Report of the Scientific Committee 2020

1. INTRODUCTORY ITEMS

The 2020 meeting of the Scientific Committee (henceforth 'Committee') was originally planned for 12-24 May 2020 in Cambridge, UK, to be preceded by a workshop and two pre-meetings. Due to the global coronavirus pandemic (COVID-19), it was announced on 24 March 2020 (IWC.ALL.372) that the in-person meeting would not take place. The Chair (Suydam) and vice-Chair (Zerbini) of the Committee then proceeded to work with the Convenors and the Secretariat to plan a series of 'virtual' meetings to advance the work of the Committee in 2020, to be held during the period 11-24 May 2020.

Convenors were tasked by the Chair to revise their sub-group agendas in order to address only the most pressing issues for 2020 through a combination of e-mail exchanges and virtual meetings. The revised agendas focused on the tasks requested by the Commission at IWC67, including the draft work plans and budgets that would need to be reviewed by the Commission.

1.1 Chair's welcome and opening remarks

In welcoming participants, the Chair explained that the 2020 Scientific Committee meeting (SC68B) was unlike any previous Committee meeting. The COVID-19 pandemic had forced cancellation of the annual in-person meeting and the Ecosystem Functioning Workshop. For the first time, the Committee needed to progress key items through virtual sessions (using Zoom) and/or email. The Committee leadership, including the Chair, vice-Chair and Convenors and the Secretariat created a new process based on careful discussion and preparation to determine the priority topics that could be addressed through a virtual meeting and revised the SC68B meeting agenda to reflect these priorities.

The typical in-person meeting schedule consists of several days of pre-meetings or workshops, followed by two morning Plenary sessions to set the stage for the two-week Committee meeting. Following the two days of initial Plenary sessions, seven days of sub-group meetings and three days of Plenary are usually held to discuss a variety of issues and agree the Committee's report. This year, the organisation of the meeting was altered to accommodate the unusual circumstances (see Table 1).

There were no Plenary sessions at SC68B. The information typically provided at the early Plenary sessions was instead provided via e-mail. Similarly, the Plenary sessions that are usually held at the end of the Committee meeting were replaced by concluding sub-committee sessions to draft report work plans and budget proposals for 2021.

One of the most important challenges for holding virtual sessions was the wide range of time zones occupied by Committee members. The time available each day for virtual sessions was restricted to just two hours (14:30 to 16:30 GMT+1), which were selected to allow all participants the chance to attend the meeting. However, this narrow window imposed hardships on some participants because of early morning or late night work schedules in their time zones. As many as three concurrent sessions during that two-hour time slot were scheduled each day, for a total of 39 possible virtual sessions. That number of sessions was substantially reduced from the about 110 sessions during a typical in-person meeting. This decrease in the amount of time available to meet in 2020 was reflected in a greatly reduced SC68B agenda.

The Committee's leadership established a plan for developing and agreeing the Committee's 2021 budget and report. The agreed report and budget represent the Committee's decisions and recommendations and are particularly important for seeking endorsement from the Commission and informing other parties about the Committee's priorities and progress. Regarding the 2020 Committee report, each sub-group was directed to summarise their discussions and recommendations in a style similar to a Chair's Summary in a normal year. No sub-group annexes were planned for 2020 although more technical or complicated issues were allowed as annexes. The full Committee was provided the opportunity to comment on all sections of the draft report with the exception of the budget. The report was updated based on those comments. The following report represents the agreed discussions and recommendations of the Committee for 2020. The budget largely followed the normal process but instead of being discussed in Plenary at the end of the meeting, it was reviewed and agreed during a virtual session with the Heads of Delegation (HoD).

Table 1

2020 Scientific Committee meeting schedule.

Date(s)	Topic
11 May	Pre-meetings ASI and E. Regular session - SD-DNA.
12-24 May	Meetings of the sub-groups and one session with Heads of Delegation.
24 May	Reports for each agenda item, including recommendations, work plan and budget were agreed by each relevant sub-group.
25 May	Meeting of the Convenors group to discuss and recommend a budget.
26 May	Meeting of the Heads of Delegation to agree the 2021 budget request and discuss other items as necessary.
25 May-~15 June	Chair, vice-Chair, Secretariat and Convenors edit and finalise the Committee's 2020 report.

IWC Executive Secretary (Lent) thanked the Committee Chair and vice-Chair as well as all the Convenors, rapporteurs, funding request assessors and participants for their efforts to advance the work of the Committee in these challenging circumstances. The IWC Secretariat supported these efforts by being present in the virtual meetings to address audio-visual (AV) and information technology (IT) needs as well as to provide technical assistance for the Convenors, rapporteurs and participants. The Executive Secretary introduced Dr Iain Staniland, the new Lead for Science, who joined the Secretariat on 9 May 2020. On this same date, Greg Donovan moved into a new part-time position as Scientist Emeritus, a one-year position that will promote a smooth transition for the Secretariat's support for the Committee, as well as an opportunity to complete legacy projects (see Item 24.3).

The list of meeting participants is given as Annex A. This year there were over 300 participants, and 33 member countries were represented.

Impact of COVID-19 on cetacean research

The COVID-19 pandemic not only affected the scope and format of the 2020 Committee meeting, it also presents a number of challenges for ongoing scientific research. Of particular concern are the obstacles that the virus creates for continuing many of the long-term monitoring programmes and research that underpin much of the Committee's work. For example, in many cases scientists are prohibited from travelling to field locations to collect data, whether for new or long-standing projects.

The global situation with COVID-19 provides unique opportunities to better understand how cetaceans respond to changes in habitat, particularly when those changes are related to human activities. For example, the pandemic has substantially reduced human presence in many areas and may have contributed to, *inter alia*, reductions in vessel traffic, ocean noise, and stress to individual animals. Assessing how cetaceans respond to these dramatic changes may provide a glimpse into how they respond to future rapid environmental transformation.

Attention: C, SC

The Committee **strongly requests** *governments and research organisations to be as flexible and proactive as possible to ensure that, where feasible and safe, vital long-term monitoring projects are able to continue in a form that protects their value to the SC and the wider research community.*

The Committee also **recognises** *that the substantial reduction in human activities in the aquatic environment in response to the COVID-19 pandemic provides unprecedented research opportunities. Therefore, the Committee* **urges** *governments and the research community to increase efforts to evaluate potential changes in cetacean behaviour and habitat use in areas where human presence has been substantially affected by the pandemic.*

1.2 Remembrances

The Committee remembered colleagues who passed away in the previous year.

(1) Sidney Holt (tribute by Justin Cooke)

Dr Sidney Holt passed away in his adopted home of Italy on 22 December 2019. His career in marine science began in 1946 at the fisheries lab in Lowestoft, UK. Among fishery scientists, he is best known for his 1957 volume, with Ray Beverton, *On the Dynamics of Exploited Fish Populations* (Beverton and Holt, 1957), which became a classic in fishery management. Following some severe bouts of sea sickness, he left Lowestoft to work on nature conservation in Scotland, but soon found the ants and midges to be even worse than the sea. By then, his reputation as a gifted fishery scientist had reached the FAO in Rome, which he joined in 1953. Sidney and his wife, Judy, soon fell in love with their new home country, Italy, where they spent most of the rest of their lives. Sidney's work on whales started in 1961, when he was appointed to the Committee of Three Scientists to assess the rapidly worsening status of Antarctic whale stocks. He continued to submit numerous papers to the IWC Scientific Committee over the next 40 years, attending most meetings of the Committee from 1962 to 2000. He was particularly interested in the development of management procedures, including the New Management Procedure (NMP) adopted in 1975 and the Revised Management Procedure (RMP) completed in 1994, and in the designation of sanctuaries, starting with the Indian Ocean Sanctuary established in 1979. Holt will be remembered by colleagues as a persistent, often challenging, debating partner, with an encyclopaedic knowledge of a wide range of topics.

(2) Ed Mitchell (tribute by Randy Reeves)

Dr Ed Mitchell died on 20 October 2019 at his home in Los Angeles County, California. As a palaeontologist, he had a special interest in the evolutionary relationships of marine mammals and most of his early research concerned fossil pinnipeds. His career changed course in the mid-1960s when he relocated to Canada to lead the government's research programme on North Atlantic large whales. Mitchell joined the IWC Scientific Committee in 1968 and remained an active and influential member of the Committee until Canada withdrew from the Commission in the early 1980s. He published numerous papers on various species including bowhead, humpback, fin, Atlantic right, gray, minke, bottlenose and killer whales. Perhaps his most important contribution to the IWC was to organise and chair the first meeting of the Committee's small cetaceans

sub-committee which was held in 1974 in Montreal, Canada. He edited the proceedings, published as a special issue of the *Journal of the Fisheries Research Board of Canada* in 1975 (Mitchell, 1975a) – a benchmark for cetacean science and conservation and in many ways a precursor to the classic *Rep. int. Whal. Commn. (RIWC)* Special Issue on gillnets and cetaceans published in 1994 (IWC, 1994a). Also noteworthy was his 1975 book *Porpoise, Dolphin and Small Whale Fisheries of the World: Status and Problems* (Mitchell, 1975b). Mitchell was a formidable, outspoken and sometimes provocative scientist and an expert on the history of whaling.

(3) Seiji Ohsumi (tribute by Hidehiro Kato and Bob Brownell)

Dr Seiji Ohsumi-san passed away on 2 November 2019. He was one of the leading members of the IWC Scientific Committee for over five decades, serving as Japan's Head of Delegation during the 1990s. Ohsumi's graduate research was one of the first studies using whale earplugs, in this case for age determination, of fin whales. He started his career at the Laboratory of Fishery Zoology of the University of Tokyo, and later moved to the Whales Research Institute and the Far Seas Research Laboratory. In addition to his further earplug studies on fin whales (Ohsumi, 1964), his early career work included studies of sei whales in Bonin waters (Nishiwaki *et al.*, 1954) and the school structure of sperm whales (Ohsumi, 1971). The 1966 Committee and Commission meetings were held in Tokyo, and Ohsumi helped to host the 22 scientists who attended that meeting – including Mitchell who was attending his first IWC meeting. Ohsumi was a prolific researcher with over 500 scientific articles and publications on cetaceans. His work was recognised with numerous awards including the Royal Norwegian Order of Merit and Special Award of the Mammal Society of Japan. The last years of Ohsumi's career were spent at the ICR (Institute of Cetacean Research) where he served as a senior advisor. Even after retirement, he continued to go the ICR office each day until his death.

(4) The Committee of Three Scientists

With the passing of Holt in this past year, all members of the 'Special Committee of Three Scientists' ('Committee of Three') have now passed on. The other two members were Doug Chapman (1920-96), who chaired the Committee, and 'Kay' Allen (Kenneth Radway Allen, 1911-2008). These scientists were active in the very tumultuous period of the IWC in the early 1960s. Members of the Committee who lived through the period can attest to the critically important contribution the Committee of Three brought to the Commission during its most contentious times. The final report of the Committee of Three was completed in 1963 and included in the Report of the 14th Meeting of the International Whaling Commission (IWC, 1963, Appendix V). With the addition of John Gulland (1926-90), the Committee became the Committee of Four, but was sometimes still referred to as the Committee of Three, and produced a further report in 1964, published in the Report of the 15th Meeting of the International Whaling Commission (IWC, 1965). The Committee's reports were instrumental in achieving recognition of the severe over-exploitation of Antarctic baleen whales at the time and helped to ensure that sufficient residual populations of species such as blue and humpback whales remained to seed their subsequent recovery. Whilst in subsequent years the views of the former members of the Committee of Three/Four began to diverge on the best approach to meeting the Convention's mandate, they continued to bring the highest-quality science and their own unique perspectives to inform discussions within IWC.

1.3 Appointment of rapporteurs

Several members of the Secretariat, led by Staniland, were appointed rapporteurs and were assisted by various members of the Committee as appropriate. Chairs of sub-committees and Working Groups appointed rapporteurs for their meetings (see Item 1.5).

1.4 Meeting procedures and time schedule

SC/68B/GEN/03 provided a guide to participants, particularly for those attending for the first time, which outlined the organisation of the Committee. The Chair and vice-Chair provided information to Committee participants about the proposed process for SC68B (SC/68B/GEN/05). A schedule of virtual sessions was established in advance of the meeting and regularly updated on the IWC's web portal. A Zoom instruction video was prepared for Committee participants and posted on the IWC's web portal in advance of the meeting.

1.5 Establishment of sub-committees and Working Groups

The table on the next page contains the various sub-committees and Working Groups of the Committee, the relevant Convenor, Co-Convenor, and rapporteur(s). The Committee is grateful for the commitment by these individuals, without which the Committee could not complete its work.

Two pre-meetings were held on 11 May:

(1) Underwater Noise – discussed by the sub-committees on Environmental Concerns (E) and Human-Induced Mortality (HIM); and
(2) Approach to Provide Advice on Status of Stocks – discussed by the Standing Working Group on Abundance Estimates, Stock Status and International Cruises (ASI).

Committee sub-groups and Convenors/rapporteurs for 2020.

Sub-committees/Working Group name	Convenor	Co-Convenor	Rapporteur
Scientific Committee Plenary	Robert Suydam	Alex Zerbini	IWC Secretariat
Ad hoc Working group on Photo-ID, PH	Paula Olson	-	No rapporteur
Standing Working Group on Abundance Estimates, Stock Status and International Cruises, ASI	Alex Zerbini	Geof Givens	Thomas Doniol-Valcroze
Ad hoc Working Group on Sanctuaries, SAN	Chris Parsons	-	No rapporteur
Sub-committee on *Implementation Reviews* and Simulation Trials, IST	Greg Donovan	John Brandon	Andre Punt Dave Weller Greg Donovan
Sub-committee on Aboriginal Subsistence Whaling, ASW	Lars Walløe	-	Dave Weller
Working Group on Stock Definition and DNA Testing, SD&DNA	Aimee Lang	Ralph Tiedemann	Frank Cipriano
Sub-Committee on In-depth Assessments, IA	Debbie Palka	Helena Herr	Justin Cooke Philip Clapman
Sub-Committee on the Other Northern Hemisphere Whale Stocks, NH	Jooke Robbins	-	Kim Goetz
Sub-Committee on the Other Southern Hemisphere Whale Stocks, SH	Jen Jackson	Elanor Bell	Elisa Seyboth Eric Archer Ana Širović
Sub-Committee on Conservation Management Plans, CMP	Bob Brownell	Jorge Urban-Rámirez	Sarah Mallette Dave Weller
Sub-Committee on Non-deliberate Human-Induced Mortality of Cetaceans, HIM	Russell Leaper	Rohan Currey	Marguerite Tarzia David Mattila Danielle Buss
Sub-Committee on Environmental Concerns, E	Patricia Holm	Danielle Cholewiak	Tilen Genov
Standing Working Group on Ecosystem Modelling, EM	Toshihide Kitakado	-	Doug Butterworth
Sub-Committee on Small Cetaceans, SM	Lindsay Porter	Fernando Trujillo	Randy Reeves Maria Clara Jimenez Frank Cipriano Peter Thomas
Sub-Committee on Whale Watching, WW	Leslie New	-	Naomi Rose

The results of these pre-meetings were included under the relevant Agenda Items.

The following sub-groups met virtually this year during the period 11-24 May 2020. Their reports have been subsumed under the relevant agenda items in the report below after review by the Committee. Sub-groups with an asterix (*) did not meet virtually but addressed agenda items and agreed their sub-group reports via e-mail.

Ad hoc Working Group on Photo-ID, PH*

Standing Working Group on Abundance Estimates, Stock Status and International Cruises, ASI

Ad hoc Working Group on Sanctuaries, SAN*

Ad hoc Working Group on Databases and Related Issues, GDR*

Sub-committee on Implementation Simulation Trials, IST

Sub-committee on Aboriginal Subsistence Whaling, ASW*

Working Group on Stock Definition and DNA Testing, SDDNA

Sub-Committee on In-depth Assessments, IA

Sub-Committee on the Other Northern Hemisphere Whale Stocks, NH

Sub-Committee on the Other Southern Hemisphere Whale Stocks, SH

Sub-Committee on Conservation Management Plans, CMP

Sub-Committee on Non-deliberate Human-Induced Mortality of Cetaceans, HIM

Sub-Committee on Environmental Concerns, E

Standing Working Group on Ecosystem Modelling, EM

Sub-Committee on Small Cetaceans, SM

Sub-Committee on Whale Watching, WW

The following intersessional Workshop reports were presented to the meeting. The reports of these Workshops are published in this volume of the *Supplement*.

Reports of intersessional meetings and their published locations in this volume.

SC/68B/REP/01	Report of the Meeting of the IWC-POWER Technical Advisory Group (TAG), January 2020, Tokyo, Japan	This volume, pp.231-258
SC/68B/REP/02	Report of the Planning Meeting for the 2020 IWC-POWER Cruise, January 2020, Tokyo, Japan	This volume, pp.259-272
SC/68B/REP/03	Report of the IWC Workshop on Marine Debris: The Way Forward, 3-5 December 2019, la Garriga, Catalonia, Spain	This volume, pp.273-310
SC/68B/REP/04rev1	South Asian River Dolphin Task Team Workshop Report, Kuala Lumpur, 19-21 July 2019, University of Nottingham, Kuala Lumpur, Malaysia	This volume, pp.311-332
SC/68B/REP/05	*Sotalia guianensis* Pre-assessment Workshop, 26-28 November 2019, São Paulo, Brazil	This volume, pp.333-378
SC/68B/REP/06	Report of the Workshop on Advancing Efforts to Address Underwater Noise from Shipping, 11 May 2020, Virtual Meeting	This volume, pp.379-386

2. ADOPTION OF AGENDA

The adopted Agenda is given as Annex B.

3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

3.1 Documents submitted

The documents submitted to the meeting are listed in Annex C. All papers were only available at the meeting in electronic format. A total of 185 primary papers and 6 intersessional meeting reports were available.

3.2 National Progress Reports on research

All member nations are urged by the Commission to provide Progress Reports to the Scientific Committee. The National Progress Reports have their origin in Article VIII paragraph 3 of the Convention and Scientific Committee Rule of Procedure E.1.

As agreed at the 2012 Annual Meeting, National Scientific Progress Reports were submitted electronically through the IWC Progress Reports Data Portal. The Secretariat noted that revisions were made to the on-line submission process in order to facilitate the submission of data, including enhanced instructions. Countries were reminded on 17 March 2020 (IWC.ALL.371) of the critical importance of providing the National Progress Reports as well as any data relevant to the work of the Commission. The Secretariat reported that it had received 17 National Progress Reports so far this year (Australia, Brazil, Croatia, Denmark, France, Germany, Italy, Japan, Korea Rep. of, Mexico, Netherlands, New Zealand, Panama, South Africa, Spain, UK and USA), which is an increase from the 13 received in 2019. The Secretariat is investigating ways of making the data entry easier, including the possibility of bulk upload, and welcomes any feedback from countries who submitted data this year.

3.3 Data collection, storage and manipulation

3.3.1 Catch data and other statistical material

Table 2 lists data received by the Secretariat since the 2019 meeting. Details of large whale catches from the 2019 season are listed in document SC/68B/O/08. There were no catches in Icelandic waters in 2019.

Allison reported that she had been in contact with people working on conservation in Indonesia who have supplied unofficial information about catches of sperm whales and small cetaceans. This information is being added to the summary catch database.

3.3.2 Progress of data coding projects and computing tasks

Allison reported that the new version of the catch database had been delayed but is now almost ready and will be released in mid-2020. The previous version of the database is available on request. The abundance master tables have been fully checked and now include all abundance estimates agreed by the Committee over the past five years. The IWC website has been updated with summaries of these revised master tables. Additional estimates have been added from earlier years, although their status needs to be confirmed.

Programming work has concentrated on fully specifying details of the North Pacific common minke whale trials and updating the corresponding control program and data files. In addition, in collaboration with Punt, the North Atlantic common minke whale control program has been updated to incorporate both Greenland *SLA*s and to output the details required to classify population status.

