See Annex M, item 10 for additional discussion.

15.7 Emerging whalewatching industries of concern
Mahanty *et al.* (2015) reported the results of a passive acoustic monitoring study undertaken in the southeastern Arabian Sea off the coast of Kerela, India in January to May 2015. The study identified what may be new humpback whale breeding habitat in the northern Indian Ocean, as detected by one fixed, static array.

Prior to this study, the most distant acoustic detection of humpback whales from the Arabian Sea area was Sri Lanka. The presence of singing whales off Kerela suggest this may be a previously unknown breeding area. See Annex M, item 11 for details.

It was suggested that a regional organisation in the Arabian Sea could be effective in addressing the management concerns that arise with this critically endangered population. The region previously proposed such a group, but it may be too early for one to form, given the lack of knowledge about the whales in some areas within the region. There needs to be more education and outreach to Arabian Sea range states, particularly those that are not Commission Members or otherwise aware of this issue.

Minton *et al.* (2015) detailed a workshop held in Dubai in January 2015, attended by regional researchers with the aim to review information and develop a unified and collaborative research strategy for Arabian Sea humpback whales. Knowledge and capacity gaps were identified and recommendations made, including establishing network resourcing and outreach links with additional stakeholders and governments of range states. Studies have started and group efforts now require basic resources to initiate work plans. See Annex M, item 11 for additional details and discussion.

The Committee **agrees** that every effort to manage whalewatching regionally in the Arabian Sea must be made and it **endorses** the workshop's recommendations (see Executive Summary of Minton *et al.*, 2015).

Finally, an overview of research activities and emerging threats in Oman during the 2014-15 season was presented, and the proposed approach for spending funds allocated by the Commission in 2014 to support development of a sustainable whalewatching industry in the Sultanate was described. Research continues to confirm the importance of Hallaniyats Bay and the Gulf of Masirah as important Arabian Sea humpback whale habitat, where threats from shipping, hydrocarbon exploration and extraction, and fishing industries are emerging. The proposed approach for 2014-16 Commission funding is to continue with the same team and condense the work plan into one year, concentrating on training vessel captains to ensure they adhere to whalewatching guidelines. Government and industry stakeholders will also be consulted to get further comment on regulation and monitoring of the industry.

The Committee thanked the Commission for its financial support for this work. The Committee **agrees** that there is a need to cap the number of boats until there are effective regulations in place, and **recommends** management action to limit the industry's expansion until regulations are developed. See Annex M, item 11 for additional details.

15.8 Progress on previous recommendations
A questionnaire to identify situations where Committee advice on whalewatching has been utilised during efforts to develop guidelines or other protective initiatives for whalewatching management was presented for review and comment. The Committee **recommends** that the developers solicit input from the Committee intersessionally, distribute it to relevant parties before the 2016 annual meeting, and report back with any results at that meeting.

15.8.1 Panama
SC/66a/WW14 outlined the results of boat-based observations of whalewatching operator compliance with regulations in Bocas del Toro. Almost three-quarters of boat operators were noncompliant with boat distance requirements. When boat operators, at both noncompliant and compliant distances, were further evaluated for their compliance with the regulations on boat manoeuvring, boat operators at noncompliant distances were also noncompliant with respect to manoeuvring 67% of the time, i.e., they were 'double noncompliant'. Operators were also often noncompliant with the requirement for limited number of boats: 45% of the time, three or more boats at a time were recorded observing a dolphin group (requirement = two boats at a time observing a dolphin group), and up to 15 boats were seen with a group of dolphins on three occasions.

SC/66a/WW15 reported the results of a survey on tourists' perspectives on dolphin-watching in Bocas del Toro. Tourists wanted more educational tours (88% of tourists said this was important) and they wanted a boat operator who was licensed for whalewatching (87%), educated about dolphins (92%), and followed whalewatching regulations (97%). In addition, 93% of tourists believed that the Panamanian government should provide more environmental protection for Bocas Del Toro.

SC/66a/WW16 reported the results of a survey on operators' perspective. Almost half of boat operators said they have not received any whalewatching training. Only 27% said they were aware of official whalewatching regulations, while 40% said they did not know of any regulations and 33% emphatically stated there were no regulations. Boat operators were also not knowledgeable about the status of the dolphins. However, boat operators stated that dolphin conservation was important to them (93% of boat operators said that marine environmental protection was important, and 93% said that dolphin conservation was 'very important' to them). Thus, despite a lack of compliance with dolphin-watching regulations in Bocas del Toro, tourists are supportive of regulations for boat operators and better environmental protection in the region, and boat operators agree that protecting the local dolphins is important.

SC/66a/WW01 described a community planning effort for Bocas del Toro. Five meetings, taking place in late 2014 through early 2015, were organised with local leaders and representatives of some of the relevant government agencies. The meeting participants noted three urgent issues to be addressed within the next year: (1) restructuring the tours offered to significantly reduce the use of Dolphin Bay and other threatened ecosystems; (2) building a 'Dolphin Centre' at the entrance of Dolphin Bay, to serve as a control post for boats entering the bay and as a visitor centre; and (3) implementing a dolphin-watching licensing scheme (and compliance evaluation).

It was noted that training workshops that rely on PowerPoint presentations and printed materials are often ineffective in Bocas del Toro, as many boat operators are functionally illiterate. Operators prefer to speak with people they know and may not feel comfortable asking questions of non-locals and government officials.

It was noted that operators are doing what passengers ask them to do; for example, passengers ask the operators to get closer to the dolphins and the operators comply, despite knowing close approaches within 100m are illegal. Therefore, it is important to educate passengers, so they understand that close approaches are harmful.

During discussion of the efficacy of 'top-down' versus 'bottom-up' regulation of whalewatching, some members felt bottom-up, community level management may be more effective in communities like Bocas del Toro compared to top-down, government-enforced management. The Committee **recommends** additional studies on the effectiveness of the two styles of whalewatching management, with results to be presented at future Committee meetings. The Committee **recommends** that any future workshops in Bocas be designed to maximise the sense of local ownership of the process and outcomes.

The Committee **agrees** that tourism representatives should also be included in these workshops wherever appropriate and possible. The Committee **recommends** that researchers and managers working in Bocas del Toro work with those who advertise the area as a tourism destination to set more realistic and conservation-minded expectations.

The Committee **expresses grave concern** about the continuing, intransigent situation with dolphin harassment by dolphin-watching operators in Dolphin Bay and noted that the advice it has been offering to the Panamanian government over a number of years is not being heeded. It **recommends** that dolphin-watching in Panama be a focus of discussion at the Joint Meeting of the Scientific and Conservation Committees at the end of SC/66a and **agrees** that the Joint Meeting should consider how concerns and associated advice related to Bocas del Toro might be most effectively delivered to the relevant authorities in Panama and, more generally, how concerns and advice about whalewatching might be most effectively delivered to relevant countries/authorities.

The Committee reiterates points made at previous meetings, including that Panamanian authorities appear to be insufficiently committed to controlling the dolphin-watching situation in Bocas, despite the repeated recommendations of the Committee and others. The Committee **recommends** that the relevant authorities in Panama make the enforcement of the dolphin-watching regulations a higher priority.

The Committee **agrees** that efforts to address the situation in Bocas del Toro must be three-pronged: (1) engage the authorities; (2) educate boat and tourism operators and tourists; and (3) support research. In addition, the Committee **strongly recommends** the formation of a permanent local organisation in Bocas del Toro to manage these three approaches. Tourists, boat operators, and the community all support more protection for the Bocas del Toro dolphins, but without local 'champions' and long-term local ownership of capacity building efforts, the situation is unlikely to improve.

See Annex M, item 12 for additional details and discussion.

15.9 Work plan
The work plan on general issues related to whalewatching is given as Table 20 (for details see Annex M). Budget implications are discussed under Item 26.

Table 20

Work plan on matters related to whalewatching.

Item	Intersessional period/groups	SC66b
Assess impact of whalewatching:		
Intersessional groups on various aspects	(1) MAWI working group (2) Swim-with-whale group (3) Data collection group	Review progress and develop work plan
Emerging concerns	Encourage submission of new information (e.g. on new technologies; new species entering existing areas)	Review progress and develop work plan
Regional reviews (South Pacific)	Secretariat to invite SPREP to submit a review document	
5-year strategic plan and joint work with Conservation Committee:		
Handbook	Development of beta-site (small drafting group)	Review progress and develop plan to finalise
Other matters	How best to ensure effective transmission of advice	Review progress
Other regular items:		
Regulations and guidelines	Upload new compendium	Continue to review
Progress on recommendations	Contact authorities in Bocas del Toro; Arabian Sea	Continue to review
Platform of opportunity data	Intersessional group	Review progress
Structure for 'digest table'	Intersessional group	Review progress

16. DNA TESTING (DNA)

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

16.1 Review genetic methods for species, stock and individual identification
SC/66a/SD3 described a project to verifying the status, storage conditions and metadata of samples from stranded cetaceans collected by the Department of Primary Industries, Parks, Water and Environment (DPIPWE) and the Tasmanian Museum and Art Gallery (TMAG). The samples date from 1862 to the present, and the verified sample collection contains 4,349 specimens held over two collections at DPIPWE and TMAG. A summary of previous or ongoing research using samples obtained through the Tasmanian Government sample holdings was also presented. The collection metadata set is to be made publically available.

The Committee was pleased to receive this information and commends the work done. Details of this paper and the discussion are found in Annex N, item 5.

Keane *et al*. (2015) described the genome and transcriptome sequences of bowhead whales and analysed them for evidence of genes associated with aging and disease protection, and other adaptations. To investigate the genetic basis for longevity and other adaptations, a single female bowhead from Greenland was sequenced for the genome and two Greenland and two Alaska bowheads were sequenced for the transcriptome. Using various methods of analysis, genes were identified as candidates for adaptations to aging, cancer protection, DNA repair, sensory perception of sound, growth, thermoregulation, immune system, blood homeostasis, digestive system, dentition, and adipogenesis. Although genome sequences are available for many species of importance to medical research and to agriculture, this is the first genome sequence of a species of primary importance to a subsistence diet.

Seim *et al*. (2014) described the transcriptome sequence from four BCB bowheads for liver (*n* = 4), heart (*n* = 1) and kidney (*n* = 3). A total of 9,395 candidate protein coding genes were identified. In liver, 45 genes were differentially expressed in the bowhead and included genes associated with insulin signalling. This is likely indicative of genetic adaptations to a lipid rich diet as compared to terrestrial relatives of whales, especially artiodactyls, which are adapted to a carbohydrate rich diet. Other genes were identified that are likely associated with hypoxic stress, vascular development, and DNA repair. Study of the bowhead heart transcriptome revealed genes associated with cardiac metabolism and likely adaptations to hypoxia, a key associate to their diving capability, and to vascular aging. In the kidney, 53 genes were identified with differential expression in the bowhead and included known DNA repair genes. These could be key to the prevention of age-related kidney decline that is known to result from the reduced ability to of kidney cells in aging humans and other mammals to repair and proliferate.

The Committee commended the large amount of work and valuable information produced in these two published studies. It recognises that the availability of both a genome (Keane *et al.*, 2015) and a transcriptome (Seim *et al.*, 2014) for the bowhead whale are a valuable resource for future investigations in a Committee context, namely: (1) as a source for potentially informative markers (SNPs), which are useful in the context of stock definition/DNA registers; and (2) to facilitate the estimation of (effective) population size.

A workshop sponsored by the North Slope Borough on the bowhead genomics program is planned for October 2015 in which technical papers as well as issues surrounding data use will be addressed.

The Committee appreciates that the genomic resources accumulated in Keane *et al*. (2015) and Seim *et al*. (2014) are published and hence publicly available. Details of these papers and the discussion are found in Annex N, item 5.

SC/66a/BRG12 summarised the progress made toward two goals of the bowhead genetics project: (1) building a mtDNA database; and (2) developing a SNP panel and database. The authors continue to sequence 3 mitochondrial genes (control region, cyt-b, and ND1), as this combination has been shown to have more power in resolving relationships than the commonly used control region alone. To date, there are data from 711 whales: 447 sequenced for cyt-b, 427 for ND1, and 638 for the control region. Of these, 345 whales are completed for all three loci. A summary of methods used for choosing a SNP panel and assay method was given. Of the 155 previously identified bowhead SNPs, the authors chose a subset of 96 loci based on the following criteria: (1) desire to include all sex chromosome markers; (2) minimising linkage among loci; and (3) ease in developing primers to amplify the SNP. The SNP panel was derived from SNPs identified in previous studies using a combination of methods, including whales from three populations. This should minimise ascertainment bias as much as possible. Both the mtDNA and SNP data will continue to be used for monitoring stock structure, population size estimates, and historical demography of bowheads.

Last year (IWC, 2015f, p.60) the Committee received information on the bowhead whale genetic project (Baird *et al.*, 2014). SC/66a/BRG12 provided additional information on this project. As last year, the Committee commended the amount of work undertaken in this study. This information is of relevance to the present agenda item as SNPs could potentially replace microsatellite markers in national DNA registers for large whales.

The Committee **agrees** that a comparison of the methods presented in SC/66a/BRG12 to SNP assessment performed by ddRAD sequencing (Lah *et al.*, 2014) is desirable and **encourages** that this work is undertaken and presented to the 2016 Annual Meeting. Details of this paper and the discussion are found in Annex N, item 5.

16.2 Review results of the amendments of sequences deposited in *GenBank*
In previous years, the Committee agreed that the list of accession numbers involving inconsistencies due to a lag in the taxonomy recognised by *GenBank* or uncertainty in taxonomic distinctions currently under investigation (see IWC, 2014h, pp.396-8) should be sent to *GenBank* with a letter explaining the background and the main reasons for the inconsistencies (see IWC, 2014d, p.56). Last year (IWC, 2015f, p.60), the Committee agreed that Cipriano should keep in contact with *GenBank* in the next intersessional period to facilitate the work by *GenBank* staff on the correction of the inconsistencies based on the list sent.

Cipriano informed the Committee of the work done intersessionally. There are two planned or underway mechanisms for taxonomy updates at the NCBI: (1) already being used (currently only for bacteria) is genome sequencing from type specimens, in order to find and correct the vast majority of the misidentified sequences in *GenBank*; and (2) being considered is to allow annotation of *GenBank* sequences by interested parties, in order to note taxonomic mis-assignment or questions about geographic source of the organisms involved.

<div align="center">87</div>

The Committee thanked Cipriano for his work and **encourages** him to keep contact with NCBI in the next intersessional period to have further discussion and to make progress on the second proposed mechanism.

In response to a query the Committee was informed that over 250 problematic sequences were identified during the last full review of such issue in 2013 (IWC, 2014d), and these included situations where taxonomic usage had changed or was in flux, use of alternate synonyms for the same species, lack of identification to the subspecies level, and difficulties in identification to species of origin from sequence information alone.

Suggestions for additional improvements were made including adding mechanisms for detecting and correcting duplicate sequences from the same specimen, consistent inclusion of specimen numbers to allow cross-referencing, and noting geographic source of a specimen including latitude/longitude whenever possible.

16.3 Collection and archiving of tissue samples from catches and bycatches

The Committee previously endorsed a new standard format for the updates of national DNA registers to assist with the review of such updates (IWC, 2012b, p.53) and the new format has worked well in recent years. This year the update of the DNA registers by Japan, Norway and Iceland were based again on this new format. Details are given in Annex N, appendices 2-4 for each country, respectively, covering the period up to and including 2014. The Committee thanked the countries involved for providing this information.

16.4 Reference databases and standards for diagnostic DNA registries

Annex N, appendices 2-4 summarise the status of mtDNA and microsatellite analyses of the stored samples for Japan, Norway and Iceland, respectively. In almost all cases, the great majority of samples have been analysed for at least one of either mtDNA or microsatellites and in most cases both. Work on unanalysed samples is continuing. Details of the exact number of samples collected and analysed are provided in Annex N, item 8.

In response to a query it was clarified that strandings are not considered in the new standard format for the update of national DNA registries as these are not subjected to market operations.

The Group appreciated the efforts of Japan, Norway and Iceland in compiling and providing this detailed information of their registries.

16.5 Work plan

The work plan on general issues related to DNA testing is given as Table 21 (for details see Annex N). Budget implications are discussed under Item 26.

Table 21

Work plan on matters related to DNA testing.

Item	Intersessional period/groups	SC66b
Progress on genetic methods	(1) North Slope Borough workshop (2) Comparison of the methods presented in SC/66a/BRG12 to SNP assessment performed by ddRAD sequencing	Review progress and relevant documents presented to all sub-groups
Amendments to *GenBank*	Continued work on improving methods for amendment	Review progress
Archiving of samples	Continued work by relevant countries	Receive reports
Reference databases	Continued work by relevant countries	Receive reports

17. SCIENTIFIC PERMITS

17. 1 Review report of the NEWREP-A expert review workshop (SC/66a/Rep06)

Table 22

Summary of the objectives of NEWREP-A

1. Improvements in the precision of biological and ecological information for the application of the RMP to the Antarctic minke whales
   a. Abundance estimates taking into account g(0) and additional variance
   b. Improvements in precision:
      i. age data
      ii. refinement of SCAA model and estimation of biological parameters
   c. Refined stock structure hypotheses in Areas III-VI
   d. Specification of RMP ISTs for Antarctic minke whales
2. Investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models.
   a. Krill abundance estimation and oceanographic observation

    b.   Abundance estimates for some cetaceans as input data for ecosystem modelling
    c.   Estimation of prey consumption by Antarctic minke whale and its nutritional condition
    d.   Spatial interaction among baleen whales (Ecosystem Modelling Part 1)
    e. Investigation of ecosystem dynamics in the Antarctic Ocean (Ecosystem modelling Part 2)

17.1.1 Chair's summary

The expert panel (hereafter 'the Panel', chaired by Palka, was comprised of 5 current members of the Committee, 3 scientists who have never participated, 1 scientist who rarely participates in the Committee, and the Head of Science (in accord with the guidelines). Expertise in all areas of the research programme was available. Twelve papers were submitted to the workshop: the proponent's proposal, 6 papers by Scientific Committee observers, and 5 papers in response to the observer papers.

