

Report of the Scientific Committee

Codes for highlighted action items: S=Secretariat; SC=internal to the Scientific Committee; G=general scientific recommendations; C-A=advice to the Commission; C-R=recommendation to the Commission; CC=relevant to the Commission's Conservation Committee; AWS=relevant to the Commission's Aboriginal Subsistence Whaling sub-committee; CG-A=advice to a Contracting Government or Governments; and CG-R=recommendations to a Contracting Government or Governments.

The meeting (SC/67a) was held at the Golf Hotel, Bled, Slovenia, from 9-21 May 2017 and was chaired by Caterina Fortuna. The next meeting of the Commission (IWC/67) will take place in late 2018. The list of participants is given as Annex A (only 35% of the Contracting Governments were represented by delegates).

1. INTRODUCTORY ITEMS

1.1 Chair's welcome and opening remarks

Fortuna welcomed the participants to the meeting. On behalf of the Scientific Committee she thanked the Government of Slovenia and the City of Bled, especially her Slovenian colleagues Commissioner Andrej Bibič and Mateja Legat, for inviting it back to such a beautiful place. She thanked the IWC Secretariat staff for their hard work during the intersessional period along with Greg Donovan (Head of Science), vice-Chair Robert Suydam and the convenors and all Committee members.

Andrej Bibič, IWC Commissioner for Slovenia, welcomed participants to Bled and hoped that everyone would enjoy their time there. He noted that most commodities come from natural resources and therefore conservation of nature and sustainable management are tasks of strategic importance. He acknowledged that scientific knowledge is crucial in implementing effective conservation and management strategies and he wished participants every success during the 2017 Scientific Committee meeting.

Thomaž Lovrenčič, Ambassador at the Ministry of Foreign affairs, also welcomed participants to Bled whose beautiful green setting provides an excellent setting for the demanding work of the Committee. The Committee's work contributes to Government Policy and the Slovenian Government strongly agrees with the principles contained in the IWC Convention, that is finding a balance between conservation of whale stocks and the orderly development of the whaling industry. Humans have a responsibility to work together to find sustainable long-term solutions in the maritime environment, both now and for future generations. He hoped that the meeting would be a great success.

Brockington, the IWC Executive Secretary, thanked the representatives of Slovenia for their warm welcome. The IWC has been remarkably productive over the last three years, has organised a specialist event or workshop on cetaceans at the rate of approximately once per month on many aspects of cetacean conservation and management. He highlighted some of the ways that the Commission has been receiving and acting upon recommendations of the Scientific Committee. He acknowledged the implementation of the new format for Scientific Committee report recommendations and referred to the database of recommendations that the 'Scientific Committee-Conservation Committee joint working group' is working on that will record and track progress. He thanked Fortuna for her initiative in increasing

focus for the Committee and improving its alignment with Commission priorities. Access to the advice of the Committee allied with the commitment of Governments and increased co-operation with inter-governmental organisations and observers provides an increasingly powerful model for addressing urgent conservation and management needs.

The Committee was saddened to learn of the death of Carole Carlson. Carlson was involved with the Scientific Committee for over two decades, attending her first meeting in Puerto Vallarta, Mexico in 1994. She will be remembered for her great contribution to the work of the then newly formed sub-committee on whalewatching, acting as wise rapporteur. She helped to steer the Committee's scientific discussions on sustainable whalewatching and championed the effective contribution that data collected carefully from platforms of opportunity can make to science and conservation. One of her major contributions was the development and maintenance of the IWC Compilation of Worldwide Whalewatching Regulations. She also made major contributions to the development of good practice guidelines for new whalewatching operations in many parts of the world. Her work on humpback whale photo-identification catalogues, initially in the North Atlantic and later in the Antarctic, greatly contributed to the comprehensive assessment of those species in both areas. Apart from her important scientific contributions, Carole will be especially remembered for her unfailing cheerfulness, her desire to help colleagues from all countries and her encouragement to young scientists and 'IWC beginners'. Her generosity of spirit will be greatly missed. The Scientific Committee gave a celebratory round of applause in her memory.

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.

1.4 Establishment of sub-committees and Working Groups

The following pre-meetings were held:

- (1) the Standing Working Group on Environmental Concerns held a pre-meeting Workshop on 'Harmful Algal Blooms and their Toxins' from 7-8 May;
- (2) the Working Group on Ecosystem Modelling held a pre-meeting on 'Spatial-Modelling-Based Abundance Estimates' from 7-8 May; and
- (3) the SORP Antarctic Blue and Fin Whale Acoustic Trends Working Group (ATWG) met from 5-8 May.

Several 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 In-Depth Assessments;

Annex G – Sub-Committee on Other Northern Hemisphere Whale Stocks;

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

Annex I – Working Group on Stock Definition and DNA testing;

Annex J – Working Group on Non-Deliberate Human-Induced Mortality of Cetaceans;

Annex K – Standing Working Group on Environmental Concerns;

Annex L – Working Group on Ecosystem Modelling;

Annex M – Sub-Committee on Small Cetaceans;

Annex N – Sub-Committee on Whalewatching;

Annex O – Sub-Committee on Conservation Management Plans;

Annex P – Matters Related to Special Permit Discussions;

Annex Q – *Ad hoc* Working Group on Abundance Estimates, Stock Status and International Cruises;

Annex R – *Ad hoc* Working Group on IWC Global Data Repositories and National Reports;

Annex S – *Ad hoc* Working Group on Photo-Identification;

Annex T – *Ad hoc* Working Group on Interactions between Scientific and Conservation Committees;

Annex U – Statements on the Agenda;

Annex V – Matters Related to Working Methods; and

Annex W – Intersessional Email Correspondence Groups.

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, 2013a, pp.78-79).

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 several specialist databases (including catches, sightings, ship strikes, images – see Item 22).

As agreed at the 2013 Annual Meeting (IWC, 2014a), all National Progress Reports were submitted electronically through the IWC National Progress Reports data portal. This year 12 countries provided National Progress Reports including data on bycatch, entanglement, ship strikes, direct and indirect takes, sampling, sightings and tracking studies. These countries were: Australia, Croatia, Denmark, Germany, Iceland, Italy, Japan, Korea, New Zealand, Spain, United Kingdom and the USA.

Attention: C-A

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 14% of member nations – see also the recommendations under Item 13.2 and 23.3.2.

3.3 Data collection, storage and manipulation

3.3.1 Catch data and other statistical material

Table 1 lists data received by the Secretariat since the 2016 meeting.

3.3.2 Progress of data coding projects and computing tasks

Allison reported that Version 6.1 of the catch databases was released in July 2016 and is available on request. She requested information on any sources of data missing from the databases. Work has continued on the entry of catch data into both the IWC individual and summary catch databases, including data received from the 2015 and 2016 seasons.

Data from Gilmore's files held at the NMML in Seattle for Japanese coastal catches by one company in the years 1938-42 has been coded and added to the database. These catches represent ~30-40% of the Japanese coastal catches each year over this period.

Data from the Japanese North Pacific sei and Bryde's whale marking programme has been entered and validated; data for the other species is being entered.

Data from the 2013 and 2014 POWER cruises has been validated, as was reported last year. Some queries have been sorted out and the process documented. Data from the 2015 cruise has been validated but await clarification of some points. This and the DESS database is discussed under Item 11.3.1.

Programming work has concentrated on development, conditioning and running of the *Implementation* trials for North Atlantic common minke whales and initial work on North Pacific Bryde's whale trials (see Items 6.2 and 6.3). This and other work is described under the relevant sub-committee items.

4. CO-OPERATION WITH OTHER ORGANISATIONS

Attention: C-A

The Committee stresses the value of co-operation with other organisations when addressing the range of issues affecting cetacean conservation and management. In addition to the summaries below, co-operation is also discussed where relevant elsewhere in the agenda.

4.1 African States Bordering the Atlantic Ocean (ATLAFCO)

There was no meeting of the Ministerial Conference of ATLAFCO during the intersessional period.

4.2 Arctic Council

4.2.1 PAME (Protection of the Arctic Marine Environment)

The PAME I-2017 meeting was held in Copenhagen, Denmark from 29 January-1 February 2017. No IWC observer attended

Table 1
List of data and programs received by the IWC Secretariat since the 2015 meeting.

Date	Contact	Code	Notes
Catch data from the 2016 and 2016/17 season			
18/04/17	Russia: V. Ilyashenko	E128 Cat2016	Individual data from Russian aboriginal hunt 2016.
19/04/17	Japan: H.Kumakiri	E128 Cat2016	Individual data for Japan's catch in 2016 in the North Pacific (JARPN II) and 2016/17 in the Antarctic (NEWREP-A) (Excel and pdf format).
25/04/17	USA: R. Suydam	E128 Cat2016	Individual records from USA Alaska aboriginal bowhead hunt 2016.
26/04/17	Norway: N. Øien	E128 Cat2016	Individual minke records from the Norwegian 2016 commercial catch. Access restricted (specified 14/11/00).
03/05/17	Iceland: G. Víkingsson	E128 Cat2016	Individual records of minke whales caught by Iceland 2016 [there was no fin whale catch].
18/05/17	St Vincent and The Grenadines: J. Cruickshank-Howard	E128 Cat2016	Information from St Vincent and The Grenadines aboriginal hunt 2016-17.
08/05/17	Canada: L. Vuckovic	E128 Cat2016	Details of the Canadian bowhead harvest for the 2016 season and notification of the 2017 quota.
25/04/17	USA: R. Suydam	E128 Cat2016	Reported landed harvest of beluga whales from western and northern Alaska, 2007-16, compiled by the Alaska Beluga Whale Committee.
Catch data from previous seasons			
22/10/16	Greenland: N. Levermann	E125 Cat2015	Individual catch data from the Greenland aboriginal hunt (all species) in 2015.
18/03-11/2016	S. Mizroch, S. Kromann and Y. Ivashchenko	E127 C	Individual catch data from Gilmore's files held at the NMML, Seattle, for Japan coastal catches by Taiyo Gyogyo in 1938-42.
13/12/16	Y. Hideyoshi	E127 C	Information on 90 Bryde's whales caught 1954-67 (which were formerly reported as 'sei' whales in records which did not distinguish sei and Bryde's whales).
07/04/17	S. Mizroch	E127	USA whale marking program data (1962-69).
07/07/17	R.L. Brownell	CD102	Catch data from Japanese factories operating in the Antarctic in 1946/47 and 1947/48. The data relate to a blue and fin whale baleen collection held at the Smithsonian Institute (reported to Scientific Committee 2015).
Sightings			
07/04/17	Japan: K. Matsuoka	E129	Data from the 2016 JARPNII dedicated sighting survey.
12/04/17	Japan: K. Matsuoka	CD101 E129	Data from the 2016 POWER sightings cruise plus CD received 20/04/17.
30/04/17	Japan: K. Matsuoka	E129	Data from the 2016-17 NEWREP-A dedicated sighting survey.

the meeting. The Committee agrees that if possible an IWC observer should attend the next meeting of PAME.

4.3 Convention on Biological Diversity (CBD)

The Conference of Parties met 4-17 December 2016 in Cancun, Mexico. No IWC observer attended the meeting.

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

The 35th Meeting of the CCAMLR Scientific Committee was held 17-21 October 2016 in Hobart, Australia. Although no IWC observer attended the meeting, co-operation with CCAMLR remains an important component of the IWC's work and is discussed further under Item 16.1.2.

4.5 Convention on the Conservation of Migratory Species (CMS)

4.5.1 Scientific Council

The First Meeting of the Sessional Committee of the Scientific Council (ScC-SC1) was held 18-21 April 2016 in Bonn, Germany. No IWC observer attended the meeting.

4.5.2 Conference of Parties

There was no meeting of the Conference of Parties during the intersessional period. The next meeting will take place 22-28 October 2017 in Manila, Philippines.

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

The report of the observers at the 8th Meeting of Parties to ASCOBANS¹ held in Helsinki, Finland from 30 August

to 1 September 2016 is given as SC/67a/02G. There was no meeting of the Advisory Committee (AC) during the intersessional period.

Thirteen resolutions were passed after they had been prepared during the last AC meeting. Those of relevance to the IWC are summarised below.

- (1) The harbour porpoise population of the Baltic Proper continues to be endangered, with an IUCN status of 'endangered by extinction'. The resolution reiterates the importance of the Jastarnia plan and furthermore specifies the aim to reduce bycatch to zero.
- (2) Common dolphins have a bycatch which is thought to be unsustainable. ASCOBANS will continue to work towards a comprehensive conservation plan for the common dolphin in the eastern North Atlantic.
- (3) Mitigation of bycatch, with the aim to reduce bycatch of cetaceans to zero, with the intermediate precautionary aim to reduce bycatch to less than 1% of the best available population estimate; and to focus on monitoring programmes for robust estimation of cetacean bycatch, as well as the development, implementation and evaluation of mitigation measures.
- (4) Ocean energy can potentially have an impact on cetaceans due to noise or collision.
- (5) Impacts of polychlorinated biphenyls (PCBs). Several actions are proposed, in particular to monitor PCB exposure in small cetacean species across the ASCOBANS range, with particular emphasis on species considered to be at high risk, such as killer whales, bottlenose dolphins and harbour porpoises.
- (6) Addressing the threats from underwater unexploded ordnance, which are on the one hand the toxic substances they can release into the marine environment and on the other hand the potential for injury during explosions.

¹http://www.ascobans.org/sites/default/files/document/ASCOBANS_MOP8_Report.pdf.

- (7) Cumulative effects are an emerging issue, which can only be addressed in conjunction with partners, and by thinking strategically when dealing with transboundary issues.
- (8) CMS family guidelines on environmental impact assessments for marine noise-generating activities signal that underwater noise is a serious issue that affects a whole range of species. These draft guidelines address issues on assessing, mitigating and minimising the negative effects of sound on marine species.

The Committee thanked Geelhoed and Scheidat for their report and **agrees** that they should represent the Committee as observers at the next ASCOBANS meeting.

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

4.5.4.1 MEETING OF PARTIES

The 6th Meeting of the Parties (MoP) to ACCOBAMS met from 22-25 November 2016 in Monaco. The report of that meeting, which also celebrated the 20th anniversary of ACCOBAMS, can be found on the ACCOBAMS website². IWC/ACCOBAMS cooperation has been high throughout the period and continues to remain strong. The MoP adopted several resolutions relevant to the work of the IWC including:

- (1) Resolution 6.7 on the ACCOBAMS Scientific Committee;
- (2) Resolution 6.13 on ACCOBAMS Survey Initiative (this project has previously been endorsed by the IWC Scientific Committee);
- (3) Resolution 6.14 on Population Structure Studies;
- (4) Resolution 6.15 on Assessment of IUCN Conservation Status of Cetaceans in the ACCOBAMS Area;
- (5) Resolution 6.16 on Interactions between Fisheries and Cetaceans;
- (6) Resolution 6.17 on Anthropogenic Noise;
- (7) Resolution 6.18 on Implementation of an ACCOBAMS Certification for Highly Qualified Marine Mammal Observers;
- (8) Resolution 6.19 on Ship Strikes on Cetaceans in the Mediterranean Sea;
- (9) Resolution 6.20 on Commercial Cetacean Watching Activities in the ACCOBAMS Area;
- (10) Resolution 6.21 on Species Conservation Management Plans;
- (11) Resolution 6.22 on Cetacean Live Strandings; and
- (12) Resolution 6.24 on New Areas of Conservation of Cetacean Habitats.

The willingness of the IWC to contribute on areas of common interest was stressed and ACCOBAMS welcomed collaboration with the IWC. The Committee thanked Donovan for acting as the IWC Observer at the MoP. The next MoP will be in three years.

4.5.4.2 SCIENTIFIC COMMITTEE

ACCOBAMS Scientific Committee met from 7-9 February 2017 in Monaco and the report can be downloaded from the ACCOBAMS website³. The primary objective of the meeting was to agree a workplan to implement the scientific components of the resolutions adopted during the MoP referred to above. Again, the willingness of the IWC to cooperate on matters of mutual interest was stressed. The

next ACCOBAMS Scientific Committee meeting will take place in autumn 2018. The Committee thanked Donovan for acting as the IWC representative at the ACCOBAMS Scientific Committee meeting and **agrees** that he should continue to do so.

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

The 17th meeting of the Conference of the Parties took place from 24 September-5 October 2016 in Johannesburg, South Africa. No IWC observer attended the meeting.

4.7 Food and Agriculture Organisation of the United Nations (FAO)

The Committee on Fisheries (COFI) met 11-15 July 2016 in Rome, Italy. No observer attended FAO related meetings in the intersessional period.

4.8 Inter-American Tropical Tuna Commission (IATTC)

The 91st (extraordinary) meeting of the Inter-American Tropical Tuna Commission (IATTC) was held in California, USA, 7-10 February 2017. No observer attended IATTC meetings in the intersessional period.

4.8.1 Agreement on the International Dolphin Conservation Program (AIDCP)

No observer attended IADCP meetings in the intersessional period.

4.9 International Committee on Marine Mammal Protected Areas (ICMMPA)

The report of the observer is given as SC/67a/02H. Over 90 Marine Mammal Protected Area (MMPA) researchers and managers, as well as government and conservation group representatives from 19 countries, met in Puerto Vallarta, México, from 13-17 November 2016 for the Fourth International Conference on Marine Mammal Protected Areas (ICMMPA4). A primary focus of the conference was to explore the role of effective partnerships and planning strategies for managing and monitoring protected areas with marine mammals. For further information visit the ICMMPA website⁴.

A trilateral workshop began during ICMMPA4 and continued for a few days after the conference concluded. The aim of the workshop was to develop working agreements to aid cooperation when dealing with entangled whales across national boundaries. The primary outcome of the workshop has been increased communication and cooperation between the three countries (Canada, the USA and Mexico). This has already led to the US gear experts identifying US crab gear that was removed by teams from Mexico (RABEN) from whales in Mexico this winter.

The Committee thanked Rojas-Bracho for his report and **agrees** he should represent the Committee at the ICMMPA Task force meeting.

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

The report of the IWC observer documenting the 2014 activities of ICES is given as SC/67a/02A. During the year, the ICES Working Group on Marine Mammal Ecology (WGMME) met 8-11 February 2016 in Madrid, Spain.

One OSPAR request involved collation of data and assessment of status for cetaceans in the OSPAR areas of the Northeast Atlantic. In relation to coastal bottlenose dolphins and killer whales, most time-series of abundance

²<http://www.accobams.org/>.

³<http://www.accobams.org/>.

⁴<http://icmmpa.org/conference/fourthconference>.

data are rather short in relation to the generation time of these long-lived animals. Assessment was only possible for five populations, with an indicative assessment provided for another one. In many locations, coastal bottlenose dolphin populations declined or disappeared before or during the 20th century, but most of the current populations seem to be stable. The relationships between coastal bottlenose dolphins and wider ranging offshore populations remain unclear. For most other cetacean species, there is only one robust estimate of abundance. For those species for which there are multiple estimates of abundance, the time-series are short relative to the life cycle of the species and the precision of the estimates is generally low leading to poor power to detect trends from these data. It is therefore not possible to infer with any confidence whether populations are decreasing, stable or increasing. However, there has been a clear shift in harbour porpoise distribution from north to south in the North Sea. Notwithstanding the inability to detect trends, recent estimates of abundance are either similar to or larger than comparable earlier estimates. There is currently no evidence of an impact of anthropogenic activity on either distribution or abundance of cetacean species in OSPAR Regions II (Greater North Sea), III (Celtic Seas) and IV (Bay of Biscay and Iberian Coast). More data are needed to make an informed assessment; results from a large-scale survey in summer 2016 will aid this process.

In addition, the WGMME reviewed and reported on: (1) new information on population abundance, population/stock structure and management frameworks for marine mammals; and (2) information on negative and positive ecological interactions between grey seal and other marine mammals. In relation to the latter topic, a workshop is proposed for 2017.

The ICES Working Group on Bycatch of Protected Species (WGBYC) met in Copenhagen from 1-5 February 2016. Since the commencement of WGBYC in 2009 it has been collating, storing and summarising annual data reported by European member states concerned by Regulation 812/2004. This has resulted in the development of a WGBYC database that currently stores nine years (2006-14) of data on fishing effort, dedicated monitoring effort and observed bycatch of cetaceans (and increasingly of other protected species). However, WGBYC's ability to evaluate the magnitude of bycatch mortality of cetaceans and other protected species or species of possible concern continues to be hampered by limited availability of accurate total fishing effort from relevant European waters for gear types covered by this regulation. WGBYC continues to highlight the inconsistent submission and content of annual reports provided by some member states and the shortcomings of the regulation to accurately reflect the magnitude of cetacean bycatch in European fisheries.

The following have been achieved by the WGBYC.

- (1) WGBYC now has a framework for automatic data uploading and storage jointly managed with the ICES Data Centre.
- (2) WGBYC data continues to demonstrate weaknesses in the current Data Collection Framework (DCF) to adequately capture bycatch incidences of rare event species.
- (3) WGCATCH now formally recognises the need to address sampling protocol deficiencies for rare event species in the DCF by incorporating an explicit Term of Reference to address this issue at their annual meetings and they have expanded their membership to include WGBYC.

- (4) WGBYC continues to advance overall understanding of protected species bycatch levels by using its database to: (a) now include a summary table of bycatch rates for seabird species in addition to small cetaceans; and (b) undertake bycatch risk assessments for harbour porpoise and a new addition in 2016 - common dolphins.
- (5) Several member states continue with mitigation research projects highlighting the importance of continuing to work toward solutions to difficult bycatch management and conservation issues in the face of challenging data and limited resources.

More information is available from the ICES website <http://www.ices.dk>.

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

4.11 International Maritime Organisation (IMO)

The report of the observer is given as SC/67a/02E. At IWC/66, the Commission endorsed recommendations of the Conservation Committee and Scientific Committee for continued engagement with the IMO. This included recommendations related to ship strikes and to submit a paper to the IMO Marine Environment Protection Committee providing an update of recent information related to the extent and impacts of underwater noise from shipping.

There have been several recent discussions at the IMO relevant to the IWC recommendations. Costa Rica submitted two proposals to the IMO Navigational Communications and Search and Rescue (NCSR) subcommittee in March 2017 related to reducing ship strike risks to humpback whales. These were 'Establishment of a new area to be avoided (ATBA) off the Pacific coast of Costa Rica' (NCSR/4/3/2) and 'Establishment of a recommendatory two-way route in Golfo Dulce, off the Pacific coast of Costa Rica' (NCSR/4/3/3). The proposal for the area to be avoided was recommended by NCSR and will be considered by the Maritime Safety Committee (MSC 98) which will meet 7-16 June 2017. The NCSR invited Costa Rica to consider the establishment of national ships' routing measures within the Golfo Dulce after the implementation of the ATBA, if deemed necessary. The NCSR also suggested that proposed routing measures which were primarily related to environmental protection should first be considered by the Marine Environmental Protection Committee (MEPC). The next MEPC meeting (MEPC 71) is scheduled for 3-7 July 2017.

The IMO International Code for Ships Operating in Polar Waters (Polar Code) came into force on 1 January 2017. This applies to passenger and cargo ships covered by SOLAS and includes environmental provisions for the prevention of pollution by oil, noxious liquid substances, sewage, and garbage. Section 11.3.6 of Chapter 11 on Voyage Planning includes the requirement that in considering routes through polar waters, masters shall take into account 'current information and measures to be taken when marine mammals are encountered relating to known areas with densities of marine mammals, including seasonal migration areas' and 'current information on relevant ships' routing systems, speed recommendations and vessel traffic services relating to known areas with densities of marine mammals, including seasonal migration areas'. Provisions relating to non-SOLAS ships, including fishing vessels and pleasure craft will be discussed in the future.

The Committee thanked Ferris and Leaper for their report and **agrees** that they should represent the Committee at the next IMO meeting.

4.12 International Union for the Conservation of Nature (IUCN)

The 6th World Conservation Congress (IUCN's 4-yearly general meeting) was held in Hawai'i in September 2016. Workshops relevant to cetaceans covered the role of Important Marine Mammal Areas (IMMAs) in cetacean conservation; the management of marine traffic, including the use of IMO measures in IMMAs; the South Atlantic Whale Sanctuary; and balancing whale conservation with oil and gas development, which included a presentation of the Western Gray Whale Advisory Panel (WGWAP) work. Three cetacean-related resolutions were adopted: (i) an action to avert the extinction of the vaquita; (ii) a recommendation for the lethal component of the whale research programmes in the Antarctic and North Pacific to be cancelled; and (iii) one supporting the adoption of the South Atlantic Whale Sanctuary and the implementation of its management plan.

IUCN's joint Task Force on MMPA's, drew up a series of regional workshops to propose candidate Important Marine Mammal Areas. The first workshop, for the Mediterranean, was held in Greece in October 2016 and the second, for the South Pacific, in Samoa in March 2017. The programme is discussed further in Annex J.

The WGWAP met in November 2016 in Moscow, and its Noise Task Force met at IUCN in April 2017, where it reviewed *inter alia* a simulation study on the efficacy of mitigation measures for reducing the sonic exposure of whales during seismic surveys. The next meetings of WGWAP and of the Task Force are scheduled for November 2017 in Moscow. A report of WGWAP activities is contained in Annex O, Appendix 5.

Updated Red List assessments for all cetacean species and selected subpopulations are underway and are expected to be completed this year. Two on-line workshops were held, with several Committee members participating. The new assessments will be posted on <http://www.redlist.org> when they have been reviewed by external experts and approved by the Red List Authority. Updates of other projects in which Cetacean Specialist Group members are involved are posted on the Group's web site⁵. The Committee thanked Cooke and Reeves for their report and **agrees** that they should continue to act as observers to IUCN for the IWC.

4.13 North Atlantic Marine Mammal Commission (NAMMCO)

4.13.1 Scientific Committee

The report of the IWC observer at the 23rd meeting of the NAMMCO Scientific Committee (SC) held in Nuuk, Greenland from 4-7 November 2016 is given as SC/67a/02B.

4.13.1.1 BYCATCH

A permanent NAMMCO Bycatch Working Group (Bycatch WG) met for the first time in Reykjavik in 2016. They reviewed the status of bycatch reporting systems, types of fisheries and assumed bycatch risks as well as required and existing bycatch related data. The Bycatch WG will meet every 1-2 years.

4.13.1.2 IMPACTS OF HUMAN DISTURBANCE IN THE ARCTIC

A Symposium on 'Impacts of Human Disturbance on Arctic Marine Mammals' was held 13-15 October 2015. Impact assessments on migrating species/stocks, industrial activities and the difficulties in separating the impacts of human activities from climate change were all discussed.

4.13.1.3 FIN WHALES

The SC accepted a new estimate of 40,788 for fin whales from the Icelandic/Faroe Islands shipboard survey in 2015 (NASS2015) as the most appropriate to use in future assessments. Furthermore, the SC accepted the new estimates corrected for perception bias of 465 in West Greenland and 1,932 in East Greenland. It should be possible to produce a combined estimate for North Atlantic fin whales, including estimates from NASS2015 and the additional Norwegian surveys in 2015.

4.13.1.4 HUMPBACK WHALES

The SC accepted the new abundance estimates of 1,321 in West Greenland and 4,012 in East Greenland from the NASS2015 surveys. Work on abundance estimates from the Icelandic, Faroe Islands, and Norwegian surveys in 2015 are still in progress.

4.13.1.5 COMMON MINKE WHALES

The SC accepted a new total common minke whale estimate (from the NASS2015 survey) of 36,185 for the entire central north Atlantic, and an estimate for Icelandic coastal waters (IC or CIC in RMP terms) of 12,710 for generating management advice. A new abundance estimate from the Icelandic coastal aerial survey conducted in 2016 will be finalised in 2017. Fully corrected abundance estimates of 4,204 whales in West Greenland and 2,681 whales in East Greenland from the NASS2015 survey were also accepted.

The combined results from the 2014-16 data in the present Norwegian survey cycle indicate large shifts in distribution. Preliminary estimates of common minke whale abundance show a considerable decrease in the Svalbard area (2014), a relative stable situation in the Norwegian Sea (2015) and a considerable increase in the Jan Mayen area (2015 and 2016).

4.13.1.6 BLUE WHALES

There were some blue whale sightings during the NASS2015, mostly on the East Greenland shelf break. It is unlikely that an abundance estimate will be developed. There was one sighting in East Greenland and none in West Greenland.

Biopsies are being collected from whales around Svalbard for diet (fatty acids and stable isotopes), ecotoxicology studies and genetics. Also, whales are tagged to look at migration movements. Photos are being collected around Svalbard and Iceland, for a photo-identification study in the North Atlantic.

4.13.1.7 PILOT WHALES

Abundance estimates for pilot whales from the Greenland NASS2015 surveys of 11,993# in West Greenland, and 338 in East Greenland, were accepted by the SC. The SC concluded that this survey was not designed to provide a complete coverage of the stock area in Baffin Bay and that the abundance estimates from West Greenland must therefore be considered a minimum estimate. Work on the estimate from the Iceland/Faroe Islands parts of NASS2015 shipboard survey is still in progress.

4.13.1.8 HARBOUR PORPOISES

An increased research effort on harbour porpoises in Norway is being driven by the concerns regarding bycatch. The Norwegian coast from 62°N to Lofoten was covered by aerial surveys as part of the SCANS-III survey in 2016, and abundance estimates are expected in spring 2017.

Over 1,300 Icelandic harbour porpoises have been genotyped at 11 microsatellite loci.

Porpoises tagged with satellite transmitters in central West Greenland in July-October made large scale movements in the North Atlantic, after leaving the Greenland shelf area.

⁵<http://www.iucn-csg.org>.

It is believed that they feed on mesopelagic fish species at depths between 100 and 300m. The return to the coastal areas took place in June and most porpoises showed site fidelity to the tagging area, except for two animals, that chose East Greenland as their summering ground the year after they were tagged.

Abundance estimates were developed for harbour porpoises from the 2015 Greenland aerial surveys. The SC accepted the estimates of 83,321 harbour porpoises in West Greenland and 1,642 harbour porpoises in East Greenland. This is an increase in West Greenland from the 2007 estimate.

4.13.1.9 NASS2015

NAMMCO's whale sighting surveys in the Northeast Atlantic in 2015 (NASS2015) included an intensive survey with the purpose of estimating the abundance of pilot whales around the Faroe Isles, an aerial survey of the coastal waters in East Greenland and a ship-based survey around Jan Mayen following methods developed for the Norwegian minke whale surveys. The SC remarked that NASS2015 was successful. Norway and Iceland will likely continue to aim at surveying every six years. This would set the timing of a next NASS survey in about 2021. Cooperation with Canada and USA would be desirable for a future NASS.

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

4.13.2 Council

The report of the IWC observer at the 25th Annual Council meeting of NAMMCO held in Nuuk, Greenland, 5-6 April 2017 is given as SC/67a/02C. The following relevant items were discussed.

- (1) *Outreach strategies.* The new website contains information on the conservation and management status of all marine mammal population, as well as matters related to marine mammals in a broader sense.
- (2) *A performance review* of the organisation by external experts will be carried out in 2017-18. IWC and NAFO have both been asked and accepted to nominate one expert to the panel.
- (3) *Inspection and Observation.* The observer scheme monitors whether national legislation and advice given by the Commission are respected. In 2016, two observers were onboard two Norwegian minke whalers and no infraction was reported. The scope for 2017 is minke whaling in Iceland.
- (4) *Surveys.* At NAMMCO-25, new abundance estimates based on the data collected during NAMMCO surveys were presented for fin, humpback, common minke and pilot whales, harbour porpoises, and dolphins.
- (5) *Quota advice.* New quota advice was given for fin whales and minke whales off Iceland.
- (6) *Scientific Advice.* During 2017 topics to be dealt with include: (a) stock assessments of fin, humpback and common minke whales, as well as narwhals and white whales; (b) a global circumpolar review of the conservation status of white whale and narwhal stocks; (c) review of bycatch of marine mammals by NAMMCO countries; and (d) a workshop to gain a wider perspective on cetacean distribution and abundance in the whole North Atlantic. The Scientific Committee was also tasked to advise on the best process to investigate the effects of non-hunting related anthropogenic impacts on marine mammals.

The parties of NAMMCO agreed on the 'Nuuk Declaration' reaffirming their will in ensuring the sustainable and responsible use of marine mammals.

The Committee thanked Moronuki for his report and **agrees** that he should represent the Committee at the next NAMMCO Council.

4.14 North Pacific Marine Science Organisation (PICES)

The report of the IWC observer at the annual meeting of PICES held in San Diego, USA, 2-13 November 2016 is given as SC/67a/02I.

In 2016, the marine birds and mammals section (S-MBM) focussed on 'the consumption of North Pacific forage species by marine birds and mammals'. It synthesised new dietary information and estimated food consumption using a new generation of bioenergetic models. These efforts were useful for understanding: (1) top-down pressures on fish communities and fisheries; (2) spatial shifts in lower trophic levels and, in turn, top predators; and (3) climate effects on top predators. A 5-year plan has been developed and has been separated into two phases. The first phase will focus on top-down effects (2016-17), second phase on bottom-up effects (2018-19). The following items will be covered:

- (1) influence of climate variability and change on trophic linkages and MBM distribution and abundance;
- (2) synthesis of diets and estimate consumption by MBMs (and perhaps other top predators) for use in ecosystem models;
- (3) synthesis of information on prey quantity, quality, composition and distribution to understand and predict impacts from climate variability and change on MBMs; and
- (4) activity plan in 2017 for S-MBM.

The 2017 annual meeting of the PICES will be held at Vladivostok, Russia from 20 September-1 October. The Section-MBM meeting will be held on 22 September 2017.

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

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

The report of the observer documenting the activities of SPAW is given as SC/67a/02F.

Neither the Secretariat nor the Scientific Committee's observer were able to attend any SPAW meetings over the past year. However the IWC Secretariat is continuing to work on a draft MOU with CEP-SPAW and future capacity building is planned for the region.

The Committee thanked Mattila for his report. A new observer will be identified during the intersessional period.

4.16 Pacific Region Environment Programme (SPREP)

The report of the observer documenting the activities of SPREP is given as SC/67a/02D. After IWC/66, the IWC Secretariat continued to be actively engaged with the SPREP Secretariat. In particular, after the 'Year of the Whale' had been officially endorsed by SPREP's members, work focused on cooperative activities in support of that initiative. This included providing technical expertise and representation at the IUCN workshop on identifying Important Marine Mammal Areas (IMMAs) in the SPREP Region (March, Apia Samoa), and representation at the 'Whales in a Changing World' conference (April, Nuku'alofa, Tonga). Two presentations were given: one about the IWC focusing on its Science and Conservation work; and the other about

the impacts of entanglement and bycatch, and the IWC's initiatives to mitigate these impacts. As a result, several Pacific Island Countries expressed interest in the IWC's capacity building with regard to entanglement. While the IWC was not able to send a representative to last year's annual meeting of SPREP's members, it is anticipated that the Secretariat will be able to attend this year's meeting (September 2017) in Apia, Samoa. An entanglement response training for Samoa may be held in conjunction with the SPREP annual meeting.

The Committee **agrees** that Nelson should be requested to represent the Committee at future SPREP activities.

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

There are several common assessment topics that apply to the Scientific Committee work as whole, not only to the Revised Management Procedure (RMP). This item includes, but is not restricted to, assessment issues generated from the RMP discussions. It includes issues such as: (1) the relationship between $MSYR_{mat}$ and $MSYR_{1+}$; (2) text for the 'requirements and guidelines for conducting surveys' e.g. wrt model based abundance estimates; (3) implications of RMP and AWMP simulation trials for consideration of 'status'; and (4) matters of relevance to special permits that involve RMP considerations including effects of catches upon stocks.

5.1 Evaluate the energetics based model and the relationship between $MSYR_{1+}$ and $MSYR_{mat}$

$MSYR$ is a key parameter in the *Implementation Simulation Trials* used to evaluate the conservation and catch performance of alternative RMP variants for specific species and Regions. The Committee has previously adopted a pragmatic and precautionary lower bound for $MSYR_{1+}=1\%$ for use in trials. However, much remains to be learnt regarding $MSYR$. One issue is the relationship between $MSYR_{1+}$ and $MSYR_{mat}$. The Committee has been reviewing progress on using an individual based energetics model (IBEM) to provide insights into this relationship. SC/67a/RMP02 illustrated some improvements in the parameterisation of the IBEM for humpback whales and summarised initial work developing a simpler model that can emulate the IBEM. Such an emulator model may form the basis for future *Implementation Simulation Trials* once it is fully developed, and allow the Committee to replace the current deterministic model used as the basis for the operating models used in *Implementation Simulation Trials* by a stochastic model. The current emulator model is based on a stage-structured population dynamics model so would be unable to use age data for conditioning, which will limit its use in trials.

Attention: SC

The Committee **recommends** that the author of SC/67a/RMP02 continue to assess whether it is possible to represent the trajectories from the IBEM using the emulator model; compare the yield curves from the IBEM with those from the emulator model; and develop guidelines for how to use an emulator model as the basis for a multi-stock, multi-area population dynamics model and how such a model could be conditioned given available data.

5.2 Implications of *ISTs* for consideration of 'status'

This matter is considered under Item 12.3.

5.3 General consideration of how to evaluate the effect of special permit catches on stocks

Evaluation of the effects of catches on stocks should be based on the best available information regarding the status and productivity of the stock or stocks in the area in which scientific permit catches are to occur. Conducting projections to evaluate the effects of catches will rely on a well-specified sampling plan that includes details on where within the study area and when catches are expected to occur. Should this information be uncertain, it will be necessary to consider sensitivity to alternative plausible outcomes of the sampling plan.

Where possible, evaluation of scientific permit catches should be based on existing models and methods developed by the Committee. The Committee developed guidelines (Annex D, Appendix 2) for three situations:

- (1) where either an AWMP or RMP *Implementation* has been completed for the species/region concerned;
- (2) where an in-depth assessment has been completed; and
- (3) other cases (i.e. where neither (1) nor (2) apply).

The Committee notes that in all cases, projections should be conducted that consider a set of scenarios that aim to cover the core uncertainties for the region and species (although, not at the level of detail one would expect for an RMP/AWMP *Implementation*). In some cases, the amount of modelling work could be minimal if it is clear that the effects of the catches will be minimal.

Attention: SC

The Committee **recommends** that the guidelines provided in Annex D, Appendix 2 are followed when reporting (or reviewing evaluations of) the effects of special permit catches on stocks.

5.4 Work plan

Details of work to be undertaken both before and during the 2018 Annual Meeting are given in Table 2. Intersessional groups are provided in Annex W.

6. RMP – IMPLEMENTATION-RELATED MATTERS

This agenda item includes: (1) ongoing *Implementation Reviews*; and (2) preparation of new *Implementation Reviews*. For discussions related to the stock structure and abundance of these stocks see also Items 10 and 11.

6.1 North Atlantic common minke whales

6.1.1 Report of the intersessional Workshop

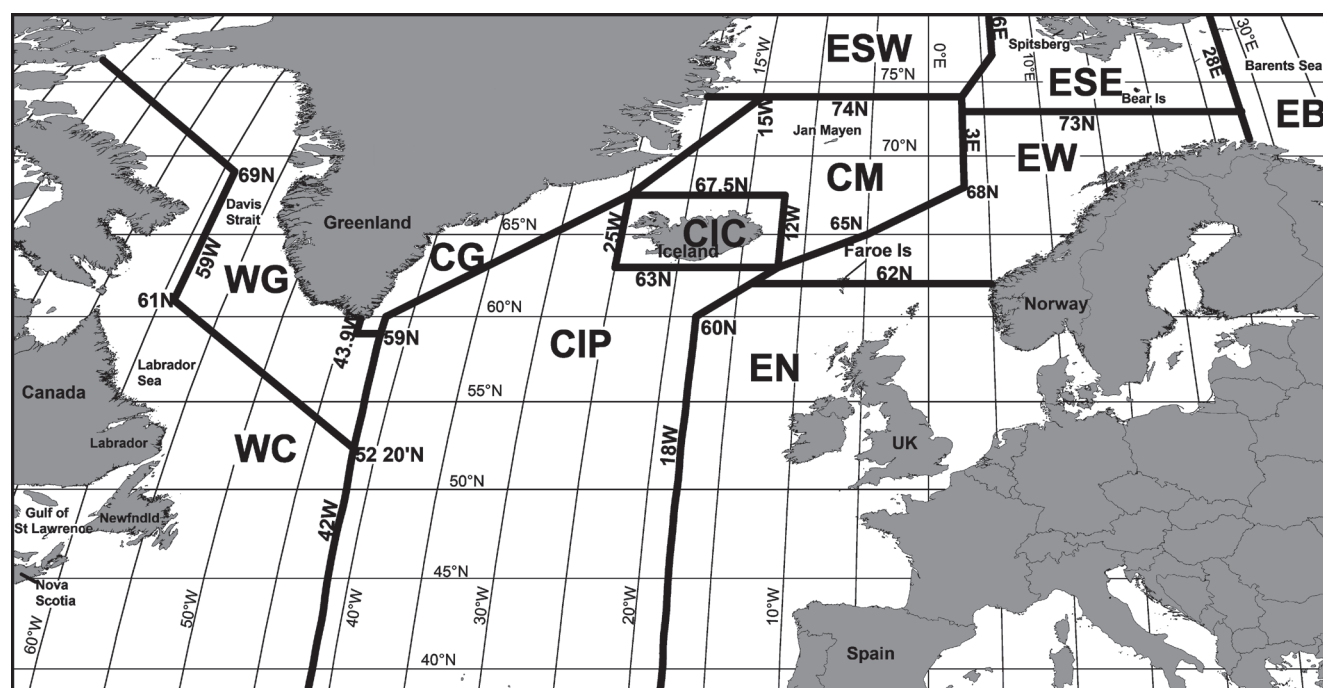
The *Implementation Review* process for North Atlantic common minke whales began with a joint AWMP/RMP Workshop in 2014, followed by a pre-meeting in 2014, intersessional Workshops in 2015 and 2016, and discussions at the 2016 and 2017 Annual Meetings (IWC, 2016c; 2017b). Last year, the Committee concluded that although it was unable to complete the *Implementation Review*, it could do so if an intersessional Workshop was held.

Donovan reported on outcomes of the third RMP intersessional Workshop on the *Implementation Review* for North Atlantic common minke whales held 16-18 December 2016 in Copenhagen, Denmark (SC/67a/Rep05), which aimed to finalise the trial specifications, confirm the trials to be conducted and their plausibility rankings, agree those

Table 2

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

Item	Intersessional period	During SC/67b
Conduct work to evaluate the energetics-based model and hence the relationship between $MSYR_{1+}$ and $MSYR_{mat}$.	(a) Parameterise the individual-based model for 'minke-like' whales (de la Mare); (b) further develop emulator models (de la Mare); and (c) conduct simulations of the <i>CLA</i> for the energetics-based model (de la Mare).	Continue to work to evaluate the energetics-based model and hence the relationship between $MSYR_{1+}$ and $MSYR_{mat}$.
Implications of <i>ISTs</i> , for consideration of status.	(a) Update the Guidelines for <i>Implementations</i> and <i>Implementation Reviews</i> to reflect decisions on evaluation status of stocks (Donovan); and (b) modify the control programs used for <i>Implementation Simulation Trials</i> to report the three measures of status (Allison).	Review proposed guidelines.
Improvements in management performance (in relation to RMP and SCAA) by improved precision in biological parameters.	Develop documents on guidance on the level of information to be provided to show quantitatively that any proposed research will have management benefits.	Review any proposals on guidance on the level of information to be provided to show quantitatively that any proposed research will have management benefits.

Fig.1. Sub-areas used in the *Implementation Review* for the North Atlantic common minke whales

trials that needed reconditioning, and identify a workplan for the completion of the *Implementation Review*. The final trial specifications reflect the outcomes of the extensive deliberations during the Workshop. These trials consider four stock structure hypotheses covering the range a single stock to a hypothesis in which there are three stocks, two of which consist of two sub-stocks each. Figs 1 and 2 show the sub-areas and stock hypotheses referred to in the text.

Attention: SC

The Committee **endorses** the report of the Workshop on the *Implementation Review of North Atlantic common minke whales (SC/67a/Rep05)*, **thanks** Donovan for chairing it and the participants for their work during it and subsequently.

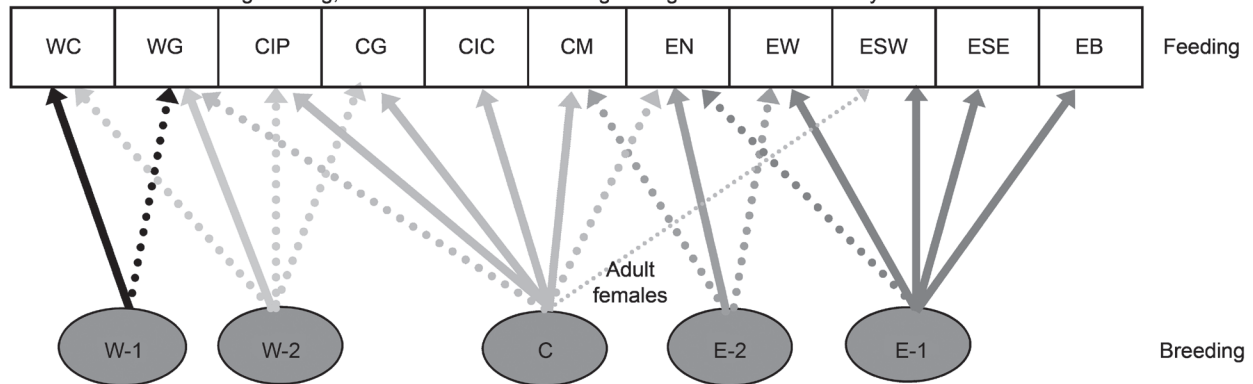
6.1.2 Completion of Implementation Review 6.1.2.1 FINALISE TRIAL SPECIFICATIONS AND CONDITIONING

The Committee received a summary of the modifications to the trials since the last meeting (Annex D, item 3.1.2.1.2).

The Committee reviewed the results of the final conditioning using tabular and graphical summaries developed for previous *Implementation* and *Implementation*

Reviews (Annex D, table 3). The Committee noted that two of the trials (NM09-1 and NM09-4) led to unrealistic outcomes for one of the sub-stocks (E-2). This sub-stock is found in sub-areas CM, EN and EW (Fig. 1). Unlike the C stock and the E-1 sub-stock, there is no sub-area in which only the E-2 sub-stock is found. Thus, there are no data that directly inform on the minimum value for the unexploited abundance of the E-2 sub-stock. To address this, the trials based on stock hypotheses I and II (Fig. 2) arbitrarily specify that 50% of the whales in the EN sub-area at equilibrium are from the E-2 sub-stock, with the entries in the mixing matrices for females in the E-2 sub-stock being pre-specified. However, results of the conditioning show the size of the E-2 sub-stock to be much smaller than those of the nearby E-1 sub-stock. In addition, there is no stochastic mixing prior to the start of the projection period. The results of projections of the size of the E-2 sub-stock will be impacted by stochastic mixing. For years in which few C and E-1 whales are in sub-area EN, the exploitation rate on the E-2 sub-stock will be high, which is exacerbated for trial NM09-1. The operating model assumes that the allocated catch limits are taken exactly, irrespective of how few whales there are in the EN sub-area. This is unreasonable.

Hypothesis (I). Base case: three breeding stocks, two with two sub-stocks. The solid lines indicate low mixing. The dotted lines in addition to the solid lines indicate high mixing, with the faint lines indicating mixing of adult females only.



Hypothesis (II). Three breeding stocks, one with two sub-stocks.

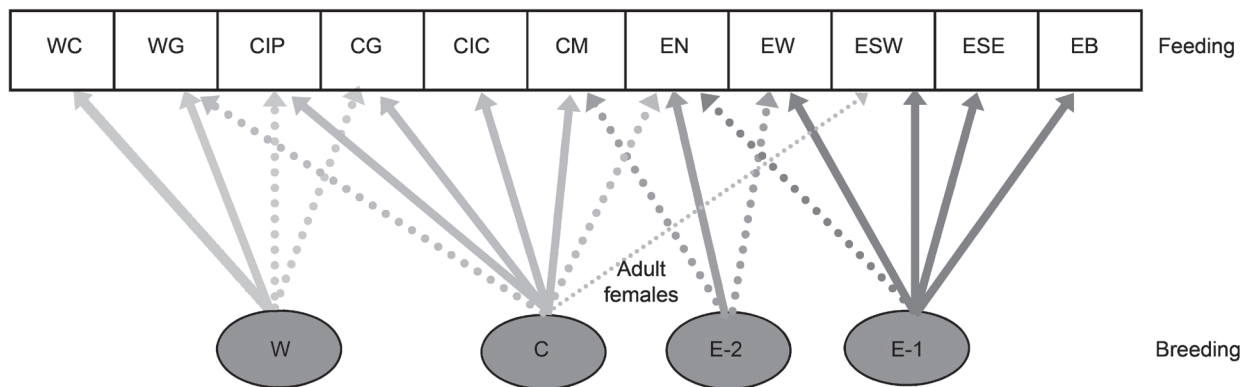


Fig. 2. Stock structure hypotheses for common minke whales in the North Atlantic referred to in the text

Table 3
The Implementation Simulation Trials for North Atlantic minke whales.

Trial no.	Stock hypothesis	MSYR	No. of stocks	Boundaries	Catch sex-ratio for selectivity	Trial weight	Notes
NM01-1	I	1% ¹	3	Baseline	2008-13	M	3 stocks, E and W with sub-stocks
NM01-4	I	4% ²	3	Baseline	2008-13	H	3 stocks, E and W with sub-stocks
NM02-1	II	1% ¹	2	Baseline	2008-13	M	2 stocks, E with sub-stocks
NM02-4	II	4% ²	2	Baseline	2008-13	H	2 stocks, E with sub-stocks
NM03-1	III	1% ¹	1	Baseline	2008-13	M	1 stock
NM03-4	III	4% ²	1	Baseline	2008-13	M	1 stock
NM04-1	IV	1% ¹	2	Baseline	2008-13	M	2 cryptic stocks
NM04-4	IV	4% ²	2	Baseline	2008-13	M	2 cryptic stocks
NM05-1	I	1% ¹	3	Stock C not in ESW	2008-13	M	3 stocks, E and W with sub-stocks
NM05-4	I	4% ²	3	Stock C not in ESW	2008-13	M	3 stocks, E and W with sub-stocks
NM06-1	II	1% ¹	2	Stock C not in ESW	2008-13	M	2 stocks, E with sub-stocks
NM06-4	II	4% ²	2	Stock C not in ESW	2008-13	M	2 stocks, E with sub-stocks
NM07-1	I	1% ¹	3	Baseline	2002-07	M	Alternative years to adjust selectivity-at-age
NM07-4	I	4% ²	3	Baseline	2002-07	M	Alternative years to adjust selectivity-at-age
NM10-1	I	1%	3	Baseline	2008-13	M	E-2 stock in EN 90%
NM10-4	I	4%	3	Baseline	2008-13	M	E-2 stock in EN 90%
NM12-1	I	1% ¹	3	Stock E1 not in ESW	2008-13	M	3 stocks, E and W with sub-stocks
NM12-4	I	4% ²	3	Stock E1 not in ESW	2008-13	M	3 stocks, E and W with sub-stocks
NM13-1	II	1% ¹	2	Stock E1 not in ESW	2008-13	M	2 stocks, E with sub-stocks
NM13-4	II	4% ²	2	Stock E1 not in ESW	2008-13	M	2 stocks, E with sub-stocks
NM01-1v	I	1% ¹	3	Baseline	2008-13	M	CV of future abundance = ½ basecase value
NM01-4v	I	4% ²	3	Baseline	2008-13	H	CV of future abundance = ½ basecase value
NM02-1v	II	1% ¹	2	Baseline	2008-13	M	CV of future abundance = ½ basecase value
NM02-4v	II	4% ²	2	Baseline	2008-13	H	CV of future abundance = ½ basecase value
NM03-1v	III	1% ¹	1	Baseline	2008-13	M	CV of future abundance = ½ basecase value
NM03-4v	III	4% ²	1	Baseline	2008-13	M	CV of future abundance = ½ basecase value
NM04-1v	IV	1% ¹	2	Baseline	2008-13	M	CV of future abundance = ½ basecase value
NM04-4v	IV	4% ²	2	Baseline	2008-13	M	CV of future abundance = ½ basecase value

¹1+; ²mature.

The Committee noted that evidence for sub-stocks within the E stock was weak and that the support for retaining the EN sub-stock as a possibility was because of some differences in chemical concentrations in blubber (IWC, 2015c). Given the unexpected results in terms of unexploited size of the EN sub-stock and the weak evidence for existence of this sub-stock, the Committee assigned trials NM09-1 and NM09-4 low plausibility.

Attention: SC

The Committee **endorses** these changes to the trials specifications for the North Atlantic common minke whale Implementation Review (see Annex D, Appendix 6 for the final trial specifications) and Annex W2 for the list of trials. The Committee **agrees** that the remaining trials have been satisfactorily conditioned.

6.1.2.2 REVIEW TRIAL RESULTS

The four-step procedure for defining ‘acceptable’, ‘borderline’ and ‘unacceptable’ performance first agreed by the Committee (IWC, 2008a, p. 6) and encapsulated in the most recent version of the Committee’s Requirements and Guidelines (IWC, 2012c) is detailed in Annex D, item 3.1.2.2 together with a flow chart summarising the decision process to be followed (Annex D, fig. 4).

The Committee reviewed the results of the *Implementation Simulation Trials* following the ‘Requirements and Guidelines’ as had been the case during recent *Implementations* and *Implementation Reviews*. The tables and plots used to evaluate the performance statistics for each trial and RMP variant are detailed in Annex D, item 3.1.2.2.

The master set of plots and tables is archived by the Secretariat and is available to members of the Committee on request. The five management variants to be considered are listed in Annex D, item 3.1.2.3. The catch limits for minke whales by Norway are based on the 0.62 tuning of *CLA* and an RMP variant in which sub-areas EN, ESW+ESE, EB, and EW are treated as *Small Areas* with catch cascading based on the *E Combination Area*. Table 5 in Annex D summarises the application of the rules for evaluating conservation performance.

Attention: SC

After reviewing the results of the *Implementation Simulation Trials* (Annex D, item 3.1.2.2), the Committee **agrees** that variants 1, 3, 4 and 5 are acceptable in terms of conservation performance for North Atlantic common minke whales (see Fig. 1 for the sub-areas):

- (1) Sub-areas CIC, CM, CG, CIP, EN, EB, ESW+ESE and EW are *Small Areas*, with the catch limits for these *Small Areas* based on catch cascading from the C and E Combination Areas. The catch from the ESW+ESE *Small Area* is all taken in sub-area ESE. The catch limits set for the CM, CG and CIP *Small Areas* are not taken (except that the aboriginal catch is taken from CG);
- (2) Sub-areas CIC, CM, CG, CIP, EN, ESW+ESE, and EB+EW are *Small Areas*, with the catch limits for these *Small Areas* based on catch cascading from the C and E Combination Areas. The catch from the EB+EW *Small Area* is all taken in sub-area EW and the catch from the ESW+ESE *Small Area* is taken in the ESE sub-area. The catch limits set for the CM, CG and CIP *Small Areas* are not taken (except that the aboriginal catch is taken from CG);
- (3) As for variant 1, except that sub-areas CIC+CIP+CM are a single *Small Area* and all of the catches from this

Small Area are taken in sub-area CIC. The catch limits set for the CG *Small Area* are not taken (except that the aboriginal catch is taken); and

- (4) Sub-areas CIP+CIC+CG+CM, EN, EB, ESW+ESE and EW are *Small Areas*, with the catch limits for the E *Small Areas* based on catch cascading from the E Combination Area. All the catches from CIP+CIC+CG+CM *Small Area* are taken in sub-area CIC (after taking the Aboriginal catch from CG) and those for the ESW+ESE *Small Area* are taken in sub-area ESE.

Of these, variant 5 has the best catch performance.

6.1.3 Conclusions and recommendations

The Committee is pleased to have completed the *Implementation Review* of North Atlantic common minke whales. The next review will be expected to occur around 2022.

Attention SC, C-A

The Committee has completed the *Implementation Review* of North Atlantic common minke whales. Based on the results of the *Implementation Simulation Trials*, the Committee agrees that variants 1, 3, 4 and 5 (see Item 6.1.2) are acceptable in terms of conservation performance. Of those, variant 5 achieves the best performance in terms of catch.

6.2 North Pacific common minke whales

6.2.1 Review of new information

The Committee was informed that a minor error had been detected in the code implementing the *Implementation Simulation Trials* for the western North Pacific minke whales. The error has been corrected, with no substantial changes to the conclusions from the *Implementation Review* that was completed in 2013 (IWC, 2014b). The Committee was also informed (see Annex I and Item 19) that the results of kinship analyses are inconsistent with the mixing matrices associated with stock structure hypothesis C as currently implemented in the *Implementation Simulation Trials*. The implications of this will need to be accounted for during the next *Implementation Review*.

6.2.2 Prepare for the next Implementation Review

The *Implementation* for the western North Pacific minke whales was the most complex and challenging, owing in particular to lack of data from some areas to help address stock structure uncertainty. The Committee noted that considerable new information (especially genetics data) has been collected since the last *Implementation Review* in 2013. The Committee recognised that the most difficult aspect of the last *Implementation Review* had been selecting, modelling and assigning plausibility to stock structure hypotheses. Despite considerable new data and analyses, it was likely that resolving how to handle stock structure uncertainty in the next *Implementation Review* will again be challenging.

Attention: SC, C-A

Much progress on complex topics such as addressing stock structure uncertainty can be accomplished during focused workshops. The Committee therefore **recommends** that a preparatory Workshop be held prior to SC/67b focused on stock structure for western North Pacific minke whales. For practical and cost reasons, this meeting can be held immediately before or after the Second Intersessional Workshop for the western North Pacific Bryde’s whales (see Item 6.3).

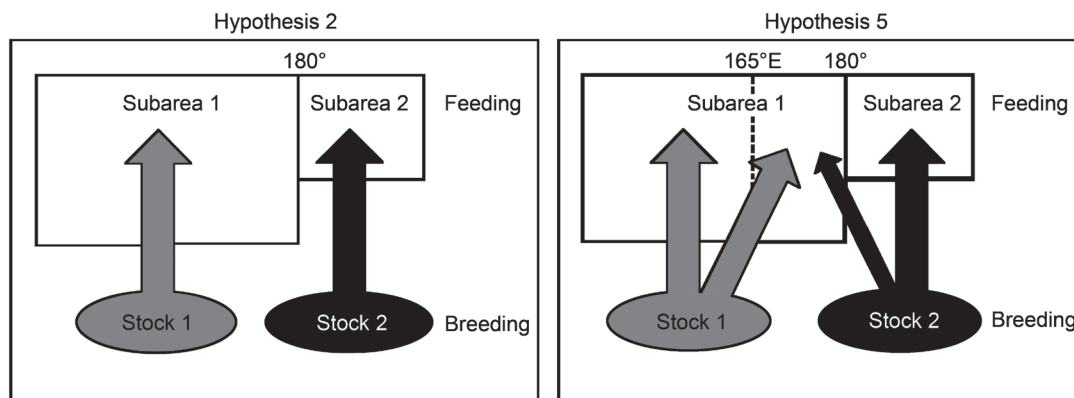


Fig.3. The two hypotheses that will be considered in the *Implementation Simulation Trials*.

6.3 Western North Pacific Bryde's whales

6.3.1 Report of the intersessional Workshop

Regular *Implementation Reviews* are required under the RMP. The first *Implementation Review* for the western North Pacific Bryde's whales was originally scheduled for 2013. However, in 2012, the Committee postponed the *Implementation Review* until 2016 to allow additional sightings and genetics data to be available and analysed (IWC, 2013b). The Committee has agreed that this will be a full *Implementation Review*. The first intersessional Workshop on the *Implementation Review* of western North Pacific Bryde's whales took place in March 2017, chaired by Donovan (SC/67a/Rep07).

The Workshop made considerable progress. It reviewed the new information relevant to stock structure and agreed to take forward two stock structure hypotheses (Fig. 3):

- Hypothesis 2:* There are two stocks, one feeding in sub-area 1 and the second feeding in sub-area 2.
- Hypothesis 5:* There are two stocks, one feeding in sub-area 1 and the second feeding in sub-area 2 with mixing occurring in sub-area 1E. There are more animals from stock 1 than stock 2 in the mixing area.

The Workshop also reviewed new information on abundance estimates and developed a workplan to try to obtain agreed abundance estimates (including additional variance) for use in conditioning the trials and the *CLA*, developed a new set of simulation trials for the *Implementation Review* that involve exploring the implications of uncertainty in stock structure, stock boundaries, MSYR, removals and additional variance, and identified a way to try to complete the *Implementation Review* at the 2017 Annual Meeting.