Table 2

List of data and programs received by the IWC Secretariat since the 2019 meeting.

Date received	From	IWC reference	Details
Catch data from the 2019 season			
06/04/2020	Japan: S. Suzuki	E139 Cat2019	Individual data for Japan's catch in 2019 in the North Pacific (NEWREP-NP and commercial).
19/04/2020	USA: R. Suydam	E139 Cat2019	Individual records from USA Alaska aboriginal bowhead hunt 2019.
26/05/2020	USA: R. Suydam and Alaska Beluga Whale Committee	E139	Summary of white whale catches in Alaska, 2010-19.
22/04/2020	Norway: N. Øien	E139 Cat2019	Individual minke records from the Norwegian 2019 commercial catch. Access restricted (specified 14/11/00).
08/05/2020	Russia: D. Litovka	E139 Cat2019	Individual data from Russia aboriginal hunt of gray and bowhead whales, 2019.
04/05/2019	Canada: M. Sweeting-Woods	E139 Cat2019	Details of the Canadian bowhead harvest for the 2015-19 seasons and some information on the 2020 quota.
Catch data from earlier seasons			
18/04/2020	N. Setiasih	E139	An unofficial summary of sperm whale catches in Indonesia 2003-13.
18/04/2020	P.L. Mustika	E139	Unofficial information on catches in Indonesia including a summary of sperm whale catches 1959-2004 and small cetacean catches 1996-2004.
Sightings data			
17/03/2020	Japan: K. Matsuoka	E138	2019 POWER sightings cruise data (including videos and copies of sheets).
14/05/2020	Japan: K. Matsuoka	E140	Data from the 2019 Japanese dedicated sighting surveys including JASS-A (weather, effort, sighting and distance and angle experiment records).

4. COOPERATION WITH OTHER ORGANISATIONS

4.1 Secretariat update on engagement with other organisations

The Secretariat prepared document SC/68B/O/12 which provides detailed information on the Secretariat's activities in collaboration with other organisations. A brief overview based on that document is provided as Items 4.2-4.10 below.

4.2 African States Bordering the Atlantic Ocean (ATLAFCO/COMHAFAT)

The Secretariat has been collaborating with the Executive Secretary of ATLAFCO/COMHAFAT on matters relating to active outreach on the review process for the Working Group on Operational Effectiveness (WG-OE). A planned outreach event to cover WG-OE as well as general information for IWC members from Africa was cancelled due to the pandemic. However, the Secretariat provided written documentation (in English and French) encouraging ATLAFCO/COMHAFAT members to increase their engagement with the IWC, including providing data, National Progress Reports, participation in meetings and taking on leadership roles in the IWC.

4.3 Arctic Council

No report was received under this Item.

4.4 Convention on Biological Diversity (CBD)

As a member of the Liaison Group of Biodiversity-related Conventions (BLG), the IWC has been engaged in the development of the post 2020 framework for biodiversity and associated targets and indicators[1]. Several IWC Circulars (IWC.CCG.1353, IWC.CCG.1361 and IWC.CCG.1338) have highlighted this activity and the opportunities for the IWC to be engaged either through the Secretariat or through national efforts. The IWC Chair and Secretariat participated in a number of events related to the post-2020 process. The Commission was represented by the Committee vice-Chair (Zerbini) at a marine-themed meeting in November 2019 at CBD headquarters in Montreal, Canada. Engagement through the Secretariat, IWC and Committee leadership, as well as through member governments, helps ensure that elements for the future framework take into account the relevant science and stewardship mandate of the Commission.

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

A University of Cambridge graduate student has prepared a thesis focused on scientific collaboration between the IWC and CCAMLR. The recommendations from this research have been used to develop a joint work plan with input from scientists at the British Antarctic Survey. This work plan includes: improved communication, possibly through the development of a Memorandum of Understanding (MoU); formalising the process for designating observers for other intergovernmental organisations (IGOs); and arranging side events at the respective scientific meetings. A paper addressing this work plan will be submitted to the IWC meeting in 2021.

[1] *https://www.cbd.int/sp/default.shtml.*

4.6 Convention on the Conservation of Migratory Species (CMS)

The Secretariat has continued ongoing co-operation with the CMS and its daughter agreements, ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas) and ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area) on a wide range of common challenges, including bycatch, strandings, CMPs, ship strikes, ecosystem functioning and whale watching. The CMS was engaged in the preparations for the pre-SC68B Workshop on Ecosystem Functioning (now postponed until after SC68B). IWC Executive Secretary (Lent) participated in the CMS COP13 in Gandhinagar, India, 17-22 February 2020. The CMS COP13 addressed a number of issues relevant to the IWC's Scientific and Conservation Committee work, including bycatch, whale watching, important marine mammal areas, marine noise, and aquatic wild meat. Outcomes and decisions at this CMS COP13 can be found on the CMS website[2].

In June 2019 the IWC Strandings Coordinator attended the joint ACCOBAMS and ASCOBANS Workshop on harmonisation of the best practices for necropsy of cetaceans and for the development of diagnostic frameworks. The IWC Bycatch Coordinator is a member of the joint ASCOBANS/ACCOBAMS working group on bycatch. The joint working group is planning to hold its first face to face meeting in October 2020, although this may be delayed.

The Scientific Committee of ACCOBAMS met 26-28 February 2020 in Cap d'Ail, France. Their papers and reports can be found on the ACCOBAMS website[3]. There are considerable synergies with the work of the IWC Scientific Committee and this excellent collaboration with ACCOBAMS was welcomed and encouraged, in particular on the issue of abundance estimation, ship strikes, bycatch, whale watching and the completion of the whale watching handbook developed in conjunction with CMS, the harmonisation of best practices for cetacean necropsy and tissue sampling and marine debris. The IWC is also collaborating with ACCOBAMS on a joint CMP for Mediterranean fin whales.

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

The Secretariat continues to engage with CITES on several issues including the development of a procedure for transboundary transport of diagnostic specimens for cetacean disease investigations in emergency situations. Two related Resolutions exist on: (1) a simplified procedure (SP) for shipping of samples in cases of emergency; and (2) scientific exchange exemptions (SEE). Both the SP and the SEE are available for national CITES management authorities but are so far underutilised procedures. The CITES secretariat is currently drafting guidance which will be presented to the Standing Committee of CITES in October.

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

The IWC continues to strengthen collaboration with the regional and global bodies that address fishery management and in particular, the challenge of cetacean bycatch. The IWC's Bycatch Coordinator participated in an expert Workshop to develop draft FAO Technical Guidelines for reducing bycatch of marine mammals in fisheries (September 2019). Opportunities for further collaboration with the FAO are currently being explored on outreach, capacity building and technical input associated with the Technical Guidelines. IWC representation is planned for the next meetings of the FAO and the Regional Secretariat's Network (dates to be confirmed). The Secretariat plans to intervene in support of the work planned under the new Responsible Fishing Operations Umbrella Programme and on the Technical Guidelines and their implementation, and to promote IWC/FAO collaboration. The draft guidelines can be found on the FAO website[4] and the final version (release date to be confirmed) will serve as an important reference for national and regional fishery management organisations. The IWC has also engaged with staff in the FAO and Regional Fisheries Management Organisations (RFMO) Secretariats involved in the Common Oceans ABNJ Project, in relation to possible IWC involvement in a Phase 2 project relating to improving sustainability of global tuna fisheries.

4.9 Regional fisheries management organisations (RFMOs)

The Secretariat commissioned a review by a US NOAA Knauss Sea Grant Fellow on the activities and management actions of different RFMOs to assist the Bycatch Mitigation Initiative in prioritising which organisations to engage with. Paper SC/68B/HIM/05 was presented at SC68B for consideration and provides important background information and relevant recommendations for the IWC in raising awareness of cetacean bycatch in RFMOs.

The Executive Secretary joined the Bycatch Coordinator at the 1st Joint Tuna RFMO Bycatch Working Group meeting, in December 2019. While the event was focused on bycatch of elasmobranchs in tuna fisheries, the Secretariat organised an IWC side event, in collaboration with other partners, as an opportunity for an overview of the Bycatch Mitigation Initiative and noted IWC's interest in collaborative work to ensure sustainable fisheries.

Indian Ocean Tuna Commission (IOTC) - The Bycatch Coordinator participated remotely in the IOTC Working Party on Ecosystems and Bycatch (WPEB) to present the Report of the IWC Workshop on Bycatch Mitigation Opportunities in the Western Indian Ocean and Arabian Sea. The IOTC WPEB noted that bycatch associated with set and drifting gillnet fishing

[2] *https://www.cms.int/sites/default/files/document/cms_cop13_doc.6.2_rev.1_annotated-agenda_e_0.pdf.*

[3] *https://accobams.org/meetings/thirteenth-meeting-of-the-scientific-committee.*

[4] *http://www.fao.org/3/ca7620en/ca7620en.pdf.*

gear comprises one of the greatest threats to cetaceans in the Western Indian Ocean. It also noted that the IWC Workshop represented the beginning of a process to work collaboratively to better understand and address bycatch of cetaceans in the Western Indian Ocean. The WPEB encouraged active collaboration and data sharing between the IWC, IOTC and other stakeholders to achieve this goal.

International Commission for the Conservation of Atlantic Tunas (ICCAT) - The Bycatch Coordinator has been engaging with ICCAT's Bycatch Coordinator to discuss possible synergies and collaboration.

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

The Secretariat is working with counterparts in SPAW to explore a possible MoU to facilitate collaboration in areas of common interest in cetacean science and stewardship, particularly in small-scale coastal fisheries. A draft MoU will be shared with the IWC Bureau at their 25 May 2020 meeting to obtain guidance on whether this MoU, or a modification thereof, should be presented to the Commission at IWC/68.

Committee members' update on engagement with other organisations

The Secretariat prepared a document (SC/68B/O/07Rev1) which provides the reports of observers representing the Committee at various meetings of other IGOs. Committee observers are named in brackets following each IGO name.

4.11 International Union for the Conservation of Nature (IUCN) (Cooke)

There is a long-standing collaboration between IUCN and the IWC on matters of mutual interest. In recent years these have focussed on the Western Gray Whale Advisory Committee (WGWAP) and the newly formed IUCN Marine Mammal Protected Areas Task Force (MMPATF). The WGWAP progress report to the Scientific Committee is given as SC/68B/CMP/06. The most recent meeting was that of the Noise Task Force, held as a virtual meeting from 7-9 April 2020, focussing on key agenda items related to advice regarding seismic surveys and other noise-related issues off Sakhalin Island, Russian Federation. The report will be available on the WGWAP website[5] in June 2020.

The main objective of the MMPATF is to facilitate mechanisms by which the marine mammal protected areas 'community of practice' can collaborate, share information and experience, access and disseminate knowledge and develop tools for establishing, monitoring, and managing MMPAs to promote effective spatial solutions and best practices for marine mammal conservation. The IWC has provided input to this process and is working with the Task Force to find new ways to identify Important Marine Mammal Areas (IMMAs) on the high seas, through the use of historical, remote and proxy data. The WWF, with input from IWC and the MMPATF, have expanded the analyses of shipping and IMMAs to all currently identified IMMAs and are presenting preliminary results at SC68B (SC/68B/HIM/03).

The IUCN Marine Mammal Protected Areas Task Force held its 4th regional Workshop in Salalah, Oman, in March 2019 to select candidate Important Marine Mammal Areas (IMMAs) for the Western Indian Ocean and Arabian Seas. The 55 candidate IMMAs proposed by the Workshop are currently undergoing independent review. More details are given under Item 20.2.1.

A Joint IWC-IUCN-ACCOBAMS Workshop was held in Messinia, Greece in April 2019 to evaluate how the data and process used to identify IMMAs can assist the IWC to identify areas of high risk for ship strikes. More information is given in SC/68A/HIM/07.

The IUCN Red List web site (*redlist.org*) has been redesigned and restructured. Since the last Committee meeting, new or updated Red List assessments have been published for a further 40 cetacean taxa, in addition to the 29 cetacean taxa that were assessed in the 2017/18 intersessional period. Reassessments for *Kogia* spp., Indo-Pacific bottlenose dolphin, harbor porpoise, Atlantic white-sided dolphin and Longman's beaked whale are nearing completion. Remaining high priorities for re-assessment include Hector's dolphin, tucuxi, sperm whales and the Arabian Sea subpopulation of humpback whales.

IUCN continues to convene the Western Gray Whale Advisory Panel (WGWAP), which provides advice to Sakhalin Energy Investment Company (SEIC) and other parties, especially on the mitigation of industrial and other impacts on the gray whales that feed each summer off Sakhalin Island, Russia. A new Cumulative Effects Task Force had its first meeting in April 2019.

News items on activities by members of the IUCN Species Survival Commission (SSC) Cetacean Specialist Group (CSG) are posted on the CSG website, *iucn-csg.org*. In particular, there are regular updates of the vaquita situation: the species still survives but hopes for averting its extinction are fading fast.

4.12 Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) (Simmonds)

Several ASCOBANS events took place in 2019 including a joint meeting with ACCOBAMS focused on harmonisation of cetacean necropsy protocols and diagnostic frameworks. In addition, there was the inaugural meeting of the Common Dolphin Group addressing coordination of the Species Action Plan, the 8th meeting of the North Sea Group focused on

[5]*https://www.iucn.org/western-gray-whale-advisory-panel.*

harbour porpoises, and the 25th meeting of the Advisory Committee, which touched on cetacean watching, pollution, ship strikes and climate change, among other topics. A full report is available on the ASCOBANS website[6].

4.13 International Council for the Exploration of the Sea (ICES) (Haug)

The ICES Working Group on Marine Mammal Ecology (WGMME) met at the Institute for Terrestrial and Aquatic Wildlife Research, University of Veterinary Medicine Hannover, Foundation, in Büsum, Germany, 11-14 February 2019. Topics featured included new information on seal and cetacean population abundance and stock structure, management frameworks and anthropogenic threats. The ecological roles of marine mammals were also reviewed, which underscored the complexity and multitude of ecological interactions. Bycatch was also a topic including the challenge of obtaining data from various sources, and the importance of using appropriate bycatch figures for management.

The ICES Working Group on Bycatch of Protected Species (WGBYC) met in Faro, Portugal, 5-8 March 2019. There was extensive discussion of data collection on bycatch and appropriate methods for estimating total bycatch. In addition, compliance with pinger requirements was reviewed with the finding that only one member country is in full compliance.

The 2019 ICES Annual Science Conference (ASC) was held in Gothenburg, Sweden, 9-12 September 2019. The conference included sessions in which marine mammals were included as an integral part. More information is available on the ICES website[7].

4.14 International Maritime Organisation (IMO) (Leaper)

The Secretariat and members of the Committee have continued to work with IMO particularly on underwater noise and ship strikes. Leaper and a member of the Secretariat attended an IMO policy workshop addressing the means for quieting ships, in support of the development of a proposal on underwater noise. Regarding ship strikes, there were no routing proposals specifically related to cetaceans at the meeting of the IMO sub-committee that addresses these issues. The IMO Secretariat also joined Leaper (the Convenor of the IWC's Scientific Committee's HIM sub-committee) in a meeting in London with a high-level representative from Sri Lanka, for discussion of the challenge of blue whale ship strikes in high-risk areas identified by the work of IWC.

4.15 North Atlantic Marine Mammal Commission (NAMMCO) (Haug)

The 26th anniversary meeting of the NAMMCO Scientific Committee (SC) was held 29 October-1 November 2019 in Torshavn, Faroe Islands. A discussion on procedures for generating management advice concluded that both a management procedure approach (e.g. RMP, AWMP and *SLA*s) or stock assessment calculations (HITTER FITTER methods and Bayesian assessment) can be used for all species under NAMMCO's purview. However, stock assessment models appear to have some advantage over the management procedure approach as they can be tailored to stocks and species with less use of time and resources. Therefore, the NAMMCO SC recommends the continued use of stock assessment approaches using population dynamics models as appropriate for generating advice on sustainable harvest levels. The next meeting of the NAMMCO Bycatch Working Group will be in spring 2021.

4.16 North Pacific Marine Science Organisation (PICES) (Tamura)

The PICES 2019 meeting was held in Victoria, BC, Canada, 16-27 October 2019. A future five-year project will focus on interactions between marine birds and mammals (MBMs) and other ecosystem components and stressors, touching on forecasting changes in forage species and the response of top predators. The study will also review marine birds and mammals as ecological indicators and predictors of changing marine ecosystems.

5. GENERAL ASSESSMENT AND MODELLING ISSUES (IST)

Several assessment topics apply to the work of the Committee as whole. This item focuses on general assessment issues, including: (1) the relationship between $MSYR_{mat}$ and $MSYR_{1+}$; (2) implications of RMP and AWMP simulation trials for consideration of 'status'; and (3) 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 $MSYR_{mat}$

There were no papers submitted on this topic this year. It was agreed that next year the topic would be included under the work on Ecosystem Modelling. Should issues relevant to simulation testing under RMP/AWMP arise out of those discussions they would be considered by the sub-committee on *Implementation Simulation Trials* at the relevant meeting.

5.2 Implications of ISTs for consideration of species' and populations' status

This matter is dealt with under Item 11.4.

[6] *https://www.ascobans.org/en/meeting/ac25.*

[7] *http://www.ices.dk/news-and-events/asc/asc2019/Pages/default.aspx.*

Table 3

Work plan for general assessment and modelling issues.

Topic	2020 Annual Meeting (SC68B)	2021 Annual Meeting (SC68C)
Work to evaluate the energetics-based model and hence the relationship between $MSYR_{1+}$ and $MSYR_{mat}$	No papers presented this year	Will be considered in EM
Use of ISTs for consideration of status: Modify control programs to report the three measures of status.	Completed - see ASI discussion under Item 11.4	Will be considered under ASI

5.3 Progress on previous recommendations and on the work plan

Table 3 summarises progress with previous recommendations and the work plan for 2021. No new issues were raised for consideration next year, but the situation will be reviewed intersessionally.

6. AWMP *IMPLEMENTATION*-RELATED MATTERS (IST)

6.1 Common minke whales off Greenland

Last year, the Committee received a paper that tested the *Strike Limit Algorithm* (*SLA)* agreed for common minke whales off West Greenland for trials relevant to the East Greenland hunt (SC/68A/IST/04). Based upon this work, the Committee agreed that the *WG common minke SLA* tested for East Greenland minke whales performed satisfactorily in terms of the Commission's conservation and need objectives for the *Evaluation Trials* and therefore that this '*G-Common minke SLA*' is appropriate to provide management advice to the Commission on both the West and East Greenland common minke whale hunts, subject to final consideration of the results of the *Robustness Trials* at this year's meeting. To enable this, the Committee agreed that a single simulation testing framework for the North Atlantic common minke whales should be developed and a synthesis paper be provided that includes results for all *Evaluation Trials* (i.e. trials used to choose an *SLA* and evaluate its performance) and *Robustness Trials* as well as the evaluation of carryover and interim allowance for the East and West Greenland common minke whales.

6.1.1 Synthesis paper on testing framework and results for the 'G-common minke SLA' for common minke whales off west and east Greenland

SC/68B/IST/06 provided the final trial specifications for the North Atlantic common minke whales tailored to evaluate *Strike Limit Algorithms* (*SLA*s) for aboriginal subsistence whaling hunts off West and East Greenland. These were implemented and used to test the *G-Common minke SLA* based on the agreed *Evaluation* and *Robustness Trials*. Previous evaluations of carryover provisions and the interim allowance approach (IWC, 2019d) were extended to make use of the new trials and to account for both hunts.

The technical descriptions can be found in SC/68B/IST/06. The final set of trials is provided as Table 4 and conditioning was performed satisfactorily (selected diagnostic statistics are available in the paper and the full set from the Secretariat). The code for the '*G-Common minke SLA*' has been lodged with the Secretariat and the Secretariat has checked that the code gives the same results as the executable version used previous for testing purposes.