The review by the Panel was guided by Terms of Reference for reviews of Special Permit research proposals developed by the Scientific Committee (referred to as 'Annex P', IWC, 2015k, pp.349-53). It also agreed to take into account the instructions from the Commission to the Scientific Committee found in Resolution 2014-5. It followed the working practice of previous Panels in that there were open discussion sessions for presentations by the proponents and observers who had submitted papers, and closed sessions for the Panel to discuss the presentations and documents and write its report.

The Panel report (SC/66a/Rep6) is divided into sections broadly based on the terms of reference: consideration of objectives and sub-objectives and the relationship amongst them; methods to address objectives including consideration of non-lethal alternatives as appropriate, sample size estimation, effect of proposed catches upon the stocks, back-up pan for contingencies, provisions for cooperative research, and finally the conclusions and recommendations. Table 1 of the report summarised the recommendations, Table 2 summarised the Panel's views on matters related to Objective I and Table 3 summarised the Panel's views on aspects of Objective II.

(A) OVERALL CONCLUSION

The report provides a long and detailed review. What follows here is a short Panel Chair's summary of only the broad conclusions. The Panel emphasised that its task was to provide an objective scientific review of the NEWREP-A proposal; its task was not to provide either a general condemnation or approval of research under special permit.

As its overall conclusion, the Panel recognised the considerable work that had been undertaken by the proponents in developing the NEWREP-A proposal. However, as detailed in the body of the report, the proposal contained insufficient information for the Panel to complete a full review. The Panel made a number of important recommendations for additional work that it believed to be essential to be completed before a full review of the programme under the Annex P and Resolution guidelines can be completed. It noted that the recommended analyses can be conducted with existing samples/data and new non-lethal sampling efforts.

With respect to timelines, the Panel recognised the value in maintaining long-term datasets. However, the Panel agreed that if there is a short (e.g. 2-3 year) gap in the existing series to enable the recommended analyses to be completed related to fully quantifying and prioritising sub-objectives and determining appropriate techniques (lethal or non-lethal), this will not have serious consequences for monitoring change. The Panel therefore agreed that the recommendations in Table 1 of its report should be completed and the results evaluated before there is a final conclusion on lethal techniques and sample sizes. This consideration does not affect the non-lethal components of the proposal, which can be undertaken without discontinuation of the current research. The Panel's view on the need for new samples and/or data, feasibility, relevance, and contributions to the RMP, scientific research and conservation and management for aspects of Primary Objectives I and II of NEWREP-A are summarised in Tables 2 and 3, respectively.

In summary, with the information presented in the proposal, the Panel noted that it was not able to determine whether lethal sampling is necessary to achieve the two major objectives; therefore, it concluded that the current proposal did not demonstrate the need for lethal sampling to achieve those objectives.

The sections below cover the aspects of the proposal in more detail in light of the Terms of Reference and the Resolution.

(B) PROGRAMME MANAGEMENT, RESOURCES, TIMELINES, FEASIBILITY (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.2[18])

While welcoming additional information provided during the Workshop, the Panel had noted that a revised proposal must provide more information on programme management, personnel and logistics, to enable it to evaluate this aspect of feasibility for such an extensive programme.

Following the reviews of previous Panels (for JARPN II and JARPA II), the present Panel also highlighted the importance of having sufficient resources allocated to modelling. This is especially important in responding to recommendations that will allow a full evaluation of the feasibility of meeting objectives within the timeframe and sample sizes, irrespective of whether lethal or non-lethal methods are used.

(C) CONSIDERATION OF OBJECTIVES (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.1; DETAILS ITEMS 2.1.2; 2.2.2,)

The objectives of NEWREP-A are summarised in Table 22 above. The Panel agreed that Objective 1 (Improvement in the precision of biological and ecological information for application of the RMP) was of general importance for conservation and management.

---

[18] In this Chair's summary, the item numbers in parentheses refer to the items in SC/66a/Rep06)

However, the proposal had not quantified the likely level of improvement which is a vital component for evaluating the proposal in terms of either the feasibility of meeting the objectives or appropriate sample sizes (irrespective of whether using lethal and/or non-lethal methods). The Panel recommended a quantitative method to accomplish this so that a revised proposal could be evaluated.

The Panel also agreed that Objective 2 (Investigation of the structure and dynamics of the Antarctic marine ecosystem through building ecosystem models) was an important area of research. It recognised that because this is a worldwide developing field of research, it was more difficult to evaluate feasibility of meeting the objectives and to determine appropriate sample sizes.

(D) METHODS INCLUDING CONSIDERATION OF NON–LETHAL ALTERNATIVES (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.1; DETAILS ITEMS 3.1.3, 3.1.5, 3.2.2, 3.3.4, 3.4.3, 3.5.3, 3.6.2, 3.7.2, 3.8.2, 3.9.3, 3.10.2, 3.11.2)
The Panel noted that the evaluation of lethal and non-lethal methods in the proposal and in one of the papers by the observers were largely qualitative. It advised that at least for Objective I, a quantitative approach to the different approaches could be developed using RMP *Implementation Simulation Trials*. The Panel report noted the complexities of a full evaluation of lethal and non-lethal methods that includes concepts of feasibility and validation. It also raises the issue of who is responsible for testing and validating new techniques. The Panel also stressed that for both objectives it is not how much methods reveal about individual metrics but how it contributes overall to the objectives.

The Panel noted that an essential component for several potential non-lethal alternatives is the collection of biopsy samples. It recommended the undertaking of a full field experiment to address this and the factors that must be involved. Several of its recommendations also involved analytical and laboratory work to validate proposed non-lethal alternatives and quantify uncertainties to enable full comparisons to be made (e.g. DNA – methylation techniques for age). It had noted that these could be undertaken using existing samples.

(E) SAMPLE SIZE (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.4; DETAILS ITEM 4)
The Panel had noted that the data for lethal sampling were proposed for a variety of purposes. Analytical calculations for each purpose with an integration of all for a full programme may be the ideal but is probably not possible in advance for a programme that includes modelling development (e.g. for Objective 2).

The Panel therefore concentrated on the approach used by the proponents to estimate the sample size for a particular purpose – to detect a change in age at sexual maturity (it noted that the proponents had not included a direct link from this to how it would improve conservation and management and recommended an approach to address this). The Panel welcomed the efforts of the proponents to provide a quantitative assessment of the necessary sample size but noted that assumptions made mean that the sample size was underestimated, perhaps considerably. Advice on an improved approach was provided – without this sample size could not be evaluated.

The Panel noted that samples sizes required to produce a specified improvement in the amount of management-relevant information should be undertaken for all aspects of the proposal (irrespective of whether lethal or non-lethal methods are used) to provide an overall view of sample size for the programme.

(F) EFFECT OF CATCHES UPON THE STOCKS (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.5; DETAILS ITEM 5)
The Panel agreed that given the estimated abundance of the stocks involved, the precautionary nature of the RMP and the nature of the sampling regime proposed, the conclusion (catches of 333 animals every second year in the two study areas will not harm the stocks) is very likely robust to either of the analytical methods used. However an improved approach was recommended.

(G) BACK-UP PLAN FOR CONTINGENCIES (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.6; DETAILS ITEM 6)
The Panel welcomed the recognition in the proposal of the importance for planning for unexpected disturbances. It noted that although the precise nature of such disturbances could not be known, analyses could be undertaken based upon past disruptions in order to develop contingency plans.

(H) PROVISION FOR CO-OPERATION (CONCLUSIONS AND RECOMMENDATIONS – ITEM 8.7; DETAILS ITEM 7)
The Panel welcomed the recognition in the proposal of the importance of collaboration but noted that at this stage there was insufficient information available on the potential extent and scope of collaborations with national and international scientific bodies. The Panel made recommendations in regard to *ad hoc* and formal types of collaboration. The Panel welcomed the stated intention to submit plans to CCAMLR for advice on the proposed krill research.

(I) RECOMMENDATIONS (ITEM 8)
It was noted that specific Panel recommendations are summarised in table 1 of SC/66a/Rep06. The table also identifies the purpose of the recommendations (e.g. to evaluate objectives, to evaluate feasibility of either lethal or non-lethal techniques, to evaluate whether lethal sampling is required, to evaluate sample size, to improve existing components), the timeframe assuming sufficient resources and whether new samples are required.

Palka completed her summary by noting that the Panel had concluded that additional work was required before a full review of any updated version of NEWREP-A could be completed and in particular before an evaluation of whether proposed objectives were achievable (whatever techniques, lethal or non-lethal were employed).

17.1.2 Committee conclusions on the report of the Panel
The Committee thanked the Panel for its hard work and extensive report. It noted that conclusions and recommendations of the Panel will form an important component of the Committee's review.

The Committee's overall conclusions on the NEWREP-A proposal can be found under Item 17.1.5. These take into account the Panel report, the response of the proponents (Item 17.1.3) and a Committee review of the proponents intersessional work (Item 17.1.4).

17.1.3 Response of proponents to NEWREP-A
SC/66a/SP1 provided the proponents' preliminary response to SC/66a/Rep 6 that had been submitted 40 days in advance of the Committee meeting. It contains two main sections: general comments in light of the Terms of Reference (TORs) of the review workshop prescribed in Annex P; and comments and responses to the conclusions and recommendations of the Expert Panel. The paper is summarised by the proponents briefly below.

With respect to the first TOR (comment briefly on the perceived importance of the stated primary objectives from a scientific perspective and for the purposes of conservation and management, noting particularly its relevance to the work of the Scientific Committee), the proponents believed that the Panel had acknowledged the reasonableness of both Main Objectives I and II.

Regarding the second TOR (provide advice and suggestions on components of the programme that might be achieved using non-lethal methods, including, where appropriate, power analyses and time-frames), the proponents noted that the Panel had agreed that at present, the techniques commonly used for the determination of biological parameters used in the proposed SCAA model require lethal sampling (earplugs for age determination, length and reproductive organs for sexual maturity). It also noted that two important inputs to multi-species modelling can potentially be obtained from lethal sampling; total consumption and prey preference.

Regarding the third TOR (determine whether the proposed field and analytical methods are likely to achieve the stated quantified objectives within the proposed time-frame, where appropriate, commenting on sample size and time-frame consideration), the proponents noted that the Panel had stated that determining the appropriate sample size for the complete programme, although desirable in principle, may not be possible in advance', that the broad approach taken with respect to ASM was not unreasonable and that the proponents had provided a more quantitative approach to examining sample size than in JARPA II. It had also welcomed the additional information on timeframes presented during the workshop that had not been provided in the proposal.

Regarding the fourth TOR (provide advice on the likely effects of the catches on the stock or stocks involved under various scenarios of length of the programme – this will include inter alia examination of abundance estimates provided and may involve a different analysis to that provided in the original proposal, including assumptions that short permit proposals may be projected further into the future), the proponents noted that the Panel had agreed that that the proposed catches in the two study areas will not harm the stocks.

Regarding the last TOR (review the proposed intermediary targets and suggest when an intermediate review or reviews should take place), the proponents noted that the Panel did not make a recommendation on the intermediary targets and the timing of intermediate review(s).

The proponents noted that the Panel had made a total of 29 recommendations. The proponents believed that these can be divided into two groups: (1) those relevant to a 'full evaluation of whether any new lethal sampling is required' and 'issues related to sample size' (13 recommendations); and (2) those not relevant to such issues (16 recommendations). The proponents consider that it is not necessary to address all the recommendations 'before there is a final conclusion on lethal techniques and sample sizes' as more than half of the recommendations are not related to issues on the necessity of lethal sampling and the reasonableness of the sample size. Among the recommendations that are classified in the former category above, the proponents consider that investigations in response to particular recommendations should be accorded the highest priority. These are recommendations 1, 11, 12, 13 and 26 in Table 1 of SC/66a/SP1. SC/66a/SP1SP1 provides detailed responses and a working timeframe for the 29 recommendations while SC/66a/SP8 details progress on work and results for the highest priority recommendations as well a detailed research plan for the dedicated sighting survey in the 2015/16 austral summer season.

The proponents consider that the Panel's conclusions and recommendations provided in Item 8 of SC/66a/Rep 6 appear to assume that the necessity of lethal sampling cannot be proven unless the feasibility studies of all of the conceivable non-lethal research techniques, both current and future ones, are completed and the conclusion is reached that none of the non-lethal techniques is a feasible alternative to lethal sampling. The proponents believe that a more reasonable approach is to determine the feasibility of non-lethal methods based on the scientific and technical knowledge available at present, and if deemed unfeasible, to initiate lethal sampling in the meantime while continuing feasibility studies on non-lethal methods on an ongoing basis.

Finally SC/66a/SP1 states that a consolidated Revised Research Plan for NEWREP-A will be prepared after this the present Committee meeting, taking account of the discussions at the meeting.

SC/66a/SP8, provided in accordance with the normal document rules for annual meeting papers, reported on updates of the analytical parts of NEWREP-A and a research plan for the dedicated sighting surveys in 2015/16 to respond to the relevant recommendations provided by the Expert Panel.

A total of five investigations (a-e) were conducted and reported in Annex 1 of SC/66a/SP8. Item (a) is documentation for describing a specification of the calculation used in analyses based on the statistical catch-at-age analysis (SCAA) model. Items (b) and (c) are exercises to investigate the nature of the SCAA model for Antarctic minke whales using existing data to assess how sensitive the SCAA results are to values of a biological parameter (the age-at-sexual maturity, ASM) and ecological assumptions (a stock boundary position). This exercise provides some information on the impacts of change in age-at-sexual maturity and the assumption concerning stock structure on the estimation of the population dynamics of Antarctic minke whales.

Item (d) is relevant to the proposed sample size for NEWREP-A. The NEWREP-A sample size was determined to achieve sufficient power to detect a future change of a specified size in the age-at-sexual maturity over a specified period of time. In the proposal for the plan, a simulation test was conducted under the assumption of a stable age distribution. However, the Panel recommended a more complex approach to estimate the necessary sample size (SC/66a/Rep06, pp. 31-2). The proponents' response is reported in SC/66a/SP8. The estimated statistical power from this new analysis was a little less than the statistical power reported in the original proposal of the NEWREP-A. Nevertheless, the authors believed that the proposed sample size of 333 guarantees reasonable power to detect a change in the age-at-sexual maturity over time.

Finally in Item (e), given the proposed sample size, the level of expected improvement in the precision of quantities estimated by the SCAA after the 12 year period of NEWREP-A was assessed. The results indicated that the future age-data are necessary to achieve reasonable precision for estimates of recruitment and recruitment rates. The authors considered that these results are a clear indication of the value of age-data to be obtained in NEWREP-A in understanding the population dynamics of Antarctic minke whales and hence improving their management, together with abilities to potentially detect the impact of climate change on this species.

The proponents noted that some analyses are still ongoing and these are planned to be completed before the start of the NEWREP research programme. Results from these analyses will be used to modify the plan of NEWREP-A as necessary.

Annex 2 of SC/66a/SP8 provided a detailed research plan for the dedicated sighting survey in the 2015/16 austral summer season, which incorporates several recommendations from the Panel. Because NEWREP-A is a multidisciplinary survey, Annex 2 provides a summary of activities not only for the sighting survey procedures including the research area, vessels, designs and guidelines for whale abundance estimation, but also includes details of krill surveys, oceanographic surveys, and feasibility studies for biopsy sampling and the telemetry experiment. Detail of the research area (Area V), specification of the vessels to be employed in the 2015/16 season, and tracklines with a combination of closing and IO modes are given. The correspondence between the proposed sighting survey design and the Committee's 'Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme' (IWC, 2012d) is also provided in the document. The proposed NEWREP-A sighting survey also includes: (1) krill surveys with an echosounder system and net sampling; and (2) several feasibility studies for biopsy sampling for the Antarctic minke whales, as well as for a number of telemetry experiments.

17.1.4 Evaluation of the intersessional work undertaken by the proponents
A small working group was convened to evaluate the analyses provided in SC/66a/SP8 and additional work presented in Annex Q2-4, in the light of the Panel recommendations (Punt – chair, Butterworth, Cooke, de la Mare, Kitakado, Matsuoka and Palka) and its report is given as Annex Q1. It provides a detailed evaluation of the progress made in meeting the Panel's recommendations.

The Committee **concurs** with the conclusions of the Working Group. The Committee **notes** that SC/66a/SP8 indicated that it is possible to conduct analyses along the lines suggested by the Panel to analyse the available information more fully to determine whether NEWREP-A will lead to better estimates of quantities which could be used for management purposes. It **recognises** that SC/66a/SP8 (and Annex Q2-4) represent a progress report and essentially none of the analyses are final. However, it **agrees** that substantial progress has been made on several of the recommendations. As expected of a progress report, the documentation of the analyses was incomplete which precluded a full review. More detailed information will be needed for any full review. Nevertheless, the preliminary results indicate that collection of age data will reduce uncertainty in estimates of future recruitment. Whether this is likely to lead to substantial improvements in conservation and management is yet to be demonstrated. The approach recommended by the Panel to evaluate how well NEWREP-A could estimate trends in age-at-sexual-maturity was not fully implemented. Nonetheless, the results thus far suggest that higher sample sizes are required to achieve the desired levels of statistical power. The review of the design of the dedicated sightings surveys was undertaken by the sub-committee on in-depth assessments and that can be found in Annex G, item 7.3. As the Panel had noted, fully addressing the recommendations related to surveys and survey design will require several years.