The Committee was pleased to note that the intersessional Workshop led to considerable progress towards completing the *Implementation Review* and had been conducted in an excellent spirit of co-operation among the participants.

Attention: SC

The Committee **endorses** the report of the Workshop on the *Implementation Review* of western North Pacific Bryde's whales (SC/67a/Rep05), **thanks** Donovan for chairing it and the participants for their work during it and subsequently (and see Item 6.3.2 with respect to updated trials).

6.3.2 Progress since the intersessional Workshop

Work had begun on updating the previous *Implementation Simulation Trials* for the North Pacific Bryde's whales to include the new hypotheses and trials, as well as estimated additional variance. However, no conditioning results are available at present. It will be necessary to update the trials

to include density-dependence in *M* as agreed last year (IWC, 2017b). In addition, the future survey plan needs to be clarified. The updated trial specifications are available in Annex D, Appendix 6.

6.3.3 Conclusions and recommendations

Attention: SC

The *Implementation Review* for western North Pacific Bryde's whales is progressing well, but the ambitious workplan established at the March 2017 Workshop could not be achieved in the limited time available. The Committee therefore recommends that an intersessional workshop takes place to facilitate completing the *Implementation Review*.

6.4 Review RMP *Implementation Review* schedule for the next six years

There is a system of regular (5-6 year) *Implementation Reviews* with established guidelines. The current schedule of *Implementation Reviews* (which may need to be adjusted if the *Implementation Reviews* that are scheduled first take longer than anticipated) is as follows.

- Western North Pacific Bryde's whales: Started in 2017 (expected to be completed in 2018).
- Western North Pacific common minke whales: Starting in 2018.
- North Atlantic common minke whales: Starting in 2022.
- North Atlantic fin whales: Starting in 2023.

It is not feasible to simultaneously conduct more than one *Implementation* or *Implementation Review*; discussion of the personnel and resources required to allow the *Implementation Review* process to continue is provided under Item 26. The Committee is starting the *Implementation Review* for the western North Pacific common minke whales with a preparatory meeting before SC/67b. The focus of the Committee at the 2018 Annual Meeting will be completing the *Implementation Review* for the western North Pacific Bryde's whales, reviewing the conclusions of the preparatory meeting, and planning for the First Intersessional Meeting for the western North Pacific common minke whales.

6.5 Work plan

Details of work to be undertaken both before and during the 2018 Annual Meeting are given in Annex D, item 3.6 and summarised in Table 4.

7. ABORIGINAL SUBSISTENCE WHALING MANAGEMENT PROCEDURE

This item continues to be discussed as a result of Resolution 1994-4 of the Commission (IWC, 1995), which has been

Table 4
Work plan for RMP *Implementation*-related matters.

Item	During the intersessional period	During SC/67b
North Atlantic minke whales	-	Review any new abundance estimates, with ASI.
Western North Pacific minke whales	Conduct a preparatory meeting focused on synthesising information on stock structure.	Initiate the <i>Implementation Review</i> .
Western North Pacific Bryde's whales	(a) Conduct the Second Intersessional Workshop. (b) Code the resulting trials, condition the trials, and conduct projections under proposed RMP variants.	Conduct the work required for the 'Second Annual Meeting' and complete the <i>Implementation Review</i> .
North Atlantic fin whales		Review any new abundance estimates, with ASI.

strengthened by Resolution 2014-1 (IWC, 2016a). 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 *SLAs* (*Strike Limit Algorithms*) and providing management advice for Greenlandic hunts, with a focus on fin and common minke whales; (2) providing management advice for aboriginal hunts (see Item 8); and (3) additional work related to the AWS (Aboriginal Subsistence Whaling Management Scheme). Considerable progress on items (1) and (3) was made because of the AWMP Intersessional Workshop on Developing *SLAs* for the Greenland hunts and the AWS, held from 17-22 December 2016 in Copenhagen, Denmark (SC/67a/Rep06) and use of the AWMP Developers' Fund.

7.1 *SLA* development for the Greenland hunts

At its 2018 meeting, the Commission will be setting new block quotas for aboriginal hunts. In Greenland, a multispecies hunt occurs; in West Greenland this involves catches of common minke, fin, humpback and bowhead whales. The Committee has reiterated its strong intention to complete and recommend *SLAs* for all Greenland hunts by the 2018 Scientific Committee meeting. The Commission had endorsed the *Humpback SLA* in 2014 (IWC, 2015d) and the *WG-Bowhead SLA* in 2016 (IWC, 2017b). Progress on fin and common minke whales is provided below. The Working Group on ASI (Annex Q) had reviewed the new Greenland abundance estimates referred to it by the AWMP intersessional Workshop (SC/67a/Rep06) and had endorsed the estimates that had been provided in table 1 of that report for use in the *SLA* development process and implementation.

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

7.1.1 Development of an *SLA* for the Greenlandic fin whale hunt

In 2015 (IWC, 2016d), the Committee agreed that from a conservation perspective, it was acceptable to try to develop an *SLA* for this hunt on the assumption that the animals off West Greenland comprised a single population represented by the abundance estimates from that area. In doing so, the Committee recognised that this will make achieving need satisfaction more difficult.

7.1.1.1 NEW INFORMATION (INCLUDING THE REPORT OF THE INTERSESSIONAL WORKSHOP)

The AWMP intersessional Workshop (SC/67a/Rep06) held in December 2016 noted that the point estimate of a comparable 2015 survey estimate of fin whales off West Greenland was only one tenth the size of the previous one (465 in 2015 compared to 4,470 in 2007). The difference between these estimates is certainly too large to attribute to hunting, and furthermore there was no evidence to suggest a real decline in abundance. Consequently, the Workshop examined the possibility that in some years only part of this population is present off West Greenland. It therefore agreed to model these abundance estimates by means of a two-component process whereby each year either all whales in the population entered the West Greenland region, or only a proportion of those whales (where the proportion was drawn randomly from a probability distribution). The Workshop had agreed that this issue must be reflected in the way future survey estimates for this region are generated when testing *SLAs* and that the trials incorporate conservative and realistic testing scenarios.

The Committee **thanked** the Intersessional Workshop for the good progress made, noting that without such workshops it will not be possible to develop *SLAs* by 2018.

After a review of the conditioning results, the Committee adopted the conditioned trials except for two trials (GF24-2 and GF24-4, see Annex E) that were excluded because the abundance data were not adequately fitted by the model. Table 5 shows the agreed final trial structure.

SC/67a/AWMP06 and SC/67a/AWMP12 describe candidate *SLAs* for the West Greenland fin whale hunt. The performance of the candidate *SLAs* ranged from fully meeting the conservation performance criterion for all *Evaluation Trials* with $MSYR_{1+}$ of 1% and medium and high need envelopes, to alternatives with poorer conservation performance but improved need satisfaction. They cope with sporadic low abundance estimates by ignoring them, at least for a certain period. This new approach must be carefully tested. The Committee noted that there was a balance to be struck between designing new trials to test the conservation risk associated with an *SLA* eliminating low abundance estimates, and allowing *SLAs* to treat the data in any manner (i.e. acceptability is determined by *SLA* performance in realistic trials, regardless of design features).

Although some *Evaluation Trials* should specifically test the effect of disregarding outlying abundance estimates, the Committee noted that the *Robustness Trials* were well suited for more speculative exploration of performance of such *SLAs*. This issue will be considered further at the first of the proposed Intersessional Workshops (see Item 25).

7.1.1.2 CONCLUSIONS AND RECOMMENDATIONS

There is still considerable additional work required before final selection of an *SLA* for West Greenland fin whales. Tasks include: (a) developing new trials exploring

Table 5a

The *Evaluation Trials* for fin whales. Values given in **bold type** show differences from the base case values.
For all trials, the probability p that all animals are off West Greenland when a survey takes place=0.5; if some whales are not off West Greenland, the proportion off West Greenland is generated from a beta distribution with parameters (3,7).

Trial	Description	$MSYR_{1+}$	Need scenarios	Survey frequency	Historical survey bias	No of replicates	Future survey CV
01-4	$MSYR_{1+} = 4\%$	4%	A, B, C	10	1	400	0.40
01-2	$MSYR_{1+} = 2.5\%$	2.5%	A, B, C	10	1	400	0.40
01-1	$MSYR_{1+} = 1\%$	1%	A, B, C	10	1	400	0.40
01-7	$MSYR_{1+} = 7\%$	7%	A, B, C	10	1	400	0.40
02-4	5 year surveys	4%	A, B	5	1	400	0.40
02-2	5 year surveys; $MSYR_{1+} = 2.5\%$	2.5%	A, B, C	5	1	400	0.40
03-4	15 year surveys	4%	A, B	15	1	400	0.40
03-2	15 year surveys; $MSYR_{1+} = 2.5\%$	2.5%	A, B, C	15	1	400	0.40
03-1	15 year surveys; $MSYR_{1+} = 1\%$	1%	A, B, C	15	1	400	0.40
04-4	Survey bias = 0.8	4%	A, B	10	0.8	400	0.40
04-2	Survey bias = 0.8; $MSYR_{1+} = 2.5\%$	2.5%	A, B	10	0.8	400	0.40
05-4	Survey bias = 1.2	4%	A, B	10	1.2	400	0.40
05-2	Survey bias = 1.2; $MSYR_{1+} = 2.5\%$	2.5%	A, B	10	1.2	400	0.40
06-4	3 episodic events	4%	A, B	10	1	400	0.40
06-2	3 episodic events; $MSYR_{1+} = 2.5\%$	2.5%	A, B, C	10	1	400	0.40
06-1	3 episodic events; $MSYR_{1+} = 1\%$	1%	A, B, C	10	1	400	0.40
07-4	Stochastic events every 5 years	4%	A, B	10	1	100	0.40
07-2	Stochastic events every 5 years	2.5%	A, B	10	1	100	0.40
08-4	Asymmetric environmental stochasticity	4%	A, B	10	1	100	0.40
08-2	Asymmetric environmental stochasticity	2.5%	A, B, C	10	1	100	0.40
08-1	Asymmetric environmental stochasticity	1%	A, B, C	10	1	100	0.40
09-2	$MSYR_{1+} = 2.5\%$ with future survey CV 0.35	2.5%	A, B, C	10	1	400	0.35
10-2	$MSYR_{1+} = 2.5\%$ with future survey CV 0.45	2.5%	A, B, C	10	1	400	0.45

Table 5b

The *Robustness Trials* for fin whales.

Trial no.	Factor	$MSYR_{1+}$	Need scenario	No of rep	Future survey CV
21-4	Linear decrease in K in future	4%	A, B	100	0.40
21-2	Linear decrease in K in future	2.5%	A, B	100	0.40
22-4	Linear increase in M in future	4%	A, B	100	0.40
22-2	Linear increase in M in future	2.5%	A, B	100	0.40
23-4	Strategic surveys	4%	A, B	100	0.40
23-2	Strategic surveys	2.5%	A, B	100	0.40
25-4	$p=0.5$; Proportion generated from beta (2,10)	4%	A, B	100	0.40
25-2	$p=0.5$; Proportion generated from beta (2,10)	2.5%	A, B	100	0.40
26-4	$p=0.189$ (Proportion generated from beta (3,7))	4%	A, B	100	0.40
26-2	$p=0.189$ (Proportion generated from beta (3,7))	2.5%	A, B	100	0.40
27-4	$p=0.811$ (Proportion generated from beta (3,7))	4%	A, B	100	0.40
27-2	$p=0.811$ (Proportion generated from beta (3,7))	2.5%	A, B	100	0.40
28-2	Baseline with future survey CV 0.2	2.5%	A, B	100	0.20
29-2	$p=0.5$; Proportion generated from beta (2,10)	2.5%	A, B	100	0.20

the implications of *SLAs* that disregard low abundance estimates; (b) updating conditioning; and (c) developing a format for tabular and graphical display of the behaviour of such *SLAs* that integrates aspects of the D1 and D10 statistics (that measure conservation performance), with the goal of better understanding when and how often the *SLAs* disregard abundance estimates, and the performance implications thereof.

Attention: SC, C-A, ASW

The Commission requires advice on new ASW quotas at the 2018 Scientific Committee meeting. This advice is best provided using long-term *SLAs*. Considerable intersessional work is required to complete the *SLA* for the Greenland hunt of fin whales. The Committee **advises** the Commission that its intersessional workplan should allow it to recommend a West Greenland fin whale *SLA* at its 2018 Annual Meeting. To achieve that goal the Committee **recommends** that:

- (1) the tasks outlined in this report should be completed intersessionally under the auspices of the AWMP Steering Group prior to the AWMP Workshop in late October 2017 (see Item 25); and

- (2) the Workshop should: (a) review the new trials exploring the implications of *SLAs* that disregard low abundance estimates; and (b) review the final trial results and complete the selection of an *SLA* for West Greenland fin whales.

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

The development of an *SLA* for the common minke whale hunts off West and East Greenland is the most complex of those required for Greenland. It has been agreed that the basis of the development approach should be the RMP operating models for the entire North Atlantic. Stock structure issues were examined in 2014 by a joint AWMP/RMP Workshop (IWC, 2015b) that resulted in four stock structure hypotheses and a number of associated mixing matrices – see figs 2 and 3 in IWC (2015b). An initial RMP trial structure was developed in 2014 (IWC, 2015b).

7.1.2.1 NEW INFORMATION (INCLUDING THE REPORT OF THE INTERSESSIONAL WORKSHOP)

The AWMP Intersessional Workshop (SC/67a/Rep06) received the new 2015 abundance estimate for West Greenland minke

whales, and noted that one explanation for the large difference in the abundance estimates was movement of whales from the west (WG) to the east coast (CG) of Greenland. The Workshop recommended that the *Implementation Simulation Trials* for the North Atlantic common minke whales (Annex D, Appendix 6) be evaluated to show if they exhibited behaviour consistent with negative spatial correlation in abundance between West and East Greenland that might be associated with whale movement between regions.

The Committee reviewed the RMP *Implementation Simulation Trials* which were completed at this meeting (see Item 6.1 and Annex D) given the previous agreement to use the operating model framework as the starting point for the AWMP development process. Punt and Allison reported that the RMP *Implementation Simulation Trials* structure successfully introduced negative correlation in the simulated abundances between East and West Greenland.

Tiedemann reviewed stock structure inferences agreed upon during the AWMP/RMP Joint Workshop (IWC, 2015b) with special reference to Greenland (sub-areas WG and CG - see fig. 1 of Annex E). He outlined ongoing analyses of new samples and techniques not considered in the 2014 review and it was further suggested to add additional previously unanalysed specimens from Iceland (2016) and Greenland (2013-16) and to try to acquire further samples from Canada. With some support funding, validation of POPs and analysis of new samples can be accomplished in time for the October 2017 Workshop. Clarifying stock structure hypotheses is an essential component of the work needed to complete and test candidate *SLAs*.

SC/67a/AWMP05rev used an age- and sex-structured population model with density regulated growth to estimate source-sink-like migration of minke whales in West Greenland waters. The hunt of minke whales in West Greenland is relatively large compared with the estimates of absolute abundance for the area, but a constant female biased sex ratio in the catches indicates that the hunt is sustainable. This suggests that the hunt is also likely to be supported by whales from other areas. SC/67a/AWMP05rev shows that it is possible to estimate this influx of whales using an open population model and a likelihood function that includes both the abundance data from West Greenland and the reported catches by sex.

Two alternative approaches for modelling the effect in SC/67a/AWMP05rev were considered: (a) the proportion of the West Greenland sub-stock that feeds off West Greenland is density-dependent, i.e. the mixing matrices are density-dependent, and (b) there is density-dependent dispersal between the W-1 stock (in trials with two W stocks) and the W-2 sub-stock and between the C stock and the W-2 sub-stock.

7.1.2.2 CONCLUSIONS AND RECOMMENDATIONS

Development of an *SLA* for the Greenlandic hunt of common minke whales constitutes the largest remaining task of the Committee. Moreover, it is the most complex case that has been undertaken. Development of earlier *SLAs* have required up to five years. However, the Committee can build upon the operating models developed for the RMP *Implementation Review* and believes it should be able to develop an *SLA* for the common minke whale hunts off Greenland by next year's meeting with sufficient resources and two intersessional workshops. The first Workshop (autumn) will evaluate the trials structure, provisional conditioning, and identify any required modifications as well as consider candidate *SLAs*. Subsequently, necessary modifications to the trial structure will be coded and final conditioning undertaken. The second workshop (spring) will evaluate this work and examine

initial performance results from candidate *SLAs*. Final evaluation of *SLAs* based on the full set of agreed trials will occur at the 2018 Scientific Committee meeting.

Attention: SC, C-A, ASW

The Commission requires advice on new ASW quotas at the 2018 Scientific Committee meeting. This advice is best provided using long-term SLAs. Considerable intersessional work is required to complete the SLA for the Greenland hunt of common minke whales. The Committee advises the Commission that its intersessional workplan should allow it to recommend a common minke whale SLA at its 2018 Annual Meeting. To achieve that goal the Committee recommends that:

- (1) *two intersessional Workshops are held in Copenhagen, one in autumn 2017 and one in spring 2018; and*
 - (2) *financial support is given for genetic analyses using additional samples.*
-

7.1.3 West Greenland bowhead whales

The WG-Bowhead *SLA* had been tested on conservative scenarios because the catches from Canada are not subject to IWC management and it is not known whether future surveys in Canada will take place or how regularly. The AWMP Intersessional Workshop (SC/67a/Rep06) agreed that the effects if the number of replicates to be used in the development of an *SLA* should be examined for the WG-Bowhead *SLA Evaluation Trials*. SC/67a/AWMP04 reported on the results of this simulation exercise. Examination of the results shows that for one trial not even 1,000 replicates would be sufficient to provide sufficient precision for the estimated probability interval of the D10 statistic to include the threshold value of 1.

Attention: SC

Following the results of the simulation exercise in SC/67a/AWMP04, the Committee agrees:

- (1) *to set the number of replicates for Evaluation Trials to 400 for the West Greenland bowhead whale case (the number of replicates for other development cases will be determined on a case-specific basis) since there is Monte Carlo error in the estimates of the performance statistics and recognising the diminishing returns in precision obtained as the number of replicates increase; and*
 - (2) *that Allison and Brandão should rerun a selection of the trials with 400 replicates to verify the original trial conclusions and the results should be presented at the intersessional Workshop in autumn.*
-

7.2 Aboriginal Whaling Management Scheme

The Scientific Committee initially recommended (and has subsequently repeated) the scientific aspects of an Aboriginal Whaling Scheme (AWS) in 2003, but this has still not been adopted by the Commission (IWC, 2003) and subsequent years)⁶. Since that time, the Committee has developed several additional *Strike Limit Algorithms*, established its Data Availability Agreement (IWC, 2004a, p.56; 2004b), considered further additional issues such as survey intervals, and developed greater experience with all aspects of the AWMP.

⁶The original ASW proposal was, in summary, for a grace period of one block during which the block strike limit was halved and the hunters could choose how to allocate the catches by year. If an abundance estimate was agreed during the grace period, the *SLA* would be used to calculate a new limit for the block.

AWS provisions are one of the last major remaining components of the comprehensive aboriginal subsistence whaling management framework first requested by the Commission in 1994 and developed with an enormous expenditure of scientific effort and resources over the last two decades. The Commission has agreed that the AWS is a key component of this framework. Accordingly, in consultation with the Commission and its ASW sub-committee, the Scientific Committee informed the Commission in 2015 (IWC, 2016e) that it intends to develop recommendations for all scientific components and aspects of an AWS. Ideally, this work will be completed well in advance of the 2018 Commission meeting when new aboriginal whaling limits are due to be established. Last year (IWC, 2017d), the Committee made considerable progress on this work and developed an outline ('Some ideas on draft principles and scientific provisions of a potential Aboriginal Whaling Scheme (AWS)'). The focus of discussions last year had related to the interim allowance strategy and carryover provisions.

7.2.1 The interim allowance strategy

The 'interim allowance' strategy deals with the situation where an abundance estimate is temporarily and unintentionally delayed more than 10 years from the previous survey (IWC, 2016e, p.22). It was first tested using the *Bowhead SLA* and found to be acceptable in that case (IWC, 2017b, p.22). Punt developed code for testing the interim allowance strategy for West Greenland bowhead, humpback and fin whales. SC/67a/AWMP01 presented the results of testing for the West Greenland humpback whale case.

Attention: SC; C-A; ASW; G

The Committee **agrees** that:

- (1) *the interim allowance strategy is acceptable for the WG Humpback SLA;*
- (2) *testing for West Greenland bowhead whales should occur intersessionally;*
- (3) *testing for West Greenland fin and common whales should be undertaken once those SLAs have been developed; and*
- (4) *testing the interim allowance strategy for the SLA for eastern north Pacific gray whales should occur during the next Implementation Review.*

7.2.2 Carryover provision

A review of the originally proposed (IWC, 2003) AWS provision for the carryover of unused strikes to provide the necessary flexibility for hunters to meet need when the hunts operate in unpredictable and difficult environmental conditions began two years ago. During the initial development of *Strike Limit Algorithms* and the AWS, the Commission had agreed (IWC, 2001, p.20):

'...that blocks of five years with an inter-annual variation of fifty percent were satisfactory in terms of allowing for the likely variability in hunting conditions. It therefore agreed that these values are appropriate for use in trials. It was recognised that this does not commit the Commission to these values in any final aboriginal whaling management procedure.

At that time, the Committee also agreed that the same 50% allowance could be carried over between the last year of one block and the first year of the next. The rationale for this limitation has not changed: from a scientific perspective, *SLAs* are robust with respect to this carryover provision, particularly since all allocated strikes are considered as taken in the testing process. Considerable work on carryover

provisions was undertaken at the 2016 Annual Meeting and this was reported to the Commission who were informed that the Committee hoped to be able to present a proposed carryover provision in 2018 as part of a revised AWS. It was noted that there is a lack of clarity and consistency in the way this issue is dealt with in the present *Schedule*.

This work continued at the intersessional Workshop held in December 2016 thanks to extensive work by Givens (2016). The Workshop developed two possible options (the 'block-based' and the 'annual expiration' option) and provided examples of how these might work. The Workshop agreed that whatever approach or approaches may be ultimately proposed to the Commission, it is important that they are presented as simply as possible to facilitate Commission discussion and adoption. Discussion at this meeting focussed on how best to provide advice to the Commission, taking into account the difficulties that had been experienced in previous Commission discussions of the use of carryover provisions when adopting catch/strike limit blocks.

Attention SC; C-A; ASW; G

The concept of carryover is an essential component of the Aboriginal Whaling Management Scheme. The Committee's role is to provide scientific advice on any carryover provisions that meet the conservation objectives of the Commission whilst providing adequate flexibility to the hunts. The Committee:

- (1) **reiterates** its previous agreement that that SLAs are robust with respect to a 50% inter-annual variability within blocks and to the same 50% allowance between the last year of one block and the first year of the next;
- (2) **recognises** that are strengths and weakness in the options it is considering and **agrees** that these should continue to be considered and developed intersessionally;
- (3) **recommends** that:
 - (a) Donovan should raise the issue of carryover with the Commission's ASW-WG which will meet in the intersessional period, summarising the work the Committee has done so far and noting its willingness to review any options referred to it at the 2018 Scientific Committee meeting; and
 - (b) members of the Committee who are from countries with subsistence hunts should also draw attention to the willingness of the Committee to review any options referred to it at the 2018 Scientific Committee meeting;
- (4) **advises** that whatever approach is adopted, it is important to establish an initialisation year for the carryover calculations to begin; and
- (5) **recognises** that choosing an initialisation year is a matter for the Commission but **agrees** that from a scientific perspective, it is acceptable to go back up to 3-4 blocks (unless there had been a quota reduction during the period)⁷.

7.2.3 The full AWS

The Committee did not have time to further review the other issues on the draft AWS developed last year (IWC, 2017c). This item will be included on the agenda of the intersessional Workshops. An intersessional correspondence group (see Annex W) was established to review the existing draft and provide a discussion document for the First Intersessional Workshop.

⁷To assist the Commission, Annex E, Appendix 4 summarises the situation with respect to carryover for each hunt for up to four blocks.

Table 6
AWMP Implementation and Implementations Reviews.

Hunt	Year SLA developed (IRs completed)	Next Implementation Review
Alaskan bowhead	2002 (2007, 2012)	Start 2018
Chukotka gray/Makah gray	2004 (2010)/2013	Start 2019
West Greenland humpback	2014	Start 2020
West Greenland bowhead	2015	Start 2021
West Greenland fin	2017/18 est.	2023 estimated
West Greenland/East Greenland common minke	2018	2024 estimated

Table 7
Proposed work plan (ICG=intersessional correspondence group, SG=Steering Group).

Topic	Intersessional	2018 Annual Meeting
(1) Development of Greenland SLAs	SG-AWMP, two Workshops (autumn, spring)	Complete and recommend
- Fin whales (review results)	Finalise at first Workshop	Recommend SLA
- Common minke whales (develop)	Both Workshops	Recommend SLA
- WG-Bowhead SLA trials (review results)	Finalise at first	Confirm SLA
(2) Aboriginal Whaling Scheme	ICG-AWS, short review of progress at Workshops	Recommend draft
- Interim allowance strategy	ICG-AWS	Complete
- Carryover provisions	Donovan to consult ASW-WG	Complete
- Remaining issues	ICG-AWS	Complete
(3) B-C-B bowhead Implementation Review	SG-BCB	Complete
(4) Review new Makah hunt proposal	Workshops if proposal submitted	Complete if possible
(5) Provide catch/strike limit advice	-	Recommend limits

7.3 Review Implementation Review schedule for next 6 years

The provisional timetable for *Implementation Reviews* given in Table 6.

The Committee noted that the next *Implementation Review* for B-C-B bowhead whales is scheduled to start in 2018. Guidelines for *Implementation Reviews* are provided in IWC (2013c). The primary objectives of an *Implementation Review* are to:

- (1) review the available information (including biological data, abundance estimates and data relevant to stock structure issues) to ascertain whether the present situation is as expected (i.e. within the space tested during the development of the SLA) and determine whether new simulation trials are required to ensure that the SLA still meets the Commission's objectives; and
- (2) to review information required for the SLA, i.e. catch data and, when available at the time of the Review, new abundance estimates (note that this can also occur outside an *Implementation Review* at an Annual Meeting).

Attention: SC, C-A, ASW

The Committee **agrees** that at present, there is no information that suggests that the situation for the B-C-B bowhead whale stock is outside the tested parameter space. On this basis, it **agrees** that:

- (1) it should be possible to complete the *Implementation Review* at the 2018 Annual Meeting;
- (2) the Steering Group (Annex W) established to prepare for the Review should ensure that the appropriate Data Availability Guidelines are publicised and met; and
- (3) that the necessary information to complete the Review is presented.

7.4 Work plan

The AWMP work plan is summarised in Table 7. Budgetary items are considered under Item 25.3.

8. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING INCLUDING MANAGEMENT ADVICE

The Commission is considering the renewal of catch/strike limits for aboriginal subsistence whaling hunt at its 2018 meeting. The Committee has agreed that the best way to provide advice to the Commission on such hunts is through long-term SLAs. The first SLAs agreed were for the hunts for the B-C-B Seas stock of bowhead whales and the Chukotkan hunt of eastern gray whales (advice for the proposed Makah hunt was developed in 2013). An *Interim SLA* (IWC, 2009) was developed for the Greenland hunts (up until 2018) to allow the development of long-term SLAs for these hunts. The Committee endorsed the *Humpback SLA* in 2014 (IWC, 2015c), and the *WG-Bowhead SLA* in 2016 (IWC, 2017b) and expects to finalise SLAs for the remaining Greenland hunts at its next meeting (see Item 7).

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.

8.1 Eastern Canada/West Greenland bowhead whales

8.1.1 New information (including catch data)

The Committee welcomes the provision of detailed information from Canada on their bowhead hunt showing that two females were taken in 2016 with none struck and lost. Samples of liver, skin, blubber, and muscle were collected from both whales. The Canadian quota for the Eastern Canada-West Greenland bowhead whale population is 7 for 2017. No bowheads were taken off Greenland in 2016.

The Committee noted that the reported catch was within the parameter space that was tested for the *WG-Bowhead SLA* and that the SLA had been developed on the conservative

assumption that the number of animals estimated off West Greenland represented the total abundance of animals in West Greenland-Eastern Canada.

Attention: SC, G, CG-A

Information from Canada is important for the provision of management advice for the Greenland hunt. Last year, the Committee received two draft abundance estimates for eastern Canada: a line transect abundance estimate for 2013 (Doniol-Valcroze et al., 2015) and a genetic mark-recapture of abundance for the period of 2008 to 2012 (Frasier et al., 2015). The Committee:

- (1) **recommends** that the authors of those papers are invited to the next Annual Meeting with a view to the Committee reviewing and endorsing the new abundance estimates; and
 - (2) **recommends** continuation of the Greenlandic large-scale biopsy sampling programme and encourages continued collaboration with Canada on genetic and other work related to stock structure and abundance.
-

8.1.2 Management advice

Attention: C-A

The Committee reiterates that the agreed WG-Bowhead SLA (IWC, 2016g) remains the appropriate tool to provide management advice for bowhead whales off West Greenland. Using this, together with the agreed 2012 estimate of abundance for West Greenland (1,274 CV=0.12), the Committee advises that an annual strike limit of 2 whales will not harm the stock.

8.2 North Pacific gray whales

8.2.1 New information (including catch data)

New abundance estimates for the Pacific Coast Feeding Group, the eastern North Pacific, the Sakhalin Island feeding group, and the larger Sakhalin Island and Southern Kamchatka feeding group were available after being reviewed by the *Ad hoc* Working Group on Abundance Estimates, Stock Status and International Cruises (see Annex Q) and accepted by the Committee.

SC/67a/AWMP03 presented data on aboriginal subsistence whaling in Chukotka during 2016. Hunting was conducted at 15 local communities. A total of 120 gray whales, 54 males and 66 females, were landed in 2016 including one stinky (i.e. inedible) whale. No whales were struck and lost. The paper also presented information on length, weight, edible products as well as some discussion of need. Tissue sampling occurred for 60 whales.

SC/67a/AWMP011 summarised the catch from 2012-16, with a total of 640 gray whales landed, 165 of which were investigated by Russian scientists. Twelve ‘stinky’ whales with a strong medical smell and taste were landed during this time. No whales were observed in poor body condition. A total of 71 gray whale were photo-identified during surveys in the Mechigmensky Bay from 2013-16 and added to the Chukotka regional catalogue which is available online at: <https://yadi.sk/i/9qx1eUiNs6t6s>. A comparison of the Chukotka catalogue to those from Kamchatka and Sakhalin waters showed no positive matches.

Attention: SC, G, CG-A

The Committee welcomes the information on Russian studies of gray whales and recommends the continued collection of photo-identification of live and harvested whales, and genetic samples and biological observations of harvested whales.

At the 2016 Commission meeting, the Russian Federation expressed concern that the present catch limits were insufficient to meet subsistence needs due to the landing of inedible, stinky whales counting against the catch limit for gray whales. In response to the concern, the Commission instructed the Scientific Committee to examine two scenarios that bracket the likely range of stinky whales landed and struck and lost whales in future hunts (Morishita et al., 2016):

- (a) that from 2019, the number of killed animals in each year is increased by ten whales (to include both inedible and struck-and-lost whales); and
- (b) that from 2019, the number of killed animals in each year is increased by 6% of the landed (this includes both inedible and struck-and-lost).

The examination was undertaken using the existing *Gray Whale SLA*. The Committee noted that *SLAs* deal only with the number of strikes taken regardless of whether the animals are landed, lost and/or stinky and count every strike as a dead animal. For scenario (a) it has been assumed that the catch limit would average 134 whales per year during the block instead of the current average of 124 whales per year. For scenario (b) the ratio of landed whales to the number of struck and lost whales and inedible, stinky whales in recent years has been used to determine a multiplier to increase the catch limit for running the *SLA*.

Allison reported that, depending on scenario, the above changes would lead to a block quota starting in 2019 of between 789 to 815 strikes (or an average of 132-136 strikes per year). She had run the *SLA* and found that these strike limits are allowed by the *SLA*. Details of the runs and data used are given in Annex E (Appendix 5).

8.2.2 Management advice

Attention: C-A, SC, CG-A

- (1) *As in previous years, the Committee agrees that the Gray Whale SLA remains the appropriate tool to provide management advice for eastern North Pacific gray whales. The Committee advises that the present block quota is in accord with the SLA and will not harm the stock. In addition, it confirmed that a six-year block quota beginning in 2019 of up to 815 strikes would not harm the stock.*
 - (2) *Weller reported that the US Government is currently reviewing a revised whaling management plan for the Makah hunt in Washington State. The Committee encourages the USA to provide the Committee with any revised plans as early as possible to allow consideration of the revised hunt management plan to occur intersessionally, such that, should they be deemed necessary, there is time for additional trials to be developed and run before the Annual Meeting in 2018. An Implementation Review for gray whales is currently planned in 2019.*
-

8.3 Bering-Chukchi-Beaufort (B-C-B) Seas bowhead whale

8.3.1 New information (including catch data)

Harvest data from the aboriginal hunt in Alaska were presented in SC/67a/AWMP02rev1. In 2016, 59 bowhead whales were struck resulting in 47 animals landed, including 28 females, 18 males and one whose sex was not determined. Eight of the nine females presumed to be mature (based on total length or pregnancy) were examined and five were

pregnant, suggesting a high pregnancy rate in 2016. SC/67a/AWMP03 reported that Chukotkan natives in the Russia Federation harvested two bowhead whales (one male and one female) in 2016.

SC/67a/AWMP10 provided a summary of the health status of Bering-Chukchi-Beaufort Seas (B-C-B) bowhead whales as requested by the Committee in 2016. The report summarised extensive information from a wide variety of studies. The health metrics that are most relevant to the *Implementation Review* (population size and trend, calf production and crude pregnancy rates) show stable or positive trends. No serious health issues were identified but some indicators should be carefully monitored, these include: the number of bowhead carcasses recorded during aerial marine mammal surveys, killer whale predation on calves, entanglement of fishing gear, and general pathological findings. The authors thanked the whale hunters of the Alaskan coast communities for their cooperation.

Attention: SC, G, CG-A

The Committee **welcomes** the report on the health status of B-C-B bowhead whales which it hopes can be generated every other year. It **encourages** other aboriginal whaling groups and researchers to collect similar data which in many cases does not require specialist equipment. This would allow assessment of differences in parameters such as prevalence of killer whale scarring in different ecosystems or to identify health parameters that differ between healthy, growing populations such as B-C-B bowhead whales, and those with conservation concerns.

SC/67a/AWMP09 presented new photo-identification data that were collected from a 2011 aerial survey of B-C-B bowhead whales. The data were used to estimate bowhead survival rate and population abundance using Huggins models embedded in a Robust Design capture-recapture analysis. The estimated survival rate was 0.996 with approximate lower confidence bound 0.976, which is consistent with previous estimates and with research showing that bowheads exhibit great longevity (up to 200 years).

SC/67a/AWMP07 reported that the population survey for B-C-B bowheads expected in spring 2017 did not occur for several reasons, including funding, and environmental conditions. The last successful survey was in 2011. The next survey will occur in time to produce a new estimate of abundance by 2021.

Whilst recognising the difficulties, the Committee noted the importance of acquiring a new abundance estimate for B-C-B bowheads within the next few years. It noted that estimates from other approaches than the ice-based census (e.g. using photo-identification data) would be acceptable if the CVs fell within the range considered when developing the *Bowhead SLA*⁸. It was noted that the CV of the next B-C-B bowhead abundance estimate may exceed 0.25 due to difficulties associated with deteriorating ice and lead conditions. In this event, the Committee may decide that an *Implementation Review* is necessary, to consider trials with larger survey CVs.

Attention: SC, G, CG-A

The Committee **encourages** efforts to try to ensure that an ice-based census of bowhead whales off Point Barrow can

be completed, noting that the methodology has produced some of the best series of estimates available for cetaceans. It **recommends** that funding is made available to complete such a survey. The Committee noted that it is unlikely that a survey will be completed in 2018 due to the need to prepare for the Implementation Review.

8.3.2 Management advice

Attention: C-A

The Committee **reiterates** that the Bowhead SLA continues to be the most appropriate way for the Committee to provide management advice for the Bering-Chukchi-Beaufort Seas stock of bowhead whales. 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; however, there is a carryover provision that allows for any unused portion of a strike quota from past years 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.

8.4 Common minke whales off East Greenland

8.4.1 New information (including catch data)

In the 2016 season, 15 common minke whales were landed in East Greenland, and none were struck and lost. Three of the landed whales were males, 12 were females, and genetic samples were obtained from 12 of the landed whales.

Attention: SC, G, CG-A

The Committee **encourages** the continued collection of samples of common minke whales landed off East Greenland and a collaborative approach to analyses.

8.4.2 Management advice

Attention: C-A

The Committee notes that 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 small proportion of the Central stock (IWC, 2016f, p.189). The Committee **advises**, as last year, that the annual strike limit of 12 will not harm the stock.

8.5 Common minke whales off West Greenland

8.5.1 New information (including catch data)

In the 2016 season, 146 common minke whales were landed in West Greenland and two were struck and lost. Of the landed whales, there were 110 females, 35 males and one of unknown sex. Genetic samples were obtained from 114 of these whales in 2016 and the Committee was 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 noted that one common minke whale died because of entanglement in West Greenland in 2016.

Attention: SC, G, CG-A

The Committee **encourages** the continued collection of samples of common minke whales landed off West Greenland and the collaborative approach to analyses. It **stresses** the importance of comparative analyses with Canadian samples.

⁸The *Bowhead SLA Evaluation Trials* used estimated survey CVs up to 0.25, and *Robustness Trials* up to 0.34.

8.5.2 Management advice

Attention: SC, G, CG-A

In 2009, the Committee was able to provide management advice for common minke whales off West Greenland for the first time. This year, noting that an SLA for this stock is expected at the Scientific Committee meeting next year, the Committee **advises**, as last year, that an annual strike limit of 164 will not harm the stock.

8.6 Fin whales off West Greenland

8.6.1 New information (including catch data)

A total of eight fin whales (four females and four males) were landed, and one was struck and lost, off West Greenland during 2016. The Committee was pleased to note that genetic samples were obtained from seven of these, and that the genetic samples of fin whales off West Greenland are analysed together with the genetic samples from the hunt in Iceland. The Committee noted that one fin whale died because of entanglement in West Greenland in 2016.

Attention: SC, G, CG-A

The Committee **encourages** the continued collection of samples of fin whales landed off West Greenland and a collaborative North Atlantic approach to analyses.

8.6.2 Management advice

Attention: C-A

Noting that an SLA for fin whales off West Greenland is expected at the Scientific Committee meeting next year, the Committee **advises**, as last year, that an annual strike limit of 19 whales will not harm the stock.

8.7 Humpback whales off West Greenland

8.7.1 New information (including catch data)

A total of five (one male and four females) humpback whales were landed, and none were struck and lost, in West Greenland during 2016. The Committee was pleased to learn that genetic samples were obtained from all the landed whales and that Greenland was contributing fluke photographs to the North Atlantic catalogue, both from captured whales and other field studies. Three humpback whales were observed entangled in fishing gear in West Greenland in 2016, which is considerably lower than the ten whales that were entangled in 2015. Of these, two were permitted to be killed, and one was disentangled by fishermen. The Committee noted last year that bycaught whales had been included in the scenarios for the development of the *Humpback SLA* and that if high levels continued, then this would need to be considered in any future *Implementation Review* (the next is expected in 2020).

Attention: SC, G, CG-A

With respect to West Greenland humpback whales, the Committee:

- (1) **reiterates** the importance of collecting genetic samples and photographs of the flukes from humpback whales landed off West Greenland and a collaborative approach to analyses; and
- (2) **welcomes** the news that the Greenland authorities obtained IWC disentanglement training in 2016 and that they successfully disentangled one humpback whale.

8.7.2 Management advice

Attention: C-A

The Committee reiterates that the agreed Humpback SLA (IWC, 2015a) remains the appropriate tool to provide management advice for humpback whales off West Greenland. Using this, Committee **advises**, as last year, that an annual strike limit of 10 will not harm the stock.

8.8 Humpback whales off St Vincent and The Grenadines

8.8.1 New information (including catch data)

No whales were taken by St Vincent and The Grenadines in 2016. One female (length 50') has been taken so far in 2017.

Last year, the Committee had expressed concern that there is no officially agreed abundance estimate from the MONAH programme that took place in 2004 and 2005. A recent NOAA status review (Bettridge *et al.*, 2015) referred to that programme and provided an estimate of 12,312 humpback whales (95% CI 8,688-15,954) for 2004/05 but referenced this as 'NMFS, unpublished data'.

Attention: SC, G, CG-A

With respect to humpback whales off St. Vincent and The Grenadines, the Committee:

- (1) **recommends** that the status and disposition of genetic samples collected from past harvested whales be determined and reported next year;
- (2) **reiterates** the recommendation that photographs for photo-id and genetic samples are collected from all whales landed in future hunts;
- (3) **requests** that a scientific representative from the St Vincent and The Grenadines attends next year's Scientific Committee meeting, especially since next year the Commission will review aboriginal whaling quotas; and
- (4) **recommends** that the USA (NOAA, NMFS) provides a paper to the next meeting that will allow the Committee to properly review this abundance estimate and, if appropriate, adopt it as an estimate suitable for providing management advice.

8.8.2 Management advice

Attention: C-A

The Committee has **agreed** that the animals found off St Vincent and The Grenadines are part of the large West Indies humpback whale breeding population (the last agreed abundance estimate was for 1992/93 - 11,570 (95% CI 10,290-13,390 – but see Item 8.8.1 above). 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**, as last year, that this block catch limit will not harm the stock.

9. WHALE STOCKS NOT SUBJECT TO DIRECTED TAKES

9.1 In-depth Assessments (IA)

9.1.1 Comprehensive Assessment of North Pacific humpback whales

9.1.1.1 PROGRESS ON INTERSESSIONAL WORK

SC/67a/Rep08 provided an Executive Summary⁹ of the IWC's first Workshop on the Comprehensive Assessment

⁹The Workshop discussed an enormous amount of material and did not complete its work until the evening of the last day. It was not possible in the short time before the Committee meeting to finalise the Report and the participants authorised the Chair to develop an Executive Summary.

of North Pacific Humpback Whales. The objective was to identify and review available information on stock structure, removals (catches, bycatches and ship strikes), abundance and trends (by stock and area), biological parameters and environmental issues. The Workshop was held from 19-21 April 2017 at the kind invitation of the Marine Mammal Laboratory in Seattle. It was convened by Phil Clapham, and Greg Donovan was elected Chair.

9.1.1.2 PREPARATION FOR ASSESSMENT

9.1.1.2.1 STOCK STRUCTURE HYPOTHESES

The Workshop reviewed information on stock structure from a suite of datasets including photo-identification, genetics, telemetry, acoustics, catches and sightings. This included reviewing the SPLASH (Structure of Populations, Levels of Abundance and Status of Humpbacks) project and updated information from the Russian Pacific, the Bering and Chukchi Seas, Japan and Mexico. Geographic 'building blocks' were developed that were to be used when describing the various stock structure hypotheses for the summering and wintering groups (see Annex F, item 4 for more details).

The Committee received updates on several additional biopsy and photo-identification projects. One update was on work conducted on Saipan in the Marianas during February 2017. This new catalogue, containing fluke images for 24 humpback whales, is being compared to catalogues from the Philippines, Okinawa, Russia, and Japan. The genotype of one individual had been matched between Saipan and Ogasawara; given the small sample size, this suggested a strong connection between the two areas.

The other update was on the genetic and photo-identification studies in Okinawa waters that have been active since 1991. Currently these samples are being compared with other data sets. Similar data are potentially also available from Ogasawara.

9.1.1.2.2 ABUNDANCE DATA AND TRENDS

The Workshop examined a comprehensive ongoing mark-recapture analysis using data for the whole North Pacific derived from the SPLASH dataset. The completed analysis will consider the revised (since SPLASH) stock structure hypotheses considered at the Workshop. The Workshop also compiled a list of completed abundance estimates and data that could be used to generate estimates for areas needed in this assessment.

9.1.1.2.3 CATCH HISTORY AND OTHER REMOVALS

The Workshop examined the existing catch data and agreed the series for incorporating into the assessment. After reviewing available information on bycatch and ship strikes, the Workshop agreed that it will develop several scenarios reflecting both past and likely future removals that will capture the uncertainties.

The Committee was advised that additional data on mortalities were available from various sources and **agrees** that such data should be sent to the Convenor of the North Pacific humpback assessment steering group (see Annex W).

9.1.1.2.4 LIFE HISTORY PARAMETERS

The Workshop compiled and reviewed available information on biological parameters for humpback whales in all oceans.

9.1.1.2.5 ENVIRONMENTAL ISSUES

The Workshop considered the potentially changing carrying capacity in the North Pacific. It was agreed that whilst separating the effects of environmental changes from the traditional view of populations approaching carrying capacity is something to strive for, such data are not available. However, the Workshop noted several interesting

studies linking humpback whale occurrence and density with environmental factors. Further investigations into the effects of environmental changes in the habitat of humpback whales are encouraged.

9.1.1.3 ASSESSMENT MODEL

In the light of discussions of the available data, the Workshop agreed that future modelling efforts should employ a simple modelling framework based upon an age-aggregated model using a Bayesian estimation approach.

9.1.1.4 CONCLUSIONS

The Workshop made considerable progress towards completing a Comprehensive Assessment. It developed several research recommendations that do not have cost implications for the IWC that are detailed in Annex F.

Attention: SC

The Committee thanks Donovan and the Workshop participants, commending them for the progress that has been made. It established an intersessional steering group under Clapham (Annex W), tasked with ensuring progress with the recommendations made at the Workshop with respect to:

- (a) refining and prioritising the stock structure hypotheses developed at the Workshop and develop draft mixing matrices;*
 - (b) facilitate the additional work on abundance estimates and any other model inputs; and*
 - (c) finalising plans for a second workshop in 2018.*
-

Details of work to be undertaken both before and during the 2018 Annual Meeting are given in Annex F, item 4.4. The two-year work plan is summarised in Table 8.

9.1.2 In-depth Assessment of North Pacific sei whales

9.1.2.1 PROGRESS ON INTERSESSIONAL WORK

SC/67a/1A02 documented progress with model development. The model can be run when the input data have been prepared. The catch series and Japanese *Discovery* marking data have been coded and entered with the assistance of Allison and Yoshida. No new analyses of sightings data were presented. The specific data items for use in the assessment are discussed below.

9.1.2.2 PREPARATION OF DATA FOR THE ASSESSMENT

9.1.2.2.1 STOCK STRUCTURE HYPOTHESES

Issues of stock structure were discussed extensively at the 2015 and 2016 meetings (IWC, 2016e; 2017b). Last year, the Committee agreed to proceed on the basis of two alternative hypotheses: (i) a single stock for the entire North Pacific (Kanda *et al.*, 2015; Pastene and Yoshida, 2015); and (ii) a 5-stock hypothesis presented in Mizroch *et al.* (2016). After much discussion, the Committee considered that the evidence for the 5-stock hypothesis is weak. The genetic information was consistent with a single stock in the area covered by the samples. However, it noted that all the samples had been taken from the area of just one of the stocks proposed in Mizroch *et al.* (2016), namely the North Pacific pelagic stock.

There is no implication that the lines shown in Appendix 2 in Annex F correspond to stock boundaries and the decision to proceed does not imply endorsement of either hypothesis at this stage.

9.1.2.2.2 ABUNDANCE DATA AND TRENDS

Last year, the Committee identified abundance data that ranged from surveys from which usable abundance estimates are already available to surveys resulting in zero or minimal

Table 8
Work plan for North Pacific humpback whales (from IA).

Species/area	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Comprehensive assessment of North Pacific humpback whales	Reconvene intersessional steering group and convene 2 nd Workshop to further data preparation and development of the assessment model	Review progress of intersessional Workshop and continue comprehensive assessment

sei whale sightings, which can be used to bound the area of abundance. This year, the Committee developed a final list of abundance information for use in the assessment (see Appendix 3 of Annex F). It comprises of estimates that are published or contained in documents to the Committee and data from published sources that can be used with minimal analysis. In addition, areas were identified where sei whales do not occur to any significant extent. Most of the remaining work on abundance involves extracting existing estimates from papers and assigning or prorating them to sub-regions.

9.1.2.2.3 MARKING DATA

The coding of the Japanese *Discovery* marking data is now complete. A small US dataset is being coded that could be used if submitted to the Secretariat in time for the assessment, but these are not essential input to the assessment.

The Committee had little information on marking efficiency, mark retention, or recovery efficiency. Several options on how to handle these issues were suggested in Annex F. The North Pacific sei whale assessment steering group (Annex W) is encouraged to investigate the sensitivity of these options.

9.1.2.2.4 CATCH HISTORY

Allison reported that nearly all catches have either actual positions or have been assigned approximate positions that are precise enough to assign them to one of the sub-regions for the assessment. The only exception is some USSR catches where a decision needs to be made where to assign them to. Decisions have been made on assigning catches of uncertain species and sex.

9.1.2.2.5 LIFE HISTORY PARAMETERS

The life history and exploitation-related parameters required by the assessment model are age-at-recruitment (or selectivity ogive), age-at-maturity (or maturity ogive), and the natural mortality rate. For initial runs of the assessment model, the same parameter values would be used as at the last assessment of North Pacific sei whales.

9.1.2.3 ASSESSMENT MODEL

The model described in SC/67a/IA02 is similar to that used in multi-stock *Implementation Simulation Trials*. The time step is half-yearly, with summer defined as May to October and winter as November to April. The model can accommodate any definitions of feeding and breeding areas with any degree of mixing between them. The model uses catches, marks and recoveries, and abundance information, which are used to calculate a likelihood function of the parameters. This model will be used for the assessment. The North Pacific sei whale assessment steering group (Annex W) will compile the list of input data (and see above). The Committee also recognised that the assessment model may need to consider density dependence, if there are sufficient data.

The Committee did not develop detailed mixing matrices, but realised the model should allow movement between the wintering grounds and the summer feeding areas, as indicated by the mark recaptures. Several general options for initial exploration were discussed in Annex F. The North Pacific sei whale assessment steering group (Annex W)

will review initial model runs and can consider alternative mixing assumptions if initial runs of the assessment model are not consistent with the data.

Attention: SC, S

The Committee agrees to proceed with assessment modelling for North Pacific sei whales based on two alternative hypotheses – a single stock and 5 stocks using the model described in SC/67a/IA02. To facilitate the completion of this assessment under the intersessional steering group (Annex W), it:

- (1) *authorises the ISG to modify proposed boundaries, if necessary, to facilitate the divisions of data into sub-regions;*
- (2) *agrees that the ISG will not attempt to assign relative plausibilities to the alternative hypotheses at this stage of the assessment;*
- (3) *agrees that the ISG should produce a table of inputs to the assessment model including those for abundance, uncertain species and sex were made;*
- (4) *recognises that new estimates or existing estimates that have not been formally categorised for use in assessments will need to be examined by the working group on abundance estimates (see Item 12); and*
- (5) *requests Allison to identify any remaining needed adjustments to the catch series for North Pacific sei whales that may be necessary, and to refer them to the ISG for endorsement.*

9.1.2.4 WORK PLAN

Details of work to be undertaken both before and during the 2018 Annual Meeting are given in Annex F, item 3.4. The two-year work plan is summarised in Table 9.

9.1.3 In-depth Assessment of Indo-Pacific Antarctic minke whales

In 2014, after 13 years, the in-depth assessment of Antarctic minke whales in the Indo-Pacific Antarctic region was completed. At that time, it was suggested that all of the components and results of the assessment that had been concluded over the years be brought together in one document. SC/67a/SH14 was presented to this meeting as a draft of the document for consideration by the Committee. The document covered a wide variety of topics discussed over 13 years including systematics, commercial and research catches, abundance estimates, spatial distribution patterns, stock structure, biological information, population dynamics, feeding ecology and energetics, pollutants and marine debris, and species interactions. The Committee welcomed the document and acknowledged the great effort that had gone into summarising the information and results collected over a period of so many years. After a general discussion, several suggestions to improve the document were made and these are detailed in Annex F. An intersessional correspondence group under Murase (Annex W) has been established to finalise the manuscript, considering comments received during this year's meeting, and to submit the manuscript to a peer-reviewed journal.

Table 9

Work plan for North Pacific sei whales (from IA).

Species/area	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
In-depth assessment of North Pacific sei whales	Re-establish the ISG (Annex W) to further data preparation and development of the assessment model.	Review progress of intersessional work and continue in-depth assessment.

Table 10

Work plan for North Pacific blue whales.

Species/area	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
North Pacific blue whale assessment	Review information to examine the feasibility of undertaking an assessment and as appropriate develop a timetable.	Review progress on the research items identified and the work of the intersessional group, and develop a work plan.

9.2 Evaluation for potential new In-Depth Assessments

9.2.1 North Pacific blue whales

9.2.1.1 REVIEW OF NEW INFORMATION

SC/67a/NH01 reports on the preliminary analysis of a year (2012) of low frequency acoustic data collected by seismometers off Hokkaido, Japan. The authors identified a new call type ('Japan-type song') that is probably produced by blue whales and is different from those previously reported in the Northwestern Pacific. SC/67a/NH02 summarises previously published information regarding the occurrence of blue whale songs across the North Pacific. The Northeast Pacific song type is commonly recorded along the west coast of North America. The Northwest Pacific song type is commonly recorded in the central and western North Pacific. The two songs overlap in the Gulf of Alaska as well as lower latitude areas of the central North Pacific. Rone *et al.* (2017) provided information on blue whales observed from sighting surveys in the Gulf of Alaska in 2009, 2013 and 2015.

9.2.1.2 EVALUATING THE POSSIBILITY OF INITIATING AN ASSESSMENT AND WORK PLAN

An intersessional correspondence group (ICG) chaired by Branch reported on data available for an assessment of North Pacific blue whales. It had identified five priority action items: (1) obtain abundance estimates from the IWC-POWER surveys; (2) obtain abundance estimates from the JARPN and JARPNII surveys; (3) analyse and compare genetic samples from the Eastern North Pacific, IWC-POWER and JARPN and JARPNII to examine stock structure throughout the North Pacific; (4) compare existing photo-id catalogues (e.g. IWC-POWER, Cascadia Research Collective, JARPN/JARPNII catalogues); and (5) review new acoustic locations and song information. Although good progress is being made more work is still needed before an assessment can be initiated, especially with respect to new abundance estimates and stock structure information. The Committee **agrees** that the ICG (see Annex W) should continue its work.

9.2.1.3 WORK PLAN

The work plan for North Pacific blue whales is shown in Table 10.

9.2.2 Southern Hemisphere Pygmy blue whales

9.2.2.1 SOUTHERN HEMISPHERE POPULATION STRUCTURE

The Committee is currently preparing for a Comprehensive Assessment of pygmy blue whales. For this reason, it continues to gather information on population structure using acoustic and genetic data (see item 5.1 in IWC, 2017e). Progress has been made on building a pygmy blue whale song library with effort directed towards finding the

best quantitative ways to discern differences between song types and song type variants. This work will be concluded in 2018. To further assist with genetic assessments, an intersessional group was formed to ensure standardisation of DNA profiles among researchers working on both blue and fin whales across the Southern Hemisphere and protect against depletion of tissue samples which are shared amongst multiple research groups, through coordinated data sharing and development of genomic archives where possible.

SC/67a/PH04 provided a progress report on matching within the Southern Hemisphere Blue Whale Catalogue, which has been supported by funding from the Committee (see item 10.2.2 in IWC, 2017e). This helps understanding of blue whale movements between regions, and allows estimation of regional abundance. Since 2016, this catalogue has increased by 13% with photo-identifications from the western Indian Ocean. New research groups from Chile and the western Indian Ocean have joined the catalogue, and plan to upload their photographs shortly. The Catalogue is expected to be held on the IWC server by December 2017.

Attention: SC

*The Committee **encourages** the continuance of the Southern Hemisphere Blue Whale Catalogue, and **recommends** a priority focus on matching photographs within regions to estimate regional abundance of pygmy blue whales.*

9.2.2.2 INDONESIA/AUSTRALIA BLUE WHALES

The Southern Hemisphere Blue Whale Catalogue holds 525 right sides and 508 left side photo-identifications from Australian catalogues. It may be large enough to enable abundance estimation but this cannot be confirmed until all date and location data are available from regional contributors.

Attention: SC, G

*In order that assessment of the suitability of Australian photographs for estimating regional abundance can be conducted, the Committee **recommends**:*

- (1) Australian research groups submit this date and location information to the Southern Hemisphere Blue Whale Catalogue; and
- (2) Quality Control analysis of the Australian component of the Catalogue.

9.2.2.3 MADAGASCAR BLUE WHALES

The Committee was informed about ongoing acoustic monitoring off the northwest coast of Madagascar. Between December 2016 and April 2017, Madagascar-type blue whale song was detected on all recorders throughout December and into at least early January. Sri Lanka-type blue whale song

was detected on 11 December and was consistently detected for at least two days. These preliminary results suggest the seasonal presence of an aggregation of blue whales off the northwest coast of Madagascar, representing two different ‘acoustic populations’. The detection of Sri Lanka-type songs was unexpected, and may suggest a previously unknown migratory route for these whales. Acoustic deployments are ongoing and will be reported to the Committee in 2018.

Attention: SC, G

The distribution, population isolation and abundance of Madagascar-type blue whales is unknown. The Committee encourages additional offshore surveys and data collection (e.g. acoustics, genetics and photo-identifications) by regional scientists to further assess the composition of this northwest Madagascar aggregation.

9.2.2.4 NEW ZEALAND BLUE WHALES

SC/67a/SH02 summarised a recent study of New Zealand blue whales (2014-17) with a focus on the Taranaki Bight. This multi-disciplinary study included acoustics, genetics and photo-identification of New Zealand blue whales, with 31 whales genetically identified. These blue whales have significantly lower genetic diversity than the other blue whale populations. They were significantly differentiated from Antarctic blue whales and Southeast Pacific blue whales, but not from Australian blue whales. However, the work presents multiple lines of evidence supporting the recognition of a resident or seasonally resident blue whale population around New Zealand.

Attention: SC, G

The New Zealand population of blue whales is poorly understood. The Committee:

- (1) **commends** the exceptional work detailed in SC/67a/SH02;
- (2) **encourages** further data gathering and analysis to obtain a mark recapture abundance estimate;
- (3) **recommends** that the photo-identifications are combined with others within the Southern Hemisphere Blue Whale Catalogue to measure regional abundance and connectivity;
- (4) **encourages** further acoustic monitoring at sites close to New Zealand; and
- (5) **encourages** acoustic data collection from other sites in the southwest Pacific, given the low differentiation between New Zealand and Australia, and the need to understand the level of seasonal overlap of New Zealand and Australia blue whale song types.

9.2.2.5 SOUTHEAST PACIFIC BLUE WHALES

LeDuc *et al.* (2017) investigated global blue whale stock structuring. Blue whales in the northeast and southeast Pacific are genetically differentiated, while samples in the Eastern Tropical Pacific (ETP) showed some degree of spatial differentiation, supporting the hypotheses that the region is used by whales from both hemispheres but in different seasons (see Annex I, item 2.1). The Committee discussed whether low levels of differentiation across the ETP might imply inter-breeding between the two populations. The Committee also discussed the value of comparing the newly found biological data from Japanese catches of blue whales off Chile in the 1960s to catches in other waters (e.g. the Antarctic and Indian Oceans) to establish whether the Chilean blue whale is morphologically distinct from the Antarctic blue whale and other pygmy blue whales.

Redfern *et al.* (2017) constructed habitat use models for blue whales using sightings and effort data from the California Current and ETP to infer areas of likely habitat use in the Northern Indian Ocean, where blue whale distribution is poorly known. These models could also be used to predict blue whale distributions off Chile. This would provide useful potential distributional information in relation to the pre-assessment of southeast Pacific blue whales, allowing assessment of whether the regional abundance estimates are representative of the whole population.

An IWC Workshop was held in Chile in December 2016 (SC/67a/Rep03), to explain the IWC population assessment process and facilitate blue, humpback, and fin whale photo-identification standardisation and integration. A blue whale discussion group reviewed progress on catalogue sharing, data availability and dataset sizes. Most photo-identification data are from the Chiloe Island region, with some opportunistic sightings from Isla Chañaral to the north. All groups agreed to contribute to the Southern Hemisphere Blue Whale Catalogue to proceed towards a southeast Pacific blue whale assessment. The work has been slowed by the need for each group (with limited resources) to fully reconcile their blue whale photographs before contributing them to the Catalogue.