Although all trials were run and the results are available from the Secretariat, attention was on the most informative performance statistics related to conservation performance (D) and need satisfaction (N):

(a) D1: Final depletion (population size at the end of the 100-years; 1+ population component);
(b) D10: Relative increase (population size at the end of the 100-years relative to that at the start of the projection period; 1+ population component);
(c) N9: Average need satisfaction over 20 years (N9-20);
(d) N9: Average need satisfaction over 100 years (N9-100); and
(e) N12: Mean down step.

The focus in the paper was on the most challenging trials where $MSYR_{1+}$=1% (all trials with $MSYR_{mat}$=4% performed adequately). The authors noted that the results for the Evaluation Trials matched those previously reviewed and agreed by the Committee to perform adequately to meet the Commission's conservation and need objectives[8]. They also noted that performance was adequate for the *Robustness Trials* (i.e. trials used to ensure that an SLA behaves predictably in more extreme trials).

[8]In only one *Evaluation Trial* (M04-1, a trial with MSYR1+=1% and the 'A3' mixing hypothesis) was median D1 less than 0.6 (0.592) and median D10 less than 1.0 (0.890) (SC/68B/IST/06, table 5). For 1% *Evaluation Trials* M01-1 and M11-1, with stock hypothesis 1 (five stocks, including W-1 and W-2 stocks), the lower 5th percentile of the D1 statistic was less than 0.6 (0.574 and 0.576) and the lower 5% percentile of the D10 statistic was less than 1.0 (0.857 and 0.851).

Table 4

The final set of trials (for a full explanation see the Trials specifications, Annex D).

Trial	*MSYR*	Stock hypothesis	Mixing proportions	Mixing	Survey bias	Survey period	Survey CV	Condition
Evaluation Trials								
M01	1% (1+) and 4 % (mat)	1	A1	Independent	1	10	Base	Yes
M02	1% (1+) and 4 % (mat)	2	B1	Independent	1	10	Base	Yes
M04	1% (1+) and 4 % (mat)	1	A3	Independent	1	10	Base	Yes
M06	1% (1+) and 4 % (mat)	1	A5	Independent	1	10	Base	Yes
M08	1% (1+) and 4 % (mat)	2	B2	Independent	1	10	Base	Yes
M09	1% (1+) and 4 % (mat)	2	B3	Independent	1	10	Base	Yes
M11	1% (1+) and 4 % (mat)	1	A1	Density-dependent	1	10	Base	Yes
M12	1% (1+) and 4 % (mat)	2	B1	Density-dependent	1	10	Base	Yes
Robustness Trials								
M03	1% (1+) and 4 % (mat)	1	A2	Independent	1	10	Base	Yes
M05	1% (1+) and 4 % (mat)	1	A4	Independent	1	10	Base	Yes
M07	1% (1+) and 4 % (mat)	1	A6	Independent	1	10	Base	Yes
M21	1% (1+) and 4 % (mat)	1	A1	Independent	0.8	10	Base	Yes
M22	1% (1+) and 4 % (mat)	2	B1	Independent	0.8	10	Base	Yes
M23	1% (1+) and 4 % (mat)	1	A1	Independent	1.2	10	Base	Yes
M24	1% (1+) and 4 % (mat)	2	B1	Independent	1.2	10	Base	Yes
M25	1% (1+) and 4 % (mat)	1	A1	Independent	1	15	Base	
M26	1% (1+) and 4 % (mat)	2	B1	Independent	1	15	Base	
M27	1% (1+) and 4 % (mat)	1	A1	Independent	1	10	Base + 0.05	
M28	1% (1+) and 4 % (mat)	2	B1	Independent	1	10	Base + 0.05	
M29	1% (1+) and 4 % (mat)	1	A1	Independent	1	10	Base - 0.05	
M30	1% (1+) and 4 % (mat)	2	B1	Independent	1	10	Base - 0.05	
M31	4% (1+)	1	A1	Independent	1	10	Base	Yes
M32	4% (1+)	2	B1	Independent	1	10	Base	Yes

Carryover

SC/68B/IST/06 also examined the request from the US Acting Commissioner and the Danish Commissioner to examine a period of accumulation (three blocks), a time until expiration (greater than three blocks), and a limit on usage (total strikes not exceeding 150% of the annual strike limit). An approach to examine this for bowhead whales from the Bering-Chukchi-Beaufort Seas, and bowhead and humpback whales off West Greenland has been developed and agreed (IWC, 2019d). The same approach was used and detailed in SC/68B/IST/06 for the Greenland common minke whale hunts.

None of the lower 5th percentiles for final depletion (D1) for the carryover scenarios exceed those for the scenario with no carryover and the authors note that this confirms previous conclusions by the Committee that carryover provisions are unlikely to lead to poorer conservation performance.

Interim Allowance

Finally, SC/68B/IST/06 also examined the agreed interim allowance approach for the Greenland hunts, i.e. a provision that strike limits are reduced by 50% during a grace period if a recent abundance estimate has not been available for 10 years (IWC, 2019e). Once again, the paper used the same approach used to evaluate the interim allowance approach for Bering-Chukchi-Beaufort Seas bowhead whales. There is no conservation impact of adopting an interim allowance approach if the survey interval is 10 years. The conservation performance statistics for a 15-year survey interval are lower for the interim allowance approach but only for trial M04-1, the D1 statistic is lower than for the 10-year survey period. In contrast to the 10- and 15-year survey periods, a 20-year survey period leads to several instances in which conservation performance statistics are poorer than was the case for a 10-year survey interval.

The paper had been circulated with a request for comments by early May. In response to a question concerning the D10 and N9 statistics for some trials, it was clarified that the results were consistent with those already approved by the Committee. The only other comments received were in accord with the conclusions of the paper (and last year's meeting) with respect to the acceptable performance of the *G-common minke SLA*, the carryover provisions and the Interim Allowance Approach.

In discussion, it was noted the selection of *SLA*s for the West and East Greenland hunts was based on *Evaluation Trials* (see Table 4). In addition, the sub-committee noted that there would be value in examining why need satisfaction was worse for trials M11 and M12 than for the remaining *Evaluation Trials*, and that the results for the interim allocation approach calculations re-emphasised the value of the provision to conduct an early *Implementation Review* if survey estimates of abundance are not available at the anticipated frequency.

6.1.2 Conclusions

The Committee **thanks** Punt, Allison and Witting for their work. The full trial specifications are given as Annex D.

Attention: C, ASW, SC

In response to a recommendation last year, the Committee received a synthesis paper (SC/68B/IST/06) that includes results for all Evaluation and Robustness Trials as well as the evaluation of carryover and interim allowance for the East and West Greenland common minke whale hunts. The Committee **advises** *the Commission that the results confirm that:*

(1) *the 'G-Common minke SLA' is appropriate to provide management advice to the Commission on both the West and East Greenland common minke whale hunts; and*
(2) *the carryover provisions and interim allowance approach have been satisfactorily tested and thus that the AWS provisions should be updated accordingly for the Greenland hunts for common minke whales.*

6.2 *Implementation Review* for North Pacific gray whales (Chukotka and Makah hunts)

The purpose of an *Implementation Review* (IWC, 2019c) is to:

(1) review the available information to see if the present situation is as expected (i.e. within the space tested during the development of an *SLA*) and determine whether new simulation trials are required to ensure that the *SLA* still meets the Commission's objectives; and
(2) 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).

6.2.1 New information

Stock structure

The Committee first considered the available information on stock structure reviewed fully under Item 10.1.3.1, highlighting the recommendation there that the plausibility of some of the stock structure hypotheses should be revised and some of the definitions clarified as part of the rangewide review and assessment. Nevertheless, in the context of the *Implementation Review*, the Committee **agrees** that these changes will not alter its existing advice with respect to the suitability of the either the *Gray Whale SLA* or the Makah Management Plan for the provision of advice on the Chukotkan and proposed Makah hunts.

Abundance Estimates

The Committee received updated abundance estimates of gray whales (SC/68B/ASI/01) for the small Pacific Coast Feeding Group (PCFG). The paper was presented and discussed under Item 11.1.1 where it was agreed that it was suitable for the provision of management advice. The Committee welcomed the updated time series (1996-2017 with the most recent point estimate of 232, SE 25.2) provided in Table 13. It **agrees** that the updated time series will not alter its existing advice with respect to the suitability of the either the *Gray Whale SLA* or the Makah Management Plan for the provision of advice on the Chukotkan and proposed Makah hunts.

The Committee welcomed information that NOAA/SWFSC (Southwest Fisheries Science Center) had: (a) completed an eastern North Pacific gray whale abundance survey in 2019/2020 and is working on the related estimate; and (b) that a repeat survey will be conducted in 2020/21. It **reiterated** its appreciation for this invaluable time series of abundance data.

Removals

The most recent catch data from the Chukotkan hunt are discussed under Item 8.1.3.

The Committee also received updated estimates of bycatch and ship strike data (SC/68B/IST/08) that include new records of non-hunting, human-caused injuries and mortalities (NHHCIM) of gray whales from 2016, 2017, and 2018. The average annual number of mortalities and injuries prorated as mortalities for 2016-18 was 13.2, a large increase from the annual average of 8.3 for the period 1982-2015. The authors found that NHHCIM was variable by year, with 2018 being one of the years with the highest recorded NHHCIM from 1924 through 2018. Strong correlation (R=0.62) was found between ENP gray whale abundance and observed NHHCIM in an analysis of data from 1974 through 2015. It is possible that the increased number of observations per year was driven, at least in part, by high abundance of gray whales during those years.

The Committee thanked the authors for this thorough update and review. In noting that the numbers in the paper represented 'raw' counts (and thus underestimated true removals), it was recalled that in the assessment the uncertainty was captured by scenarios that multiplied numbers by 4 times and 20 times. There was some discussion of the higher than expected number of bycaught animals in 2012 that might have been a result of fishing effort for Dungeness crab. The Committee encouraged the authors in their efforts to model gray whale incidental mortality with abundance, fishing effort

and other potential explanatory variables and to present them to future meetings. It **agrees** that the updated time series of incidental mortality will not alter its existing advice with respect to the suitability of the either the *Gray Whale SLA* or the Makah Management Plan for the provision of advice on the Chukotkan and proposed Makah hunts.

Other Information

The Committee received SC/68B/IST/07 that presented the results of a new Bayesian approach for estimating gray whale calf production using long-term data (1994-2019) on mother-calf pairs collected by land-based observers surveying the northbound migration from Piedras Blancas Light Station, in central California. The new approach formally accounts for the uncertainty associated with unsampled periods, and the differences in weekly passage rates of whales throughout the migration. This new approach resulted in slightly higher estimates of calf production across all years compared with the previous approach.

The Committee welcomed this new Bayesian approach and highlighted the great value of this important long-term monitoring effort by NOAA/SWFSC. It **agrees** that efforts should be made to examine ways to directly incorporate these data into future assessment modelling exercises.

The Committee received results of a long-term study on the body condition of Pacific Coast Feeding Group (PCFG) gray whales (SC/68B/IST/03). The discussion of this paper can be found under Item 8.1.3. The authors noted that: (a) predictions for annual body condition were greatly improved by incorporating the Pacific Decadal Oscillation (lagged two years) and September kelp canopy cover along the Washington coast (lagged one year) in the analysis; and (b) the body condition of whales feeding off Sakhalin Island improved faster than was observed for PCFG whales, which returned to a more predictably 'good' body condition by the end of a feeding season.

In SC/68B/IST/02, the Committee received information on carcass sightings (n=60, 2009-19) and probable cause of death for gray whales detected during line-transect aerial surveys in the eastern Chukchi Sea during July-October. Images were obtained for 56 (93%) of the carcasses recorded and 73% had injuries consistent with killer whale predation (cause of death could not be determined for the remaining cases). Further discussion of this paper can be found under Item 8.1.3. The Committee was disappointed to learn that this long-term series of aerial surveys would not be continuing.

Finally, the Committee noted the information presented on an unusual mortality event of gray whales (n=215) along the Mexico/US/Canada coast in 2019 (SC/68B/IST/05) that is discussed under Item 9.1.3. The situation continues to be monitored in 2020.

6.2.2 Conclusions

The Committee **thanks** the authors of the papers presented this year for providing information relevant to the *Implementation Review*.

Attention: C, ASW, SC

The Committee **agrees** *that data on calf production and health (including the long-term aerial survey monitoring of carcases) provided a valuable addition to the 'traditional' information on stock structure, abundance and removals as part of the gray whale Implementation Review this year and* **encourages** *the continued collection of such information for provision to future Implementation Reviews.*

After reviewing this information, the Committee **advises** *the Commission that it has completed its Implementation Review for North Pacific gray whales and* **recommends** *that the Gray Whale SLA and the Makah Management Plan remain the appropriate basis for the provision of advice on the Chukotkan and proposed Makah hunts.*

The Committee also **recommends** *that the Workshop and modelling exercise to finalise the update of the rangewide assessment and scientific aspects of the gray whale CMP be supported.*

6.3 Carryover and interim allowance for Eastern North Pacific gray whales

6.3.1 Results of intersessional work

Gray whales are subject to a hunt off Chukotka (Russia) and a potential hunt by the Makah Tribe off Washington State (USA). An *SLA* for the Chukotka hunt was adopted in 2004 (the *Gray Whale SLA*; IWC, 2005). The USA proposed the Makah Management Plan that was evaluated using a management strategy evaluation that accounted for multiple management units because there is a possibility that the Makah hunt will take animals from the PCFG (Pacific Coast Feeding Group) and/or the WFG (Western Feeding Group). The Committee concluded (IWC, 2019e) that the Makah Management Plan was adequate noting that this is dependent on photo-identification studies continuing into the future.

Last year, the Committee agreed that the carryover and interim allowance approach should be evaluated for the *Gray Whale SLA*. The Makah Management Plan does not include the concept of carryover nor that of interim allowance. Thus, these concepts only apply to the hunt off Chukotka. However, the strike limit for the Chukotka hunt encompasses strikes throughout the eastern North Pacific, including any strikes off Washington State by the Makah Tribe. An approach of implementing a minimum annual strike limit for a Makah hunt (3 whales) for the purposes of the simulations to evaluate

carryover and the interim allowance approach for Chukotka was endorsed by the Committee during its 2019 meeting (IWC, 2020b). Given the strike limit envelope for eastern North Pacific gray whales starts at 140 and increases thereafter, the impact of this assumption on conservation performance statistics will be minimal.

The Committee noted that the Makah Tribe's need statement is for 4 whales and that this analysis was completed for the currently proposed plan.

SC/68B/IST/01 examined the carryover and Interim Allowance Approach following the approaches developed for other stocks (e.g. Bering-Chukchi-Beaufort Seas bowhead whales and humpback whales off West Greenland) Five carryover options chosen to encompass any likely actual carryover situations were evaluated using the base-case trials, and all satisfied the Commission's conservation objectives. Simulations for the 'original' phase out rule (a reduction in catch limit of 50% after 10 years without a survey estimate of abundance) and the 'interim allowance' approach (the 50% reduction does not apply) suggest that 'interim allowance' can lead to better need satisfaction than 'original' with no increase in risk to the stocks of gray whales in the North Pacific. Thus, 'interim allowance' satisfies the Commission's conservation objectives for the North Pacific gray whales. The author commented that the Committee may wish to view the performance statistics for the carryover options and 'interim allowance' for some of the sensitivity tests.

The paper had been circulated with a request for comments by early May and the comments received were in support of the conclusions of the paper. Scordino clarified that while the three whales satisfies the hunt management plan that NOAA currently has proposed for the Makah hunt, it does not cover the Makah Tribe request for four whales per year with a maximum of five in any given year. He thus noted that NOAA's proposed management plan should not be seen as the need of the Tribe. The plan is likely to have a lifetime of 10 years after which it will be re-evaluated.

6.3.2 Conclusions

The Committee **thanks** Punt for his work in response to the Committee's recommendation last year.

Attention: C, ASW, SC
In response to the recommendation last year, the Committee received the results of an evaluation of carryover and interim allowance for the Chukotka gray whale hunt (SC/68B/IST/01). The Committee **advises** *the Commission that the results confirm that the carryover provisions and Interim Allowance Approach have been satisfactorily tested and* **recommends** *that the AWS provisions should be updated accordingly for this hunt.*

6.4 Progress on previous recommendations and work plan

The Committee reviewed its recent recommendations and agreed that all had been met satisfactorily. Table 5 highlights the primary issues for consideration at next year's meeting (SC68C) noting that last year it had identified the need to consider the West Greenland humpback whale *Implementation Review* in light of the need for a new *In-Depth Assessment* of North Atlantic humpback whales (the last Comprehensive Assessment was completed in 2002). It **agreed** that the intersessional group established under Item 8.1.4 (see Annex K for details) to begin to plan the *In-Depth Assessment* would also include members of the sub-committee on IST and that a plan for conducting the *Implementation Review* would be informed by those discussions, particularly with respect to stock structure.

Last year, given the commonality of stocks in some cases and the need to try to undertake only one *Implementation Review* at a time, the Committee had agreed to develop a longer-term *Implementation Review* work plan (IWC, 2020b), recognising that in some cases the period between such reviews may be slightly longer than the target of every six years. The Committee reviewed the plan this year, recognising that it is provisional depending on the time taken to complete each review (1-2 years). An updated proposed schedule is given as Table 6.

Table 5

Work plan for IST *Implementation* matters.

Topic	2020 Meeting	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Final work on *G-common minke SLA,* carryover and interim relief	Completed	n/a	n/a
Implementation Review for the ENP gray whales	Completed	n/a	n/a
Carryover and interim allowance for ENP gray whales	Completed	-	-
Update AWS in light of results at the 2020 meeting	-	Donovan/Staniland will undertake this	Review
Implementation Review West Greenland humpback whales	-	Work with IA Steering Group on matters related to the in-depth assessment of North Atlantic humpback whales and decide how to undertake the *Implementation Review*	Agree plan for review
Implementation Review for common minke whales (RMP)	-	-	Develop plan

Table 6
Potential long term work plan for RMP and AWMP *Implementation Reviews.*

Species/area	Year *Implementation* (*IR*s) completed	Next *Implementation Review*
West Greenland humpback whales (AWMP)	2014	Estimated start 2021
North Atlantic common minke whales (RMP)	1993 (2003, 2008, 2017)	Estimated start 2022
North Atlantic fin whales (RMP)	2009 (2016)	Estimated start 2023
West Greenland fin whales (AWMP)	2018	Estimated start 2023
West Greenland bowhead whales (AWMP)	2015	Estimated start 2024
Alaskan and Chukotka bowhead whale hunts (AWMP)	2000 (2007, 2012, 2018)	Estimated start 2025
Common minke whales off Greenland (AWMP)	2018, 2019	Estimated start 2026
Chukotka and Makah gray whales hunt (AWMP)	2004 (2010, 2013, 2020)	Estimated start 2027

7. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING (ASW)

7.1 New information and recommendations

7.1.1 Bering-Chukchi-Beaufort Seas bowhead whales

Two abundance surveys for Bering-Chukchi-Beaufort (B-C-B) bowhead whales were carried out in 2019: (1) an ice-based count in spring near Utqiaġvik (formerly Barrow); and (2) an aerial line-transect survey across the US and Canada Beaufort Sea in August. The resulting abundance estimates are discussed and summarised under Item 11.1.

Data on B-C-B bowhead whale population indices, whale health and hunter observations for 2018 and 2019 were provided in SC/68B/ASW/03. Productivity indices including calf production and body condition of subadults remained within the bounds of previous data and the health of individuals was generally good. Evidence indicating fishing-gear entanglements and injuries from killer whales and ship strikes was evaluated. Rates of entanglement (~12%) and killer whale predation attempts (~ 6%) appear to be constant at low levels over recent years; vessel strikes are rare.

From 2009 to 2019, 44 bowhead whale carcasses (31 at sea and 13 on land) were observed from aerial line-transect surveys during July-October in study areas across the eastern Chukchi and western Beaufort Seas (SC/68B/ASW/02). September had both the highest survey effort and number of carcass sightings in both study areas. During the 11-year study, the probable causes of death were: (a) killer whale predation 55% (24/44); (b) aboriginal subsistence whaling 'struck and lost' 9% (4/44); and (c) undetermined 36% (16/44).