There was relatively little additional discussion of the Panel report within the Committee. SC/66a/SP9 that evaluated the need for lethal sampling was briefly presented and discussed. This paper was a combination of the information already provided to the expert workshop in SC/F15/05 and 06. It had been summarised in Annex D of SC/66a/Rep06 and reflected the authors' view that lethal methods are not required for NEWRPEP-A. The Committee also heard a response from the proponents that expressed their view that lethal sampling was required. This explanation had also been provided to the expert workshop and had been included as Annex F in SC/66a/Rep06.

Some members commented on information provided by the proponents (SC/66a/SP1 and SP8) in response to recommendations by the NEWREP-A review panel with respect to Objective II. They noted that the JARPA II review panel in 2014 had expressed similar concerns to those expressed by the Panel regarding the lack of details of the ecosystem model structure proposed, and the issues associated with the data needed to parameterise the models. In addition they noted that the Committee has repeatedly come up against the issue that the uncertainties in overall consumption rates are such that data from stomach contents have not contributed to narrowing the confidence intervals compared to other methods. Until the success of the proposed telemetry studies has been demonstrated, the likely contribution of these to reducing uncertainty in the length of the feeding season cannot be evaluated, since this requires considerably longer tag deployments than has previously been achieved. These members therefore concluded that the new information presented does not provide the level of detail over and above the information gaps identified in the NEWREP-A proposal to enable a full evaluation.

Other members disagreed. They believed that sufficient information had been provided in SC/66a/SP1, 2 and 8 as well as SC/F14/J26, with respect to model structure for initial work. This initial work had led to the expanded work on krill data contained in NEWREP-A. Ecosystem model development is an iterative process as recognised by the Panel and additional information will be provided in 2016 and 2107. They also believed that the methods proposed in NEWREP-A using stomach content data were appropriate to obtain estimates of consumption rates and that the proposed approach had responded to recommendations contained in the JARPA II review (IWC, 2015e). They noted that the telemetry experiments and night surveys will also contribute to reduced uncertainty. Finally they commented that for multi-species models, as noted by the Committee (IWC, 2015i), it is not the absolute amount eaten, but trends over time that are important such as those provided in Konishi *et al*. (2014; 2008).

Brierley noted that comments in the Panel report regarding what could be obtained from lethal methods must not be interpreted as the Panel agreeing that there was a demonstrated need for the data that would be forthcoming from those methods.

17.1.5 Discussion of NEWREP-A in relation to Resolution 2014-5
In an initial general discussion of this item, a number of comments both supporting NEWREP-A and opposing it were made, some addressing particular issues and others offering broad comments on the general merits or otherwise of the lethal aspects of the proposal, ecosystem management, interpretations of the Resolution from a procedural perspective, a letter[19] from a group of 500 scientists from 30 countries opposing the proposal and various comments on the judgement of the International Court of Justice (and see Annex Q). From this discussion, it was clear that it would not be possible to develop a consensus Committee view of NEWREP-A. The Committee agreed that it would not be helpful to the Commission to provide them simply with a long list of comments. Therefore, it was agreed that in order to provide advice to the Commission as instructed under Resolution 2014-5, it would establish a drafting group (under Palka) to consider the five items in the Resolution in turn, highlighting for each the views of the Panel, agreements by the Committee where they existed, and concise statements of differences of opinion where they existed. Their report as modified by the Plenary has been incorporated into the Committee's report, below and thus represents the Committee's view.

It should be noted that at the time of writing its report, the Panel (SC/66a/Rep06, item 8) had concluded that: it had made a number of important recommendations for additional work that it believed to be essential to be completed before a full review of the programme under the Annex P and Resolution guidelines could be completed; and with the information presented in the proposal, it was not able to determine whether lethal sampling is necessary to achieve the two major objectives. Therefore, it had concluded that the current proposal did not demonstrate the need for lethal sampling to achieve those objectives.

The views expressed by the Committee below also take into account additional work undertaken by the proponents since the Panel report was published (SC/66a/SP1, SP8, Annexes Q2-4 and NEWREP-A addendum).

The Committee **agrees** that in the case of the NEWREP-A, the objectives of this Special Permit research (Table 22) are directed to improvements in the conservation and management of whales. Thus, issues (a) and (b) of the Resolution are tightly related. Therefore, the Committee **agrees** to combine its advice for these two issues.

17.1.5.1 COMMENTS ON ITEMS (A) AND (B) OF RESOLUTION 2014-5

> (a) whether the design and implementation of the programme, including sample sizes, are reasonable in relation to achieving the programme's stated research objectives;

> (b) whether the elements of the research that rely on lethally obtained data are likely to lead to improvements in the conservation and management of whales;

In regards to both Objectives I and II, the Committee **agrees** (as did the Panel) that the programme has clearer objectives than JARPA II and that Japan has provided further clarifications and responses to some of the issues raised in the earlier reviews.

---

[19] : http://icb.org.ar/scientists_on_newrepA_eng.html

OBJECTIVE I

The Panel's views with respect to these items are summarised under Item 17.1.1 (C) and (E) and its recommendations for future work provided in SC/66a/Rep06, table 1.

The Committee noted that at this meeting, the proponents had begun to address the recommendations of the Panel with respect to estimating the statistical power to detect changes in age at sexual maturity (SC/66a/SP8). The simulations conducted generally follow the approach suggested by the Panel. However, as noted in the Technical Group Report (Annex Q1) not all sources of variance were taken into account.

The proponents also provided simulation results to address some of the gaps identified by the Panel, including simulations of the ability to estimate recruitment by the SCAA, although they do not yet evaluate the extent to which the precision of estimates of other parameters such as M and MSYR might be improved given further data. Preliminary results indicate that collection of age data will reduce uncertainty in estimates of future recruitment. Whether this is likely to lead to substantial improvements in conservation and management is yet to be demonstrated.

The Committee **agrees** that additional work needs to be done to evaluate the level of improvement that might be expected either in the SCAA or in RMP performance by improved precision in biological parameters, and it agrees that the current SCAA does not of itself constitute a full specification of the various operating models/*Implementation Simulation Trials* needed for management procedure testing.

Some members concluded that since there was still no valid determination of the sample size required to detect a trend in age of sexual maturity (ASM), it had not been demonstrated that lethal sampling could achieve the objective.

They noted that the Committee had concluded last year that the SCAA estimates of MSYR are not robust. They also noted that the results to date have not shown that the proposed takes would lead to any improvement in the conservation and management of whales. The initial attempts by the proponents to provide this demonstration using the SCAA model show that the changes in the ASM have very little effect on the resulting estimates of MSYR (SC/66a/SP8, table 3), which are well above the range determined by the MYSR review (IWC, 2013c, pp.110-111). This is consistent with the advice of the Panel '... it appears unlikely that allowing for time-varying age-at-50%-maturity will enable quantities such as MSYR to be estimated more accurately and precisely'.

Other members noted that the initial evaluations have shown that all but one of the extra sources of variability mentioned as needing incorporation in ASM calculations, when considered individually, have small impacts. The effect of ageing-error is larger, but not such that it would change the results of the sample size evaluation radically (see Annexes Q2-4).

They noted responses to the Panel report are a work in progress; the proponents have already demonstrated the precision to be expected in estimates of cohort strength which, for example, provide strong potential to assist the determination of the effects of climate change (Butterworth and Punt, 2000; Maunder and Watters, 2003).

They stated that although explicit demonstration of management improvement through the use of catch-at-age data is yet to be demonstrated (this is an important item on the agenda for the remaining work in progress), this must be viewed in the context of the near universal practice in major renewable marine resource scientific committees, of rating assessments and management advice that is based on the incorporation of such data as superior. If such data were not highly valuable for this purpose, these groups would not expend so much of their resources in acquiring them to use in a similar way to the SCAA for Antarctic minke whales for analytically very similar situations. They also noted that the SCAA has been well received by the Scientific Committee (IWC, 2014f, pp.233-5). An interpretation of the roles of the recruitment function parameters in the SCAA as exactly equivalent to the roles they played in RMP trials would be flawed. Finally they commented that that the ICJ found that 'the use of lethal sampling *per se* is not unreasonable in relation to the research objectives of JARPA II.' (Judgement at paragraph 224).

OBJECTIVE II

The Panel's views with respect to these items are summarised under Item 17.1.1 (C) and (E) and its recommendations for future work provided in SC/66a/Rep06, table 1.

The Committee **agrees**, as did the Panel, that the ecosystem and multispecies modelling in the proposal are generally a valid approach to the main Objective II of investigating the ecosystem through modelling studies.

Some members noted that with respect to Objective II, it is already well established that Antarctic minke whales feed almost exclusively on krill. To estimate the total consumption of krill by minke whales, the Panel recommended the use of a bioenergetics model that estimates basic energy requirements using standard allometric relationships and previously collected data. Consequently the collection of further stomach contents is unnecessary. They consider that the additional information presented at this meeting does not change the Panel's conclusion in relation to whether lethal sampling is necessary to achieve the programme objectives nor does it establish that the proposed sample sizes are reasonable.

Other members noted that contributions from NEWREP-A here relate both to Objectives I and II. In respect of the RMP, they noted that the Scientific Committee has agreed as follows: 'The Committee has repeatedly recognised that data currently not used directly by the RMP can play an important role in providing an independent check on the status of the population managed under the RMP. In addition, other important types of biological data are used indirectly, the most obvious example being data clarifying the identity of stocks in the different regions. The types of samples that were considered likely to be of importance were, for example, those

94

related to reproductive capacity, condition of the animal (e.g. blubber thickness) and various tissue samples to facilitate work on stock identity, growth and contaminant burdens. It was noted that data from such samples could form the basis for a periodic review of evidence for changes in carrying capacity (IWC, 1993, p.61). Thus information from NEWREP-A related to feeding, ASM, and body condition, *inter alia*, all contribute in both respects.

They also pointed out that Committee again confirmed the potential importance of body condition indices to its work (IWC, 2012), and has agreed that a decline in blubber thickness and in fat weight that was statistically significant at the 5% level occurred during the JARPA period (IWC, 2015f, pp.46-47). Stomach fullness data (for which a significant change over time has also been demonstrated recently (Konishi and Walløe, In press) both contribute in the above respect and provide the key information needed to inform estimation of parameters of prey abundance-predator consumption functional forms in ecosystem models. These are considerably more important than absolute estimates of consumption whose uncertainty is common in ecosystem models and can be addressed by sensitivity tests.

They stated their view that SC/66a/SP8 and Annex Q2-4 has shown that the sample size proposed is sufficient to provide SCAA cohort-strength estimates with reasonable precision. They concluded that in their view the situation has changed since the Panel report, given the demonstration in SC/66a/SP/8 and Annex Q2-4 that the non-lethal DNA-methylation approach to ageing does not allow remotely adequate precision to be achieved for cohort-strength estimates from SCAA.

17.1.5.2 COMMENTS ON ITEM (C) OF RESOLUTION 2014-5

(c) whether the objectives of the research could be achieved by non-lethal means or whether there are reasonably equivalent objectives that could be achieved non-lethally

The Panel's views on this are summarised under Item 17.1.1 (D) and its recommendations for future work provided in SC/66a/Rep06, table 1. It had recommended research on the following non-lethal methods to provide information on evaluating lethal versus non-lethal techniques: the effort required to obtain biopsy samples; satellite tagging; DNA-M technique for ageing; assessing sexual maturity through hormones in blubber from biopsies; aerial photogrammetric techniques to measure whale length. The Panel also noted that there are new techniques to determine biological parameters that require validation and calibration.

The Committee noted that the following data are identified by the proponents as being unobtainable by non-lethal means: morphometrics as part of stock structure determination, age determination, ASM, nutritive condition and food consumption via stomach contents. The question of reasonably equivalent objectives was not considered.

The Committee **agrees** with the Panel that it will not be able to determine whether non-lethal means can be used to achieve certain objectives until the recommended field experiments, laboratory work and analyses are conducted.

Some members noted information on stock structure can be obtained by non-lethal measures. While some non-lethal methods require further development, the calibration of DNA ageing methods and estimation of energy requirements for input to multispecies models could be achieved with existing material. They also pointed out that the earplug method has not been calibrated against known-age animals, and does not achieve substantial increase in precision compared with non-lethal methods (Polanowski *et al.*, 2014).

Other members noted that in respect of variance considerations, recent investigations have indicated that the precision of methylation-based recruitment estimates from SCAA are much worse than those obtainable from ear-plus based readings, with the methylation-based results hardly better than those in the absence of any age information at all (Annex Q2-4). Hence at this time indications are that the non-lethal methylation approach cannot provide ageing information at a level of precision useful to inform assessments and consequently management.

As regards possible bias in earplug readings, they noted that in 2011, the Committee concluded regarding age reading that 'all these issues are largely resolved' (IWC, 2012c, p.180). Furthermore it had reported the previous year that 'studies of fin whales as well as corpora counts and animals with known histories indicated that the growth layers counted to age whales were laid down annually' (IWC, 2011b, pp.191). Reference to a number of experts in the field of earplug age readings have elicited the comment that there is no obvious reason to suspect any major bias in the approach (Lockyer, C.L. and Kato, H. pers.comm.).

Finally, they commented that the ICJ found that 'as a matter of substance, the relevant resolutions and Guidelines that have been approved by consensus call upon States parties to take into account whether research objectives can practically and scientifically be achieved by using non-lethal research methods, but they do not establish a requirement that lethal methods be used only when other methods are not available.' (Judgement paragraph 83).

17.1.5.3 COMMENTS ON ITEM (D) OF RESOLUTION 2014-5

(d) whether the scale of lethal sampling is reasonable in relation to the programme's stated research objectives, and non-lethal alternatives are not feasible to either replace or reduce the scale of lethal sampling proposed

On the question of the feasibility of non-lethal alternatives to replace or reduce the scale of lethal sampling, the Committee noted that the points noted under item (c) are also relevant.

The Panel's views with respect to this item are summarised under Item 17.1.1 (B), (D) and (E) and its recommendations for future work provided in SC/66a/Rep06, table 1.

The Committee **notes** that the proponents estimated the required sample size only for the objective of detecting a trend in the age at sexual maturity. It **recognises** that during this meeting simulations were presented to evaluate the statistical power to detect changes in age at sexual maturity (SC/66a/SP8). It agreed that the simulations generally followed the approach suggested by the Panel but future recruitment was not stochastic, no allowance was made for cohort-specific deviations in ASM, and over-dispersion associated with the annual proportion mature by age was not modelled. It was noted that more additional variation leads to lower power as does lower effect size. Consequently, the estimated sample sizes are likely to be too small. Ideally, there should be a management-related (or biologically-based) justification for the effect sizes.

In light of the above, some members considered that in the absence of a valid determination of the sample size required to meet programme objectives, the proposed scale of lethal sampling cannot be established as reasonable.

Other members referred to the comments on these points that they provided under Item 17.3.1.

17.1.5.4 COMMENTS ON ITEM (E) OF RESOLUTION 2014-5

> (e) such other matters as the Scientific Committee considers relevant to the programme, having regard to the decision of the International Court of Justice, including the methodology used to select sample sizes, a comparison of the target sample sizes and the actual take, the timeframe associated with a programme, the programme's scientific output; and the degree to which a programme coordinates its activities with related research projects.

The Committee noted that the methodology used to select sample sizes is addressed under Item 17.4.3. It also noted that the NEWREP-A proposal, which is for 12 years, states the intention to evaluate progress after six years, in order to determine the further time frame required to reach the objectives.

The Panel's views with respect to these items are summarised under Item 17.1.1 (B), (D), (G) and (H) and its recommendations for future work provided in SC/66a/Rep06, table 1.

The Committee **agrees** that while noting the additional information provided by the proponents at this meeting, it nevertheless **recommends** further focussed collaboration on those aspects of NEWREP-A highlighted in the Panel report, especially related to the development of ecosystem models, prey studies and evaluation of non-lethal techniques.

Some members concluded that commencement of lethal sampling in the 2015/16 season was not justified and noted that the situation should be reviewed at the next Committee meeting taking account of any new information available at that time (see Annex Q5).

Other members concluded that the Government of Japan had provided their detailed responses to these points in SC/66a/SP1 and SC/66a/SP2. They believed that the utility of the age data to provide estimates of cohort-strength has now been demonstrated, so that there is no reason to postpone immediate initiation which would lead to deterioration in the precision with which the strength of cohorts currently in the population could be estimated. Paragraph IV of Article 8 of the ICRW recognises that the 'continuous collection and analysis of biological data … are indispensable to sound and constructive management of the whale fisheries, Contracting Governments will take all practical measures to obtain such data'. Although some of the Panel's recommendations have yet to be addressed, they noted their view that many of these involve analyses associated with ongoing data collection.

The proponents commented that the main text included responses to the points raised in Annex Q5.

17.1.5.5 CONCLUSION

Despite lack of consensus in the Committee's responses to the questions in the Commission's resolution, the Committee nevertheless **agrees** that the analyses recommended by the Panel and further specified in Annex Q1 should be completed, and that progress should be reviewed again next year.

17. 2 Preparation of JARPN II review workshop

Last year, the Committee had updated Annex P with respect to data availability (IWC, 2015f, p.82). SC/66a/SP3 provided a list of the available data for the review developed by the proponents two months before the Annual Meeting in accordance with the new process. SC/66a/SP4 contained a request to access to data under the Committee Procedure B for Data Access by de la Mare and colleagues for consideration by the Committee, again in accord with the new procedures. He noted his appreciation for the help he received from the government of Japan regarding data availability. The analyses proposed would be along the lines presented in NEWREP-A to investigate sample size.