Attention: SC, G

To proceed to an assessment, there is a need to better establish the genetic identity, habitat use and abundance of southeast Pacific blue whales. The Committee:

- (1) **encourages** further effort to collect genetic samples from Peru and Ecuador;
- (2) **recommends** predicting southeast Pacific blue whale habitat following Redfern *et al.* (2017), and assessing the results using southeast Pacific sightings and effort data;
- (3) **welcomes** progress towards combining blue whale catalogues in the region; and
- (4) **strongly encourages** Chilean researchers to reconcile their catalogues internally and upload them to the Southern Hemisphere Blue Whale Catalogue to allow estimation of regional abundance.

9.2.3 Antarctic blue whales (Areas III and IV)

9.2.3.1 GENETIC STUDIES

SC/67a/SH11 presented genetic species identification from bones (25 blue whales) found at South Georgia and the Antarctic Peninsula, likely to have been deposited ~100 years ago. Blue whale genetic diversity was high. A total of 14 of 21 maternally inherited haplotypes were unshared with contemporary blue whale samples, suggesting a loss of genetic diversity from South Georgia.

The Committee were also informed about progress on the analysis of a set of ~1,000 fin and blue whale baleen plates collected from Antarctic Areas IV and V during 1946-49 by Japanese whalers and stored at the Smithsonian Institution. A subset of baleen samples is now undergoing DNA extraction and sequencing to test the feasibility of applying next-generation sequencing on these samples. A report will be provided in 2018.

Attention: SC, G, S

Given the importance of bone and baleen collections for documenting the loss of genetic diversity and shifts in population structure, the Committee:

- (1) **encourages** collection and analyses efforts to continue; and
- (2) **requests** the Secretariat to write a letter of support to CITES to assist with collection of whalebones from the Antarctic.

Table 11
Work plan for Southern Hemisphere Antarctic and pygmy blue whales.

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Antarctic blue whales	Antarctic Blue Whale Catalogue – continue matching. Continue analysis of Antarctic blue whale baleen plates. Complete analysis of post-CPIII to measure blue whale abundance.	Report - Report
Pygmy-type blue whales	Southern Hemisphere Blue Whale Catalogue – matching (Annex W). Analysis of blue whale catches in all regions (pelagic fleets and land stations) to delimit population, boundaries, regions. Development of permanent blue whale song reference library to assist with standardisation and analysis of call distribution and structure.	Report Report Report Website
Southeast Pacific blue whales	Analyse Chilean blue whale catch length data and compare with blue whale catches from other regions. Reconcile Chilean photo-identification data within the SHBWC. Apply habitat models developed for California Current and Eastern Tropical Pacific to construct habitat use analyses for Chilean blue whales and validate with sightings data (Annex W); standardisation of DNA profiles (Annex W).	Report - Report
Southwest Indian Ocean blue whales	Conclude acoustic study off NW Madagascar.	Report
Australia/Indonesia blue whales	Complete addition of date/location metadata to Australia/Indonesia blue whale photos within the SHBWC and conduct quality control across all images.	Report
New Zealand blue whales	Continue reconciliation of NZ photo-identification catalogues within the Southern Hemisphere Blue Whale Catalogue.	Report

9.2.3.2 CRUISE REPORTS

SC/67a/ASI07 and SC/67a/SP05 reported Antarctic blue whale photo-identifications (9 individuals) and biopsies (2 individuals) from the NEWREP-A survey (a dedicated sightings survey in Area V-West) and the Antarctic minke whale sampling survey (conducted in Area III-East and Area IV). During these surveys, a total of 15 schools with 19 individuals of blue whales were sighted.

9.2.3.3 ACOUSTIC STUDIES

Samaran reported on the goals and outcomes of a pre-meeting of the IWC-SORP Acoustic Trends project. The project goal is to investigate trends in acoustic detections of Antarctic fin and blue whales. The pre-meeting conducted a high-level review of their work completed to date, identified gaps in data collection efforts, and developed a plan to expand data collection from the Southern Ocean Hydrophone Network. They also developed a new framework for standardised analysis of long-term Antarctic acoustic recordings, identifying a need for additional coupled behavioural and acoustic studies to enable a more robust interpretation of acoustic data with a view towards development of call density and animal abundance estimates. This plan will be implemented over the next two years with a report presented to the Committee in 2018.

The Committee was pleased to receive a large number of papers providing information on acoustic studies in the Southern Hemisphere on blue whales. These included studies analysing the effect of environmental conditions on acoustic behaviour and sightings (Shabangu *et al.*, 2017), studies on spatio-temporal distribution and seasonal movements throughout the Antarctic and towards the tropics (Thomisch *et al.*, 2016). These are discussed in detail in Annex H, item 3.2.3.

Attention: SC, G

The Committee welcomes the significant new results on Antarctic blue whale distribution and seasonal movements, and encourages:

- (1) *the IWC-SORP Acoustic Trends project to develop methods for abundance estimation of fin and blue whales using acoustics, noting the importance of this to IWC assessment work;*

- (2) *the collection of Antarctic blue whale biopsy samples and photo-identifications from lower latitudes to better understand blue whale population structuring (and see Items 9.2.2.5 and 9.2.3.1); and*
- (3) *the continuation of acoustic monitoring to document blue whale seasonal movements.*

9.2.3.4 PROGRESS TOWARDS POPULATION ASSESSMENT AND WORK PLAN

The Committee was informed that an estimate of model-based abundance from post-CPIII SOWER surveys is being developed and would be provided to the 2018 meeting.

SC/67a/PH01 reported the results of the comparison of Antarctic blue whale identification photographs from two new sources to the existing Antarctic Blue Whale Catalogue. The summary of this paper can be found in Annex S, item 3. The value of continuing opportunistic data collection, particularly photographs, on Antarctic blue whales was highlighted, since this species remains poorly known. The number of resightings from the Antarctic Blue Whale Catalogue to date means that it is premature to try to estimate abundance at this stage.

Attention: SC, G

The Committee welcomes the progress being made towards being able to undertake regional population assessments of blue whales. In particular, it recommends continuing opportunistic photo-identification data collection in the Antarctic to assist with developing estimates of population abundance for Antarctic blue whales.

9.2.4 Southern Hemisphere fin whales

9.2.4.1 POPULATION STRUCTURE

Last year, the Committee initiated discussion on the possible assessment of Southern Hemisphere fin whales (IWC, 2017b, p.42). This year, it reviewed the limited information currently available to summarise population structuring of Southern Hemisphere fin whales, noting that they may comprise two subspecies, *B. physalus quoyi* and *B. physalus patachonica* (a pygmy form hypothesised to be located in the low to mid latitudes). Global population structuring of fin whales was investigated by Archer *et al.* (2013) but the uneven

geographical spread and small number of samples from areas other than the southeast Atlantic prohibits a statistically robust assessment of Southern Hemisphere fin whale population structure. Acoustic data show distinct call features for fin whales in East Antarctica (~70°E) compared to those near the west Antarctic Peninsula and Scotia Sea (Gedamke, 2009). Unpublished analyses of fin whale vocalisations off Juan Fernandez Island (Chile) indicate that these are also comparable to those detected off the west Antarctic Peninsula.

Attention: SC, G, S

Knowledge of population structure is essential to future efforts to assess Southern Hemisphere fin whales. To determine the longitudinal differentiation and potential sub-species structure among fin whales the Committee encourages using:

- (1) *strategic collection of skin biopsy and bone samples for genetic and isotope analysis;*
- (2) *satellite telemetry to discern seasonal movements; and*
- (3) *photo-identification to understand site fidelity and residency patterns and linkages between high- and low-latitude grounds.*

*The Committee also recommends that the Secretariat provide a letter of support for a study examining the evidence for *B. patachonica*, which requires access to the holotype for this species from the Buenos Aires Museum.*

9.2.4.2 DISTRIBUTION AND ABUNDANCE

SC/67a/SH09 reviewed available metadata on Southern Hemisphere fin whales, compiling data from dedicated and opportunistic surveys, moored acoustic recorders, sonobuoy surveys, photo-identifications, satellite tagging and biopsy sampling. Most datasets were from the western Antarctic Peninsula and Scotia Arc. Apart from circumpolar IDCR/SOWER data, limited sighting effort has been conducted in Areas II, III, IV and V. Most acoustic recordings in areas other than the western Antarctic Peninsula and Scotia Sea are from Area IV/V. No telemetry data from Antarctic regions other than the western Antarctic Peninsula were identified. However, telemetry data, biopsy samples, photo-identification data and effort-related sightings data are available from the coast of Chile. The authors concluded that major gaps exist with regard to understanding population structure and identity, migration patterns and movements of fin whales within the area, as well as abundance, habitat utilisation and foraging ecology. A summary of these data is provided in Appendix 2 of Annex H.

SC/67a/WW02 reports the movements of six fin whales satellite tagged off Isla Chañaral, Chile (~29°S) during austral spring 2015. Whales were tracked between 4 and 162 days. Five of the six whales remained at middle latitudes for prolonged periods of time, moving in a north-south pattern near the coast, and spending most of their time in area-restricted search behaviour. One individual exhibited clear southbound migratory behaviour, remaining in transit for most of the period it was tracked. These results suggest that some of the fin whales that are observed in Chile follow a migration to high latitudes, whereas others remain in lower latitudes, likely feeding, along the Chilean coast. The method of de la Mare (2014) was used to give some example results from estimating indices of relative abundance for Antarctic fin whales (see Annex H, Appendix 2). Catch per unit effort (CPUE) data can be used to assess regions of past high densities of fin whales in the Southern Ocean.

Matsuoka and Hakamada (2014) provided estimates of abundance for fin whales from Antarctic Areas III-E-IV, as well as for Areas V-VI-W, using data from JARPA and JARPA

II line-transect sighting surveys from 1989/90-2008/09 collected south of 60°S to the ice edge during the austral summer. These abundance estimates will be reviewed by the ASI Working Group (Annex Q) at next year's meeting.

Attention: SC, G

With respect to obtaining information on the distribution, movements and abundance of Southern Hemisphere fin whales for use in an assessment, the Committee recommends that:

- (1) *telemetry studies, photo-identification and biopsy sampling be continued; and*
- (2) *de la Mare incorporate newly available Soviet fin whaling data into his catch density model to derive the fullest possible picture of past fin whale aggregation patterns.*

9.2.4.3 CRUISE REPORTS

SC/67a/ASI07 and SC/67a/SP05 provided information on fin whales from the 2016/17 NEWREP-A sighting survey in the western sector of Area III-East (55-65°E), Area IV (70-130°E) and Area V (130-165°E). A total of 118 schools with 350 individual fin whales were sighted during these surveys.

9.2.4.4 ACOUSTIC STUDIES

SC/67a/SH03 presented preliminary analyses of directional sonobouys and real-time passive acoustic detection for fin whales during the Antarctic Circumnavigation Expedition, January-March 2017. The Committee looks forward to receiving the final analyses.

Recent visual observations suggest that the region around Elephant Island (61°08'S 55°07'W) may be important feeding area for fin whales, perhaps during migration. SC/67a/SH06 reported preliminary analysis of acoustic data from north of Elephant Island from January-November 2013. Fin whales were present for most of the period, peaking in the austral autumn with low or no presence in August and September. Acoustic presence peaked during austral autumn.

Attention: SC, G

The Committee encourages further acoustic analysis of fin whale calls to discern population structure and distribution patterns. The Committee also encourages data sharing between acoustic studies to provide a more comprehensive view of fin whale seasonal occurrence and distribution.

9.2.4.5 PROGRESS ON POPULATION ASSESSMENTS

SC/67a/IA01 analysed Japanese catches of fin whales in the Southern Hemisphere, comparing true Soviet length data from the *Yuri Dolgorukiy* factory fleet during 1960-75 to data for the same period reported to IWC by Japan. Length distributions between the two nations were broadly similar, although a peak in Japanese catches at 17.4m (the minimum length for this species) prior to implementation of the International Observer Scheme in 1972 suggested a degree of 'stretching' to hide some catches of under-sized animals. The authors conclude that the Japanese Southern Hemisphere fin whale data in the IWC Catch Database are probably largely reliable.

The Committee was informed that design-based strata-level estimates of abundance from IDCR-SOWER CPIII surveys are being developed and would be provided to the 2018 meeting.

SC/67a/SH07 outlined a plan to coordinate future research on Southern Hemisphere fin whales, focused on the western Antarctic Peninsula.

Table 12
Work plan for Southern Hemisphere fin whales.

Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Complete work on design-based strata-level abundance estimates.	Report
Continue to compile available data and assess gaps for an assessment.	Report
Complete review of population structuring.	Report
Include newly available Soviet catches in modelling of Southern Ocean fin whale catches to estimate relative densities across the Southern Hemisphere.	Report

Attention: SC, G

To allow for a possible future assessment of fin whales, the Committee **agrees** that considerably more co-ordinated research is needed. It **recommends** the following goals (from SC/67a/SH07) for the western Antarctic Peninsula region, recognising that this will be a long-term plan:

- (1) characterise the whales in the aggregations acoustically and genetically to determine the population identity of whales using this area (a single breeding stock vs. multiple stocks mixing);
- (2) explore the spatio-temporal extent of the aggregations and estimate density and abundance of aggregating fin whales;
- (3) investigate the feeding ecology and prey dependencies, identifying vulnerabilities;
- (4) track movements and habitat use of fin whales in the area; and
- (5) identify migration routes and destinations.

9.2.6.5 WORK PLAN

The work plan is shown in Table 12.

9.2.5 North Atlantic sei whales

9.2.5.1 REVIEW OF NEW INFORMATION

Little is known about the distribution and abundance of sei whales in the western North Atlantic. Cholewiak provided an update on recent passive acoustic data collected by the NOAA Northeast Fisheries Science Centre that provide new insights into sei whale acoustics and distribution. Two studies were described: (1) year-round data were analysed from two sites along the shelf break of Georges Bank, USA; and (2) an array of recorders was used to localise and track sei whales in Massachusetts Bay (in the northeastern USA). In the first study, peak detections occurred at these sites in late October and late December, providing the new information on winter occurrence of this species. The second study characterised three types of vocalisations that have not been previously described, providing new vocalisations that may be used for passive acoustic monitoring efforts. The Committee **welcomes** this new information, **encourages** this work and looks forward to future results.

9.2.6 North Atlantic right whales

Last year, the Committee had recommended that a comprehensive update on North Atlantic right whales be submitted in 2017 (IWC, 2017b). It was requested that this update include recent findings from ongoing research on distribution, mortality and calving for all range states including Iceland, as well as information on mitigation measures that are occurring in both US and Canadian waters, including measures proposed to mitigate the potential effects of future geological and geophysical seismic surveys.

In lieu of the comprehensive update requested in 2016, the Committee was informed that the US Northeast Fisheries Science Center (NEFSC) had developed a Bayesian state-

space implementation of a Jolly-Seber mark-recapture model that will estimate abundance and survival over the period 1990-2015. The paper detailing this analysis is not yet available. Information was also received concerning an unusually low number of calves ($n=5$) in 2017. Kraus *et al.* (2016) reported that of the diagnosed mortalities of right whales between 2010 and 2015, 85% were attributed to bycatch/entanglements and 15% to ship strikes. This is in contrast to the records from 1970 to 2009 that reported 35% of the diagnosed mortalities were due to bycatch/entanglements and 44% due to ship strikes. Thus, while the combination of shipping lane changes and ship speed reductions appear to have significantly reduced the number of ship strikes on right whales (Laist *et al.*, 2014), modifications of fishing gear have not resulted in an observed decrease in series injuries and mortalities (Pace *et al.*, 2014). Annex G, Appendix 2 provides an updated summary on North Atlantic right whales provided by the NEFSC. See additional discussions on entanglements under Item 13.1.4.

Attention: CG-A, SC, G,

The Committee **reiterates** its previous recommendation for the submission of a comprehensive update on the status of North Atlantic right whales (IWC, 2017b, p.40), which are endangered. It **stresses** the importance of this being submitted to the 2018 meeting of the Committee to enable an initial review of status. This will allow time, if necessary, for explanations or additional analyses to be undertaken before the proposed 2018 Workshop on the Comparative Biology, Health, Status and Future of North Atlantic Right Whales: Insights from Comparisons with other Balaenid Populations. The Committee **agrees** that the Steering Committee (Annex W) should continue its work to plan the workshop.

9.2.7 North Pacific right whales

SC/67a/NH07 summarised North Pacific right whale sightings by Japanese cruises in the western North Pacific since 1982 including recent Japanese and Russian joint cruise data. SC/67a/NH04 summarises recent sightings of western North Pacific right whales mainly in Russian coastal waters. In recent years, an increasing number of sightings have been reported but it is not clear whether these reflect a true increase in abundance or an increase in search effort. The Committee thanked the authors of these papers that responded to a previous Committee recommendation (IWC, 2017b, p.40). The Committee was also pleased to hear of a collaboration between Japanese and American scientists for a basin-wide genetic study.

Attention: SC, G, CG-A

The Committee made several research recommendations that will improve its ability to assess the status of right whales in the North Pacific (for details see Annex I):

- (1) development of an abundance estimate from the Japanese cruises;

- (2) *a comparison of photo-identification catalogues from Japan, Russian, the USA and Canada; and*
- (3) *a genetic comparison of samples from Japan, Russian, the USA and Canada.*

It encourages that this work is completed as soon as possible and the results reported to the Committee.

9.3 New information and workplan for other northern stocks

9.3.1 North Pacific fin whales

9.3.1.1 REVIEW NEW INFORMATION

The Committee welcomed new information on fin whales observed from sighting surveys in the Gulf of Alaska in 2009, 2013 and 2015 (Rone *et al.*, 2017). Overall, the results suggest that fin whales are increasingly common within the former whaling grounds of the Gulf of Alaska, but it is not clear whether the apparent shift to an inshore distribution is real or a function of sighting effort.

The Committee was also pleased to hear of an ongoing analysis of fin whale song patterns in Southern California and the Gulf of California, Mexico, from data collected since 2001, and in recordings collected at low latitudes across central and western Pacific since 2009. The Committee looks forward to receiving a paper detailing the results next year.

Archer at Southwest Fisheries Science Center (NOAA Fisheries) is conducting a global review of fin whale taxonomy with a focus comparing North Pacific fin whales with those in the North Atlantic. It was noted that there are no samples currently available from fin whales in the East China Sea. This is an important data gap since early immunogenetic (Fujino, 1960) and morphological studies (Ichihara, 1957) indicated that these fin whales comprise a separate stock. The Committee looks forward to an update on this genetic study next year.

The Committee **welcomes** this new information, **encourages** this work and looks forward to future results.

9.3.2 Omura's whale

9.3.2.1 REVIEW NEW INFORMATION

Omura's whales were first described as a species by Wada *et al.* (2003) and understanding of the biology of the species has increased considerably since then. To establish the known range and start to assess range-wide threats to Omura's whales, SC/67a/NH12 summarised its distribution based upon reports ($n=116$) verified by the authors. All records were between 35°N and 35°S, with 79% between 23.5°N and 23.5°S. Cerchio reported on new findings on northwest Madagascar Omura's whales. Cerchio *et al.* (2015) reported on the detailed physical description and ecology of a population of Omura's whale off Madagascar; additional information on this population is presented in Annex G, item 7. de Vos (2017) reported on the first documentation of Omura's whale off Sri Lanka.

Attention: G

The Committee welcomes the substantial new information presented on the poorly known Omura's whale. It encourages further work throughout range, particularly in areas where research similar to that being conducted off Madagascar can be conducted. The Madagascar studies have made a substantial contribution to knowledge of this species and the Committee recommends that this work to be continued and expanded.

9.3.3 North Atlantic Bryde's whales

Rosel *et al.* (2016) presented information on Bryde's whales in the Gulf of Mexico where they are the only resident baleen

whale species. They are restricted to a small area, mainly in the northeastern Gulf along the continental shelf. In 2009 (the year before the *Deepwater Horizon* oil spill) the population was estimated to be 33 (CV=1.07), similar to the eastern North Pacific right whale population. Their distribution may have covered the northern and southern Gulf as whaling records report sightings and some takes of 'finback' whales there which were probably Bryde's whales (Reeves *et al.*, 2011). The small population size, restricted range and low genetic diversity places these whales at significant risk of extinction. The northern Gulf is highly-industrialised. Oil and gas operations, commercial fishing, and large ports with significant shipping pose significant threats (Rosel *et al.*, 2016). Several human-induced mortalities are known in recent years. The impact of the 2010 *Deepwater Horizon* oil spill may have resulted in a maximum 22% decline.

The available evidence clearly demonstrates that this recently identified taxon, which ranks as at least a new subspecies and possibly a species. Its precarious conservation status mimics that of the eastern North Pacific right whale population estimated to be about 30 whales. Therefore, these Gulf of Mexico Bryde's whales should also be considered critically endangered.

Attention: CG-A, S

The Committee agrees that the small population of Bryde's whales in the Gulf of Mexico (which ranks as at least a separate subspecies and possibly a species) is the world's most critically endangered baleen whale and there is grave concern for its continued survival. It recommends that US authorities use all available legal and regulatory tools to provide the maximum protection for this population. The necessary actions are detailed in Annex G, item 9 and include: (a) the continued exclusion of seismic surveys from the eastern Gulf of Mexico; (b) the design and conduct of targeted research programmes and restoration projects; (c) measures to reduce the risk of ship strikes and entanglement; and (d) collaborative studies by Mexican and US scientists in the southwestern Gulf where American whalers encountered what were likely Bryde's whales in the late 18th and 19th centuries.

The Committee requests that the Secretariat: (a) transmits the concerns in Annex G, item 9 to the range states; and (b) to IMO with respect to ship strike mitigation.

9.3.4 North Atlantic blue whales

The Committee received new information on studies on blue whale song occurrence in the North Atlantic. There appears to only one blue whale song type in the North Atlantic, excluding Antarctic blue whale songs reported from low latitudes (SC/67a/SH10).

9.3.5 North Atlantic humpback whales

The Committee received information on an Unusual Mortality Event (UME) along the United States Atlantic coast from Maine to North Carolina between 1 January 2016 and 5 May 2017. A total of 43 humpback whale mortalities have been documented. For further discussion see Item 15.7.1 and Annex K.

9.3.6 North Atlantic bowhead whales not subject to aboriginal subsistence whaling

No new information was available to the Committee.

9.3.7 North Pacific bowhead whales not subject to aboriginal subsistence whaling

SC/67a/NH10 presented a mark-recapture abundance estimate for bowhead whales in the western Okhotsk Sea.

Table 13
Work plan for other Northern Hemisphere stocks (excluding those subject to ASW).

Topic	Intersessional period	2018 Annual Meeting (SC/67b)
North Atlantic sei whales	-	Review new information, if any.
North Atlantic right whales	Plan for future Workshop (Annex W)	Review workshop report.
North Pacific right whales	SG-4 on right whale Workshop	Review proposal.
North Pacific fin whales	-	Review new information, if any.
North Pacific blue whales	ICG-18 on North Pacific blue whale assessment	Review ICG recommendations.
Omura's whale	-	Review new information, if any.
North Atlantic Bryde's whales	Intersessional work of the Secretariat with range states and IMO with respect to ship strike mitigation.	Review report for the Secretariat.
North Atlantic blue whales	-	Review new information, if any.
North Atlantic humpback whales	ICG-5 abundance reviews from Icelandic surveys.	Review recommendations from ICG-5 on Icelandic surveys, with ASI.
North Atlantic bowhead	-	Review new information, if any.
North Pacific bowhead	-	-
North Pacific sperm whales	ICG-19 on sperm whale assessment.	Review recommendations.
Indian Ocean sperm whales	ICG-19 on sperm whale assessment.	Review recommendations.

The Committee endorsed the 2016 estimate of 218 whales (CV=0.22) as adequate to provide a general indication of abundance (see Annex Q, item 12.1).

Attention: SC, G

The Committee expressed concern at the small population size of the Okhotsk Sea bowhead whales. It noted that there was some evidence that this population may be in decline. Additional data are required to understand the status of this population. The Committee recommends that fieldwork resume in 2018 and be repeated at least every 2nd year thereafter.

9.3.8 North Pacific sperm whales

Rone *et al.* (2017) provided information on the occurrence and distribution of sperm whales in the northwestern Gulf of Alaska (south and east of Kodiak, including offshore waters), from three joint visual/acoustic surveys conducted in 2013 and 2015. SC/67a/NH06 presented sightings of sperm whales in several coastal areas of Russia.

The Committee agrees that the Intersessional Group on investigating possible ways to assess sperm whales is reappointed under Brownell (Annex W).

9.3.9 Northern Indian Ocean sperm whales

SC/67a/SH13 reported on the known historical and recent unpublished records of sperm whale captures, strandings and sightings from Oman and the United Arab Emirates (UAE). There is a year-round presence of sperm whales off these coasts. The authors suggest that Arabian Sea sperm whales form a discrete population that is likely to be subject to threats associated with increased shipping activity. A threefold increase in container shipping traffic between 2004 and 2014 was noted. A project, initiated by Government of Fujairah and Port of Fujairah in 2017 is the first dedicated field based study on sperm whales in the region and offers the potential to disseminate information on the negative associations of whales and ships to the 14,000 vessels that visit the port every year.

Attention: SC, G

The Committee encourages analysis of genetic samples from Northern Indian Ocean sperm whales to better assess the level of differentiation and diversity of this poorly understood population.

9.3.10 Work plan

The work plan is given in Table 13.

9.4 New information and work plan for other Southern stocks

9.4.1 Southern Hemisphere sei whales

No new information was provided this year.

9.4.2 Southern Hemisphere humpback whales

9.4.2.1 BREEDING STOCK D

The assessment of the breeding stocks D (West Australia), E1 (East Australia) and Oceania was completed in 2014 (IWC, 2015d), but there were substantial associated problems in obtaining a reliable estimate of absolute abundance for breeding stock D. The available survey data for this breeding stock have presented two challenges: (1) there are few data to inform a correction for surface availability; and (2) there is a potential inconsistency between observer protocols and the Distance-based approach employed to estimate abundance. See Annex H (IWC, 2016h; 2017e) for a detailed discussion of these issues. The provision of a reliable abundance estimate for Breeding Stock D is also important for stock assessments off East Australia and Oceania, since all three populations have been co-analysed in a three-stock model framework, to accommodate overlaps in high latitude catch allocation (IWC, 2015d). This year the Committee agreed that there was no strong case to further examine past survey data for BSD, because recent efforts by two experienced modellers could not improve on previous analyses of abundance. Rather efforts should focus on designing and implementing a new 'survey' (perhaps using new approaches, as provided by drones, for example). Prior to implementation, an assessment of the feasibility of such a 'survey', focusing in particular on the study conducted by du Fresne *et al.* (2014), is required.

Attention: SC, G, CG-R

*Obtaining a reliable estimate of absolute abundance for humpback whale Breeding Stock D (west Australia) is a priority for any future in-depth assessment. The Committee recommends an evaluation of abundance survey feasibility be carried out for this population, focusing in particular on the study conducted by du Fresne *et al.* (2014), with a view to implementing a new survey of this population in the future.*

9.4.2.2 BREEDING STOCK G

As discussed for blue whales above, an IWC photo-identification Workshop was held in Chile in 2016 (SC/67a/Rep03, see Item 9.2.2.5 for details). The Workshop participants agreed a strategy for combining photo-identification catalogues from the Central and Eastern South

Table 14
Work plan for Southern Hemisphere humpback whales.

Item	Intersessional period	2018 Annual Meeting (SC/67b)
Ongoing work	Re-analysis of sightings data reported by duFresne to assess best location/approach for new sightings surveys off West Australia (BSD).	Report
	Analysis of high and low latitude stock mixing proportions in the southeastern Indian Ocean and southeast Pacific using genetic data.	Report

Pacific and the Antarctic Peninsula. A compilation of existing photo-identification data was made as part of an existing initiative (Humpback Whale Catalogue Sharing Initiative, HWCSI) to investigate connectivity among various areas in both breeding and feeding grounds of BSG (SC/67a/Rep03, table 4). All participants who were part of the HWCSI agreed to collaborate on developing new population estimates of abundance for BSG humpback whales, via the following process: (1) development of a data sharing agreement; (2) reconciliation of regional catalogues; (3) matching of photo-identification data (e.g. use of existing software); (4) description of quality control procedures; (5) development of a framework to compute new abundance estimates.

SC/67a/PH03 summarised work conducted in the past year by the Antarctic Humpback Whale Catalogue (detailed in Annex S). Olson noted the development of an automated matching system by the Happywhale project (SC/67a/PH02), which is collaborating with the Antarctic catalogue, potentially represents a major advance for catalogue matching, which can offer the possibility of rapid comparisons to facilitate broad investigations involving multiple catalogues across a wide area.

9.4.2.3 FEEDING GROUNDS

SC/67a/ASI07 and SC/67a/SP05 report sightings of 253 groups of humpback whales (516 animals) during the NEWREP-A survey (a dedicated sightings survey in Area V-West) and 534 groups (1,017 animals) during the Antarctic minke whale sampling survey (conducted in Area III-East and Area IV). A total of 30 individual humpbacks were photo-identified, and 11 were biopsied (SC/67a/ASI07: seven individuals and SC/67a/SP05: four individuals).

The Committee received an update about the population structure of breeding stock A, B, C and Arabian Sea humpback whales, which is now published (Kershaw *et al.*, 2017). The paper contains some increased sample sizes and new analyses that overall reinforce previous conclusions discussed in Annex H (IWC, 2008b) and subsequent Scientific Committee reports.

9.4.2.4 WORK PLAN

The work plan is given in Table 14.

9.4.3 Southern Hemisphere right whales not the subject of CMPstem

This year, the Committee was provided with updates on whale trends and distribution for three southern right whale calving grounds: off South Africa; south and southwest Australia; and in the New Zealand sub-Antarctic. In 2016, the Committee agreed to re-examine the estimates of historical population size of southern right whales (IWC, 2017b, p.38). This year, the Committee initiated a review of available catch data for southern right whales (with a focus on pre-modern whaling catches) to decide if any substantive new information is available to assist with assessments of stock status for this species. This review will continue (see work plan below).

9.4.3.1 SOUTH AFRICA

SC/67a/SH05 provided the results of the 2016 survey of southern right whales along the coast of South Africa, part of the extensive long-term monitoring programme. Only 55 cow-calf pairs and 9 unaccompanied whales were sighted during the entire survey. This is the lowest sighting density of the last 25 years and about 10-15% of the expected total based on surveys up to 2014. This marked decline has been recorded in the last few years, with unaccompanied adults declining since 2010 and cow-calf pairs since 2015. A subsequent analysis of seasonal presence patterns does not suggest that there has been a shift in coastal longshore distribution, since sightings have been reduced at all locations along the South African coast. It suggests that animals have remained offshore and not returned to the coast to calve in 2015 and 2016.

Attention: SC, G, C-A, CG-A

*The Committee is **concerned** that the future of this exemplary long-term monitoring programme of right whales in South African waters remains uncertain. The Committee:*

- (1) **strongly recommends** continuation of the survey and the use of IWC funds to allow the survey to take place as a one-off extraordinary measure (see item 6.1.3 of Annex H);
- (2) **requests** the Commission to **urge** South Africa to do all it can to ensure the long-term future of this vital monitoring programme; and
- (3) **encourages** South African scientists to investigate the offshore movements and locations of southern right whales with future surveys.

9.4.3.2 AUSTRALIA

The Committee was informed about the latest of a series of aerial surveys conducted in South and West Australia in late August 2016. Counts were obtained of 628 individuals including 228 calves of the year. These counts were higher than the very low count of 97 individuals in 2015, but still below the recent trend line. Regression analysis from 1993-2016 gives increase rates for all animals of 5.55% (95% CI 3.78-7.86), and for cow/calf pairs 6.01% (3.49-8.59) per annum. Work at the Head of the Bight (South Australia) now comprises 26 years of cliff-based counts and photo-identifications; southern right whales are particularly concentrated in this location. The estimated increase rate of whales sighted there from 1991-2016 is 5.5% (95% CI=0.03) per annum. There is no evidence for a population increase in calving females at Logan's beach, southeastern Australia, where they are most concentrated.

Attention: SC, G, CC, CG-A

With respect to right whales in southeast Australia, the Committee:

- (1) **expresses concern** that abundance remains low despite this area having been a significant historic calving ground; and

Table 15
Workplan for southern right whales not subject to CMPs.

Item	Intersessional period	2018 meeting
All	Update available data regarding pre-modern catches in the Southern Hemisphere.	Report
South Africa	Conduct 2017 right whale aerial survey off South Africa to collect photo-identification and count whales.	Report

(2) *recommends that an assessment of the likely effects of fish farms and other developments in hindering population recovery in this region.*

9.4.3.3 NEW ZEALAND

Torres *et al.* (2016) surveyed southern right whales around the sub-Antarctic Campbell Island in the austral winter of 2014, using a variety of techniques. Primary findings suggest that this area is part of the broader New Zealand southern right whale population, and primarily used by sub-adults who forage in the sub-Antarctic. SC/67a/SH08 presented calving rate estimates for this population from the Auckland Islands over 2006 to 2013. Calving interval was estimated at 3.31 years (95% CI 3.06-3.57) and juveniles and adult survival at 0.98 (SE 0.07). A stochastic model using these values and accounting for parameter uncertainty and year-to-year variability, estimates population growth at 4.8% (95% CI 2.4%-6.4%).

9.4.3.4 WORK PLAN

The work plan is given in Table 15.

9.4.4 Antarctic minke whales

SC/67a/ASI07 and SC/67a/SP05 report sightings of Antarctic minke whales during the NEWREP-A survey (a dedicated sightings survey in Area V-West) and the Antarctic minke whale sampling survey (conducted in Area III-East and Area IV). A total of 481 groups of Antarctic minke whales (873 individuals) were sighted. Three satellite tags were successfully deployed on Antarctic minke whales. A feasibility study on biopsy sampling Antarctic minke whales was conducted and 15 biopsy samples were collected (see Appendix 1, SC/67a/ASI07).

9.4.5 Dwarf minke whales

No new information was provided this year.

9.4.6 Southern Hemisphere Bryde's whales

Pastene *et al.* (2015) summarised a genetic analysis to investigate the species identity and population genetic structure of South American Bryde's whales using samples collected off Chile and Brazil. Phylogenetic results identified the Bryde's whales of South America as *Balaenoptera brydei*. No significant genetic differentiation was found between Chilean and Peruvian Bryde's whales, but significant differences were found between western South Atlantic (Brazil) and eastern South Pacific (Peru and Chile) Bryde's whales, consistent with the notion that *B. brydei* is not distributed south of ~40°S on both sides of South America.

SC/67a/SH15 presented results from 2000-17 surveys and photo-identifications of Bryde's whales along the Ecuador, Peruvian and Panama coasts, spanning 573 marine mammal surveys. During these, 81 groups of Bryde's whales (102 individuals) were recorded and 64 individuals were photo-identified. Three were resighted; one of these was between Ecuador and Peru.

Attention: SC, G

Bryde's whales in the South American waters are poorly understood. The Committee **welcomes** these new contributions (Pastene *et al.*, 2015 and SC/67a/SH15). It **encourages** genetic studies to confirm the identity of Bryde's whales in Ecuadorean and Peruvian waters, given the possible presence of two Bryde's whale forms in the region (*B. b. edeni* and *B. b. brydei*).

9.4.7 Southern Hemisphere sperm whales

SC/67a/SH12 reported detections of sperm whales from visual observations and a towed array of hydrophones over 2014-17 in sub-Antarctic and Antarctic waters of the northwest Antarctic Peninsula. The study increases the knowledge of the status of sperm whales in the Southern Ocean and emphasises the importance of acoustics to detect populations. Details can be found in Annex H, item 8.

10. STOCKS THAT ARE OR HAVE BEEN SUGGESTED TO BE THE SUBJECT OF CONSERVATION MANAGEMENT PLANS (CMP)

This item covers stocks (with a focus on progress with scientific work and information) that are either: (1) the subject of existing CMPs; or (2) are high priority candidates for a CMP. It also considers stocks that have previously been considered as potential CMPs, recognising that the Commission has stressed the need for Range States to support any IWC CMPs.

10.1 Stocks with existing CMPs

10.1.1 SE Pacific southern right whales

10.1.1.1 NEW INFORMATION

The Committee received information on the entanglement and mortality of a right whale from this critically endangered population in southern Chile in February 2017 (SC/67a/HIM14). This is discussed further in Annex J, item 2.1. See also Items 10.1.1.2 and 13.1.3.

SC/67a/CMP13 reported on recent progress on the development of acoustic monitoring of this population, a project which was supported by the Scientific Committee in 2016. The use of moored hydrophones to investigate seasonal distribution of animals along the coasts of Chile and Peru is proposed and this may potentially provide information on the location of breeding grounds using reproductive vocalisations. The information the project may provide is central to the implementation of the long-term monitoring programme envisioned by the CMP. The Committee noted that the primary goal is to identify breeding areas for this population and the secondary goal is to use acoustic recordings to inform vessel-survey effort.

10.1.1.2 PROGRESS WITH THE CMP

SC/67a/CMP09 reported on the first international coordination meeting to implement the eastern south Pacific southern right whale CMP which was held 7-8 March 2017 in Santiago, Chile. During the meeting, a Memorandum of Understanding between Peru and Chile to formalise co-operation on the CMP was agreed, a Bi-National Steering Committee for 2017-18 was established, priority actions

were reviewed and an implementation strategy was proposed. Short-term priority rangewide actions included the identification of a breeding area; increased photo-identification and genetic data; increased capacity regarding entanglement response and increased species identification capacity. A second meeting is scheduled for March-April 2018 in Peru.

Attention: CC

*The Committee **welcomes** the progress being made in implementing the SE Pacific southern right whale CMP for this critically endangered population. The Committee:*

- (1) **commends** the scientific work being undertaken and the international co-operation this entails and it **looks forward** to receiving the results of the acoustic studies;*
 - (2) expresses **concern** regarding the entanglement mortality reported in SC/67a/HIM14 and **reiterates** that anthropogenic mortality should be kept to a minimum; and*
 - (3) **welcomes** the information that increased entanglement response capacity is a priority action within the CMP.*
-

10.1.2 Southwest Atlantic southern right whales

10.1.2.1 NEW INFORMATION

SC/67a/CMP01 reported on aerial surveys conducted to estimate the relative abundance of southern right whales from the mouth of the Chubut River (42°30') to Puerto Lobos (42°), with long-term efforts to document temporal changes in distribution by age and sex classes. The authors concluded that data support the increasing trend in abundance for southern right whales in the Península Valdés nursing area, while the rate of increase is decreasing. Additionally, it was noted that the rate of increase for calves is smaller than previously reported and that the numbers of solitary individuals and breeding groups are no longer increasing, suggesting that whales are relocating within and out of the Península Valdés area. The authors commented that once whales reach a density of 2.5-3.0 per km² they begin to relocate along the coast in areas presumed to be of poorer habitat.

SC/67a/CMP06 reported on the series of aerial surveys of this population undertaken since 2007 in San Matías Gulf, Argentina. Whales were mainly found near the northwest coast of the San Matías Gulf but some changes in distribution have been noted. In discussion, it was noted that although the kelp gull population in the San Matías Gulf has been increasing, gull harassment has not been recorded in areas outside Península Valdés.

SC/67a/CMP08 provided information on opportunistic sightings of southern right whales on the Patagonian shelf and shelf break off Argentina during austral summer was presented, along with satellite-telemetry data from whales tagged off Península Valdés following the Committee's recommendation last year (IWC, 2017b). Encounter rates in the Patagonian shelf between 42°S to 46°S were substantially higher than south of 46°S and in the shelf break, which is consistent with satellite-telemetry data and indicated a probable feeding ground. In discussion, it was noted that traditionally, catalogues of this species involve aerial photographs using aerial surveys. The authors noted that photographs had been taken from the vessel and they welcomed future discussions on how to reconcile these with aerial photographs.

10.1.2.2 PROGRESS WITH THE CMP

The Committee was updated on actions developed during June 2016-April 2017 in Argentina for the southern right whale CMP for the SW Atlantic (see Annex O, Appendix

2). Activities were proposed and carried out to: (1) ensure long-term monitoring of abundance, trends and biological parameters; (2) enhance existing stranding networks including the capacity for undertaking post-mortem examinations; (3) research movements, migration routes and the location of feeding grounds; (4) develop and implement a strategy to minimise kelp gull harassment; and (5) develop a strategy to increase public awareness.

The report highlighted telemetry studies undertaken to address activity (3) regarding movements, migration routes and the location of feeding grounds, for whales wintering near Península Valdés. Between 2014-16 ten location-only and six archival transdermal satellite tags were deployed on individuals of both sexes and different maturity/reproductive stages. Data showed substantial individual and yearly variation and provided new insights regarding habitat use and the potential for connections with additional habitat along the coast of Argentina during the breeding and calving season. Future studies are planned.

Attention: CC, CG-R

*The Committee **welcomes** the progress being made in implementing the SW Atlantic southern right whale CMP for this endangered population. It **acknowledges** the importance of the CMP and **encourages** the continued cooperation and collaboration between all research groups and stakeholders to build the knowledge needed to inform mitigation action for this population. In particular, the Committee **recommends**:*

- (1) continued exploration of methods to encounter and observe live calves prior to death and to gather individual health information on both cows and live and recently deceased calves;*
- (2) increased efforts to elucidate the differences between nutritional stress imposed on calves caused by disruption of nursing behaviour and other types of physiological stress resulting from open wounds, energetic expenditure related to avoidance behaviours and other stressors experienced by whales;*
- (3) continuation of the work to understand habitat-use, dispersal and migratory patterns at different scales, in connection to overall population demography;*
- (4) continuation of long-term monitoring studies including photo-identification and aerial surveys;*
- (5) increased effort to obtain biopsy samples given the few that are now available; and*
- (6) increased use of suitable platforms of opportunity for data collection.*

*The Committee **reiterates** previous recommendations to continue development, implementation and support for the Action Plan to mitigate kelp gull-Southern right whale interactions, recognising the efforts made by the local government of Chubut (IWC, 2016j).*

10.1.3 North Pacific gray whales

10.1.3.1 THE RANGEWIDE ASSESSMENT

The fourth Rangewide Workshop on the Population Structure and Status of North Pacific Gray Whales was held from 27-29 April 2017 in La Jolla, California (SC/67a/Rep04). This series of workshops originated in the need to consider new telemetry and photo-identification data that suggested that the 'traditional' ideas surrounding two separate populations in the North Pacific ('eastern' and 'western') needed re-evaluation. The present Workshop's primary focus was to review new information in the light of the stock structure hypotheses developed at previous workshops. Updated information on the analyses of whole genome sequences and SNPs

and news that additional studies were ongoing to compare samples from Sakhalin Island and Mexico were presented. New photo-identification data for PCFG (Pacific Coastal Feeding Group) whales was presented, and the Workshop reviewed new information on abundance and on mixing rates for PCFG whales for use in the modelling framework. The formal review of the abundance estimates presented at the Workshop was referred to SC/67a. An important component of the Workshop discussions was related to how to develop and include time series of bycatch (and ship strike) data in the assessment. Based upon the new information, the Workshop agreed to take four stock structure hypotheses forward.

Punt summarised the progress made on the modelling aspects of the work plan since the Workshop. He noted that the model specifications and associated code had been updated to treat entanglements and ship strikes separately and to calculate survival rates for PCFG animals separately for animals that joined the population before and after 1999.

There was some discussion of the work needed to finalise the assessment at the next meeting. As requested, the Committee reviewed the new abundance estimates presented at the Workshop. These were endorsed and accepted for use in modelling (Item 12.1).

In discussion of the approach used to estimate bycatches and ship strikes, it was noted that the mixing rates used in the model were informed by data from northwest Washington, and that these data do not represent a random sample of the west coast. It was suggested that photo-identification and telemetry data could assist in providing some inferences on residence time. Recognising the difficulties of modelling bycatch and the associated uncertainty, the Committee agreed that the three scenarios agreed upon during the Workshop represented a reasonable way forward.

In recent years as part of the rangewide review, the Committee has recommended and encouraged the sharing of gray whale samples to better understand the stock structure of North Pacific gray whales. Japan kindly indicated its willingness to share samples collected by its scientists if a formal request was submitted. A formal request from USA to Japan through the IWC Data Availability Group is now being reviewed by Japan. The Committee noted that such cooperation and collaboration is also facilitated through the Memorandum of Cooperation (MoC) 'concerning conservation measures for the Western Gray Whale population' among the participating range states. The Committee looks forward to receiving papers detailing analyses that incorporate these data. Recommendations related to the CMP can be found under Item 10.1.3.3.

Attention: SC, CC

*The Committee **recognises** the importance of the rangewide review of the status of North Pacific gray whales to the updating of the CMP and to the provision of advice on aboriginal subsistence whaling. The Committee:*

- (1) ***thinks** the Convenors and participants of the rangewide Workshop on North Pacific gray whales, welcomes the progress made and **endorses** the report of the Workshop and its recommendations; and*
 - (2) ***recommends** that a 5th workshop be undertaken with a goal of completing the rangewide review at the 2018 Annual Meeting.*
-

10.1.3.2 REGIONAL STUDIES

See Item 13.1.2 for information on known sources of data on non-hunting, human-caused injuries and mortalities of

gray whales in the North Pacific from stranding networks (SC/67a/HIM06), and gray whale entanglements in the western North Pacific (SC/67a/HIM17).

10.1.3.2.1 RUSSIA

The Committee has had a long-standing co-operation with the IUCN Western Gray Whale Advisory Panel (WGWAP) and the CMP is a joint IUCN/IWC CMP for western gray whales. A progress report on this work can be found in Annex O, Appendix 5. Since 2016, the Panel's Noise Task Force met twice and focussed primarily on follow-up work related to monitoring and mitigation during Sakhalin Energy's 2015 seismic survey off Sakhalin Island and development of a monitoring and mitigation plan for another large-scale seismic survey in 2018.

The Committee reviewed findings from 2016 field studies conducted by the Russia Gray Whale Project (formerly the Russia-US Programme) on gray whales feeding near Piltun Lagoon in the western North Pacific off Sakhalin Island (SC/67a/NH03). This research programme has been ongoing since 1997 and represents the 20+ year time series that has served as the foundation for the assessment of the population.

There was a general discussion of the information from the Sakhalin and Kamchatka areas including the results of SC/67a/NH11 (for a full discussion of that paper see Item 12). Additional studies off Kamchatka will assist in better understanding the relationship between whales from Sakhalin and Kamchatka.

Attention: SC, S

*The Committee **commends** the ongoing work on gray whales in the Russian Federation. The Committee:*

- (1) ***recommends** that studies in the Kamchatka area resume as they can provide valuable information for analyses regarding stock structure and status;*
 - (2) ***recognises** the importance of the work of the Russian Gray Whale Project to the assessment of the animals feeding off Sakhalin and **recommends** that it continues;*
 - (3) *in light of previous recommendations that the two groups working off Sakhalin (the Russia Gray Whale Project and the Joint Programme of Sakhalin Energy and ENL) work together to develop a single, publicly available photo-identification catalogue, **encourages** Donovan to work with the various data holders to facilitate the development of a single, reconciled catalogue and database; and*
 - (4) ***encourages** the Russian Federation to continue to collect photo-identification data (including from Chukotka) and recommends that any technical obstacles (e.g. lack of small boats) be overcome to collect biopsy samples from areas where there are few samples for rangewide genetic analyses.*
-

10.1.3.2.2 JAPAN

The recent status of conservation and research on gray whales in Japan was reported in SC/67a/CMP02. During May 2016-April 2017, no anthropogenic mortality has been reported from the adjacent waters off Japan, while two opportunistic sightings of gray whales were made in Tokyo Bay on 22 February and 18-23 April.

Sightings from Izu archipelago and Shizuoka prefecture from 2015 to 2016 were identified as the same individual. In discussion, an additional report (sourced on Facebook) of a gray whale seen and reported photographed off Aogashima Island, Japan, was noted. Whilst the photograph was clearly

of a gray whale, the Committee noted that confirmation of the location can be more problematic in such cases unless the original source is known.

Attention: CG-A

*The Committee **welcomes** the provision of information from Japan on gray whales, especially that of the sightings off Japan's coast, and **encourages** researchers to continue to collect sighting information on this species off the coast of Japan which may also provide information as to what age classes are found there.*

10.1.3.2.3 EAST CHINA SEA

Gagnon (2016) reported on recent acoustic detections made by the US Navy of what have been tentatively classified as gray whales in the East China Sea. These detections have been made on numerous occasions over the last six years (2011-16) using towed hydrophone arrays in mobile, high-precision acoustic monitoring systems. These calls have been detected annually in relatively shallow waters between September and March. The whales remain in the same general areas for weeks at a time, but have generally been observed to be moving south in the autumn and north in the spring. These acoustic data have not yet been accompanied by visual observations to confirm species identification. The author expressed his willingness to collaborate with biologists familiar with gray whale calls, with the goal of verifying species identification. If it is determined with high probability that these are gray whale calls, it will be important to develop a dedicated field-research effort to verify species identification with visual observations, photographs and biopsies.

Attention: CC, CG-R, G

The acoustic information provided in Gagnon (2016) is potentially of great importance to our understanding of population structure and breeding grounds of gray whales in the western North Pacific. The Committee:

- (1) **welcomes** the information regarding acoustic detections of possible gray whales in the East China Sea and expresses its **appreciation** to the author and the US Navy for bringing it forward;*
 - (2) **endorses** the recommendation from the Workshop that every effort be made to determine with high probability whether or not the calls are from gray whales and **encourages** the US Authorities to assist in this process; and*
 - (3) if they are gray whale calls, **recommends** that a dedicated field effort is planned and executed to observe, photograph and biopsy the animals.*
-

10.1.3.2.4 MEXICO

The results of gray whale research conducted in the breeding lagoon of San Ignacio and Bahía Magdalena complex were presented in SC/67a/CMP11. Overall, the number of gray whales and their seasonal occupation in the lagoon were slightly lower than seen in previous years, and the authors thought that this was probably due to cooler sea-surface temperatures. Conversely, the number of single animals observed in the Bahía Magdalena complex was notably higher in 2017.

An update and overview of results from shore-based surveys of northbound eastern North Pacific gray whale calf production was presented. Calf production has been particularly high during the past 5 years with an estimated

total production of more than 6,500 calves during this period. The 2016 estimate of calf production (1,351) is about 5% of the reported total abundance (26,960) for the eastern North Pacific population in 2016. The midpoint of the migration is now occurring about a week later than it did in the mid-1990s.

Attention: G, CG-R

*The Committee **welcomes** the results of the long-term studies of gray whales in the wintering areas in the lagoons of Mexico and the northbound shore-based migration counts. It **reiterates** the importance of these long-term studies and **recommends** that they continue, particularly for analyses of abundance and calf production in conjunction with environmental factors. Such analyses can provide general as well as specific insights on the population dynamics of whales in response to environmental factors.*

10.1.3.3 PROGRESS WITH THE CMP

The Committee **recognises** the importance of the IUCN/IWC CMP to the conservation of gray whales. It **reiterates** its willingness to assist in scientific aspects of the development and updating of the CMP. As referred to above, the forthcoming rangewide Workshop will provide a major component of the scientific input to the CMP.

Attention: CC, C-R

The Committee is willing to assist in the development and updating of the IUCN/IWC CMP for western gray whales. Accordingly, the Committee:

- (1) **reiterates** its support for the stakeholder workshop planned to occur before the 2018 Commission meeting and **recognises** that the results of the Workshop are important for the updating of the CMP;*
 - (2) to facilitate the stakeholder workshop, **recommends** that a small drafting group meeting be held to update the scientific aspects of the CMP;*
 - (3) **encourages** the range states of other CMPs to follow the positive example of the Memorandum of Co-operation signed by Japan, Russian Federation, USA, Korea and Mexico.*
-

10.1.4 Franciscana

10.1.4.1 NEW INFORMATION

SC/67a/SM04 provided a preliminary report on an assessment of the fisheries characteristics in two Franciscana Management Areas (Ia and Ib) thought to have the smallest abundance, which are geographically disjoint from all other areas and likely subject to high levels of bycatch. Of the 76 fishers interviewed, 54 claimed to know of franciscana, but only nine could accurately identify them based on illustrations.

In discussion, it was noted that, typically, most fishers can identify franciscana in the field and that the improper identification of the species from photographs may have been an artefact of the photographs that were used or that fishers chose to provide false answers in the interest of securing access to fishing within these areas.

10.1.4.2 PROGRESS WITH THE CMP

SC/67a/SM12 reported on the beginning of the implementation of the franciscana CMP. A Steering Committee has been initiated including representatives from Argentina, Brazil, and Uruguay, IWC Conservation Committee Chair, IWC Scientific Committee Chair, IWC CMP Standing working group Chair and IWC Head of Science. Iñíguez is the co-ordinator. The two main objectives of the CMP are to protect franciscana habitat

and to minimise anthropogenic threats (e.g. bycatch) to the population. A number of priority actions have been developed to meet those objectives.

The Committee **welcomed** news that Brazil will be providing one million dollars for research and conservation work according to its National Action Plan for Franciscana in management areas II and III.

Attention: CC, SC

The franciscana CMP is the first for a small cetacean species and the Committee welcomes the development of more small cetacean CMPs as appropriate. The Committee:

- (1) *commends the breadth of work that has been undertaken towards franciscana research and conservation;*
 - (2) *commends efforts being made to coordinate research across international boundaries;*
 - (3) **recommends** *that this collaboration continue and expands, whilst recognising the difficulties involved;*
 - (4) **recommends** *that a review of franciscana be conducted as soon as possible that incorporates new estimates of franciscana mortality (as previously recommended by the Committee); and*
 - (5) **recommends** *that the use of pingers be further investigated in the range of the coastal environment of this species.*
-

10.2 Progress with identified priorities

10.2.1 Humpback whales in the northern Indian Ocean including the Arabian Sea

10.2.1.1 NEW INFORMATION

The Committee was pleased to receive several papers reviewing information from around the region, including humpback whales in the Persian Gulf (SC/67a/CMP14), baleen whale records from Pakistan including the results from a promising programme implemented by WWF-Pakistan to train captains and crew members of tuna gillnet vessels to document sightings, entanglements and bycatch (SC/67a/CMP05); and baleen whale records from the Indian coast of the Arabian Sea. Details can be found in Annex O, item 3.1.1.

SC/67a/CMP12 reported on Oman-based satellite telemetry studies initiated in 2014. Telemetry data from nine whales showed whales spending 35% of their time in the Gulf of Masirah and 27% in Hallaniyat Bay. The authors updated the Committee on the increasing threats to areas of critical habitat and high cetacean biodiversity, including increased numbers of gillnet fishing vessels in Hallaniyat Bay. Shipping traffic in the Gulf of Masirah is expected to increase in baleen whale the next five years due to new investment and the further development of the port of Duqm and associated industrial area. The port of Duqm has supported and is currently supporting a management and mitigation plan, but continued effort is required to ensure that research informs such plans. The authors noted that recent stranding records confirm the importance of addressing bycatch in this area.

SC/67a/CMP15 reported on the use of an Ensemble Ecological Niche Modelling approach to predict humpback whale habitat throughout the Arabian Sea using vessel-sightings data and satellite-telemetry data from Oman. Model predictions fit well with historical locations of Soviet whale captures from the 1960s and co-occur with areas of high vessel-traffic density in the Northern Indian Ocean. Telemetry data provided the most robust source of data, but models could be improved upon by incorporating data from other range states.

The progress of the Arabian Sea Whale Network (ASWN), an informal collaboration between researchers and conservation bodies working toward better understanding and

the conservation of whales in the Arabian Sea, was presented in SC/67a/CMP07rev1. The paper summarised the 12 reports prepared for this Committee meeting by ASWN members and colleagues working in the region, including contributions from Oman, India, Pakistan, Sri Lanka and the Persian Gulf, demonstrating concrete progress toward increased awareness, data collection and capacity building in the region. Most recommendations (see IWC, 2016h, p.280) related to improved communication, awareness raising and capacity building have progressed adequately, but the raising of funds for shared regional-level projects has been challenging and limited to funds granted by the IWC and WWF. Co-funding from WWF and the Environment Society of Oman enabled EWS-WWF to sign a contract with Flukebook¹⁰ allowing photo-identification data from Oman to be included in the online platform starting in June 2017. A fully functioning data platform with expanded capacity to archive and analyse sightings, strandings and genetic data, as well as photo-identification data should be ready to share by next year.

Attention: SC, G, C-R, CC

The Committee welcomes the new information from the region on this critically endangered population and commends the researchers for their initiative, who are sometimes working in difficult conditions with a low level of funding. In light of the information presented, the Committee:

- (1) **recommends** *that additional systematic research be conducted within the Persian Gulf area to characterise the residency of whales reported in this area;*
 - (2) **commends** *the initiation of the 2012 observer programme in Pakistani waters, work which produced considerable data where previously there was none - and recommends that it continue and be replicated, where possible, throughout the region, especially where it is not feasible to conduct systematic cetacean surveys;*
 - (3) **welcomes** *the new records of humpbacks from the Indian coast of the Arabian Sea, recognising the importance of the research efforts - and recommends that further emphasis be placed on using acoustics to document cetaceans in these and other areas of the region;*
 - (4) **recommends** *that all entanglements be reported to the IWC and ship strikes entered into the IWC database;*
 - (5) **recommends** *that an enhanced effort be made to archive any tissue samples that are or become available in a central repository;*
 - (6) **expresses its appreciation to the Government of India, Maharashtra Forest Department and the local office of the United Nations Development Programme for their support of the work reported in SC/67a/CMP03;**
 - (7) **recommends** *that the satellite-telemetry work in Oman (SC/67a/CMP12) as much remains to be learned about whales in this area and where sources of potential anthropogenic mortality appear to be increasing;*
 - (8) **recommends** *that the collaborative efforts with industry to minimise risks to cetaceans in the port of Duqm be adopted in other ports and harbours in the region; and*
 - (9) **welcomes** *the extensive ensemble niche modelling work (SC/67a/CMP15) to predict humpback whale habitat throughout the Arabian Sea and recommends that the modelling be expanded to: (a) include data reported from Pakistan and India and be used to inform future research efforts; and (b) be used to examine potential threats from shipping using AIS/Vessel traffic data and fishing using any available data on fishing effort in the region.*
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¹⁰<http://www.flukebook.org/>.

10.2.1.2 PROGRESS WITH INTERNATIONAL CO-OPERATION AND REGIONAL MEASURES SUCH AS CMPS

SC/67a/CMP07rev1 summarised the progress of the Arabian Sea Whale Network (ASWN), an informal collaboration between researchers and conservation bodies. Progress was also made towards the implementation of a regional online data platform, funded under IWC SH3B, where a contract between the IWC and the Emirates Wildlife Society (EWS)-WWF, who will host the project, was signed in February 2017. See also Item 10.2.1.1.

The Committee was provided an update from the intersessional correspondence group assigned to consider proposing the Arabian Sea as candidate for a CMP. The group had been unable to secure endorsement from range state members and thus it initiated the ASWN to build momentum towards the development of regional conservation initiatives in the including a CMP. The IWC Scientific and Conservation Committees recently reiterated the value of an Arabian Sea CMP for this species (IWC, 2017b).

The Committee was informed that CMS has introduced a new mechanism with which to designate the status of species or populations as 'Concerted Action'. Efforts are underway to draft and complete a proposal to obtain this recognition for Arabian Sea humpback whales during the next CoP of CMS parties in October 2017. It would be valuable if the IWC collaborates on this effort, following the model of the joint IWC/IUCN CMP for western gray whales. Efforts are also underway to obtain support from the relevant range states for this initiative, which, as a joint IWC-CMS initiative, would include all Arabian Sea humpback whale range states.

Attention: C-A, S, SWG-CMP, CC

The Committee reiterates its serious concern about the status of the critically endangered Arabian Sea humpback whale population and the anthropogenic threats it faces. It stresses the value of regional initiatives and encourages range states to explore the possibility of future collaboration. The Committee therefore:

- (1) **commends** the work performed by researchers in the Arabian Sea, noting the expansion of research topics and recognising the difficulty of establishing and maintaining such a network, which it recognises as important for the conservation and management of this highly endangered humpback population;
 - (2) **encourages** range states to explore the possibility of future collaboration either through a CMP and/or CMS 'Concerted Action' and encourages IWC co-operation in these initiatives.
 - (3) **recommends** further development of the online regional data archiving platform to facilitate regional analyses and the comparison of data between study sites and the identification of locations conducive to passive acoustic monitoring to inform directed effort for documenting basin-wide distributions;
 - (4) **recommends** that the IWC Secretariat communicate the Committee's endorsement of the online data archiving platform to the relevant range states;
 - (5) **reiterates** last year's recommendation to collect tissue sample where possible to facilitate studies on the genetic identity of Arabian Sea humpbacks; and
 - (6) **recommends** continuation and expansion of all work that improves the knowledge of Arabian Sea humpback whales to inform conservation and mitigation measures.
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10.3 Stocks previously suggested as potential CMPs

No new information was provided for the following populations: (1) blue whales from the northern Indian

Ocean; (2) sperm whales in the Mediterranean; and (3) boto in Amazonia. Donovan reported that efforts are underway to develop a CMP for fin whales in the Mediterranean by ACCOBAMS following the IWC model (and see Item 4.5.4).