Harvest data from the aboriginal hunt for bowhead whales in Alaska were presented in SC/68B/ASW/01. In 2019, 36 bowhead whales were struck resulting in 30 animals landed (2009-18: mean struck=57.1, SD=10.3; and mean landed=43.5, SD=7.1). Efficiency (no. landed/no. struck) in 2019 was 83%, higher than the average (76.7%; SD=7.1%) for the past 10 years. Of the whales landed, 19 were females (9 presumed sexually mature based upon length) and 11 were males. Three mature females were examined: two were pregnant, one with a term foetus (3.9m long) and one with a small foetus (29cm long), and the third was secreting colostrum. The other mature females could not be carefully examined because they were mostly butchered in the water.

During the 2019 subsistence hunt in Russia, one 18.9m female bowhead whale was struck and landed (SC/68B/ASW/05).

The Committee noted that an annual review of management advice was not required but **agrees** that the new information provided did not require calling for an early *Implementation Review* (IWC, 2019e).

7.1.2 Eastern Canada/West Greenland bowhead whales

SC/68B/ASW/04 reported on the Canadian subsistence hunt of Eastern Canada-West Greenland (EC-WG) bowhead whales that occurs annually within the Nunavut Settlement Area (NSA) and the Nunavik Marine Region (NMR). Oceans Canada licences bowhead whale hunts upon written confirmation that the appropriate Regional Wildlife Organisation has approved the hunt plan. The combined maximum allowed take is seven EC-WG bowhead whales per year. During the 5-year period 2015-19, a combined (NSA and NMR) total of 11 bowhead whales was landed and one whale was struck and lost. In 2019, four bowhead whales were struck and landed. The length of the whales ranged from 8.0m to 14.27m and they comprised three females and one individual of undetermined sex.

The Committee thanked Canada, a non-member nation, for providing this important information, and welcomed Canadian participants at this and future meetings.

No bowhead whales were struck off West Greenland in 2019.

The Committee noted that an annual review of management advice was not required but **agrees** that the new information provided did not require calling for an early *Implementation Review* (IWC, 2019e). The Canadian hunt of bowhead whales is taken into account within the *WG Bowhead SLA*.

7.1.3 North Pacific gray whales

The hunts of North Pacific gray whales were subject to an *Implementation Review* at this meeting and this is discussed under Item 6.2. In addition to the discussion in Item 6.2 and below on matters related to the actual and potential hunts (Chukotkan and Makah), information on gray whales is also considered under Item 9.1.3.

The results of a long-term study on the body condition of Pacific Coast Feeding Group (PCFG) gray whales were provided in SC/68B/IST/03. Whales were photographed during vessel surveys conducted in the feeding season (June-November) from: (a) 1996 through to 2013 in northern Washington; and (b) 1996 through to 2002 off Vancouver Island, and photographs of 181 PCFG whales were examined. Body condition was found to improve through the feeding season and the rates, and the start and finish values varied annually. A multiple regression analysis found that the best-fitting model for body condition by year included the Pacific Decadal Oscillation (lagged by two years) and September kelp canopy cover along the Washington coast (lagged by one year). These factors greatly improved predictive ability for average body condition compared to models that did not include environmental parameters. A comparison with a study on body condition of gray whales off Sakhalin Island, Russia (Bradford *et al.*, 2012), found that the body condition of whales feeding off Sakhalin Island improved faster than PCFG whales and that most of the Sakhalin whales returned to a 'good' body condition by the end of a feeding season. This may reflect life history differences of whales that undertake a long migration (Sakhalin whales) and those with a relatively short migration (PCFG whales).

Carcass sighting and probable cause of death data for eastern North Pacific gray whales detected during aerial line-transect surveys in the eastern Chukchi Sea were presented in SC/68B/IST/02. More information can be found in Item 6.2.1.

Information on the 2019 subsistence hunt in Russia was presented in SC/68B/ASW/05. A total of 135 gray whales (66 males and 69 females) was landed, including three inedible 'stinky' whales that were destroyed. In addition, two whales were struck and lost. Mean body length (10.0m), blubber thickness (122mm) and weight (10.3 tonnes) were recorded (in 2018, mean length and weight were 9.7m and 9.3 tonnes). The largest animal taken was a 14.4m female (31.7 tonnes). No females were lactating and only one had a foetus. Eight whales had evidence of interactions with killer whales. Data on the toxicology of gray whales from Chukotka (SC/68B/E/11) are discussed under Item 14.1.

The Committee noted that an annual review of management advice was not required and noted the conclusion of the *Implementation* under Item 6.2 that the *Gray Whale SLA* and the Makah Management Plan remain the best way to provide management advice. It was noted that 'stinky whales' are accounted for in the *Gray Whale SLA* that calculates the aboriginal subsistence hunting strike limit.

The Committee **welcomes** the information on Russian studies of gray whales off Chukotka and US studies of PCFG whales and the eastern North Pacific in general.

Attention: SC, CG, ASW
With respect to matters related to hunts of North Pacific gray whales, the Committee **reiterates** *previous advice that biological data, genetic samples and photographic data are collected from live and harvested whales and analysed to provide information on stock structure and biology.*

7.1.4 Common minke whales off East and West Greenland

A total of 11 common minke whales (one male, eight females and two of unknown sex) were landed in East Greenland in 2019. None were reported as struck and lost. A total of 153 minke whales (36 males, 116 females and one of unknown sex) were landed in West Greenland. Seven minke whales were struck and lost.

The Committee noted that an annual review of management advice was not required and noted the review of the performance of the *G-Common minke SLA* under Item 6.1.2. The Committee confirms that this SLA is the best way to provide management advice to the Commission on both the West and East Greenland common minke whale hunts.

7.1.5 Fin whales off West Greenland

Seven fin whales (two males, three females and two of unknown sex) were landed in 2019. One fin whale was struck and lost. The Committee noted that an annual review of management advice was not required but **agrees** that the new information provided did not require calling for an early *Implementation Review* (IWC, 2019e).

7.1.6 Humpback whales off West Greenland

Four humpback whales (three males and one female) were landed in 2019. None were struck and lost.

The Committee noted that an annual review of management advice was not required but **agrees** that the new information provided did not require calling for an early *Implementation Review* (IWC, 2019e). As noted under Item 6.4, intersessional work will take place to enable the Committee to agree a plan for the *Implementation Review* of humpback whales off West Greenland at SC68C.

7.1.7 Humpback whales off St. Vincent and The Grenadines

Three humpback whales (one male and two females) were landed in 2019. None were struck and lost.

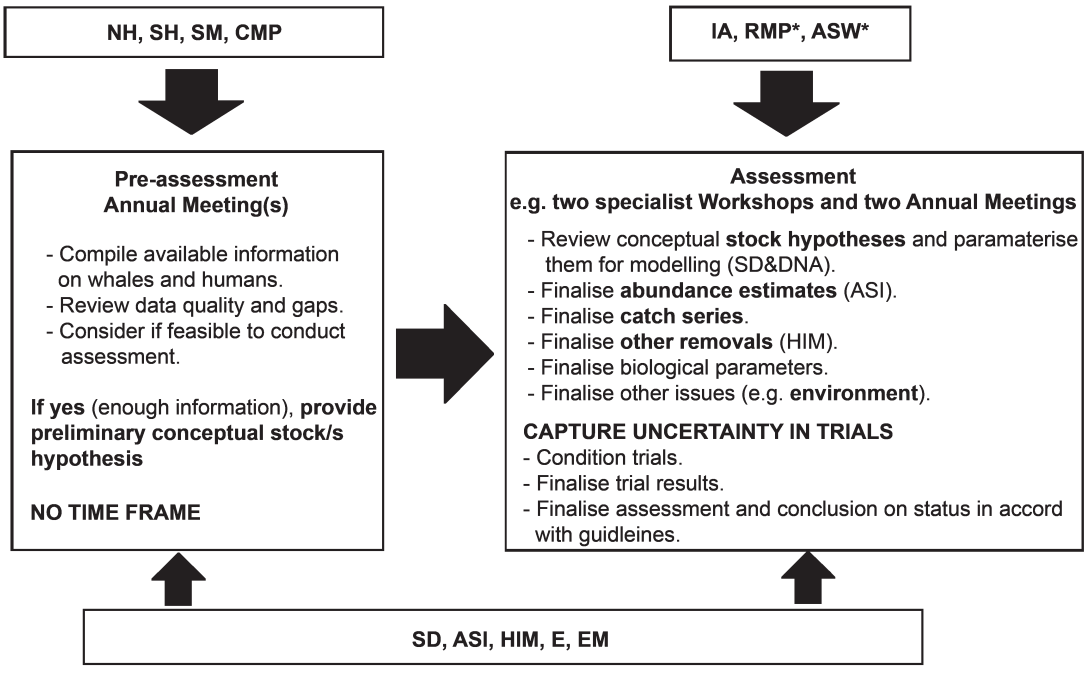

Fig. 1. Comprehensive and In-depth Assessment process. *Now part of IST.

The Committee noted that an annual review of management advice was not required but **agrees** that the new information provided did not require any change to its existing management advice (IWC, 2019e).

7.2 Progress with previous recommendations

SC/68B/ASI/02 presented findings of an ice-based survey of bowhead whales conducted near Utqiaġvik (formerly Barrow) and completed in the spring of 2019. This work addressed the 2017 recommendation that encouraged the funding and completion of a new ice-based survey estimate of bowhead whale abundance.

Paper SC/68B/E/11 noted that a photo-identification catalogue of gray whales was developed for surveys of Mechigmensky Bay, Russia. This work partially addresses the 2019 recommendation to collect photographic data in this area. The Committee recommends continuation of this work and collection of photographs and genetic samples from harvested whales as previously recommended.

Attention: SC, ASW, CG
The Committee **encourages** *that whenever possible, biological and genetic samples and photographic data for all species of whales subjected to aboriginal subsistence whaling be collected and combined to help assess stock structure and assessment-related questions.*

8. WHALE STOCKS NOT SUBJECT TO DIRECTED TAKES[9]

8.1 Comprehensive or *In-Depth Assessments* (IA)

An updated process for undertaking Comprehensive (the first time an assessment is completed for a species/region) and *In-Depth Assessment*s (subsequent assessments for a species/region) was agreed in 2018. The full process is described in Donovan (2018) and (IWC, 2020a, p.15) and is summarised in Fig. 1.

8.1.1 Comprehensive Assessment of North Pacific humpback whales

Work towards a Comprehensive Assessment of North Pacific humpback whales began in 2016. An intersessional Workshop was held in April 2017 (IWC, 2018a). In 2018, a simplified age-aggregated assessment model and four potential stock structure hypotheses were proposed (IWC, 2019c). However, there were still questions about the connections among the proposed breeding and feeding areas. In 2019, Cheeseman was able to improve an automated photo-ID matching algorithm that became the technical basis for his website *https://happywhale.com*. As a result, in 2019, the *Comprehensive Assessment* was postponed until the completion of a large-scale photo-ID matching exercise. This exercise was to incorporate a substantial quantity of new data from many regions across the North Pacific, including some from areas that had been under-represented during the ocean-basin-wide SPLASH project in 2003-05 (Calambokidis *et al.*, 2008).

[9]North Pacific common minke and sei whales are subject to direct catches by a non-member nation. At SC68C, the Committee will discuss which agenda item is the best for reviewing these two stocks.

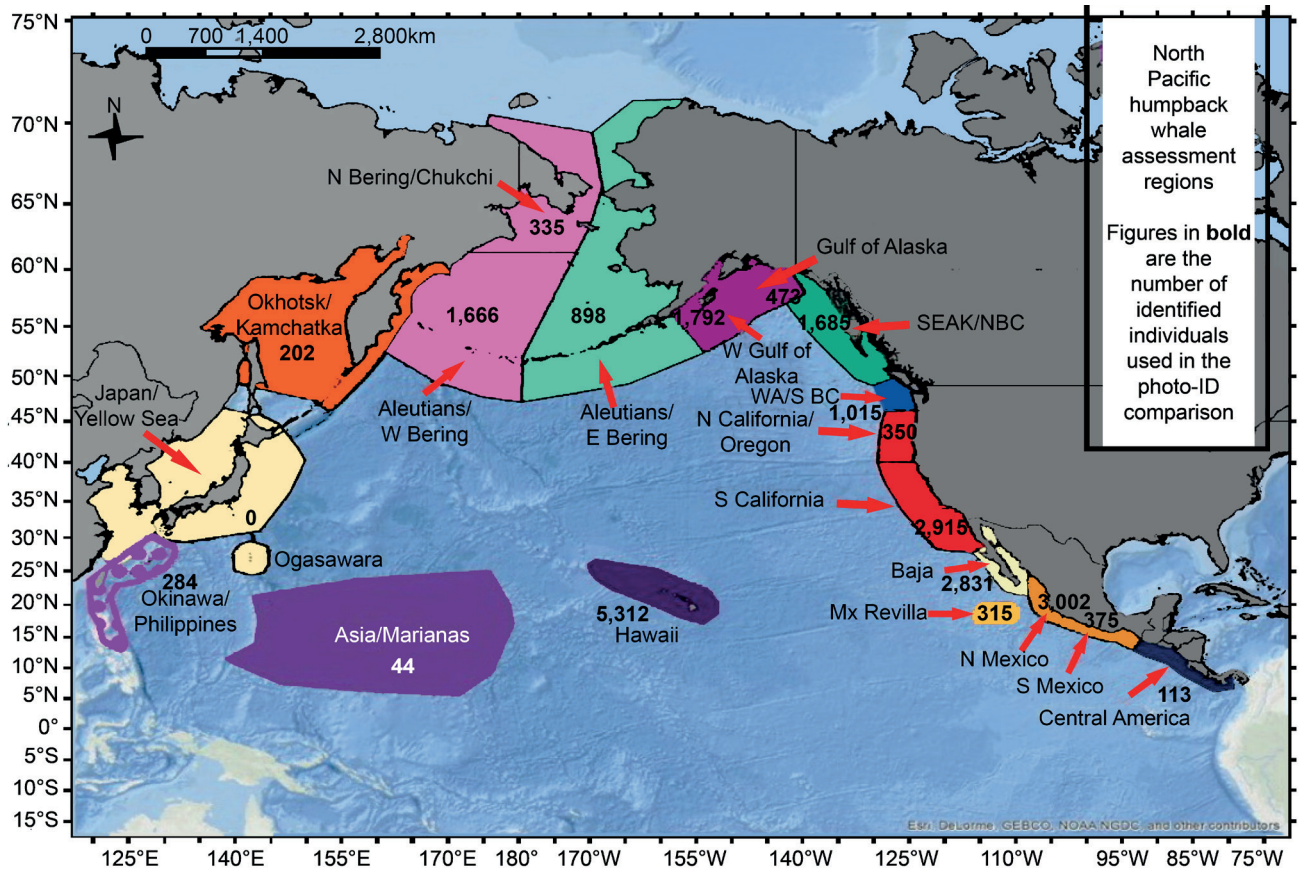

Fig. 2. North Pacific humpback whale assessment regions representing feeding and breeding areas. Numbers in each area are the identified individuals used in the preliminary photo-ID comparison.

8.1.1.1 Stock Structure

Understanding of stock structure, which is essential for the modeling process of the Comprehensive Assessment, is being refined using results from the large-scale photo-ID matches and genetic analyses. Analyses of historical 'Discovery' mark data are ongoing and will be presented to the Committee when completed; overall, the sample sizes concerned are relatively small. These data may not add meaningfully to the existing picture of movements and stock structure, but this will be assessed when the analyses are completed.

8.1.1.1.1 Photo-ID Matching

The matching exercise represented a substantial undertaking requiring extensive discussions with numerous photo-ID catalogue holders, and the development of a Memorandum of Understanding (MoU) governing the terms of data submission and use. This was undertaken by Cheeseman with assistance from Clapham and was finally concluded to the satisfaction of all parties. The MoU stresses that the data and preliminary results summarised in SC/68B/ISG/01 were to be used solely for the purpose of assisting the Committee's Comprehensive Assessment process; they should not be used for any other purpose, and should not be shared or published without the written permission of the photo-ID catalogue holders concerned.

The existence of what is now an essentially fully automated system has revolutionised humpback whale photo-ID matching. Freely available to anyone, it has facilitated fast matching across the very large photo-ID collection (now numbering >35,000 individuals in one consolidated global catalogue) and has detected even very challenging matches that have gone unnoticed, sometimes for many years.

Using the large volume of information submitted by collaborators through mid-April 2020, Cheeseman and Clapham initiated a preliminary photo-ID comparison (SC/68B/ISG/01). This matching exercise involved 38 photo-collections in 18 previously defined regions. The only change was to the region previously defined as 'Aleutians/Western Bering Sea', which encompassed all of the western Bering Sea. It became clear from newly acquired Russian data that there are two distinct areas within this region, separated at about 61°N. Consequently, the region was split, and the northern portion designated a separate area, entitled 'North Bering/Chukchi'. Other than for Okinawa, there were no current contributions from Japan and the Committee **encourage**s the submission of photos and data. Fig. 2 shows the regions used for this comparison.

This preliminary comparison involved 66,055 encounters of 17,230 unique individuals and resulted in the interchange index for all pairwise comparisons reported in table 1 of SC/68B/ISG/01, where more details of this comparison exercise can be found. There are several outstanding gaps in the data and it would be beneficial if they could be addressed soon. In particular, there is a lack of samples from the 'unknown' breeding area (postulated to be the Mariana Islands), the Aleutians and Bering Seas, Central America, Okinawa and Ogasawara.

The Committee welcomes the progress made on this substantial exercise and thanked the many photo-ID holders who have already submitted images.

Attention: SC, CG
The Committee **encourages** *other photo-ID holders to contribute, and that the analyses can be completed using a more comprehensive set of photographs, with the results to be presented to SC68C.*

A separate but complementary effort to the Comprehensive Assessment, known as 'SPLASH-2', is a follow-on to the successful 2004-06 SPLASH project. NOAA is providing seed funding to initiate this project by bringing collaborators together (through one or two workshops, e.g. virtual in autumn 2020, and in-person in summer 2021) to identify humpback ID photographs from each region of the North Pacific that are potentially available for analysis, to prepare as many photographs as possible for computer-assisted matching, and to identify gaps in the distribution of data that, if filled, could contribute substantially to a better understanding of North Pacific humpback whales.

The Committee **welcomes** this new project and looks forward to collaborating with this effort.

8.1.1.1.2 Genetic Analyses

SC/68B/IA/02 assessed the temporal stability and geographic differentiation of mitochondrial DNA (mtDNA) control region haplotypes from humpback whales on the eastern North Pacific feeding grounds using thirty-one years (1988-2019) of biopsy sampling effort (*n*=951), which resulted in the identification of 777 unique individuals. Pairwise comparisons of mtDNA haplotype frequencies across three temporal strata showed no significant differences for Central California, the geographic region with the most extensive temporal sampling coverage. Tests of geographic differentiation considered six regional strata: Northern British Columbia, Southern British Columbia/Washington, Oregon, Northern California, Central California and Southern California. All pairwise comparisons were significant, except the comparison between Northern California and Oregon and revealed a greater degree of geographic structure in these feeding grounds than previously assumed. The results also provided new evidence for the temporal stability of fine-scale maternal fidelity of humpback whales to feeding grounds along the eastern North Pacific. Further analyses are underway to improve the assignment of individuals from feeding grounds to breeding grounds using nuclear genetic markers.