A small group was established under Fortuna to examine this request. Fortuna reported back that after clarification that the next workshop would be a final review not an ongoing review, the request had been withdrawn.

It was noted that SC/66a/SP5, 6 and 7 would serve as primary background documents for the Steering Group planning for the Expert Panel review of JARPN II. The Committee **agrees** that the JARPN II final review would take place under the revisions to Annex P agreed by the Committee under Item 27.3.

The Committee noted that the proposed JARPN II final review (scheduled for early 2016) would take place before the conclusion of the full field period expected to be 2016). Morishita explained the rationale behind this. As the Committee had been informed

(IWC, 2015f, p.65-6), in the light of the ICJ case the Government of Japan had reviewed the JARPN II programme and had decided that from 2014, the focus of the programme would be narrower within the existing objectives and the sample sizes reduced accordingly for some components.

The Committee noted that when samples sizes were amended in 2014, it should have triggered a full review under Annex P. However, the proponents considered this to be an amendment to the JARPN II program rather than a new proposal. In the light of the present situation that Japan has announced that JARPN II will be replaced by a new proposal to be submitted for review by the Committee in 2017, the Committee **recommends:**

(1) that the JARPN II review by the Panel and Committee should focus on:

  (a) a final review of the programme in accordance with the revised Annex P; and

  (b) an evaluation of the effects of the change in focus and the reduced sample size from 2014-16 against the original objectives of JARPN II;

(2) to do this will require data for the 2000-14 period, data from the JARPN programme that preceded JARPN II (i.e. 1994-99) and, when available, 2015;

(3) given the need for additional data to that originally specified:

  (a) Japan will submit an updated SC/66a/SP3 summarising the full dataset by 19 June 2015;

  (b) the data will be available in electronic format by 17 July;

  (c) applications for use of the data by Committee members should follow the specified *pro forma* should be sent to the DAG (Chair Robert Suydam) in the usual manner and Japan will make every effort to respond positively to such requests and provide data promptly;

  (d) other deadlines and dates will follow Annex P.

The Committee also **agrees** that the data for the period up to 2016 shall be available for the review of any new North Pacific proposal submitted by Japan for review in 2017.

17.3 Review results from ongoing permits
The Committee noted that it has decided not to discuss annual cruise reports between periodic reviews. These are therefore only summarised briefly below.

SC/66a/SP5 outlined results of the 2014 JARPN II coastal component off Sanriku (northeastern Japan, corresponding to a part of sub-area 7). The survey was conducted from 26 April to 11 June 2014, using four small-type whaling catcher boats as sampling vessels. Sampling of common minke whales was conducted in coastal waters within 50n.miles of Ayukawa, and all animals collected were landed at the JARPN II research station established in Ayukawa for biological examination. Sampling vessels surveyed over 5,700 n.miles, and encountered 51 schools (51 individuals) of common minke whales. The vessels also obtained sightings of humpback (42 schools, 52 animals) and fin whales (5 schools, 5 animals). A total of 30 common minke whales were collected (16 males, average body length 5.92m and 14 females average body length 5.78m). Four males and two females were sexually mature and the two females were pregnant. Dominant forestomach prey species was Japanese sand lance (*Ammodytes personatus*, 68.9%; juveniles, 10.3; adults, 58.6), followed by Japanese sardine (*Sardinops melanostictus*, 13.8%), krill (*Euphausia pacifica*, 10.3%) and mackerels (*Scomber japonicus* and *S. australasicus*, 6.9%). The Japanese sardine and mackerel were first detected at the coastal component off Sanriku. Japanese anchovy, which was one of the major prey species in the previous surveys, was not found from the whale stomach. The change of prey species was also observed in surveys of coastal component off Kushiro.

SC/66a/SP6 outlined the offshore results of the 2014 JARPN II research programme conducted in sub-areas 7, 8 and 9. There were two main research components in the 2014 survey: a whale sampling survey and a dedicated sighting survey. The whale sampling survey was carried out from 16 May to 29 July 2014. A total of 3,307n.miles was surveyed in a period of 67 days. A total of two common minke, 346 sei, 116 Bryde's, 69 sperm, 8 blue, 19 fin and five humpback whales were sighted and 90 sei and 25 Bryde's whale were sampled by the SSVs. All whales sampled were examined on board the research base vessel. In June and July, sei whales fed mainly on copepods followed by mackerels and Japanese sardine in sub-areas 8 and 9. Bryde's whales fed mainly on Japanese anchovy followed by mackerels in sub-areas 7 and 8. Two dedicated sighting surveys were carried out from 11 May to 29 June in sub-areas 7, 8 and 9 and from 1 August to 14 September in western North Pacific. A total of 2,823 and 4,813n.miles was surveyed during those surveys by the SVs, respectively. Data obtained in this research will be used in the elucidation of the role of whales in the marine ecosystem through the study of whale feeding ecology in the western North Pacific.

SC/66a/SP7 outlined results of the 2014 JARPN II coastal component off Kushiro, northeastern Japan (middle part of sub-area 7CN). The survey was carried out from 4 to 24 September 2012, with additional period for sighting survey in 2-3 September. The survey was conducted using four small-type whaling catcher boats as sampling vessels, in coastal waters within 50 nautical miles from the Kushiro port. All the animals collected were landed at the JARPN II research station for biological examination. The vessels surveyed 3,154 n.miles (309.5 hours), encountered 110 schools (121 animals) of common minke whales, and collected 51

animals. The vessels also obtained sightings of humpback whales (15 schools, 16 animals), fin whales (three schools, four animals) and sperm whales (6 schools, 8 individuals). Average body length of 35 male common minke whales was 6.28m (SD=1.08) and 6.44m (SD=0.98) for 16 females. The 16 males and two females were sexually mature. The two females were both pregnant. Dominant forestomach prey species was walleye pollock (*Theragra chalcogramma*, 58.8%), followed by Japanese sardine (*Sardinops melanostictus*, 35.3%), mackerels (*Scomber japonicus* and *S. australasicus*, 3.9%) and medusa fish (*Icichthys lockingtoni*, 2.1%). Japanese anchovy, which was one of the major prey species in the previous surveys off Kushiro, was not found from whale forestomach at the present survey. Japanese sardine, which was first found at the 2012 survey, was the second dominant species. The observation coincided with an increase in catch of Japanese sardine by fisheries around Kushiro, where the species was much caught after an interval of around 30 years.

17.4 Review of continuing proposals
17.4.1 Presentation by proponents
Morishita provided a summary of changes to the JARPN II research programme, which to some extent were made in response to the findings of the ICJ. He stated that the government of Japan will develop a new research plan after the 2016 final review of the research programme and explained in response to the SC65b recommendation the adjustments to the JARPN II programme to provide a detailed justification for the adjusted sample sizes (see SC/66a/SP10) and their allocation to lethal and non-lethal components of the programme. He noted that the following 'items to consider from the ICJ ruling' were the basis for changes to the JARPN II research programme: (1) more research emphasis was placed on feeding preferences of the target species in the North Pacific study area; (2) reasonable sample sizes were recalculated based on this change in emphasis (based on coastal data through 2010 and offshore data through 2012); (3) some of the species in JARPN II were dropped from further study in period before new research plan (e.g. sperm whale sampling was discontinued, offshore minke whale sampling was suspended, sei and Bryde's whale sampling will be continued); and (4) regarding lethal and non-lethal research methods, several different methodologies will be compared, including samples from lethal samples and from biopsies and faecal samples. In addition, the effort and cost needed to collect a minimum sample for either approach will be compared, as well as efforts to compare estimates of age and dietary preferences.

Tamura and colleagues provided a short summary of a preliminary report of the efficiency and practicability of biopsy sampling, faecal sampling, and prey species identification from genetic analyses conducted in 2014 (see SC/66a/SP11). They noted that biopsy sampling of sei and Bryde's whales has been conducted on many cruises and has been shown to be reasonably efficient. However, the efficiency (the number of obtained samples per targeted individuals) of biopsy sampling was lower than that of lethal sampling. In particular, considerably more effort had proved necessary to conduct biopsy sampling for common minke whales as an alternative to lethal sampling. The work to date has also led them to conclude that sampling of faeces from swimming whales is inefficient because it is rarely encountered and even then, the results appear to be highly biased depending on the prey species consumed by whales, as some sinks quickly. A preliminary study of DNA analyses of the content of large intestine of whales using next-generation sequencing (NGS) technologies clearly indicated that the genetic prey ID only from the contents of the large intestine is insufficient to understand feeding habits of the whales, because of the low identification rate. Furthermore, the prey species compositions identified in the large intestine were quite different from those in the stomach.

17.4.2 Discussion
A comment was made that calculations in SC/66a/SP10 regarding sample size ignored the contribution to the variance arising from the inter-annual variations in diet. An analysis incorporating this variance component needs to be conducted before it can be determined whether the sample size is adequate to achieve the targeted precision, or indeed whether this is possible with any sample size.

Morishita noted this comment and suggestion. He explained that the rationale for the sample sizes was provided to the Committee, including the final decision by the Government of Japan, and asked the Committee for further suggestions to improve the sample size calculations.

In response to a question as to whether Japan had developed a working definition of 'for scientific purposes' in the light of the ICJ discussions. Morishita noted that while the government of Japan did not develop an alternative definition it considers 'for the purpose of scientific research' to mean that a research programme fulfils the conditions the ICJ presented in its judgment. He added that the ICJ did point out several conditions which would need to be met for the Court to consider a research proposal to have met reasonable standards for 'scientific purposes'. Therefore, Morishita commented that the government of Japan's approach was to meet those conditions in developing NEWREP-A research programmes in the Southern Ocean. He noted that such conditions included a detailed comparison of lethal and non-lethal sampling protocols, as well as the detailed justification for the proposed sample size.

A question was raised regarding the difference between the rationale given for discontinuing the sampling of offshore minke whales which was related to ecosystem change in the North Pacific, compared to the Southern Ocean where further sampling was motivated by investigating change. Morishita responded that the shifts in the North Pacific common minke whale sighting patterns which could have been caused by the changes in forage community abundance estimates were in a single direction, while this was not the case for the Southern Ocean minke whales.

With respect to the discussion of SC/66a/SP11 comparing lethal and non-lethal sampling, Clapham noted that in his experience better results are obtained for biopsies and the collection of faecal material if sampling is conducted from a small boat (launched from a 'mother ship'). He had also found that biopsy sampling conducted with a compound crossbow was less efficient than that conducted with an air rifle. It was noted that for offshore surveys, large vessels were used, while for coastal surveys, smaller vessels were used although not inflatables. It was also noted that experience and training can play an important role in the efficiency of biopsy sampling. For example, the times to obtain biopsy samples from Bryde's and sei whales from the large vessels used in the IWC-POWER cruises (SC/66a/Rep01) using Larsen guns were considerably lower than the times presented in SC/66a/SP11.

Tamura commented on the difficulties in using small boats safely in open waters or under conditions of heavy seas. He added that further research was planned to better understand differences between the two sampling approaches. He also noted that the issue of representativeness of a sampling approach has yet to be addressed. Morishita added that one of the research components of NEWREP-A was to compare the sampling efficiencies of lethal and non-lethal sampling and for that purpose the same sampling approach will be employed in principle in non-lethal sampling as lethal sampling.

After a clarification that 'handling time' was not included in the comparison of lethal and non-lethal sampling, the comment was made that it was likely that recovering a biopsy dart would be significantly shorter in terms of handling time than flensing a large whale carcass.

The comment was made that many studies have shown that faecal sampling can accurately describe diet composition. The primers used in this study amplify all metazoa and so it was predictable that prey signals could be lost. It is also possible to block predator signal directly or design primers specific for expected types of prey as reported in many other studies.

In response, Tamura responded that he was aware of the published studies referred to. However, the results from their initial studies found that the efficiency of non-lethal sampling methods depended on the prey species. This raises some concerns about sampling bias associated with faecal studies relative to stomach contents information. He also noted that using DNA methods from faecal sampling could confound analysis of the diet with secondary items from the prey.

In conclusion, the Committee thanked Japan for providing the additional information provided in SC/66a/SP10 and 11. However, the Committee was **unable to reach consensus** on whether the additional information was sufficient to justify the revised number of whales to be taken under the JARPN II programme. It noted that consideration of the effects of this reduced sample size would be considered at the proposed expert panel meeting in early 2016. The Committee **agrees** to keep this matter on its agenda.

17.5 Work plan
The work plan on issues related to special permit whaling is given as Table 23. Budget implications are discussed under Item 26.

Table 23

Work plan on matters related to special permit whaling.

Item	Intersessional period/groups	SC66b
NEWREP-A	Work by proponents to address recommendations in SC/66a/Rep06 and Annex Q1	Review progress
JARPN II final review	(1) Proponents to submit updated data list; (2) Follow revised Annex P with workshop in February 2016	Review Panel report and further consideration of effects of reduced sample size
New proposals	If new North Pacific proposal is to be presented, follow revised Annex P	Receive reports

18. WHALE SANCTUARIES

At last year's meeting, the Scientific Committee established an *ad hoc* Working Group to facilitate the review process for the Southern Ocean Sanctuary (SOS) and the South Atlantic Whale Sanctuary (SAWS) proposal (IWC, 2015f). The Committee requested the Commission to advise on the scientific objectives of the SOS and on the process to review both the Sanctuary and the proposal, including a method to involve external reviewers (IWC, 2015f, pp.67-8). During the present meeting, the Scientific Committee established a timeline, developed outline agendas, and appointed a Steering Group to coordinate these reviews. A summary of the discussions held by the Committee are presented below and details of the agreed process to review the SOS and SAWS proposal are provided in Annex O.

18.1 Preparation for the decadal review of the Southern Ocean Sanctuary
A process for the review and refined objectives of the SOS were proposed to the Conservation Committee (IWC/65/CC05) and were agreed by consensus by the Commission (Chair's Report of the 65th Meeting of the Commission). This process included holding a joint workshop of the Scientific Committee and the Conservation Committee to review the Sanctuary. The Committee **agrees** to review the scientific aspects of the SOS during next year's meeting, according to the refined objectives and terms of reference developed by the Commission. The discussions, conclusions and recommendations from the Scientific Committee will be included in the Scientific Committee report and will be presented at a joint meeting of the Conservation Committee and the Scientific Committee proposed to occur after the 2016 annual meeting of the Scientific Committee.

The Committee reviewed SC/66a/SAN1, which provided a summary of the previous SOS review and some considerations relevant to the upcoming review, including an overview of scientific research conducted in the SOS and the Indian Ocean Sanctuary. The Scientific Committee **agrees** that this document will be useful in the review of the SOS and that an updated version should be presented at next year's meeting.

18.2 South Atlantic Whale Sanctuary (SAWS) proposal
Because no specific guidance was received by the Commission in regards to the review process of the SAWS proposal, the Scientific Committee agreed on terms of reference for the review, which were developed based on previous instructions to review Sanctuaries and Sanctuary proposals provided by the Commission (IWC, 2002a), on the recommendations from the Scientific Committee resulting from the review of the SOS in 2004 (IWC, 2005a), and on the terms of reference established by the Commission for the upcoming review of the SOS. The Scientific Committee **agrees** that the review of the SAWS proposal will be conducted during a pre-meeting to be held immediately before SC66b. The primary objective of the pre-meeting will be to review the SAWS proposal in the light of their stated scientific objectives. The report of the pre-meeting will be reviewed by the Scientific Committee at SC66b and the conclusions and recommendations of the Scientific Committee will be discussed during the proposed joint meeting of the Scientific Committee and the Conservation Committee after SC66b.

18.3 Process to involve external reviewers in the review of the SOS and the SAWS proposal
The Scientific Committee agreed in 2004 that the involvement of external reviewers (e.g. non-regular members of the Scientific Committee) in the review of the SOS had been largely positive and that involvement of external reviewers should continue, both for future reviews and reviews of future sanctuary proposals (IWC, 2005a). At last years' meeting, there were different views in relation to the method used to involve external experts in the 2004 review with limited support for external reviewers operating independently from the Scientific Committee and further clarification on this process was requested from the Commission (IWC, 2015f, p.68).

The Commission advised that the Scientific Committee should develop its own procedures for the involvement of external reviewers (Chair's Report of the 65th Meeting of the Commission). The Committee **agrees** that external reviewers will be invited to participate in the review of the SOS and the SAWS proposal in conjunction with, not independently of, members of the Scientific Committee. The Scientific Committee also **agrees** that the complement and balance of the external reviewers will be decided by the Steering Group, with the goal of obtaining a fair, and objective review. Careful effort will be made to avoid potential conflicts of interest and emphasis will be given to including external reviewers whose expertise is relevant to the review of sanctuaries and sanctuary proposals and not found already within members of the Scientific Committee.

Different views were expressed in regards to whether the IWC Sanctuaries could be seen as a subset of Marine Protected Areas (MPAs) and whether the SOS review and the SAWS proposal should be reviewed in that context. The Committee **agrees** that the Steering Group will determine the relevance of including literature pertaining to MPAs as background material for the review of the SOS and the SAWS proposal. Noting there is confusion about the definition of the precautionary principle and the precautionary approach, and whether or not the two are equivalent, the Committee also **agrees** that this aspect be referred to the Steering Group.

18.4 Work plan
The work plan on issues related to the review of the Southern Ocean Sanctuary (SOS) and the proposal for a South Atlantic Whale Sanctuary (SAWS) is given as Table 24. The date of the joint Scientific Committee/Conservation Committee workshop will be determined intersessionally. Budget implications are discussed under Item 26.

Table 24

Work plan on matters related to Sanctuaries.