10.4 Work plan

The work plan is shown in Table 16.

11. STOCK DEFINITION AND DNA TESTING

This agenda item merges two previously separate sub-groups (the Working Group on Stock Definition and the Working Group on DNA). The new Working Group on Stock Definition and DNA Testing (see Annex I) assessed genetic methods used for species, stock and individual identification, including matters associated with the maintenance of DNA registers (see Item 11.1); continued to develop and update guidelines for preparation and analysis of genetic data within the IWC context (see Item 11.2); and provided the Committee with feedback and recommendations concerning stock structure related methods and analyses, including those relevant to other sub-committees (see Item 11.3).

11.1 DNA testing

The DNA item has been considered since 2000 in response to IWC Resolution 1999-8 (IWC, 2000).

11.1.1 Genetic methods for species, stock and individual identification

This year, several papers were presented that used Single Nucleotide Polymorphisms (SNPs) to look at population or species-level questions of relevance to the Committee. Two of these papers used available whole genome data to design panels to genotype a moderate number of SNPs, most or all of which were chosen from genes known to be under selection, for use with population-level questions (e.g. stock structure, relatedness) in gray whales and bowhead whales, respectively (SC/67a/SDDNA02 and SC/67a/SDDNA03). A third paper used whole genome data to design a panel consisting of a small number of highly diagnostic SNPs to detect hybrid and back-crossed individuals across minke whale species (Malde *et al.*, 2017). These three papers highlighted the value of having whole genome sequence data available, which facilitates the design of SNP panels to address specific questions and allows multiple such panels, designed for different purposes, to be developed as needed.

The fourth paper used a different approach, double digest restriction-site associated DNA sequencing (ddRAD-seq), that does not require that genome sequence data is available *a priori* but instead allows for the simultaneous discovery and genotyping of thousands of SNPs (Lah *et al.*, 2016). These SNPs were used in combination with 13 microsatellite loci and mitochondrial haplotype data to examine spatial structure in harbour porpoises in the Baltic Sea; analysis using this combined dataset provided improved delineation of harbor porpoise population assignments for the Baltic Sea porpoises. When the data types were compared, SNPs outperformed microsatellite markers, particularly in the assignment of specimens to clusters of genetically similar individuals that may constitute separate stocks.

Attention: SC, G

The Committee welcomes the opportunity to review papers that used Single Nucleotide Polymorphisms (SNPs) to look at population or species-level questions. The comparison of SNP data produced in different laboratories and over time

Table 16
Summary of the work plan for the sub-committee on Conservation Management Plans (CMP).

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Southeast Pacific right whales	-	Review progress on scientific aspects of the CMP.
South Atlantic right whales	-	Review progress on scientific aspects of the CMP.
Gray whales	Workshop; CMP drafting group	Complete rangewide review.
Franciscana		Prepare for in-depth review.
Humpback whales in the northern Indian Ocean	-	-

is more straightforward than in microsatellites (traditionally the most commonly used nuclear markers) and thus facilitates the collaboration and data sharing that is often important in addressing questions of relevance to the Committee.

11.1.2 'Amendments' of sequences deposited in GenBank

While GenBank is an important resource to the scientific community, it is essentially an uncurated database of DNA sequences and thus contains sequences that are misidentified or have other annotation problems (Federhen, 2014). While retaining the 'raw data' represented in GenBank is valuable, less-experienced users may be unaware that additional sequence validation may be needed when incorporating GenBank sequences into a study.

Attention: SC, G

The Committee **encourages** continued efforts to work with GenBank staff to identify a mechanism to allow annotation of GenBank sequences by interested parties to note taxonomic mis-assignment, questions about the source of the organism involved, or locus misidentification. The Committee **agrees** that a section discussing the precautions that should be used when including GenBank sequences in a study should be added to the IWC DNA quality guidelines (Item 11.2.1 below).

11.1.3 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, 2012a, 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 Appendices 3-5 of Annex I for each country, respectively, covering the period up to and including 2016.

The Committee thanked the countries involved for providing this information.

11.1.4 Reference databases and standards for diagnostic DNA registries

The status of the DNA registries of Japan, Norway, and Iceland, respectively, are summarised in Annex I, Appendices 3-5. Almost all samples in the three registries have been analysed for microsatellites, and work on unanalysed samples is continuing. Almost all samples in the registries of Japan and Iceland have also been analysed for mtDNA. The Committee appreciates the efforts of Japan, Norway and Iceland in compiling and providing this detailed information of their registries.

Last year, the Committee welcomed information from Norway that they planned to upgrade the Norwegian minke whale DNA register (NMDR) by genotyping a suite of carefully selected Single Nucleotide Polymorphisms (SNPs) intended to keep the register's primary function of traceability of whale products in Norway and in the international market.

The Committee also noted that SNP genotyping should be seen as a complement to, not a replacement of, the current microsatellite genotyping (IWC, 2017b, p.71).

Attention: SC, CG-A

During this year's discussion of the Norwegian minke whale DNA register, the Committee was informed that mtDNA analysis on Norwegian samples had been discontinued and that microsatellite typing would eventually be replaced by SNP analysis. The Committee **expresses** concern regarding the comparability of the DNA registers in the future and **reiterates** the recommendation from last year that additional technical details of Norway's plan be provided at future meetings (IWC, 2017b, p.71). The Committee **encourages** coordination of all DNA registers so that they are based on comparable genetic markers, while also acknowledging that DNA registries are maintained on a voluntary basis.

11.2 Guidelines for DNA data quality and genetic analyses

Two sets of guidelines have been developed for reference in the Committee's discussions of stock structure. Both sets are subject to ongoing update as appropriate.

11.2.1 Update DNA quality guidelines to include discussion of NGS data

The first set of guidelines addresses DNA validation and systematic quality control in genetic studies. These guidelines have been made available as a 'living document' on the IWC website since 2011¹¹. In recent years, it has become common for the Committee to review papers using data derived from Next Generation Sequencing approaches, including SNPs, to address stock structure questions (see Item 11.3). Last year, the Committee agreed that the DNA data quality guidelines needed to be updated to incorporate discussion of data quality measures used for Next Generation Sequencing data (IWC, 2017b). The Committee reviewed a draft of the updated guidelines and suggested additional revisions to be addressed intersessionally.

Attention: SC

The Committee **emphasises** the importance of keeping its guidelines related to genetic data quality and analyses up to date. It therefore **reiterates** the need to update these guidelines to incorporate discussion of data quality measures used for Next Generation Sequencing data. The intersessional working group established last year and convened under Tiedemann (Annex W) will continue its work to address this issue (see Item 12.5).

11.2.2 Genetic analysis guidelines (completion)

The second set of guidelines covers types of statistical analyses of genetic data that are commonly used in IWC contexts, and contains examples of management problems

¹¹<http://iwc.int/scientific-committee-handbook#ten>.

that are regularly faced by the Committee. These genetic analysis guidelines were completed intersessionally and have been accepted for publication by the *Journal of Cetacean Research and Management*.

11.3 New statistical and genetic issues concerning stock definition

The Stock Definition and DNA Working Group discussed several papers relevant to stock structure discussions in other Committee sub-groups early in the meeting and passed its advice on to them (see Annexes D, G, H, M, O and Q). Technical comments on these papers are given in Annex I.

During the intersessional period, new information on the stock structure of western North Pacific common minke whales and western North Pacific Bryde's whales became available. These discussions are summarised below.

11.3.1 Simulation tools for spatial structuring (e.g. TOSSM)

Genetic analyses on the stock structure of North Pacific common minke whales have been conducted by Japanese scientists following specific recommendations made at the Expert Workshop to Review the ongoing JARPNII Programme (IWC, 2010b). Results of these analyses were reviewed at the Expert Panel of the Final Review of the Western North Pacific Japanese Special Permit Programme (JARPNII) (IWC, 2017a) and at the subsequent IWC Scientific Committee meeting in 2016 (IWC, 2017b). At SC/67a, the Committee reviewed new results addressing these recommendations (SC/67a/SDDNA01) as well as a summary of previously conducted work (SC/67a/SDDNA05rev1).

In order to make progress on understanding stock structure in North Pacific minke whales, the 2009 Expert Panel Review recommended that the spatial distribution of close kin be examined (IWC, 2010b, p.419). Last year, the Committee heard a summary of preliminary results of an ongoing analysis to identify parent-offspring pairs among sampled North Pacific minke whales that were also presented at the 2016 Expert Panel review (IWC, 2017a). Although a technical evaluation of the analysis was not possible at that time, given that no primary paper was provided for review, the Committee provided advice on several topics (IWC, 2017b, p.46).

This year, the Committee reviewed a paper summarising these results and addressing some of the topics listed last year. SC/67a/SDDNA01 presents the results of using a dataset of complete genotypes at 16 microsatellite loci, accompanied with mtDNA and biological information, in 4,554 North Pacific common minke whales to infer Parent-Offspring (PO) relationships, using a Maximum-Likelihood approach. In accordance with the advice received last year (IWC, 2017b, p.46), the occurrences of PO pairs was addressed using mother-foetus pairs as positive controls, the relationship between estimated and observed values of the False Discovery Rate (FDR) and Power (P) was evaluated by simulation, and additional microsatellites ($n=10$ loci) were used in conjunction with biological information to validate identified PO pairs.

Among the validated P-O pairs, O stock pairs were significantly overrepresented, while pairs between J and O stock individuals were absent. Specimens neither assigned to J nor O stock ('unassigned') exhibited a stronger affinity to the O stock. The J stock seems to appear on both sides of Japan closer to the coast, while the O stock occurs mostly east of Japan, both close to the coast and far offshore. This analysis provides no evidence for further stock structure in the area covered by this data set.

In reviewing technical aspects of SC/67a/SDDNA01, concern was expressed about the lack of independence that is incurred when the same dataset (the 16-locus genotype data) is used to assign individuals to stocks (Pastene *et al.*, 2016a), estimate the likelihood of possible POP relationships within those stocks, and then make inferences about the plausibility of stock structure hypotheses based on these findings. Alternative stratification schemes, such as using geography or a second set of independent microsatellite loci to stratify the samples into genetic clusters, would circumvent this concern. It was noted that the lack of independence does not invalidate the inferred PO pairs, but could bias the estimates of FDR. This bias is expected to result in additional False Positives (FPs), as individuals belonging to the same stock would be genetically more similar to each other than expected in a random sample set. This pattern can be seen in the separate analysis of the J stock minke whales, in which no FPs were identified. The two known J-Stock POPs (i.e. mother-foetus pairs) were not detected, neither in the complete dataset nor when the J stock minke whales were analysed separately.

Among inferred O-stock PO pairs, many included one individual sampled near the coast and one sampled in offshore waters, and the biological data associated with these individuals suggested a pattern of offspring being found close to shore and the parent (both mothers and fathers) being found offshore. It was further noted that in the assigned O-stock whales, the number of sampled males is markedly larger than the number of sampled females (Annex I, Appendix 2).

Attention: SC

In reviewing the result of kinship-based analyses of North Pacific common minke whales, the Committee:

- (1) **agrees** that this work provides a good example of the value of increasing the number of loci in analysis of kinship in reducing False Discovery Rate and increasing statistical power;
 - (2) **recognises** the value of having biological data associated with the individuals used in kinship-based analyses, which allowed the plausibility of genetically inferred Parent-Offspring pairs to be verified;
 - (3) **encourages** the inclusion of such biological data when available.
-

The Committee also received a summary of updates on stock structure analyses of western North Pacific common minke whales that have been conducted in response to recommendations of the Committee and Expert Panels (SC/67a/SDDNA05). This summary covered genetic analyses (kinship, assignment tests, ordination-based methods, and assessment of statistical power), morphometrics, and catch-at-age analysis. The proponents considered that the results: (1) provided strong support to stock structure Hypothesis A (proposing only J and O stocks), with a single O stock exhibiting a pattern of sexual and age segregation during migration; and (2) contradicted Hypothesis C, which proposes two J stocks and two O stocks.

In considering the technical aspects of work presented in SC/67a/SDDNA05, the Committee noted that the subset of samples selected for additional genotyping was not chosen at random from the entire area but were instead chosen at random from a subset of samples collected in sub-areas 6 and 7 with the intent of generating a dataset that would include a relatively equal proportion of J and O stock whales. Given that these samples represent only a portion of the area being

considered, however, this selection could result in a bias in the assignment probabilities generated in the STRUCTURE analysis.

Attention: SC

With respect to genetic studies of western North Pacific common minke whales presented in SC/67a/SDDNA05, the Committee:

- (1) **welcomes** the typing of additional loci in the subset of samples and recognised the logistical constraints inherent in genotyping additional samples; and
 - (2) **advises** that an assignment test analysis in which the additional loci were genotyped in samples collected from a broader region would be a more appropriate than using only a subset of samples from certain areas.
-

In terms of the implications of new information in evaluating the plausibility of the stock structure hypotheses included in the ISTs for Western North Pacific minke whales, the Committee noted that several gaps in understanding persist for western North Pacific common minke whales: (1) the breeding areas remain unknown, and current hypotheses only partially consider the potential for mixing of whales on migratory routes or wintering grounds; (2) the results presented in SC/67a/SDDNA05 do not contribute to an understanding of the heterogeneity that has been identified in some previous studies within the O-type whales (Wade and Baker, 2012); and (3) while the table illustrating the location and number of inferred PO pairs within and between regions suggests connectivity between areas, it does not provide information on how those numbers compare to the numbers of sampled animals in each region for which no PO pair relationships were inferred, which would provide insight into the relative magnitude of connectivity between areas.

Attention: SC

*Although questions about the stock structure of minke whales in the western North Pacific may not be fully resolved, particularly in the absence of knowledge about the location of breeding grounds, the Committee noted the importance of evaluating the evidence at hand with respect to the stock structure hypotheses under consideration. As such, the Committee **agrees** that the results of the kinship analysis are inconsistent with the mixing matrices associated with Hypothesis C as currently implemented in the RMP trials (isolation between sub-areas 7CS-7CN, 8 and 9). The Committee **thanks** the authors of SC/67a/SDDNA01 and SC/67a/SDDNA05 for their work to address the recommendations of the Expert Panel and the Committee.*

11.3.2 North Pacific Bryde's whales

With respect to North Pacific Bryde's whale, one of the short-term recommendations made by the JARPN II expert review panel was that the presence of multiple stocks within sample partitions should be assessed using ordination-based methods such as STRUCTURE and DAPC (IWC, 2017a, p.543). In response to this recommendation, last year the proponents presented the results of a STRUCTURE analysis to the Committee; this analysis did not detect heterogeneity within sub-area 1 or between the two sub-areas (1 and 2), which had been identified as significantly differentiated using contingency table analysis. Given these results, the Committee noted that the STRUCTURE analysis had little power to detect clusters when F_{ST} is low and only weak levels of differentiation are present and recommended that

further analyses using alternative ordination-based methods be conducted to evaluate their use in addressing the presence of multiple stocks within sample partitions (IWC, 2017b, p.47).

In response to last year's recommendation by the Committee, the proponents presented SC/M17/RMP01, the results of a Discriminant Analysis of Principal Component (DAPC) at the Workshop on the *Implementation Review* of Western North Pacific Bryde's whales Japan (SC/67a/Rep07). Consistent with the STRUCTURE results, the DAPC analysis did not detect additional structure within the North Pacific, although structure was identified at a broader scale (e.g. between Bryde's whales from the North Pacific, eastern and western South Pacific and eastern Indian Ocean). In combination with the previous results showing significant differentiation between sub-areas 1 and 2 in both mitochondrial and microsatellite DNA but no detected heterogeneity within sub-area 1 (Pastene *et al.*, 2016b), these results are consistent with the occurrence of two weakly-differentiated stocks within the region encompassing the sub-areas.

While at the review, additional analyses were suggested and subsequently conducted to further explore the possibility of spatial genetic structure (SC/67a/Rep07). These analyses examined patterns of fine-scale spatial heterogeneity relative to the longitude of sample origin. Mean values of microsatellite heterozygosity (H_E and H_O), mitochondrial haplotype diversity, and the first two principal components of the DAPC were calculated for sectors consisting of 5° longitude and plotted as moving averages over 10°. Although no patterns of heterogeneity were revealed in the microsatellite data, spatial heterogeneity was detected in the mitochondrial haplotype diversity and the first two PCs of the DAPC.

While the Committee noted that the initial DAPC analyses were not informative about stock structure, the additional spatially explicit analyses provided information relevant to stock-structure which was used in conjunction with biological information for stock structure inference (summarised in table 4 of SC/67a/Rep07). The Committee further noted that spatially explicit analysis of information captured in single principal components (PCs) in a DAPC or other Principal Component Analyses (PCAs) may unravel stock-structure patterns not as easily detected in representations combining several PCs and/or geographic regions in a single visualisation.

Attention: SC

*The Committee **acknowledges** the presented analyses of stock structure in North Pacific Bryde's whales and did not provide any additional recommendations for further analysis. The Committee **re-iterates** the utility of ordination methods in stock structure inference (IWC, 2017b, p.48).*

11.3.3 Terminology

Defining and standardising the terminology used to discuss 'stock issues' remains a long-standing objective of the Working Group, in order to help the Committee report on these issues according to a common reference of terms (IWC, 2014d, pp.287-288). Although some progress was made to clarify how stock structure related terms are used within the sub-committees that focus on baleen whales, difficulties have arisen in trying to align this usage with that of the sub-committee on small cetaceans. This topic will be considered at next year's meeting (see Item 11.4).

11.3.4 Simulation tools for spatial structuring (e.g. TOSSM)
TOSSM was developed with the intent of testing the performance of genetic analytical methods in a management context using simulated genetic datasets (Martien *et al.*, 2009), and more recently the TOSSM dataset generation model has been used to create simulated datasets to allow the plausibility of different stock structure hypotheses to be tested (e.g. Archer *et al.*, 2010; Lang and Martien, 2012).

In recent years, a wide-range of software packages have become available for producing simulated datasets that can be used for statistical inference and/or validating statistical methods (Hoban *et al.*, 2012; and see IWC, 2017b, p.48), and in 2016 the Committee agreed to expand this item (formerly specific to TOSSM) to include a broader range of tools (IWC, 2016e, p.43). The Committee will conduct an intersessional review of the available packages and evaluating their utility to the work of the Committee for consideration next year (see Item 11.4).

11.3.5 Close-kin mark-recapture and epigenetic aging

The Committee heard a presentation on the close-kin mark-recapture (CKMR) approach (Bravington *et al.*, 2016), which uses multi-locus genotyping to find close relatives among tissue samples from dead and/or live animals. The number of kin-pairs found, and their pattern in time and space, can then be embedded in a statistical mark-recapture framework to infer absolute abundance, parameters like survival rate, and even stock structure. Although CKMR should be useful without additional information in many cetacean stock delimitation applications, it will yield precise results much faster if age can be estimated, even roughly.

While age can already be obtained in some situations (e.g. bycatch of odontocetes where teeth can be obtained and sectioned), the utility of CKMR for cetaceans will be now increased given the new capability to use the same tissue-samples for epigenetic ageing (DNA methylation), which has in the last few years been successfully used to estimate age in humpback whales and other mammal species (Jarman *et al.*, 2015; Polanowski *et al.*, 2014). Methylation rates may be specific to species or even populations, and thus epigenetic age estimates need to be verified. This may be easier with odontocetes, where epigenetic age estimates could be calibrated by comparison to ages estimated by counting growth layer groups in teeth (Perrin and Myrick, 1980). It was noted that while estimates of the actual age of animals is needed for some applications, inference of relative age is sufficient in other cases. Such inferences can be used in calibration of epigenetic methods when long-term close kin sampling is pursued.

Attention: SC

Epigenetic ageing is particularly valuable in the context of estimating abundance with the close-kin mark-recapture approach, as it can increase precision in such estimates by allowing the parent to be distinguished from the offspring. It may further be informative in the context of RMP Implementations or Implementation Reviews. The Committee agrees that learning more about the applicability of epigenetic aging to the work of the Committee is a priority and encourages the submission of papers relevant to this topic next year (see Item 11.4).

11.3.5.1 INFERENCE OF DEMOGRAPHIC HISTORY USING WHOLE GENOME SEQUENCES

The Committee also received information on the application of a new analysis technique that allows inferences about

demographic history to be drawn based on a whole genome sequences (Li and Durbin, 2011). Whole genome sequences possess extensive records of the ancestry of individuals, and individuals belonging to the same population are expected to exhibit the signatures of shared historical events not present in genomes from individuals of different populations. The ability to reconstruct these histories has increased recently due to the reduced cost of genome sequencing and advances in bioinformatics and analytical methods largely originating from human population genomics. SC/67a/SDDNA04 applies this technique to provide insight into the demographic history of gray whales using whole genome sequences from two whales sampled off the coast of Sakhalin Island, Russia, and one whale sampled off the coast of Barrow, Alaska. Given the small number of genomes analysed, this work was largely intended as a ‘proof of concept’ exercise to demonstrate the feasibility of using this approach with the gray whale genome data, and sequencing of the genomes of additional samples is planned. These preliminary results, however, suggest a greater extent of recent historical inbreeding in the Sakhalin gray whale genomes than in the genome sequenced from the gray whale sampled off Barrow. The inferred trajectories of effective size over time derived from the eastern and two western genomes seemed to be generally similar until the late Pleistocene. However, it was not possible to determine if the Sakhalin whales were part of the eastern or western breeding stocks as some of the analyses employed in this study fail to differentiate them.

The Committee noted that some limitations are inherent in this approach. In particular, the analysis is not informative with respect to recent population history, and both the inferred dates and the estimates of effective population size over time depend on parameter values used for generation time and mutation rate, which are subject to uncertainty. However, the Committee welcomes the opportunity to receive further information on the application of this new technique and looks forward to hearing more details about this work in the future.

11.4 Work plan

The work plan is summarised in Table 17.

12. CETACEAN ABUNDANCE ESTIMATES, STOCK STATUS

In recent years (see IWC, 2014a), the Committee has recognised the need for consistency in the way it reviews and categorises abundance estimates, which in the past were reviewed only within the sub-group to which they were submitted. This year, a new approach was adopted such that all abundance estimates were reviewed by a dedicated Working Group on Abundance Estimates, Stock Status and International Cruises (WG-ASI, whose report is in Annex Q) and the advice passed on to the relevant sub-group early in the meeting if it was needed for their deliberations. WG-ASI was also tasked with the development of a table of an agreed set of abundance estimates for use by the Committee and a biennial document compiling abundance estimates for the Commission and the public that provided a broad overview by species and ocean basin, and by specific areas if appropriate.

In addition, the Committee has been asked by the Commission to provide a biennial document that provides an overview of the status of whale stocks, largely based upon completed assessments and or RMP/AWMP *Implementations or Implementation Reviews*.

Table 17
Summary of the SDDNA work plan.

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Item 11.1 DNA testing	Develop papers relating to the ToR and comparison of methods for SNP development and assessment.	Review intersessional progress.
Item 11.2.1 DNA quality guidelines	Intersessional email group to discuss updating guidelines to include data produced using next generation sequencing approaches.	Review intersessional progress; present an updated version of the guidelines.
Item 11.3.3 Terminology	-	Revisit terminology with specific reference to the implications of inferred stock structure in other sub-committees.
Item 11.3.4 Simulation-based tools	Intersessional email group to review software packages and evaluate utility to the SDDNA WG.	Review intersessional progress.
11.3.5 Epigenetic ageing	Develop papers relating on epigenetic ageing and its use in discussions of stock definition and/or abundance estimation.	Review intersessional progress.

12.1 Summary of abundance estimates and update of IWC consolidated table

The Committee reviewed new information on abundance estimates of large whales and small cetaceans received (Annex Q, item 3). The Committee noted that estimates of abundance not reviewed during this meeting due to time constraints would be reviewed intersessionally by an intersessional correspondence group who would report on its work to SC/67b.

Attention: SC, S, C-A

*New abundance estimates endorsed by the Committee for inclusion in the IWC consolidated table are presented in Table 18. The Committee **recommends** these estimates are incorporated into the table of already agreed abundance estimates and uploaded to the IWC website. The Committee also **recommends** that the table continue to be updated intersessionally through the intersessional correspondence group (Annex W).*

Based upon the experience gained at this meeting, the Committee noted that a process needed to be developed to facilitate the review of: (a) new abundance estimates in a timely fashion prior or during the Annual Meeting; and (b) existing estimates that had not yet been endorsed by the Committee. This process should include identifying minimum requirements for the presentation and review of abundance estimates for inclusion in the IWC consolidated table. The Committee also noted that this process should consider how to validate non-standard software, non-standard methods, and how to address issues related to estimates computed from population models.

Attention: SC

*The Committee **recommends** that draft guidance be developed intersessionally (ICG-4, Annex W) for review at SC/67b on:*

- (1) *a process to facilitate the review of abundance estimates in a timely fashion prior or during the annual meetings;*
- (2) *minimum requirements for presentation and review of abundance estimates for inclusion in the IWC consolidated table;*
- (3) *a process to validate non-standard software, non-standard methods and how to consider estimates computed from population models;*
- (4) *a process to evaluate abundance estimates already included in the IWC consolidated table, but not yet reviewed by the Committee; and*
- (5) *estimates of abundance relevant to the work of the Committee that were available but not reviewed during this annual meeting.*

12.2 Methodological issues

12.2.1 Model-based abundance estimates (and amendments to RMP guidelines)

In recent years, the Committee has recognised the need to develop its expertise in evaluating spatial-model-based abundance estimates from sighting surveys because these models have potential advantages in reducing bias resulting from patchy coverage, and in providing more reliable estimates of variance when compared to standard line transect methods. A pre-meeting, held on 7-8 May 2017, reviewed the current state of spatial modelling for cetacean abundance estimation, and introduced a software package 'Itdesigntester' for exploring the reliability of design-based abundance estimates of specific surveys. The report is given as Annex Q, Appendix 6.

The Committee has for some time (IWC, 2015c, p.9) been considering the need to amend the Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme (IWC, 2012a, p.509) to incorporate abundance estimates produced using methods (e.g. spatial models, mark-recapture models) not yet considered by the Guidelines. One of the tasks of the pre-meeting was to consider such amendments for spatial model based estimates, but time constraints meant that these amendments could not be discussed in detail.

Attention: SC

*The Committee **recommends** that draft amendments to the Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme be developed intersessionally (ICG-4, Annex W) to incorporate methods to compute abundance estimates not yet considered by the Guidelines, for review at SC/67b.*

12.2.2 Review new survey techniques/equipment

The Committee received new information on novel survey techniques. SC/67a/NH09 presented a new, innovative method to potentially study large whales using Very High Resolution (VHR) satellite imagery using the WorldView-3 satellite. Visual and spectral analysis resulted in the successful detection of four candidate species: fin, humpback, southern right and gray whales. This study showed the potential of using satellite imagery to study baleen whales. The application of high-resolution satellite imagery for ship strike assessments was also raised and its potential for surveying was mentioned (Annex Q, item 6.1.2).

Bravington *et al.* (2016) described a new method for computing abundance estimates and other population parameters by integrating mark-recapture methods with the relatedness of individuals inferred from genetics.

Table 18
Table of agreed abundance estimates during the 2017 Scientific Committee meeting (see below for the key).

Area	Cat.	Eval. extent	RMP/AWMP status	Date stamp	Range of years	Method	Corr.	Estimate	CV	Approx. 95% CI	Original reference	Comments	Aerial coverage	Programme	On web?
North Atlantic common minke whales															
West Greenland	1	1	S	2015	2015	SC	A+P	5,241	0.49	2,114-12,992	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
West Greenland	1	1	S	2007	2007	SC	A+P	9,853	0.43	4,433-21,900	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
East Greenland	1	1	S	2015	2015	LT	A+P	2,681	0.45	1,153-6,235	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
Iceland	Not Ac	-	-	2016	2016	-	-	-	-	-	SC/67a/NH05	Coverage too poor. Could re-stratify to use as minimum estimate.	-	-	-
ES	P	-	-	-	2014-16	-	-	12,846	-	-	SC/67a/RMP03	Final estimate to be calculated on completion on full survey cycle.	-	-	-
EW	P	-	-	-	2014-16	-	-	16,537	-	-	SC/67a/RMP03	As above	-	-	-
CM	P	-	-	-	2014-16	-	-	57,472	-	-	SC/67a/RMP03	As above	-	-	-
North Atlantic fin whales															
West Greenland	1	1	S	2015	2015	LT	P	465	0.35	233-929	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
North Atlantic humpback whales															
West Greenland	1	1	S	2015	2015	LT	A+P	1,008	0.38	493-2,062	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
East Greenland	1	1	S	2015	2015	LT	A+P	4,288	0.38	2,097-8,770	Hansen <i>et al.</i> (2016); IWC/67a/Rep06	-	-	-	R
(Iceland)	-	-	-	-	-	-	-	-	-	-	-	Several estimates to be reviewed intersessionally.	-	-	-
North Atlantic bowhead whales															
Svalbard	3	1	-	2015	2015	LT	A	343	0.488	136-862	Vacquier-Garcia <i>et al.</i> (2017)	Partial coverage and high CV.	-	-	R
North Pacific bowhead whales															
Okhotsk Sea	3	1	-	2016	1995-2016	MR	A+P	218	0.22	142-348	SC/67a/NH10	(Require copy of time series)	-	-	-
North Pacific gray whales															
Sakhalin Is.	3	4	-	1995	1995-2015	MR:PA	A+P	74	0.06	65-82	SC/67a/NH11	(Require copy of time series).	-	-	-
Sakhalin Is.	3	4	-	2015	1995-2015	MR:PA	A+P	191	0.04	175-208	SC/67a/NH11	(Require copy of time series).	-	-	-
Sakhalin and Kamchatka	3	4	-	1995	1995-2015	MR:PA	A+P	129	0.08	107-149	SC/67a/NH11	(Require copy of time series).	-	-	-
Sakhalin and Kamchatka	3	4	-	2015	1995-2015	MR:PA	A+P	282	0.05	255-312	SC/67a/NH11	(Require copy of time series).	-	-	-
N California-N Vancouver Is.	1	1	-	2015	-	P Id	-	243	0.08	-	Calambokidis <i>et al.</i> (2017)	SD=18.9; N _{min} =228.	-	-	-
California	2	1	-	-	2014/15	-	-	28,790	-	23,620-39,210	Durban <i>et al.</i> (2017)	Suitable for use in SLA and conditioning range-wide model. Some methodological issues.	-	-	-
California	2	1	-	-	2015/16	-	-	26,960	-	24,420-29,830	Durban <i>et al.</i> (2017)	As above	-	-	-
North Pacific Bryde's whales															
1W	1	1	I	2011	2008-15	LT	-	15,422	0.289	-	SC/67a/RMP04	g(0)=1. Could be updated if g(0) estimated in future. See SC/67a/RMP04 re additional variance.	78.4	POWER /JARPNI	-

Cont.

Area	Cat.	Eval. extent	RMP/AWMP status	Date stamp	Range of years	Method	Corr.	Estimate	CV	Approx. 95% CI	Original reference	Comments	Aerial coverage	On Programme web?
IE	1	1	I	2011	2008-15	LT	-	6,716	0.216	-	SC/67a/RMP04	As above	92.4	POWER /IARPNII
	2	1	I	2014	2008-15	LT	-	4,161	0.264	-	SC/67a/RMP04	As above	78.9	POWER /IARPNII
WW N Pacific	-	-	-	-	2008-15	LT	-	26,299	0.185	18,000-38,000	-	Combined estimate ~ 26,000	-	R
Mauī dolphin North Island, NZ	1	1	-	-	2015-6	MR	-	63	0.11	-	Baker <i>et al.</i> (2012)	Based on assumption of closure.	-	-
Hector's dolphin Cloudy Bay, NZ	1	1	-	-	2011-12	MR	-	269	0.12	-	Hamner <i>et al.</i> (in press)	Based on assumption of closure	-	-
Key to table headings:														
Heading		Contents												
Area	If <i>Areas</i> are identified in an RMP context these should be used. If estimates pertaining to only a portion known range are agreed to be included (e.g. for AWMP) a comment should be included to show that this constitutes only part of the population. Otherwise use broad categories (e.g. Schedule <i>Management Areas</i>) and indicate whether total or partial coverage unless.													
Category	As described below. In each case if not clear add an asterisk to indicate that the estimate needs to be considered further. Use either: (1) acceptable for use in in-depth assessments or for providing management advice; (2) underestimate - suitable for AWMP usage or other 'conservative' management but not reflective of total abundance; (3) while not acceptable for use in (1) or (2), adequate to provide a general indication of abundance; (P) Provisional or Preliminary estimates (will be omitted from published tables); (X1) Category (1) estimates that have been superseded by newer estimates (will be omitted from published tables); or (NID) Not discussed. Used to show other estimates which have not been discussed by the Scientific Committee, but which may be discussed in future. They are shown 'Greyed out' and will be omitted from published tables.													
Evaluation extent	Degree to which the estimate was considered originally by the sub-committee concerned. Use: (1) estimate was examined in detail by the sub-committee; (2) estimate was partially examined by the sub-committee but method standard; (3) degree to which the estimate was considered by the sub-committee is unclear but method standard; (4) estimate was partially considered by the sub-committee partially and a new method was used; or (5) degree to which the estimate was considered by the sub-committee is unclear and a new method was used.													
RMP/AWMP status	Status in RMP trials. Use: '1' agreed to be suitable for use in an actual <i>CLA</i> calculation to produce a catch limit; 'C' used in the <i>RMP</i> trial conditioning as an absolute estimate of abundance; 'C _{min} ' used in the <i>RMP</i> trial conditioning a minimum estimate of abundance; 'CP' provisional estimate suitable for use in conditioning but further analysis needs to be considered before use in an actual <i>CLA</i> or <i>SLA</i> calculation; 'T' used in RMP/ <i>SLA</i> trials but further analysis needs to be considered before use in an actual <i>CLA</i> or <i>SLA</i> calculation; 'S' agreed to be suitable for use with a <i>SLA</i> to produce strike limits; 'E' suitable for conditioning <i>Evaluation</i> and Robustness Trials, and for <i>Implementation Reviews</i> . 'R' Suitable for conditioning Robustness Trials or suitable for conditioning some <i>Evaluation</i> or Robustness Trials, or <i>Implementation Reviews</i> , utilising a minimum estimate of abundance.													
Date stamp	The year to which the estimate applies. This will normally be the year of the survey unless the estimate is based on multiple years or a population assessment model (Note: Consideration needs to be given as to whether estimates from such models are acceptable for this table, in contrast to, for example, mark-recapture based estimates which do require model-processing.)													
Range of years	The years concerned when estimate applies to surveys over a number of years.													
Method	LT: line transect (or distance-sampling). MR: mark-recapture; SM: spatial modelling; LT+SM: distance-sampling with spatial modelling; CC: Cue counting; PA: population assessment; PId: Photo-identification of individuals; SC: Strip census; GMR: Genetic mark recapture.													
Correction (Corr)	Where applicable, indicate if the estimate is corrected for A: availability (corrects for the time the whales are available at the surface); P: perception bias (corrects for missed sightings); A+P: availability and perception bias; or adjustment for <i>g</i> (0)<1 applied. Note. Care should be taken regarding the interpretation of <i>g</i> (0) because the distinction between availability and detection bias for ship-board surveys is somewhat arbitrary and dependent on the exact analysis method employed.													
Estimate	Estimate of 1+ abundance unless otherwise indicated.													
CV	CV of estimate from survey sampling error only.													
CV (AV)	CV with Additional Variance component arising from annual distributional changes added.													
95% CI	Approximate 95% confidence intervals (or equivalent) rounded to three significant figures of upper limit.													
Aerial coverage	Aerial coverage as a percentage.													
IWC reference	The reference to where the estimate was discussed in the Scientific Committee.													
Original reference	The reference of the analysis presented originally.													
Comments	Brief comments on survey and any difficulties encountered.													
Program	Survey program/organiser.													
On web?	Is estimate listed on the IWC website? Y: yes R: recommended for inclusion On web?													

Table 19
Work plan for consideration of abundance estimates and status.

Topics	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Process for evaluating abundance estimates	ICG-4 (Annex W): (1) Develop a process to facilitate the review of abundance estimates in a timely fashion prior or during the annual meetings. (2) Identify minimum requirements for presentation and review of abundance estimates for inclusion in the IWC consolidated table. (3) Develop process to validate non-standard software, non-standard methods and how to consider estimates computed from population models. (4) Consider how to evaluate abundance estimates already included in the IWC consolidated table, but not yet reviewed by the SC. (5) Amend the RMP Guidelines, particularly in regard to methods so far not included in the guidelines (e.g. spatial modelling and mark-recapture).	Review report from intersessional correspondence group and agree the process for review of abundance estimates in the future. Amend the RMP Guidelines.
Review of abundance estimates	Review estimates of abundance of North Atlantic humpback whales and Asian coastal and river dolphins (ICG-5, Annex W).	Review report from intersessional correspondence group and new estimates presented at SC/67b.
Tables of abundance estimates	Incorporate the estimates agreed at this meeting to the IWC consolidated table and upload them to the IWC website, and continue to update the IWC Abundance Table intersessionally (Allison).	Review intersessional progress and develop the biennial document for the Commission.
Status	Provide information on status from recent <i>Implementations</i> or <i>Implementation Reviews</i> (Allison, Donovan, Punt, Zerbinì).	Review intersessional progress and develop the biennial document for the Commission.

This method is currently referred to as Close-Kin Mark-Recapture (CKMR). For a discussion of this approach see Annex I (item 6.2.1) and Item 11.3.5.

The Committee **looks forward** to receiving new information on novel techniques applicable to the estimation of cetacean abundance.

12.3 Consideration of the status of stocks

The Scientific Committee has been asked to provide the Commission with a summary of advice on the status of stocks on a broad level (e.g. ocean basin or region). RMP and AWMP *Implementation Simulation Trials* are designed to provide robust management advice but not ‘status’ in the traditional sense expected by the Commission (i.e. what is the present ‘stock’ level compared to the unexploited level and what are the likely future trends). Rather they provide considerable output for a wide range of plausible scenarios that would need to be integrated and summarised to provide measures of status. The Committee noted that the results of a set of *Implementation Simulation Trials* should be summarised by the following three statistics to provide information on status:

- (1) current depletion (number of animals aged 1+ and older relative to 1+ carrying capacity);
- (2) current 1+ abundance; and
- (3) 1+ abundance in 2050 if all future RMP and AWMP catches (but not projected bycatches) are assumed to be zero.

Results should be provided for two values for the MSY rate (1% in terms of harvesting of the total (1+) component of the population and 4% in terms of harvesting of the mature component) unless the base-case trials are based on a higher value for the lowest plausible value for the MSY rate, or if the MSY rate has been estimated and there is an agreed value. In addition, results should be summarised across simulations and trials (medians over simulations and averages across base-case trials).

Each base-case trial may have a different number of breeding stocks. Results should be reported by area, specifically for the Ocean Basin (i.e. ‘Region’) and by ‘Medium Area’ rather than by the sub-areas on which the population model underlying the trials are based, to avoid having a very large number of summary statistics. However, there needs to be flexibility in reporting. For example, the Committee may also

wish to present results for individual biological stocks about which it considers the Commission needs to be informed in situations where the default of reporting results by area provides a misleading impression. The choice of the stocks for which results are reported needs to be decided during *Implementations* and *Implementation Reviews*.

Attention: SC, S

The Committee recommends that the ‘Guidelines for Conducting Implementations and Implementation Reviews’ (IWC, 2012c) be updated and that the control programs used for Implementation Simulation Trials be modified by the Secretariat to report three measures of status: current depletion, current 1+ abundance and 1+abundance in 2050 on an Ocean basin or Medium Area basis. In addition, the results for all stocks should be calculated and made available to the Commission where considered appropriate, but not included in the primary summary.

12.4 Work plan

The work plan is given as Table 19.

13. BYCATCH

At IWC/66 in October 2016, recognising the scope and urgency of the bycatch issue, and that it is recognised as the single greatest threat to cetaceans from human activities globally, the Commission endorsed a number of actions proposed by the Conservation Committee as part of a new Bycatch Mitigation Initiative. These included the formation of a Standing Working Group under the Conservation Committee which will supervise the establishment of an Expert Panel and a coordinator position. The interim coordinator (Simmonds) suggested that one of the first tasks that the Committee could assist with is to provide nominations for the Expert Panel.

13.1 Review new estimates of entanglement rates, risks and mortality (large whales)

13.1.1 Bering-Chukchi-Beaufort Sea (B-C-B) bowhead whales

Scars associated with entanglement injuries and ship strikes have been documented on B-C-B bowhead whales harvested by Alaskan Eskimos for several decades (SC/67a/HIM04).

Aerial photographs taken over multiple years indicated that ~12% of bowhead whales harvested by Alaska native hunters show evidence of rope scarring likely associated with Bering Sea pot fisheries and that about 2% of these animals carry injuries/scars from ship strikes (SC/67a/HIM04). Images from a multi-year photo mark-recapture study (SC/67a/AWMP08) were examined to identify whales that had acquired entanglement injuries during the study period. The probability of a bowhead acquiring an entanglement injury was estimated, suggesting a 2.4% (1.2%, 3.6%) annual probability of acquiring a scar. George *et al.* (2017) found that about 50% of large (~17m) and presumably old, harvested whales carried entanglement scars. These results suggest that entanglement may be of future concern for B-C-B bowhead whales and that the issue warrants further consideration. Suggestions of how to obtain improved information are provided in Annex J, item 2.1. It was noted that an *Implementation Review* for this stock will take place at next year's meeting (see Item 7.3).

Recognising the value of this work, and the increasing concern about the prevalence of large whale interactions with fishing gear, examination of rates of interaction (e.g. scar acquisition) for other populations was suggested. It was noted that the advances in drone technology might help to obtain images for these types of analyses.

13.1.2 Gray whales

Gray whales are likely more vulnerable than most whale populations to interactions with fishing gear due to their nearshore migratory and feeding behaviour. SC/67a/HIM06 compiled all known sources of data on non-hunting, human-caused injuries and mortalities of gray whales in the North Pacific (mainly from 1980 to 2015) when stranding networks were established along the US Pacific coast. The authors estimated the number of serious injuries and mortalities of around 300 gray whales. This represents a minimum estimate because of the difficulties in determining cause of death, limited spatial coverage of stranding networks and that whales injured or killed at sea may not be reported. Primary causes of mortality were net fisheries (39.7%), unknown entanglements (21.5%), ship strikes (19.1%), and pot fisheries (17.1%).

It was noted that it might be possible to extrapolate, using the data presented in SC/67a/HIM06, to regions of gray whale habitat not covered by the established stranding networks. The rangewide assessment of North Pacific gray whales (Item 10.1.3) has developed an approach to modelling bycatches and developing scenarios to consider the various sources of uncertainty (SC/67a/Rep04, item 3.2.1.2).

SC/67a/HIM17 reviews gray whale entanglements in the western North Pacific, including gear types used in the Russian Far East that are known or suspected to impact gray whales. The coastal salmon trap fishery off northeastern Sakhalin Island, which overlaps spatially and temporally with feeding gray whales during the summer and fall, was identified as an area where entanglement risk is very high. This risk is of concern because adult females and their calves show strong site fidelity to this area at a time when females are recovering from pregnancy and lactation and calves are being weaned. This document has been sent to the relevant government agencies in Sakhalin and the Russian Federation.

13.1.3 Southern right whales

Entanglement was identified as the main factor in the death of an eastern South Pacific (ESP) southern right whale stranded on Isla de Chiloe, southern Chile. This is the third entanglement from this Critically Endangered population reported from Chile, raising concerns that this threatens population recovery.

Attention: CC, CG-A

The Committee **recommends** that the planned expansion of entanglement response capability in the eastern South Pacific, as part of the implementation of the CMP for this critically endangered right whale population (see Item 10.1.1), be considered as a matter of urgency.

13.1.4 North Atlantic right whales

North Atlantic right whales are generally discussed under Item 9.2.6.

Documented entanglements, long-term population studies and mark-recapture techniques were used to evaluate the effect of entanglement events on survival of North Atlantic right whales (Robbins *et al.*, 2015). Estimates were based on 50 individuals observed carrying entangling gear between 1995 and 2008, and compared to 459 others that were never observed with gear during the same period. Entangled adults had low initial apparent survival (0.749, 95% CI: 0.601-0.855), but those that survived the first year achieved a survival rate (0.952, 95% CI: 0.907-0.977) that was more comparable to unaffected adults. Juveniles had a post-entanglement survival rate that was comparable to the initial survival of entangled adults (0.733, 95% CI: 0.532-0.869) and lower than un-impacted juveniles (0.978, 95% CI: 0.969-0.985). Of three entanglement characteristics examined, health status was the best predictor for subsequent survival, but the entanglement configuration and the resulting injuries also appeared to affect the outcome. When the entanglement configuration was assessed as high risk, human intervention (disentanglement) improved survival.

Entangled females showed a lower survival rate than males and it was noted that this may be due to higher energetic burdens related to pregnancy and lactation. The possibility of inferring survival (and mortality) from scarring rates was discussed and has been estimated for humpback whales (Robbins *et al.*, 2009). However, such inferences require estimates of the frequency of entanglement and survival when entanglement does occur.

The success of a disentanglement intervention varies between species, as well as the complexity and severity of the entanglement itself, but its (positive) effect on subsequent survival of right whales is most pronounced for severely entangled whales. This is likely to be similar for other species, but a comparable analysis for humpback whales was complicated by several factors. Death caused by entanglement can be by drowning, a gradual decline in body condition from impaired feeding, or a chronic infection. Recent work by van der Hoop *et al.* (2016) showed that the drag of even a relatively short length of rope can create significant energetic costs.

13.2 Reporting of entanglements and bycatch in National progress reports

As in previous years, the Committee reviewed summary tables of bycatch and ship strikes from National Progress reports. Discussions related to changes to the National Progress reports are given under Item 22.

13.3 Mitigation measures for preventing large whale entanglement

The IWC's entanglement initiative¹² stresses that entanglement response must include good documentation that should contribute to a better understanding of the issue with the goal of preventing entanglements. The issue of data collection was included in training given to almost 600 trainees from

¹²<https://iwc.int/entanglement>.

15 different countries between 2014 and 2017. These newly formed networks are expected to submit data to the IWC's entanglement database when this is completed. It was noted that a recently convened IWC Workshop on co-operation for transboundary entanglements had already increased communication on gear removed from live entangled whales in Mexico, resulting in the identification of the type and origin of much of it. It was noted that upcoming trainings were being planned for Russia, Colombia, Chile/Peru and Norway, and that several Pacific Island Countries had also expressed interest.

Attention: C-A

*The Committee **agrees** that the IWC's initiative to develop a global entanglement response network is valuable to its work, and **encourages** its continued expansion.*

Between 1990 and 2010 the reported entanglement rate of humpback whales in gear from the pot-based Western Australian rock lobster fishery was relatively stable at around one or two per year. However, from 2010, reported entanglements increased dramatically, peaking at 17 in 2013, linked primarily to the fishery moving from seasonal to year-round (SC/67a/HIM10). To reduce entanglements, a series of fishing gear modifications were implemented eliminating surface rope in waters deeper than 20m and minimising float numbers. The utility of these measures was assessed using entanglements reported between 2000 and 2016, using a model that incorporated expected changes in whale population size, entanglement sighting probability, commercial fishing effort, inter-annual variation in the timing of the whale migration and the implementation of gear modifications. Results suggest gear modifications reduced entanglements by ~65%.

The Committee **commended** Australia and the fishery for what appears to be a major reduction in the numbers of whales entangled in this fishery. Similar gear modifications (e.g. reduced rope from pot gear) along the New England coast of the USA have not produced similar measurable reductions and several possible explanations for this were discussed. The Committee **agrees** that the numbers of witnessed (and reported) entanglement events in both areas are likely a subset of the total entanglements. This is a concern in Western Australia, since both entangled whales that have been tracked with a telemetry device (for later intervention) had moved far offshore, raising the concern that if this is true for other entangled whales then detection of the animals and intervention to remove gear is unlikely.

Samples of rope recovered from North Atlantic right whales were used to determine rope polymer type, breaking strength, and diameter of the recovered gear in order to examine the effects of fishing rope strength on the severity of large whale entanglements (Knowlton *et al.*, 2016). Right and humpback whales were found in ropes with significantly stronger breaking strengths at time of manufacture than common minke whales. The results suggested that broad adoption of ropes with breaking strengths of ≤ 7.56 kN could potentially reduce the number of life-threatening entanglements for large whales by at least 72% but could still provide sufficient strength to withstand the routine forces involved in many fishing operations.

Attention: CC, G

*The Committee **recommended** that ropes with reduced breaking strength should be developed and tested to evaluate efficacy and to determine feasibility of use in a variety of fisheries.*

Mitigation methods that have been undertaken with the objective of reducing cetacean bycatch and their efficacy and future potential were reviewed through case studies (SC/67a/HIM01). These included methods for reducing risk of contact between cetaceans and fishing gear, such as effort reduction, fishing bans and gear modifications, together with methods for reducing harm should entanglement occur. The review found rather few examples of implemented mitigation measures substantially reducing cetacean bycatch. Generally, mitigating cetacean bycatch has not been viewed as intrinsic to successful fisheries management, but rather as a separate management issue. However, where reductions in bycatch have occurred, a feature of these situations has often been that a systemic change in the fishery itself has resulted in reduced cetacean bycatch, rather than the success of any mitigation measures specifically imposed for cetaceans. SC/67a/HIM01 is intended to become a Technical Briefing published by the Convention on Migratory Species.

Attention: C-A, CC, WKM&WI

*The Committee **draws the attention** of the Commission, Conservation Committee and Working Group on Whale Killing Methods and Welfare Issues to the summary of options for mitigation of large whale entanglement provided in Annex W.*

*The Committee **agrees** that a similar table covering measures to mitigate bycatch of small cetaceans would be valuable and included this on the work plan for SC/67b.*

13.4 Estimation of rates of bycatch, risks of, and mortality for small cetaceans

Anderson (2014) highlights the scope and scale of cetacean bycatch in the Western, Central and Northern Indian Ocean tuna fisheries. Gillnets are the main source of bycatch of cetaceans throughout this region, and gillnet fleets are believed to be expanding. There is also evidence of large-scale drift gillnetting on the high seas in the region despite prohibitions by the UN and Indian Ocean Tuna Commission (IOTC). Purse seines have also been set in association with baleen whales.

Attention: SC, S

*In light of information on the scope and scale of cetacean bycatch in the Western, Central and Northern Indian Ocean and the considerable data gaps associated with intensive and extensive gillnet fisheries, the Committee **recommends** that:*

- (1) bycatch in the region be included in the work plan for the 2018 meeting; and*
 - (2) the Secretariat writes to the Indian Ocean Tuna Commission to offer help and advice from the Committee in efforts to implement cetacean bycatch data collection and reporting protocols.*
-

Ridoux described two recent unusual multiple stranding events of common dolphins that occurred in February-March 2017 along the French Atlantic coast. Around 800 dead common dolphins stranded (dead) from 1 January to 31 March 2017, mostly during two distinct events. Bycatch in fisheries was reported to be the primary cause of death given for 119 individuals of the 134 carcasses necropsied before mid-March.

The Committee noted that these events highlighted the need for accurate estimates of bycatch following on from discussions of a study by Peltier *et al.* (2016) last year (IWC, 2017b). In short, that study incorporated modelling of the

Table 20

Summary table of large whale mitigation measures that have been implemented to mitigate large whale bycatch and entanglement.

Measure	Situation to which it might be applied	Implementation process	Selected examples (not comprehensive)	Evaluation
Reducing amount of high risk gear in areas with whales				
Reduce fishing effort with high risk gears across a fishery.	Limits on effort are used in many fisheries management situations to address over capacity and reduce fishing mortality for target species.	A strategic component of fisheries management. Requires better coordination with fisheries management organisations such that effort reductions are prioritised in fisheries which pose a high risk to whales.	Rates of humpback whale entanglement of Newfoundland and Labrador (Canada) showed a clear relationship with fishing effort.	Will reduce risks if part of an overall fisheries management strategy with appropriate monitoring and enforcement.
Long-term or seasonal restrictions to reduce effort with high risk fishing gears in specific areas (e.g. time-area closures).	Any substantial overlap between whale distribution and high risk gears (throughout the year or seasonal).	Implemented by fisheries management organisations at global, regional, national and local levels.	High Seas and European Union (EU) driftnet bans, seasonal closures in New England (USA) trap/pot fisheries.	Only effective for the area and duration to which they apply. Limited efficacy if areas only address a proportion of the overlap between gear and whale distribution.
Reducing amount of line and surface systems in the water in pot/trap fisheries.	Pot/trap fisheries marked with surface floats and with pots/traps linked together by groundline.	Measures taken at local level.	New England vertical line restrictions, sinking ground line and minimising surface floats. Australian western rock lobster fishery. Timed or acoustic release of surface floats to remove vertical line.	Insufficient data from New England (USA) to demonstrate reduced entanglement rates but monitoring ongoing. Humpback whale entanglements in western Australia appear to have reduced.
Reduce gear loss.	Particularly pot/trap fisheries in areas covered by ice or with severe weather or in areas with gear conflicts (mobile gear).	Measures taken at national and local levels. Needs to be incentivised through fisheries management.	Bering Sea-Aleutian Island Crab Rationalization Program (USA).	Mainly relevant for fisheries with high rates of lost gear.
Reduce 'wet storage' of gear.	Fishers sometime leave gear in water even when not actively fishing.	Requirements to lift or attend to gear within a set time. Better coordination between fishers who may be using gear just to preserve their patch.	In the Australian west coast rock lobster fishery, pots must be hauled every seven days.	Limited potential for risk reduction but may be achieved through engagement with fishers.
Gear modification to reduce the risk of whales making contact with gear				
Net sleeves or other devices to protect bait/catch to reduce depredation and associations between whales and long-lines	Long-line interactions with odontocetes, including sperm whales.	Co-operative development of practical systems with fishers who benefit from less interference with target catches.	Chilean Patagonian toothfish demersal longline fishery.	Effective at reducing entanglement risk if feeding opportunities are removed such that whales are no longer attracted to the long-lines.
Pingers and acoustic alarms.	Attempting to keep whales away from gear e.g. large set nets.	Pinger requirements have been implemented for set net fisheries to reduce small cetacean bycatch.	No data demonstrating effective use. Studies of commercially used devices on migration routes of humpback whales showed no measurable avoidance response.	Although effective in certain circumstances for small cetaceans, no current systems appear effective for large whales.
Coloured or more visible line.	Allowing whales to detect and avoid gear.	Measures taken at national and local levels.	Not yet implemented.	Proof of concept research undertaken thus far that appears promising, but needs further research for low light and other species.
Reducing the risk of severe or fatal injury if contact does occur				
Weak links and reduced line strength allowing whales to break free from entanglement.	Any line that can pose risk of entanglement; links that break at points such as floats or weights which likely to get jammed around a whale.	Measures taken at national and local levels.	Weak links and limits on line strength required on North Atlantic right whale calving grounds off US.	Studies of gear recovered from entangled whales suggests risks could be reduced by limiting line strength.
Disentanglement.	Areas where whales are likely to be observed and suitably trained and motivated people are equipped to respond.	The IWC has held a number of workshops and training sessions for large whale disentanglement.	In South Africa interventions were successful in removing gear from 81% of whales entangled in shark nets off KwaZulu-Natal.	Not a prevention measure. Only a small fraction of the entanglements that occur are likely to be successfully disentangled in most areas.

drift of carcasses to estimate bycatch numbers from stranded animals. The Committee agreed that this approach be reviewed by an expert group (led by Currey) that will need to include people with expertise not currently residing within the Committee. Ridoux noted that the French authorities are also reviewing the situation. This might provide further information relevant to the work of the Expert Group.

Attention: SC, CG-A

*Given that the large number of stranded common dolphins reported at the beginning of 2017 along the French Atlantic coast raise serious concerns, the Committee **recommends** that an expert group (ICG-7, Annex W) be established to evaluate the methods used in Peltier et al. (2016) to estimate total bycatches from strandings data in the Bay of Biscay.*

13.5 Scientific aspects of mitigation measures for small cetaceans

13.5.1 Hector's and Māui dolphins in New Zealand

SC/67a/HIM07 estimated that the reported bycatch of Hector's and Māui dolphins was 4-5% of actual bycatch, due to low levels of observer coverage and voluntary reporting by fishermen. Current bycatch was estimated to substantially exceed sustainable levels calculated using the PBR approach (Wade, 1998). The authors stated that observer coverage would need to greatly increase to achieve bycatch estimates with a CV of 30%. Government plans for video monitoring of all inshore fishing vessels could substantially increase the amount and quality of information on dolphin bycatch. They also noted the difficulties of accurately estimating bycatch and population size of small cetaceans or establish a causal link between protection measures and either increasing population size or decreasing bycatch.

In discussion, it was noted the Ministry for Primary Industries in New Zealand (MPI) is currently conducting a spatially explicit risk assessment, which will address their concerns over possible bias in the approach of SC/67a/HIM07. The New Zealand Government are also investigating how best to implement video monitoring and would welcome advice from the Committee. The Committee looks forward to receiving and discussing the results of the risk assessment.

With respect to video monitoring, it was noted that ASCOBANS held a workshop¹³ on remote electronic monitoring in 2015 which noted the relatively rare occurrence of cetacean bycatch and recommended that all of the collected video footage be viewed rather than just shorter samples, which are used for other fisheries monitoring purposes. It was suggested that quantitative targets for precision and bias of bycatch estimates would be useful in designing the video monitoring programmes such as that in New Zealand. The need to ground truth video data may result in a need for observers.

SC/67a/HIM12 suggested that less than 30% of Māui habitat is protected from set nets and only 8% is protected from both set net and trawl threats. Gear switching from set net and trawl to longlining has been identified as one potential alternative to reduce the impact of fisheries on this dolphin population. The study noted that the fishing industry is taking proactive steps towards transition to alternative gears.

In discussion, it was suggested that when considering gear switches to reduce bycatch, an important risk statistic is the relative risk for the same catch of the target fish species.

Attention: CG-A

*The Committee **agrees** that the evidence presented suggests that longlines are a potential alternative to reduce risk from the set nets and trawling currently associated with bycatch of Māui dolphin and that this should be investigated. It **recognises** that Government support is required to develop and implement such alternatives and assess any associated impacts on target catch or other marine species (and see Item 17.7.1).*

13.5.2 FAO Coordinating Working Party on Fisheries Statistics (CWP)

IWC is a member of the CWP. The Secretariat has been asked by FAO if IWC wished to remain a member of this group. It was noted that recent reports of CWP meetings did not show any activities related to cetacean bycatch. The CWP handbook¹⁴ provides useful information on definitions to describe fisheries including for fishing effort and fishing gears. The Committee already uses FAO codes for gear types in the national progress reports (and it uses these definitions wherever possible).

Attention: S

*The Committee **acknowledges** the work of the FAO Coordinating Working Party on Fisheries Statistics (CWP) but notes that given the present CWP focus it is not necessary for the IWC to remain a member. However, the Committee **encourages** continued IWC engagement with FAO, including its Committee of Fisheries.*

13.5.3 Effect of new USA rules on imports from external fisheries

Williams *et al.* (2016) evaluated a new rule requiring countries exporting seafood to the USA to demonstrate that their fisheries comply with the US Marine Mammal Protection Act (MMPA). Countries will be given a (maximum) 5-year grace period to achieve and document compliance before potential import restrictions come into force. The authors noted that the new regulations present opportunities, but also risks, for work to address cetacean bycatch effectively in some countries.

It was noted that one of the risks relevant to the Committee is the potential for unintended consequences including reduced reporting. In some situations, introduction of penalties for fisheries with cetacean bycatch appear to have caused reporting rates to drop. Another potential risk is that fisheries with a high cetacean bycatch may simply switch markets.

Attention: CG-R

*The Committee **recommends** that the USA and/or other countries that are affected by the implementation of the new US law requiring countries exporting seafood to the USA to demonstrate that their fisheries comply with the US Marine Mammal Protection Act, provide updates to the Committee on its implementation.*

13.6 Work plan

The work plan related to bycatch and entanglement is given in Table 21.

¹³<http://www.ascobans.org/en/meeting/WS-REM-2015>.

¹⁴<http://www.fao.org/fishery/cwp/en>.

Table 21
Work plan on bycatch and entanglement.