SC/68B/IA/03 used mitochondrial sequence data to characterise and compare two 'migratory herds' (meaning whales using the same feeding and breeding grounds) that use the California/Oregon (CA/OR) feeding ground. This involved two new datasets. One dataset consisted of the full mitochondrial genome sequences (16,384 base pairs) from the herd that feeds off CA/OR and winters in Central America (the CentAm-CA/OR herd; *n*=65), and the herd that also feeds off CA/OR but winters off mainland Mexico (the MMex-CA/OR herd; *n*=50). The second dataset consisted of mtDNA control region sequences (389 base pairs) from humpback whales sampled off CA/OR during the 2018 California Current Ecosystems Studies survey (*n*=227). These new datasets were compared to published mtDNA control region datasets collected from the MMex wintering aggregation (*n*=62), the CA/OR feeding aggregation in 2004 (*n*=123), and the CA/OR feeding aggregation in 1988-1989 (*n*=49). The results showed that the CentAm-CA/OR and MMex-CA/OR herds are genetically differentiated from each other (F_{ST} = 0.054 and 0.044 for full mitogenome and control region sequences, respectively). However, because the herds shared a high proportion of haplotypes, even when using full mitogenome sequences, many individuals could not be reliably assigned to a herd using only mitochondrial data. Consequently, further analyses are underway to add nuclear loci to this analysis.

SC/68B/CMP/26Rev1 used genetic and photo-ID data to analyse the relationship of the humpback whales from southern Mexico with whales from other Pacific regions off Mexico and Central America. The photo-ID matching included 7,250 individuals from six regional catalogues of the Mexican Pacific (BCS; Sinaloa; Nayarit-Jalisco; Colima; Guerrero; and Oaxaca). The highest Recapture Index was among the whales from Colima, Guerrero and Oaxaca in southern Mexico. The mtDNA control region haplotype frequencies sequenced from 51 skin samples collected in Oaxaca (48) and Guerrero (3) showed significant differences with the other three breeding sites studied in Mexico (Baja California, Bahía de Banderas and Revillagigedo Archipelago). In contrast, there were no significant differences with the humpback whales from Central America. The photo-ID results indicated that the whales from Colima to Oaxaca belong to the same congregation, and the genetics show that these whales are part of the same population unit as the whales of Central America. In summary, the humpback whales from southern Mexico belong to the Central American population; there is no clear boundary between the northern and southern coastal humpback whales in the Mexican Pacific, and the northern area may include a mixture of coastal and offshore whales. Future steps include comparisons of the photo-ID catalogues from the Central America humpback whales and Mexico to better understand the movement of the whales in the region and develop an abundance estimate.

The Committee emphasised the importance of the three genetic analyses above to the Comprehensive Assessment of North Pacific humpback whales and encourages the authors to continue their work and present an update to the intersessional Workshop and subsequently to the Committee next year, for review by the SD/DNA sub-group.

The DNA register for North Pacific humpback whales now has a total of 3,225 individuals, including pre-SPLASH samples dating back to 1987 and post-SPLASH samples up to 2019. As a result of the collaborative effort to investigate stock structure for the SPLASH program, the Cetacean Conservation and Genomics Laboratory at Oregon State University adopted a standard DNA profiling system that includes sequencing of mtDNA control region haplotypes, molecular analysis of sex and genotyping at 10 microsatellite loci. DNA profiles were used to identify 1,805 individuals from 2,193 biopsy samples collected as part of the SPLASH program in 2004-06. Comparison of genotypes provided 90 matches between breeding grounds and feeding grounds. Patterns of interchange were particularly complex for whales sampled in the three regions off Mexico. A compatible DNA profiling system has also been used for a DNA register of humpback whales from Oceania, where it has been applied to estimate abundance as well as to investigate stock structure.

The Committee noted that all DNA profiles, which include microsatellite genotypes, are suitable for population assignment procedures and those with mtDNA haplotype information are suitable for mixed-stock analyses (Albertson *et al.*, 2018). If the requirement for individual identification of samples is relaxed, then there is also the potential to include a larger number of samples from the Russian Far East and Mexico for a mixed-stock analysis using mtDNA haplotype frequencies only. A mixed-stock analysis could apportion feeding ground genetic samples to breeding grounds and estimate the probability of an individual from a feeding ground originating from a defined breeding ground; these assignments could be used as proxies for catch allocation in the assessment model. The Committee **reiterates** that such a mixed-stock analysis be funded using existing funds (see Item 22).

8.1.1.2 Abundance and Trends

At the first Workshop for this Comprehensive Assessment, a list was compiled of abundance estimates and data that could be used to generate such estimates, in addition to proposed future work related to these estimates (IWC, 2018a). All abundance estimates that will be used in the assessment model need to be reviewed by the ASI sub-group of the Committee and must also be re-stratified or otherwise re-calculated to align with the stock structure hypotheses.

Inai *et al.* (2020) calculated abundance estimates for humpback and other baleen whales from the 2010-18 IWC-POWER cruises dataset and presented this work at the IWC-POWER Technical Advisory Group meeting in Tokyo in January 2020 (SC/68B/REP/01). The abundance of humpback whales migrating to the southern Aleutian archipelago (2010-12 survey areas: north of 40°N, south of the Alaskan coast including both the US and Canadian EEZs between 170°E-135°W) in summer (July-August) was estimated as around 9,900 (CV=0.53) under the hazard-rate model with explanatory variables of the year of survey, school size and visibility. The abundance to the north of the Aleutian archipelago (2017-18 survey areas: eastern Bering Sea) in summer (July-August) was estimated as about 13,000 (CV=0.41) under the hazard-rate model with visibility, cue and wind speed variables. In total, abundance in the 2010-12, 2017-18 survey areas was given as around 23,000 (CV=0.60). Additional work to improve the CV of this and other estimates is currently underway and will be submitted to ASI for evaluation and endorsement.

It was noted that abundance estimates for Japanese surveys from the northwestern North Pacific (including the area south and southeast of Kamchatka, incorporating survey work from the Emperor Seamounts region) could be an important input to the assessment. Kitakado advised that he would attempt to provide this information.

It is noteworthy that there have been recent major changes in the apparent abundance of humpback whales in both Southeast Alaska and the West Coast of the USA. The former region features low relative abundance and is 'missing' well-known whales, a phenomenon which has also been observed in the Hawaiian breeding grounds. This is likely to be related to a major oceanographic event (Cartwright *et al.*, 2019). On the US West Coast, abundance appears to be increasing. Calambokidis and Barlow (2020) present new abundance estimates for recent years; these show major increases in abundance (including at a rate of increase beyond the plausible biological maximum) for California/Oregon as well as for Washington State/southern British Columbia.

In addition, analysis of the 2018 US west coast line-transect sighting data is being finalised and will be shared with the IWC when complete. The humpback whale abundance estimate from this survey could provide an important input to the assessment.

Palacios reported on a 13-day sighting and acoustic survey of Northern Hemisphere humpbacks that he and Rasmussen conducted in February 2018 in the Gulf of Chiriqui in Panama. This area is thought to be used by both Northern and Southern Hemisphere humpback whales, though at different times (Rasmussen *et al.*, 2007; 2012). There was only one sighting (a mother/calf pair), but numerous acoustic detections of singing whales. The survey supported the hypothesis that the occurrence of Northern Hemisphere humpbacks in the southern area of Central America is declining, whereas Southern Hemisphere whales are increasing there; however, the survey was conducted in a year with major oceanographic changes in the North Pacific, when (for example) far fewer whales were observed in other parts of Central America as well as in Hawaii (Cartwright *et al.*, 2019).

The Committee welcomed these new abundance estimates and encourages all abundance estimation analyses to be completed and presented to SC68C to be reviewed by the SWG on ASI.

8.1.1.3 Removals

Ivashchenko has continued to collect new catch data for humpback whales from Soviet sources and to submit them for inclusion in the IWC catch database; although they represent relatively minor additions to the existing catch series. The Committee thanked Ivashchenko for contributing the new data to the IWC catch database.

It was noted that the assessment needs to incorporate an estimate for bycatch as well as direct catch removals, since bycatch has become an important issue in some areas (e.g. the West Coast of the US). Robbins *et al.* (2009) proposed an approach for estimating entanglement mortality from scar-based studies of entanglement, using Gulf of Maine humpback whales as an example. Entanglement scarring rates in some North Pacific areas are comparable to the Gulf of Maine (Neilson *et al.*, 2009; Robbins *et al.*, 2007), so that those results could be considered as a proxy in the absence of direct information. However, if there were to be a follow-up to the SPLASH project, then it could also be possible to collect the data necessary to quantify entanglement rates on an annual basis in some North Pacific areas, as is needed to estimate mortality by the proposed method.

In view of the importance of bycatch and ship strikes, as well as catches, in the assessment models, a strategy needs to be developed to enumerate the bycatch and ship strikes to be used in this Comprehensive Assessment.

8.1.1.4 Biological Parameters

The first Workshop (IWC, 2018a) compiled and reviewed the available information on biological parameters for humpback whales in all oceans. There has been no new work on biological parameters.

8.1.1.5 Assessment

The general underlying structure of the assessment model has been developed, but before the model can be run the input data (e.g. removals and abundance estimates) need to be updated, reviewed by the Committee, and allocated/disaggregated for each stock structure hypotheses. In addition, mixing matrices need to be developed and parameterised.

The Committee **agrees** that the Intersessional Steering Group be re-established to further the work towards this assessment including planning for the intersessional Workshop (funding for this and modelling work was already endorsed by the Committee, see Item 22).

Attention: SC, R

The Committee is undertaking a Comprehensive Assessment of North Pacific humpback whales. In particular this year, it **recognises** *the great contributions of many research organisations across the North Pacific which made the large-scale photo-ID matching effort possible and* **reiterates** *its previous strong encouragement for all catalogue holders to contribute photographs to participate in this exercise, after the appropriate data sharing agreements have been reached.*

In order to complete the assessment expeditiously, the Committee **agrees** *that:*

(1) *the Intersessional Steering Group under Clapham, should be re-established including the work plan outlined in SC/68B/ISG/01;*
(2) *the breeding/feeding subareas should be re-evaluated to be consistent with the new results from the matching effort;*
(3) *ongoing genetic analyses should be completed and reviewed by the Committee;*
(4) *abundance estimates should be completed and reviewed by the Committee;*
(5) *options to quantify bycatch and ship strikes should be developed;*
(6) *the proposed mixed-stock analysis should be funded and conducted to apportion feeding ground genetic samples to breeding grounds, and to estimate the probability of an individual from a feeding ground originating from a defined breeding ground as proxies for catch allocation in the assessment model;*
(7) *the abundance and removals should be re-calculated to correspond to the new subareas, mixing matrices developed, and input into the assessment model; and*
(8) *the intersessional Workshop should, progress permitting, focus on finalising the stock structure hypotheses, abundance and removals and their appropriate allocation by stock hypotheses.*

8.1.2 Comprehensive Assessment of North Pacific sei whales

Last year, the Committee reviewed preliminary results from an assessment model, which had encountered difficulties in reconciling all the available types of data: absolute abundance estimates from POWER and other surveys; relative abundance data from scouting vessels and some further surveys; and mark-recovery data. An Intersessional Correspondence Group was established to review the data used and to oversee the further development of the population model. Its report is provided in SC/68B/ISG/04.

The intersessional group refined the input data in several respects: replacing minimum estimates of abundance with best estimates; improving the breakdown of survey strata to subareas of the population model; and incorporating additional

variance. The population modelling proceeded on the basis agreed last year of two main stock structure hypotheses: (i) a single breeding stock in the North Pacific; and (ii) five breeding stocks. The group explored a range of variations on the two basic hypotheses but found no variants that could fit all the available data in a satisfactory manner. It concluded that the work could not be considered complete at this stage. The current version of the population model and its variants is specified in SC/68B/IA/04. The group listed several further variants of the population model, including the incorporation of more seasonal structure that should be considered. It put forward a work plan to develop and review these variants.

In light of Japan withdrawing from the IWC and thus becoming an observer at the Committee meeting, Japanese scientists confirmed their general stance that their highest priority had become data collection and analytical work related to their national research programmes on assessments and management of large whale species such as sei, Bryde's and common minke whales, noting that participating in scientific discussions in general at Committee meetings (including participation in Steering Groups) would also strengthen its assessment of whales and management of whaling. They clarified that on a voluntary basis they may submit relevant results of their work to future Committee meetings. In a spirit of collaboration, they also agreed to the use of the data held by Japan which have been already incorporated into the current population dynamics modelling framework of the Comprehensive Assessment of North Pacific sei whales. Should it become necessary to use the previously collected data for purposes other than this assessment or new data to be collected by Japan for any purpose, Committee members would need to apply for the use of those data through the standard procedures of the Institute of Cetacean Research or the National Research Institute of Far Seas Fisheries (standard data related to catch and bycatches are and will continue to be publicly available). The Committee thanked the Japanese scientists for these clarifications and was pleased that two Japanese experts will be involved with the Intersessional Steering Group for the purpose of responding to questions regarding the data held by Japan that are already being used.

Attention: SC
To progress work on the Comprehensive Assessment of North Pacific sei whales the Committee:

(1) **agrees** *to re-establish the intersessional group under Cooke, and* **endorses** *its work plan, which is designed to enable completion of the assessment by the Committee next year; and*
(2) **endorses** *the continuation of the assessment modelling work by Punt with its associated budget.*

8.1.3 Progress on In-Depth Assessment of western North Pacific common minke whales

Donovan presented the report of the Intersessional Steering Group on western North Pacific common minke whales (SC/68B/ISG/05). It had been agreed last year (IWC, 2020b) that, with the withdrawal of Japan from the IWC, it was not appropriate to continue with the ongoing RMP *Implementation Review* for common minke whales in the western North Pacific. However, given the levels of bycatch of common minke whales in the western North Pacific, particularly adjacent to Korea and Japan, as well as Japan's resumption of commercial whaling within its EEZ, it was considered important for the Committee to examine the conservation implications of removals throughout the region. It was agreed that the appropriate process to follow was that of an *In-Depth Assessment*, with a particular focus on the levels of bycatch from and the status of the J-stock.

An intersessional Workshop had been planned to further the *In-Depth Assessment*, but it had not been possible to hold it this year. The Committee **reiterates** its support for holding the Workshop prior to SC68C. Intersessional progress had focussed on working on the details of the assessment specifications (based upon the RMP trial specifications but no longer using the Revised Management Procedure in projections) and validating the computer code to implement the three stock structures and other scenarios already agreed (IWC, 2020b). The Committee was pleased to hear that this work, essential for holding a productive workshop, was almost complete, noting that there are a small number of issues to be resolved within the Steering Group prior to the workshop (SC/68B/IA/05). The final specifications for the population model will be published as an Annex to the Workshop report.

The Committee noted that the clarification regarding the participation of Japanese scientists in the Comprehensive Assessment of North Pacific sei whales (Item 8.1.2) also applied to the *In-Depth Assessment* of common minke whales in the western North Pacific, both with respect to data held by Japan which have been already incorporated into the current simulation framework, the use of new data (and the process to obtain them) and the level of participation of two Japanese scientists in the Intersessional Steering Group. The Committee **encourages** scientists from Korea and Japan to provide recent information on fishing effort (as well as bycatch numbers) to Allison to assist with the modelling of bycatches for the assessment. It notes that an intersessional working group will finalise abundance estimates for use in the assessment as discussed. It was pleased that two Japanese experts will be involved with the Intersessional Steering Group and **encourages** Japanese experts to participate in the intersessional Workshop, if possible.

Table 7
Work plan for Comprehensive and In-depth Assessments.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Comprehensive Assessment of North Pacific humpback whales	Re-establish the ISG to further data preparation, development of the assessment model and hold a Workshop	Review progress of intersessional work and continue the assessment
Comprehensive Assessment of North Pacific sei whales	Re-establish the ISG to further data preparation and development of the assessment model	Review progress of intersessional work and continue/finalise the assessment
In-depth Assessment of western North Pacific common minke whales	Re-establish the ISG to further development of the assessment model and hold a Workshop	Review progress of intersessional work and continue/finalise the assessment
In-depth Assessment of North Atlantic humpback whales	Re-establish the ICG to further data preparation for the assessment	Review progress of intersessional work and continue the assessment

Attention: SC
The Committee **reiterates** *the need to conduct an In-Depth Assessment of western North Pacific common minke whales with a focus on the bycatch levels from and the status of J-stock. Recognising the difficulties in holding the Workshop agreed last year prior to SC68B, the Committee* **reiterates** *the importance of the Workshop and:*

(1) **recommends** *that the funds allocated last year are used to hold a Workshop prior to SC68C when it is safe to do so, and supports the request for computing support;*
(2) **agrees** *that the primary objectives of the Workshop are to: (a) build upon the work undertaken thus far on finalising and conditioning the assessment models; (b) review the results of the initial conditioning and determine the necessary scenarios to consider including for future projections; and (c) develop a work plan that will allow for results to be presented to SC68C, ideally enabling the In-Depth Assessment to be completed at SC68C; and*
(3) **establishes** *a Steering Group under Donovan to: (a) oversee the preparations for the Workshop including finalising the agenda, the pre-Workshop preparations, the venue, the date of the Workshop and the list of invited participants; and (b) examine the most appropriate way to incorporate minimum, maximum and zero estimates of abundance in the modelling framework (taking into account discussions of similar issues in other assessments).*

8.1.4 Preparation for In-Depth Assessment of North Atlantic humpback whales (and see Items 7.1.7 and 7.1.8)

Due to the Covid-19 disruption and no new papers having been submitted this year, discussion of this topic was postponed until next year's meeting and in the meantime will be advanced by an Intersessional Correspondence Group, convened by Robbins (see Annex K). The Intersessional Correspondence Group will continue its work to identify existing and forthcoming information on North Atlantic humpback whale stock structure, abundance, biological parameters and human impacts. A report of these activities will be provided at next year's Committee meeting.

Other discussions on North Atlantic humpbacks include preparations for an *Implementation Review* of West Greenland humpback whales (and see Item 6.6), bycatch in the Scottish creel fishery (and see Item 12.2), and the unusual mortality event of humpbacks in the western North Atlantic (and see Item 14.3.2).

8.1.5 Work plan

Table 7 provides the work plan for Comprehensive and *In-Depth Assessment*s. For details of Intersessional Correspondence Groups, see Annex K.

8.2 Potential new assessments: progress on previous recommendations and prioritised work plan (SH and NH)

8.2.1 Non-Antarctic Southern Hemisphere blue whales (SH)

The Committee is preparing for a Comprehensive Assessment of non-Antarctic Southern Hemisphere blue whales, which is anticipated to be finalised by 2022. Pre-assessment of the available data was planned to be conducted at the 2020 and 2021 meetings. In 2020, the Committee received new information on acoustic population structuring, regional catch allocations and photo-ID matching.

The Committee welcomed two papers on pygmy blue whale demography (SC/68B/SH/10 and SC/68B/SH/12), which have been translated into English from Russian, and provide useful information on blue whale morphometric variation between subspecies, by sex and demographic status.

8.2.1.1 Southeast Pacific Ocean Blue Whales

Obtaining a new abundance estimate for southeast Pacific blue whales remains a high priority for the Committee, requiring finalisation of catalogue matching across the region and quality coding of images to obtain a regional mark-recapture dataset. An update of photo-ID catalogue matching within this region (SC/68B/PH/02) is discussed under Item 20.2.4. Intersessionally, photo-identifications from the eastern tropical Pacific and South America (838 individuals) were compared. Ten matches were

found within Chile. But no matches were detected between the eastern tropical Pacific and the southeast Pacific (SC/68B/PH/02), although a match between Chile and the Galápagos had been found previously (Torres-Florez *et al.*, 2015). In 2019, the Committee advised that additional photo-ID catalogue holders for the Costa Rica Dome be invited to join the Southern Hemisphere blue whale catalogue (SHBWC), to assess whether there is any direct overlap between this northeast Pacific blue whale wintering ground, and the southeast Pacific blue whale wintering area. A further dataset from Chile (Centro Ballena Azul and Universidad Austral de Chile) has not yet been catalogued due to lack of funds for dedicated personnel.