Item	Intersessional period/groups	SC66b
External experts for SOS and SAWS	(1) submit proposed names to Steering Group by 31 August 2015 (2) finalise list by 31 October 2015	Attend SAWS pre-meeting and SOS review
SOS	Solicit documents including updated SC/66a/SAN1 to be submitted by 1 May 2016	Hold review during meeting and develop advice for joint SC/CC workshop prior to IWC66
South Atlantic Sanctuary proposal	(1) Submission of revised proposal (if there is one) by 1 January 2016 (2) Submission of documents by 1 January 2016 (3) Hold pre-meeting on 3 June 2016	Review pre-meeting report and develop advice for joint SC/CC workshop prior to IWC66

19. SOUTHERN OCEAN RESEARCH PARTNERSHIP

SC/66a/SH08 summarised the work undertaken under IWC-SORP in 2014/15. SORP[20] had been proposed to the Commission (IWC) in 2008 with the aim of developing a multi-lateral, non-lethal scientific research programme that would improve the coordinated and cooperative delivery of science to the IWC. There are now 11 member countries in the Partnership: Argentina, Australia, Brazil, Chile, France, Germany, Italy, New Zealand, Norway, South Africa and the United States. The paper reported on the continued progress of IWC-SORP and there are five ongoing research projects. Scientific details of the projects were discussed under the relevant agenda items.

The Committee **reiterated** the value of the scientific information arising out of the IWC-SORP projects to its work and **recommends** its continuation. As last year (IWC, 2015f, p.69), it **urges** the Commission to review the funding status of IWC-SORP and to facilitate sustainable support for long-term research projects such as these.

20. IWC LIST OF RECOGNISED SPECIES.

The Committee noted that there were no proposals to amend the list of recognised species. It **agrees** to keep this item on its agenda and **reiterates** the need to ensure that the IWC list is synchronised with that of the Society for Marine Mammalogy Taxonomy Committee.

21. CONSERVATION MANAGEMENT PLANS

21.1 Progress with scientific aspects of existing CMPs
Progress on existing CMPs can be found under the following items:

> (1) western gray whales (Item 10.7.4 and Annex F);
> (2) South Atlantic right whales (Item 10.8.1 and Annex F)
> (3) Southeast Pacific right whales (Item 7.1.2 and Annex J).

21.2 Progress with assisting development of new CMPs
With respect to possible new CMPs, the Committee referred to its earlier discussion of potential large whale candidates (IWC, 2014d, pp.62-3) and small cetaceans (IWC, 2015f, p.69).

The discussion of a potential franciscana CMP can be found under Item 14.5.1 and a potential CMP on non-deliberate human impacts under Item 12.7.1.2.

22. COMPILATION OF AGREED ABUNDANCE ESTIMATES

Allison reported that this year she had concentrated on compiling details of the abundance estimates used by the AWMP and RMP sub-committees together with information on the category (i.e. whether the estimate is acceptable for use in in-depth assessments, an underestimate or provides a general indication of abundance, etc.), the evaluation extent and other data as detailed in IWC (IWC, 2014i, pp.416-7). Allison had checked the sources of the estimates and added a history showing whether values have been updated or a wrong value published in the past. Work has begun to extend the list to other species and stocks. The intersessional group on abundance estimates was re-established to advise on this work.

In discussion it was suggested that the convenors discuss how best to formally agree the status of all estimates at the 2016 Annual Meeting and to set up a procedure to ensure that estimates and their status are evaluated and recorded in a standard way in future, for example by considering establishing an Abundance Estimate Working Group.

23. RESEARCH AND WORKSHOP PROPOSALS AND RESULTS

23.1 Review results from previously funded research proposals
Table 25 summarises the status of the work funded by the Committee last year. All projects were completed successfully apart from one that is ongoing. The projects all contributed considerably to the work of the Committee and the Committee thanked all of those involved.

---

[20] http://www.marinemammals.gov.au/sorp

Table 25

Workshop proposals agreed during this meeting (TBD: to be decided).

Title	Relevance	Date	Venue
AWMP Workshop to develop *SLAs* for the Greenland hunts and consider AWS	AWMP	Mid-December 2015	Copenhagen
Workshop to forward the modelling process to understand status of North Pacific gray whales	BRG, AWMP, E	April 2016	La Jolla
Investigations of large mortality events and mass strandings	All (incl. SM)	Early December	San Francisco
Preventing the entanglement of whales in fishing gear (Commission expert workshop)	HIM, COMM	April 2016	TBD
Entanglement database expert group	HIM, COMM	TBD	TBD
IWC-POWER planning and Technical Advisory Group meetings	IA, BRG, RMP	8-11 October 2015	Tokyo
Expert group meeting to update DESS	All	TBD	TBD
Evaluating abundance estimates: diagnostics and testing	All	Pre-meeting	Bled
Workshops to further progress on the *Implementation Reviews* for the North Atlantic common minke and fin whales	RMP, AWMP	Spring 2016	Copenhagen
Review of South Atlantic Whale Sanctuary	SAN	Pre-meeting	Bled
Workshop for the final review of JARPN II	SP	February 2016	Tokyo

23.2 Review workshop proposals for 2015/16
The Workshop proposals for 2015/16 are summarised in Table 26 and discussed under the relevant agenda items. Budgetary matters are considered under Item 26.

Table 26

Progress on workshop and research proposals agreed last year (IWC, 2015, table 22 and pp. 70-80)

RP no.*	Title	Relevance
AWMP01	AWMP Workshop to develop *SLAs* for the Greenland hunts	Completed (SC/66a/Rep3)
AWMP02	AWMP developers fund	Completed; Annex E
BRG01	Development of an sex- and age-structured population dynamics model for North Pacific gray whales	Completed (SC/66a/BRG2)
BRG02	Southern right whale mortalities at Península Valdés: population and health monitoring research	Completed (SC/66a/Rep09)
BRG03	Workshop to forward the modelling process to understand the status of gray whales across the North Pacific	Completed (SC/66a/Rep08)
E01	State of the Cetacean Environment Report (SOCER)	Completed (SC/66a/E03)
E02	POLLUTION 2020	Completed (SC/66a/E01)
E06	Climate change meeting	Completed (SC/66a/Rep07)
E07	CERD pre-meeting	Completed; Annex K
E08	Investigations of large mortality events and mass strandings	To take place in December 2015
EM01	Using baleen whale tag data to inform ecosystem models	Completed (SC/66a/E04)
EM02	CCAMLR-IWC Workshop on the development and application of multi-species models to the Antarctic marine ecosystem	Planning in progress (Annex K1)
HIM01	Ship strikes database coordinator	Completed (SC/66a/HIM08)
IA01	IWC-POWER cruise 2015	Completed (SC/66a/Rep01; 02, SC/66a/IA05)
RMP01	Testing proposed new guidelines for evaluating spatial model-based and design-based abundance estimates	Ongoing (Annex D)
RMP02	Evaluating abundance estimates: diagnostics and testing	Ongoing (Annex D)
RMP03	Workshops to further progress on the *Implementation Reviews* for the North Atlantic minke and fin whales	Completed (SC/66a/Rep04; 05)
RMP04	Evaluation of density dependence parameters for inclusion in RMP testing based on energetics modelling	Ongoing (SC/66a/EM02)
RMP06	Essential computing support to the Secretariat	Completed (SC/66a/Rep04; 05; Annex D, Annex E)
SH01	Synthesis of the results of the comprehensive assessment of Southern Hemisphere humpback whales	Completed (SC/66a/SH03)
SH02	Modelling support/Southern Hemisphere humpback whales	Completed (SC/66a/SH04; 05)
SH03	Research Contract 16, Antarctic Humpback Whale Catalogue	Completed (SC/66a/SH14)
SH04	Southern Hemisphere Blue Whale Catalogue	Completed (SC/66a/SH28)
SH06	Priority tasks to support the regional conservation effort of Arabian Sea humpback whales	Ongoing (SC/66a/SH22; 23)
SH07	Southern Ocean Research Partnership (IWC-SORP) coordination	Completed (SC/66a/SH24)
SP02	Workshop on review of new Special Permit proposals	Completed (SC/66a/Rep06)
WW01	Emerging whalewatching industry in Oman	Ongoing (SC/66a/SH23)
-	Invited Participants	Completed

24. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2016 ANNUAL MEETING

Table 27 provides an overview of the main items for consideration next year based upon the work plans discussed by the sub-groups and detailed in their reports and additions made during plenary. More details can be found under the work plan agenda items for the various subjects.

Table 27

Initial topics for consideration at the 2016 Annual Meeting. These will form the basis of the draft agenda to be circulated by 7 April 2016.

Topic	SC/66b (2016)
RMP-related matters	
Evaluate energetics-based model	Review results.
Abundance estimates	Review Workshop report and Guidelines document
Common minke whales (WNP)	Review RMP variants and research proposals if submitted; agree abundance estimates for use in actual applications of the RMP.
Common minke whales (NA)	Complete *Implementation Review*
Fin whales (NA)	Complete *Implementation Review*
Bryde's whales (WNP)	Review new information.
HIM-related matters	
Reviews of mitigation measures for ship strikes and entanglement	Review papers on using simulations to assess ship strike mitigation effectiveness if submitted; review results of entanglement prevention workshop.
Entanglement	Continue to examine new information on rates, risks and mortality and provide advice.
Entanglement (support Commission initiatives)	Communication of key issues; advice for specific CMPs; review database development; review progress with including entanglement information in National Progress Reports
Ship strikes	Continue to examine new information on rates, risks and mortality and provide advice.
Ship strikes (database)	Review progress by database co-ordinators and progress with reviewing new reports and application of new criteria
Ship strikes (support Commission initiatives)	Communication of key issues; advice for specific CMPs; review progress with including ship strike information in National Progress Reports

Topic	SC/66b (2016)
Time series of mortality estimates for use in assessments	Review progress.
AWMP-related matters	
Validate *WG-Bowhead SLA*	Complete.
SLA for WG bowhead whales	Review Canadian catch information
SLA for common minke whales	Review progress: developers' work
SLA for fin whales	Expect to finalise *SLA*
Aboriginal Whaling Scheme	Expect to complete work related to BCB bowhead whales
Annual review of catch limits	Complete.
Implementation Reviews	Prepare for gray whale *Implementation Review*.
Whale stocks-related matters	
Antarctic minke whales	Continue to examine new information.
Southern Hemisphere humpback whales	Complete evaluation and determine future work plan.
Southern Hemisphere blue whales (including pygmy blue whales)	Continue to examine new information related to stock structure, abundance and catches.
Southern Hemisphere fin whales	Examine Southern Ocean sightings data.
North Pacific sei whales	Continue in-depth assessment.
North Pacific gray whales	Continue to review new information especially with respect to the rangewide assessment
Southern right whales	Continue to review new information and develop work plan with respect to future updated assessments.
North Atlantic right whales	Continue to examine new information.
North Pacific right whales	Continue to examine new information.
North Atlantic bowhead whales	Continue to examine new information if available.
Okhotsk Sea bowhead whales	Continue to review new information with respect to stock structure, catch and abundance estimation
Arabian Sea humpback whales	Continue to examine new information
Sperm whales	Continue to examine new information related to stock structure, abundance and catches
Eastern North Pacific blue whales	Continue to examine new information
Pacific abundance surveys (e.g. IWC-POWER and others)	Review proposals for future surveys and cruise reports of past surveys
Antarctic abundance surveys (e.g. NEWREP-A and others)	Review proposals for future surveys and cruise reports of past surveys
Stock definition-related matters	
Terminology review and unit-to-conserve	Continue to work on defining common reference terms, with a focus on examining those used for small cetaceans and determining how they relate to the terms commonly used in other sub-committees and working groups.
Updates to genetic data analysis and DNA data quality guidelines	Review to see if updates are required.
Statistical and genetic issues concerning stock definition	Continue to review technical issues regarding papers submitted to all sub-groups of the Committee.
Testing of Spatial Structure Models (TOSSM)	Examine the future application of TOSSM datasets; advance the use of TOSSM to provide guidelines for setting subarea boundaries for assessment
Environmental concerns-related matters	
SOCER	Receive SOCER (Polar Seas)
POLLUTION 2020	Continue to refine modelling approach; *in utero* transfer analyses and modelling; review new information on risk and mitigation for PCBs
Oil spills	Finalise agenda for oil spill workshop.
Contaminant threat information	Data integration and mapping.
CDoC (previously CERD)	Report on progress.
Strandings and mortality events	Receive report of workshop; review new information and update strandings list.
Anthropogenic sound	Focus session on masking and PCoD (population consequences of disturbance); continue planning for 'stress and sound' workshop; receive information on the effectiveness of marine mammal observers as a mitigation measure
Marine debris	Receive report from the Intersessional Working Group.
Climate change	Receive information from the Intersessional Working Group.
Arctic	Receive information from the Intersessional Working Group.
Habitat issues	Receive new information.
Ecosystem modelling-related matters	
Co-operation on ecosystem model development and matters of common interest to IWC and CCAMLR	Continue to discuss how to further long-term scientific exchange between SC sub-committees and sub-groups of the two organisations.
Progress in species distribution guideline model development	Review progress and continue. Receive results of joint NMFS-IWC workshop on ensemble-average modelling if held.
Ecological change in the Southern Ocean	Discuss the results of a collaborative analysis on Antarctic minke whale body condition if received. Review progress on competition modelling.
Effects of long-term environmental change	Continue review of long-term datasets and development of analytical and modelling tools.
Small cetacean-related matters	
Main topic	Ongoing review of *Tursiops* taxonomy and population structure with focus on North Atlantic (including Mediterranean, Black and Caribbean Seas and the Gulf of Mexico) and South Atlantic
Voluntary Fund for small cetaceans conservation research	Continue; review new proposals, as necessary

104

Topic	SC/66b (2016)
Review previous recommendations	Continue (priority will be given to vaquita, Hector's and Maui's dolphins, franciscana, beluga, river dolphins).
Review on takes of small cetaceans	Continue.
Increased integration with other SC sub-groups	Continue to develop integration and exchange with other SC sub-committees and sub-groups.
Towards maintaining populations at 'viable levels'	Discuss and finalise definition in conjunction with relevant sub-groups.
Whalewatching-related matters	
Assess the impacts of whalewatching on cetaceans	This is the ongoing and primary topic and incorporates work of several intersessional groups
Review whalewatching in a specific region	Review whalewatching in the South Pacific
Consider information from platforms of opportunity	Review progress and modify standard elements and guidelines if required.
Review whalewatching guidelines and regulations	Ongoing work – the most recent compilation is submitted to the IWC Secretariat and included on the IWC website.
Consider emerging issues of concern	Continue ongoing work.
Progress on previous recommendations	Continue ongoing work.
DNA-related matters	
Progress on genetic methods	Continue ongoing work.
Amendments to *GenBank*	Continue ongoing work.
Progress on archiving of samples from catches and bycatches	Continue ongoing work.
Reference databases and standards for diagnostic registers	Continue ongoing work.
Special Permit-related matters	
NEWREP-A	Continue to review
JARPN II	Review the Panel report
New proposals	Prepare review under Annex P if received
Sanctuary-related matters	
Consider review methods	Review and collate information to assist with review of scientific aspects of sanctuaries and sanctuary proposals.
Periodic review of Southern Ocean Sanctuary	Finalise review
Review South Atlantic Sanctuary proposal	Finalise review

25. DATA PROCESSING

Allison reported on the computing needs and requirements identified for the forthcoming year. These are summarised in Table 28.

Table 28
Computing tasks for 2015/16

REVISED MANAGEMENT PROCEDURE (RMP) – IMPLEMENTATION-RELATED MATTERS

North Atlantic fin whales
(1) Code finalisation and conditioning (Annex D, item 6.7)
(2) Conduct projections and circulate results (Annex D, item 6.7)

North Atlantic minke whales
(1) Code finalisation and conditioning (Annex D, item 6.7)
(2) Conduct projections and circulate results (Annex D, item 6.7)

North Atlantic sei whales
(1) Summarise information on the distribution of sei whales from catch records (carried over, Annex D, item 6.3)

Western North Pacific minke whales
(1) Run 'hybrid' versions of RMP variants if requested by Japan, to allow evaluation of candidate 'variants with research' (Annex D, item 6.7);
AWMP

(1) Provide operating model to developers for common minke whales off West Greenland (see also related tasks under RMP)
(2) Other work related to the development of an *SLA* for fin whales and common minke whales off West Greenland if specified by the intersessional Workshop (Annex E item 8)
(3) Validate the *WG-Bowhead SLA*

IN-DEPTH ASSESSMENTS
(1) Replace the official USSR North Pacific catch data in the IWC databases with the revised catch series (Ivashchenko and Clapham 2013) (Annex G item 4.5).
(2) Entry of Japanese Discovery Marking data in the North Pacific (Annex G item 4.5).
(3) Update the IWC individual catch database using original Japanese records that distinguish between sei and Bryde's whale catches from North Pacific land stations 1955-71. [Lower priority item].
(4) Validation of the 2013 and 2014 POWER cruise data

(5) Further validation of IDCR/SOWER data

(6) Complete validation of the 1995-97 blue whale cruise data and incorporate into the DESS database (carried over).

26. FUNDING REQUESTS.

The Committee noted that last year the Committee had submitted a two-year budget to the Commission (IWC, 2015f, p.75) that had been accepted by the Commission although at the Commission meeting there had also been an agreement (by Japan, Australia and NZ) to square bracket the £23,000 for the periodic review of JARPN II.

Fortuna summarised the budget requests for 2016 and noted that there was sufficient money already allocated to cover these requests. The Committee therefore **recommends** the budget provided in Table 29. It was noted that the funding for the JARPN II workshop was to be reviewed by the Commission in light of the Committee's review of Annex P. The Committee **draws the attention** of the Commission to the revised Annex P (see Item 27.3 and Annex P) that has been adopted by the Committee by consensus.