Item	Intersessional period	SC/67b Annual Meeting
Global disentanglement database	Development work continuing	Review proposal
Small cetacean mitigation measures	Develop a summary table of available measures	Review progress
	Assist with bycatch mitigation initiative	Review progress
Indian Ocean bycatch	Secretary write to IOTC to offer Committee assistance	Review progress
Strandings and bycatch levels	Expert group to review (ICG-7, Annex W)	Review expert group report

14. SHIP STRIKES

14.1 Review estimates of rates of ship strikes, risk of ship strikes and mortality

Hill *et al.* (2017) described a study of vessel collision injuries on live North Atlantic humpback whales in the southern Gulf of Maine based upon photographs of 624 individuals from 2004 through 2013. Around 15% of individuals exhibited injuries consistent with one or more vessel strikes. Of these, 29% involved propellers and most were only known to penetrate the skin (29%) or into the blubber (66%). Some 10% of injuries were fresh when first seen, and 29% were in the process of healing, including one that was not considered fully healed until two years later. These results likely underestimate vessel collision rates and impacts because multiple events, events resulting in acute mortality, and those that involved only blunt force trauma could not necessarily be detected. There was only one vessel strike formally reported in the area during the study period, and so these results also indicate that events are underreported.

Attention: G, CC

Noting the difficulties of determining the depth of wounds or detecting blunt trauma from images and the relevance of such information to its work on ship strikes, the Committee recommends that a careful examination of stranded carcasses and comparison with catalogues of images, that might include the stranded animal pre-mortem, would be valuable and, in some cases, might assist the determination of blunt force trauma.

The dynamics of collisions between large ships and large whales was explored using simulations in SC/67a/HIM16. An exploratory analysis assuming a body size and mass typical of a fin whale suggests that only at high vessel speeds or with side-on collisions would the impact energy be in the range required to cause death by blunt trauma. However, even at moderate speeds the collision can impose a lateral bending movement on the whale's spine, sufficient to cause serious or catastrophic spinal injury but not necessarily near the point of impact. Spinal injury that is not immediately fatal may compromise the motility of the whale and render it incapable of feeding, leading to death from malnutrition over time. Carcasses from such delayed deaths may not be readily recognised as ship strike mortalities.

The Committee noted that this study could help refine understanding of the relationship between speed and lethal impacts. The results could also help with advice on identifying whether a ship strike had occurred. For example, sightings of animals in poor body condition or unable to swim effectively, but with no obvious external trauma, could have been compromised by internal injuries from ship strike.

Attention: G, CC

The Committee recommends that the work on dynamics of collisions between large ships and large whales, such as that

in SC/67a/HIM16 continue, noting its potential to provide advice on mitigation measures. It also encourages the author to discuss with relevant stranding coordinators what type of data could be collected to help improve the models.

14.2 Mitigation of ship strikes in high risk areas

14.2.1 Review progress towards assessing and mitigating ship strikes in previously identified high risk areas

The Committee has previously noted concern over the impacts of ship strikes around Sri Lanka and reviewed studies related to ship strike risk and mitigation options. In view of these concerns a review of historical information on large whales stranded around Sri Lanka was undertaken (SC/67a/HIM11). Details are presented in Annex J. It was not possible to determine the cause of death for any stranded individual before 2002. The first two large whales that were confirmed deaths from ship strikes were in 2002 and 2003¹⁵. Determining cause of death was only possible for two of the 54 strandings after 2004 and both were ship strikes. There were 12 additional deaths that were reported as ship strikes but these could not be confirmed due to the limited available details. However, the true number of whales killed from vessel strikes must be much greater than the confirmed number.

Blue whales are an example of a species that have well-defined habitat and are subject to anthropogenic threats. Redfern *et al.* (2017) applied methods for predicting cetacean distributions in data poor ecosystems to blue whales in the northern Indian Ocean. Models based on blue whale sightings from combined California Current and eastern tropical Pacific surveys were used to predict blue whale distributions in the northern Indian Ocean (NIO) because of the potential similarity of blue whale ecology in both regions. Predictions of blue whale habitat in the NIO from these models compared favourably to hypotheses about NIO blue whale distributions, provided new insights into blue whale habitat, and can be used to prioritise research and monitoring efforts.

The authors noted that they were now able to further explore the use of these models to assess ship strike risk in the NIO. In 2016, the Committee had agreed that the results previously presented from this study on large scale distribution patterns, together with those of Priyadarshana *et al.* (2016), covering a smaller area, were sufficiently consistent to support a proposal to IMO to move the shipping lanes off the southern coast of Sri Lanka, should Sri Lanka so wish.

Attention: G, SC, CG-A

The Committee agrees that the results presented by (Redfern et al., 2017) on applied methods for predicting cetacean distributions in data poor ecosystems would allow it to provide advice on the relative risks of different routing options south of Sri Lanka.

¹⁵Except for one humpback whale entangled in fishing gear in 1981.

The Committee also noted that this approach could be advanced in several possible ways and extended to modelling multiple species as well as expanded to other regions. Telemetry data can also assist in developing models of habitat use. It was noted that the information derived from such models is useful over timescales relevant to managing shipping threats (such as routing measures), but that models could also potentially include further relevant variables associated with climate change to make longer-term predictions.

In February 2017, a dead blue whale carcass was found at Estero Mena, southern Chile with at least four clear propeller cuts on the peduncle and the entire tail missing. The third confirmed case of a dead baleen whale from ship collision in this important feeding area for blue whales and other baleen whales.

Attention: G, SC, CG-A

*The recent reported cases of baleen whale mortalities from ship strikes in Southern Chile raises **concerns** about this threat and the need to take actions to reduce the risk of ship strikes. The Committee **recommends** that modelling work (cf Redfern et al., 2017) to identify high risk zones for ship strikes in southern Chile be undertaken so that possible mitigation options might be evaluated.*

SC/67a/HIM03 used Automatic Identification System (AIS) data to reconstruct the track and speed of a container vessel which docked in Colombo, Sri Lanka with a dead blue whale wrapped over the bulbous bow. This incident was reviewed by the Committee in 2013 (De Vos et al., 2013). It had not been possible to match a change in vessel speed with the location of the ship strike in SC/67a/HIM03. However, the Committee had previously considered the potential for 'forensic' use of AIS data and such data are being increasingly used within the Committee. There are several commercial providers who may be willing to provide data for conservation related purposes although access is not always easy. It was suggested that the IWC could pass on data requests in a standardised format which would minimise the work for the data provider. It was also noted that if the IWC was coordinating data requests then any data that were provided could be archived for future use along with the request specification.

Attention: SC, S

*The Committee **agrees** that IWC could play a valuable role in coordinating data requests from scientists to AIS data holders for work agreed useful by the Committee. It **recommends** that the Secretariat and the HIM Convenor explore ways in which this can be achieved, including the developing a memorandum of understanding between IWC and a data provider.*

14.2.2 Consideration of methods to identify 'high risk' areas

In 2013, IUCN established a Task Force (TF) on Marine Mammal Protected Areas (MMPA). As its first major initiative, the TF developed develop criteria for identifying Important Marine Mammal Areas (IMMAs) through a consistent and independent expert process. The objective was to be able provide marine mammal information into existing national and international conservation tools with respect to marine protected areas such as Ecologically or Biologically Significant Areas (EBSAs) under the Convention on

Biological Diversity (CBD), and Key Biodiversity Areas (KBAs) identified through the IUCN Standard. The IMMA process also assists in providing strategic direction and priorities to the development of spatially explicit marine mammal conservation measures. Notarbartolo di Sciara, co-chair of the MMPA TF, presented an overview of the IMMA process, and the results of the TF's first regional workshops to identify IMMAs in the Mediterranean Sea (SC/67a/HIM15) and in the Pacific Islands region. Regional workshops submit candidate IMMAs (cIMMAs) to subsequent review by an independent panel. Future workshops are being planned in the North-East Indian Ocean (2018), West Indian Ocean (2019), waters adjacent to Australia and New Zealand (2020), and East Pacific Ocean off Latin America (2021).

The Committee noted that this initiative has the potential to assist the work of the IWC. For example, one candidate IMMA in the Mediterranean coincided with an existing high risk area for ship strikes in the Hellenic Trench where the Committee had considered routing measures. In addition to their potential relevance to ship strikes (e.g. through voyage planning or speed reduction), managers might consider using IMMAs in co-occurrence analyses with fishing, noise (e.g. soundscape) or other spatial threats.

Both the IWC Scientific Committee and the Commission's Standing Working Group on Ship Strikes (SSWG) have recognised that the IMMA process may be of value to the work of the Committee in several ways, but most immediately in assisting to identify potential 'high risk' areas for ship strikes. The Committee agreed that a small group (ICG-6 IMMA historical data, Annex W) should be established to work with IUCN MMPA TF intersessionally in order to provide advice on the most appropriate use of the IWC's (and other) historical datasets in the IMMA consideration process.

Attention: SC, CC

*Both the IWC Scientific Committee and the Commission's Standing Working Group on Ship Strikes (SSWG) have recognised that the IUCN IMMA (Important Marine Mammal Areas) process may be of value to IWC work, most immediately in assisting to identify potential 'high risk' areas for ship strikes. Following the SSWG strategic plan, the Committee **recommends**:*

- (1) continuation of the effort to identify IMMAs; and in particular*
- (2) the establishment of a joint IWC-IUCN TF group to identify those IMMAs which could be taken forward to the IMO in the context of ship strikes, starting with the Mediterranean Sea.*

14.3 Co-operation with IMO Secretariat and relevant IMO committees

SC/67a/HIM09 reviewed developments in the marine mammal avoidance provision of the IMO Polar Code, along with a general review of available information on collection of data and mechanisms to convey these data to ships masters. The review highlighted the possible impacts of polar shipping, and the context for the creation of the Polar Code, a provision which calls for current information on marine mammal densities and migratory routes to be considered in voyage planning and routing.

The Secretariat had been contacted intersessionally with a request for comment and advice related to a proposal for vessel routing measures affecting cetaceans that was intended to be submitted to IMO. The Committee noted that there

may be a need to respond to such requests intersessionally, and that there was overlap with providing information to USCG and AWSC in addition to input into the IUCN IMMA process related to shipping.

Rosenbaum provided a description of a cooperative effort, between several NGOs, IGOs and UN member countries, to bring issues of shipping and cetaceans, primarily noise and ship strikes, to the attention of the UN (see Annex J, item 5). The Committee noted that it could potentially provide expertise on this issue but **agrees** that, as the current effort is largely policy oriented, in the first instance the Secretariat should communicate with the authors of the initiative to see what role IWC might appropriately play.

Attention: SC, S, CC

The Committee recognises the importance of being able to provide scientific advice on cetaceans with respect to routing and other shipping measures in response to requests to the IWC. Recognising that this is a substantial undertaking and that an appropriate process needs to be developed, the Committee recommends:

- (1) that information on known cetacean densities and migratory routes in the Arctic and Southern Ocean, including appropriate models of distribution patterns, should be compiled and reviewed by the Committee and made available in an appropriate form to assist the Polar states, IMO, and Arctic Council in the implementation of the IMO Polar Code's marine mammal avoidance provision; and*
- (2) that information regarding cetaceans in the Western Arctic and Bering Strait migratory routes should also be collated and presented to the United States Coast Guard (USCG) and the Arctic Waterways Safety Committee (AWSC) to support their development of mitigation measures in those waters.*

*To develop this advice and a general process for responding to such requests, the Committee **establishes** an intersessional correspondence group (see Annex W) to:*

- (a) consider how best to respond to requests for advice on routing measures;*
 - (b) consider how to collate information regarding cetaceans in the Western Arctic and Bering Strait migratory routes; and*
 - (c) provide input into the IMMA process related to shipping.*
-

15. ENVIRONMENTAL CONCERNS

The Commission and the Scientific Committee have increasingly taken an interest in the environmental threats to cetaceans. In 1993, the Commission adopted a resolution on research on the environment and whale stocks and on the preservation of the marine environment, IWC Resolution 1993-12 (e.g. IWC, 1996; 1997; 1998; 1999; 2010a). As a result, the Committee formalised its work by establishing a Standing Working Group that has met every year subsequently.

15.1 Pollution 2020

15.1.1 Review on intersessional progress

Hall provided a summary on the progress of the intersessional correspondence group for persistent organic pollutants (see Annex K, Appendix 2) under the three items in the work plan.

- (a) Continue modelling of contaminants, including potential addition of PBDEs.* Development and refinement of the individual based model (effectS of Pollutants On Cetacean populations, SPOC) has continued during the intersessional period focusing on uncertainty in the *in utero* transfer parameter and how best to use published toxicological data for PBDEs.
- (b) National and international progress on risk and mitigation for PCBs.* A number of news items reporting the high levels of PCBs in killer whales and other European cetaceans published by Jepson *et al.* (2016) resulted in a call for countries to adhere to the Stockholm Convention on Persistent Organic Pollutants. The Committee suggests that many mitigation methods be explored. The Committee also notes that the SPOC model might be used to estimate the population half-life of PCBs in cetaceans, under different remediation scenarios, to inform managers of how long it would take for any measures to be apparent in a particular population.
- (c) Data integration and mapping.* Work on the contaminant mapping tool continued intersessionally and many of the suggestions and comments provided by the Committee members at SC/66b have now been implemented. It will be available on the website by SC/67b.

SC/67a/E09rev1 presented new information on PCBs in free-ranging common bottlenose dolphins from the Gulf of Trieste, in relation to demographic parameters. Males had significantly higher PCB concentrations than females and nulliparous females had higher concentrations than parous females, due to maternal offloading. A large proportion of the population had levels above the estimated threshold for physiological effects in marine mammals.

The Committee discussed possible sources of PCB pollution into the Adriatic Sea, noting that remediation plans for regions with semi-closed bodies of water should consider the long marine system retention times. Identification of regions where contaminant levels have decreased as a result of remediation actions could help direct future mitigation recommendations in other regions and this will be examined by an intersessional correspondence group (see Annex W).

PCB monitoring combined with long-term photo-identification and population ecology studies can be highly informative for assessing the impacts of POP pollution, especially as such information is often lacking for wild populations. Such studies could then be compared to predicted model outputs to indicate ongoing or new sources of contaminants to a particular region.

Attention: G, C-A

*The Committee **recognises** the important contribution of the Pollution 2020 programme to its ability to provide the Commission with advice on contaminants. The Committee:*

- (1) **thanks** Hall for her continued improvements to the contaminant mapping tool and the modelling modifications;*
- (2) **recommends** these tools be made available to the public; and*
- (3) **recommends** that the proposed model modifications and the population half-life of POPs objectives be progressed next year (SC/67b).*

*In addition, the Committee **draws the attention** of the Commission to issues related to PCBs and cetaceans and especially the results of: (a) Jepson *et al.* (2016) regarding*

the high levels of PCBs in killer whales and other European cetaceans; and (b) SC/67a/E09rev1 and the high levels in the Adriatic Sea. The Committee therefore:

- (1) **endorses** international efforts to reduce PCBs in the environment; and
- (2) **recommends** that the work of Genov and colleagues in the Adriatic continues, and that their data are integrated into the modelling and mapping work described under Item 15.1.1.

15.1.2 Receive review on mercury in cetaceans

SC/67a/E08 reported heavy metal concentrations in the tissues of gray whales and Pacific walrus from the coastal waters of the Chukchi Peninsula between 2008 and 2016. The levels of many elements were higher in the liver than the other tissues sampled. The Russian State Maximum Permissible Levels for the various metals were exceeded in very few samples, most notably in the 'stinky' gray whale samples from 2008. The Committee notes that the elevated cadmium and lead concentrations in the gray whales are of interest.

The topic of mercury in cetaceans was placed on the Committee's agenda in response to IWC Resolution 2016-4 from the Commission on the 'Minamata Convention' that 'requests the Scientific Committee to provide at IWC/67 a summary of the current state of knowledge on the presence of heavy metals, with emphasis on mercury compounds, in cetaceans worldwide, and to identify areas of ocean health and human health concerns, and geographic areas where research should be prioritised in this regard'.

SC/67a/E04 provided a summary review of the significant amount of data on mercury in cetacean species that have been reported globally since the first reports in the 1970s. The aim was to provide a snapshot of existing peer reviewed papers and technical reports on levels and trends in various species. The paper provides an additional evaluation regarding which species would be considered more at risk for mercury and which ocean basins.

The Committee thanks the authors for this preliminary review, which helped guide the development of the response to the Commission's resolution and recognises that further synthesis is needed. It notes that data on prey contaminants might be available regionally or nationally and links to such data sources might also be useful.

Attention: C-A, SC, G

In response to the Commission's resolution (IWC Resolution 2016-4) at this stage, the Committee:

- (1) **draws the attention** of the Commission to the preliminary review (SC/67a/E04) of data on mercury in cetacean species that have been reported globally since the first reports in the 1970s;
- (2) **recommends** that a more in-depth synthesis of available data be undertaken and that experts in mercury cycling and mercury toxicology in cetaceans participate in providing further information with the objective of completing a report for the Commission by SC/67b; and
- (3) **recommends** that the mercury and selenium levels provided in the presented review, and solicited from additional technical experts, be added to the contaminant mapping tool.

15.2 Oil spill impacts

15.2.1 Development of information resource and communication strategy

Information on several oil spill planning and preparedness guidance documents that are nearing completion in the US

and internationally were presented. In the US, NOAA has completed the National Marine Mammal Oil Spill Response Guidelines for marine mammals and is now developing regional annexes.

Internationally, the first phase of a global oiled wildlife emergency response system (funded by the International Association of Oil and Gas Producers/International Petroleum Industry Environmental Conservation Association (IOGP/PIECA) Oil Spill Response-Joint Industry Project - Phase II) was completed in December 2016. Funding was also awarded to a cohort of leading oiled wildlife response specialists to develop a 'Good Practice Guide on Wildlife Response Preparedness' which could apply to marine mammal response.

15.2.2 Progress on oil spill science, planning and preparedness

The Committee welcomed SC/67a/E03 which reported information on heavy fuel oil (HFO) and Arctic cetaceans, and updated the Committee on efforts in other international fora to study and mitigate the risk of use and carriage of HFO by vessels in the Arctic. A further update on the work of the Arctic Council to study the impacts of HFO use and past incidents was also presented, including the recent inclusion of concerns surrounding HFO presented in the Fairbanks Declaration of 11 May 2017 (Arctic Council, 2017).

Attention: G, CG-A

*The Committee **draws the attention** of the Commission to the importance of understanding the risks to cetaceans caused by transport of heavy fuel oil in the Arctic and **recognises** the ongoing valuable work taking place in the Arctic Council, Circumpolar Biodiversity Monitoring Program. To complement this, the Committee:*

- (1) **encourages** submissions to future meetings of the Committee under the Item on Pollution 2020 on the impact of heavy fuel oils on cetaceans and on possible mitigation measures; and
- (2) **recommends** the collection of baseline data on health and contaminant levels for cetaceans in the Arctic, including standardisation of assessment measures among studies of bowhead whales and white whales.

15.3 Cumulative impacts

15.3.1 Brief update on intersessional progress and plans for 2018

The Committee considered the five research recommendations from the recent report on the cumulative impact of stressors on marine mammals (National Academies of Sciences Engineering and Medicine, 2016). The Committee noted that the 2004 IWC Workshop on Habitat Degradation (IWC, 2006) was also highly relevant to this topic and would provide additional useful guidance for the proposed workshop.

Attention: SC, G

The problem of assessing cumulative and synergistic stressors on cetaceans is long standing. To assist in this effort, the Committee:

- (1) **recommends** the holding of a workshop on cumulative effects (see Item 25); and
- (2) **endorses** the recommendation from the (National Academies of Sciences Engineering and Medicine, 2016) that future research should focus on efforts to develop case studies that apply the Population Consequences of Multiple Stressors (PCoMS) framework to actual marine mammal populations and that this should be a component of the workshop.

15.4 Harmful algal blooms

On 7-8 May 2017, a pre-meeting entitled 'Workshop on Harmful Algal Blooms (HABs) and Associated Toxins' was held (SC/67a/Rep09). Experts presented information related to HAB dynamics and drivers, including mechanisms underlying toxin production and detection, as well as major HABs and their toxins of concern for cetaceans.

15.4.1 *Synthesis of current state of science and impacts to cetaceans*

The Workshop concluded that the global distribution and increasing ubiquity of HABs and their toxins has resulted in an increasing risk to cetacean health at the individual and population levels. It also noted that data from HAB monitoring, marine mammal strandings and toxin analysis in tissues and environmental samples should be integrated at appropriate spatial and temporal scales. There are many resources available online and that a list of contacts in the HAB community by country or region would be valuable for cetacean researchers. Two-way communication between stranding responders, oceanographers and the ocean observing community was also suggested.

15.4.2 *Health impacts of HABs and their toxins*

Investigations of human and cetacean exposure to HABs have similar confounding issues associated with duration of exposure and toxicity of bloom, information on health prior to the exposure, and concurrent exposures to other possible contaminants. Linking HABs and their toxins to cetacean impacts is difficult because of the multiple HAB species that may be involved, the varying oceanographic conditions, varying HAB and cetacean biology, and varying data availability and quality.

The use of 'omics technologies' (from genomics to metabolomics) to investigate toxin exposures and their impacts on individual animal health holds promise for the development of HAB biomarkers, particularly in instances of unexplained mortality events or investigations of the effects of chronic exposures in cetaceans.

15.4.3 *Workshop conclusions and recommendations*

The Workshop recommended that cetacean biologists should link with GlobalHAB, ICES, PICES, SCOR¹⁶, and other HAB groups, to increase communication and active information exchange between biologists and the HAB community. The Workshop noted the rapid global expansion of aquaculture systems that may alter coastal habitats and enrich nutrients into the marine environment which can increase the occurrence and intensity of HABs. While development of dose-response relationships may not be feasible for any cetacean species, data could be synthesised from multiple sources to estimate dose-response relationships in cetaceans. These sources could include laboratory experiments of other species, measured concentrations from cetaceans and pinnipeds with confirmed acute toxicosis, and control cases without evidence of HAB-related disease. Finally, the Workshop recommended that the development of biomarkers in relevant (and obtainable) tissues and other matrices, both of exposure and of effects, be pursued as a priority.

In discussing the report, the Committee noted that increasing HAB events worldwide are influenced by a variety

of factors, including changes in climate and temperature, as well as human activities that result in exponentially increasing inputs of nitrogen and phosphorus into the environment. It also recognised that whilst HABs increase in frequency in many regions of the world, the effects of HABs on cetacean health, both at an individual and population level, are not fully understood. In addition, the ability to assign the cases to a specific cause is hampered by logistics, weather conditions, and resources. The technical expertise necessary to perform post-mortem examinations on cetaceans and to collect appropriate samples is still lacking in many regions of the world. It is likely that the documented HAB-related mortalities reflect only a small proportion of those that are occurring.

The Committee **commends** Hall, Rowles, and the Workshop participants for their hard work and excellent report.

Attention: CG-A, G

The Committee **agrees** that the global distribution and increasing ubiquity of Harmful Algal Blooms (HABs) and their toxins has resulted in an increasing risk to cetacean health at the individual and population levels. The Committee cautions that the documented HAB-related mortalities reflect only a small proportion of those that are occurring. The Committee **endorses** the recommendations of the HAB Workshop as follows, recognising that some are long-term projects:

- (1) cetacean biologists should link with GlobalHAB, ICES, PICES, SCOR and other HAB groups to facilitate information exchange;
- (2) efforts to investigate data that could improve understanding of dose-response functions should be pursued;
- (3) toxins in cetacean prey be monitored; and
- (4) HAB toxin detection methods be standardised and research into appropriate biomarkers of exposure and response be pursued by researchers in the field.

In addition, the Committee **advises** IWC member governments to support efforts to:

- (1) control nutrient input including reducing use of nitrogen and phosphorous;
 - (2) support best aquaculture practices¹⁷ and relevant international agreements, initiatives and standards set out by FAO's Fisheries and Aquaculture Department; and
 - (3) prioritise HAB impacts in their monitoring and research plans, as well as capacity building for stranding response and post-mortem investigation of unusual cetacean events.
-

15.5 Marine debris

15.5.1 *Brief update on intersessional progress and plans for 2018*

The Committee noted that the issue of plastic pollution and marine debris will be considered at the Convention on the Conservation of Migratory Species (the Bonn Convention) and marine debris will be a topic at the forthcoming Conference of Parties in October 2017. The Committee looks forward to a report from this meeting next year (SC/67b). The Committee has established an intersessional correspondence group to plan for a future workshop on marine litter and plastics (ICG-27, Annex W).

¹⁶GlobalHAB - Global Ecology and Oceanography of Harmful Algal Blooms (<http://www.geohab.info/>); ICES - International Council for the Exploration of the Sea (<http://www.ices.dk/Pages/default.aspx>); PICES - North Pacific Marine Science Organization (<http://www.ices.dk/Pages/default.aspx>); SCOR - Scientific Committee on Oceanic Research (<http://www.scor-int.org/>).

¹⁷<https://bapcertification.org/>.

15.6 Diseases of concern

15.6.1 Progress on website and communications (including quarterly CDOC updates) and plans for 2018

SC/67a/E07rev1 reported the progress made by the IWC intersessional steering group on Cetacean Diseases of Concern (CDoC) between May 2016 and April 2017. During IWC SC/66b, the Commission endorsed a recommendation to continue the work associated with refining the website and making it operational as soon as possible¹⁸. The main page is open to the public, but disease information pages require login.

The Committee was pleased that changes suggested last year have been incorporated intersessionally (IWC, 2017b). Some concerns were raised about the uncertainty around the time and money spent on website development and management and usage by the community given that the website is not yet available to the community and usage cannot yet be determined.

Attention: SC

The Committee **recognises** the importance of the content on the CDoC website, thanks Simeone for her efforts in improving the design of the CDoC website and updating the website content and notes the potential synergy between CDoC and the Strandings Initiative, especially with respect to Hot Topics, Laboratory List, and reporting portal. The Committee **recommends** that:

- (1) the CDoC intersessional correspondence group (ICG-24, Annex W) includes members of the Strandings Initiative to evaluate potential overlapping tasks;
- (2) the current content of the CDoC site is reviewed by the intersessional correspondence group so that content be made available to users as soon as possible;
- (3) HAB experts review the relevant site content, and that the list of international HAB organisations be shared on the CDoC site; and
- (4) that the intersessional correspondence group suggests a mechanism to provide relevant disease information to interested parties on a quarterly basis.

15.6.2 New information

SC/67a/E01 compared photographs from bowhead whales of the Okhotsk Sea sub-population with data from the Bering-Chukchi-Beaufort Seas population. Both populations are exposed to entanglement in fishing gear and killer whale predation, however the killer whale injuries are more severe in the Okhotsk Sea. Moulting-related skin conditions are unique to the Okhotsk Sea bowheads which also carry a greater body burden of whale lice. These differences may reflect the different marine habitats. The study shows that photographs of bowhead whales can be used not only for photo-identification but also for information on health and human interactions. The status of the Okhotsk Sea sub-population is also discussed under Item 9.3.8 whilst the Bering-Chukchi-Beaufort Seas population is discussed under Item 8.3.1.

15.7 Strandings and mortality events

15.7.1 Short review on intersessional progress and plans for 2018

At its IWC/66 meeting in 2016, the Commission endorsed the recommendations of the Whale Killing Methods and Welfare Issues Working Group (WKM&WI WG) and the Scientific Committee on Strandings, including the establishment of a Strandings Expert Panel and Coordinator

post. Following discussion in the WKM&WI WG, the issue of funding for the Strandings Coordinator was referred to the Finance and Administration Committee (F&A). The F&A Committee noted that funding was not allocated to this initiative and that costs might have to be met through voluntary contributions at least initially.

SC/67a/E06 summarised the work carried out by the intersessional steering group (SG-16) on strandings that was tasked during SC/66b with selecting the Expert Panel, overseeing its first meeting (including the development of the budget), and working with the Secretariat as appropriate. The Expert Panel has been selected although efforts are needed to improve representation from Asia and Africa.

The Committee also discussed a draft governance structure developed by the intersessional SG and Secretariat. The Committee agreed that there should be a transition from the intersessional group to a permanent Steering Group to enhance communication between the Expert Panel and the Scientific Committee, Conservation Committee, and the WKM&WI WG. The interim and proposed final reporting structures and activities are shown in figs 1 and 2 of Annex K.

Attention: C-R, CC, WKM&WI

The Committee **reiterates** the importance of the Strandings Initiative as approved by the Commission at IWC/66, **thanks** Simeone for excellent work leading this effective intersessional effort, notes the need for an emergency response fund and **recommends** that:

- (1) the intersessional steering group (SG-16) remains and proceeds with the development of the initiative until the Commission appoints the steering group following the process provided in the draft governance and reporting structure (Annex K, figs 1 and 2) and see point (4) below;
- (2) the Chair of the Conservation Committee (or his/her appointee) and the Chair of the Whale Killing Methods and Welfare Issues Working Group (or his/her appointee) join the intersessional SG;
- (3) the ISG finalises the Expert Panel and select representatives from Asia and Africa from the existing list of nominees if possible;
- (4) the Commission establishes a steering group, comprised of members of the Scientific Committee, the Conservation Committee, and the Whale Killing Methods and Welfare Issues Working Group as soon as practical;
- (5) as concurrent priorities:
 - (a) the Secretariat initiate the process to recruit a Stranding Coordinator as soon as possible;
 - (b) the Expert Panel, once finalised, elects a chair, and works intersessionally and virtually;
 - (c) the intersessional SG and the Expert Panel, in consultation with the Secretariat, develop a job description and person specification for the Stranding Coordinator - some members of the Expert Panel and ISG should sit on the interview panel; and
 - (d) the intersessional SG with the Secretariat develop a funding mechanism for emergency stranding response;
- (6) the Expert Panel and the intersessional SG should also work with intergovernmental organisations such as the IUCN Wildlife Health Specialist Group and with the governments of member countries to develop a procedure for transboundary transport of diagnostic specimens for cetacean disease investigations in emergency situations.

¹⁸<https://cdoc.iwc.int/>.

15.7.2 New information

The Committee welcomed SC/67a/HIM02, which described a pilot study that tested the ability of VHR (Very High Resolution) satellite imagery to identify and count stranded whales during the Chilean sei whale stranding event that took place along the mid-Patagonian coast between February to May 2015. The authors concluded that VHR imagery could be an important future tool for detecting stranding events of baleen whales in remote areas and noted that their work is ongoing.

Attention: G, SC

Despite questions of cost and access to images, the Committee agrees that:

- (1) *the use of VHR satellite imagery to identify and count stranded whales shows promise in areas where clear satellite images can be obtained (e.g. satellite images will not work for areas where carcasses will be obscured such as mangroves);*
- (2) *serial images would further illuminate issues with the timing of whale deposition especially in remote locations where carcasses persistence is unknown; and*
- (3) *continued refinement of this method should occur to fully evaluate its potential, especially for remote areas.*

A humpback whale unusual mortality event is occurring along the US Atlantic Coast in which forty-three whales stranded from 1 January 2016 through 5 May 2017. Of the 22 cases examined, 10 cases had evidence of blunt force trauma or pre-mortem propeller wounds indicative of vessel strike. This is well above the 16-year average for vessel strikes of 2.5 whales. The Committee notes that there may not have been changes in vessel traffic, but that the whales feeding behaviour may have changed causing a possible overlap with some shipping lanes.

Attention: CG-R

The Committee recommends that studies to investigate the reasons for the increase in vessel strikes to humpback whales on the Atlantic coast of the USA should continue, along with risk assessment analyses and the investigation of potential mitigation measures.

Carretta *et al.* (2016) used the fraction of carcasses recovered after stranding and abundance and survival rate data from field studies to estimate annual deaths for a population of coastal bottlenose dolphins. During a 12-year period (1995-2006), 327 animals (95% CI=253-413) were expected to have died and been available for recovery, but only 83 carcasses attributed to this population were documented. This estimate will be of additional value in developing carcass recovery correction factors for more pelagic dolphin species in the region that might be less likely to strand.

Although this study did not distinguish between natural and human caused mortality, the correction factor provides a starting place for modelling human-caused effects in subsequent studies (e.g. see SC/67a/Rep07). Inclusion of other environmental factors might provide information on what to expect during a specific ocean regime. Since stranding network effort affects the ability to generate this kind of carcass correction factor, the study also emphasises the importance of increasing and maintaining stranding response capacity.

Attention: CG-R

Estimating numbers of entangled or ship struck whales from strandings data is difficult but important when trying to estimate possible population level effects. The Committee

welcomes the study of Carretta et al. (2016) which has already influenced modelling scenarios (e.g. see Item 10.1.3) and stresses the importance of understanding carcass recovery and how it can be scaled up to the whole population for other situations (e.g. it has practical applications for assessing oil spill damage, and see discussion under Item 13.4).

15.8 Noise

15.8.1 Update on national and international ocean noise strategies

The Committee welcomed information on ongoing efforts by the USA (including NOAA's Ocean Noise Strategy Roadmap), Canada (Ocean Protection Plan) and IUCN (a resource guide for managers on geophysical and other imaging surveys) to develop strategies for addressing ocean noise issues. It also noted the ongoing development of two new acoustic standards via the Acoustical Society of America's ANSI standards process, covering expert recommendations on standardising industry-related PAM operations and guidance on metadata associated with the collection and analysis of passive acoustic data.

15.8.2 Update on intersessional cooperation with the IUCN WGWAP Noise Task Force

The Committee welcomed the sharing of recommendations from the IWC Acoustics Masking Workshop (IWC, 2017g) and the IUCN WGWAP Noise Task Force in response to a recommendation last year (discussions were initiated in early 2017).

15.8.3 New international and national guidelines and advice (e.g., IMO)

The IWC Acoustic Masking Workshop (IWC, 2017g) (IWC, 2017b, p.617-27) had recommended connecting IWC recommendations on ocean noise with the UN Sustainable Development Goals (SDG14) process to 'Conserve and sustainably use the oceans, seas, and marine resources for sustainable development'. Rosenbaum reported on a side event on ocean noise, shipping and whale conservation that occurred prior to the UN Oceans Conference (February 2017) to discuss implementation of SDG14.

Legislation applied to seismic surveys to mitigate effects on marine mammals in 20 Latin American countries was reviewed in Reyes Reyes *et al.* (2016). Currently, only Brazil and Peru have enacted mandatory guidelines. Some countries and companies have voluntarily adopted mitigation measures legislated by other countries. However, seismic survey mitigation remains unlegislated in most Latin American countries and there is an urgency to increase awareness and urge regulators to enact and enforce proper legislation for marine seismic survey activities.

In addition, the Committee notes that the New Zealand Department of Conservation Guidelines (Department of Conservation, 2005) for minimising acoustic disturbance from seismic survey operations are being revised and looks forward to a presentation of these updated guidelines.

Attention: CG-A, CG-R, SC

The Committee has repeatedly expressed concern about the potential impacts of noise on cetaceans. The Committee reiterates this concern and:

- (1) *welcomes the update on international efforts to develop noise guidelines and acoustic standards;*
- (2) *encourages expanded international coordination regarding assessment and protection of acoustic habitat quality; and*

- (3) **recognises** the commonalities identified among recommendations from recent ocean noise workshops and planning documents (e.g. Annex K, Appendix 3) and **agrees** to continue to identify synergies and develop priorities for actions to reduce exposure of cetaceans to anthropogenic noise.

With respect to seismic surveys, the Committee:

- (1) **reiterates** its previous recommendations on seismic survey noise reduction guidelines since 2004 (IWC SC/56, IWC SC/57, IWC SC/58, IWC SC/59, IWC SC/62, and IWC SC/66);
- (2) **recognises** the recommendations from Reyes et al., 2016 and **reiterates** the need for international guidelines; and
- (3) **recommends** as a matter of urgency that member countries should collaborate regarding implementation of best available practices for minimising the negative impacts of seismic survey exploration on marine mammals and their acoustic habitats, and to promote collaborative efforts among industry partners to reduce the need for multiple surveys within the same habitats.

Last year (IWC, 2017b, p.53), the Committee recommended a paper for submission to the IMO Marine Environment Protection Committee (MEPC), providing an update of recent information related to the extent and impacts of underwater noise from shipping. This will assist the broader recommendations for enhanced cooperation between IWC and IMO and follows a similar update on ship strikes which was well received by IMO MEPC. The next MEPC meeting, MEPC 71 will be held in July 2017 and at least one paper related to underwater noise from shipping has been tabled at that meeting, and when this is discussed IWC could offer to develop a technical paper on the issue for MEPC 72 (expected in early 2018).

Attention: S

*With respect to the development of a paper for submission to the IMO Marine Environment Protection Committee (MEPC), the Committee **recommends** that:*

- (1) intersessional correspondence group (ICG-25, Annex W) provides the Secretariat with a summary of the relevant material and discussions in the form of a paper that could be presented to MEPC 72 with a focus made on the 2016 recommendations and rationale; and
- (2) that the Secretariat or an expert from the Scientific Committee attends MEPC 71 to offer a technical paper for MEPC 72. This work should be completed by March 2018.

15.9 Climate change

15.9.1 Brief update on intersessional progress

A new report on the consequences of global warming produced under the auspices of the IUCN was launched at the IUCN World Congress in September 2016 (Laffoley and Baxter, 2016). One chapter (Simmonds, 2016), outlined the potential effects on marine mammals including shifts in feeding and breeding grounds; movement of mobile species into new areas resulting in further conflicts with human activities; mismatches between peak productivity and cetacean migration timings; declines in species with restricted habitats and changes in the balance of species with increasing occurrences of invasive species.

15.9.2 Reconsiderations of this agenda item in light of other items (e.g. Arctic issues, river dolphins)

The Committee discussed how the topic of climate change, which cuts across many agenda items, could be better

integrated into its work. There was reference to previous discussions and workshops on this topic and subsequent recommendations from those. A steering group had met in 2014 to make recommendations to direct future considerations of this topic by the Committee.

Attention: SC, C-A

*With respect to climate change, the Committee **agrees** that:*

- (1) the impact of climate change should be considered in an integrated manner highlighted when it is a specific driver within the topics being covered; and
- (2) that the intersessional correspondence group (ICG-26, Annex W) refine ideas for a future workshop and identify relevant climate change issues, noting the discussions under Item 15.10.1.

15.10 Arctic issues

15.10.1 Progress on priority topics including co-operation with other bodies

Moore provided information on the four priority topics on Arctic Issues endorsed at SC/66b (IWC, 2017b, pp.54-55). The Arctic intersessional correspondence group reviewed recent activities under each topic. Priority one was to provide updates on cetacean species that routinely occur in the Arctic. In the Pacific Arctic, it was noted that while sea ice extent has declined, bowhead and gray whales in the eastern Chukchi Sea have not changed their distributions appreciably over a 34-year sampling period. Seasonal migrant species of baleen whale are now commonly seen north of Bering Strait.

A review of possibilities and constraints in the future harvest of living resources in a changing northeast Atlantic Arctic Ocean was presented in Haug *et al.* (2017). Global warming drives changes in oceanographic conditions in the Arctic Ocean, which may result in favourable conditions for increased biological productivity. However, production in the central Arctic Ocean will continue to be limited by light and vertical stratification. Upwelling conditions and inflowing Atlantic Water may result in high production in areas along the shelf breaks that may influence the distribution and abundance of marine mammals. Both migrant cetaceans and harp seals are likely to follow any receding sea-ice edge, if sufficient food resources become available in the region. Such northward expansions of more boreal marine mammal species are likely to cause competitive pressure on some endemic Arctic species (bowhead whales, white whales, narwhals), as well as putting them at risk of predation and diseases.

Vacquié-Garcia *et al.* (2017) described recent late summer distribution of whales in high Arctic Norwegian waters. Based on line-transect surveys conducted in August 2015, bowhead whales were predominantly seen close to the ice-edge, whereas narwhals were located deeper into the ice. No white whales were observed during these surveys. The results suggest little spatial overlap between the seasonally occurring whales and the narwhals, bowhead and white whales.

Priority topics 2-4 (IWC, 2017b, pp.54-55) focused on aspects of integrating the work of the Committee with various Arctic Council working groups. Topics where synergies may be found include activities related to the Arctic Marine Shipping Assessment (AMSA) and the IMO Polar Code and Voyage Planning activities. In particular, the Bering Strait Port Access Route Study and the Arctic Waterways Safety Committee were noted. With regard to ecosystem assessment

activities, the Circumpolar Biodiversity Monitoring Program (CBMP), the State of the Arctic Marine Biodiversity Report (SAMBR), the Ecosystem Approach (EA) to Management, and the Arctic Council Emergency Prevention Preparedness and Response (EPPR) reports seemed the most relevant to the work of the Committee.

Possible changes to the structure of the Committee agenda were also discussed with the objective being to better integrate information flow on impacts to cetaceans of environmental variability associated with climate change, in the Arctic and elsewhere, among the sub-committees and working groups of the Committee.

Attention: SC

*The Committee **agrees** that the thematic and focus topics of the Standing Working Group on Environmental Concerns are all occurring in the context of climate change, as are all other topics considered in several sub-committees of the Committee (e.g. SM, EM). Therefore, the Standing Working Group on Environmental Concerns **recommends** that Climate Change be better integrated in the work of the full Committee. The Committee **agrees** that Arctic Issues will no longer be a standing topic in the Standing Working Group on Environmental Concerns agenda and papers would be addressed under the most appropriate agenda items for the issue being presented.*

15.11 State of The Cetacean Environment Report – SOCER

The State of the Cetacean Environment Report was the result of several IWC resolutions including Resolutions 1997-7 and 1998-5, which directed the Scientific Committee to provide regular updates on environmental matters that affect cetaceans. Resolution 2000-7 welcomed the concept of SOCER and requested the annual submission of this report to the Commission. The first full SOCER was submitted in 2003 and subsequent editions initiated and continued a cycle of focusing on the following regions: Mediterranean and Black Seas, Atlantic Ocean, Pacific Ocean, Arctic and Antarctic Oceans, Indian Ocean. Each SOCER also includes a Global section addressing the newest information that applies generally to the cetacean environment. The 2017 SOCER (see Annex K, Appendix 5) focuses on the Indian Ocean, summarising key papers and articles published from about 2015 through 2017 to date. Next year the 2018 SOCER will focus on the Mediterranean and Black Seas.

The 'Ocean Health Index' rates the Western Indian Ocean with a good score (79 of 100 points), but the Eastern Indian Ocean receives a poor value of 55. Another evaluation, the 'First Global Integrated Marine Assessment' conducted by the UN, identified the key Indian Ocean threats as bycatch, habitat degradation and loss, and pollution (including marine debris). Importantly, it outlined the lack of information available on the state of the Indian Ocean and stresses research gaps. One study reported that the Indian Ocean gyre apparently contains more floating debris than both the Southern Pacific and Southern Atlantic gyres combined. Several papers pointed to the threats facing endangered river dolphins in India, Pakistan and Nepal due to various modifications of waterways. Globally, the problem of climate change predominated. Unprecedented levels of carbon dioxide in the atmosphere (410ppm) have been recorded, and it is predicted that global temperatures that have not been experienced in 420 million years will be recorded soon. 2016 was officially the hottest year on record with global temperatures 1.2°C above the average temperatures

during the late 19th/early 20th centuries. Further studies on cetaceans exposed to the Deepwater Horizon oil spill demonstrate clear population impacts, including long-term deterioration of cetacean health, a decrease in reproductive rates and an increase in mortality rates in bottlenose dolphins exposed to oil. Further details can be found in Annex K, item 12 and Annex K, Appendix 5.

The Committee notes that the annual SOCER can be downloaded from the IWC website (<https://iwc.int/socer>) and is also published in the Supplement to the *J. Cetacean Res. Manage.* as an appendix to the annex which is the report of the Standing Working Group on Environmental Concerns. Although infectious diseases were not included in the SOCER this year due to the lack of peer-reviewed publications in the focus region, this subject matter has been included in SOCER in previous years. The Committee **thanked** the editors of SOCER for their report and **commended** them on compiling this information.

15.12 Work plan

The proposed work plan is provided in Table 22 and the proposed work flow is provided in Annex K, Appendix 6.

16. ECOSYSTEM MODELLING

The report of the Working Group on Ecosystem Modelling is given as Annex L. 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:

- (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.

16.1 Cooperation with CCAMLR on multi-species modelling

16.1.1 Review ecosystem modelling in the Antarctic Ocean
SC/67a/EM14 updated an existing ecosystem model for the Antarctic Ocean (Mori and Butterworth, 2006) to incorporate model improvements and updates of abundance and trend information for krill and predator species. While the updated models presented a better fit than previously, there was more oscillatory behaviour in the trajectories for krill and some of its main predators, probably due to the new approach used to model natural mortality for krill. This may in turn resolve a key mismatch in the model, which predicts Antarctic minke whale oscillations in the Indo-Pacific region to be out of phase with results from a SCAA assessment of these whales.

SC/67a/EM12 illustrated additional models describing a focused spatial 'Model of Intermediate Complexity for Ecosystem Assessments' (MICE) for phytoplankton, krill, copepods and five baleen whale species for the Southern Hemisphere. Predicted Antarctic blue, fin, and southern right whale populations are at <50% pre-exploitation numbers (*K*) in 2100, even given 100 years without catches. Southern right whales were estimated to currently be <11% of their carrying capacity, while humpback whales were predicted to recover to *K* by 2050. Results demonstrated key differences in population trajectories and estimates between models

Table 22
Summary of the work plan for environmental concerns.

Topic	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Cumulative impacts	Plan the pre-meeting.	Pre-meeting Workshop on modelling cumulative effects and case studies.
Pollution 2020 (including oil spills and mercury)	Finalise Phase 1 of the SPOC model with the recent modifications and make available on the IWC website. Begin Phase 2 to include assessing risks from PBDEs and assess population half-life of POPs in cetaceans. Make current map available on the IWC website	Report on the SPOC model to include the addition of effects of PBDEs and POP population half-life estimates. Report on progress with the contaminant mapping and trends tool development including addition of mercury.
	Synthesise available mercury data and integrate into map.	-
	Identify appropriate IPs for mercury cycling and toxicology.	-
	Produce report on mercury.	Summary report on mercury to Commission.
	Identify PCB remediation courses of action.	Update on progress.
Strandings	Work with Secretariat to develop and implement the International Strandings Initiative.	Update on progress.
SOCER	Produce report.	Mediterranean and Black Seas.
CDoC	Finalise the IWC CDOC website redesign and content, determine best approach to maintain information in website and the consultation/discussion fora, work with Strandings Initiative.	Update on progress as appropriate.
Noise	Planning for future Workshop on noise.	Update on progress as appropriate.
	Intersessional advisory group to provide Secretariat with summary of shipping noise for MECP 72.	Progress reported.
Marine litter	Pre-planning for marine debris Workshop on marine litter and plastics at SC/68a in 2019.	Working paper outlining the workshop agenda.
Climate change	Discussions of future work including planning for a Workshop.	-

that account for, or ignore, predator-prey linkages. This is a strategic model that provides a platform for exploring additional hypotheses and management strategies.

In discussion, it was noted that while these two ecosystem models have differences in objectives, trophic interactions captured and scales of the models, there are also some synergies. Both are krill-based predator-prey multispecies models, and are naturally underpinned by similar data requirements (though at different scales) and a requirement for a sound understanding of ecosystem function. The need for better data for describing population dynamics of individual species, and for more quantitative information about energy transfer between related trophic levels was emphasised.

16.1.2 Update on cooperation with CCAMLR

Several CCAMLR members were welcomed and thanked for their participation in discussions, including Mark Belchier, current Chair of the CCAMLR Scientific Committee. It was agreed that data sharing, data quality control, and identifying data gaps were key issues to be resolved at an institutional level between the IWC and CCAMLR. Therefore, it is timely that planning is taking place for another IWC-CCAMLR workshop on data requirements for ecosystem models in 2019 (see Item 16.1.3). CCAMLR and IWC share similar goals in terms of developing whole-of-ecosystem modelling approaches, and that this similarity can benefit both organisations.

16.1.3 Update on the plan for joint SC-CAMLR – IWC SC workshops

In 2008, IWC and CCAMLR held a joint Workshop where data holders on krill predators and oceanography came together (IWC and CCAMLR, 2010). A formal proposal is being drafted to develop multi-species models and a joint IWC-CCAMLR workshop has been planned following a 2-step approach (IWC, 2017b, p.56). The first stage is to hold a pre-meeting workshop before SC/67b in 2018 to: (a) review new data (from 2008 when the last Workshop was held); (b) discuss the types of multi-species models to meet the needs of both organisations; and (c) develop a workplan for a second workshop in 2019. The western Antarctic

Peninsula will be a focus area for modelling as it is a high priority area for krill management and there are considerable data available. The details of this two-year process are given in Annex L, Appendix 5.

Attention: SC

The Committee recommends that collaboration between IWC-SC/SC-CAMLR continues, and that the revised plan for the workshops on multispecies modelling be implemented (Annex L, Appendix 5).

16.2 Applications of species distribution models (SDMs) and ensemble averaging

16.2.1 Review progress of guideline for SDMs

An intersessional steering group (SG-20, Annex W) has been operating since SC/65b to develop guidelines and recommendations for best modelling practices for SDMs. It has conducted a preliminary review of SDMs applied to baleen whales and preliminary reviews of machine learning methods, which are commonly used as SDMs. Subsequently, general guidelines for the application of SDMs were developed. SC/67a/EM15 updated this work by integrating a further 12 reviews of new SDM papers. The intersessional SG plans to complete its work prior to SC/67b. The work plan includes the following tasks: (1) revising descriptions of each machine learning method; (2) adding short methods descriptions for boosted regression trees and generalised additive models (GAM); (3) adding a short guideline for GAM, with appropriate citations; and (4) final preparation for journal publication.

The Committee thanked the SG for work during the intersessional period. It was noted that while the focus of the review had been on machine learning methods for SDMs, GAMs were becoming an increasingly useful framework for these kinds of analyses. It suggested that the GAM section of the Guidelines be expanded when possible. The Guideline document for SDMs is intended to be a 'living' document that is regularly reviewed and update. It was suggested that the guidelines would benefit from an explanatory application to some real or simulated data.

16.2.2 Review progress of work on SDMs and ensemble modelling

In 2016, another correspondence group, established in 2015, determined that a scaled-down version of the original work plan developed at the preparatory Workshop ‘Towards Ensemble Averaging of Cetacean Distribution Models’ (IWC, 2016c) was necessary. It decided to focus on the risk of ships striking blue whales off the USA west coast, using only those models that covered the entire USA west coast. The US-CG created a unified grid for all predictions and identified areas where model predictions were similar and where they were different, and developed methods to scale the predictions (e.g. density versus probability of occurrence). Finally, the receiver operating characteristic curve and related metrics were used to explore methods for weighting the predictions in the ensemble. It is expected that this work will be completed in the coming year and a manuscript will be submitted to a peer-reviewed journal.

Redfern *et al.* (2017) focused on the prediction of cetacean distributions in data poor ecosystems, with blue whales used as a case study. GAMs were used to relate the number of blue whales in each transect segment to the habitat variables that identified variations in upwelling, circulation, and water column stratification that may affect forage availability. Four measures of model performance identified a single model that provides the best match to the blue whale sightings in each ecosystem. Model assessment metrics and independent experts identified a single best model that performed better than the ensemble, and that performed consistently well on both quantitative metrics and qualitative expectations. The model was used to predict blue whale distributions, rather than using an ensemble of predictions from GAMs with different habitat variables.

While the methods performed well for these data, the possibility remains that the good performance may be specific to the case in question. Therefore, there was interest in whether selecting a ‘best’ model may result in uncertainty being under-represented should the method be applied more generally. The broad geographic area of the study region would also likely capture several distinct behavioural states (e.g. transiting and foraging), so different models may be capturing different aspects of behaviour unequally. The methods for combining uncertainty when averaging an ensemble of models are not yet well developed. The Committee **encourages** an update on the progress of this work at future meetings of the Scientific Committee.

16.3 Effects of long-term environmental variability on whale populations

The issue of variability in baleen whale demographics was examined at an MSYR Workshop held in 2010 (IWC, 2011b). Simulation work presented at this meeting (Annex L, Appendix 4) suggested that the trajectories of recovering stocks would be expected to show little signal of environmental variability until they have recovered to about half of carrying capacity or more. As a result, the fact that many populations have shown smooth exponential increase as they have recovered from low levels, does not imply that they will continue to show smooth trends. This is particularly true for the case of the Southern Hemisphere populations.

Attention: SC

*The Committee **agrees** to keep the item on the effects of long-term environmental variability on whale populations on its agenda, to be discussed if new analyses are forthcoming. It **suggests** that efforts be made to include effects of*

environmental variability in population models, including the individual-based energetic models that are being developed (see Item 5.1).

16.4 Modelling of competition among whales

Three studies (SC/67a/EM10, SC/67a/EM11 and Weinstein *et al.*, 2017) examined the foraging ecology of humpback and Antarctic minke whales from satellite tagging studies in the waters off the western side of the Antarctic Peninsula. This research is part of the IWC-SORP supported research programme on the foraging ecology of baleen whales in the Antarctic. Movement models were used to understand the influence of environmental parameters (e.g. sea ice) on foraging behaviour, how the foraging ranges of each species was defined and affected by environmental variables, seasonal changes in movement patterns and the overlap between humpback whales and krill fisheries. While an overlap in the core foraging areas of humpback and Antarctic minke whales was identified, the latter had to search far broader areas to find suitable habitat for foraging and predator avoidance. There was no indication that prey was limiting in this ecosystem at this time. However, there was evidence that both whale behaviour and krill catch effort were spatially clustered, with distinct hotspots of the whale activity in the Gerlache and southern Bransfield Straits. These areas aligned with increases in krill fishing effort, and present potential areas of current and future conflict.

The Committee **welcomes** this work undertaken under IWC-SORP and looked forward to further updates.

16.5 Update on body condition analyses for the Antarctic minke whales

Following the suggestion of the Committee at last year’s meeting, scientists from Australia, Japan and Norway worked to develop a set of models that best capture the Committee’s previous recommendations regarding body condition of Antarctic minke whales (IWC, 2017b, p.58), sharing data through Procedure B of the Data Availability Agreement.

SC/67a/EM01-03 used linear mixed effects and penalised regression splines to model total body weight as non-linear functions of body length, time within season, foetus length and long-term trend over year. Four discrete subsets of the JARPA data were examined after exploratory analyses revealed differences in the length-weight relationship between sexes and between those animals considered to have a high or low diatom load. Only for females with high diatom load there was some signal to indicate a decline in body weight. However, the long-term trend was not linear, was not consistently in decline for all animals within the group, and was based on small sample sizes (average 37 samples/year). The authors expressed concern that there were systematic trends in the segment of the population being sampled, as evidenced by changes in ages and sex ratios. As a result, they felt it was difficult to determine whether the apparent changes in body condition in a subset of the models reflected real changes in the population, or whether the changes were an artefact due to variability in the segment of the population being sampled. The authors concluded that there had not been a detectable change in body condition over the course of the JARPA surveys.

SC/67a/EM04, 07-08 and 16 incorporated six response variables: five related to storage of fat: blubber thickness at two sites, half girth at two sites, and fat weight, and an index based on total weight, (which had been suggested by the authors of SC/67a/EM01) to analyse the JARPA data.

A linear mixed effect model intended to incorporate all effects influencing body condition was analysed, and model selection was carried out using the focused information criterion (FIC). The authors concluded that the results were consistent with the conclusion that there had been a decrease in body condition over the 18 years under study, because five out of the six proxies for body condition had clear, negative, significant estimates for the linear effect of year. The exception being the proxy related to total body weight.

There was extensive discussion within the Working Group on Ecosystem Modelling regarding the relative merits of the models presented, with the focus being on three main areas: the appropriate response variable, the statistical merits of each approach and the selection of the data to be analysed. No consensus was reached regarding the choice of response variables, because while some evidence was presented that total weight may not be an appropriate proxy for body condition (Annex L, Appendix 2), there was also the contention that the concordance between fat weight and total weight lent considerable support to the proposal that total weight was an appropriate measure of body condition. There was agreement on the general merits of the various approaches, but disagreement that the inclusion of spatial covariates by the authors of SC/67a/EM04, 07-08 and 16 resulted in confounding with time, and that the model selection process may have introduced variability into the estimates of the standard deviation, which has the potential to bring results into question. No consensus was reached regarding the spatial covariates, but the role of the model selection process was explored (Annex L, Appendix 3), although it was determined that a full exploration of these effects could not be carried out during the meeting. The models in SC/67a/EM04, EM07-08 and EM16 were applied to the four discrete subsets of the JARPA suggested by SC/67a/EM01-03 (Annex L, Appendix 3). The results of these supplementary analyses did not lead to agreement.

The Committee recognises that, thanks to the collaborative effort, considerable progress had been made in achieving convergence on the question of how to analyse for trends in body condition and/or blubber thickness in the JARPA data. The Committee recognises that the estimating changes over time is complex, because of the need to take account of additional components of variance which are partially confounded with the realised sampling design, and which had not been taken into account on the initial analysis (IWC, 2015c).

Attention: SC

The Committee agrees that the estimation of changes in body condition data over time is more complex than had originally been assumed. Nevertheless, there was no clear majority opinion to change the conclusion reached by the Scientific Committee in 2014 that a 'decline in blubber thickness and in fat weight that was statistically significant at the 5% level had occurred during the JARPA period.' (IWC, 2015c, p.46).

16.6 Other

16.6.1 Stable isotope analysis

SC/67a/EM05-06 found that faecal material could be used to validate stable isotope sampling techniques, because the stable isotope values of krill remained unaltered by their passage through the digestive tract. The contribution of krill in the digested food of baleen whales was estimated to be substantial, which demonstrated that: (i) results from macroscopic gross analysis of faeces may be misleading because less digestible components, such as fish bones, may be overrepresented; and (ii) that faecal stable isotope values contribute significant information to the assessment

of short-term diet. All baleen plates, independently of their position in the filtering apparatus, size or coloration, grow at the same rate and display similar stable isotope values and oscillations. Therefore, position of sampling along the baleen plate row should not be a reason of concern when conducting stable isotope studies. The authors considered that these results are applicable to other species, such as Antarctic minke whales.

16.6.2 Review the information on krill distribution and abundance by NEWREP-A

SC/67a/EM09 reported krill and oceanographic surveys in the Antarctic Area V-W during 2016/17 austral summer season as a part of second NEWREP-A dedicated sighting survey. Two research vessels were engaged with krill acoustic survey and net samplings by small ring nets and an Issak-Kid Midwater Trawl (IKMT) for species identification and size compositions of plankton at 32 stations and 13 stations, respectively. Oceanographic observations using CTDs and water sampling were also conducted coincidentally. Krill and oceanographic data are currently being examined, and results obtained in the 2016/17 season will be presented to a CCAMLR specialists' workshop. Feedback from the specialists will be reflected in the planning of the 2017/18 survey.

16.6.3 Review of other topics related to Ecosystem Modelling

SC/67a/EM13 took note of IWC Resolution 2016-3 'Cetaceans and Their Contribution to Ecosystem Functioning'. In the resolution, the Commission asked 'the Scientific Committee to screen the existing research studies on the contribution of cetaceans to ecosystem functioning to develop a gap analysis regarding research and to develop a plan for remaining research needs'. SC/67a/EM13 was intended to help this process and provided a bibliography of relevant scientific publications and suggestions for further research to help fill knowledge gaps. In response to a request for advice on how to build hypotheses into quantitative models, advice was presented on the use of tools such as EcoSim, as well as other papers and projects on animal movement and habitat use that speak to how and where animals can be part of ecosystem models using data, rather than simulations. The Committee encourages relevant submissions in the future, especially considering Resolution 2016-3.

Attention: SC, CC

The Committee agrees that its Working Group on Ecosystem Modelling is the proper place to bring forward work focused on biological hypotheses relevant to IWC Resolution 2016-3 'Cetaceans and Their Contribution to Ecosystem Functioning'. An intersessional correspondence group was established (ICG-28, Annex W) to further develop proposals for a way forward in SC/67b, and how to best integrate this stream of work into the Scientific Committee.

16.7 Work plan

The work plan on ecosystem modelling is provided in Table 23.

17. SMALL CETACEANS

17.1 Review of taxonomy and population structure of bottlenose dolphins (*Tursiops* spp.) in the East Pacific and western North Pacific oceans

17.1.1 Introduction

In 2014 (IWC, 2015c) it was agreed that the Committee would undertake a review of taxonomy and population structure in the genus *Tursiops*, over several meetings.

Table 23

Summary of the work plan for the EM working group (ISG=Intersessional Steering Group; ICG=Intersessional Correspondence Group).

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
(1) Cooperation with CCAMLR on multispecies modelling.	Prepare a pre-meeting Workshop under an ISG (see Annex W).	Pre-meeting Workshop to review the status of multispecies models and data series (see Appendix 5).
(2) Applications of species distribution models.	ICG activity (see Annex W).	Review progress.
(3) Effects of long-term environmental variability on whale populations.	Continue further analyses.	Review progress.
(4) Further investigation of individual-based energetics models.	Continue further analyses.	Review results.
(5) Modelling of competition among whales.	Continue further analyses.	Review results.
(6) Update of information on krill distribution and abundance by NEWREP-A.	Conduct a survey by consultation of CCAMLR specialists.	Review results of the survey and analysis.