The Committee welcomed this update. In discussion, it was noted that additional spatial coverage is provided by photo-ID images from the 1997/98 IDCR-SOWER cruise (Findlay *et al.*, 1998), which are already part of the SHBWC and included in SC/68B/PH/02. While no matches have been found between these images and those in the SHBWC southeast Pacific catalogue to date, it was agreed that additional photos are available prior to 2003 in Chile which have not yet been submitted to the SHBWC and may reveal matches to IDCR-SOWER data as they are closer in time to this period. These should be added to the catalogue (and see Item 8.2.9). Priority intersessional work for this catalogue should be finalisation of southeast Pacific matching, quality coding and creating of mark-recapture datasets for analysis, with the appropriate analysis time determined by review.

A good understanding of population structure and connectivity is necessary to conduct population assessments. Last year (IWC, 2020a), the Committee proposed comparisons of catch length data and mitochondrial DNA patterns between the southeast and northeast Pacific in order to establish the level of population connectivity because a recent study suggested that these populations have some genetic interchange on their low-latitude wintering grounds (LeDuc *et al.*, 2017). The Committee was informed that this work will be completed in 2021.

Attention: SC, R

To assess blue whale population connectivity across hemispheres in the eastern Pacific, the Committee **reiterates** *that it* **encourages** *a comparison of: (1) morphometric; (2) genetic data between northeast and southeast Pacific whales; and (3) completion of photo-ID catalogue matching and quality coding in the southeast Pacific, to enable regional abundance estimation.*

To finalise the southeast Pacific blue whale pre-assessment, the Committee **agrees** *that the southeast Pacific photo-ID dataset should be quality coded and matched to 2018, and mark-recapture analyses conducted.*

8.2.1.2 Southeast Indian Ocean Blue Whales

No new information was received. Additional metadata for year of collection are required to finalise the SHBWC Australian photo-ID dataset for mark-recapture analysis. Additional photo-IDs may be forthcoming from the Philippines, Timor Leste and Indonesia and these should be submitted (as should any new photo-IDs) to the SHBWC. An assessment of the suitability of the data already submitted to the SHBWC for mark recapture analysis should be conducted intersessionally after updating tasks have been completed.

Population trend data from southeast Indian Ocean blue whales are available from Australia, derived from acoustic recordings (McCauley *et al.*, 2018). However, caution was advised because these trend data are derived from the instantaneous number of singers. The analyses assumed that: (i) song production rate was constant over time and the area monitored; and (ii) detectability was the same each year; however, small changes in ambient noise levels (e.g. 1-2 dB) can affect the area monitored and detectability drastically. The Committee was informed that the IWC-SORP Acoustic Trends Working Group is developing a method to obtain acoustically-derived time series of abundance estimates for Antarctic blue and fin whales (see SC/68B/SH/04 and Item 8.2.2), based on the more standard distance-sampling approach. Whilst acoustic analyses focused on song are unlikely to yield reliable estimates of absolute abundance, they may inform on general population trends in places with long term acoustic time series. It is important that the analyses minimise the effect of the biases inherent in these data, including accounting for behavioural complexities involved in the use of a male-limited breeding display (song) for assessing parameters to describe an entire population.

Attention: SC, R

To finalise the Southeast Indian Ocean blue whale pre-assessment, the Committee **recommends** *that the Australian photo-ID dataset be reconciled with location and time metadata urgently, and mark recapture analyses conducted.*

The Committee also **agrees** *that the abundance trend analysis for southeast Pacific blue whales conducted by McCauley et al. (2018) be reviewed by the ASI working group, with acousticians included in that discussion.*

8.2.1.3 Southwest Pacific Ocean Blue Whales

In 2018, the Committee received a mark-recapture based estimate of southwest Pacific blue whale abundance (Barlow *et al.*, 2018). In 2019, the ASI Working Group cautioned that the abundance estimate might only represent whales using the South Taranaki Bight region and recommended further exploration and modification of the models used in the analysis (Item 2.1.3; IWC, 2020j).

Attention: SC, CG, R
To complete pre-assessment of the Southwest Pacific blue whale population, the Committee **reiterates** *that it* **strongly encourages:**

(1) *further work to update the abundance estimate of blue whales in New Zealand (Barlow et al., 2018) and presentation of an updated estimate to SC68C;*
(2) *New Zealand photo-ID catalogue holders to submit images to the Southern Hemisphere Blue Whale Catalogue (IWC, 2019c, p.21) and that catalogue submissions, matching and quality coding of the SHBWC dataset for New Zealand are finalised intersessionally; and*
(3) *these data are used to provide an abundance estimate to SC68C spanning the widest possible area over which data have been collected.*

8.2.1.4 Southwest Indian Ocean Blue Whales

Blue whales in the southwest Indian Ocean are poorly understood with few data available on their movements and abundance (including photo-ID and genetic data).

SC/68B/SH/08 summarised seasonal song patterns from acoustic monitoring off northwest Madagascar, southwest Indian Ocean (SWIO). Pygmy blue whale song detection was bimodal, peaking in activity during May-July and October-January, suggesting the area represents a migratory corridor between winter breeding and summer feeding habitats north and south of Madagascar, respectively. Central Indian Ocean blue whale song-type (CIO, *aka* Sri Lanka song), and a blue whale song-type attributed to the northwest Indian Ocean (NWIO) population (Oman song-type described by Cerchio *et al.* (2020) were detected for short periods between January and May. Winter breeding habitat for the SWIO blue whales is hypothesised to be the equatorial region off Kenya to the Seychelles. This is based on the timing of recent sightings off Kenya being congruent with the migratory timing off NW Madagascar, and the Soviet catches near the Seychelles providing foetal length data which indicate a Southern Hemisphere breeding cycle, in addition to the timing of the catches. Summer habitat is proposed to be the Madagascar Plateau/Ridge based upon Best *et al.* (2003).

The Committee noted that this work addresses a previous IWC recommendation to better understand population movements of pygmy blue whales in the southwest Indian Ocean (item 5.3.3 in IWC, 2017e). These data have also been used to inform the catch allocation models during the Southern Hemisphere blue whale pre-assessment (Item 8.2.1.6).

The Committee discussed the availability of photo-IDs from the Madagascar region, including some from an IDCR-SOWER cruise (Best *et al.*, 2003), and others from Gardline and Committee participants. Work is required to organise the IDCR-SOWER photographs into a catalogue prior to submission.

Attention: SC, G, CG, R
The Committee notes that the distribution and population isolation of blue whales is poorly understood in the northern and western Indian Ocean (IWC, 2019g, p.21). The Committee therefore **encourages** *submission of photos from the southwest Indian Ocean region to the SHBWC. Submissions should include information on the date of collection (to assist in determining the population of origin given their different usage of the area). Once compiled, matching of this photo-ID catalogue with the catalogue being compiled in the NWIO should be a priority activity to assess connectivity. The Committee also* **reiterates** *its strong encouragement for the collection and analysis of available tissue samples for the analysis of genetic population structure in this region to assist with characterising these populations.*

8.2.1.5 Northwest and Central Indian Ocean Blue Whales

Cerchio *et al.* (2020) describes the new 'Oman' blue whale song-type, (hereafter the NWIO song) recorded off Oman, the equatorial central Indian Ocean (Chagos Archipelago) and the SWIO (northwest Madagascar). Spatiotemporal variation at these sites suggests that the main distribution is centred in the northern Indian Ocean/Arabian Sea west of 70°E, with a minor presence in the SWIO. The distribution of this distinct song-type suggests that two pygmy blue whale populations occur in the northern Indian Ocean (the other with the CIO song-type, see Item 8.2.1.4). Intensive Soviet whaling probably took whales from the NWIO population, and the lack of prior detection of this song-type suggests that this may be a small, vulnerable blue whale population.

Given the current acoustic evidence, the Committee agreed that the Oman blue whales should be recognised as a distinct population, and thus 'North Indian Ocean blue whales' need dividing into NWIO and CIO. The methods and results in Cerchio *et al.* (2020) have been used to inform the catch allocation model for NWIO and CIO for the upcoming Comprehensive Assessment (Item 8.2.1). However, the distribution of these two types throughout the Indian Ocean is still poorly understood, with for example few data available from the eastern Arabian Sea and some caution is needed. Genetic data are required to support these acoustic identifications and analysis of genetic population structure including sloughed whale skin and faecal samples (the latter are not subject to CITES restrictions). Concurrent collection of acoustic and genetic data would be of particular value to help establish the relationship between acoustics and population identity more directly.

The Committee **encourages** a project to conduct passive acoustic monitoring off Oman to establish the seasonal presence and distribution of NWIO whales better this work to be conducted, noting that this has financial implications (see Item 8.2.9).

Since there are no abundance and trend data for the NWIO population, a population assessment cannot be conducted. The Committee therefore **strongly encourages** collection of abundance data, either via mark-recapture (genetic or photo-ID) or line transect survey. While acknowledging the small number of sightings in this area, the Committee **encourages** the submission of existing photo-ID data (<10 whales) to the SHBWC. Matching with photo-IDs from Madagascar would also be valuable because of potential spatial overlap, and for possible further confirmation of absence of temporal overlap between this and the SWIO population (see Item 8.2.9).

Attention: SC, CG, G, R, CC

The Committee **reiterates** *that the distribution, population structure and taxonomy of blue whales is poorly understood in the northern and western Indian Ocean (IWC, 2019c, p.21). The Committee* **recommends** *that IWC member and non-member governments and regulatory bodies support scientists in the important research priorities given below and adopt management measures in core areas of habitat for blue whales in the Arabian Sea to ensure the conservation of this poorly understood population. The Committee* **agrees** *the following research priorities:*

(1) *continued photo-identification and increased genetic sampling and analysis of blue whales off Oman and throughout the region;*
(2) *passive acoustic monitoring to determine seasonal presence and if possible, population abundance and trends; and*
(3) *comparison of blue whale photographic catalogues with other blue whale catalogues in Oman, India, Sri Lanka and any others available in the Indian Ocean (and possibly the Antarctic).*

8.2.1.6 Progress Towards Comprehenisve Assessment

In preparation for the Comprehensive Assessment of non-Antarctic Southern Hemisphere blue whales in 2022, the Committee has supported ongoing work compiling the SHBWC to identify re-sightings for capture-recapture analysis of abundance (SC/68B/SH/11). In order to have sufficient time for the Committee to review these abundance estimates, catalogue matching needs to be completed by the 2021 meeting.

The SHBWC is a long-term initiative which has been financially supported by the Committee in order to deliver regional photo-ID based mark-recapture estimates of blue whale abundance. It currently comprises 1,773 blue whales, including 188 identifications added since 2019. Last year (item 3.2 in IWC, 2020c), the Committee agreed to focus catalogue matching within regions and on the southeast Pacific (eastern tropical Pacific, Chile, Peru and Ecuador) and southeast Indian Ocean (Australia, Indonesia and Timor-Leste) catalogues. Photo-ID upload and matching is complete for the southeast Indian Ocean catalogue and nearly complete for the southeast Pacific (SC/68B/PH/02). Additional metadata are required to prepare the southeast Indian Ocean catalogue for mark-recapture analysis. Some additional photo-ID upload is still anticipated for the southwest Pacific (New Zealand) catalogue. Quality coding of photo-IDs within these two catalogues is the next priority before mark-recapture analysis can be conducted. Progress on the migration of this catalogue to IWC servers is almost complete but has been delayed in part by IT personnel changes in the IWC Secretariat. The Committee welcomed the update. Further details are given in Item 8.2.9.

Attention: SC, S

In order to progress the Comprehensive Assessment in this region, the Committee **agrees** *that southeast Indian, southwest and southeast Pacific catalogue data should be matched only up to 2018, with the choice of timespan for each determined once the spread and density of each mark recapture dataset has been reviewed by an Intersessional Correspondence Group, who will review the development of the mark-recapture dataset, the choice of years and regions to include within each dataset, and to advise on the subsequent analysis framework.*

It also **agrees** *that photo-ID matching should continue as high priority via the following intersessional tasks: (i) addition of missing metadata (year/location) where not yet available (June to December this year); (ii) quality coding of regional catalogues (June to September); (iii) finalising any outstanding matching within the southwest and southeast Pacific catalogues (June to December); (iv) construction of mark-resight datasets for left and right sides (January to February); and (v) conducting mark recapture analyses of abundance (February to April). Recognising that a substantial software update would be required in order to continue maintaining the SHBWC, the Committee also* **recommended** *that the Secretariat provide IT support to help resolve the server migration delays and software and computing issues. This work has financial implications for the Committee.*

An assessment is also planned for central Indian Ocean (CIO) blue whales. Photo-ID information from this region has been uploaded to the SHBWC, but substantial work with regional collaborators is required to produce a comprehensive

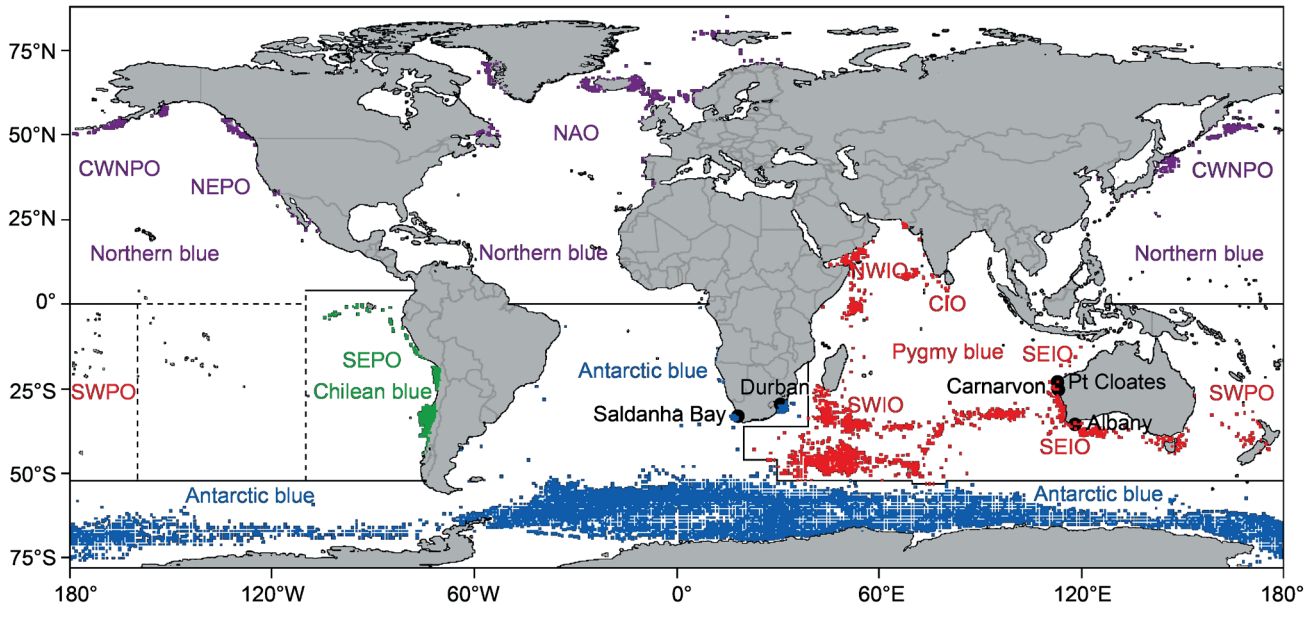

Fig. 3. Global blue whale catches of each of the four generally accepted subspecies (northern blue, Chilean blue, Antarctic blue, and pygmy blue), showing assumed boundaries in black used to enclose the catches of each. Dashed boundaries enclose an area in the South Pacific with no known blue whale data. Individual populations are shown by acronyms for pygmy blue whales: north-west Indian Ocean (NWIO, Oman), central IO (CIO, Sri Lanka), south-west IO (SWIO, Madagascar), south-east IO (SEIO, Australia/Indonesia), south-west Pacific Ocean (SWPO, New Zealand); Chilean blue whales (SEPO); and northern blue whales: north-east PO (NEPO, California/Mexico), central and western north PO (CWNPO, Japan to Gulf of Alaska), north Atlantic Ocean (NAO). Selected land stations are labelled.

CIO photo-ID catalogue (this includes submission of photo-IDs, addition of metadata to existing submissions and, for some contributors, reconciliation of their photographs prior to upload). The Committee therefore acknowledged that mark-recapture data are unlikely to be available for the CIO population within the planned Comprehensive Assessment timeline. Nevertheless, recognising the conservation concerns associated with this population (IWC, 2019c, p.21), further work should be carried out intersessionally to assess the CIO photo-ID catalogue for potential mark-recapture analysis.

Since Southern Hemisphere blue whale songs vary amongst regions (IWC, 2019f), the Committee has supported a web-based Southern Hemisphere blue whale song library (item 3 in IWC, 2020c) to assess blue whale population distribution and structure. which will enable researchers to compare their blue whale acoustic recordings with validated song archetypes. The library is close to completion and should be launched on the IWC website (*https://iwc.int/blue-whale*) in mid-2020.

Work towards a Comprehensive Assessment of non-Antarctic Southern Hemisphere blue whales began in 2017, with initial results presented in 2018 (item 3.1 in IWC, 2019f). The southeast Pacific blue whale population is geographically more distant, and the Committee agreed to assess this population as a single unit (IWC, 2016b). As the other populations include areas of geographic overlap, pre-assessment analyses have focussed on using acoustic data to delineate populations (Širovič *et al.*, 2018) and to assign catches based on acoustic patterns (Branch *et al.*, 2019). Catch estimates for each population were presented in 2019 for the southwest and southeast Indian Ocean, southwest Pacific and northern Indian ocean as a single unit (item 3.2.2 in IWC, 2020c). However recent identification of a second song type in the northern Indian Ocean suggested that this area contains two acoustically distinct populations: the northwest Indian Ocean and central Indian Ocean (Cerchio *et al.*, 2020; IWC, 2019f).

Intersessional work was therefore conducted using acoustic patterns to allocate catches between these two northern Indian Ocean populations (Fig. 3; SC/68B/SH/09). The regional acoustic datasets were expanded, a neural network model was developed in collaboration with Microsoft AI for Earth to detect and identify blue whale songs within the Indian Ocean hydrophone data, and account was taken of song seasonality in the spatial catch allocation model. Catch allocation was also improved via modifications to the model fitting and bootstrapping, to assign catches to the five putative blue whale populations (southwest Pacific SWPO, southeast Indian SEIO, southwest Indian SWIO, northwest Indian NWIO and central Indian CIO). This work is anticipated to be completed by 2021 and the finalised catch series can be used to conduct a Comprehensive Assessments where abundance and trend data are available. Continued development of new methods for rapid analysis of large acoustic datasets is welcomed, with a recommendation to ensure the efficacy and performance of the approach, are well documented via a peer-reviewed paper that quantifies false positive and false negative performance, variation in performance in different ambient noise regimes and acoustic habitats, as well as the speed of the method and the usability of the tool to a diverse group of researchers.

Table 8

Available abundance and trend estimates for Southern Hemisphere non-Antarctic blue whales.