The Committee also noted that there was a surplus money in the voluntary contributions fund for the joint IWC/IQOE workshop held in 2014 (IWC, 2015b, pp.413-24). The Committee noted that acoustic work would be an important component of the agenda of the SWG on environmental concerns next year and **requests** the Secretariat to consult with the contributors to the voluntary fund to request that the balance of the money can be spent on appropriate invited participants to next year's meeting.

Table 29

Summary of budget requests for 2016 based upon the budget agreed last year. For explanation and details of each project see text and (IWC, 2015, pp. 26-80). Items in bold type are new items this year funded using the money allocated last year for such projects. Items marked * are for items agreed last year but for which the estimate has been changed slightly in the light of new work. Items marked ** are ongoing items agreed last year that require no additional money.

RP no.	Title	Relevance	2016
AWMP01	AWMP Workshop to develop *SLAs* for the Greenland hunts	AWMP	11,000*
AWMP02	AWMP developers fund	AWMP	7,500*
BRG01	Development of an sex- and age-structured population dynamics model for North Pacific gray whales	BRG, AWMP, E	0**
BRG03	Workshop to forward the modelling process to understand the status of gray whales across the North Pacific	BRG, AWMP, E	10,000*
BRG03(2)	Technical drafting group for CMP	BRG, HIM, E	2,000
E01	State of the Cetacean Environment Report (SOCER)	E	3,000
E02	POLLUTION 2020	E, SM	2,000
E02b	Contaminant status, trends and risk assessments in cetaceans	E	5,000
E04	Masking and ship noise	E	**4,000**
E08	Large mortality events and strandings workshop	E	0**
EM01	Using baleen whale tag data to inform ecosystem models	EM	5,600
EM02	CCAMLR-IWC Workshop on the development and application of multi-species models to the Antarctic marine ecosystem	EM	4,000
HIM01	Ship strikes database coordinator	HIM	10,000
HIM02	Preventing the entanglement of whales in fishing gear	HIM, COMM	10,000
IA01	IWC-POWER cruise 2016	IA, BRG, RMP	36,000
IA02	Assessment modelling for In-Depth Assessments of Antarctic minke and North Pacific sei whales.	IA	5,000
RMP01	Testing proposed new guidelines for evaluating spatial model-based and design-based abundance estimates	All	0**
RMP02	Evaluating abundance estimates: diagnostics and testing	All	0**
RMP03	Workshops to further progress on the *Implementation Reviews* for the North Atlantic minke and fin whales	RMP, AWMP	10,000*
RMP04	Evaluation of density dependence parameters for inclusion in RMP testing based on energetics modelling	RMP/EM	6,000
RMP06	Essential computing support to the Secretariat for RMP	RMP	10,000
SH01	Synthesis of the results of the comprehensive assessment of Southern Hemisphere humpback whales	SH	1,000
SH02	Modelling support/Southern Hemisphere humpback whales	SH	2,000
SH03	Research Contract 16, Antarctic Humpback Whale Catalogue	SH	15,000
SH04	Southern Hemisphere Blue Whale Catalogue	SH	18,300
SH06	Priority tasks to support regional conservation effort of Arabian Sea humpback whales	SH	17,500*
SP01	Workshop for periodic review of JARPN II	SP	[23,000]
WW01	Emerging whalewatching industry in Oman	WW	4,000*
SAN	Pre-meeting to review SAWS	SAN	**5,000**
SAN	SC participation in joint SC/CC workshop on Sanctuaries	SAN	**5,000**
-	Invited Participants (including SM)	All	83,900*
TOTAL REQUEST			315,800

27. WORKING METHODS OF THE COMMITTEE

27.1 Rules of Procedure of the Scientific Committee
At the 2014 Biennial Meeting of the Commission, Resolution 2014-4 related to the Scientific Committee was adopted. As part of the Resolution, the Committee was asked to review potential changes to its Rules of Procedure. The Chair consulted with the Heads of Delegation early in the meeting and it was agreed to establish a small drafting group to review the potential changes and develop proposed text for discussion in the Plenary.

106

This process was followed and the revised Rules of Procedure **recommended** by the Committee are given as Annex R with changes from the existing Rules shown in bold text. The Annex also contains a table that compares the potential changes provided in Resolution 2014-4 with the Committee's agreed text and a short commentary where appropriate.

All changes were agreed by consensus but the Commission's **advice is sought** on whether or not a new paragraph 4(e) is required, and if so, which of the two options below should be incorporated:

> (e) Papers submitted under Rule of Procedure 4(a) must be scientific in character and shall not contain statements that defame any participating organisation or person, or cause serious offence to any government[1]] or [Papers submitted under the Rule of Procedure 4(a) must be based on science and facts and shall not contain disrespectful statements to any participating person, organisation or government.

The Committee notes that changes to the Committee's Rules of Procedure have normally originated within the Committee and have been recommended to the Commission for consideration. It **welcomes** the Commission's decision at its 2014 meeting to seek its views before changing the Committee's Rules of Procedure and **recommends** that a process of consultation with the Committee before its rules are changed continues to be the norm.

27.2 Biennial reporting and related matters
The 2014 Commission meeting was the first in which the Chair of the Scientific Committee had to present the reports of two Annual Meetings. In addition, it was the first meeting of the Commission in which the Chair of the Scientific Committee was not invited to present a summary of the Committee's work under each relevant Agenda Item but rather was invited to give a short (20 minute) PowerPoint overview at the start of the Commission meeting covering all relevant topics. It should be noted that relevant aspects of the Committee's report were submitted to the Commission's Aboriginal Subsistence Whaling sub-committee and the Commission's Conservation Committee which met immediately prior to the Commission.

In order to assist the Commission, the Chair, Vice-Chair and Head of Science also developed a brief summary report combining the two Scientific Committee reports with a focus on summarising the main conclusions with a focus on those that were of direct relevance to the Commission (IWC/65/24). A full set of recommendations was annexed to that document.

The Committee **agrees** that it is important to consider the best way to provide biennial advice to the Commission. It also **recommends** that the Commission allocates sufficient time for the Chair to present its key findings to the Commission in a manner that reflects the Committee's main relevant conclusions and recommendations. It established an intersessional correspondence group to develop suggested ways to achieve this, containing at least the Chair and Vice-Chair of the Committee, the Head of Science, the Chair of the Commission, de la Mare, Kitakado, Simmonds, Rendell, Ritter and Rojas Bracho.

27.3 Revisions to Annex P in light of Commission Resolution 2014-5
At the 2014 Biennial Meeting of the Commission, Resolution 2014-5 was passed related to special permits. As part of that Resolution, the Committee was instructed provide advice to the Commission on a number of specific points when reviewing permits (see discussion under Item 17.1.5) and to revise Annex P in the light of the Resolution. The Chair consulted with the Heads of Delegation early in the meeting and it was agreed to establish a small drafting group (chaired by DeMaster and including Donovan, de la Mare, Goodman, Iniguez, Johnson, Lundquist, Moronuki, Muraki, Okazoe, Palka, Paniego, Rendell and Walløe) to review the potential changes and develop proposed text for discussion in the Plenary. That working group proposed the revisions by consensus.

The focus was on the sections related to the Terms of Reference for (1) the review of new proposals and (2) for ongoing and final reviews (i.e. two sections of the complete Annex P). Where elements from the Resolution covered similar subject matter to existing terms of reference, it was agreed that the language from the Resolution should be preferred, as this had been specifically framed to reflect the ICJ judgment. The terms of reference have been expanded to apply to both the Panel review and the Committee review (they originally only referred to the Panel). The Committee adopted the revisions by consensus and they have been highlighted and incorporated into a full revised document (Annex P). The Committee **recommends** the revised Annex P to the Commission.

The Committee notes that next year it may consider practical improvements to the way that Annex P is implemented.

27.4 Funding procedures
SC/66a/SCP03 represented the report of an intersessional working group established last year (IWC, 2015f, p.82) to build upon the discussions of the budget process agreed last year.

The Committee welcomes and endorses this report (Annex S) including the amended *pro forma* that will be placed on the Commission's website. It **agrees** that it now has a transparent and practical approach to developing a new two-year budget at next year's meeting.

SC/66a/SC01 that provided a summary by the Secretariat of the present state of the research fund and relevant voluntary funds including spending to date, allocated funding and any unallocated funds.

---

[1] Same text as found in the Code of Conduct for non-governmental organisations.

The Committee welcomes this report that will prove valuable when setting next year's budget and looks forward to a similar document next year. In order to assist this process it was **agrees** that next year's document should include information (as appropriate) on when the money had been allocated and spent.

27.5 Other matters
SC/66a/SCP/2 provided some initial thoughts on how the Committee might begin to incorporate welfare considerations into its work in light of the agreement of a new IWC Welfare Action Plan at the 65th meeting of the IWC. The Committee considers and funds research which involves direct interaction with cetaceans. To help ensure transparency and maintain its scientific credibility and reputation, the authors believe that a clear process is necessary to ensure this research includes appropriate appraisal of animal use in light of internationally recognised and adopted standards. A significant number of countries, intergovernmental bodies, professional associations, government agencies, and academic institutions have implemented regulations, policies, procedures, or codes of practice to help weigh the need for animal use in research and to assess welfare implications. In many cases these appraisals draw on guidelines from global organisations such as the World Organisation for Animal Health (OIE) and the International Council on Laboratory Animal Science (ICLAS), incorporating concepts such as the Three R's (Replacement, Reduction, and Refinement) and harm – benefit analysis. The authors concluded that in order not to duplicate existing mechanisms, they were proposing changes to the research pro-forma and Annex P in order to help the Committee understand how the appraisal of animal use, including welfare implications, had been made at a national level.

There was considerable discussion of this paper and the extent to which animal welfare matters were the responsibility of this Committee as compared to the Commission' working group. It was noted that animal welfare issues had relevance to some Committee activities including entanglement and strandings and also that at present the Committee does not contain specialists on animal welfare issues.

In conclusion the Committee **agrees** the following:

(1) a small amendment will be added to the research *pro forma* which allows further information to be provided on how the use of animals in proposed research has been appraised;
(2) an informal intersessional correspondence group on welfare was agreed to facilitate informal discussions on the consideration of welfare in the Scientific Committee in light of the IWC Welfare Action Plan and the work of the Commissions intersessional working group on welfare;
(3) the question of amendments to Annex P will be considered at a later date in light of the significant amendments already agreed (see Item 27.3).

28. ELECTION OF OFFICERS

This was the final year of office for the Chair (Kitakado) and the Vice-Chair (Fortuna). In accordance with its Rules of Procedure, the Vice-Chair automatically becomes the new Chair for the next three years. The Committee **elects** Suydam (USA) to be the new Vice-Chair by consensus.

The Committee rose in appreciation to thank the outgoing Chair. It wished to formally record its great thanks for his wise, fair and good humoured Chairing over the last three years, noting that he had had to deal with some complex and difficult issues during his period of office.

The Committee also welcomed with enthusiasm the new team of Fortuna and Suydam and looked forward to working with them over the next three years.

29. PUBLICATIONS

Donovan reported on matters related to the *Journal* which is now online and free access as reported last year. He congratulated his team who had completed the very large supplement (557pp. compared to the first supplement of 281pp.). He also noted that considerable progress had been made in reducing the backlog of papers that had been building up for the regular issues but that this may not be possible to maintain as his PA who is primarily responsible for the regular issues was on maternity leave and cover was not being provided. This is also relevant to discussions of future special issues. He noted that the Secretary was initiating a review of the value of the *Journal* to the Commission and if it continues how to produce it most efficiently including the possibility of outsourcing. The results of the review would be presented to the Commission for decision at its 2016 meeting.

In response to a question, the Secretary indicated that as the budget did not include money for maternity cover he felt that it was incumbent upon him to undertake a full review of the *Journal* and its production process in the light of the Commission's needs. He elaborated further that one option to consider was that taken by journals of some learned societies and have it dealt with by existing publishers. He explained that he was open to suggestions.

The Committee **reiterates** that the Journal plays an important part in its work and that it believes that it should be adequately resourced to minimise any backlog and **recommends** that the Committee should be involved in the review.

With respect to future special issues, it **agrees** that highest priority should be accorded to the forthcoming IDCR/SOWER volume (and see Item 10.17.2).

30. OTHER BUSINESS

Donovan commented that this year's meeting covered a number of important and difficult topics that had aspects that were scientific but other aspects that were much better suited to discussions within the Commission itself. He stressed the importance of the Committee focussing on those scientific aspects that were in line with its expertise and leave other matters for the Commission itself. These views were shared by the Chair of the Commission who was present at the meeting this year.

31. ADOPTION OF REPORT

The Committee adopted the report at 1645hrs on 3 June 2014, apart from the final items discussed during the last session. As is customary, those items were agreed by the Chair, rapporteur and Convenors. The Chair thanked the participants for their positive and co-operative attitude, particularly given the sensitivity of some agenda items. He especially thanked the rapporteurs, Secretariat and Vice-Chair for their excellent assistance. Finally, he reiterated his thanks to the host government and the hotel for the excellent facilities which contributed greatly to the success of the meeting. Echoing the sentiments raised under Item 28, participants thanked the Chair for his customary expert and fair handling of the meeting, his dedication and his great contribution to the effective working of the Committee.

REFERENCES

Acevedo, J., Rasmussen, K., Félix, F., Castro, C., Llano, M., Secchi, E., Saborío, M.T., Aguayo-Lobo, A., Haase, B., Scheidat, M., Dalla Rosa, L., Olavarria, C., Forestell, P., Acuña, P., Kaufman, G. and Pastene, L.A. 2007. Migratory destinations of humpback whales, *Megaptera novaeangliae* from the Magellan Strait feeding ground, southeast Pacific. *Marine Mammal Science* 23(2): 453-63.

Aksenov, A.A., Yeates, L.C., Pasamontes, A., Siebe, C., Zrodnikov, Y., Simmons, J., McCartney, M.M., Deplanque, J.P., Wells, R.S. and Davis, C.E. 2014. Metabolite content profiling of bottlenose dolphin exhaled breath. *Analytical Chemistry* 86: 10616-24.

Aldrin, M., Huseby, R.B. and Schweder, T. 2008. A note on tuning the *Catch Limit Algorithm* for commercial baleen whaling. *Journal of Cetacean Research and Management* 10(3): 191-94.

Alexander, A., Steel, D., Hoekzema, K., Mesnick, S., Engelhaupt, D., Kerr, I., Payne, R. and Baker, C.S. In prep. Female philopatry drives high levels of regional structure in the globally distributed sperm whale (*Physeter macrocephalus*). 34pp.

Allison, C. 2011. Direct catch data for western North Pacific minke whale simulation trials. Paper SC/D11/NPM3 presented to the First Intersessional Workshop for the *Implementation Review* of western North Pacific common minke whales, 12-16 December 2011, Tokyo, Japan (unpublished). [Paper available from the Office of this Journal].

Atkinson, S., Crocker, D., Houser, D. and Mashburn, K. 2015. Stress physiology in marine mammals: how well do they fit the terrestrial model? *J. Comp. Physiol. B.*: DOI 10.1007/s00360-015-0901-0.

Attard, C.R.M., Beheregaray, L.B., Jenner, K.C.S., Gill, P.C., Jenner, M.N.M., Morrice, M.G., Teske, P.R. and Moller, L.M. 2015. Low genetic diversity of pygmy blue whales is due to climate-induced diversification rather than anthropogenic impacts. *Biology Letters* 2015: 5pp.

Baird, A.B., Suydam, R.S., George, J.C. and Bickham, J.W. 2014. Update on mtDNA and SNP database for bowhead whales. Paper SC/65b/BRG13 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 8pp. [Paper available from the Office of this Journal].

Besseling, E., Foekema, E., Van Franeker, J., Leopold, M., Kuhn, S., Bravo Rebolledo, E., Hebe, E., Mielke, L., Ijzer, J., Kamminga, P. and Koelmans, A. 2015. Microplastic in a macro filter feeder: humpback whale *Megaptera novaengliae. Mar. Pollut. Bull.* In press.

Bezamat, C., Wedekin, L.L. and Simoes-Lopes, P.C. 2014. Potential ship strikes and density of humpback whales in the Abrolhos Bank breeding ground, Brazil. *Aquatic and Freshwater Ecosystems* 2014: 14pp.

Boertmann, D., Kyhn, L.A., Witting, L. and Heide-Jørgensen, M.P. In press. A hidden getaway for bowhead whales in the Greenland Sea. *Polar Biology*: 5pp.

Branch, T.A. 2007. Abundance of Antarctic blue whales south of 60°S from three complete circumpolar sets of surveys. *Journal of Cetacean Research and Management* 9(3): 253-62.

Brieman, L. 2001. Random forst. *Machine Learning* 45: 5-32.

Brownell, J.R.L. and Donovan, G.P. 1988. *Report of the International Whaling Commission (Special Issue 9). Biology of the genus {ICephalorhynchus}*. International Whaling Commission, Cambridge, UK. [ix]+344pp.

Butterworth, D.S. and Punt, A.E. 2000. On determining linkages between environmental factors and cetacean population dynamics. Paper SC/52/E25 presented to the IWC Scientific Committee, June 2000, in Adelaide, Australia.

Calambokidis, J. and Barlow, J. 2004. Abundance of blue and humpback whales in the eastern North Pacific estimated by capture-recapture and line-transect methods. *Marine Mammal Science* 20(1): 63-85.

Calambokidis, J., Barlow, J., Ford, J.K.B., Chandler, T.O. and Douglas, A.B. 2009. Insights into the population structure of blue whales in the Eastern North Pacific from recent sightings and photographic identification. *Marine Mammal Science* 25(4): 816-32.