Understanding whether there is any consistency in the derivation of various local forms across the range, and to which taxonomic or population unit(s) they belong, has been challenging, and the taxonomy of the various forms is still unresolved. An additional aim of this exercise was to develop a widely applicable taxonomy assessment framework for small cetaceans.

Bottlenose dolphins are among the most widely distributed cetaceans. Factors contributing to taxonomic uncertainty in this genus include a wide distribution across highly variable environments, variability within locally adapted populations, sympatry of various forms in some regions, a lack of specimens from many regions, and differences in research methods and designs. In many regions where bottlenose dolphins occur, different forms (ecotypes/morphotypes) have been described, based on distribution (e.g. offshore vs coastal differentiation), morphology, and genetic profiles. Worldwide, 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.

17.1.2 Summary of the 2015 review for the Indo-west Pacific Ocean and Oceania

In the first phase of reviewing the Indo-west Pacific Ocean and Oceania (IWC, 2016e), outstanding taxonomic and population distinction issues concerning bottlenose dolphins were highlighted. In the Indo-West Pacific, *T. aduncus* and *T. truncatus* are clearly distinguishable. However, *aduncus*-type dolphins exhibit considerable regional variability. It was difficult to resolve the taxonomic status of *T. australis* (a species recently described from south Australian waters) in part because of discordance in results using different genetic markers, and morphometric analyses did not show a difference between putative *T. australis* specimens and *T. truncatus* (Hale *et al.*, 2000; Jedensjö *et al.*, 2013; Kemper, 2004). However, the lack of morphological distinctiveness relative to *T. truncatus* could be related to the distinctions between species being blurred by convergence.

17.1.3 Summary of the 2016 review for the Atlantic Ocean and the Mediterranean and Black Seas

Only one recognised species, *T. truncatus*, is present throughout the Atlantic Ocean and the Mediterranean and Black Seas, and the Black Sea population is recognised as a subspecies, *T. truncatus ponticus*. The 2016 review (IWC, 2017b) showed that two distinct morphotypes of *Tursiops* are present in the western North Atlantic. Morphological and ecological (diet preferences, parasite loads) differences have been documented between a smaller coastal form and a larger offshore form, and genetic analyses revealed significant genetic differentiation for a wide range of molecular markers. Significant morphological

differentiation in the western South Atlantic between a large coastal form and a smaller offshore form may be indicative of species or subspecies-level differences; the two morphotypes are parapatric along the coast from southern Brazil and sympatric in northern Argentina. The Committee considered whether there was sufficient evidence to elevate the coastal form in the Western South Atlantic to species status (as *T. geophyreus*), but concluded that there was not enough evidence to draw firm conclusions. In addition, it stressed the necessity of evaluating the genetic context before proposing new species. However, the significant morphological differentiation between the large coastal form and a smaller offshore form (a single, but strong line of evidence) is consistent with subspecies-level differences. The 2016 review further illustrated the need to standardise and widen the types of markers (morphological, genetic, ecological and behavioural/acoustic) used to define groups.

17.1.4 Summary of the 2017 review for the eastern north Pacific (ENP), eastern south Pacific (ESP) and western North Pacific (WNP)

This year, the Committee considered published information on bottlenose dolphin distribution and potential taxonomic (species, subspecies) distinctions in the eastern north Pacific (ENP), eastern south Pacific (ESP) and western North Pacific (WNP). Newly available information on *Tursiops* from areas covered in 2015 and 2016 was also reviewed. In all the areas considered during the three-year review, sizeable areas have almost no information, thus presenting major challenges in understanding bottlenose dolphin diversification worldwide. From this review, it was clear that well differentiated morphotypes of *T. truncatus* are present in the ENP, while in the WNP, the presence of the two recognised species is well documented. In the ENP, both morphological and genetic data provide convincing evidence for the presence of two distinct morphotypes of *T. truncatus*, with a level of genetic differentiation consistent with long-term separation. In California, the 'coastal morphotype' (originally described as *T. gilli* 1873) is restricted to waters within 1 km of the coast from at least Ensenada, Mexico to San Francisco, California. Coastal and 'offshore' morphotypes (originally described as *T. nuuanu* 1911) are also present in the Gulf of California and there appears to be significant genetic differentiation between the Gulf of California and California coastal populations, but a comprehensive morphological analysis comparing the two has not yet been performed. In the Gulf of California, the coastal morphotype is restricted in range to the upper portion of the Gulf and may be of conservation concern given documented bycatch in fisheries.

In the ESP, morphological data support the presence of two morphotypes in Peru, Ecuador and Colombia. Only the offshore morphotype and a small, possibly hybrid group are documented in Chilean waters. Further work is needed

to determine whether the coastal morphotype is present in Chile. In addition, it was noted that there is a possibility that *Tursiops* moves around the tip of South America and comparisons of morphological and genetic data between both sides of the continent will be valuable. Sample sizes in most of the studies have been relatively low and that increased sampling throughout the region would be helpful. Further work is needed to determine whether the coastal morphotype is present in Chile.

Attention: SC, G

So that the taxonomic status of the different bottlenose dolphin morphotypes in the eastern Pacific can be better resolved, the Committee recommends that a wide range of data (morphological, genetic and other) from the northern and southern regions be compared so that the ranges of any potential taxonomic units in the eastern Pacific can be fully explored.

In contrast to the eastern Pacific, current WNP data do not support the presence of multiple morphotypes of *T. truncatus* (although population genetic differentiation is documented). Both *T. aduncus* and *T. truncatus* appear to co-exist throughout much of the range examined, however, sample sizes in published morphological studies are small and it is not yet possible to rule out the presence of multiple morphotypes of *T. truncatus* in the western North Pacific.

17.1.5 Process to conclude the review

To conclude this taxonomic review, a workshop will be conducted prior to SC/67b (see Item 25) that will focus on the relative importance of morphology, behaviour, mtDNA and nuclear genetic data for consideration of differences at the specific, sub-specific and population levels. In addition, the strength of evidence for taxonomic status of *Tursiops* in various localities, using the information compiled from the three years of meetings, will be evaluated and hypotheses on taxonomic status will then be formulated. At SC/67b, a summary table of the available types, amount, and strength of the evidence available for each taxonomic 'contrast' will be presented. The Committee will then also be presented with recommendations that identify important outstanding areas for further research in addition to recommendations on how standard genetic markers, morphotypic analyses and behavioural data should be integrated so that a consistent classification system for *Tursiops* can progress.

17.2 A review of small cetaceans in rivers, estuaries and restricted coastal habitats in Asia, *Platanista* spp., *Orcaella* spp. and *Neophocaena* spp.

17.2.1 Coastal finless porpoise

The Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) occurs on both west and east coasts of India. The species is more common on the west coast, where there is contiguous availability of preferred habitat. Stranding records indicate that entanglement in fishing gear remains a major threat to this species. Gillnets, purse seine nets and shore seine nets are known to catch finless porpoise with a minimum of 10-12 individuals reported as bycatch every year from at least two areas. Recent surveys of the Sindhudurg coast offshore areas show seasonal differences in finless porpoise occurrence, with higher densities in the wet season (October-February). Passive acoustic monitoring (CPOD) at Sarjekot also shows seasonal and diel patterns of occurrence in nearshore waters, again with peak occurrence throughout the wet season and beyond (October-June). Only small portions of the vast India coastline have been surveyed

for finless porpoise and there are large data gaps, e.g. the Sundarbans. Some samples are collected from by-caught porpoises but this is not consistent and more collaboration between states is required. It is thus difficult to draw firm conclusions concerning finless porpoise population structure and abundance or the scale and sustainability of bycatch in India. Acoustic monitoring offers a potential way of assessing distribution and perhaps relative abundance.

In the Malaysian state of Sarawak, finless porpoises are the second most frequently observed cetacean with the highest encounter rates in the Bintulu-Similajau region. Abundance estimates (as yet not validated by the Committee, see Item 12) are only available from Kuching Bay 74-246 (CV=31%). Abundance varied seasonally, with higher densities observed between March and May, when most new calves were observed and feeding was the dominant behaviour. The shallow inshore waters of Kuching Bay are an important feeding and calving area for finless porpoise in Sarawak. There is intense fishing activity within the porpoise preferred habitat, and interviews with the local fishing communities indicate that 93% of fishermen recall up to five cases of bycatch in their village within the past year, and 35% of fishermen accidentally entangled (either live or dead) one porpoise per year. Although the areas studied in Sarawak are small, relative to the total coastline of north Borneo, it appears that this area does report a high number of finless porpoise when compared to the other Malaysian states of coastal Borneo.

Attention: SC

Given the poor level of information available to evaluate the status of the Indo-Pacific finless porpoise, the Committee recommends that:

- (1) *surveys for (relative) abundance, habitat use and distribution of Indo-Pacific finless porpoise be carried out with emphasis on areas where the least is known (e.g. India, Indo-Malay Archipelago, Arabian/Persian Gulf); and*
 - (2) *efforts be made to improve bycatch monitoring (ideally with onboard observer programmes, and at a minimum with stranding notification, investigation, sampling and reporting) in all areas of known overlap between finless porpoise occurrence and fishing activity (especially gillnetting).*
-

17.2.2 Yangtze finless porpoise

Information from the current *ex situ* conservation efforts for the critically endangered Yangtze finless porpoise (*Neophocaena asiaeorientalis asiaeorientalis*) indicates that populations within three managed reserves are successfully reproducing. One of these reserves had sufficient individuals to transport some to a new *ex situ* area and it is hoped that this will continue in the long term so that genetic heterozygosity might be maintained across these geographically isolated reserves. The People's Republic of China has formally recognised the risk the Yangtze finless porpoise population faces and has greatly increased resources for research, enforcement of regulations, and public awareness activities. The Government has also increased restrictions of various activities, e.g. fishing and sand mining, in several areas throughout the porpoise's natural habitat.

Attention: SC, CG-A

The Committee has expressed its great concern over the status of this critically endangered subspecies and welcomed the new information presented at this meeting.

The Committee:

- (1) **welcomes** the information that a fishery ban in the entire Yangtze basin by 2020 has been proposed and **agrees** that, at a minimum, enforcement of a fishing ban at least throughout all finless porpoise reserves is required;
- (2) **notes** that the programme for translocating finless porpoise appears to be effective, and **commends** the Chinese Government, Prof Wang Ding and his colleagues for the progress they have made in this regard;
- (3) **agrees** that a few areas of particularly high-quality habitat (e.g. oxbows along the main channel of the Yangtze) should be identified, and that the suitability of such areas as ex situ reserves be carefully assessed prior to any porpoise being introduced; and
- (4) **re-iterates** its previous recommendation that primary conservation actions should focus on restoring and maintaining suitable habitat for porpoise throughout the Yangtze River and associated lakes - this includes maintaining a network of in situ reserves, making efforts to ensure that genetic diversity is preserved and limiting harmful human activities.

17.2.3 Riverine Irrawaddy dolphin

Irrawaddy dolphins (*Orcaella brevirostris*) are restricted to coastal waters near river mouths, three large rivers and three large lagoons or sounds within South East Asia. The species is listed as Vulnerable on the IUCN Red List and five of the six demographically isolated 'subpopulations' are IUCN listed as Critically Endangered. These include all three riverine populations - Ayeyarwady River in Myanmar, Mahakam River in Indonesia and Mekong River in Cambodia and Laos, as well as sub-populations in Songkhla Lagoon in Thailand and Malampaya Sound in the Philippines. The sub-population within the Chilika Lake, India, is listed as Vulnerable by IUCN.

17.2.3.1 IRRAWADDY DOLPHINS IN THE MEKONG RIVER, CAMBODIA AND LAOS

The Mekong River dolphin population has been in decline for many years and is now believed to number between 64-1,001. There is a high mortality of neonates and young calves, although recent observations by WWF-Cambodia note eleven calves in 2016, of which two have known to have died. During the first 5 months of 2017, five calves have been recorded. Mekong dolphins face many threats, including bycatch in gillnets, illegal and destructive fishing practices, i.e. explosives, electricity and poison, as well as increased boat traffic in the river. Of special concern is the construction of hydropower dams both upstream of their range and soon possibly within it. The Government of Cambodia, in collaboration with WWF and development partners, have taken several steps to protect the dolphins, including wildlife law amendments, which includes the establishment of an office within the Department of Fisheries Conservation, specifically for the management and conservation of marine mammals. In 2012, the Mekong River Dolphin's Protection and Management Area was created and 72 river guards are permanently based at 16 outposts to enforce a gillnet ban. The Government of Cambodia, again in collaboration with WWF, has hosted a series of expert workshops on Mekong River dolphin conservation and research efforts that aim to foster valuable international collaboration on research methods and conservation approaches, e.g. threat identification, evaluation of sources of mortality and enforcement methods. Implementation of recommendations from the workshops has significantly contributed to a

reduction in illegal fishing activities and a corresponding reduction in dolphin mortality from gillnet entanglement, greater survival of calves (a continuing concern) and an improved understanding of the dolphins' behaviour.

Despite the recent progress in successful management and conservation actions, the population is now fragmented within a 180km segment of the Mekong mainstem between Kampi and the Khone water falls, at the Cambodia-Lao PDR border. Their distribution is concentrated in nine deep pools where the dolphins reside in the dry season, although there is interaction between the adjacent pools, except one, in the wet season. One of these pools, the transboundary pool at the Lao PDR/Cambodia border, is separated from the nearest downstream pool by 60km of rapids, which prevents this group interacting with other groups downstream.

Four major dam projects are of extreme concern and are expected to have significant impacts on Mekong river dolphins by:

- fragmenting of populations, by creating impassable barriers to interchange;
- inducing loss of habitat and microhabitats, both through siting of structures and changes to the very specific conditions riverine dolphins use to survive in constant river flow;
- provoking loss of prey through fish declines;
- creating disturbance, both short-term during construction and long-term during operations; and
- direct mortality or debilitation from exposure to construction noise and explosions.

It is believed that if built, these dams will increase extinction risk for the entire Mekong dolphin population. The Don Sahong dam, within Laos but adjacent to the Cambodian border, has been under construction since 2014, despite protests from the governments of Cambodia, Thailand and Vietnam. It is located several hundred meters upstream of the pool in which dolphins are isolated. Since the construction began, the transboundary population has declined from five to three individuals. Sediment load from construction is also making the trans-boundary pool shallower and the remaining dolphins now move regularly outside the pool, however, are prevented from moving completely away by the downstream rapids. Interviews with fishermen indicate that fish stocks in the deep pools are diminished and fish migrations have been disturbed. In addition, fishermen displaced from the dam site, are now fishing in the deep pool area, contributing to an increase in illegal fishing activities. The reduction in numbers and isolation of this group and the ongoing pressures they are facing, has raised the question of whether translocation of these animals to another area of population concentration should be explored as a conservation measure.

The proposed new dams, the Sambor, Stung Treng and Sekong dams, are all within or adjacent to the dolphins remaining core habitat. If these proposed dams were constructed, it is likely that the entire population of Mekong dolphins will be lost. The proposed Stung Treng dam would cut off the transboundary dolphin subpopulation from any possibility of contact with downstream subpopulations.

A recommendation concerning these activities is provided below.

17.2.3.2 IRRAWADDY DOLPHINS IN THE MAHAKAM RIVER, INDONESIA

This population inhabits a 420km stretch of the Mahakam River, Indonesia. The most recent abundance estimate (as yet not validated by the Committee, see Item 12) of 69-81

(CV 7%) individuals. The population has been declining since at least 2005. At least 4-6 calves are born every year and an average of four stranded specimens are recovered every year.

17.2.3.3 IRRAWADDY DOLPHINS IN THE AYEYARWADY RIVER, MYANMAR

There remain three apparently disjunct populations of dolphins in the Ayeyarwady River, estimated to total 60-70 individuals. The main threats to Ayeyarwady dolphins are gold mining, entanglement in gillnets and electric fishing. A Management Plan for the Ayeyarwady Dolphin Protected Area (ADPA) has been developed by the Myanmar Department of Fisheries, in collaboration with WCS, although little is known of its efficacy.

17.2.3.4 IRRAWADDY DOLPHINS IN BANGLADESH

The waterways of the Sundarbans Reserved Forest in Bangladesh are the only place where Irrawaddy and Ganges River dolphins (*Platanista gangetica*) occur in the same habitat. In 2002, the abundance of Irrawaddy dolphins was estimated (as yet not validated by the Committee, see Item 12) at 451 (CV=9.6%). Over the past ten years, 49 Irrawaddy dolphin carcasses have been recovered with most mortality attributed to gillnet entanglement. In 2012, the Government of Bangladesh declared three Wildlife Sanctuaries in areas of high Ganges dolphin density, however, these areas encompass habitat in which both species occur. As yet, little is known of its efficacy of this management action.

Attention: S, SC, CG-A

The Committee is greatly **concerned** at the status of riverine populations of Irrawaddy dolphins and **welcomes** the report of the 2017 international expert workshop (WWF and FiA, 2017) and **endorses** its principal conclusions, summarised below. The Committee:

- (1) **agrees** that gillnets continue to represent a primary and ongoing threat and therefore, continued implementation of a suite of measures to address this threat is required;
- (2) is **concerned** that the construction of dams on the Mekong poses a serious threat to the survival of Mekong dolphins through population fragmentation, habitat destruction, limitation of prey availability, and changes in water levels;
- (3) **agrees** that if the proposed construction of large hydropower projects on the Mekong mainstem in Cambodia proceeds, almost all of the dolphins' habitat in the Mekong will be modified or eliminated and the risk of extinction will be greatly increased;
- (4) **recommends** that the IWC Secretariat write to the Cambodian Council of Ministers and relevant Cambodian Ministries expressing the Committee's grave concerns regarding the impacts on Mekong dolphins of the proposed multiple dam construction; and
- (5) **recommends** that any effort to assess the conservation value and feasibility of translocating these individuals to another social group of dolphins downstream in Cambodia include consideration of the likely social and genetic consequences of such a move for the overall population (this includes determination of the age and sex of each dolphin in the transboundary pool through available information and tools, e.g. analysis of existing photo-id data, genetic analyses of skin samples collected by biopsy, and photogrammetry).

17.2.4 Indus River dolphin (*bhulan*)

The Indus River dolphins (*Platanista gangetica minor*) study presented to the Committee was funded from the IWC Small Cetacean Voluntary Fund (Item 17.7). The work was conducted in 2017, and provides critical information which contributes directly to this Committee's work. The Indus dolphin is listed as Endangered by IUCN and has been a global conservation priority for nearly half a century. The linear extent of their range has reduced from an historic 3,500km of river to 1,000km. This has been caused by habitat fragmentation and degradation due to the construction of dams and barrages across the Indus and its tributaries. Dolphins frequently become stranded in irrigation canals isolated from the main river, which slowly shrink during the dry season and, without translocation, the dolphin dies. There has been a substantial increase in fishing pressure in core dolphin areas, which has not only increased fishing-induced mortality, but also reduced prey availability. Use of illegal fishing practices (e.g. poison, small mesh size, overnight setting of gear) also contribute to dolphin mortality.

The total population of the subspecies in Pakistan is divided by six irrigation barrages into five largely discrete subpopulations, the largest of which occurs between the Guddu and Sukkur barrages in Sind Province and this area, Indus Dolphin Game Reserve, is protected under RAMSAR. Despite the threats these subpopulations face, surveys to estimate abundance (as yet not validated by the Committee, see Item 12) suggest that the total population size has increased; 1,200 (2001), 1,550-1,750 (2006), 1,450 (2011) and 1,800-1,900 (2017). It was noted that a small isolated population (18-35 individuals - as yet not validated by the Committee, see Item 12) of Indus dolphins existed some 600km upstream of this area, in India. In late March 2017, the flow of the river in this area in India was stopped for barrage maintenance and most of these dolphins have now disappeared¹⁹. The dolphins in Pakistan are now believed to be the only remaining population of this sub-species.

Planned research and conservation priorities are aimed to strengthen efforts to rescue dolphins from canals, continue population monitoring, assess and reduce fishery-caused mortality, and promote and support community-based conservation actions. A national action plan is required which would unite current conservation and management efforts and laws must be amended so that a common conservation framework for the entire country can be implemented. If dolphins are to be rescued, capture and translocation methods should be further developed. The potential value of tagging rescued dolphins and monitoring them after release was recognised. This would serve as a way of determining post-release survival and facilitate the study of home range areas (including movement through barrages). It was noted that a single river dolphin has been successfully radio-tagged and this provided the first direct evidence of a dolphin moving through barrage gates, in both up and down-stream directions.

Attention: SC, CC, CG-R, G

The Committee is **concerned** over the status of the Indus River dolphin (Annex M, item 7.3.6) and **recommends** that:

- (1) the Pakistan Government and NGOs that are involved in Indus River dolphin monitoring, research and conservation in Pakistan to strengthen and scale-up the dolphin monitoring and rescue network with the involvement of local communities and local authorities, so that it covers the entire range of the subspecies;

¹⁹<http://www.iucn-csg.org/index.php/2017/05/08/lost-indus-dolphins-in-the-beas-river-india/>.

- (2) *the aims of this work should be the collection of information on habitat loss, fishing-induced mortality, illegal hunting, and strandings and the support of the programme of rescuing dolphins that have become trapped in canals; and*
- (3) *a programme of focussed research should be developed on dolphin movements through barrages, including collection of tissue samples from canal-entrapped animals, to assess population structure and genetic connectivity of Indus dolphin subpopulations.*

17.2.5 Ganges River dolphin

17.2.5.1 INDIA

The Committee has previously expressed serious concerns over the potential impacts of the Indian Waterways Development Plans to the Ganges River dolphin (*Platanista gangetica gangetica*). After major dredging began in 2014, in areas within and adjacent to the Vikramshila Gangetic Dolphin Sanctuary, a marked decline in dolphin occurrence was observed. Dolphins avoided dredging sites and displayed evasive behaviour.

The initial results of this study indicate that there are negative, and potentially stressful, impacts of waterways development activities on river dolphins. In response to global concern, including a letter written by this Committee, the Indian Waterways Authority have agreed to conduct a new assessment of waterways impacts on river dolphins. Nevertheless, dredging and shipping activities continue in the Ganges, and there are multiple ongoing threats to the dolphin population.

Multi-stakeholder engagement has improved as evidenced by a joint workshop, supported by industry, academic institutions and conservation NGOs. The Workshop, held in March 2017, brought together 12 researchers from six wildlife conservation organisations and provided insights to and assessment training on river hydrology, population estimation and ecology, acoustics, threat assessment, and conservation approaches for dealing with diverse threats at multiple scales (e.g. fisheries, pollution, irrigation, water demands). This Workshop offered a good opportunity for direct dialogue with the National Thermal Power Corporation Ltd., one of the main industry stakeholders of the waterways project, and it greatly increased awareness of the potentially harmful impacts of the waterways plans on dolphins.

17.2.5.2 NEPAL

The few remaining Ganges river dolphins in Nepal are currently restricted to only three river systems with a best total estimate of <28 individuals. Both the abundance and range of dolphins have declined sharply in all the river systems of Nepal due to environmental and anthropogenic threats, which include the presence of barrages which have fragmented natural populations and regulated natural flows. Declining public and government concern over the dolphins' status, reduced awareness of the dolphins' existence in Nepal, and the advancement of investment and development strategies that conflict with the protection of dolphin habitat are detrimentally impacting the dolphins continued survival in Nepal. The complete disappearance of Ganges dolphins from Nepal is inevitable unless meaningful conservation measures are initiated and sustained. International support, both technical and financial, will be required for such work to move forward.

Attention: SC, CC

The Committee continues to have grave concerns over the status of the Ganges River dolphin.

(1) For India, the Committee:

- (a) **encourages** further systematic monitoring of underwater noise in the dolphins' habitat;
- (b) **notes** with concern the evidence of local population decline in areas of dredging; and
- (c) **urges** further, larger-scale efforts to monitor the impacts of such development.

(2) For Nepal, the Committee **recommends**:

- (a) *urgent action and communication of recent research findings to the Government of Nepal, mainly to prioritise maintenance of ecological flow regimes, river restoration and community-based fishery regulations to prevent further habitat degradation and bycatch of the remaining small populations upstream of river barrages on and near the India-Nepal border; and*
- (b) *trans-boundary surveys by India and Nepal to assess threats to the meta-populations of which Nepal's sub-populations are a part.*

17.2.6 Coastal Irrawaddy dolphins

In India, the range of the coastal Irrawaddy dolphin (*Orcaella brevirostris*) extends from Visakhapatnam in the south-east to west Bengal and the Sundarbans. The largest known, and best studied, 'subpopulation' consists of more than 100 individuals in Chilika Lake. This population faces pressure from entanglement in fishing gear and disturbance from increasing dolphin watching operations.

In Sarawak, Malaysia, a small population of dolphins (approx. 150) reside with Kuching Bay. There is a high degree of site-fidelity. The dolphins prefer to be closer to river mouths, when compared to finless porpoise in the same bay. The Small Cetacean Voluntary Fund supported a study focused on dolphin-fisheries interactions, showed that there is an extensive overlap of artisanal fisheries activities and dolphin occurrence and interview surveys confirm that accidental bycatch is prevalent.

Attention: SC, CC

*With respect to the coastal populations of Irrawaddy dolphins, the Committee **recommends**:*

- (1) *continued dedicated surveys to monitor distribution, habitat use, threats and population trends in areas such as Sarawak and Chilika lagoon - survey effort should be extended to cover gap areas, such as other coastlines in the Indo-Malay Archipelago, the Sunderbans of West Bengal, and the coast of Orissa and West Bengal in India. Passive acoustics and/or photo-identification should be used where feasible; and*
- (2) *heightened cooperation between local authorities, researchers, and the tourist industry at Chilika lagoon, India, - dolphin protection should be strengthened through better documentation of dolphin occurrence and movements, training of dolphin watch operators on dolphin watch guidelines, as well as management efforts to address the impact of fishing on the dolphins.*

17.2.7 Australian snubfin dolphin

The snubfin dolphin (*Orcaella heinsohni*) was described in 2005 and occurs in northern Australia and southern Papua New Guinea (PNG). Studied 'populations' are typically smaller than 100 individuals and no population studied to date is estimated at more than 250 mature individuals. Genetic studies indicate that snubfin dolphins live in small,

relatively isolated populations with limited gene flow among them. Habitat degradation and loss are ongoing and expected to increase across the species range. Bycatch in the Queensland shark control programme and in commercial fisheries also occurs. A continuing decline in the number of mature individuals is anticipated. New information was presented to the Committee on the genetic identity of the *Orcaella* spp. that occur in southern PNG that confirmed, for the first time, that those populations are *O. heinsohni*. There are no confirmed records of *Orcaella* sp. from other regions of the Pacific Islands or other parts of New Guinea. The demarcation between *O. heinsohni* and *O. brevirostris* therefore remains unknown. The viability of the small, apparently isolated snubfin dolphin population in southern PNG is uncertain but it is threatened by entanglement in fishing gear and possibly by directed catch.

Attention: SC, CC

The Committee **encourages** several research and other actions for the Australian snubfin dolphin, including:

- (a) dedicated multi-year studies on the distribution, abundance and habitat use;
- (b) an expansion of current biopsy sampling efforts;
- (c) the collection of samples from stranded carcasses;
- (d) organisational and nation-wide collaborations for the timely retrieval and necropsy of stranded and by-caught specimens;
- (e) capacity building and partnerships with Australian and PNG Indigenous communities; and
- (f) an evaluation of the efficacy and safety of tag attachment procedures for snubfin dolphins and once determined to be effective and safe, the use of satellite tagging to determine movements, home range and habitat preferences.

The Committee **recommends** that baseline surveys be conducted of specific areas (judged to be ecologically similar to areas known to be inhabited by the species in Australia and southern PNG) around New Guinea and the eastern Indonesian Archipelago (particularly Sulawesi, Maluku and Nusa Tenggara) and northern Timor-Leste to determine the extent of occurrence of snubfin dolphins.

17.2.8 Conclusions and recommendations

Attention: SC, CC

The Committee **recognises** that fisheries bycatch, particularly in gillnets, continues to compromise the survival of cetaceans in freshwater, estuaries and restricted coastal habitats. In addition, for freshwater cetaceans, waterways development projects, such as the construction of dams, barrages and waterways, can lead to fragmentation, degradation or destruction of their habitat.

The Committee **expresses** deep concern that the continuation and projected increases of these threats will likely lead to regional decline and extirpation of some Asian cetacean populations.

The Committee **recommends** that targeted conservation actions be directed toward reducing the impact of fisheries bycatch and water development projects on Asian freshwater, estuarine, and coastal cetaceans to ensure their long-term survival.

The Committee **encourages** integrated research on habitat loss, stranding in irrigation canals, fisheries bycatch mortality, and possible combined impacts of these threats. It also **encourages** collection of specimens and samples from

stranded or bycaught animals for taxonomic studies and population structure. This Committee further encourages increased liaison with other committees, such as E, to determine what additional samples may be of interest to their work.

17.3 Poorly documented hunts of small cetaceans for food, bait or cash and changing patterns of use

It was agreed last year (IWC, 2017b) to conduct a series of regional workshops that aimed to explore the global wild meat²⁰ issue. The first workshop, held in November 2016 in Thailand, focused on data sharing and the development of a toolkits of investigative techniques relevant to documenting wild meat trade in Asia. It also provided an opportunity to conduct the first Asian IWC Entanglement Response Training Workshop (led by Mattila). The workshop had some 24 attendees representing 12 countries and included scientists, stranding programme co-ordinators, wildlife managers, law enforcement agencies and NGOs. The multi-stakeholder group invited to the workshop is now better informed about cetacean issues in the region and links have been made to the Asian terrestrial wild meat issue community. It is hoped that liaison and collaboration with terrestrial wildlife trade researchers will accelerate progress for cetaceans. Annex M, item 8 discusses the possibility of developing a cetacean database on this issue similar to one developed for terrestrial animals. Two more regional workshops are also planned intersessionally and will be held in South America (late 2017) and Africa (immediately prior to SC/67b). Next year, all three workshop reports (Asia, South America and Africa) and a report of intersessional work on the boto/piracatinga issue in the Amazon, will be tabled for discussion and review.

Attention: SC, CC

The Committee **agrees** that an intersessional group (SG-30) would work, with the input of the GDR Convenor, to consider the possibility of a cetacean wild meat database in line with the guidelines and pro forma for IWC databases considered under Item 22 for discussion at SC/67b.

Further to last year's recommendation that working relationships between the IWC and other international bodies be pursued, the Committee **agrees** to provide updates on this issue to the Aquatic Working Group of the Convention on Migratory Species, who also works on wild meat and related issues.

17.4 Small cetacean task team

Task Teams are created to provide timely advice on situations where a population of cetaceans is known or suspected to be in danger of significant decline that could lead to extirpation or extinction, with the ultimate aim of ensuring that this does not occur. The first Task Team was established for the franciscana in 2015-16. The Franciscana Task Team consists of local experts (coordinated by Zerbini) produced a draft proposal specifying urgent actions to be reviewed by the Task Team Steering Committee. The project proposal was approved and attracted significant funding from the governments of Brazil and Italy. As the rapid action part of this process is now complete, which facilitated the establishment of the franciscana as the subject of a Conservation Management Plan under the CMP Committee, the Franciscana Task Team work is now successfully completed. It was agreed that

²⁰This term has been accepted by this Committee and other IGO's, e.g. CMS, who work on this issue.

the next candidate for development of a Task Team will be the South Asian River dolphin. The Steering Committee is currently establishing a team of experts to develop a project description and initiate activities intersessionally. Progress on this will be reported at SC/67b.

17.5 Status of the voluntary fund for small cetacean conservation research

In 2016, donations for the Voluntary Fund for Small Cetacean Conservation Research were received from the Governments of France, Italy, the Netherlands, Switzerland and the United Kingdom as well as from the Animal Welfare Institute, Cetacean Society International, Environmental Investigation Agency, Humane Society International, International Fund for Animal Welfare, Legaseas, OceanCare, ProWildlife and Whaleman Foundation.

The Committee **expresses** its sincere gratitude for these contributions and noted that these funds support critical conservation research projects of direct relevance to the work of this sub-Committee.

Last year, this Committee recommended several projects for and these were included in the Scientific Committee's budget as given in its report to the Commission. This budget was approved and funding for five projects was confirmed intersessionally (see Table 24).

Three of these projects were initiated in 2017 and progress summaries were received from all PIs. The main objective of Heinrich's project is to estimate the population size of the Chilean dolphin throughout its predicted range in the Ecoregion Chiloense. The first surveys, covering approximately a third of the total surveys area, recorded 47 groups of Chilean dolphins, 23 groups of Peale's dolphins and one group of Burmeister's porpoise. The main objective of Lai's project is to investigate the occurrence of small cetaceans for sale in fishmarkets in China, using posts on social media to identify which areas frequently feature marine mammal products on display. Two markets were visited, in Zhejiang and Guangxi Provinces, one of which reported cetacean meat for sale. Progress on the *Abundance Survey for Indus River Dolphin* was presented in Annex M. Full reports shall be provided to the Committee upon each project's completion. It is anticipated that a new call for proposals will be announced after the 2018 Commission Meeting.

17.6 Review takes of small cetaceans

17.6.1 New information on takes

The Committee received the summary of takes of small cetaceans in 2016 extracted from this year's online National Progress Reports and prepared by Hughes of the IWC Secretariat (see Annex M).

17.6.1.1 DIRECT TAKES

No direct takes of small cetaceans were reported in the 2017 National Progress Reports. The Committee **notes** that it would be helpful if the Secretariat encouraged all member countries and IGOs (e.g. NAMMCO) to submit information on direct takes as a routine procedure.

The content of the Japan Progress Report on Small Cetaceans, a public document available from the website of the Fishery Agency of the Government of Japan²¹, was summarised. It was noted that two new species had been proposed for quotas: the rough-toothed dolphin with a proposed quota of 46 and the melon-headed whale with a proposed quota of 704. A public review is currently underway in Japan regarding this proposal.

SC/67a/SM06rev1 reviewed available information of southern form short-finned pilot whales which are smaller than the northern form. The southern form occurs in high density in two areas, which are believed to be geographically isolated. The population structure of bottlenose dolphins within these areas is understood to be similarly divided. Current abundance estimates do not account for this separation in either species and there is concern that without consideration of population structure, the Japanese pilot whale and bottlenose dolphin fisheries assessment will not accurately reflect impact on these populations. Most of the short-finned pilot whale quota is allocated to the Taiji drive fishery in Wakayama. There has been a marked decline in catches of the southern form short finned pilot whales from this area, with concomitant increase in catches of other species, which the authors interpreted as an indication of a decline of the southern form short-finned pilot whale coastal population.

17.6.1.2 LIVE CAPTURES

According to official reports, 21 killer whales were captured in the western Okhotsk Sea between 2012-16. Thirteen of these were exported to China and three are still on display in a facility in Moscow. The fate of the remaining animals is not known. Although no mortality during capture or captivity has been officially reported during this period, the lack of any regulatory monitoring of the operations does not compel the companies involved in the capture/captivity industry to provide accurate reports. The Committee has previously expressed concern over the capture of live killer whales as current quotas consider all killer whales in the Okhotsk Sea as one stock, however, there are known to be both transient (mammal-eating) and resident (fish-eating) killer whales. The transient killer whale stock, which is the targeted by the live capture industry, is estimated to number less than 300 individuals and the current rate of removals from a population of this size is almost certainly unsustainable.

In discussion, it was noted that Russian fisheries authorities do not currently recognise different ecotypes of killer whales in the Sea of Okhotsk. According to Filatova, the Ministry of Natural Resources is reviewing the Russian Red Book listing and the status of Russian Far East killer whales is currently under discussion. A question was raised as to how the total allowable catch of killer whales is calculated, but no explanation could be provided by those in attendance. The Russian delegation noted that information presented by an Invited Participant does not reflect the official position of the Russian Federation.

Japan and the Russian Federation stated that takes or captures of small cetaceans in both countries are strictly regulated by appropriate governmental bodies, in accordance with scientific basis and national regulations, and quotas are allocated according to the latest confirmed scientific information on respective stocks.

Attention: C-A, CG-A

The Committee reiterates its long-standing recommendation that no small cetacean removals (live capture or directed harvest) should be authorised until a full assessment has been made of their sustainability. This is especially important for killer whales because populations are generally small and have strong social bonds and removals have unknown effects on their demographic structure.

The Committee expresses concern that removals of Okhotsk Sea killer whales have continued from this population since it received its last update on this situation (IWC, 2015e). With regard to killer whales in Russia, the Committee recommends that: (a) the two ecotypes of killer whales should be recognised; and (b) they are managed as distinct units.

²¹http://www.jfa.maff.go.jp/j/whale/w_document/pdf/h26.pdf;
http://www.jfa.maff.go.jp/j/whale/w_document/attach/pdf/index-4.pdf.

Table 24

Summary of projects commissioned by the Voluntary Fund for Small Cetacean Research, and their Principal Investigators (PI).

PI	Project title
Heinrich Lai	First region-wide estimates of population size and status of endemic Chilean dolphins (<i>Cephalorhynchus eutropia</i>) in southern Chile (I). Assessment of online information as a tool to improve the documentation of the availability of marine mammals for consumption and other uses in southern China (I).
Khan Weir	Abundance survey for Indus River dolphin (I). Assessing the conservation status of the Atlantic humpback dolphin (<i>Sousa teuszii</i>) in the Saloum Delta, Senegal (P).
Sanjurjo	Business model to save vaquita from extinction while improving fishermen livelihoods in the Upper Gulf of California (P).

Key: I=work has been initiated; P=work is pending.

17.7 Progress on previous recommendations

17.7.1 Māui dolphin

SC/67a/SM15 provided the annual update of New Zealand's management measures as well as data collection and research activities over the past year for Māui dolphins (*Cephalorhynchus hectori maui*). Measures to protect this sub-species as part of the New Zealand Threat Management Plan include a range of regulations and prohibitions that cover threats such as set net, trawl and drift net fishing, seismic surveying and seabed mining. A program of on-going research is underway to inform a review of the Threat Management Plan, scheduled to commence in 2018. The Ministry for Primary Industries is finalising an updated marine mammal risk assessment, which will be submitted to the Scientific Committee in 2018. More details on this can be found in Annex M. Also, further background on the status of Māui dolphins can be found in previous years' Scientific Committee reports.

Attention: SC, CC, G-A

The Committee **notes** that no new management action regarding the Māui dolphin has been enacted since 2013. It therefore **concludes**, as it has repeatedly in the past, that existing management measures in relation to bycatch mitigation fall short of what has been recommended previously and expresses continued grave **concern** over the status of this small, severely depleted subspecies. The human-caused death of even one individual would increase the extinction risk. In addition, the Committee:

- (1) **welcomes** the update on research on Māui dolphins provided and looks forward to receiving the final report on the updated marine mammal risk assessment in 2018;
- (2) **notes** with interest the reported fishing industry initiatives to reduce the use of potentially entangling gear in the range of Māui dolphins, which are discussed in the SC/67a/HIM12 (see Item 13.5.1);
- (3) **re-emphasises** that the critically endangered status of this subspecies and the inherent and irresolvable uncertainty surrounding information on most small populations, point to the need for precautionary management;
- (4) **reiterates** its previous recommendation that highest priority should be assigned to immediate management actions to eliminate bycatch of Māui dolphins, including closures of any fisheries that are known to pose a risk of bycatch to dolphins (i.e. set net and trawl fisheries) within the range of Māui dolphins;
- (5) **notes** that the confirmed current range extends from Maunganui Bluff in the north to Whanganui in the south, offshore to 20 n.miles, and it includes harbours - within this defined area, fishing methods other than set nets and trawling should be used; and

- (6) **respectfully urges** the New Zealand Government to commit to specific population increase targets and timelines for Māui dolphin conservation, and again respectfully requests that reports be provided annually on progress towards the conservation and recovery goals.

17.7.2 Vaquita

Rojas-Bracho reviewed and reported on developments in vaquita conservation in Mexico since SC/66b. Two meetings of the *Comité Internacional para la Recuperación de la Vaquita* (CIRVA) have been held since SC/66b, CIRVA-8 in November 2016 (SC/67a/SM11) and CIRVA-9 in April 2017 (SC/67a/SM14rev1), both in La Jolla, California, USA. A summary of the reports of these two meetings can be found in Annex M.

Attention: S, SC, CG-A, CG-A, C-A, C-R

The Committee **expresses** its disappointment and frustration that, despite almost two decades of repeated warnings and the significant efforts made to protect vaquitas, the species continues to be on a rapid path towards extinction. The Committee **is gravely concerned** about the estimate that only 30 individuals remained as of November 2016, the news that 5 dead vaquitas were recovered during March/April 2017, and the fact that conservation measures have been ineffective and insufficient. Therefore, the Committee **repeats the recommendations** it made in 2016 and **unreservedly endorses and adopts the recommendations** made in the CIRVA-8 and CIRVA-9 reports (see SC/67a/SM11 and SC/67a/SM14).

Given the extreme urgency of the situation, and the immediate extinction risk to the vaquita, the Committee:

- (1) **recommends** that the Government of Mexico ensures that the current ban on gillnets in the northern Gulf of California does not lapse, is effectively enforced and is made permanent, and that this ban is extended to include the possession and sale of gillnets throughout the immediate area;
- (2) **recommends** that the appropriate authority in Mexico further develop and permit the use of 'vaquita safe' fishing gears as a matter of urgency, and provide incentives for their immediate and full uptake;
- (3) **commends** the Government of Mexico for its attention and response to the CIRVA findings and respectfully **requests** that reports continue to be provided annually to the IWC Scientific Committee on actions and progress towards conservation and recovery goals for the vaquita;
- (4) **requests** that the Secretariat write to all IWC Commissioners to: (a) provide an update on the vaquita situation (including describing the species' status based on information reviewed by the SC at SC/67a); (b) re-emphasise the commitments made under IWC

Resolution 2016-5; (c) summarise the recommendations made by the SC over the last 20 years; and (d) urge them to raise this issue as a matter of urgency through the appropriate diplomatic channels;

- (5) **recommends** that members liaise with their Governments to raise the profile of the vaquita and identify and pursue wider international engagement opportunities such as through efforts to achieve the UN Sustainable Development Goals (SDG14); and
- (6) **noting** that the demise of the vaquita is being driven by the high demand for totoaba swim bladders in international markets, **requests** that the IWC Secretariat send a written appeal to the CITES Secretariat to facilitate immediate action in addressing the illegal international trade in swim bladders from totoaba, an Appendix I species, as a matter of utmost urgency.

The evolution of the vaquita issue raises questions on how the recommendations of the Scientific Committee are communicated and implemented and how the Scientific Committee can work together with other bodies of the Commission in order that the IWC, as an organisation, can operate in a co-ordinated and coherent way to facilitate urgent conservation action.

Attention: SC, CC

The continued decline of the vaquita raises fundamental questions on how the recommendations of the Scientific Committee are communicated. The Committee **recommends** that the joint Conservation Committee/Scientific Committee Working Group considers the challenges associated with effectively communicating and implementing urgent conservation recommendations, particularly with respect to vaquita.

Time Is Running Out

In summary, the vaquita is the world's smallest cetacean, inhabiting a very limited range in the upper Gulf of California, Mexico. The population was being steadily reduced by lethal entanglement in fishing gear for decades before a recent surge in illegal fishing for totoaba began, fuelled by the demand for swim bladders in China and Hong Kong. Previous estimates of abundance were 567 (95% CI 177-1,073) in 1997, dropping to 245 (95% CI 68-884) in 2008, to 59 (95% CRI 22-145) in 2015, and to around 30 remaining in November 2016 (95% CRI 8-96). Now, after another massive illegal totoaba fishing season during the first five months of 2017, with six documented vaquita deaths in that period, the vaquita population has been even further reduced and species extinction is imminent. If the current illegal fishery for totoaba continues unchecked in 2018, the vaquita will be gone. It will have followed the same course as China's Yangtze River dolphin (the baiji) and become the second species of small cetacean to be lost in the early 21st century.

17.7.3 Amazon riverine dolphins (boto and tucuxis)

Concerns over the increased use of dolphins from the Amazon River (botos *Inia geoffrensis* and tucuxis *Sotalia fluviatilis*) as bait for piracatinga (*Calophysus macropterus*) fishery in the Amazon Basin has been expressed previously by this Committee. The Brazilian Government provided a progress report on the effectiveness of the 5-year moratorium on the piracatinga fishery (from 1 January 2016). The report focused on one of priority areas of the Evaluation Monitoring

Plan, i.e. monitoring trends in abundance of Amazon River dolphins. More details on this can be found in Annex M. The intersessional working group (convened by Zerbini) established to assist the Brazilian government in evaluation and reporting procedures, identified new information, which indicated that the river dolphin/piracatinga issue is escalating in these neighbouring countries due to the regional increase in trade and demand for this fish. This group proposed that an intersessional workshop to facilitate communication and collaboration among the countries which are all part of the boto/piracatinga issue would be timely.

Attention: SC, CC, CG-A

The Committee has previously expressed **concern** over the increased use of dolphins from the Amazon River (botos and tucuxis) as bait for the piracatinga fishery in the Amazon Basin. This year, the Committee:

- (1) **thinks** the Brazilian Government for the update on their efforts to combat the use of Amazon riverine dolphins as bait for the piracatinga fishery;
- (2) **welcomes** the update provided by the Brazilian Government on the newly initiated Evaluation Monitoring Plan (EMP) which includes the identification of sustainable fishing methods for the piracatinga fishery, inspection and control strategies, and efforts to understand and curtail the international market demand for piracatinga;
- (3) **respectfully requests** that Brazil provides detailed information to the next meeting of the Scientific Committee on the implementation of all five elements of the EMP;
- (4) **encourages** collaborative efforts among the states in which the dolphins occur;
- (5) **respectfully requests** information from Bolivia, Colombia, Ecuador, Peru and Venezuela in line with its recommendation last year (IWC, 2017b); and
- (6) **endorses** the proposal for an intersessional workshop in Brazil in 2018.

17.7.4 Taiwanese humpback dolphins

Proposed large-scale offshore windfarm developments threaten the fewer than 75 remaining Taiwanese humpback dolphins (*Sousa chinensis*) inhabiting the limited shallow (<30m) waters along Taiwan, China's heavily industrialised west coast. An expert panel met in Taipei from 17-21 April 2017 to address this threat, which is in addition to the others this population already faces: fisheries interactions, habitat degradation and destruction, air and water pollution, freshwater diversion from major estuaries, and noise disturbance.

In 2014, at SC/65b, the Committee briefly discussed three candidate windfarms planned for the Eastern Taiwan Strait, one of which was to overlap the northernmost range of the Taiwanese humpback dolphin. However, the most recent industry proposals, discussed at the Workshop in April, are for up to 600 turbines in multiple windfarms, involving several companies, with several overlapping the core, as well as the northern and southern ends of, the dolphins' range. Construction and operational noise and disturbance are expected to be severe; the installation of a single test wind turbine recently within Critical Habitat for the Taiwanese humpback dolphin entailed nearly 3,000 pile driving strikes.

The Committee considered marine renewables at its 2012 meeting (IWC, 2013a, p.47) and endorsed the recommendations of the marine renewables Workshop

(which included offshore wind) held just prior to that meeting. These recommendations included: (1) developing a strategy to minimise risk; (2) pursuing a broad, staged approach to management; (3) conducting ‘fundamental’ research; (4) evaluating threats; and (5) monitoring impacts (IWC, 2013a, p.47). Taiwan, China already has fundamental research results (see Wang *et al.*, 2016) and there have been several thorough evaluations of threats (Ross *et al.*, 2010; Slooten *et al.*, 2013; Wang *et al.*, 2016).

Attention: CG-R

*Given this proposed large-scale offshore windfarm developments threatening the Taiwanese humpback dolphins the Committee **recommends** that authorities of Taiwan, China: (1) develop an overall and comprehensive strategy to minimise risk to this species from the proposed windfarm development; (2) pursue a broad, staged and adaptive approach to management (e.g. there are now two test turbines in place and about to start operation – data from the construction should be thoroughly evaluated, reviewed by international experts, and used to identify effective mitigations for future turbine instalment); and (3) closely monitor acoustic, chemical, physical and biological features of the area before, during and after construction, as well as the impacts on the dolphins during construction activities.*

*The Committee also **reiterates** its previous recommendation that a precautionary approach should be used when installing windfarms within critical cetacean habitat (IWC, 2013a, p.49), such as the core range of the IUCN critically endangered Taiwanese humpback dolphin.*

*The Committee once again highlights the critically endangered status of the Taiwanese humpback dolphin and **endorses** the recommendation of the expert Workshop, held in Taipei 17-21 April 2017, to expand the currently proposed boundaries of ‘Major Wildlife Habitat’ (the formal term under Taiwan ROC’s domestic legislation) north and south and to proceed as soon as possible to formal declaration under the Wildlife Conservation Act.*

17.8 Work plan

The work plan on small cetaceans is given as Table 25.

18. WHALEWATCHING

18.1 Assess the impacts of whalewatching on cetaceans

18.1.1 Review work plan on Modelling and Assessment of Whalewatching Impacts (MAWI)

An intersessional Workshop on the Modelling and Assessment of Whalewatching Impacts (MAWI) was funded by the IWC and is now scheduled to occur in late 2017 or early in 2018 (SC/67a/WW08). The Workshop will define the key research questions that are required to understand the potential impacts of whalewatching. Several potential participants were identified and Workshop attendance could be maximised and cost reduced if the chosen venue coincided with a major marine mammal science meeting. Individuals should be invited to participate in the Workshop who work in or represent countries or regions with emerging whalewatching industries where MAWI might initiate studies, such as Oman, Africa or Brazil. The Workshop might also benefit from a list of critically endangered cetacean populations that are subject to whalewatching that was compiled for SC/65b (Gleason and Parsons, 2015; IWC, 2016i).

18.1.2 Review specific papers assessing impacts

SC/67a/WW04 reported on a land-based study conducted in Maui, Hawaii, USA, to determine whether local vessel traffic, including whalewatching activities, affects the behaviour of humpback whales. The preliminary results showed that animals changed aspects of their behaviour, including increased swim speed, decreased dive times and direction of travel, with respect to the presence and distance of vessels. The authors suggest a continued precautionary approach be undertaken in relation to vessel traffic and whalewatching activities for this region, including slow speeds when approaching groups of cetaceans. It was noted in discussion that the shorter dives may indicate disrupted resting behaviour and that the Committee’s earlier definition of ‘high speed’ in relation to whalewatching vessels - 13 knots or greater (IWC, 2005, p.331) - was confirmed at last year’s meeting (Currie *et al.*, 2015). The study will continue over the next two years and a future paper using multivariate analyses and generalised linear models will be submitted. Discussions about these analyses will continue between the authors and Committee members intersessionally. The Committee **welcomes** the overall design of this study, as land-based observations of vessel disturbance remove the potential that a research vessel can confound results of such studies.

Attention: SC, CC

*The Committee **reiterates** that the definition of ‘high speed’ in relation to whalewatching vessels is 13 knots or greater. This definition should be used when referring to high speed vessels within the framework of MAWI and subsequent Committee discussions.*

Since 2004, the Committee has welcomed a useful review summarising recent whalewatching research (Parsons *et al.*, 2004). SC/67a/WW05 provided this year’s review; the Committee again thanks the authors. Recent studies on impacts on cetaceans from whalewatching are summarised in table 1 of Annex N.

Pagel *et al.* (2016) provided insights on behaviours of wild and unhabituated killer whales toward human divers and snorkelers in Norway. Observations were made from 58 opportunistic underwater video recordings. No aggressive, threatening or sexual behaviours were identified. Results should be viewed with caution due to the small sample size and the fact that the video footage was not originally taken for scientific purposes, while in discussion it was also noted that the ethogram could be improved. Video can be valuable when the study area is remote or weather or daylight restricts data collection.

18.1.3 Consider documented emerging areas of concern (e.g. new areas/species, new technologies, in-water interactions) and how to assess them

Vail (2016) compiled a compendium of negative interactions between people and bottlenose dolphins in Florida (USA). Impacts included fatal injuries to dolphins from several causes. The author suggested that the proximity and encouragement of direct and close interaction with dolphins has eroded the ‘protective barriers that once existed between wild dolphins and the general public’. In discussion, it was noted that these types of serious, human-inflicted injuries could be considered a newly identified, indirect, impact of whalewatching. It was also noted that whalewatching and dolphin feeding may have resulted in habituation of dolphins to people, which might have contributed to dolphins’ negative interactions with people involved in other pursuits.

Table 25
Summary of the work plan for small cetaceans.

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
Global <i>Tursiops</i> taxonomy	Intersessional Workshop <i>Tursiops</i> taxonomy.	Report to sub-committee
Boto	Intersessional Workshop boto/piracatingua.	Report to sub-committee
Poorly documented takes	Email group to plan and conduct South American and African Workshop (SG-21, Annex W).	Report to sub-committee
Small Cetacean Task Team	Work on South Asian River dolphins.	Report to sub-committee

Attention: CC, WKM&WI, SC

Vail (2016) identified negative impacts on dolphins, including fatalities, that may have arisen indirectly from whalewatching activities and cetacean habituation to humans. Given the potential management implications, the Committee recommends:

- (1) *that the paper be brought to the attention of the Conservation Committee and that its Standing Working Group on Whalewatching should include the potential for these types of injurious and fatal interactions in its discussion about management actions;*
- (2) *that the paper should also be brought to the attention of the Working Group on Whale Killing Methods and Welfare Issues; and*
- (3) *that the issue of cetacean habituation (and sensitisation, a related condition), especially as it relates to whalewatching, should be considered at SC/67b based upon the work of an intersessional correspondence group (ICG-32, Annex W).*

SC/67a/WW02 (see discussion under Annex H, item 4.2) presented the results of a telemetry study in Chile on fin whales that identified some areas (e.g. near Coquimbo and Valparaiso) that the authors concluded may be suitable for the development of whalewatching.

SC/67a/WW03 updated information on whalewatching targeting endangered Arabian Sea humpback whales. Guidelines for whalewatching in Oman were developed in 2013/14 as part of an IWC-supported project. This project also included awareness-raising and initial training of tour operators and vessel captains in key locations to minimise negative impacts of whalewatching on Arabian Sea humpback whales and to highlight business approaches for whalewatching in Oman (an objective relevant to the Conservation Committee). A Workshop is planned in Oman by the end of 2017 to address some of those issues and to provide outreach materials. The authors noted that the current level of impacts is considered to be low, although no formal studies have been undertaken. Draft national regulations for whalewatching have been prepared based on the guidelines referred to above. The most likely reason for operators 'harassing' cetaceans was ignorance and the deliberate involvement of the whalewatching community in developing management proposals was key to improving the situation. It was also suggested that limiting the number of operators through regulation might become necessary to mitigate impacts on cetaceans. A final point was that this region could be suitable for developing methods to assess cumulative impacts from anthropogenic activities on an endangered population of large whales.

Attention: C-A, CC, CG-R, SC

The Committee welcomes the substantial progress outlined in SC/67a/WW03 with regards the whalewatching activities in Oman targeting endangered Arabian Sea humpback whales that was responsive to previous Committee requests

and recommendations (IWC, 2016e, p.68; 2017f, p.395). It also expresses appreciation to the Commission for providing funding for producing whalewatching guidelines for Oman and providing initial training of tour operators and vessel captains. The Committee also:

- (1) **recommends** that this update is forwarded to the Conservation Committee's Standing Working Group on Whalewatching; and
- (2) **endorses** the authors' recommendations, given in Annex N, Item 2.3; and
- (3) **agrees** that this area and species should be included in the upcoming MAWI Workshop (see Item 18.1.1).

18.2 Five-year strategic plan and joint work with the Conservation Committee

18.2.1 Develop procedures to provide scientific advice as requested in the plan (including the online Handbook) and make the Scientific Committee more effective at providing information to the Commission

18.2.1.1 ADDRESSING MANAGEMENT ISSUES WITHIN THE SCIENTIFIC COMMITTEE AND SYNERGY WITH THE CONSERVATION COMMITTEE

The IWC passed Resolutions 1993-9 and 1994-14, directing Member States to submit information on whalewatching. With Resolution 1996-2, it directed the Scientific Committee to begin examining whalewatching and its impacts. The first report from the Sub-Committee on Whalewatching was in 1998. At that meeting, Terms of Reference for the Sub-Committee on Whalewatching were:

- (1) scientific protocols for research on the effects of whalewatching;
- (2) the scientific basis for management;
- (3) research on the effectiveness of management; and
- (4) criteria for selection of suitable areas for long-term studies on the effects of whalewatching on cetaceans.

These original terms of reference show that the scientific basis for management and the effectiveness of management (e.g. mitigation measures) are within the remit of the Committee.

There was some discussion (see Annex N, item 4.1) about transferring management-related topics to the Conservation Committee's Standing Working Group on Whalewatching (SWGWW). Several members expressed concern about transferring such topics before the SWGWW has capacity to address them, given its present expertise and the short (sometimes only half a day every two years) time available for discussion.

Attention: C-A, C-R, SC

The Committee agrees that topics related to the science of whalewatching (e.g. impacts of cetaceans, assessments and effectiveness of mitigation measures) should remain within its remit, noting the opportunities also to invite outside experts and the use of joint workshops with the Conservation Committee to address topics of common interest.

The Committee recognises that some issues and studies addressing management and mitigation of impacts of whalewatching will be within the realm of the social sciences, because whalewatching involves people. Therefore, the Committee recommends:

- (1) *pursuing periodic joint intersessional workshops with the Conservation Committee's Standing Working Group on Whalewatching (SWGWW), to which social scientists would be invited to participate in discussions about relevant topics; and*
- (2) *that the two Committees should begin planning and pursuing an initial workshop of this nature within two years.*

One application of the Committee's expertise would be to 'ground-truth' the work begun by Carole Carlson to compile global guidelines and regulations, some of which are without an empirical basis. Many management regimes are based on information that is specific for one species or area, and it may be that what works for one species does not work for another. The compilation could also be used by the Conservation Committee to recommend needed adjustments to help managers tailor guidelines or regulations for each target species and habitat.

18.2.1.2 NEXT ITERATION OF THE CONSERVATION COMMITTEE'S FIVE YEAR STRATEGIC PLAN FOR WHALEWATCHING

SC/67a/WW01 was discussed in a joint session with the *ad hoc* Working Group on Interactions between the Scientific Committee and the Conservation Committee (see Annex T and Item 26.1). It presented an update on the Five Year Strategic Plan for Whalewatching developed by the Conservation Committee's SWGWW. This Strategic Plan covers the period 2011-16. Core principles of the plan include:

- (1) the IWC should play an advisory role, with management responsibility remaining with national governments or their subsidiaries;
- (2) the Strategic Plan should recognise that local issues require local solutions;
- (3) the Strategic Plan should help facilitate responsible whalewatching practises; and
- (4) the Strategic Plan should be a resource for industry, governments, and stakeholders.

The Strategic Plan has five equally important objectives: (1) Research; (2) Assessment (Monitoring); (3) Capacity Building; (4) Development; and (5) Management. Within the framework provided by these objectives, the Strategic Plan identifies a suite of actions, time lines, and responsible parties, which are summarised in Appendix I of the first Five Year Strategic Plan²². The Scientific Committee is identified as being a responsible party for addressing the objectives of Research and Assessment, and co-responsible for some Capacity Building, and Management objectives.

The original time period for the Strategic Plan closed last year. At IWC/66, the Commission agreed to develop a revised Strategic Plan for the period 2018-24. The Committee was asked by the Conservation Committee to review the existing Strategic Plan and provide advice on whether these actions remain valid or require revision or additions.

Discussions focussed on whether the objectives and actions of the Strategic Plan needed to be changed or updated (Annex N, item 4.1.2). The Committee agreed

that a full review would require an intersessional or pre-meeting. It was suggested that a joint intersessional meeting of 2-3 days' duration, with results to be presented at SC/67b, would facilitate the Committee's ability to provide useful recommendations. This would allow the Committee to produce timely and constructive recommendations and advice, recognising that the revision of the Strategic Plan is the task of the Conservation Committee.

Attention: C-R, SC, CC

The Committee recommends that a joint (Scientific Committee and the Standing Working Group on Whalewatching) intersessional meeting be held well in advance of SC/67b, to discuss and draft structured and specific recommendations and advice on any revisions for the 2018-24 Five-Year Strategic Plan for Whalewatching. These draft recommendations would form the basis of discussions at SC/67b so that the Committee's recommendations can be submitted to the Joint Meeting of the Conservation and Scientific Committees to be held directly after SC/67b. The budget request for this meeting is considered under Item 25.