Location	Method	Time-series	Demographic parameters	Citation	Consider for Comprehensive Assessment?
Southeast Pacific					
18°30′-38°S	Line transect survey	1997/98	Abundance: spatial model used to estimate 303 whales (95% CI 176-625)	Williams *et al.* (2011); Williams *et al.* (2017)	Used in 2011 population assessment. Survey spanned broad area north of Gulf of Corcovado, the current main concentration area (item 5.3.1.1 in IWC, 2017d). Remains primary abundance estimate for Comprehensive Assessment unless SHBWC catalogue yields spatially representative abundance estimate.
Northern Gulf of Corcovado 41°45′-42°12′S (includes also Chañaral 26°S but no re-sightings between areas)	Mark recapture analysis	2006-12	Abundance: POPAN super-population estimate for 2012: 762 (95% confidence intervals, CI=638-933) and 570 (95% CI=475-705) for left and right-side datasets respectively	Galletti Vernazzani *et al.* (2017)	No re-sights between Gulf of Corcovado and Chañaral suggests abundance may be area specific (Item 5.3.1.1, (IWC, 2017d). Not likely representative of whole population.
Dataset above	Mark recapture framework including residency/ transience components	2006-12	Abundance: for mid-year of 2008, open population estimate=450 (CV 0.17), closed population estimate=576 (CV 0.16). Uses Cooke *et al.* (2016) model	Appendix 6, IWC (2017d)	Analysis yielded abundance estimates very similar in magnitude to those presented by Galletti Vernazzani *et al.* (2017) but accounts better for differing proportions of residents and transients using the area in each year (item 5.3.1.1 in IWC, 2017d). More optimal mark-recapture modelling approach but not likely to representative of whole population.
Gulf of Corcovado 41-46°S	Line transect surveys	2009, 2012, 2014	Abundance: for 2009 (year with most data available), preferred species distribution model estimate: 373 (95% CI: 191-652)	Bedrinana-Romano *et al.* (2018)	Represents density of animals within region rather than of Chile more broadly. Not likely representative of whole population.
Southwest Pacific					
South Taranaki Bight, New Zealand	Mark recapture analysis	2004-17	Abundance: closed model in multimark (using both right and left side data), estimate: 718 (SD=433, 95% CI 279-1926)	Barlow *et al.* (2018)	ASI review group suggested additional analyses of the data (item 2.1.3 in IWC, 2020j). Request additional analysis and use if SHBWC updated abundance estimate is not available.
Southeast Indian Ocean					
Perth Canyon, Australia	Mark recapture analysis	2000-05	Abundance: best fitting open population model estimate was 791 (95% CI: 569-1,147)	Jenner *et al.* (2008)	Perth Canyon may not be representative if there is substructure between different areas (Item 5.1.3 in IWC, 2009). Use if SHBWC updated abundance estimate is not available.
South of SW Australia	Line transect survey	1993	Abundance: distance-sampling estimate was 671 (CV=0.45, 95% CI 279-1,613)	Kato *et al.* (2007)	Covers only a portion of total habitat 35-45°S, 115-125°E. Mark-recapture estimate likely to be more representative of whole population.
Exmouth, NW Australia (21°30′S)	Acoustic detections	2004	Abundance: based on number of individual whales calling during southward migration from Indonesia to Australia: 1,110 with a range of 662-1,559	McCauley and Jenner (2010)	Based on satellite tracking, this location covers most or all SEIO blue whales, but many assumptions involved in converting calls to abundance. Better to use mark-recapture estimates.
Portland, South Australia (141.2°E)	Acoustic detections	2004-16	Trend: regression of instantaneous number of singers through time yielded 4.3% ± 6.9%	McCauley *et al.* (2018)	Suggest review of the approach (see Item 8.2.1.2). Encourage re-analysis using approach developed by SORP Acoustic Trends Working Group.
Southwest Indian Ocean					
Madagascar Plateau (25-35°S, 40-45°E)	Line transect survey	1996	Abundance: estimate was 424 (CV=0.42), or 472 (CV=0.48) whales when 'like blue' sightings were included	Best *et al.* (2003)	Yes. Only estimate available. Data collected during December. At this time there are also many animals in NW Madagascar so this is likely an underestimate – it may not reflect peak density. As this is small portion of likely area, perhaps extrapolate to other areas to obtain something more representative? Spatial models from acoustic data may be useful for scaling.
Central Indian Ocean					
Sri Lanka (5°28′N-5°53′N)	Line transect survey	2014-15	Abundance: 270 blue whales (CV=0.09, 95% CI 226-322) within survey area	Priyadarshana *et al.* (2016)	Yes. Only estimate available. Represents a very restricted area and area of high blue whale concentration.

For the populations that overlap spatially, SC/68B/SH/09 proposed to focus on conducting full Comprehensive Assessments of the southeast Indian Ocean and southwest Pacific Ocean populations, and 'minimum-level' assessments of the southwest Indian Ocean and central Indian Ocean (because available abundance data represent minimum values rather than being representative of abundance of the population). At present it is not possible to assess the northwest Indian Ocean as there are no survey or abundance data available; additionally, the range of this population is poorly understood. The Committee **agreed** with this proposal, noting that most abundance estimates are from surveys of small areas within the larger range of each population, and are therefore expected to represent minimum estimates, and not necessarily represent the whole population. The abundance estimates summarised in Table 8 will be reviewed by the WG on ASI to assist with determining suitable inputs for the Comprehensive Assessment. Recognising the importance of the catch allocation process for conducting regional blue whale population assessments, further work should be conducted to finalise catch allocations and trial preliminary population assessment models in order to determine appropriate models for the Comprehensive Assessment. This has financial implications for the Scientific Committee (see Item 8.2.9).

Attention: SC, G
To complete pre-assessments of Southern Hemisphere pygmy and southeast Pacific blue whales, the Committee **agrees**:

(1) *that development of the Southern Hemisphere Blue Whale Catalogue continue, with a priority focus on: (i) finalisation of photo-ID matching within the southeast Pacific; (ii) addition of southeast Indian Ocean (Australian) metadata to associate photo-IDs with sighting date and location; (iii) quality control of southwest Pacific, southeast Pacific and southeast Indian Ocean photographs to finalise datasets for mark recapture analysis and estimation of regional blue whale abundance; (iv) assessment of the suitability of the central Indian Ocean blue whale dataset for mark recapture analysis; and (v) review and compilation of photo-ID data from Madagascar within the SHBWC; and*
(2) *with the finalisation of regional catch scenarios and the construction of preliminary population assessment models for pygmy and southeast Pacific blue whales, to proceed to a Comprehensive Assessment of these populations.*

8.2.2 Antarctic blue whales (SH)

The Committee is preparing for a new *In-Depth Assessment* of Antarctic blue whales; the last assessment (Branch, 2008) concluded that, whilst increasing, Antarctic blue whales were at only 0.9% (95% Probability Intervals 0.7-1.0%) of their pre-exploitation level (IWC, 2009, p.237). In 2019, the Committee developed a four-year timeframe for the *In-Depth Assessment*, due to conclude in 2023 (IWC, 2020c). In 2020, the Committee received updates on blue whale population structuring and information on biological parameters which can inform the *In-Depth Assessment*.

The Committee were informed that multiple recent Antarctic voyages have conducted concurrent sighting and passive acoustic surveys of Antarctic blue whales (SC/68B/CMP/22; Double *et al.*, 2015; Jackson *et al.*, 2018; Miller *et al.*, 2014; 2017; 2019; Olson *et al.*, 2013). The data from those voyages can be used to test and/or quantify the relationship between singing-rate and local male abundance. Such information would greatly assist in interpretation of long-term high latitude acoustic trends. Furthermore, voyages in 2013, 2015 and 2019 also contained focal follows of Antarctic blue whales. Analysis of these tracks will allow for testing/quantifying the relationship between whale acoustic behaviour and visually observed behaviours. Concurrent collection of biopsies and acoustic recordings during these voyages may also help to test the links between acoustic and genetic population identity. This is relevant since acoustics are being used as a proxy for the population identity of non-Antarctic blue whales (IWC, 2019f).

SC/68B/ASI/17 reported the results of 2019/20 JASS-A dedicated sighting survey program, conducted in the western part of Area III (000°-015°E; south of 60°S). The total searching distance was 1,447.9 n.miles during which 19 schools (20 individuals) of Antarctic blue whales were observed. A total of 20 individuals was photographed and 10 biopsy samples (individuals) was collected. The data will be analysed for abundance estimates and stock structure studies at the Institute of Cetacean Research.

The Committee were informed about a cetacean survey in waters around sub-Antarctic islands between about 53-55°S and 35-39°W in January and February 2020. The survey focussed on southern right whales (see Item 9.1.2) but which opportunistically collected other whale sightings during 1,147 n.miles of visual transect (SC/68B/CMP/22). During 23 survey days blue whales were encountered 38 times (~59 individuals), with 25 photo-IDs and 9 biopsies collected. This unprecedented number of sightings of blue whales suggests that these waters are becoming an important summer feeding ground for this species again.

The Committee were also informed that an annotated library of underwater acoustic recordings for testing and training automated algorithms for detecting Southern Ocean Antarctic blue and fin whales was now complete (SC/68B/SH/05).

The Committee welcomed these updates and encouraged the continuation of these surveys to understand blue whale occurrence, density, population identity and movements better.

8.2.2.1 Population Structure

To progress preparation for assessment, in 2019 the Committee requested a review of Antarctic blue whale population structuring to determine whether they should be assessed as a single entity, or as multiple population units. This review considered available genetic, acoustic, photo-ID, satellite tagging, sightings, catch and Discovery Mark data (SC/68B/SH/03), concluding that there is not currently conclusive evidence that breeding population structure exists within the Antarctic blue whale subspecies, and highlighting that small sample sizes in some areas (e.g. Antarctic Areas I, II and VI, see Sremba *et al.*, 2018) also limit the power to detect structure even if it were present. Noting that a new single nucleotide polymorphism (SNP)-based analysis of circumpolar population structure is underway (Bell, 2018, p.21), the Committee suggested that redundancy analysis using nuclear genotypes as the response variable and mitochondrial DNA (mtDNA), stable isotopes, skin microbiome data or possibly acoustics as explanatory variables could be a useful means of exploring these data for evidence of breeding ground population structure. The Committee invited updates on these topics at the 2021 meeting.

Genetic evidence shows that pygmy blue whales are present at high latitudes in Antarctic Area III (Attard *et al.*, 2012); this information may need to be factored into the In-Depth assessment. Catch allocations for Antarctic blue whales should be correct as they are assigned using length data and ovarian corpora (Branch *et al.*, 2007; 2009), but abundance estimates might include a small proportion of non-Antarctic blue whales particularly in Area III. Attard *et al.* (2012) reported genetic evidence of both hybrids (suggesting shared wintering areas) and migrant individuals in Antarctic Area III using a comparison of Antarctic blue whales and southeast Indian Ocean (Australian) blue whales. However non-Antarctic blue whales using Antarctic Area III are likely to be from the southwest Indian Ocean population, also associated with a feeding area off Madagascar (Best *et al.*, 2003). IDCR-SOWER samples from the Madagascar plateau have been analysed (LeDuc *et al.*, 2007) and an additional sample collected recently. Comparison of these southwest Indian Ocean samples with Antarctic samples using multiple nuclear genotypes (e.g. via the upcoming circumpolar SNP study, or further investigation of the dataset analysed by LeDuc *et al.*, 2017) would be useful to investigate evidence of non-Antarctic blue whale migration into the Southern Ocean and hybridisation rates with Antarctic blue whales. Additional genetic samples from the northern Indian Ocean will also be important in establishing the genetic identity of blue whales in the region and possible movements into the Southern Ocean (see Item 8.2.1.5). In discussion, the Committee also agreed that intersessional review of all photo-IDs collected in Antarctic Area III is required; morphologically, non-Antarctic blue whales appear to have heavier lesion loads, and differences in proportion can also be seen if the tail stock has been photographed. This review is important because Antarctic blue whale photo-IDs are being used to generate a new abundance estimate for the assessment, so exclusion of possible non-Antarctic blue whales would be valuable in this process.

Antarctic blue whales show significant differentiation in mtDNA between some IWC management areas (SC/68B/SH/03, Sremba *et al.*, 2012). Current patterns suggest that Antarctic blue whales range widely across the Southern Ocean in the summer, and there are few if any data available from most high-latitude oceanic areas to evaluate fidelity to wintering grounds. No wintering ground data are available to inform abundance, trend or population identity, so even if there are distinct population units, they cannot be assessed separately. Similarly, given the poorly defined differentiation of feeding grounds, assessment by regional feeding ground abundance and catch data is unlikely to provide biologically meaningful results. The Committee will therefore proceed with a circumpolar-only In-Depth assessment of Antarctic blue whales.

There is a single song type for Antarctic blue whales (Širovič *et al.*, 2009), with no evidence for the degree of dialectical variation seen among songs of Southern Hemisphere non-Antarctic blue whale populations (McDonald *et al.*, 2006; Širovič *et al.*, 2018). However, it is possible that there are subtle diagnostic differences within songs. To detect these if they occur would require a quantitative comparison of Antarctic blue whale songs from different low-latitude regions using recordings with high signal-to-noise ratios, and most low-latitude data are available from distant animals only (and see Item 8.2.9). Such an analysis must be designed to account for sources of variability and with sample sizes to allow for sufficient statistical power. These data should be combined with other relevant data (e.g. genetics, isotopes) in a redundancy analysis to assess structure.

Combined genetic and stable isotopic analyses to investigate blue whale population structuring are underway separately for: (i) blue whale bone samples from the early whaling period in the Antarctic Peninsula (Area I) and the southwest Atlantic[10] (Area II - see SC/68B/SH/06); and (ii) a large collection of baleen plates from Areas V and VI (IWC, 2019f). SC/68B/SH/06 examined genetic differentiation patterns of 'pre-whaling' Antarctic blue whales (*n*=30 bones) from the southwest Atlantic and the western Antarctic Peninsula (26 mitochondrial, mtDNA, haplotypes) compared to 'post-whaling' Antarctic blue whales (*n*=183 individuals, 52 haplotypes). Patterns showed a significant loss of diversity over time and revealed significant differentiation between early and post-whaling samples across Areas II-VI.

[10]Waters around Antarctic islands between about 53-55°S and 35-39°W.

In discussion, it was noted that additional early whaling material from Norwegian museums may be available. Researchers working on these collections are encouraged to combine datasets and conduct a circumpolar analysis of these data to identify any regional patterns. Historical samples from the early whaling period can be informative about population structure prior to exploitation, the Committee **encouraged** further collection of bone material from this period for such analyses, particularly from high latitude whaling grounds.

Differences in mtDNA frequencies of pre-whaling samples from the island at 54°15'S 36°45'W and post-whaling samples from IDCR/SOWER surveys may be attributed to a circumpolar loss of haplotypes due to a population bottleneck or to local extinction of a population showing some fidelity to that area; these two explanations are not mutually exclusive. The small sample sizes available from Antarctic Areas I and II were also highlighted and it was suggested that: (1) circumpolar studies try to harmonise sample sizes where possible; and (2) the use of nuclear markers (e.g. single nucleotide polymorphisms, SNPs) could improve the power to assess structure. A circumpolar SNP-based analysis of blue whale population structure is underway and presentation of these results in 2021 is encouraged as is further biopsy collection from Areas I and II (e.g. recent collection of *n*=9 contemporary samples in Area II reported in SC/68B/CMP/22, Area I biopsy collection *n*=1 by Bob Pitman).

In 2019, the Committee noted the possibility that southeast Pacific blue whales may also visit that area of the southwest Atlantic, based on a small number of acoustic detections of their song there (Pangerc, 2010). While the detections suggested the caller was a vagrant (it was briefly and faintly detected during winter, in August), genetic analysis of blue whale bones also revealed a mtDNA haplotype identified within both the southeast and northeast Pacific populations (LeDuc *et al.*, 2007; 2017). To examine this further, the Committee had encouraged: (1) matching of photo-IDs between Chile (*n*=478) and the southwest Atlantic; and (2) assessment of length data in catches made near the island at 54°15'S 36°45'W, to estimate the potential proportion of southeast Pacific blue whales in the catch record.

No photo-ID matches were found between these areas (SC/68B/SH/13) but the genetic data suggested only 1-2% non-Antarctic blue whales (LeDuc *et al.*, 2017) so a lack of matching with only 23 photo-IDs is not conclusive. Therefore, any new photo-IDs available from this region (e.g. SC/68B/CMP/22) should be recorded within the catalogue and reviewed for Antarctic blue whale morphological indicators for any future matching effort with lower-latitude catalogues.

SC/68B/SH/16 reported a mixture model analysis of the lengths of sexually mature female blue whales, conducted using southwest Atlantic catch data from the island at 54°15'S 36°45'W from 1923/24 onwards (earlier estimates were considered to be unreliable) and found that around 3.3% (95% CI 1.6-5.1%) of catches were southeast Pacific blue whales although if the analysis took into account rounding in reported lengths, estimates were not statistically different from zero (mean 0.6%, 95% CI 0.0-2.6%).

In discussion, it was noted that the although the southeast Pacific haplotype was found in the southwest Atlantic bones, whole mitogenome sequencing of those bones showed other genetic differences (Sremba *et al.*, 2018), so may not necessarily be southeast Pacific in origin. Some Antarctic and southeast Pacific haplotypes are genetically similar (LeDuc *et al.*, 2007). Thus this sample may represent:

(1) an Antarctic blue whale haplotype not yet detected due to low levels of genetic survey of this subspecies (or loss of haplotypes during the whaling period); or
(2) a hybrid (Attard *et al.*, 2012) with a southeast Pacific mtDNA haplotype but nuclear profile shared with Antarctic blue whales.

Further sequencing of more nuclear markers for comparison between the Antarctic and southeast Pacific region, to distinguish whales in the two areas and better establish the population identity of this bone is encouraged and genomic sequencing is underway for the southwest Atlantic bone to address this question.

The Committee noted that while acoustic, catch, and genetic data suggest it is most likely that southeast Pacific blue whales are occasional vagrants in the southwest Atlantic, a geographic overlap cannot be fully excluded. However, the historical evidence suggests southeast Pacific blue whales did not commonly occur there during the early whaling period, and the Committee **agreed** that the base case catch allocation for the upcoming assessment should assign all catches from the area around the island at 54°15'S 36°45'W to Antarctic blue whales.

Blue whales are flexible in their seasonal distributions, which are particularly associated with areas of high productivity. The available photo-ID data do not support a Chilean blue whale presence in the southwest Atlantic but lack power; acoustic monitoring may provide greater power to identify any contemporary overlap. Further acoustic monitoring in the Scotia Arc to characterise blue whale seasonal patterns, particularly during winter, is encouraged as is nuclear genome-wide analysis of the southwest Atlantic blue whale bone containing the southeast Pacific haplotype (Sremba *et al.*, 2018), to better identify population origin. An isotope analysis of the southwest Atlantic and the Antarctic Peninsula blue whale bones is underway that may inform population structure analysis further. These data could also be compared with contemporary isotopic data from the Southeast Pacific area, with appropriate correction for the difference in time and source material.

Attention: SC, G, CG

The Committee **encourages**: *(i) further collection of biopsy samples from Antarctic blue whales in order to resolve population structuring better, particularly in under-sampled Antarctic areas; (ii) continued collection and analysis of bone and baleen from historical Antarctic commercial whaling samples and sites to evaluate loss of genetic diversity and shifts in population structure; (iii) circumpolar analysis of stable isotope data from bone and baleen to assess evidence for population structuring; (iv) genomic sequencing of the southwest Atlantic blue whale bone that contains a southeast Pacific blue whale haplotype, to establish its population identity; and (v) a review of Antarctic blue whale photo-IDs to identify any whales that visually resemble non-Antarctic types.*

To highlight the importance of integrated analyses using multiple lines of evidence to detect subtle structure, the Committee **strongly encourages** *combined analyses of genetic, isotopic, acoustic and other data types to establish if there is any evidence for breeding population structure in Antarctic blue whales.*

The Committee **encourages** *year-round acoustic data collection from the Scotia Arc in order to assess seasonal blue whale occurrence.*

8.2.2.2 Wintering Grounds

Antarctic blue whale wintering grounds are poorly known but acoustic records suggest a widespread presence at lower latitudes of the Southern Hemisphere (Širovič *et al.*, 2018). Many offshore acoustic recorders are placed in Sound Fixing and Ranging (SOFAR) ocean channels, which facilitate sound propagation over great distances and consequently can result in detection of very distant calls. The months shown indicate peak presence, and times when Antarctic blue whales are likely within 200km of the recording location (Fig. 4).

SC/68B/SH/08 reported the acoustic detection of Antarctic blue whale song in the northern Mozambique Channel off northwest Madagascar. During 28 months of monitoring, song was detected consistently (sometimes several individuals) during the Austral late autumn/early winter, with a yearly unimodal peak between May and September; the high signal-to-noise ratio suggested a distribution relatively near to the coast. The region may thus represent wintering breeding habitat and be near the northern extent of the wintering range, probably for whales coming from Antarctic Area III.