Calambokidis, J., Douglas, A., Falcone, E. and Schlender, L. 2007. Abundance of blue whales off the US west coast using photo-identification. Final report to SWFSC. 13pp. [Available at *http://www.cascadiaresearch.org/reports/Rep-SWFSC-04-06-Rev3.pdf*].

Carroll, E.L., Brooks, L., Baker, C.S., Burns, B., Garrigue, C., Hauser, N., Jackson, J.A., Poole, M.M. and Fewster, R.M. In press. Assessing the design and power of capture-recapture studies to estimate population growth rate and abundance of the endangered Oceania humpback whale population. *Endanger. Species Res.*: 22pp.

Christensen, I., Haug, T. and Øien, N. 1992. Seasonal distribution, exploitation and present abundance of stocks of large baleen whales (Mysticeti) and sperm whales (*Physeter macrocephalus*) in Norwegian and adjacent waters. *ICES Journal of Marine Science* 49(3): 341-55.

Constantine, R., Johnson, M., Reikkola, L., Jervis, S., Kozmian-Ledward, L., Dennis, T., Torres, L.G. and Aguilar de Soto, N. 2015. Mitigation of vessel-strike mortality of endangered Bryde's whales in the Hauraki Gulf, New Zealand. *Biological Conservation* 186: 149-57.

Cooke, J. and Leaper, R. 1998. A model to account for the rounding of recorded angles and distances in shipborne sightings surveys. Paper SC/50/RMP19 presented to the IWC Scientific Committee, April 1998 (unpublished).

Cooke, J.G. and de la Mare, W.K. 1994. Some aspects of the estimation and modelling of baleen whale sustainable yields. *Reports of the International Whaling Commission* 44: 451-57.

Cooke, J.G., de la Mare, W.K. and Beddington, J.R. 1983. Some aspects of the reliability of the length data for the western North Pacific stock of sperm whales. *Reports of the International Whaling Commission* 33: 265-67.

Cunha, H.A., Medeiros, B.V., Barbosa, L.A., Cremer, M.J., Marigo, J., Lailson-Brito, J., Azevedo, A.F. and Solé-Cava, A.M. 2014. Population structure of the endangered franciscana dolphin (*Pontoporia blainvillei*): Reassessing management units. *PLoS ONE* 9: e85633.

Curtice, C., Johnston, D.W., Ducklow, H., Gales, N., Halpin, P.N. and Friedlaender, A.S. In press. Modeling the spatial and temporal dynamics of foraging movements of humpback whales (*Megaptera novaeangliae*) in the western Antarctic Peninsula. *Movement Ecology*: 24pp.

Darling, J. 1994. Seeing ghosts - gray whales in the Orient. *Ocean Realm Magazine*(January 1994): 18-19.

DeAngelis, M.L. 2015. Large Whale Distribution and Occurrence Workshop Report, 9-10 September 2014. NOAA NWFS Southwest Fisheries Science Centre, La Jolla, CA.

Donovan, G.P. 1991. A review of IWC stock boundaries. *Reports of the International Whaling Commission (special issue)* 13: 39-68.

duFresne, S., Hodgson, A., Smith, J., Bennett, L., Burns, D., MacKenzie, D. and Steptoe, V. 2014. Final report: Breeding stock 'D' humpback whale pilot surveys - methods and location. Prepared for AMMC. 67pp.

Eisert, R., Pinkerton, M.H., Torres, L., Currey, R., Ensor, P.H., Ovsyanikova, E.N., Visser, I.N. and Oftedal, O.T. 2014. Update on the Top Predator Alliance Proect, 2013-14 season: Killer whales. Report No. WG-EMM-14/52 to CCAMLR. https://www.ccamlr.org/en/wg-emm-14/52.

Fais, A., Lewis, T.P., Zitterbart, D.P., Ivarez, O. and Aguilar de Soto, N. 2015. Chapter V. Abundance and distribution of sperm whales in the Canary Islands: are ship-strikes sustainable? pp.29pp. *In*: Fais, A. (eds). *Acoustic Behaviour of Sperm Whales (Physeter macrocephalus): application in ecology and population studies*. PhD dissertation, Department of Animal Biology, Universidad de La Laguna.

Frantzis, A., Leaper, R., Paraskevi, A. and Lekkas, D. 2014. Distribution patterns of sperm whales in relation to shipping density in the Hellenic Trench, Greece. Paper SC/65b/HIM07 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 11pp. [Paper available from the Office of this Journal].

Fresne, S., Hodgson, A., Smith, J., Bennett, L., Burns, D., MacKenzie, D. and Steptoe, V. 2014. Final report: Breeding stocvk 'D' humpback whale pilot surveys - methods and location. Prepared for AMMC. 67pp.

Fretwell, P.T., Staniland, I.J. and Forcada, J. 2014. Whales from space: Counting southern right whales by satellite. *PLoS ONE* 9(2): e88655. [doi:10.1371/journal.pone.0088655].

George, J.C., Druckenmiller, M., Laidre, K.L., Suydam, R. and Person, B. 2015. Western Arctic bowhead whale body condition and links to summer sea ice and upwelling in the Beaufort Sea. Progress in Oceanography: in press.

George, J.C., Druckenmiller, M.L., Laidre, K.L., Suydam, R. and Person, B. In press. Bowhead whale body condition and links to summer sea ice and upwelling in the Beaufort Sea. *Progress in Oceanography*.

Guzman, H.M., Condit, R., Perez-Ortega, B., Capella, J.J. and Stevick, P.T. 2014. Population size and migratory connectivity of humpback whales wintering in Las Perlas Archipelago, Panama. *Marine Mammal Science* 31(90-105).

Hall, A.J., Kershaw, J.K., Schwacke, L.H., Ylitlo, G., Robbins, J., McConnell, B.J. and Rowles, T.K. 2013. Assessing the population consequences of pollutant exposure in cetaceans (Pollution 2000+) - from ingestion to outcome. Paper SC/65a/E04 presented to the IWC Scientific Committee, June 2013, Jeju Island, Republic of Korea (unpublished). 27pp. [Paper available from the Office of this Journal].

Hamner, R., Oremus, M., Stanley, M., Brown, P., Constantine, R. and Baker, C. 2012. Estimating the abundance and effective population size of Maui's dolphins using microsatellite genotypes in 2010-11, with retrospective matching to 2001-07. Report to the Department of Conservation, Auckland. 44pp.

Hillmer-Pegram, K. and Robards, M.D. 2015. Relevance of a particularly sensitive sea area to the Bering Strait region: a policy analysis using resilience-based governance principles. *Ecology and Society* 20(1): 12pp.

Ijsseldijk, L.L., Steenbergen, J., Gröne, A., Hiemstra, S., Kik, M.J.L. and Begeman, L. 2014. Apparent emergence of bow-caught fin whales (*Balaenoptera physalus*) found in the Netherlands. *Aquatic Mammals* 40(4): 317-20.

Irvine, L.M., Mate, B.R., Winsor, M.H., Palacios, D.M., Bograd, S.J., Costa, D.P. and Bailey, H. 2014. Spatial and temporal occurrence of blue whales off the US west coast, with implications for management. *PLoS ONE* 9(7): 1-10.

IUCN. 2015. *The IUCN Red List of Threatened Species. Version 2015.1.* http://www.iucnredlist.org. Downloaded on 01 June 2015.

International Whaling Commission. 1973. Report of the Scientific Committee, June 1972. *Reports of the International Whaling Commission* 23:28-259.

International Whaling Commission. 1991. Report of the Scientific Committee. *Reports of the International Whaling Commission* 41:51-89.

International Whaling Commission. 1992a. Report of the Fourth Comprehensive Assessment Workshop on Management Procedures, Annex D. Single stock trials for finalised procedures. *Reports of the International Whaling Commission* 42:317-18.

IWC. 1992b. Report of the Scientific Committee, Annex D. Report of the Sub-Committee on Management Procedures. *Reports of the International Whaling Commission* 42: 87-136.

International Whaling Commission. 1993. Report of the Scientific Committee. *Reports of the International Whaling Commission* 43:55-92.

International Whaling Commission. 1995a. Chairman's Report of the Forty-Sixth Annual Meeting, Appendix 4. IWC Resolution 1994-4. Resolution on a Review of Aboriginal Subsistence Management Procedures. *Reports of the International Whaling Commission* 45:42-43.

International Whaling Commission. 1995b. Chairman's Report of the Forty-Sixth Annual Meeting, Appendix 15, IWC Resolution 1994-14. Resolution on whalewatching. *Reports of the International Whaling Commission* 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. *Reports of the International Whaling Commission* 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. *Reports of the International Whaling Commission* 47:52.

International Whaling Commission. 1997b. Report of the Scientific Committee. *Reports of the International Whaling Commission* 47:59-112.

International Whaling Commission. 1998. Chairman's Report of the Forty-Ninth Annual Meeting. Appendix 7. IWC Resolution 1997-7. Resolution on environmental change and cetaceans. *Reports of the International Whaling Commission* 48:48-49.

International Whaling Commission. 1999a. Chairman's Report of the Fiftieth Annual Meeting. Appendix 6. IWC Resolution 1998-5. Resolution on environmental changes and cetaceans. *Annual Report of the International Whaling Commission* 1998:43-44.

International Whaling Commission. 1999b. Chairman's Report of the Fiftieth Annual Meeting. Appendix 8. IWC Resolution 1998-7. Resolution on coordinating and planning for environmental research in the Antarctic. *Annual Report of the International Whaling Commission* 1998:45.

International Whaling Commission. 2000a. Chairman's Report of the Fifty-First Annual Meeting. Appendix 9. IWC Resolution 1999-8. Resolution on DNA testing. *Annual Report of the International Whaling Commission* 1999:55.

International Whaling Commission. 2000b. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 2:1-65.

International Whaling Commission. 2001. 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. *Annual Report of the International Whaling Commission* 2000:56-57.

International Whaling Commission. 2002a. Chair's Report of the 53rd Annual Meeting. Sanctuaries. South Atlantic Whale Sanctuary. *Annual Report of the International Whaling Commission* 2001:18-19.

IWC. 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). *Journal of Cetacean Research and Management (Supplement)* 4: 148-77.

International Whaling Commission. 2003. Report of the Scientific Committee. Annex E. Report of the Standing Working Group on the Development of an Aboriginal Subsistence Whaling Management Procedure (AWMP). *Journal of Cetacean Research and Management (Supplement)* 5:154-255.

International Whaling Commission. 2004. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 6:1-60.

110

International Whaling Commission. 2005a. Report of the Intersessional Meeting to Review the Southern Ocean Sanctuary, Sorrento, Italy, 30 June to 1 July 2004. *Journal of Cetacean Research and Management (Supplement)* 7:403-10.

International Whaling Commission. 2005b. Report of the Scientific Committee. Annex J. Report of the Sub-Committee on Estimation of Bycatch and Other Human-Induced Mortalities. *Journal of Cetacean Research and Management (Supplement)* 7:254-62.

IWC. 2007a. Annex H: Report of the Sub-Committee on the Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 9: 188-209.

International Whaling Commission. 2007b. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. Appendix 5. Report of *Catch Limit Algorithm* (*CLA*) trials group. *Journal of Cetacean Research and Management (Supplement)* 9:110-13.

International Whaling Commission. 2008a. Report of the Scientific Committee. Annex K1. Report of the working group on ecosystem modelling. *Journal of Cetacean Research and Management (Supplement)* 10:293-301.

International Whaling Commission. 2008b. Report of the second Intersessional Workshop on the western North Pacific Bryde's whale *Implementation*, Yokohama, 10-14 December 2006. *Journal of Cetacean Research and Management (Supplement)* 10:449-510.

International Whaling Commission. 2009. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 11:1-74.

IWC. 2010a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 11-2(2): 218-51.

International Whaling Commission. 2010b. Report of the Scientific Committee. *J. Cetacean Res. Manage (Suppl.)* 11(2):1-98.

International Whaling Commission. 2010c. 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. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 12:1-75.

International Whaling Commission. 2011b. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-Depth Assessments. *J. Cetacean Res. Manage. (Suppl.)* 12:185-202.

IWC. 2012a. Annex H: Report of the Sub-Committee on the Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 13: 192-216.

International Whaling Commission. 2012b. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 13:1-74.

International Whaling Commission. 2012c. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-Depth Assessments. *J. Cetacean Res. Manage. (Suppl.)* 13:175-91.

International Whaling Commission. 2012d. Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme. *J. Cetacean Res. Manage. (Suppl.)* 13:509-17.

International Whaling Commission. 2012e. Requirements and Guidelines for *Implementations* under the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 13:495-506.

International Whaling Commission. 2013a. Chair's Report of the 64th Annual Meeting. Annex D. Resolutions Adopted at the 64th Annual Meeting. Resolution 2012-1. Resolution on the importance of continued scientific research with regard to the impact of the degredation of the marine environment on the health of cetaceans and related human health effects. *Ann. Rep. Int. Whaling Comm.* 2012:77.

International Whaling Commission. 2013b. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 14:1-86.

International Whaling Commission. 2013c. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 14:103-17.

IWC. 2014a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 15: 250-70.

International Whaling Commission. 2014b. Report of the Fourth AWMP Workshop on the Development of *SLA*s for the Greenlandic Hunts, 15-18 December 2012, Copenhagen, Denmark. *J. Cetacean Res. Manage. (Suppl.)* 15:437-54.

International Whaling Commission. 2014c. Report of the IWC Scientific Committee Workshop on Marine Debris, 13-17 May 2013, Woods Hole, USA. *J. Cetacean Res. Manage. (Suppl.)* 15:519-41.

International Whaling Commission. 2014d. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 15:1-75.

International Whaling Commission. 2014e. Report of the Scientific Committee. Annex D1. Report of the Working Group on the *Implementation Review* for Western North Pacific Common Minke Whales. *J. Cetacean Res. Manage. (Suppl.)* 15:112-88.

International Whaling Commission. 2014f. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-depth Assessments. *J. Cetacean Res. Manage. (Suppl.)* 15:233-49.

International Whaling Commission. 2014g. Report of the Scientific Committee. Annex I. Report of the Working Group on Stock Definition. Appendix 5. Key stock definition terms for the IWC Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 15:287-88.

International Whaling Commission. 2014h. Report of the Scientific Committee. Annex N. Report of the Working Group on DNA. Appendix 2. Updated list of accession numbers showing inconsistencies in GenBank. *J. Cetacean Res. Manage. (Suppl.)* 15:396-99.

International Whaling Commission. 2014i. Report of the Scientific Committee. Annex Q. Report of the *adhoc* group to develop a list of 'accepted' abundance estimates. *J. Cetacean Res. Manage. (Suppl.)* 15:416-17.

IWC. 2015a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 16: 196-221.

International Whaling Commission. 2015b. Joint Workshop Report: Predicting Soundfields - Global Soundscape Modelling to Inform Management of Cetaceans and Anthropogenic Noise, 15-16 April 2014, Leiden, Netherlands. *J. Cetacean Res. Manage. (Suppl.)* 16:411-24.

International Whaling Commission. 2015c. Report of the AWMP Intersessional Workshop on Developing SLAs for the Greenland hunts, 8-11 January 2014, Copenhagen, Denmark. *J. Cetacean Res. Manage. (Suppl.)* 16:433-58.

International Whaling Commission. 2015d. Report of the AWMP/RMP Joint Workshop on the Stock Structure of North Atlantic Common Minke Whales, 14-17 April 2014, Copenhagen, Denmark. *J. Cetacean Res. Manage. (Suppl.)* 16:543-58.

International Whaling Commission. 2015e. Report of the Expert Workshop to Review the Japanese JARPA II Special Permit Research Programme, 24-28 February 2014, Tokyo, Japan. . *J. Cetacean Res. Manage. (Suppl.)* 16:369-409.

International Whaling Commission. 2015f. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 16:1-87.

International Whaling Commission. 2015g. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure (RMP). *J. Cetacean Res. Manage. (Suppl.)* 16:100-43.

International Whaling Commission. 2015h. Report of the Scientific Committee. Annex E. Report of the Standing Working Group on the Aboriginal Whaling Management Procedure (AWMP). *J. Cetacean Res. Manage. (Suppl.)* 16:144-57.

International Whaling Commission. 2015i. Report of the Scientific Committee. Annex K1. Report of the Working Group on Ecosystem Modelling. *J. Cetacean Res. Manage. (Suppl.)* 16:277-90.

International Whaling Commission. 2015j. Report of the Scientific Committee. Annex L. Report of the Sub-Committee on Small Cetaceans. *J. Cetacean Res. Manage. (Suppl.)* 16:291-319.

International Whaling Commission. 2015k. 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.)* 16:349-53.

International Whaling Commission. 2015l. Report of the Workshop on the Rangewide Review of the Population Structure and Status of North Pacific Gray Whales, 8-11 April 2014, La Jolla, California, USA. *J. Cetacean Res. Manage. (Suppl.)* 16:487-528.

International Whaling Commission and CCAMLR. 2010. Report of the Joint CCAMLR-IWC Workshop to Review Input Data for Antarctic Marine Ecosystem Models,11-15 August 2008, Hobart, Australia. *J. Cetacean Res. Manage. (Suppl.)* 11(2):541-86.

Jambeck, J., Geyer, R., Wilcox, C., Siegler, T., Perryman, M., Adrady, A., Narayan, R. and Law, K. 2015. Plastic waste inputs from land into the ocean. *Science* 437(6223): 768-71.

Jefferson, T.A. and Rosenbaum, H.C. 2014. Taxonomic revision of the humpback dolphins *(Sousa* spp.) and description of a new species from Australia. *Marine Mammal Science* 30(4): 1,494-1,541.