18.2.1.3 ONLINE WHALEWATCHING HANDBOOK

SC/67a/WW01 also provided an update on development of the online Whalewatching Handbook. The Handbook is intended to provide advice on governance, capacity building, monitoring, compliance, business, community and education/training/communication. It will also identify examples of demonstrated best practice.

IWC/66 endorsed a series of recommendations from the Conservation Committee's SWGWW, including securing a dedicated individual to complete the Handbook by the 2018 Commission meeting (IWC/67). In February 2017, funding was secured through voluntary contributions from the UK and USA, and an offer came from the Convention on Migratory Species to translate the Handbook into French and Spanish.

Gianna Minton has been appointed to complete the Handbook. This is a large project with a tight timeframe and support from the Committee will be crucial to its success. The areas for which advice will be required are outlined in Annex N, item 4.1.2.

Attention: CC

The Committee recommends that the list compiled at SC/65b (Gleason and Parsons, 2015); see Item 18.1.1) of IUCN endangered and critically endangered cetaceans subjected to whalewatching should be included in the Whalewatching Handbook and forwarded promptly to the Conservation Committee for that purpose.

18.2.1.4 VOLUNTARY CONSERVATION FUND

There was discussion about how to fund whalewatching initiatives, including intersessional workshops and meetings, directed research responsive to the sub-committee agenda, and increased attendance of invited participants. Funds for invited participants are available equally to all sub-groups each year. As for directed research, the recently established Voluntary Conservation Fund, is open to whalewatching researchers to apply. Any entities or Member States that would like to support whalewatching research can contribute to this fund.

Attention: C-R, S

The late Carole Carlson once said 'It is my goal to encourage and facilitate a continued legacy of innovative education, outreach and research in a collective effort to promote

²²<https://iwc.int/whalewatching>.

the protection and conservation of cetaceans and marine environments for future generations'. In her memory, to help enshrine her legacy and in recognition of Carole's long and important association with whalewatching work at the IWC, the Committee:

- (1) **recommends** the establishment of a voluntary 'Carole Carlson Memorial Whalewatching Fund' to: (a) support research, education and outreach in the context of whalewatching activities; and (b) ensure that whalewatching is sustainable, educational and humane;
- (2) **recommends** that the fund be administered by the Secretariat, with advice from the Committee's sub-committee on whalewatching (cf the process for the Small Cetaceans Voluntary Fund); and
- (3) **requests** that the Secretariat advertises the launch of the fund at an appropriate time and reports back on progress to SC/67b.

18.2.1.5 INVITED PARTICIPANTS

The Committee has rarely requested funding for whalewatching invited participants; the annual digest of whalewatching research (e.g. SC/67a/WW05) has been used to provide information on the most recent relevant research, but it could also be used as a tool to identify potential invited participants. The digest should continue to be prepared and made available to the Conservation Committee as an information tool.

18.2.1.6 TERMS OF REFERENCE FOR THE SUB-COMMITTEE ON WHALEWATCHING

At SC/66b, the Committee agreed it would seek to enhance its capacity to address scientific and technical aspects of whalewatching and closely coordinate and cooperate with the Conservation Committee and its SWGWW, including through the Joint Conservation Committee and Scientific Committee Working Group. During discussions about the Five-year Strategic Plan (see Item 18.2.1, above), draft Terms of Reference (ToR) for whalewatching were reviewed, in an effort to clarify and align them more directly with the objectives and actions of the Conservation Committee's Strategic Plan for Whalewatching. This process would also aid in clearly distinguishing the roles and responsibilities of the two groups. The draft ToR are provided in Annex N, item 4.6.

To manage the workload these revised terms of reference imply, it might be necessary to focus discussions on a subset each year. Clearly to finalise these draft ToR, work must be done intersessionally and at next year's meeting.

Finally, the Committee noted that the interchange between its sub-committee on Whalewatching and the SWGWW is a positive example of building collaborations and synergies between the Scientific Committee and the Conservation Committee.

Attention: SC, C-A

The Committee agrees to seek comment from the Joint Meeting of the Conservation and Scientific Committees on the draft ToR.

18.3 Platform of opportunity data

18.3.1 Provide advice and recommended practice

SC/67a/WW07 reported on one year of cetacean sighting data from Maui, Hawaii, USA, to demonstrate the capabilities of the 'Whale and Dolphin Tracker' application. These data can provide valuable information on distribution of sightings at a scale impossible to achieve from a single research platform.

In discussion, it was noted that the principal advantage of this application over line transect surveys is that there will be a far greater number of observer-hours, which will result in a greater number of detections of more species inhabiting a large, mixed-species area.

18.4 Progress on scientific recommendations

18.4.1 Swim-with-whale operations

The intersessional correspondence group on swim-with-whale operations concluded that additional data on the capacity of swim-with-whale operations should be collected (Annex N). Working with the Conservation Committee to contact the ministries/secretaries of tourism or environment in each Member States might improve the response to the questionnaire it had developed. The Secretariat has an email list for all Commissioners and could assist in increasing questionnaire returns by contacting them with a request for assistance.

Other on-going efforts to review or conduct surveys of swim-with-marine life/whales programmes include the Convention on Migratory Species (CMS) and the World Cetacean Alliance (WCA). The WCA is collecting names and contacts from respondents, which could facilitate additional dialog with operators and participants in these activities. The IWC Secretariat can assist with contacting the Secretariats of CMS, IORA and ACCOBAMS (which also has a whalewatching working group) to request assistance in collecting additional information or points of contact about swim-with-whale operations.

Finally, the intersessional group had considered how and where new field studies might be initiated to evaluate impacts of swim-with-whale operations on the behaviour of the target species. Kaufman reported that he will report on a study of whale reactions to swimmers in Hervey Bay, Australia, probably in 2019. Other projects could be pursued in this location and the Australian government could be approached for funding.

Several other research funding sources were considered, including the Committee's general research funds; development of a specific fund for whalewatching, similar to the research fund for small cetaceans; the Commission's Voluntary Conservation Fund; and the Global Environment Facility²³ under their Healthy Oceans and Wildlife for Sustainable Development focuses. Whalewatching operators themselves could also be a funding source. It was noted that MAWI should also consider research on impacts from swim-with-whale activities in its discussions and planning.

Attention: SC, C-R, CC

Given the increasing prominence of the topic of swimming with large whales, the Committee recommends that:

- (1) *this topic should be added as an agenda item for SC/67b;*
- (2) *the intersessional correspondence group (ICG-30, Annex W) on this topic: (a) increases its efforts to obtain a higher response rate to its questionnaire survey; (b) obtains updates from the World Cetacean Alliance on its survey; and (c) reviews progress on field research on the impacts of swim-with activities on large whales from sites in Australia;*
- (3) *funding be made available from the Voluntary Conservation Fund for pursuing well-designed impact studies by qualified researchers on swim-with-whale programmes; and*

²³www.theGEF.org.

- (4) *it works closely with the developer of the online Whalewatching Handbook to ensure co-ordination of all IWC outreach efforts to whalewatching operators and other parties regarding the questionnaire survey.*

18.4.2 Communication with the Indian Ocean Rim Association (IORA)

Simmonds provided an update on the Indian Ocean Rim Association (IORA) whalewatching network initiative to build sustainable whale and dolphin watching in the Indian Ocean region. The initiative was the result of a Workshop (Government of Australia, 2016) co-organised by the IWC that was reported last year (IWC, 2017b, p.69). Simmonds noted that now that the network has been formally established, the Committee should consider how to support it. This will be discussed further at the Joint CC/SC Working Group meeting at the end of SC/67a. Many members of IORA are not members of the IWC, making communication and linkages more challenging. The Secretariat will continue to work to improve linkages and synergy between IORA and the IWC. Scientists participating in the IORA effort should be invited to participate in the sub-committee. The convenor for the intersessional advisory group should transfer to someone on the sub-committee from that region to improve coordination and communication between the organisations. Sarah Ferriss of the Secretariat volunteered in the interim to serve as convenor.

18.4.3 ACCOBAMS

Under ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area), several resolutions and actions dealing with whalewatching activities have been approved in recent years. See Annex N, item 5.3 for more details.

18.5 Work plan

18.5.1 Update on dolphin-watching in Bocas del Toro, Panama

The Committee received information that several projects have been initiated to evaluate the population status of the common bottlenose dolphins in Bocas del Toro and the impact of boat traffic on dolphin behaviour. Some results are to be presented at SC/67b. Several other initiatives are discussed in Annex N, item 6.1.

Attention: CG

The Committee welcomes the Government of Panama's increased responsiveness to protect the local dolphin population by minimising negative impacts from dolphin-watching.

18.5.2 Tracking progress on previous recommendations

The Committee has identified the need to establish a procedure to follow up on the implementation of previous recommendations and last year, Gleason (2016) reviewed the implementation of previous Committee recommendations and the dissemination of the IWC's guiding principles for whalewatching. It is important to evaluate whether the Committee's science-based management recommendations are effective.

Attention: SC, CC, S

The Committee agrees:

- (1) *that it should receive at least biennial reports on the progress of previous recommendations and the utility of the IWC Guiding Principles on whalewatching. Parsons will provide an updated report to SC/67b;*

- (2) *that the Secretariat investigate ways to update the Compilation of Worldwide Whalewatching Guidelines and Regulations; and*
- (3) *that it should form a joint intersessional correspondence group with the Conservation Committee to discuss and develop better methods for disseminating recommendations and advice on whalewatching (Annex W).*

18.6 Work plan

The work plan is shown in Table 26.

19. SPECIAL PERMITS

The Chair of the Scientific Committee brought to the attention of the Committee new information on relevant outcomes from the last Commission meeting, including the establishment of a Standing Working Group on Special Permit Programmes and some necessary amendments to the existing Annex P (see Item 26.4 for all details).

The Chair of the Scientific Committee also requested advice from the Chair of the Commission on the approach to use for evaluating special permit proposals given that: (a) the review process for NEWREP-NP has already commenced; and (b) Resolution 2016-2 requests the Scientific Committee to provide its evaluation in the same year that the Commission meets.

The Chair of the Commission responded as follows.

There is no opportunity for the Commission to meet to discuss this question. In the absence of being able to obtain advice from the Commission the Chair of the Commission discussed the issue with the Vice-chair and Secretary and provided the Scientific Committee the following instruction:

We recognize that two documents form the basis of the Special Permit discussions at the 2017 Scientific Committee (SC/67a). The first document is Annex P as it stands which sets out a process, agreed by the Commission for the Scientific Committee to conduct its discussions regarding Special Permit reviews. The second document is Resolution 2016-2 which was adopted by vote in accordance with standard Commission procedures. We recognize some Contracting Governments have expressed concerns with this resolution. However, the Scientific Committee should not attempt to resolve the issues of different positions and interpretations regarding this Resolution. Differences of opinion about the Resolution are the responsibility of the Commission, although the Scientific Committee may wish to record the positions of its members if they wish. Nonetheless the Scientific Committee is bound to follow any instructions transmitted to it in the form of a Resolution. Consequently, the Scientific Committee is required to incorporate the relevant provisions of Resolution 2016-2 into Annex P by the 2018 Scientific Committee meeting.

Therefore, at the present meeting, the Scientific Committee must conduct its scientific discussions based on materials submitted to the Committee and the comments/views/suggestion expressed on those materials by its members. Both agreements and differences among members should be recorded in the usual way and a full report prepared and adopted as is regular Scientific Committee practice.

Once the report has been adopted by the Committee it will be made available to all Commissioners, Contracting Governments and Observers within two weeks of the close of the meeting. The Chair of the Scientific Committee will provide the findings contained in the report, along with those from the 2018 Scientific Committee, to the next Commission meeting which is planned for 2018.

19.1 General considerations on improving the evaluation process

The Committee discussed general issues related to evaluating management-related benefits of scientific research studies and Special Permit programmes in particular (see Annex D, item 2.4). The Committee recognises that the present situation has been frustrating to both proponents and reviewers as

Table 26
Whalewatching work plan.

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
(1) Impacts to cetaceans from whalewatching.	ICG-30 on swim-with-cetaceans.	Review new information.
(2) Modelling and Assessment of Whalewatching Impacts (MAWI).	SG-25 MAWI Workshop.	Review report from the intersessional Workshop.
(3) Collection of cetacean data from Platforms of Opportunity.		Review new information.
(4) Whalewatching in east Africa and wider Indian Ocean.		Review available information.
(5) Strategic Plan on Whalewatching and Whale-watching handbook.	Meeting and SG-25 to conduct reviews.	Finalise review and provide recommendations.
(6) Emerging issues of concern.	ICG-32 on habituation of cetaceans to whalewatching activities.	Review new information.
(7) Previous recommendations.	Create a ICG with Conservation Committee.	Update on intersessional work.
(8) Provide scientific and technical advice to external organisations, as requested.	ICG-31 on IORA.	Update on intersessional work.

witnessed by comments in Panel reports and in responses to those by proponents. In principle, it would be useful, for both proponents and reviewers, if there was general guidance on the type and level of information to be provided to show quantitatively that a given proposed research will have management benefits. Some members noted their view any guidelines that might be developed would only be applicable to future proposals, after Annex P is modified.

Attention: SC

*Whilst the Committee **agrees** that it is not reasonable to 'accept' either a general assertion that there will be benefits to management from a research programme or to 'require' a formal demonstration with 100% certainty that there will be an improvement, it recognises from the discussions of the papers at this meeting that developing consensus on what constitutes 'sufficient' information will be difficult. It therefore:*

- (1) **agrees** that the topic should be given priority at next year's meeting; and*
- (2) **encourages** members to develop discussion documents (and where possible to draft potential guidelines) to address this issue and submit them for consideration, well in advance of next year's meeting.*

The Proponents drew the Committee's attention to their view that some of the 'recommendations' in Panel Reports are actually only suggestions for further analyses to help the proponents as they conduct future work, and do not imply fundamental flaws of the Special Permit programme. Although recent Panels have tried to categorise their recommendations, the Proponents requested that additional clarity is provided in future to avoid misunderstandings of Panel Reports arising.

In discussion, the Committee noted that the review of a Special Permit programme was a review of the full programme, not just the lethal component, recognising that meeting objectives and sub-objectives often involved integrating data from both lethal and non-lethal components.

Attention: SC

*The Committee **recommends** that future Panel Reports separate out more clearly:*

- (1) 'recommendations' which comprise either:*
 - (a) tasks that the Panel considers need to be completed (and reviewed where necessary) before the lethal component of a programme is initiated; or*

- (b) tasks required for non-lethal components of the programme to be better achieved; and*
- (2) 'suggestions' which comprise tasks that are desirable to enhance the value of the research, but are not considered essential for the programme.*

19.2 NEWREP-A

19.2.1 Report on ongoing research

SC/67a/SCSP05 reported the results of biological sampling of the Antarctic minke whale during the NEWREP-A survey conducted in Areas III-E and IV, south of 60°S during the 2016/17 austral summer season. It also reported the results of the sighting surveys, photo-ID and biopsy sampling of large whales conducted by the sighting sampling vessels (SSVs). Three SSVs and one research base vessel were engaged in the survey from 15 December 2016 to 7 March 2017. The sampling survey was started on 15 December 2016. A total of 311 primary sightings of Antarctic minke whale (involving 526 individuals) were made during 3,274 n.miles of searching distance. A total of 333 Antarctic minke whales (178 females and 155 males) was sampled; biological samples and data required for the two main objectives of NEWREP-A were obtained from each whale taken. Earplugs for age determination were collected from all whales. The Antarctic minke whale was the most sighted species in Area III-E, while the humpback whale was the most sighted species in Area IV followed by the Antarctic minke whale. Twenty humpback and four killer whales were photo-identified. Biopsy samples were collected from four humpback whales. The samples and data collected during this survey are available, for interested national and international scientists, under the guidelines for research collaboration available on the website of the Institute of Cetacean Research.

SC/67a/ASI07 reported the results of the 2016/17 NEWREP-A dedicated sighting survey in Antarctic Area V, south of 60°S. Two dedicated sighting vessels (SVs) were engaged in the survey for 33 days, from 13 December 2016 to 14 January 2017 in the western sector of Area V. The sighting survey followed the guidelines adopted by the Committee. The total searching distance was 2,937.1 n.miles, including 1,542 n.miles covered in passing mode and 1,395.1 n.miles covered in independent observer mode. The survey coverage was 77% in the northern stratum and 91% in the southern stratum. Five baleen whale species were sighted: blue (11 schools/13 individuals), fin (21/67), Antarctic minke (115/223), southern right (1/1) and humpback (253/516)

whales. At least three toothed whale species were sighted: sperm (30/30), southern bottlenose (4/8), and killer (4/26) whales. Angle and distance experiments were conducted as in previous years. Photo-id data of 9 blue, 1 southern right and 10 humpback whales were obtained. Ten biopsy samples were collected from 2 blue, 1 southern right and 7 humpback whales. Eight examples of marine debris were observed on the sea surface. The sighting data were validated and have already been submitted to the IWC Secretariat. During this survey, feasibility studies on telemetry and biopsy sampling of Antarctic minke whales were conducted as planned, and details are shown in the appendices of SC/67a/ASI07.

The authors of SC/67a/SCSP05 and SC/67a/ASI07 were thanked for providing this information to the Committee.

19.2.2 Progress with previous recommendations

SC/67a/EM09 reported on results from krill and oceanographic surveys conducted during the 2016/17 austral summer season as a part of NEWREP-A (see Annex L, item 6.1). Two vessels were engaged the surveys. Last year, the Scientific Committee recommended use of nets with finer mesh size, and this recommendation was implemented. The technical comments were received on SC/67a/EM09, but the results will be presented to the CCAMLR EMM meeting to get feedback from krill experts, and reflect them in the plan for following surveys as needed.

SC/67a/ASI04 described the research plan for the NEWREP-A dedicated sighting survey in the 2017/18 austral summer season (see Annex Q, item 5.3 for technical comments). The research plan was prepared considering the suggestions and recommendations from the NEWREP-A Review Panel regarding sighting surveys (recommendations 6 and 7), krill surveys under NEWREP-A (recommendation 15), and feasibility studies on non-lethal methods (recommendations 4 and 5) - see details in IWC (2016b) and Government of Japan (2015). The main objectives of the survey are the systematic collection of sighting data to produce abundance estimates for Antarctic minke whales and other large whale species for management and conservation purposes. This information will contribute to building ecosystem models as well as providing direct input for the SCAA and the RMP. After validation by ICR, sighting and associated data will be submitted to the IWC Secretariat. Other data and samples obtained during the survey will be available to Committee members through the Data Availability Agreement Procedure B. A cruise report will be prepared just after the survey is completed and will include a list of the samples and data collected during the survey. The cruise report will be presented to the 2018 IWC SC meeting. An oversight report will be presented as an appendix to the cruise report.

In response to a question from a member on why only Antarctic minke whales (and not other large whale species) were being targeted for telemetry studies, the proponents stated that Antarctic minke whales are the focal species of the NEWREP-A research programme and that the Expert Panel requested these trials. They noted that the use of small inflatables (e.g. Zodiacs) was not feasible because of safety concerns with their use under typical conditions far-offshore. The proponents also noted that while conducting the survey earlier in the year might potentially provide more opportunities for tagging whales, the proposed period was selected for reasons of consistency and comparability with previous surveys, with the main components of the programme in mind.

Attention: SC

*The Committee **welcomes** the proposed multi-disciplinary surveys on cetaceans, krill, and oceanographic conditions, which will also conduct biopsy and tagging experiments. The Committee **endorses** the proponents' approach (see SC/67a/EM09) including discussion with outside experts (e.g. CCAMLR). Tamura indicated that he will act as the focal point for receiving suggestions.*

SC/67a/SCSP12 presented the proponents' report on their progress in addressing the recommendations on NEWREP-A made by the Committee. These recommendations are related to need for lethal sampling, justification of sample sizes, stock structure, effects of catches on stocks, sighting survey design, feeding ecology and ecosystem modelling, krill survey, development of new non-lethal techniques, mechanisms for co-operative research and research program management. The proponents stated that they initiated the NEWREP-A after concluding that they had completed addressing the recommendations they considered most relevant to the need of lethal sampling and sample size (recommendations 1 and 26) to a reasonable level (IWC, 2017b, pp.72-90). SC/67a/SCSP12 reported the progress relative to other relevant recommendations that are being addressed during NEWREP-A. Details of the work being conducted on some of the recommendations are provided SC/67a/EM09, SC/67a/EM14 (Annex L, items 4.1 and 6.1) and SC/67a/ASI04, SC/67a/ASI07 (Annex Q, item 5.3). The proponents explained that they had assigned low priority to a few recommendations and these will not be considered further.

The first table in Annex P5 summarises the progress on the proponents' responses to Panel and Committee recommendations.

In relation to SC/67a/SCSP12, de la Mare noted that no new analyses related to recommendations 1 and 26 had been received by the Committee even though it had been agreed that further work was needed (IWC, 2017b, pp.72-90). He stated that these recommendations are central to NEWREP-A, because they address the justification for the programme and the selection of sample size. In relation to recommendation 1 (see Annex P5), he drew attention to establishment by the Committee of an intersessional Advisory Group to "... provide advice to the proponents with respect to the mathematical specifications concerning the recommendations made by the Expert Panel and the Committee" (IWC, 2017b, p.74). He noted that no progress has thus far been reported. For recommendation #26, he referred to the Scientific Committee's agreement in 2016 that "[t]here is now a need for the proponents to apply the approach of Annex T5 to the full data set and not just the censored data set in the original analysis" (IWC, 2017b, p.74). De la Mare stated that despite the suggested time required to complete this analysis, results have not been presented.

The proponents responded that the work under consideration with regard to recommendation #26 relates to 'some further refinements', thus the suggested timeline for the original recommendation is not applicable any more. They also drew attention to their response to an earlier enquiry about Recommendation 1 from the convenor of the Advisory group that the work requested was considerably advanced and in their view near completion.

They reiterated that as noted in SC/67a/SCSP12, they believed work on the *original* recommendations of the Expert Panel had been completed to a reasonable level. Regarding the *additional* recommendations agreed to by the Committee last year (such as recommendation 26), Pastene

noted that whilst work was underway, these had been given a lower priority by the proponents and, as such, would be completed at a later (but as yet unspecified) date during the programme.

The Committee noted that no new analyses regarding recommendation 26 had been submitted to the Committee at this year's meeting.

19.3 JARPEN II

19.3.1 Report on ongoing research

SC/67a/SCSP04 was the cruise report of the second phase of the Japanese Whale Research Program under Special Permit in the Western North Pacific (JARPENII) in 2016 (part I) for the offshore component. The 15th and last cruise was conducted in sub-areas 7, 8 and 9 of the western North Pacific. The two main research components were whale sampling survey and dedicated sighting survey. A total of five research vessels was used: two sighting/sampling vessels (SSVs) (whale sampling survey component), one research base vessel (Nisshin Maru, NM) (whale sampling survey component) and two dedicated sighting vessels (SVs) (dedicated sighting survey component). The whale sampling survey was carried out from 13 May to 26 July 2016. A total of 2,662 n.miles was surveyed in a period of 67 days by the SSVs. A total 444 sei, 104 Bryde's, of two common minke, 147 sperm, three blue, 15 fin and 26 humpback whales were sighted by the SSVs. A total of 90 sei and 25 Bryde's whale was sampled and biological surveys were conducted on board of NM. In May and June, sei whales fed mainly on mackerels followed by Japanese sardine, copepods and krill in sub-areas 8 and 9. Bryde's whales fed mainly on krill in sub-areas 8 and 9 in July. A dedicated sighting survey was carried out from 29 July to 6 September. A total of 3,185 n.miles was surveyed during the survey by the two SVs. Data obtained during JARPENII will be used in to elucidate the role of whales in the ecosystem through the study of feeding ecology in the western North Pacific.

SC/67a/SCSP03 reported the results of the coastal component (off Sanriku) of the Japanese whale research program under special permit in the western North Pacific (JARPENII) in 2016. The survey was carried out on the Pacific coast of Japan (the sub-area 7CS) from 9 April to 25 May 2016. The research took place in coastal waters within 50 n.miles from Ayukawa Port in Miyagi Prefecture in the Sanriku district of Japan using four small-type whaling catcher boats as sighting and sampling vessels. A total of 5,432.7 n.miles (560.5 hours) was surveyed. Sixteen animals were sampled from 28 schools (28 individuals) of primary sightings of common minke whales. Density index (the number of primary sightings of schools per 100 n.miles searching) of common minke whales within and outside of Sendai Bay were calculated as 0.45 and 0.57, respectively, and those of humpback whales were calculated as 0.41 and 0.50, respectively. The density index of common minke whales within Sendai Bay in 2016 was approximately 30% less than that before 2009, and the same as levels outside of Sendai Bay for 2009-16, while humpback whales gradually increased in all research areas after 2008. During the survey, a biopsy experiment was conducted using the Larsen system for 74 hours ten minutes. One sample was collected in five trials. Average body length of the whales was 5.75m (min.=4.74m, max.=7.90m, SD=1.21m) for males, and 5.55m (min.=4.03m, max.=7.98m, SD=1.24m) for females. In males, two of seven individuals (29 %) were sexually mature, and in females, two of nine individuals

(22 %) were sexually mature. Regarding dominant prey species found in the forestomach, three prey species were identified in the stomach contents of 14 individuals. Adult sand lance (50.0%) and Japanese sardine (50.0%) were observed from those killed within Sendai Bay, whereas only Japanese sardine (100.0%) was observed from those killed outside of Sendai Bay. Over the last decade, the distribution (individual/m³) of juvenile Japanese sand lance within Sendai bay in January after 2013 was apparently lower than before 2012, and was distributed in only the near shore area. The reasons for the decreasing number of sighting and sampling of common minke whale after 2013 may be caused by increasing numbers of humpback whales in Sendai Bay and/or decreasing recruitment of sand lance.

SC/67a/SCSP07 summarised the cruise report of the JARPEN II coastal component off Kushiro, northeast Japan (middle part of the sub-area 7CN), which was conducted from 5 September to 31 October 2016. The survey was conducted using four small-type whaling catcher boats as sampling vessels in coastal waters within 50 nautical miles from Kushiro port. All the whales collected were landed at the JARPEN II research station for biological examination. During the survey, a total of 6,051.6 nautical miles (622.9 hours) was searched and the 39 schools (40 individuals) of common minke whales were encountered. Sightings of 39 schools (64 animals) of humpback whales, of two schools (three individuals) of fin whales, a Bryde's whale, and of five schools (11 individuals) of sperm whales were also obtained. Of 40 common minke whales encountered, 21 animals were collected. One Bryde's whale was mistakenly shot. Average body length of male common minke whales collected was 7.09m (SD=0.53, Range=6.00-7.75m, n=8) and 7.07m (SD=1.01, Range=5.07-8.85m, n=13) for females. Seven animals out of 8 males were sexually mature and 6 of 13 females attained to sexual maturity. The three mature females were pregnant. Dominant prey species detected from whale forestomach was Japanese sardine (*Sardinops melanostictus*, 38.1%), followed by walleye pollock (*Theragra chalcogramma*, 28.6%) and mackerels (*Scomber japonicus* and *S. australasicus*, 28.6%). Japanese anchovy, which was one of the major prey species in the previous surveys off Kushiro, was not found from whale forestomach. 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. During the surveys, faecal searching was made for 20.3 hours on 35 animals encountered, but excretion was not observed. A total of 62.3 hours (10.0% of a total searching efforts) was allocated to the dedicated sighting surveys for biopsy sampling. An animal encountered were targeted, however no sample was collected.

SC/67a/SCSP11 contained an update of analyses on efficiency of biopsy sampling for sei, Bryde's and common minke whales, based on data and samples obtained during the 2014-16 JARPENII surveys. To refine the preliminary analyses regarding success proportions of biopsy and lethal sampling for sei, Bryde's and common minke whales based on the JARPENII data for 2014-16 submitted to the Expert Panel Review Workshop for NEWREP-NP, the differences between the two approaches were assessed using a generalized linear model (GLM) for the response variable adjusting for potential covariates (sampling method, research year, Beaufort scale and visibility at experiment and sampling vessels) based on these data. The analyses show that the success proportions for biopsy sampling were

significantly lower than for lethal sampling for all whale species. Explanatory variables in the best fitting model for sei and Bryde's whales included only 'method', and that for common minke whale included 'method' and 'vessel', indicating that environmental covariates had no significant effect. In common minke whales, only two biopsy specimens could be sampled in 14 trials, suggesting biopsy sampling is not feasible for these whales in the coastal components of the program. On the other hand, it has been noted that experience and training can play an important role in the efficiency of biopsy sampling following introduction of the Larsen system for the 2015 JARPNII. For this system the shooters would benefit from more experience and training time. These results and conclusions support the preliminary analyses submitted to the Expert Panel Workshop.

The Committee discussed the Panel's recommendation regarding the feasibility of biopsying common minke whales in the coastal component of the programme. The Panel had recognised, as does the Committee, that biopsy sampling common minke whales was more difficult than for larger whales, but had stated that, from the information presented by the proponents, it was premature to conclude that it was infeasible, for several reasons including: (a) the lack of biopsy experience of the crew; (b) the small number of attempts; and (c) the short time allocated to the experiment for biopsy sampling compared to that for lethal sampling. The Panel then provided advice on how to conduct such an experiment (SC/67a/Rep01, item 3.3.4), including the need to use experienced biopsy samples, a balanced experimental design, consideration of vessel type, weather conditions and sea state etc.

There was considerable discussion of this issue within the Committee and statements on this are given in Annex P (Annexes P1 and P2). Some members stated their view that the analysis in SC/67a/SP11 for common minke whales was inappropriate given the unbalanced design and small sample size, as had been noted by the Expert Panel. Other members commented that their experience was that obtaining large numbers of biopsy samples of common minke whales was not feasible, but thanked the proponents for their proposal to conduct additional studies to improve technical aspects of biopsy sampling equipment. The proponents stated that it was their view that in the context of their programme, biopsy sampling had been demonstrated to be infeasible by appropriate statistical analyses.

Attention: SC

*The Committee **recognises** that advice on the feasibility of biopsy sampling common minke whales (regardless of stocks and research areas) was of general scientific as well as specific interest in the context of special permit programmes and comparisons with lethal sampling approaches. It **agrees** to establish an Advisory Group under the Chair (see ICG-33, Annex W) to provide advice on developing an experimental protocol for ascertaining whether it is possible to reliably biopsy common minke whales and, if so, under what circumstances (experience, vessel type, equipment, environmental conditions, etc.). The Group could use as its starting point the advice provided by the Expert Panel (SC/67a/Rep01).*

19.3.2 Progress with previous recommendations

SC/67a/SCSP09 presented the proponents' report on their progress in addressing the recommendations on JARPNII

made by the Committee. The 2016 report of the Expert Panel final review of JARPNII (IWC, 2017a) provided several recommendations for additional analyses related to the main three objectives of the JARPNII. These recommendations, which were endorsed by the Committee last year, are related to sampling design and sample size, stock structure, feeding ecology, ecosystem modelling, environmental pollutants, and whale ageing. The Committees agreed on a timeframe to complete the additional analyses. The proponents stated that while the final review of the JARPNII program in accordance with Annex P was duly completed in 2016, continuing work in response to additional recommendations will refine their analyses on the main objectives of JARPNII. Details of the work being conducted on some recommendations are provided in SC/67a/SDDNA01, SC/67a/SDDNA05 and SC/67a/SDDNA07 (see Annex I, item 2.2). A synthesis of the additional analyses will be presented when they are completed in line with the Committee-agreed timeframe e.g. by the 2019 meeting. A few recommendations were considered of low priority by the proponents and will not be considered further.

The second table in Annex P5 summaries the progress on Panel and SC recommendations with respect to JARPNII.

19.3.3 Committee review

The Committee noted the discussions of SC/67a/SDDNA01 and SC/67a/SDDNA05 within the Working Group on Stock Definition and DNA with respect to western North Pacific common minke whales (Annex I, item 2.2). The Committee welcomed these analyses recognising that questions about the stock structure of minke whales in the western North Pacific may not be fully resolved, particularly in the absence of knowledge about the location of breeding grounds. The Committee noted the importance of evaluating the evidence at hand with respect to the stock structure hypotheses under consideration and highlights the proposed intersessional workshop focussing on stock structure issues and western North Pacific common minke whales (see Item 25).

Attention: SC

*The Committee **agrees** that the results of the kinship analysis presented in SC/67a/SDDNA01 are inconsistent with the mixing matrices associated with Hypothesis C as currently implemented (IWC, 2014c) in the Implementation Simulation Trials (isolation between sub-areas 7CS-7CN and 8-9) for western North Pacific common minke whales.*

19.4 NEWREP-NP

19.4.1 Expert Panel Review report and progress with recommendations

The Committee reviewed Tables 27a-d that summarise recommendations from the Expert Panel, progress relative to those recommendations, and the responses by the proponents. The proponents submitted further information and explanation in SC/67a/SCSP01, SC/67a/SCSP10 and SC/67a/SCSP13. Some members requested information about changes to the proposal and what they considered to be the limited response to the recommendations of the Expert Panel. The proponents stated that some 'Secondary' objectives had been changed to 'Ancillary' objectives and commented that in their view they had satisfactorily addressed the questions and suggestions of the Expert Panel.

[Tables 27a-d are on pp.79-85]

Table 27a

Summary of the Panel's conclusions in light of Annex P – Part I. PO=Primary Objective; SO=Secondary Objective. NB: items that are crossed out refer to sub-objectives in the proposal reviewed by the Panel that have now become ancillary objectives in the revised proposal submitted at the present meeting.

Lethal prospect	Importance: scientific management	Importance: conservation and management	Achievable with non-lethal methods	Equivalent objectives that can be achieved non-lethally?	Lethal components: magnitude and relevance for conservation and management	Design and implementation reasonable to achieve objectives?
PO I: Contribution to optimising the establishment of a sustainable catch limit for common minke whales in the coastal waters of Japan	Y Yes	Yes	In part (see below)	-	-	-
SO I (i): Investigate the spatial and temporal occurrence of J stock common minke whales around Japan, by sex, age and reproductive status	Y Yes, particularly given availability of age structure. New compared to past programmes.	Not needed to run CL4, but currently not feasible, but current developments may change the situation in near future.	Not needed to run CL4, but currently not feasible, but current developments may change the situation in near future.	Replacing age with length is possible but not as precise.	Magnitude and relevance of improving and understanding of spatial and temporal occurrence of J stock is useful but lethal components contribution not likely to be as substantial for overall management as addressing stock structure uncertainty and improving estimates of abundance.	The inshore sampling design makes analysis challenging and this has not been addressed. Field and laboratory implementation is reasonable.
SO I (ii): Estimate the abundance of the J and O stocks in coastal waters of Japan	- Yes	Yes, for CL4 and ISTs	NA	NA	NA	Yes. The split of abundance estimate to stock depends on appropriate modelling framework that includes stock structure.
SO I (iii): Verify that there is no structure in the O stock common minke whale in the Pacific side of Japan	Y Yes	Yes, for ISTs	Yes	NA	Substantial impact. The performance of few RMP variants are critically dependent on whether there are one or two O stocks.	The design of the sampling scheme does not maximise the information available to assess whether there is a stock structure within O stock. The analysis of more genetic loci on the existing samples is more likely to meet the objective then additional sampling.
SO I (iv): Improve RMP trials by incorporating age data in their conditioning	Y Yes	Yes, for ISTs	Much of the age data already exist but has not been included in past ISTs. Age data for the future currently not feasible, but current developments may change the situation in near future.	The past age data could be included without collecting additional lethal samples.	Unclear because there are substantial historical samples which may be sufficient to improve conditioning without additional samples being collected.	Yes, this is a modelling exercise.
SO I (v): Investigation of the influence of regime shift on whale stocks	Y Yes – for understanding responses of environmental change.	Not important	No	No	Little importance	Major concern because of small sample sizes for common minke whales offshore, timescale of programme against possible regime shifts occurring and requirement for better sampling of prey availability.
PO II: Contribution to the RMP/IST for North Pacific sei whale	Y Yes	Yes (eventually)	Yes	-	-	-
SO II (i): Abundance estimates for North Pacific sei whale taking account additional variance	- Yes	Yes, for IA	NA	NA	NA	Yes
SO II (ii): Estimation of biological and ecological parameters in North Pacific sei whales for RMP Implementation	Y Yes	Yes, for developing models for this species and IA.	Considerable age data already exist. Age data for the future but currently not feasible, but current developments may change the situation in near future.	The past age data could be included without collecting additional lethal samples.	Unclear because there are substantial historical samples which may be sufficient to improve conditioning without additional samples being collected.	Yes
SO II (iii): Study of the pattern of movement of whales of the 'pelagic stock' within the feeding grounds and between feeding and breeding grounds [Note: this objective was refined from 'Additional analyses on stock structure in North Pacific sei whale for RMP Implementation']	Y Very limited.	Yes, for IA	Limited	Yes	No	Yes
SO II (iv): Specification of RMP ISTs for North Pacific sei whale	- Yes	Yes	Yes	Yes	NA	NA
SO II (v): Investigation of the influence of regime shift on whale stocks	Y Yes – for understanding responses of environmental change.	Not important	No	No	Very little.	Major concern because of timescale of programme against possible regime shifts occurring – requirement for better sampling of prey availability.

Table 27b
Summary of the Panel's conclusions in light of Annex P – Part 2. PO=Primary Objective; SO=Secondary Objective.

Lethal	Degree of coordination with related projects?	Effects of catches on stocks	Intermediate targets	Any other relevant matter for the SC
PO I: Contribution to optimizing the establishment of a sustainable catch limit for common minke whales in the coastal waters of Japan	Y	-	-	-
SO I (i): Investigate the spatial and temporal occurrence of J stock common minke whales around Japan, by sex, age and reproductive status	Y	Build extensively on JARPN II	Unclear the intermediate target for biopsy sampling feasibility study	Unlikely to be used for the 2018 <i>Implementation Review</i> but it could feed into that in 2024
SO I (ii): Estimate the abundance of the J and O stocks in coastal waters of Japan	Y	Yes	Sufficient	Abundance relevant to much SC work. Surveys could provide information on other species.
SO I (iii): Verify that there is no structure in the O stock common minke whale in the Pacific side of Japan	Y	Builds extensively on JARPN II	OK if sufficient analyses are carried out.	Small NEWREP-NP sample are expected to be available to be used for the 2018 IR, but it could feed in the 2024 IR.
SO I (iv): Improve RMP trials by incorporating age data in their conditioning	Y	If it is a single O stock the effect of catches is minimal. Unknown as the analysis presented did not consider possibility of two O stocks.	Sufficient	This require coordination with the SC in the upcoming <i>Implementation Review</i>
SO I (v): Investigation of the influence of regime shift on whale stocks	Y	Partial. Potential for coordination with many other initiatives.	Reasonable	Data could be relevant to EM
PO II: Contribution to the RMP/IST for North Pacific sei whale	Y	-	-	-
SO II (i): Abundance estimates for North Pacific sei whale taking account additional variance	Y	Yes	Sufficient	Abundance relevant to much SC work. Surveys could provide information on other species.
SO II (ii): Estimation of biological and ecological parameters in North Pacific sei whales for RMP <i>Implementation</i>	Y	Negligible	Adequate	-
SO II (iii): Study of the pattern of movement of whales of the 'pelagic stock' within the feeding grounds and between feeding and breeding grounds [Note: this objective was refined from 'Additional analyses on stock structure in North Pacific sei whale for RMP <i>Implementation</i> ']	Y	Negligible	Adequate	-
SO II (iv): Specification of RMP ISTs for North Pacific sei whale	Y	N/A	Adequate	-
SO II (v): Investigation of the influence of regime shift on whale stocks	Y	Partial. Potential for coordination with other initiatives.	Reasonable	Data could be relevant to EM.

Table 27c
Summary of highest priority recommendations relevant to NEWREP-NP.

No.	Panel recommendations	Panel comment/timeline SC 2017 comments	Proponent response/comments
1	The Panel recommends that a more thorough quantitative review of the relative contribution of those data types that can only be obtained by lethal sampling to the ability of the proponents to meet their primary objectives is warranted for a full evaluation of options in terms of lethal vs non-lethal methods in relation to the objectives.	<i>Panel: Required for any revised proposal</i> SC 2017: Different opinions, need for more discussion (see Annex D, Item 2.4, p.4). See discussion under Item 19.1 on the development of draft documents on guidance on the level of information to be provided to show quantitatively that any proposed research will have management benefits.	Already responded for Antarctic minke whale (Government of Japan, 2016). See SC/67a/SCSP01, pp.6, 10-14; SC/67a/SCSP13, pp.2-5.
6	To demonstrate the feasibility of meeting the Secondary Objective related to regime shift, the Panel recommends that the proponents specify more fully: (a) quantitative criteria with respect to identifying [major] environmental change and potential responses by whales; (b) the adequacy of the methods and effort to specify the distribution, seasonality, and precision of the environmental data; for the regions in which the whales being studied are feeding; and (c) taking into account uncertainty, conduct a power analysis to determine the sample sizes/effort for the characterisation of the environment and whales (including distribution and prey use) needed to determine if there are changes before and after a major environmental change occurred, should one occur during the programme.	Required for any revised proposal if the proponents wish to continue with this Secondary Objective for either or both species. SC 2017: This recommendation is no longer valid. This objective has been changed into an Ancillary one and its scope has been revised.	To be treated as ancillary objective (see SC/67a/SCSP10).
12	<i>Offshore component:</i> During the workshop, the proponents provided the Panel with the sampling strategy (samples by month, year, and sub-area) and the Panel recommends that this information be included in the version of the proposal that is provided to the Scientific Committee. The Panel also recommends that tables of past samples in the same format as the new samples should be included in a revised proposal to place the new samples in a spatio-temporal context.	<i>Panel: Required for any revised proposal</i> SC 2017: Historical samples of minke whale (SC/67a/SCSP10, pp.86-87) and of sei whale (see SC/67a/SCSP10, p.111) have been included.	Not important because it is not relevant to the justification of lethal sampling of NEWREP-NP (this recommendation is related to data archiving and compilation). The additional information on sampling strategy provided to the Panel will be included in any final research plan.
13	The Panel recommends conducting analyses in which the historical age-composition data are downweighted by various levels.	<i>Panel: Required for any revised proposal</i> SC 2017: No progress as proponents disagree with Panel.	Disagree with Panel (see SC/67a/SCSP01, p.15).
15	Given the discussion under Item 3.3.4, the Panel recommends that a properly designed experiment to assess the efficiency of biopsy sampling of common minke whales be undertaken (there is already sufficient detail on catch to render additional capture experiments unnecessary). This should incorporate at least: (a) the use of the expected vessels in the programme (i.e. the small type whaling vessels); (b) the use of vessels (that may be different from the expected vessels) considered suitable by scientists already experienced with biopsy sampling this species; (c) suitable levels of effort to allow a statistical comparison (effort for biopsy sampling should be measured or converted to the same units used for examining catching efficiency); (d) effort should be carried out in various environmental conditions (e.g. sea state, swell, visibility) up to the maximum conditions that would apply to whaling; (e) advice and training from invited experienced minke whale biopsy samplers (e.g. Christian Ramp or Lars Kleivane); and (f) analyses that provide a proper comparison of biopsy sampling and catching (including time to process samples under various variables such as experience of sampler, vessel, equipment, effort under similar conditions). The Panel reiterates its comments that the proponents must ensure that data are promptly analysed to ensure a meaningful mid-term review – it also refers to its comments about providing adequate resources into work on common minke whale biopsy sampling as soon as possible to facilitate the prompt use of non-lethal techniques.	<i>Panel: High priority to begin as soon as possible this year</i> SC 2017: No progress as proponents disagree with Panel. Advisory Group established regarding biopsy sampling. See discussion under Item 19.3.1.	Not important because it is not relevant to the justification of lethal sampling of NEWREP-NP (this recommendation is related to the design of the experiments of biopsy sampling). Disagree with Panel (see SC/67a/SCSP01, p.3). See also Yasunaga <i>et al.</i> (2017).

No.	Panel recommendations	Panel comment/timeline SC 2017 comments	Proponent response/comments
21	<p>Panel recommendations</p> <p><i>Sample size (potential reduction of lethal sample size):</i> An important component of determining appropriateness of techniques is determination of sample size - as non-lethal techniques become appropriate, non-lethal and lethal sample sizes will need to be recalculated to ensure that objectives are met. The Panel noted there was no discussion in the proposal as to what the strategy would be to determine sample sizes or how the current methods that determine sample sizes might be modified to determine the new sample sizes. The Panel recommends this issue be considered by the proponents and a strategy to be included in the project proposal before the start of the fieldwork.</p>	<p><i>Panel: Required for any revised proposal</i></p> <p>SC 2017: The possibility for further work has been considered (SC/67a/SCSP10, p.39).</p>	<p>Not important because it is not relevant to the justification of initiation of lethal sampling of NEWREP-NP (this recommendation is related to future consideration of sample size).</p> <p>Agree with the Panel in principle but see SC/67a/SCSP01, p.16.</p> <p>See 'Possible modification of lethal sample sizes' section in SC/67a/SCSP10, p.39.</p>
22	<p><i>Sample size (in general):</i> The Panel strongly recommends that the Proponents take full advantage of existing materials and data to assess the suitability of the planned efforts under NEWREP-NP to resolve the current stock structure hypotheses in the targeted species, before collecting more samples. Simulation studies based upon data collected from the current samples are recommended to adjust the experimental design to address the targeted levels of population divergence/heterogeneity. Such simulations may reveal that an increase in data from existing samples may prove beneficial over collecting additional samples.</p>	<p><i>Panel: Required for any revised proposal</i></p> <p>SC 2017: The proponents made available additional microsatellite data (10 loci) for small subset of data. The proponents also presented additional analysis (i.e. kinship, STRUCTURE) in SC/67a/SD-DNA01 and SC/67a/SD-DNA05. See discussion under Item 19.3.2 and in Annex I, item 2.2.</p>	<p>Not important because it is not relevant to the justification of lethal sampling of NEWREP-NP (this recommendation is related to genetic information, but genetic information is not the basis of sample size and sampling design)</p> <p>Disagree with Panel (see SC/67a/SCSP01, p.17).</p> <p>Also see SC/67a/SCSP13, p.5 for split samples into coastal and offshore.</p>
23	<p>In relation to the impact of catches on common minke whales, the Panel recommends that the assessment of the effects of catches on stocks be based on a subset of the trials on which the 2013 <i>Implementation</i> was based (including two levels for MSYR and all three stock hypotheses) as this will better account for uncertainty regarding current abundance and future bycatch, as well as time-variation in the J-O mixing proportion. The trials will also be able to account for the location (sub-area) and timing (month) of future catches. However, the trials on which the 2013 <i>Implementation</i> was based consider $MSYR_{nat}=1\%$, whereas the Scientific Committee has agreed that the lower bound for MSYR should be $MSYR_{1+}=1\%$ (IWC, 2014a).</p>	<p><i>Panel: Required for any revised proposal</i></p> <p>SC 2017: Major concerns by the Panel were addressed by the proponents. See Item 19.4.2.2.</p>	<p>Partially agree with Panel (see SC/67a/SCSP01, p.18 and SC/67a/SCSP13, Section 4, p.45-52).</p>
24	<p>Furthermore, the analyses for common minke whales did not use the most recent estimates of abundance. Thus, before a full consideration of the effects of the catches can be concluded, the Panel recommends that the proponents update the trials so that trials are conducted for $MSYR_{1+}=1\%$ and $MSYR_{nat}=4\%$ are fit to the most recent estimates of abundance. The Panel recognises that modifying trials is a substantial undertaking (and must be accompanied by evidence of satisfactory conditioning) and it may not be possible to update even a subset of the trials prior to the 2017 Annual Meeting. However, the Panel it stresses the importance of this being completed before the programme commences.</p>	<p><i>Panel: Required for any revised proposal</i></p> <p>SC 2017: Major concerns by the Panel were addressed by the proponents. See Item 19.4.2.2. More information on technical details is recommended (see Annex D Item 4.1 p. 10-11).</p>	<p>Disagree with Panel (see SC/67a/SCSP01, p.18 and SC/67a/SCSP13, Section 4, pp.45-52)</p>
25	<p>In relation to North Pacific sei whales, the Panel recommends that the proponents consider additional analyses in which current abundance is assumed to equal to the lower 95% confidence bound for the current estimate of abundance and present results for $MSYR_{1+}=1\%$ and $MSYR_{nat}=4\%$, as these are the values selected by the Scientific Committee (IWC, 2014a).</p>	<p><i>Panel: Required for any revised proposal</i></p> <p>SC 2017: This recommendation has been met (see Annex D, Item 4.2, p.11-12).</p>	<p>Addressed in SC/67a/SCSP13, Section 4.</p>

Table 27d
Summary of high priority recommendations relevant to NEWREP-NP.

No.	Panel recommendations	Panel comment/timeline SC 2017 comments in bold	Proponent response/comments
3	<i>Sexual maturity</i> : The Panel recommends that levels of progesterone in blubber and serum should be compared with sexual maturity and reproductive status of examined females. This comparison is valuable for assessing the efficacy of biopsy sampling for assessing reproductive status.	<i>Panel: Add to the research protocols for any revised proposal.</i> SC 2017: The Proponents demonstrated intention to include analysis of blubber for progesterone, but there are few details of how.	See 'Sexual maturity' section in SC/67a/SCSP10, 3.1.1 (p.25).
4	<i>Sightings surveys</i> : The Panel highlighted several issues that must be considered when designing line transect surveys that are expected to provide abundance information to address multiple objectives. The Panel recommends that these issues related to survey design, data collection protocols and priorities, data analyses and coordination are included in the plans to be submitted to the Scientific Committee for approval, before the surveys start. The main additional issues that should be covered in the proposals for surveys submitted to the Scientific Committee are: (a) Evaluation of past surveys' analytical difficulties . These new surveys provide an important opportunity to evaluate and potentially add/modify the variables or values of variables that are collected. Evaluating the shortcomings of previous surveys (for example, sample size issues and the amount of effort expended, problems that arose in analyses of past data) could suggest ways to supplement the future surveys. (b) Appropriate temporal stratification of the surveys. (c) Appropriate direction of travel for the survey vessel(s) and direction of track lines to account for migrating animals. (d) Use of independent observer (IO) mode , especially in the offshore waters where the weather and sea state conditions are poorer. (e) Use of passive independent observer mode with abeam closing to get the benefits of estimating g(0) and also improving the precision of the group sizes. (f) Development of protocols/priorities for biopsy-related activities . (g) Evaluation of additional variance analysis and spatial model methods to determine which is preferred or whether both methods are investigated. (h) 'Regime shift'-related aspects require that consideration should be given to whether sampling of prey is possible during the line transect surveys - obtaining simultaneously collected prey and whale data seems ideal, however logistically challenging.	<i>Panel: Address in individual survey plans submitted to the Scientific Committee</i> SC 2017: New survey plan was presented to the SC by the proponents (SC/67a/AS16, appendix I). The plan was endorsed. Matsuoka IWC oversight.	See SC/67a/AS106.
5	Care is required during sub-sampling of prey in whale stomachs to ensure that the sample is representative when stomach volumes are large and prey diverse: the Panel recommends that the proponents specify how this is to be achieved in the field protocols.	<i>Panel: Add to the research protocols for any revised proposal</i> SC 2017: This recommendation referred to the former secondary objective that has been transformed into an ancillary objective. The information provided is sufficient.	See 'Stomach contents/tissue sampling' section in SC/67a/SCSP10, Annex 17 (pp.126-127).
7	In order to achieve aim of research item (i) the Panel recommends that any immune function assays used should be those already established for cetaceans (Schwacke <i>et al.</i> , 2012) so that the results are comparable to published studies.	<i>Panel: Add to the research protocols for any revised proposal</i> SC 2017: This recommendation has been met.	See 'Laboratory and analytical works' section in SC/67a/SCSP10, Annex 18 (p.135).
8	Following previous expert panel recommendations, the Panel strongly reiterates that all lipophilic compounds being measured must be reported on a lipid weight and not a wet weight basis.	<i>Panel: Add to the research protocols for any revised proposal</i> SC 2017: This recommendation has been met.	See 'Laboratory and analytical works' section in SC/67a/SCSP10, Annex 18 (p.135).
10	The Panel recommends coordination with IWC-POWER with respect to sightings surveys, biopsy sampling and photo-ID for large whales to ensure consistent data collection and processing, as appropriate. The Panel also recommends information on these species are included in annual reports to the Scientific Committee to encourage collaboration with scientists involved with research on these two species.	<i>Panel: Preparation for sightings surveys and presentation of results</i> SC 2017: This recommendation has been met.	See 'Photo-identification and biopsy sampling' in SC/67a/SCSP10, 3.1.1 (p.126).

No.	Panel recommendations	Panel comment/timeline SC 2017 comments in bold	Proponent response/comments
11	<p>Coastal component: The Panel recommends that analyses be conducted, before the start of the programme, to assess the extent of loss in power and precision due to the sampling strategy for the objectives related to common minke whales and the implications for meeting Secondary Objectives. The experience/data gained from JARPN II should be used by the proponents to investigate issues (a)-(c) below:</p> <ol style="list-style-type: none"> the design would lead to oversampling of the areas close to ports (the Panel was informed that an additional land-based station may be established in the northern Sanriku to better cover sub-areas 7CS and 7CN); the boats can search freely once they reach 30 n.miles from port if no whales have been encountered <i>en route</i> from port, which means the design is not fully specified in terms of the catches by the port-based boats; and the Nisshin Maru will conduct sampling if the number of common minke whales caught does not reach the target number, but no sampling plan for this contingency is provided. 	<p><i>Panel: Add to the research protocols for any revised proposal</i></p> <p>SC 2017: No progress as proponents disagree with Panel.</p>	<p>Disagree with Panel (see SC/67a/SCSP01, p.8).</p>
17	Rather than set an arbitrary number of telemetry tags for deployment, the Panel recommends that the number, location and timing of tag deployments should reflect the questions being addressed.	<p><i>Panel: Add to protocols for any revised proposal</i></p> <p>SC 2017: This recommendation has been partially met.</p>	<p>See SC/67a/SCSP10, (p.105 for minke whale; p.120 for sei whale).</p>
27	Although a new graduate analyst has been appointed, the Panel remains concerned , that as has been the case for all previous special permit programmes undertaken by Japan, field and laboratory work and laboratory analyses have been allocated much higher priority than analyses and modelling. This has been reflected in the long times taken to complete analyses (some of which remain incomplete). The Panel strongly recommends the recruitment of sufficient highly trained and qualified analyst/modellers to improve NEWREP-NP study design, data analysis and review.	<p><i>Panel: Prior to undertaking the programme</i></p> <p>SC 2017: It is not clear that additional qualified personnel have been hired.</p>	<p>See section on 'Description of overall project management including personnel and logistic resources' in SC/67a/SCSP10, 5.2 (p.43).</p>
28	Additional information on sample and data archiving, relational database(s) as noted by previous expert panels would be welcome.	<p><i>Panel: Include as part of any revised proposal</i></p> <p>SC 2017: The proponents partially addressed this recommendation for DNA data and associated biological information, as used in SC/67a/SD-DNA01 and SC/67a/SD-DNA05.</p>	<p>See section on 'Description of overall project management including personnel and logistic resources' in SC/67a/SCSP10, 5.1 (p.43). See also relational data set presented to the JARPNII review meeting.</p>
29	The proponents recognised the need for a backup contingency plan in the event of disruption of the programme. The primary contingency is for the cruise leader to adjust sampling efforts and locations, if necessary, for example due to bad weather preventing the collection of data in a certain location. The Panel agrees that contingency plans are needed, but noted that the proponents have not yet developed a more detailed plan/protocol, <i>a priori</i> , for how research will be modified in the event of disruption. It recommends that this be done.	<p><i>Panel: Add to protocols for any revised proposal</i></p> <p>SC 2017: This recommendation has been partially met.</p>	<p>See section on 'Adjustments of research protocols at the scene and in the year of disruption' in SC/67a/SCSP10, 5.3 (p.44).</p>

Table 27e
Summary of other recommendations relevant to NEWREP-NP.

No.	Panel recommendations	Panel Comment/timeline SC 2017 comment	Proponent response/comments
2	The Panel recommends that any Special Permit programme should include a specific Primary Objective to continually review new techniques as these become available to facilitate discussions of methods and samples sizes at milestones such as the mid-term reviews. If present data do not allow for this, a focussed pilot study to enable a full and proper evaluation of lethal vs present non-lethal methods integrated across objectives should be undertaken, prior the full programme starting; where such data already exist then the desktop-study evaluation should be undertaken <i>before</i> the permit programme begins. Such evaluations could be undertaken in light of an expanded framework as recommended under Item 3.3.4 and must be properly designed to enable more effective reviews of sample sizes/methods during mid-term reviews.	<i>Panel: Whilst relevant to the proponents, this is directed primarily at the Scientific Committee and linked to Recommendation 19</i> SC 2017: Not considered in the new proposal.	Not applicable
9	Research item (iii) relates to novel compound exposure and indicates that the levels of polybrominated diphenyl ethers (PBDEs) and other flame retardants would be quantified in blubber, prey and marine debris (presumably micro- and macro-plastics found in whale stomachs). However, there is no indication of how these results would be related to 'adverse effects' as stated in the objective. The Panel therefore recommends an integration and combined analysis of the results obtained by all three research items (i.e. relating exposure to polychlorinated biphenyls, flame retardants and novel compounds from plastics to responses) such as immune function and enzyme induction, including controlling for any effects of age (emphasizing the need to use the age estimates obtained from the earplugs rather than body length) and nutritional condition. This would require samples from the same individuals to be included in each of the three research items.	<i>Panel: Recommendation for analyses of results relevant for any mid-term review</i> SC 2017: This recommendation has been partially met as partially reflected in SC/67a/SCSP10; additional details are needed.	See section on 'Laboratory and analytical work' in SC/67a/SCSP10, Annex 18 (p.133).
14	The Panel recommends the implementation of biopsy sampling to reduce the lethal sample size as soon as it is deemed feasible rather than wait until the mid-term review.	<i>Panel: As soon as feasible</i>	Disagree with Panel [see also SC/67a/SCSP10, Fig 2 'Use and evaluation of new non-lethal techniques (field and analytical) on common minke whales in NEWREP-NP' (p.27)].
16	The Panel recommends the proponents attend the IWC-ONR joint Workshop on Tag Development, Follow-Up Studies and Best Practices to be held in September 2017 in Silver Spring, MD (USA) to become acquainted with the most current tagging technologies and deployment methods.	<i>Panel: September 2017</i> SC 2017: This recommendation has been met, as reflected in SC/67a/SCSP10.	See section on 'satellite tagging' in SC/67a/SCSP10, Annex 9 (p.105-106).
18	Once a suitable tag is developed, the Panel recommends tagging North Pacific common minke whales within the study area to address stock structuring within the NEWREP-NP study region. Again, tag deployment location and tag design should be tailored to the question being addressed.	<i>Panel: As soon as practical</i> SC 2017: The proponents provided a few details in SC/67a/SCSP10.	See SC/67a/SCSP10 (p.105 for minke whale).
19	The Panel recommends using the extensive amount of data in age-related methylation in mammal model species (e.g. humans) where thousands of CpG sites have been identified in which the level of methylation correlates with age, similar to the approach taken by Polanowski <i>et al.</i> (2014) who assessed 37 CpG sites originally identified in humans. Once putative ageing CpG sites have been identified among the candidate CpG sites observed in humans, a more targeted approach may be developed by identifying the homologous loci in the minke whale genome, thereby presumably increasing the precision of methylation-based ageing in North Pacific minke whales. This work should be undertaken in the context of whether the technique shows a suitable level of precision for meeting conservation and management objectives requiring age data, not whether it achieves a comparable level of precision to ear plug readings.	<i>Panel: Can start with existing data</i> SC 2017: No new information has been presented, but this recommendation is highly relevant in the context of age determination by non-lethal methods.	Agree partially with Panel (see SC/67a/SCSP10, p.16). Will be considered when the feasibility study on Antarctic minke whale is completed.
20	The Panel recommends that the similar data/results from the Icelandic sampling programme are incorporated in the analyses. The Panel reiterates that non-lethal techniques should be incorporated into the programme as soon as they are deemed plausible.	SC 2017: This recommendation has been partially met as partially reflected in SC/67a/SCSP10.	SC/67a/SCSP10, Fig 2 'Use and evaluation of new non-lethal techniques (field and analytical) on common minke and sei whales in NEWREP-NP' (p.27).
26	The Panel recommends that the proponents collaborate with wildlife immunologists and immunotoxicologists to assist them as optimising, validating and interpreting the results from any immune assays requires specialist skill and knowledge; it is not a trivial undertaking.	<i>Panel: Prior to undertaking the immune function analyses</i> SC 2017: This recommendation has been met, as reflected in SC/67a/SCSP10.	See section on 'Expected outcomes and future plan' in SC/67a/SCSP10, Annex 18 (p.133).