Jepson, P.D., Deaville, R., Barber, J., Aguilar, A., Borrell, A., Murphy, S., Barry, J., Brownlow, B., Barnett, J., Berrow, S., Cunningham, A., Davison, N., Esteban, R., Ferreira, M., Foote, A., Genov, T., Gimenez, J., Loveridge, J., Llavona, A., Martin, V., Maxwell, D., Papachlimitzou, A., Penrose, R., Perkins, M., Smith, B., de Stephanis, R., Tregenza, N., Verborgh, P., Fernandez, A. and Law, R.J. Toxic legacy? Severe PCB pollution in European dolphins. (submitted for publication).

Kato, H., Kishiro, T., Nishiwaki, S., Nakamura, G., Bando, T., Yasunaga, G., Sakamoto, T. and Miyashita, T. 2014. Status report of conservation and researches on the western North Pacific gray whales in Japan, May 2013 - April 2014. Paper SC/65b/BRG12 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 8pp. [Paper available from the Office of this Journal].

Keane, M., Semeiks, J., Thomsen, B. and Pedro de Magalhaes, J. 2015. Insights into the evolution of longevity from the bowhead whale genome. *Cell Reports* 10: 112-22.

Kishiro, T., Murase, H., Kanaji, Y., Yoshida, H., Minamikawa, S. and Miyashita, T. 2014. Revised research plan for the sighting survey of common minke whales in the Okhotsk Sea in summer, 2014. Paper SC/65b/RMP02 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 4pp. [Paper available from the Office of this Journal].

Konishi, K., Hakamada, T., Kiwada, H., Kitakado, T. and Walløe, L. 2014. Decrease in stomach contents in the Antarctic minke whale (*Balaenoptera bonaerensis*) in the Southern Ocean. *Polar Biology* 37: 205-15.

Konishi, K., Tamura, T., Zenitani, R., Bando, T., Kato, H. and Walløe, L. 2008. Decline in energy storage in the Antarctic minke whale (*Balaenoptera bonaerensis*) in the Southern Ocean. *Polar Biology* 31: 1509-20.

Konishi, K. and Walløe, L. In press. Substantial decline in energy storage and stomach fullness in Antarctic minke whales during the 1990s. *J. Cetacean Res. Manage* In press: 34pp.

Krafft, B.A., Krag, L.A., Klevjer, T.A., Skaret, G. and Pedersen, R. 2014. Report from the annual survey of Antarctic krill and apex predator distribution at South Orkney Islands in 2014, and assessing escape mortality of krill in trawls. Report No. WG-EMM-14/16 to CCAMLR.

Lah, L., Benke, H., Berggren, P., Gunnlaugsson, T., Lens, S., Lockyer, C., Öztürk, A.A., Öztürk, B., Pawliczka, I., Roos, A., Sibert, U., Skóra, K. and Tiedemann, R. 2014. Investigating harbor porpoise (*Phocoena phocoena*) population differentiation using RAD-tag genotyping by sequencing. Paper SC/65b/SD04 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 12pp. [Paper available from the Office of this Journal].

Laidre, K.L., Stern, H., Kovacs, K.M., Lowry, L., Moore, S.E., Regehr, E.V., Ferguson, S.H., Wiig, Ø., Boveng, P., Angliss, R.P., Born, E.W., Litovka, D., Quakenbush, L., Lydersen, C., Vongraven, D. and Ugarte, F. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. *Conservation Biology* 2015: 15pp.

Leaper, R., Cooke, J. and Van Waerebeek, K. 2000. Some aspects of the modelling of density-dependent processes in baleen whale populations. Paper SC/52/RMP20 presented to the IWC Scientific Committee, June 2000, in Adelaide, Australia (unpublished). [Paper available from the Office of this Journal].

Lusher, A., Hernandez-Milian, G., O'Brien, J., Berrow, S., O'Connor, I. and Officer, R. 2015. Microplastic and macxroplastic ingestion by a deep diving, oceanic cetacean: the True's beaked whale *Mesoplodon mirus. Environ. Pollut.* 199: 185-91.

Mackenzie, D. and Clement, D. 2014. Abundance and distribution of ECSI Hector's dolphin. New Zealand Aquatic Environment and Biodiversity Report No. 123. *Ministry for Primary Industries*: 79pp.

Mahanty, M.M., Latha, G. and Thirunavukkarasu, A. 2015. Analysis of humpback whale sounds in shallow waters of the southeastern Arabian Sea: an indication of breeding habitat. *Journal of Bioscience* 40(2): 407-17.

Marques, T.A. 2004. Predicting and correcting bias caused by error measurement in line transect sampling using multiplicative error models. *Biometrics* 60: 757-63.

Martien, K.K., Gregovich, D., Bravington, M.V., Punt, A.E., Strand, A.E., Tallmon, D.A. and Taylor, B.L. 2009. TOSSM: an R package for assessing performance of genetic analytical methods in a management context. *Mol. Ecol. Res.* 9(6): 1,456-59.

Mate, B.R., Ilyashenko, V.Y., Bradford, A.L., Vertyankin, V.V., Tsidulko, G.A., Rozhnov, V.V. and Irvine, L.M. 2015. Critically endangered western gray whalesmigrate to the eastern North Pacific. *Biology Letters* 11: 20150071. 4pp.

Maunder, M.N. and Watters, G.M. 2003. A general framework for integrating environmental time series into stock assessment models: Model description, simulation testing, and example *Fishery Bulletin* 101: 89-99.

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.* 19: 2212-28.

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.

Minton, G., Reeves, R., Collins, T. and Willson, A. 2015. Report on the Arabian Sea Humpback Whale Workshop: developing a collaborative research and conservation strategy, Dubai, 27-29 January 2015. 50pp.

Monnahan, C.C., Branch, T.A. and Punt, A.E. 2014a. Do ship strikes threaten the recovery of endangered eastern North Pacific blue whales? *Marine Mammal Science* 31(1): 279-97.

Monnahan, C.C., Branch, T.A. and Punt, A.E. 2015. Do ship strikes threaten the recovery of endangered eastern North Pacific blue whales? *Marine Mammal Science* 31: 279-97.

Monnahan, C.C., Branch, T.A., Stafford, K., Ivashchenko, Y.V. and Oleson, E.M. 2014b. Estimating historical eastern North Pacific blue whale catches using spatial calling patterns. *PLoS ONE* 9(6): 21pp.

Moore, J. and Barlow, J. 2014. Improved abundance and trend estimates for sperm whales in the eastern North Pacific from Bayesian hierarchical modelling. *Endangered Species Research* 25: 141-50.

Moore, S.E. and Gulland, F.M.D. 2014. Linking marine mammal and ocean health in the 'New Normal' arctic. *Ocean and Coastal Management* 102: 55-57.

Natoli, A., Canadas, A., Vaquero, C., Politi, E., Fernandez-Piqueras, J. and Hoelzel, A.R. 2004. Phylogeography of Mediterranean and north Atlantic common dolphin populations. *European Cetacean Society Conference Guide and Abstracts* 15: 315.

New, L.F., Hall, A.J., Harcourt, R., Kaufmann, G., Parsons, E.C.M., Pearson, H.C., Cosentino, A.M. and Schick, R.S. 2015. The modelling and assessment of whalewatching impacts. *Oceans and Coastal Management.* doi:10.1016/j.ocecoman.2015.04.006.

New, L.F., Harwood, J., Thomas, L., Donovan, C., Clark, J.S., Hastie, G., Thompson, P.M., Cheney, B., Scott-Hayward, L. and Lusseau, D. 2013a. Modelling the biological significance of behavioural change in coastal bottlenose dolphins in response to disturbance. *Funct. Ecol.* 27: 314-22.

New, L.F., Moretti, D.J., Hooker, S.K., Costa, D.P. and Simmons, S.E. 2013b. Using energetic models to investigate the survival and reproduction of beaked whales (Family *Ziphiidae*). *PLoS ONE* 8(7): c668725. doi:10.1371/journal.pone.0068725.

NOAA. 2014. *Large whale distribution and occurrence workshop report, September 9-10 2014, NOAA's NMFS Southwest Fisheries Science Center, La Jolla, CA.* 29pp.

Nowacek, D.P., Bröker, K., Donovan, G., Gailey, G., Racca, R., Reeves, R.R., Vedenev, A.I., Weller, D.W. and Southall, B.L. 2013. Responsible practices for minimizing and monitoring environmental impacts of marine seismic surveys with an emphasis on marine mammals. *Aquatic Mammals* 39(4): 356-77.

Olsen, P. and Kinzey, D. In press. Using Antarctic blue whale photo-id data from IDCR/SOWER: capture-recapture estimates of abundance. *Journal of Cetacean Research and Management*(Special Issue 4).

Oremus, M., Garrigue, C., Tezanos-Pinto, G. and Baker, C.S. 2015. Phylogenetic identification and population differentiation of bottlenose dolphins (*Tursiops* spp.) in Melanesia, as revealed by mitochondrial DNA. *Marine Mammal Science* In press: 22pp.

Orgeira, J.L., Alderete, M., Jimenez, Y.G. and Gonzalez, J.C. 2014. Long-term study of the at-sea distribution of seabirds and marine mammals in the Scotia Sea, Antartica. Report No. WG-EMM-14/06 Rev.1 to CCAMLR.

Pace, R.M., Cole, T.V.N. and Henry, A.G. 2014. Incremental fishing gear modifications fail to significantly reduce large whale serious injury rates. *Endangered Species Research* 26(115-126).

Perrin, W.F. and Brownell, R.L., Jr. 2013. Proposed 2013 updates to the IWC List of Recognised Species of Cetaceans. Paper SC/65a/O01 presented to the IWC Scientific Committee, June 2013, Jeju Island, Republic of Korea (unpublished). 4pp. [Paper available from the Office of this Journal].

Polanowski, A.M., Robbins, J., Chandler, D. and Jarman, S. 2014. Epigenetic estimation of age in humpback whales. *Mol. Ecol. Resour.* doi: 10.1111/1755-0998.12247: 12pp.

Pomilla, C., Amaral, A.R., Collins, T., Minton, G., Findlay, K., Leslie, M.S., Ponnampalam, L., Baldwin, R. and Rosenbaum, H. 2014. The world's most isolated and distinct whale population? Humpback whales of the Arabian Sea. *PLoS ONE* 9(12): 22pp.

Rasmussen, K., Calambokidis, J. and Steiger, G.H. 2012. Distribution and migratopry destinations of humpback whales off the Pacific coast of Central America during the boreal winters of 1996-2003. *Marine Mammal Science* 28: E267-E79.

Redfern, J.V., Mckenna, M., Moore, T., Calambokidis, J., Deangelis, M.L., Becker, E.A., Barlow, J., Forney, K., Fiedler, P. and Chivers, S. 2013. Assessing the risk of ships striking large whales in Marine Spatial Planning. *Conservation Biology* 27: 292-302.

Reeves, R.R., Clapham, P.J., Brownell, R.L. and Silber, G.K. 1998. Recovery Plan for the blue whale (*Balaenoptera musculus*). Office of Protected Resources, National Marine Fisheries Service, Silver Spring, MD 20910. 42pp.

Reeves, R.R., Perrin, W.F., Taylor, B.L., Baker, C.S. and Mesnick, M.L. 2004. Report of the Workshop on shortcomings of cetacean taxonomy in relation to needs of conservation and management, 30 April to 2 May 2004, La Jolla, California. *NOAA Technical Memorandum NMFS* SWFSC-363: 93pp. 17pp. [Available from rreeves@total.net].

Ritter, F., Kautek, G., Kelm, B. and Kelm, A. 2015. Detecting dodgy dolphins: assessing physical anomalies in small cetaceans off La Gomera (Canary Islands, Spain). 7pp.

Sarnblad, A., Danbolt, M., Dalen, L., Amir, O.A. and Berggren, P. 2011. Phylogenetic placement and population structure of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) off Zanzibar, Tanzania. *Marine Mammal Science* 27: 431-48.

Schwacke, L.H., Smith, C.R., Townsend, F.I., Wells, R.S., Hart, L.B., Balmer, B.C., Collier, T.K., De Guise, S., Fry, M.M., Guillette, L.J., Jr., Lamb, S.V., Lane, S.M., McFee, W.E., Place, N.J., Tumlin, M.C., Ylitalo, G.M., Zolman, E.S. and Rowles, T.K. 2014. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the Deepwater Horizon oil spill. *Environ. Sci. Technol.* 48(1): 93-103.

Secchi, E.R., Danilewicz, D. and Ott, P.H. 2003. Applying the phylogeographic concept to identify Franciscanas dolphin stocks: Implications to meet management objectives. *J. Cet. Res. Manage.* 5: 61-8.

Seim, I., Ma, S., Zhou, X., Gerashchenko, M.V., Lee, S.G., Suydam, R., George, J.C., Bickham, J.W. and Gladysehv, V.N. 2014. The transcriptome of the bowhead whale *Balaena mysticetus* reveals adaptations of the longest-lived mammal. *Aging* 6(10): 879-99.

Torres-Florez, J.P., Olson, P., Bedrinana-Romano, L., Rosenbaum, H.C., Ruiz, J., LeDuc, R. and Hucke-Gaete, R. In press. First documented migratory destination for Eastern South Pacific blue whales. *Marine Mammal Science*.

Trujillo, F., Crespo, E., Van Damme, P.A. and Usma, J.S. 2010. *The Action Plan for South American River Dolphins 2010-2020*. WWF, Fundacion Omacha, WDS, WDCS. Solamac. Bogota, D.C., Colombia. 249pp.

Van Bressem, M.F., Duignan, P.J., Banyard, A., Barbieri, M., Colegrove, K.M., De Guise, S., Di Guardo, G., Dobson, A., Domingo, M., Fauquier, D., Fernandez, A., Goldstein, T., Grenfell, B., Groch, K.R., Gulland, F., B.A., J., Jepson, P.D., Hall, A., Kuiken, T., Mazzariol, S., Morris, S.E., Nielsen, O., Raga, J.A., Rowles, T.K., Saliki, J., Sierra, E., Stephens, N., Stone, B., Tomo, I., Wang, J., Waltzek, T. and Wellehan, J.F.X. 2014a. Cetacean morbillivirus: current knowledge and future directions. *Viruses* 6: 5145-81.

Van Bressem, M.F., Minton, G., Collins, T., Willson, A., Baldwin, R. and Van Waerebeek, K. 2014b. Tattoo-like skin disease in the endangered subpopulation of the humpback whale, *Megaptera novaeangliae*, in Oman (Cetacea: Balaenopteridae). *Zoology in the Middle East* 2014: 8pp.

Venn-Watson, S., Colegrove, K.M., Litz, J., Kinsel, M., Terio, K., Saliki, J., Fire, S., Carmichael, R., Chevis, C., Hatchett, W., Pitchford, J., Tumlin, M., Field, C., Smith, S., Ewing, R., Fauquier, D., Lovewell, G., Whitehead, H., Rotstein, D., McFee, E., Fougeres, E. and Rowles, T. 2015a. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops trunctaus*) found dead following the *Deepwater Horizon* oil spill. *PLoS ONE* 10(5): 23pp.

Venn-Watson, S., Garrison, L., Litz, J., Fougeres, E., Mase, B., Rappucci, G., Stratton, E., Carmichael, R., Odell, D., Shannon, D., Shippee, S., Smith, S., Staggs, L., Tumlin, M.C., Whitehead, H. and Rowles, T. 2015b. Bottlenose dolphins strandings and Deepwater Horizon oil spill in the Gulf of Mexico. *PLoS ONE* 2015: 13pp.

Waples, R.S. 2015. Testing for Hardy-Weinberg proportions: have we lost the plot? *Journal Of Heredity* 106(1): 1-19.

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. *Journal of Cetacean Research and Management* 10(1): 89-91.

Weller, D.W. and Burdin, A.M. 2015. Western gray whales off Sakhalin Island, Russia: A catalog of photo-identified individuals 1994-2014.

Willson, A., Collins, T., Baldwin, R., Cerchio, S., Geyer, Y., Godley, B., Gray, H., Al-Harthi, S., Minton, G., Al Zehlawi, N., Witt, M., Rosenbaum, H.C. and Zerbini, A. 2014. Preliminary results and first insights from satellite tracking studies of male Arabian Sea humpback whales. Paper SC/65b/SH19 presented to the IWC Scientific Committee, May 2014, Bled, Slovenia (unpublished). 12pp. [Paper available from the Office of this Journal].

Wilson, S., Hung, H., Katsoyiannis, A., Kong, D., van Oostdam, J., Riget, F. and Bignert, A. 2014. Trends in Stockholm Convention Persistent Organic Pollutants (POPs) in Arctic Air, Human media and Biota. *AMAP Technical Report* No. 7(2014). Arctic Monitoring and Assessment Programme (AMAP), Oslo, 54pp.

Yasunaga, G., Fujise, Y., Zenitani, R., Tanabe, S. and Kato, H. 2014. Spatial and temporal variation of PCBs and organochlorine pesticides in the Antarctic minke whales, *Balaenoptera bonaerensis*, in the period 1987-2005. *Chemosphere* 126: 11-17.

Zeh, J.E., Clark, C.W., George, J.C., Withrow, D., Carroll, G.M. and Koski, W.R. 1993. Current population size and dynamics. pp.409-89. *In*: Burns, J.J., Montague, J.J. and Cowles, C.J. (eds). *The Bowhead Whale*. Special Publication No.2. The Society for Marine Mammalogy, Lawrence, Kansas. 787pp.

Zitterbart, D.P., Kindermann, L., Burkhardt, E. and Boebel, O. 2013. Automatic round-the-clock detection of whales for mitigation from underwater noise impacts. *PLOS One* 8(8): 6pp. DOI: 10.1371/journal.pone.0071217.

SC Report   19/06/2015