19.4.2 Committee review

Attention: SC

The Committee **agrees** that, overall, the Expert Panel had conducted a detailed, fair and thorough review of the NEWREP-NP proposal. The Committee **endorses** the recommendations of the Panel, recognising that it was based on the information available at the time, although the proponents stated that they did not agree with all the recommendations. The proponents also stated that they had provided substantial new information at this meeting in responding to the Panel's report that in their view responded adequately to its recommendations. Several members stated their view that the additional information had responded to the important recommendations of the Panel.

The Committee **agrees** that its advice to the Commission from its consideration of the Panel conclusions will occur at next year's meeting. Nevertheless, there was discussion of several aspects of the Expert Panel's report and the proponent's response as summarised briefly below.

19.4.2.1 IMPROVEMENT IN MANAGEMENT PERFORMANCE

The Committee received updated information from the proponents on the basis and analytical methods related to the selection of the sample sizes for common minke and sei whales (SC/67a/SCSP13), which the proponents stated had demonstrated by quantitative simulation of how estimation of population trends can be improved by using age data. Some members of the Committee asserted that the link between the collection of age data and improvement in management performance (such as use of age data increased catches given pre-specified levels of risk) was not provided in the proposal nor in SC/67a/SCSP13. Other members responded that this level of analysis was not required for evaluation of a Scientific Permit proposal and that analyses presented to the 2016 meeting of the Committee (Government of Japan, 2016b) had provided sufficient indications that a revision to the *CLA* that uses age data will lead to improved management performance. They also added that age data can be used to improve estimates of natural mortality (*M*) for North Pacific sei whales, which is related to the size of expected catches.

Further documents presented to the Committee examined the Panel conclusions on the potential reliability of estimates of *M* using statistical catch at age (SCAA) models and the likely utility of such estimates in providing information relevant to trials for the RMP. The Committee was unable to address fully the implications raised in the information presented on the management related benefits of the proposed research at this meeting. There are widely different opinions on the issues, which meant that achieving consensus was not possible at this meeting (see Annex D, item 2.4 for further details).

19.4.2.2 EFFECTS OF CATCHES

The Committee reviewed new information from the proponents on the effects of proposed NEWREP-NP catches on stocks. It recognised the great efforts of the proponents to respond to the recommendations of the Panel in a short time, particularly for the more complex case of the western North Pacific common minke whales.

Attention: SC

The Committee **agrees** that the analyses address the major concerns the Panel had with the material presented on the effects of catches on the stocks in the proposal presented to the Panel at the review meeting, and as reflected in Panel recommendations 23 and 24.

With respect to the western North Pacific common minke whales, the Committee:

- (1) **agrees** that the analyses based on bycatch data are suggestive of $MSYR_{1+} > 0.01$ and that the close-kin data suggest that a hypothesis of two *O* sub-stocks with different breeding grounds is implausible;
- (2) **recognising** that there was insufficient time to fully evaluate the technical basis for the former of these analyses, it **recommends** that the full set of equations on which the analyses in Section 4 of SC/67a/SCSP13 be provided for review next year and possible use in revised Implementation Simulation Trials; and
- (3) **notes** that the poor fits to the bycatch rates by sub-area mentioned in SC/67a/SCSP13 also support the need to revise the Implementation Simulation Trials for the western North Pacific minke whales.

*With respect to the North Pacific sei whales, the Committee **agrees** that the proponents have adequately addressed the recommendations by the Panel and that the proposed catch levels will not harm the stock.*

19.5 General statements

Two general statements were presented (Annex P3 and P4) without any substantial debate on the contents.

In Annex P3, some members stated their view that lethal sampling of NEWREP-A and NEWREP-NP had not been justified and should be halted at least until more research has been conducted, noting that 'the additional work performed since publication of the two panel's reports [for the two programmes] has not yielded results that change the situation'.

In Annex P4, the proponents stated their view, supported by some others, that they had 'demonstrated the justification for lethal sampling sufficiently for both NEWREP-NP and NEWREP-A', by: (i) responding in good faith to all the recommendations by the NEWREP-NP Panel; and (ii) responding sufficiently to those of the NEWREP-A Panel's recommendations that the Panel had thought should be addressed prior to the start of the programme.

20. WHALE SANCTUARIES

No information was submitted on existing or proposed IWC Sanctuaries this year.

21. IWC LIST OF RECOGNISED SPECIES

Cooke proposed to synchronise the updating of the IWC list with the ongoing IUCN process of cetacean species and populations revision. He will revise the list, in the form of a working document, when the ongoing IUCN review is concluded, before next year's meeting.

22. IWC DATABASES AND CATALOGUES

The reports of the *Ad-Hoc* Working Groups on Global Databases and Repositories and on Photo-identification are given in Annexes R and S, respectively.

22.1 Guidelines for IWC catalogues and photo-identification databases

Over the past year, the *ad hoc* Working Group on Photo-identification (Annex S) developed guidelines in support of the IWC's work conducting cetacean population assessments through photo-identification databases. The objective was to provide guidance for photo-identification catalogues contributing photos and data to the IWC and/or being funded in part or wholly by the IWC. Catalogues must adhere to

common standards at a level sufficient to allow the IWC to meet its population assessment goals. The Committee noted that in future years, technical appendices may be added.

Attention: SC, S

The Committee recommends that the 'IWC guidelines for photo-identification catalogues' provided in Annex S are adopted, placed on the IWC website and brought to the attention of the relevant catalogue holders.

22.2 Progress with existing or proposed new catalogues

22.2.1 Integration of eastern South and Central Pacific Blue, Humpback, and fin whale photo-catalogues

SC/67a/Rep03 summarise the proceedings of a Workshop held in 2016 in Valparaíso, Chile, following the Biennial meeting of the Society of Aquatic Mammal Experts of Latin America (SOLAMAC). The aim was to communicate the goals and intent of the IWC population assessment process to regional researchers and to facilitate blue, humpback and fin whale photo-identification standardisation and integration. Participants focussed on humpback whales agreed to collaborate on developing new population estimates of abundance for Breeding Stock G humpback whales (IWC, 2017b, p.30). A strategy for combining photo-identification catalogues to support a mark-recapture analysis and to determine population connectivity from the eastern South Pacific and the Antarctic Peninsula was agreed upon. All blue whale research groups present agreed to collaborate and to contribute catalogues towards a southeast Pacific assessment. Four research groups with fin whale photographs from South America agreed to coordinate efforts toward a unified catalogue. Due to the success of this Workshop it was recognised that 'piggy-backing' workshops onto regional meetings is a productive way to assist regional researchers in achieving population assessment goals important to the IWC Scientific Committee.

22.2.2 Southern Hemisphere and Indian Ocean humpback whales: Catalogues

22.2.2.1 ANTARCTIC HUMPBACK WHALE CATALOGUE (AHCW)

SC/67a/PH03 reported on the AHCW, which has been maintained (with funding from the IWC) by the College of the Atlantic since 1987. A total of 820 individual humpback whales were catalogued in the last year. The total numbers of whale identifications are now 7,476 (fluke), 414 (left side) and 408 (right side). The database contains records of 514 individuals identified in more than one year and 274 individuals identified in more than one region (including breeding and feeding areas). A total of 23 individuals have been identified over a period of over 20 years; the longest span is 36 years. AHCW tested the utility of the Happywhale²⁴ (first discussed last year and see below) automated image recognition system and found a high matching success rate (81%) for high quality photographs. The use of future automated matching will facilitate the comparison of large numbers of photographs and across wider geographic ranges, potentially yielding information pertinent for population assessments.

SC/67a/PH02 presented an update on the web-based marine mammal photo-identification crowd-sourcing platform known as 'Happywhale'. As of April 2017, the system had been online at Happywhale.com for 20 months. The system is in continued development, pursuing the complementary goals of engaging citizen scientists and

using that engagement to generate high quality, low cost photo-identification data to marine mammal scientists. Individual identification efforts have been focused on humpback whales in collaboration with Cascadia Research Collective, College of the Atlantic, and the Alaska Whale Foundation. The site currently displays 4,813 individual humpback whales. Development has been focused on the implementation of an automated individual identification image recognition algorithm for humpback fluke matching. The system has found long-distance matches between catalogues that would not otherwise have been compared, and has also contributed to entanglement response efforts by identifying whales along the California coast.

22.2.3 Southern Hemisphere Antarctic and pygmy blue whales: Catalogues and databases

22.2.3.1 SOUTHERN HEMISPHERE BLUE WHALE CATALOGUE (SHBWC)

SC/67a/PH04 provides a progress report of the SHBWC between June 2016 and May 2017. It now includes a total of 1,520 individual blue whale photo-identifications from areas off Antarctica, Chile, Peru, Ecuador-Galapagos, eastern tropical Pacific, Australia, Timor L'este, New Zealand, Southern Africa, Madagascar and Sri Lanka. Overall, 17 blue whale research groups from all regions are contributing to the SHBWC. In 2016-17, the catalogue increased 13% with the addition of new identifications. To date matches have only been found within regions (Chile, Australia, and Antarctica) but not between regions. Work in the next year will focus on within region comparisons to be used for assessment purposes while between region comparisons to investigate migration and connectivity will be considered a second priority. The relevance of the catalogue to population assessments is discussed in Annex H Item 9.2.2.

22.2.3.2 ANTARCTIC BLUE WHALE CATALOGUE (ABWC)

SC/67a/PH01 described the results of the comparison of new Antarctic blue whale identification photographs to the ABWC. Twenty-five new individual blue whales were identified: sixteen from the South African Antarctic Blue Whale Survey 2013/14 (Findlay *et al.*, 2014) and nine from the personal photographs of Paul Ensor (Cruise Leader, IWC/SOWER). There were no matches within or between the two photo collections or the Antarctic Catalogue. The total number of identified Antarctic blue whales is now 441, represented by 321 right sides and 336 left sides. This is 15-19% of the most recently accepted abundance estimate of 2,280 from 1997/98 (CV=0.36; Branch *et al.*, 2007). To date 3% (14/441) of whales have been re-sighted inter-annually. The low re-sighting rate may be explained by an increasing population size (Branch *et al.*, 2007). The current 3% re-sighting rate is too low to produce a precise abundance estimate in a capture-recapture model. The relevance of the catalogue to population assessments is discussed Annex H, item 9.2.3.

Attention: SC, S

The Southern Hemisphere photo-identification catalogues for humpback whales and blue whales are potential sources of data for estimating abundances and examining connectivity between feeding and breeding grounds. The Committee:

- (1) **recommends** the continuation of these catalogues;
- (2) **requests** the Secretariat send the curators of these catalogues the newly agreed 'IWC guidelines for photo-identification catalogues' (Annex S); and
- (3) **encourages** regular communication between curators of the Antarctic Humpback Whale Catalogue and the Committee.

²⁴<http://www.happywhale.com>.

Table 28

Database usage by the Scientific Committee, any database development and data entry required, and the priority to complete that work.

Database	Status	Use by Scientific Committee	Work required	Priority to complete
Progress reports	Live	Time series data on bycatch and entanglements and other anthropogenic impacts on large and small cetaceans	Complete changes agreed at SC/67a (Annex R, table 4)	High Approx. 1.5 weeks developer time
SH blue whale catalogue	Awaiting development	MR abundance estimate for population assessments, population structure	Server setup and deployment – SC budget allocated	High
Individual Catch Database	Live	Population assessments, catch limits, distribution and movement	Online portal. Idiosyncrasies within data. Creation of a database accounting for differences between total catches and those with individual data. Requires full documentation.	High
Catch Summary Database	Live	Population assessments, catch limits, distribution, movement	Online portal	High
Entanglement response	In planning	Develop best practice, information sharing and capacity development	Develop database; funding already available.	High Final proposal will be presented at SC/67b
JCRM submission site	Live	JCRM journal management system (submission to publication)	Customise some features	Medium ; current system functional
Ship strikes	Live	Time series data of ship strikes on large whales	Migration script or brute force data entry of 100+ records from another repository	In progress by Secretariat
IWC photographic cruise database and archive	Live	Keyworded data archive linked to cruise records, e.g. photo-ID, biopsy, scarring, health status etc.	Updates only	In progress by Secretariat
IWC biopsy sampling database	Under development	Facilitate stock structure analyses	Updates only	In progress by Secretariat
Document web archive	Live	For everything	Updates only	In progress by Secretariat
Bibliographic reference database	Live	Scientific Committee reports, communication	Updates only	In progress by Secretariat
New integrated sightings, photo-ID, biopsy	Under development, SC Steering Group	Population assessments, abundance estimation	Updates only once developed	In progress by Secretariat, funding available
Cetacean diseases of concern	Intranet in development		Finalise website	Part of document archive; complete at SC/67b
Whalewatching handbook	In development		Finalise website, develop database	Part of document archive; in progress by Secretariat
IWC database of recommendations	In planning	Communication with Commission, assessment of progress/response	Develop database	Proposal will be presented at SC/67b
WNP gray whale catalogue	Under construction	MR abundance estimation for population assessments, population structure	Possible migration to new system	Process to be specified
Research requests	Live	Portal to request data or samples held by the IWC	None required	N/A
Discovery Marking Data	Live	Population structure and movement, catch allocation	None required	N/A
Sightings Data (IWC-DESS)	Retired (see below)	Population assessments, abundance estimation	Data will be integrated into the new sightings, photo-ID database	N/A
Small cetaceans catches (bycatch and direct)	Retired	Not used currently	None	N/A
Compendium of whalewatching regulations	Outdated	Global comparison of whalewatching regulations, assessment of best practice	None – not a database	N/A

22.3 Progress with existing IWC databases

22.3.1 IWC databases

The Secretariat currently holds or is developing 18 databases as well as three web applications which include databases. The Committee reviewed these databases focussing on the technical and financial support required. Annex R summarises the future work required and high priority tasks.

Attention: SC, S, CG

The Committee recommends that the following activities are high priority (see Annex R):

- (1) *further development of IWC catch databases including documentation of aggregated catch information;*

- (2) *amend the National Progress Reporting systems as specified under Item 23.3.2;*
- (3) *migration of the Southern Hemisphere Blue Whale Catalogue to an IWC-managed server; and*
- (4) *development of the Entanglement Response database.*

22.3.2 National progress report database

The number of countries completing National Progress Reports has dropped from around 20 in 2000 to around 15 in recent years with only 12 in 2017. The Committee reviewed the content and database for these reports and made several recommendations (see below).

Attention: SC, S, CG

The Committee **recommends** that the Secretariat:

- (1) **develops** a system to generate PDF files of each report that will include the names of national and regional coordinators for each country as authors to assist national and regional co-ordinators to provide feedback to contributors and to facilitate review of each country's national progress report;
- (2) **develops** a system to aggregate data on specific issues such as bycatch and ship strikes - the Commission Bycatch Mitigation Initiative coordinator might also assist with promoting submission of information in National Progress reports;
- (3) **implements** changes to the structure and content of National Progress Reports (see Annex R, table 4) to reduce the workload of data entry while still retaining all the data used by the Committee - the changes include removing the specific sections on sightings, photo-identification, tag deployment, tissue sampling and direct catches of large whales while adding two sections on cetacean databases/archives and systematic surveys; and
- (4) **ensures** that the data are easily accessible by the Committee including by submitting a document at each meeting summarising catches for the previous year and appending a table of catches to the PDF files of national progress reports.

22.4 Potential future IWC databases

22.4.1 Global database for disentanglement activities (with HIM)

A new *pro-forma* was developed for new database requests and major alterations to existing databases (Annex R, appendix 2). The *pro-forma* will be completed by the proponents and reviewed by the relevant sub-committee or working group, together with technical input from the Secretariat, similar to the procedures for funding proposals.

There are several databases which receive funding from IWC but are not hosted by the Secretariat (e.g. Pollution 2020). The new *pro-forma* is intended to adequately describe the form and function of these external databases and specify data availability arrangements with the Committee. This information will assist the assessment of any associated funding proposals.

Attention: SC, S, CG

The Committee **recommends**:

- (1) adoption of the *pro-forma* developed for new database requests and major alterations to existing databases given in Annex R, appendix 2; and
- (2) that the Secretariat develops formal data availability agreements for external databases that receive funding from the IWC.

22.4.2 Global bycatch database

The Committee has previously recommended the development of a database for the IWC's Global Whale Entanglement Response Network (GWERN). This was discussed as an example of a well-advanced proposal for a new database that could be used as a test of the new *pro-forma*. Mattila agreed to fill out the *pro-forma* using the specification for the GWERN database. If, as anticipated, this database is successful, then it could be expanded to include other related data. Hence the initial structure needs to be carefully designed to allow for future expansion.

22.4.3 Development of simple technical guidelines for new proposals

Another proposal, developed jointly by the Scientific and Conservation Committees, for a database of Scientific Committee recommendations will be prepared for the 2018 Joint CC/SC Working Group and will be available at the 2018 Scientific Committee meeting. This proposal will provide another opportunity to review the *pro-forma* and refine as needed.

23. IWC MULTINATIONAL RESEARCH PROGRAMMES AND NATIONAL RESEARCH CRUISES THAT REQUIRE IWC ENDORSEMENT

23.1 IWC-POWER

SC/67a/ASI09 reported the results of the 7th annual IWC-POWER cruise, conducted between 2 July to 30 August 2016 in the central North Pacific (with the dedicated research area located between 20°N-30°N and between 135°W-160°W). The survey was conducted aboard the Japanese R/V *Yushin-Maru* No.3. Researchers from Japan, the US and Republic of Korea participated in the survey, which was implemented using methods based on the IWC SC guidelines. Further details on the cruise, including information on number of species seen, can be found in Annex Q, item 5.1.

The Committee thanked the Cruise Leader, researchers, Captain and crew, and the Steering Committee for completing the 6th cruise of the IWC-POWER programme. The Government of the USA had granted permission for the vessel to survey in their waters, without which this survey would not have been possible. The Government of Japan generously provided the vessel and crew. The Government of Republic Korea provided a researcher. Furthermore, the IWC Secretariat was thanked for providing support. The Committee recognises the value of the data contributed by this and the other POWER cruises, collected in accordance with survey methods agreed by the Committee, covering many regions not surveyed in recent decades, and addressing an important information gap for several large whale species.

SC/67a/Rep02 presented the report of the 2016 IWC-POWER cruise Planning Meeting held in Tokyo from 15-17 September 2016. The cruise will take place from 3 July-25 September 2017, including transit from and to Japan using the research vessel *Yushin-Maru* No. 2, which is kindly being provided by Japan. It had been confirmed, after the Planning meeting, that the ship will receive the necessary international clearance. Sailing with international status will provide considerable benefits with regard to permits and port entries for refuelling, and acoustic components such as deployment of sonobuoys. This will be the eighth cruise under the successful international IWC-POWER programme. Together, the cruises to be conducted in 2017, 2018 and 2019 will cover the Bering Sea. These plans were endorsed by the Committee in 2016. The 2017 cruise will cover the easternmost stratum in the Bering Sea, i.e. towards the US coast. This will give more time for obtaining the relevant permits for covering Russian waters in the westernmost stratum of the survey area. The cruise will make a valuable contribution to the work of the Scientific Committee on the management and conservation of populations of large whales in the North Pacific.

The Committee thanked Japan for hosting the IWC-POWER cruise meeting and the participants for their hard work.

Attention: SC, C-A, CG-R

The Committee **reiterates** to the Commission the great value of the data contributed by the IWC-POWER cruises which cover many regions of the North Pacific Ocean not surveyed in recent years and so address an important information gap for several large whales. The Committee:

- (1) *thanks* those governments, especially Japan who generously supplies the vessel and crew, for their continued support of this IWC programme;
- (2) *agrees* that the 2016 cruise was duly conducted following the Requirements and Guidelines of the Committee (IWC, 2012b) and looks forward to receiving abundance estimates based on these data;
- (3) *endorses* the plans for the 2017 POWER cruise, thanks the USA for providing acoustic equipment and *recommends* a detailed planning meeting for the 2018 cruise;
- (4) *recommends* that the USA and Russia facilitate the proposed research by providing respective permits for their national waters; and
- (5) *looks forward* to receiving a report from the 2017 survey at the 2018 Committee meeting.

23.2 Southern Ocean Research Partnership (IWC-SORP)

The Southern Ocean Research Partnership (IWC-SORP) was established in March 2009 as a multi-lateral, non-lethal scientific research program with the aim of improving the coordinated and cooperative delivery of science to the IWC. The Partnership currently has 13 member countries: Argentina, Australia, Belgium, Brazil, Chile, France, Germany, Italy, New Zealand, Norway, South Africa, the United States of America, and Luxembourg was welcomed at this meeting. New members are warmly welcomed.

There are five ongoing IWC-SORP themes:

- (1) 'The Antarctic Blue Whale Project';
- (2) 'Distribution, relative abundance, migration patterns and foraging ecology of three ecotypes of killer whales in the Southern Ocean';
- (3) 'Foraging ecology and predator-prey interactions between baleen whales and krill';
- (4) 'Distribution and extent of mixing of Southern Hemisphere humpback whale populations around Antarctica?' focused initially on east Australia and Oceania; and
- (5) 'Acoustic trends in abundance, distribution, and seasonal presence of Antarctic blue whales and fin whales in the Southern Ocean'.

Bell presented the IWC-SORP Annual Report 2016/17 on the continued progress of research undertaken researchers involved in the five themes since last year (SC/67a/SH04rev). This progress includes the production of 27 peer-reviewed publications in beginning of 2016, bringing the total number of peer-reviewed publications related to IWC-SORP since the start of the initiative to 95. In addition, 103 IWC-SORP related papers have been submitted to the Scientific Committee, 16 of them this year.

Fieldtrips were undertaken to a variety of places during the past year, in particular, the western Antarctic Peninsula, sub-Antarctic Marion Island, and the Coral Sea. Thousands of images for photo-identification have been collected; a variety of satellite tag-types deployed on Antarctic minke whales,

humpback whales and killer whales; hundreds of biopsy samples collected from these same species; unmanned aerial system (UAS) imagery recorded for photogrammetry purposes; and thousands of hours of acoustic recordings have been made. The support of tour companies in providing opportunistic research platforms to facilitate these activities and external data contributors were acknowledged by the Committee.

A brief report on the IWC-SORP Research Fund was also given (SC/67a/SH04rev and SC/67a/SCP02). In 2016, £144,058 GBP were allocated to 10 projects during an open, competitive grants round. £640,421 GBP remain unallocated and unspent in the fund. A new round is planned for 2017. The Committee acknowledged and thanked all contributors to the IWC-SORP Research Fund for their voluntary contributions. The Committee also noted that since SC/66b, substantial vessel time has also been secured by IWC-SORP researchers for the 2018 and 2019 austral field seasons.

Attention: SC, G

The Committee acknowledges the great value of the IWC-SORP (Southern Ocean Research Partnership) programme to its work. The Committee:

- (1) *encourages* the continuation of the Southern Ocean Research Partnership programme;
- (2) *commends* the researchers involved who are key to the overall success of the Partnership in IWC-SORP for:
 - (a) *the impressive quantity of work carried out across diverse member nations;*
 - (b) *their contributions to the work of the Committee; and*
- (3) *encourages:*
 - (a) *the continued development, testing and implementation of leading edge technology; and*
 - (b) *the continued development of collaborations between ships of opportunity and external bodies that can provide platforms for research and/or contribute data, inter alia, photo-identification data, to IWC-SORP and the wider Committee.*

The Committee also endorses the revised process for reviewing SORP project proposals (see Appendix 1 to Annex V).

23.3 National Cruises that require IWC oversight

The Committee welcomed plans for national research cruises to be conducted in the intersessional period of 2017-18. The cruises will be conducted in coastal waters of western North Africa by COMHAFAT, in the Okhotsk Sea by Russia, in the North Pacific and the Antarctic by Japan, and in the Yellow Sea by Korea. Details on the cruise plans and scientists appointed by the Committee to provide IWC oversight to these cruises are presented in Annex Q, item 5.3.

The Committee also received cruise reports from surveys conducted in the Okhotsk Sea, the western North Pacific and the Antarctic, but these were not discussed because they did not provide estimates of abundance or they did not contain information that could contribute to improve the design of future surveys.

Table 29
Work plan for cruises under IWC funding or oversight.

Item	Intersessional 2017/18	2018 Annual Meeting (SC/67b)
IWC-POWER	- 2017 IWC-POWER cruise in the Bering Sea. - Planning Meeting for the 2018 IWC-POWER cruise.	Review cruise report, report from the planning meeting and new abundance estimates from IWC-POWER cruises.
Other national cruises with IWC oversight	Develop a process to review national cruise reports by an intersessional email correspondence group.	Review new plans if presented.

Attention: SC, C-A

The Committee **endorses** the proposed sighting survey plans (see Annex Q, item 5.3) and **encourages** submission of abundance estimates from these studies in the future. The Committee also **agrees** to develop a process for the review of cruise reports at future meetings in the context of lessons that they may provide with respect to the design of future surveys or the analysis of the results of those surveys.

23.4 Work plan

The work plan is shown in Table 29.

24. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR THE 2018 MEETING

Work plans for the intersessional period and the next annual meeting are provided under the relevant agenda items and Annexes (D-T). The Committee will be developing a targeted 2-year workplan at next year's meeting for the consideration of the Commission with the objective of providing the Commission (and its sub-groups) with consolidated advice for its 2020 biennial meeting.

The computing tasks/needs for the 2017/18 period are given in Table 30.

25. SCIENTIFIC COMMITTEE BUDGET FOR THE BIENNUM 2017-18

25.1 Status of previously funded research, Workshop proposals, data processing and computing needs

25.1.1 Funded proposals for the current biennium 2017-18

Table 31 summarises the status of the work funded by the Commission last year. The great majority have been completed but several are ongoing. The projects all contributed substantially to the work of the Committee and its ability to provide advice to the Commission.

25.1.2 Funded proposals in previous years still ongoing

Several projects from previous years are still ongoing. These are all still of great value to the Committee and should be completed before the 2018 SC meeting. Details of all ongoing projects can be found in SC/67a/SCP02.

25.2 Consolidated budget for the next intersessional period (up to 2018)

Last year the Committee had submitted a two-year budget to the Commission (IWC, 2017b, p.96) that had been accepted by the Commission.

Suydam summarised the budget requests for 2018 and noted that there was sufficient money already allocated to cover these requests. The Committee therefore **recommends** the budget provided in Table 32.

SC01, SC INVITED PARTICIPANTS

Invited participants (IPs) are a vital component of the working of the IWC's Scientific Committee. IPs contribute in many ways including as sub-committees and Working Groups Convenors, co-Convenor and rapporteurs, subject area experts and Convenors of intersessional groups. All sub-committees and Working Groups benefit from this budget item. The funding requested this year is particularly high as the 2018 SC meeting is expected to take place in Kenya next year, which will mean high travel and subsistence costs. This year under this budget item 45 scientists from Argentina, Australia, Canada, Chile, France, Germany, India, Japan, Mexico, the Netherlands, Norway, Oman, Russian Federation, Slovenia, South Africa, Spain, USA and UK were supported.

25.2.1 Workshops

IA01(67A), WORKSHOP FOR AN IN-DEPTH ASSESSMENT OF NORTH PACIFIC HUMPBACK WHALES

This relates to the work of the In-depth Assessments (IA) sub-committee, and follows on from the first Workshop on the Comprehensive Assessment of North Pacific humpback whales that was held in Seattle in April 2017. The Workshop will continue the work with a view to completing or significantly advancing the assessment, including the relevant population modelling.

EM01, TWO JOINT IWC-SC AND SC-CCAMLR WORKSHOPS

A joint meeting of the scientific committees of CCAMLR and the IWC is proposed for 2018 to foster collaboration between the ecosystem modelling working groups of both Commissions responsible for managing whales and marine living resources in the Southern Ocean (see Item 16.1.3 for full details). The Workshops will establish plans for data collection and analysis towards the development of multi-species/ecosystem models of pertinence to the objectives of both Commissions.

AWMP01 AND 02, AWMP WORKSHOPS

The SWG on AWMP will hold two Workshops in the 2017/18 period to complete the development of *SLAs* for the Greenland hunts (common minke and fin whales) and work on the AWS.

CMP01(67A), FIFTH WORKSHOP ON THE RANGEWIDE REVIEW OF POPULATION STRUCTURE AND STATUS OF NORTH PACIFIC GRAY WHALES

This work is a continuation of the process set in place by the Committee in 2014. This technical Workshop will allow compilation and review of the results of the simulation trials previously agreed by the Committee. It is anticipated that this will be the final Workshop and will allow the Committee to conclude its review but, as with all simulation work, this will depend upon the results.

CMP02(67A), DRAFTING GROUP TO FINALISE THE SCIENTIFIC COMPONENTS OF THE UPDATED IUCN/IWC CMP FOR WESTERN GRAY WHALES

Finalise the scientific components of the updated IUCN/IWC CMP for western gray whales in time for the stakeholder Workshop planned to occur before the 2018 Commission meeting.

BRG04, WORKSHOP ON CETACEAN TAG DEVELOPMENT, TAG IMPACT ASSESSMENT AND TAGGING BEST PRACTICES

This project is a collaboration with the US Office of Naval Research and NOAA to co-organise and fund a workshop to evaluate and provide recommendations related to cetacean tag development, tag impacts and best practices. The Workshop will take place in September 2017.

WW01, INTERSESSIONAL WORKSHOP-DATA GAPS AND MODELLING REQUIREMENTS FOR ASSESSING THE IMPACTS OF WHALEWATCHING

The extent to which whalewatching impacts cetacean populations in the long-term remains uncertain. This Workshop will build a cohesive and coordinated approach for data collection and the development of models to assess the possible impacts of whalewatching by engaging experts from outside of the current membership of the WW sub-committee.

RMP01, INTERSESSIONAL WORKSHOPS - IMPLEMENTATION REVIEW, NORTH PACIFIC BRYDE'S WHALES

This Workshop is essential for the Committee to conduct a full *Implementation Review* of North Pacific Bryde's whales. Conducting *Implementation Reviews* are a required activity under the Committee's Requirements and Guidelines for the RMP.

Table 30

The computing tasks/needs for the 2017/18 period.

RMP

Modify the control programs used for *Implementation Simulation Trials* to report the three measures of status (see Item 5.4).

Revise the control program for the *Implementation Review* of Western North Pacific Bryde's whales to incorporate the new models; data preparation, conditioning and running of final trials (see Item 6.5).

AWMP

Amend the control program for the North Atlantic common minke whale RMP *Implementation Review* to allow: (a) density-dependence in the proportion of the West Greenland sub-stock that feeds off West Greenland; and (b) density-dependent dispersal between the sub-stocks feeding off West Greenland, as specified in Annex E, Appendix 3. Further revise the control program to implement any changes to the trial structure if specified by the intersessional Workshop in October 2017 (Item 7.1.2).

In-depth assessment

Prepare catch and marking data series for the In-depth Assessment of North Pacific sei whales using the revised boundaries agreed at this meeting (Item 9.1.2.2).

Cetacean abundance estimates and stock status

Incorporate the abundance estimates agreed at this meeting into the IWC abundance table and upload them to the IWC website. Continue to update the IWC abundance table intersessionally (see Item 12.4).

Provide information on status from recent Implementations or *Implementation Reviews* (Items 5.4 and 12.4).

IWC databases and catalogues

Catch summary database: develop system to allow online access.

Individual catch database: develop system to allow online access, document idiosyncrasies within data.

Create a database of catches for which there are no individual data, to conform with all available summary data on the area, sex and month of these catches, to enable easy creation of future catch series.

Bycatch

Assist with entry of data into the IWC ship dtrike database (Item 22.3.3).

Sightings data

Complete validation of the 2015 POWER cruise sightings data and validate data from the 2016 cruise.

Complete validation of the 1995-97 blue whale cruise data and incorporate into the DESS database (carried over).

Table 31

Progress on Workshop and Research Proposals agreed last year (IWC, 2017b, pp.83-86), see Table 26.

SC/66a RP	Title	Relevance
SC01	Invited Participants for SC/67a.	Completed
SH09	Workshop on integration of eastern south and central Pacific blue, humpback and fin whale photo-identification.	Completed (SC/67a/Rep03)
IA01	Pre-meeting for an in-depth assessment of North Pacific humpback whales.	Completed (SC/67a/Rep08)
EM01	Joint SC-CAMLR and IWC-SC Workshop.	Ongoing (Annex L)
AWMP/	AWMP/RMP joint intersessional Workshop.	Completed (SC/67a/Rep05; SC/67a/Rep06)
RMP01		
BRG02	Fourth Workshop on the rangewide review of population structure and status of NP gray whales.	Completed (SC/67a/Rep04)
BRG04	Satellite tagging best practices Workshop.	Planning in progress (Annex O)
WW01	Intersessional Workshop on data gaps and modelling requirements for assessing the impacts of whalewatching.	Planning in progress (Annex N)
RMP01	Intersessional Workshop on <i>Implementation Review</i> of North Pacific Bryde's whales.	Completed (SC/67a/Rep07)
SP01	Review SP proposal for Japan's new whale research program in the Western North Pacific.	Completed (SC/67a/Rep01)
E03	HAB pre-meeting.	Completed (SC/67a/Rep09)
AWMP02	AWMP developers fund.	Ongoing (Annex E)
SH10	Modelling analyses for future assessments of Southern Hemisphere humpback populations.	Ongoing (Annex H)
IA02	Assessment modelling for an in-depth assessment of NP sei whales.	Ongoing (SC/67a/IA02)
RMP02	Essential computing support to the Secretariat for RMP.	Completed (SC/67a/Rep07; SC/67a/Rep06; Annex D, Annex E)
BRG05	Tracking southern right whales through the southwest Atlantic.	Ongoing (Annex O)
BRG03	Passive acoustic monitoring of the eastern South Pacific right whales: improving CMP outputs.	Completed (SC/67a/CMP13)
SH05	Acoustic monitoring of pygmy blue whales in the Mozambique Channel off the northwest coast of Madagascar.	Ongoing (SC/66b/CMP12)
IA03	IWC-POWER 2016 cruise.	Completed (SC/67a/Rep02; SC/67a/IA09; Annex F)
SH01	Antarctic Humpback Whale Photo Catalogue.	Completed (SC/67a/PH03)
SH02	Southern Hemisphere Blue Whale Catalogue.	Completed (SC/67a/PH04)
SH03b	Data archiving tool for northern Indian Ocean humpback whales.	Ongoing (Annex O)
HIM01	Ship strikes database coordinator.	Completed (SC/67a/HIM08)
HIM02	Design and construction of an initial global entanglement database.	Ongoing (Annex R; Annex J)
E01	Cetacean diseases of concern.	Ongoing (SC/67a/E06)
E04	SOCER (State of the Cetacean Environment Report).	Completed (SC/67a/E05)
SC02	Follow-up from previous recommendations.	Ongoing

Table 32

Summary of budget requests for 2018 based upon the budget agreed last year. For explanation and details of each project see text and IWC, 2017b, pp. 83-86). 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.

SC/66b RP no.	Title	Relevance	2018 (£)
Meeting/Workshop			
SC01	Invited Participants - SC/67b	SC	106,035*
IA01 (67a)	Workshop for an in-depth assessment of North Pacific humpback whales	IA	11,400
EM01	Two joint SC-CAMLR and IWC-SC Workshops	EM	16,000
AWMP01	AWMP first intersessional Workshop and genetic work	AWMP, RMP	0 ¹
AWMP02	AWMP second intersessional Workshop	AWMP	10,000
CMP01 (67a)	5 th Workshop on the rangewide review of population structure and status of North Pacific gray whales	AWMP, E, CMP	2,500 ²
CMP02 (67a)	Drafting group to finalise the scientific components of the updated IUCN/IWC CMP for western gray whales	CMP	0 ³
BRG04	Satellite tagging best practices Workshop	BRG, SH, E	0**
WW01	Intersessional Workshop: data gaps and modelling requirements for assessing the impacts of whalewatching	WW	11,500
RMP01	Intersessional Workshop: <i>Implementation Review</i> of North Pacific Bryde’s whales	RMP	10,000
RMP01 (67a)	Intersessional Workshop: <i>Implementation Review</i> for Western North Pacific minke whales (joint with Bryde’s)	RMP	5,000
WW01 (67a)	Review CC strategic plan on whalewatching pre-meeting on intersessional Workshop	WW	5,000
E05/E01 (67a)	Cumulative impacts - pre-meeting or intersessional meeting	E	10,000 ⁴
SM01	Intersessional Workshop: resolving <i>Tursiops</i> taxonomy	SM, SD	8,500
SM01 (67a)	Intersessional Workshop: boto mortality	SM	11,865
Modelling/computing			
SH07	Defining blue whale population boundaries and estimating associated historical catches, using catch data in the Southern Hemisphere and northern Indian Ocean	SH	9,500
AWMP02	AWMP developers fund	AWMP	2,000
IA02	Assessment modelling for an in-depth assessment of North Pacific sei whales	IA	2,500
RMP02	Essential computing support to the Secretariat for RMP	RMP	10,000
E02	Pollution 2020: contaminants, data integration and mapping	E, SM	0*
Research			
BRG01	Aerial photographic survey of southern right whales on the South Africa Cape nursery ground	SH	0 ⁵
BRG03	Passive acoustic monitoring of the eastern South Pacific southern right whales, improving CMP outputs	CMP	14,500
SH03a	Northern Indian Ocean humpback subspecies determination-genetics	SH	7,500
IA03	IWC-POWER cruise	ASI	21,000 ⁶
SH01 (67a)	Coding for Australian blue whale photo catalogue	SH	2,500
E02 (67a)	Mercury in cetaceans (requested by the Commission)	E	4,000
Databases/catalogues			
SH02	Southern Hemisphere Blue Whale Catalogue	SHPH	15,500
SH08	Development of a permanent blue whale song reference library	SH	4,000
HIM01	Ship strike database coordinator	HIM	10,000
E01	Cetacean diseases of concern	E	2,000
Report			
E03 (67a)	IWC strandings initiative	E	0 ⁷
E04	SOCER (State of the Cetacean Environment Report)	E	3,000*
Total request			315,800

Notes: ¹£8,000 was the expected financial need for 2018 but savings from 2017 allowed for the reduced budget of £0; ²£9,500 was the expected financial need for 2018 but savings from 2017 allowed for the reduced budget of £2,500; ³£3,000 was the expected financial need for 2018 but savings from 2017 allowed for the reduced budget of £0; ⁴£14,000 was the expected financial need for 2018 but savings from 2016 allowed for the reduced budget of £10,000; ⁵£20,000 was the expected financial need for 2018 but the 2017 allocation was not required and so will be used to fully fund this in 2018; ⁶£36,000 was the expected financial need for 2018 but savings from previous years allowed for the reduced budget of £21,000. ⁷£5,915 was the expected financial need for 2018 but savings from 2017 allowed for the reduced budget of £0.

RMP01(67A), INTERSESSIONAL WORKSHOP – IMPLEMENTATION REVIEW FOR WESTERN NORTH PACIFIC MINKE WHALES

This Workshop is essential in order for the Committee to conduct a full *Implementation Review* for the Western North Pacific common minke whales following the Committee’s Requirements and Guidelines. Conducting *Implementation Reviews* are a required activity under the RMP.

WW01(67A), REVIEW CC STRATEGIC PLAN ON WHALE-WATCHING PRE-MEETING OR INTERSESSIONAL WORKSHOP

The Conservation Committee’s Standing Working Group on Whalewatching requested the WW sub-committee to review and comment on the 2011-16 Strategic Plan (SC/67a/WW01). The WW sub-committee was invited to ‘provide any advice regarding what should be included in the updated Strategic Plan for 2018-24, building on the 2011-

16 Strategic Plan’. This meeting will discuss and draft the recommendations from the WW sub-committee for the next iteration of the Strategic Plan to the Standing Working Group (to be presented at SC/67b for review and approval) and will develop a clear draft ToR for the WW sub-committee, with the goal to distinguish, and maximise complementarity between them. These draft ToR will be presented to the WW sub-committee at SC/67b to be finalised in 2018.

E05-E01(67A), CUMULATIVE IMPACTS PRE-MEETING OR INTERSESSIONAL WORKSHOP

Cumulative impacts have been highlighted as an area for concern given the number of stressors identified through the environmental concerns SWG. To progress this topic within the SWG and to ensure the most up to date information is available from specialists with knowledge of this broad field a pre-meeting or workshop will be held. This topic has relevance to other sub-committees such as SM and HIM.

SM01, INTERSESSIONAL WORKSHOP, RESOLVING *TURSIOPS* TAXONOMY

Tursiops taxonomy is unresolved, and considered a sufficiently important issue to merit focused attention of the SM subcommittee at the 2015-17 meetings of the SC. Following this review, information will be synthesised to develop general interpretations and practical applications for taxonomic classification for this genus, evidence for taxonomic status in regional populations and identification of important areas for further research.

SM01(67A), INTERSESSIONAL WORKSHOP- BOTO MORTALITY

Recent studies have provided evidence that the abundance of the boto has declined in parts of the Brazilian Amazon. The specific causes of the decline are not clear, but the killing of botos for use as bait in the piracatinga fisheries is a cause for concern. The Workshop will assess the geographic extent of the piracatinga/boto issue. The outcomes of the Workshop shall include: (1) a comprehensive assessment of the status of piracatinga/boto issue; (2) evaluate the efficacy of Brazil's moratorium; (3) produce recommendations to potentially improve conservation actions across all countries; and (4) a consolidated report to be presented to the SC at next year's meeting for review.

25.2.2 Modelling/computing

SH07, DEFINING BLUE WHALE POPULATION BOUNDARIES AND ESTIMATING ASSOCIATED HISTORICAL CATCHES, USING CATCH DATA IN THE SOUTHERN HEMISPHERE AND NORTHERN INDIAN OCEAN

Data on blue whales taken during commercial whaling throughout the Southern Hemisphere and the northern Indian Ocean, contain valuable information on population structure. This proposal will analyse catches in all regions and land stations to delimit population structure using the 2016 IWC databases.

AWMP02, DEVELOPERS FUND

The developers fund has been invaluable in the work of *SLA* development and related essential tasks of the SWG. It has been agreed as a standing fund by the Commission. It has been proved to be of great value in ensuring progress throughout the *SLA* development period for the Alaskan and Chukotkan hunts as well as recent work on the PCFG and Greenlandic hunts, including the completion of the *Humpback SLA* in 2015. The primary development tasks now facing the Committee are for the remaining Greenlandic fisheries.

IA02, ASSESSMENT MODELING FOR AN IN-DEPTH ASSESSMENT-NORTH PACIFIC SEI WHALES

The project involves developing and utilising population dynamics models as required to progress the in-depth assessment for North Pacific sei whales.

RMP02, ESSENTIAL COMPUTING SUPPORT TO THE SECRETARIAT FOR RMP

Regular *Implementation Reviews* are required under the RMP. An *Implementation Review* is underway for the North Pacific Bryde's whales, and more will follow. The Committee has developed a complex trials structure for *Implementation Reviews*. A key task of this process is to develop and validate the code for simulation trials. Secretariat staff alone cannot handle this complete process themselves, so computing support is needed.

E02, POLLUTION 2020: CONTAMINANTS, DATA INTEGRATION AND MAPPING

Following the focus session on the global status and trends in persistent organic pollutants (POPs) in key cetacean species, it was recognised that a web application to enable researchers to visualise and interrogate datasets would be

valuable. This tool would: display data on the rate of change in POP concentrations blubber in key cetacean species and identify regions where POPs remain of concern.

25.2.3 Research

BRG01, AERIAL PHOTOGRAPHIC SURVEY OF SOUTHERN RIGHT WHALES (*EUBALAENA AUSTRALIS*) ON THE SOUTHERN CAPE NURSERY GROUND IN SOUTH AFRICA, A PROPOSAL REQUEST FOR FUNDING OF THE 2017-18 SURVEY

The South African southern right whale population has been annually surveyed since 1979 resulting in a long-term index of population size. Continuing this long-term data series is vital. This proposal seeks funding to conduct the survey in 2017/18. It is not expected that the IWC will continue to provide funding for this monitoring, but it is recommended that the South African government ensure that funding is made available to support this important long-term programme.

BRG03, PASSIVE ACOUSTIC MONITORING OF THE EASTERN SOUTH PACIFIC SOUTHERN RIGHT WHALE, A KEY TO IMPROVE CONSERVATION MANAGEMENT PLAN OUTPUTS

In 2012, the IWC adopted a CMP for South Pacific southern right whales. Only few opportunistic sightings have been recorded but the location of the breeding ground is unknown. Passive acoustic monitoring is likely the most cost-effective way to investigate the seasonal distribution along the coasts of Chile and Peru. This information is crucial to facilitate the implementation of CMP long-term monitoring programme.

SH03A, CREATION OF A REGIONAL DATA ARCHIVAL AND ANALYSIS TOOL AND EXTENDED GENETIC ANALYSIS FOR CONSERVATION OF ARABIAN SEA WHALE POPULATIONS

This project will conduct an in-depth analysis of the genetics of 92 Arabian Sea humpback whales sampled off Oman between 2000 and 2015. Analysis will determine the population's taxonomic status, kinship, social structure and degree of inbreeding.

IA03, IWC-POWER CRUISE

The Committee has strongly advocated the development of an international medium- to long-term research programme involving sighting surveys to provide information for assessment, conservation and management of cetaceans in the North Pacific, including areas that have not been surveyed for decades. Objectives have been developed for the overall plan and requested funding will allow for the continuing work of the initial phase and progress on developing the medium-term phase. The amount of money is extremely small when seen in the context of Japan providing the vessel and associated costs for two years as it has in the past. The IWC contribution is for: (1) IWC researchers and equipment; (2) to allow the Committee's Technical Advisory Group to meet to review the multi-year results thus far and develop the plans for the next phase of POWER based on the results obtained from Phase I; and (3) to enable analyses to be completed prior to the 2018 Annual Meeting.

SH01(67A), CODING FOR AUSTRALIAN BLUE WHALE PHOTO CATALOGUE

This work is vital for the preparation of photo-identification data prior to their use in a capture-recapture estimate of abundance of Australian blue whales. The entire set of photographs (1,033 images) must be quality-coded by the same person (or team of persons trained together) so that there is no subjective bias in the coding of the photos. The expected outcome will provide a clean data set of photos for inter-matching that will in turn provide the data available to be used in an estimate of abundance.

Table 33

Workshop proposals agreed during this meeting (TBD: to be decided).

Title	Relevance	Date	Venue
<i>Implementation Review</i> of North Pacific Bryde's whales	RMP	February 2018	Tokyo
<i>Implementation Review</i> for Western North Pacific minke whales (joint with Bryde's)	RMP	February 2018	Tokyo
AWMP/RMP joint intersessional Workshop	AWMP, RMP	TBD	Copenhagen
Two AWMP intersessional Workshop on development of Greenland <i>SLAs</i>	AWMP	18-21 October 2017; 20-24 March 2018	Copenhagen
Rangewide review of population structure and status of North Pacific gray whales	CMP	29-31 March 2018	La Jolla
Finalise the scientific components of updated IUCN/IWC CMP for western gray whales	CMP	1-3 April 2018	La Jolla
Workshop for an in-depth assessment of North Pacific humpback whales	IA	TBD	Seattle
IWC-POWER planning meeting	ASI	October 2017	Tokyo
SOWER volume editorial meeting	ASI	October 2017	Tokyo
Joint SC-CAMLR and IWC-SC Workshop	EM	2018	
Satellite tagging best practices Workshop	SH, E, CMP	September 2017	Maryland
Cumulative impacts - pre-meeting or intersessional meeting	E	May 2018	Kenya
Workshop: data gaps and modelling requirements for assessing the impacts of whalewatching	WW	Late 2017/Early 2018	TBD
Review CC strategic plan on whalewatching pre-meeting on intersessional workshop	SC/WW	SC 2017	TBD
Intersessional Workshop: resolving <i>Tursiops</i> taxonomy	SM	February 2018	Louisiana
Intersessional Workshop: boto mortality	SM	December 2017	São Paulo

E02(67A), MERCURY IN CETACEANS

SC/67a/E04 provided a summary review of the significant amount of data on mercury in cetacean species that have been reported globally since the first reports in the 1970s. Mercury and selenium levels provided in the review and those solicited from additional technical experts will be added to the contaminant mapping tool. In addition, a more in-depth synthesis of available data will be undertaken.

25.2.4 Databases/catalogues**SH02, SOUTHERN HEMISPHERE BLUE WHALE CATALOGUE**

The Southern Hemisphere Blue Whale Catalogue is an international collaboration to facilitate cross-regional comparison of blue whale photo-identifications catalogues. To date the catalogue contains images of 1,520 individual blue whales. The request for funding will allow for comparisons of photos among different regions, which will improve the understanding of basic questions relating to blue whale population boundaries, migratory routes, visual health assessments and modelling abundance estimates. The results will contribute to the IWC Southern Hemisphere blue whale assessments.

SH08, DEVELOPMENT OF A PERMANENT BLUE WHALE SONG REFERENCE LIBRARY

Funding will be used to develop a permanent blue whale song reference library. The work will include development of a metadata standard for data submission and data use agreements. This library will facilitate research on blue whale acoustics, as well as have potential to provide information on geographic occurrence, habitat use, and baseline song types.

HIM01, SHIP STRIKE DATABASE COORDINATOR

The ongoing development of the IWC ship strike database requires data gathering, communication with potential data providers and data/database management. This project will provide support for expanding and maintaining the database.

E01, CETACEAN DISEASES OF CONCERN (CDOC)

This project will continue and expand a website to provide an information tool for cetacean diseases (infectious and non-infectious diseases as well as lesions or findings). Work will include the design, development, content management, implementation, and maintenance of the CDoC website.

25.2.5 Reports**E03(67A), IWC STRANDINGS INITIATIVE**

This is an initiative that has been proposed by the Scientific Committee, supported by the Whale Killing Methods and Welfare Issues Working Group and is likely of interest to

the Conservation Committee. It will provide expertise for coordination of emergency responses, expertise on strandings procedures, diagnostics and response and capacity building for stranding networks. It will positively impact member governments, as well as the Scientific Committee and Commission. It has relevance to the SM, HIM, and E-SWG, as well as other sub committees.

E04, STATE OF CETACEAN ENVIRONMENT REPORT (SOCER)

SOCER is a long-standing effort to provide information to Commissioners and Committee members on key current global developments that are affecting the cetacean environment. Focus will be on the Mediterranean Sea for 2018, including a section on issues of global concern. Funds are for salaries, library services, and printing.

26. WORKING METHODS OF THE COMMITTEE**26.1 Interactions between the Scientific Committee and the Conservation Committee**

Commission Resolution 2014-4 called for the Scientific Committee to continue to improve its work towards conservation-related matters and the establishment of a joint working group between the Conservation Committee and the Scientific Committee to propose a procedure to facilitate the implementation and follow up of conservation recommendations. An *ad hoc* working group (SC/CC) discussed ways to improve communication with the CC/SC joint working group, noted above, and the Conservation Committee in general (see Annex T). After fruitful discussion, several recommendations were made.

Attention: SC, CC, C-R

With respect to improved and effective interactions between the Scientific Committee and the Conservation Committee, the Scientific Committee:

- (1) **recommends** that a group²⁵ is tasked to collate near the end of the Scientific Committee meeting, a draft summary of recommendations and issues related to the Conservation Committee's Strategic Plan, for presentation to the joint Conservation Committee and Scientific Committee Working Group (CC/SC WG) for discussion. This group would meet near the end of the annual Scientific Committee meeting;

²⁵Comprised of Convenors of Scientific Committee sub-groups dealing with Conservation Committee priority topics, and Scientific Committee members familiar with the relevant issues, with assistance from the Secretariat.

- (2) **agrees** that a better way is needed to communicate back to it the priorities, issues of concern and activities of the Conservation Committee (and potentially other Commission bodies) - a proposed communication framework is presented in Annex T, fig. 1;
- (3) **requests** the joint Conservation Committee and Scientific Committee Working Group to consider meeting for a longer period to consider agenda items related to each priority topic area; and
- (4) **recommends** that the membership of the CC/SC WG be expanded so that relevant Chairs of Scientific Committee sub-committees and/or key Scientific Committee members can attend meetings depending on agenda - this will allow Scientific Committee members to offer input and assist discussion under relevant priority items (e.g. whalewatching, bycatch, marine debris, ship strikes).

It was suggested that a potentially productive way forward on priority conservation issues – where concentrated, expert scientific input could greatly improve conservation action – would be to review the scientific aspects of a priority conservation issue (e.g. bycatch, noise) at an intersessional meeting on a focussed topic, with both Scientific and Conservation Committee members present.

It was noted that the sub-committee on whalewatching had a fruitful discussion on how it can improve communication, prevent redundancy and develop joint activities with the CC Standing Working Group on Whalewatching (see Annex N, item 4.1.2).

Attention: C-A, CC

The Committee **agrees** that the proposed joint intersessional meeting to discuss the CC's new Five Year Strategic Plan for Whalewatching (see Item 18.2.1.2) could be a good model to increase Scientific Committee and Conservation Committee collaboration and communication - similar meetings could consider other topics of mutual interest that are directly relevant to the Conservation Committee's Strategic Plan and priority items.

With respect to improved communication of the Conservation Committee's Strategic Plan and priority items, the Committee **recommends** that:

- (1) Scientific Committee convenors highlight relevant Conservation Committee issues in their opening remarks;
- (2) consideration is given to having an agenda item discussing Conservation Committee priorities and potential joint meetings or work in sub-committee agendas; and
- (3) voluntary conservation reports provided by Contracting Governments are made available to the Scientific Committee.

26.2 Rules of Procedure of the Scientific Committee

The Committee reviews its working methods at each meeting. In the past two years, the Committee has worked on several improvements of its working methods (known as the 'SC Handbook') and Rules of Procedure (RoP). These included refinements (or new procedures) to: (a) improving the Scientific Committee budget review process (in 2015); (b) funding mechanisms for the IWC-SORP were brought to the Committee's attention (in 2016); (c) Annex P (both in 2015 and 2016); (d) biennial reporting (in 2015); (e) Rules of procedures related to Invited Participants, observers and submission of documents (2015 and 2016); and (f) the structural set up of the Committee (2016).

The Committee Chair, Vice-Chair, Head of Science, Convenors and Co-Convenors presented a discussion document summarising several issues raised during the intersessional period. The objective of the document (summarised in Annex V) was to start discussions to facilitate agreement of a consolidated set of revisions by consensus at the 2018 meeting. These will be then forwarded to the Commission for its endorsement. The main issues that will be considered in this context relate to: (i) communication within the Committee; (ii) RoPs on invited participants, observers and local scientists; (iii) the role and genesis of the Convenors group; and (iv) RoPs and best practices on meeting papers.

Attention: SC

Based on the discussions at this meeting, the Committee **agrees** that the Chair, Vice-Chair and Head of Science in consultation with the convenors should develop a consolidated draft version of proposed revised RoPs at least one month before the next SC meeting for the Committee's final consideration. It also **agrees** to update the Scientific Committee Handbook with the material redrafted in Annex V.

26.3 Biennial reporting and related matters

This will be discussed at next year's meeting.

26.4 Additional proposals for revisions to 'Annex P'

As noted under Item 19, the Committee will present the Commission with proposed revisions to Annex P at next year's meeting, based upon discussions last year (IWC, 2017b, p.102) and Resolution 2016-2. An intersessional correspondence group (ICG-33, Annex W) will work to develop a draft for consideration at next year's meeting.

26.5 Other matters

26.5.1 Sustainability of the IWC-SC Implementation, Implementation Review and assessment processes

At this Scientific Committee meeting the RMP Implementation Review of North Atlantic common minke whales was completed, a process that started in 2014 with a joint AWMP/RMP intersessional meeting on stock structure (IWC, 2015b). Although the meeting concluded that panmixia could not be ruled out across the total North Atlantic, the Workshop agreed that four stock structure hypotheses should be considered. Although simpler than the previous (1992) situation, the process turned out to need two intersessional meetings, two pre-meetings (2015 and 2016), and several full sessions at four Annual Meetings.

For this Implementation Review (and indeed all of them) substantial intersessional work as well as work at Workshops and annual meetings was undertaken by Punt, Allison, Donovan, de Moor and Butterworth. The current process is critically dependent on these five experts, and particularly on Allison and Punt with respect to computing and the development of operating models. Without one of the latter two, the process would probably not be carried out, or it would at least be extremely slow. A similar situation occurs for the development of *Strike Limit Algorithms* (and subsequent *Implementation Reviews*) for the AWMP.

The Committee has frequently reiterated (IWC, 2017b, p.20) that the approaches used for the RMP and AWMP are not only of specific relevance to those topics, but are 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, the rangewide assessment of gray whales and in-depth or comprehensive assessments of populations/regions.

Concern was expressed that this major development in approach might not be possible within a few years given, for example, the possible retirement and/or change in professional priorities of some of the key personnel. A variety of potential ways forward were briefly considered as a prelude to a more detailed discussion next year. These ranged from the recruitment of one or more additional experts at the Secretariat through investigating ways to simplifying or automating some of the difficult steps of the analyses chain to using the process to train scientists from Contracting Governments.

Attention: SC, C-A

The Committee reiterates the importance of the Implementation Review and assessment process to its ability to provide robust management advice with respect to the effects of human activities on cetaceans, especially but not limited to direct removals. It is concerned that efforts be made to ensure that such work can continue to be carried out in the future. The Committee:

- (1) *agrees to look at this issue in the context of medium-, long-term strategic planning on modelling capabilities and Implementation Reviews and assessments in more detail at next year's meeting; and*
- (2) *establishes an Intersessional Correspondence Group under the Committee's chair (ICG-34, Annex W). to identify a way or ways to address this issue. Donovan will ensure that a subset of this group will meet on the margins of planned RMP and AWMP intersessional meetings to provide the ICG with potential solutions and ideas. The ICG will report back to the next annual meeting with the intention that the Committee will present an action plan to the next Commission meeting.*

26.5.2 Use of paper

Total paper use at Scientific Committee meetings has been significantly reduced after 2009, with a total copy count down to 20% of levels pre-2009. The quantity of required copies has levelled out over the last two years indicating that we are approaching the minimum level of printing necessary.

In the past few years, efforts were made to reduce the amount of use of non-recycled paper to a minimum by pre-ordering a stock of paper that was 50% recycled and 50% standard. However, the recycled paper caused paper jams in all supplied machines when creating large or double-sided documents, so was used for small-scale printing only. The same problem was encountered at the Red House with the switch to recycled paper in 2016, so a similar mixed-use system is in place there.

27. PUBLICATIONS

Donovan reported briefly on the status of the IWC Publications. In particular he **stressed** that for the *Journal* to be successful, members of the Committee needed to become more active in two ways: (1) volunteering to act as associate editors to take responsibility for papers from receipt to publication in co-operation with the Secretariat; and (2) volunteering to act as responsible reviewers in terms of commitment and turnaround times. The *Journal* will be contacting the Committee on how to take this further in the coming weeks. The Committee **reiterated** its support for the

Journal and **recognised** the need to take responsibility in its running. It also thanked the Secretariat staff for their hard work during the year, noting that the present Supplement was the largest ever, totalling 671pp.

Bannister reported (by correspondence) that while progress was made at a two-day editorial Workshop following the POWER Cruise Planning meeting in Tokyo, September 2016, production of final manuscripts for the Volume remains slow, with many still in review. A further editorial Workshop over three days is planned for 8-10 October 2017, in Tokyo, following the 2018 POWER Cruise Planning meeting, where it is hoped to make considerable progress towards completion of the Volume. The Committee **thanked** Bannister for his extremely hard work on the volume and **looks forward** to seeing him at the Scientific Committee next year.

28. ELECTION OF OFFICERS

There was no need for an election this year and the Committee **thanked** the chair and Vice-Chair for their excellent work.

29. ADOPTION OF REPORT

The Chair concluded the Annual Meeting by reaffirming that the IWC Scientific Committee is a highly developed machine that produces an incredible amount of excellent science and scientific advice through important intersessional work and a well-designed final consolidation system, which is its annual meeting. She noted that nothing would be possible without the dedication of each and every member. The Chair sincerely thanked the Vice-Chair, the Head of Science, all Convenors and rapporteurs, all Committee's members and the Secretariat staff for their unremitting support and hard work. She would not survive without Greg's knowledgeable and wise advice or Robert's calm and reassuring backing. She thanked the Secretariat staff for being very patient and supportive with her. She thanked the Secretary, Simon Brockington, for welcoming her into the Red House in October 2015, to start a fulfilling adventure. Given his recent resignation, she thanked Simon for his hard work and willingness to engage in a constant and open exchange of views, which was not always easy. The Chair then gave the floor to the official Master of Ceremonies, Mark Simmonds, who thanked Simon for his great contributions to the IWC, including the disappearance of paper in the Committee. Finally, the Chair of the Commission, Joji Morishita, thanked the Secretary on behalf of the Commission for his almost seven years of service and wished him the best luck for his future career.

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