Other potential Antarctic blue whale wintering grounds include the greater Galápagos region (acoustic detections, Stafford *et al.,* 2004), offshore South Africa, Namibia and Angola based (historical catches, Best, 1994), the Lau Basin off Tonga and Samoa (Balcazar *et al.*, 2017) and recent sighting reports from Brazil (Fábio Daura Jorge, pers comm.; Rocha *et al.* (2019). Most locations are sufficiently remote to make surveys logistically challenging, and in some areas (e.g. Galápagos, southwest Pacific region) a predominance of southeast Pacific or pygmy blue whales at the same time may make visual identification more difficult.

The Committee also discussed the potential value of environmental DNA (eDNA) sampling to improve understanding of blue whale presence patterns (i.e. collection and genetic analysis of water samples); eDNA can yield mitochondrial DNA (mtDNA) control region fragments of sufficient length (~360bp; Baker, unpublished data) to allow Antarctic and non-Antarctic blue whales to be differentiated with some degree of confidence based on haplotype frequencies (LeDuc *et al.*, 2007; Sremba *et al.*, 2012). However, specific non-Antarctic blue whale populations would be hard to distinguish in some

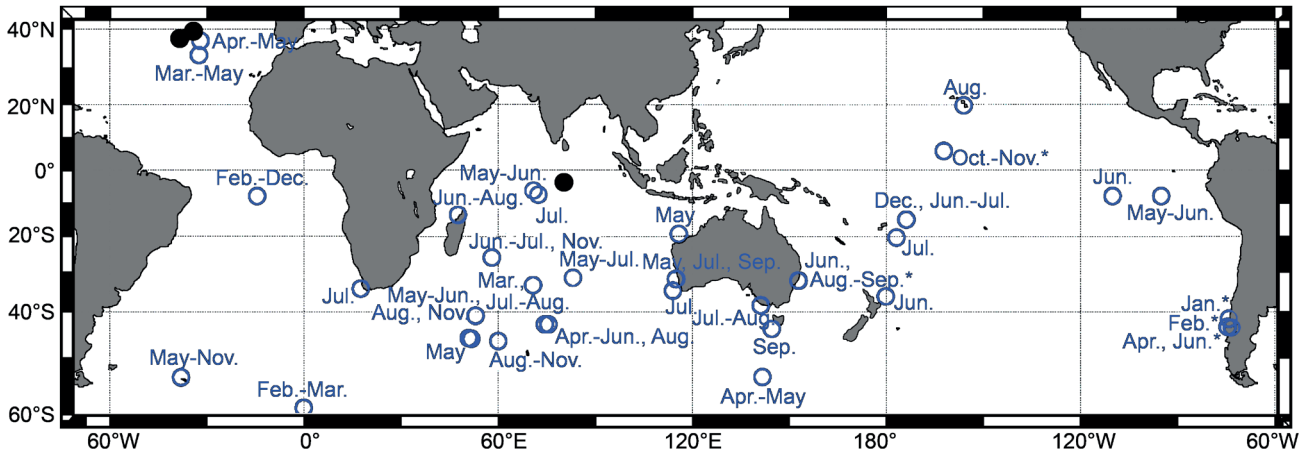

Fig. 4. Locations of Antarctic blue whale songs reported between 40°N and 60°S are marked with blue circles. Months included for each site indicate peak months of detection. In most cases year-round recordings were available. If three or more months of recording were missing per year, those peak months are marked with an asterix. A black dot marks location where full year of recording exists and no Antarctic blue whale songs were recorded. [Reproduced from Širovič *et al.*, 2018).

areas (e.g. in the Indian Ocean) because data to genetically identify populations are lacking and levels of differentiation between neighbouring populations are likely low (Barlow *et al.*, 2018). While eDNA samplers can be attached to acoustic moorings and programmed to collect samples, whales usually have to be very close for genetic detections to be made and an understanding of local oceanography is important as water mass movements have a strong influence on eDNA detection patterns (Pinfield *et al.*, 2019). There is some evidence that eDNA yields may be affected by water temperature, and that this approach may be more successful in cold waters where DNA degradation is less (Cowart *et al.*, 2017; Harrison *et al.*, 2019; Strickler *et al.*, 2015). A direct comparison of eDNA and acoustic detections is underway for northeast Pacific whales, and a similar study is underway for Omura's whales.

Attention: SC, R
Given the significant data gaps in current understanding of Antarctic blue whale wintering grounds, the Committee **strongly encourages** *further research to identify and characterise these lower-latitude wintering grounds, noting that they were likely to be associated with areas of elevated oceanic productivity, including:*

(1) *vessel surveys off northwest Madagascar to collect photo-ID and genetic samples from the whales wintering in these waters (acoustic data suggest this is feasible) for comparison with similar datasets available from Antarctic Area III (e.g. SC/68B/PH/04; Sremba et al., 2012);*
(2) *better characterisation of Antarctic blue whale temporal density and distribution patterns off the west and south coast of South Africa (which may also provide useful occurrence information on other species such as Bryde's whales); and*
(3) *efforts to collect and analyse eDNA samples.*

8.2.2.3 Abundance and Trends

In 2019, the Committee had strongly encouraged further work to update the abundance estimate for Antarctic blue whales derived by photo-ID matching of images submitted to the Antarctic blue whale catalogue. An update on matching of newly acquired images within this catalogue (SC/68B/PH/04) is discussed under Item 20.2.5. No new abundance estimate was presented, but one will be forthcoming in 2021.

The IWC-SORP Acoustic Trends Working Group aims to deliver a robust regional estimate of trends in Antarctic blue whale song density to the Committee in 2021, and a circumpolar estimate of Antarctic blue whale trends by 2022 (SC/68B/SH/04). Currently the Group is: (1) working towards improving coverage of circumpolar acoustic recordings of blue (and fin) whales; (2) standardising analysis methods to move beyond regional analyses and towards circumpolar analyses (see project reports in SC/68B/SH/05); and (3) developing a robust method for measuring long-term, regional and circumpolar trends in male song abundance.

Attention: SC, R
In order to conduct a new In-Depth Assessment of Antarctic blue whales within the next four years, the Committee **reiterates** *(IWC, 2019c, p.22) that it* **strongly encourages** *further work to update the abundance estimate and trend estimates for Antarctic blue whales from mark-recapture analyses and acoustic data.*

The Committee **strongly encourages** *the provision of acoustically derived circumpolar trend data for Antarctic blue whales.*

8.2.2.4 Progress Towards *In-Depth Assessment*

Extensive sex data from blue whales (21,542 foetuses and 311,901 postnatal individuals) were used in SC/68B/SH/01 to calculate patterns in the sex ratio across sub-species, time, space, age and length. Both data types showed a slight but significant male skew. Historically, Antarctic catches shifted from slight male-dominance before 1951 (52.4% male) to slight female-dominance thereafter (48.0% male), even though females are larger and were hence preferentially selected by whalers. Overall, blue whale sex ratios were very close to equality across time, space, and length; deviations from equality were explained best by the larger sizes attained by females, together with size selectivity in whaling due to economics and regulations.

The Committee noted that these patterns suggest that *In-Depth Assessment* models of Antarctic blue whales do not need to model sexes separately and therefore agreed that the Antarctic blue whale *In-Depth Assessment* should be conducted using sex-aggregated models.

Attention: SC, R
The Committee **agrees** *that the In-Depth Assessment of Antarctic blue whales should focus on a single circumpolar population, using sex-aggregated models, with all the catches from the island at 54°15'S 36°45'W assumed to comprise Antarctic blue whales.*

8.2.3 Southern right whales not the subject of CMPs (SH)

In 2016, the Committee agreed to start the process of gathering pre-assessment information (e.g. population structure, abundance, trend, catches) in order to conduct regional *In-Depth Assessment*s of southern right whales (item 10.8.1.5 in IWC, 2017e). This year, new information was received on regional population abundance, trends and population demography.

8.2.3.1 South Africa

The Committee welcomed the results of the 2019 survey of southern right whales flown along the coast of South Africa, part of an uninterrupted, long-term monitoring programme since 1979 (SC/68B/SH/02). It recorded the second lowest number of cow-calf pairs (*n*=94) along the South African coastline in October since 1995, in contrast to the record numbers (*n*=536) seen during the 2018 survey. For the third consecutive year, data indicated a clear shift in peak presence of cow-calf pairs to earlier in the year. Photo-ID data again indicated high levels (20%) of females with 5-year calving intervals in 2019. The second lowest number of unaccompanied adults since the commencement of the aerial surveys was also recorded.

Analyses based on a refined demographic model for South African southern right whales (including data up to 2019) will provide updated estimates of demographic parameters and is now nearing completion (SC/68B/SH/15). An assessment of South African population dynamics in relation to foraging ecology based on stable isotope data and habitat modelling is also underway (SC/68B/SH/15) and the Committee looks forward to an update at the 2021 meeting.

Attention: SC, CG, R

The Committee **reiterates** *(IWC, 2019c, p.27) the value of and its* **strong support** *for the South African long-term right whale monitoring programme to understand right whale population trends and dynamics and* **recommends** *that this monitoring continue. In addition, the Committee:*

(1) **encourages** *early planning for the upcoming season to take account of potential COVID-19 lockdown measures and identify ways to conduct the 2020 aerial surveys safely so as to avoid interruption of this crucial long-term programme;*

and reiterates that it:

(2) **encourages** *further work to understand and assess the impact of climate drivers underlying South African southern right whale population dynamics including calf productivity; and*
(3) **recommends** *further development of the South African southern right whale population dynamics model in order to provide a good representation of the underlying population dynamics.*

8.2.3.2 Australia

The Committee welcomed an update on two projects funded by Australia's National Environmental Science Programme (SC/68B/SH/15). The first is an initiative to collate photo-ID catalogues collected across Australia (southwest and southeast calving grounds) into the Australasian Right Whale Photo Identification Catalogue (ARWPIC), so as to assess regional abundance and population connectivity patterns. Most catalogues have been collated but further funds are needed for some outstanding datasets (including from a major aggregation area at Head of Bight that is ~40% outstanding), and to collate data on small or emerging calving grounds in southwestern Australia and historical surveys.

The second project is the long-term aerial survey in southwest Australia, led by the Western Australian Museum (1975-current), which provides information on regional abundance trends. An aerial survey of the 'Western' subpopulation was successfully conducted over six days in August 2019, adding to the annual, long-term survey data set started in 1993 by John Bannister. Current funding allows for another survey planned for August 2020; funding beyond 2020 is currently uncertain. The 2019 survey recorded 221 cow/calf pairs and a total count of 557 right whales. Due to considerable annual variation in whale numbers and cycles in population growth, reliable estimates of long-term changes in abundance, fecundity and survival require a long-term data series. Continued annual surveys will also strengthen capacity to identify ongoing and emerging threats that may impede recovery of this population. The Committee invited a full report on these surveys for the 2021 meeting.

The Committee also welcomed an update on long-term southern right whale cliff-based research at the major aggregation area at the Head of the Great Australian Bight, South Australia (1991-current) which assesses relative abundance, distribution, health and life histories. The 2019 survey spanned 21 days (15 July-31 August). Overall, high inter-annual variation was evident with 2019 representing the smallest cohort of breeding females visiting the site. The major Head of the Bight calving ground appears to have reached saturation capacity based on maximum packing density, and immigration and emigration to and from the site (Charlton *et al.*, 2019), leading to increased abundance at small and emerging calving grounds (Charlton *et al.*, 2019). An increase in 4 and 5-year calving intervals has been observed in recent years. Modelling of calving intervals and assessment of links to climate variables is needed to better understand drivers of these recovery patterns. Population modelling is underway using models developed for southern right whales in South Africa by Brandão *et al.* (2018). The Committee looks forward to an update at SC68C.

Assessments of health and body condition (through photogrammetry and visual health assessment) in relation to reproductive patterns are underway in Australia, following Christiansen *et al.* (2018). Further information is given under Item 8.2.3.5 and the Committee looks forward to an update at SC68C.

The southeast Australian right whale population differs genetically from the south and western Australia population (Carroll *et al.*, 2011), and, as it is much smaller (*ca* 68 breeding females; Stamation *et al.*, 2020) probably more vulnerable to anthropogenic threats. Consequently, the Committee welcomed news that new population abundance and trend estimates for the southeast of Australia has been developed by Stamation *et al.* (2020). Noting that insufficient time was available to review this information during the 2020 meeting, an intersessional review of this abundance estimate will be undertaken by the Working Group on ASI. An assessment of calving intervals, site fidelity and long-range movements in southeast Australia is being finalised and will be presented at SC68C.

Attention: SC, G, CC, CG

The Committee **reiterates** *(IWC, 2019c, p.27) its* **strong support** *for the Australian systematic long-term right whale monitoring programmes, to understand right whale population trends and dynamics, and* **recommends** *that this monitoring continue. The Committee also* **encourages**:

(1) *the ongoing work to establish levels of population connectivity between the two Australian calving grounds and to estimate regional abundance and* **recommends** *that Australian catalogues be combined into a single database in order to achieve this;*
(2) *further work to model population demography across Australia and to investigate potential links between the increase in calving intervals, health and climate; and*
(3) *the collection of biopsy samples and systematic aerial survey data from the small southeastern population to complement the long-term dataset from southwestern Australia to significantly enhance understanding of population trends, habitat use and constraints to recovery, thereby improving conservation and management.*

8.2.3.3 New Zealand

A summary of ongoing work on aerial photogrammetry, estimates of demographic parameters and genetic monitoring for New Zealand southern right whales (SC/68B/SH/15) was received and detailed reports are anticipated at the 2021 meeting.

Fieldwork planned in the sub-Antarctic Auckland Islands (austral winters 2020 and 2021) includes: (1) satellite tagging to understand habitat use; (2) photogrammetry to assess whale health; (3) collection of biopsies for stable isotope analysis and genetic sexing; (4) collection of individual life-history data to facilitate assessment of linkages between health, reproduction and climate; and (5) continued genetic monitoring of the population in order to develop mark recapture based abundance and growth rate estimates for the New Zealand population using close-kin methods.

The Committee welcomed this update, noting the strong links between the planned research and IWC-SORP Theme 6 priorities (Item 8.2.3.5) and **endorsed** the Auckland Islands research plan.

8.2.3.4 Feeding Grounds

Updates on southern right whale habitat use in their southwest Atlantic feeding grounds (SC/68B/CMP/19 and SC/68B/CMP/22) are discussed under Item 9.1.2 and new information on migratory routes is given in SC/68B/SH/04. The Committee was also advised of opportunistic (but nevertheless systematic) sightings surveys, led by the Alfred Wegener Institute, Germany, aboard *RV Polarstern* during which southern right whales were occasionally recorded in the southwest Atlantic.

The intersessional southern right whale IWC-SORP Workshop (SC/68B/SH/07) proposed that opportunities for assessing southern right whale distribution, using the Southern Ocean hydrophone network (SOHN) and Australian Ocean Data Network - Integrated Marine Observing System, should be investigated with high priority. In this regard, it was noted that Australia's Integrated Marine Observing System (IMOS) includes acoustic observations on the southern continental shelf edge of Australia and that these data have been analysed to assess presence/seasonality of whales including blue (McCauley *et al.*, 2018) and fin whales (Aulich *et al.*, 2019). Although southern right whale detections are rarely made via the SOHN in the high latitudes of the South Atlantic, some detections may have been made via this network close to Elephant Island. Further analysis of acoustic data collected in the area (including IWC-SORP voyage data collected by Argentina) is required. An Intersessional Correspondence Group was formed to progress this topic intersessionally (Item 8.2.9, and see Annex K) including encouraging communication between: (i) the IWC-SORP right whale theme members; (ii) Committee participants interested in this topic; and (iii) the IWC-SORP Acoustic Trends Working Group, to assess what southern right whale call data exists offshore and at high latitudes (including both IMOS and SOHN data) and to consider an appropriate analysis framework for using these data to assess southern right whale offshore distribution.

8.2.3.5 Progress Towards an *In-Depth Assessment*

SC/68B/PH/03 reports on the development of artificial intelligence (AI) tools to assist the automated matching of right whale photo-IDs. Auto analysis of overhead images is now implemented within the online platform Flukebook[11], and analysis of side-on images is under development. Matching between overhead and side-on images has not yet been developed. Multiple southern right whale photo-ID catalogues have been analysed within this framework and this is encouraged (and see Item 20.2.1).

In 2019 (IWC, 2020a, p.28, item 9.2.4.5), the Committee funded the matching of photo-IDs from Brazil and Argentina to progress the pre-assessment of southwest Atlantic right whales. This completed work (SC/68B/CMP/20) is discussed under Item 9.1.2. Within the Brazilian catalogue, around 14% of whales were matched to the Argentine catalogue up to 2017, a similar level to previous matching exercises extending to 2010 (see table 1 in SC/68B/CMP/20).

The Committee noted the importance of this matching effort towards a better understanding of connectivity and recent growth in the southwest Atlantic right whale calving grounds and encouraged 'multi-state' mark-recapture modelling to estimate movement rates between Argentina and Brazil compared to re-sight rates within regions.

The Committee also expressed continued support for a multi-ocean, collaborative initiative that is underway to integrate up to 50 years of southern right whale demographic data from all the calving grounds into a common modelling framework. This aims to investigate correlations between southern right whale abundance trends, calving intervals and environmental variables in the Southern Ocean, and assess population trends in parallel (SC/68B/SH/15). The regional populations with long-term photo-ID and genetic databases available to be included are the southwest Atlantic (Brazil/Argentina); southeast Atlantic (South Africa); Australia and New Zealand. The work contributes to IWC-SORP Theme 6 (SC/68B/SH/04).

The Committee welcomed the report of an intersessional Workshop held to discuss priority research and recommendations for proceeding with the newly formed IWC-SORP Theme 6 (SC/68B/SH/07). The Workshop objectives were to: (1) generate discussion with experts on tools that could be used to address the IWC-SORP Theme 6 objectives; (2) develop a tool to identify research priorities to achieve the IWC-SORP SRW theme objectives; and (3) form working groups[12] under each of the four objectives to increase communication and outreach within the IWC-SORP community and enhance the network for collaborative research.

The Workshop identified the five high priority tasks, summarised below.

(1) *Data collation/collection*: regions which still show limited or no recovery but were historically considered to be calving or nursery grounds, including Tristan Da Cunha/Gough Island, Namibia, Mozambique/Madagascar, Southeast Australia, Uruguay and Chile-Peru.
(2) *Foraging ecology*: (i) research to identify links to foraging grounds via satellite telemetry, particularly in Brazil, New Zealand, and Australia; (ii) collation of candidate prey datasets to increase the power of stable isotope data to identify prey sources and foraging grounds; and (iii) develop links with high and mid-latitude acoustic networks to better specify whale movements and distribution.
(3) *Demography*: (i) continuation of long-term photo-ID and genetic studies in Australia, Argentina, New Zealand and South Africa that permit linkages between demographics, health and climate; (ii) development of a common model to assess demographics within a comparative, multi-ocean framework - further development of this has been recommended for funding by the IWC-SORP Research Fund (SC/68B/O/01).
(4) *Health*: (i) continued assessment of southern right whale health off Argentina, in light of recent die-offs; (ii) for all wintering grounds, photogrammetry work, collection of biopsies for stable isotope analysis and genetic sexing and collection of individual life-history data to facilitate assessment of linkages between health, reproduction and climate; and (iii) development and funding of stranding, necropsy and pathology testing protocols across all regions.
(5) *Climate*: literature reviews to: (i) assess which demographic parameters or indices could be used as climate response variables based on work in other baleen whales or species with similar niches; and (ii) identify what prey database or collection resources are available, and relevant collaborators.

In relation to the planned demographic analyses (3), the inclusion of epigenetic approaches (see item 5.5 in IWC, 2019f) to measure whale age was suggested. To provide age assignments with sufficient accuracy (e.g. for population demographic models), epigenetic approaches require species-specific calibration, using, for example, a 'test' population where the ages of many whales are known (such as the Gulf of Maine humpback whales; Polanowski *et al.*, 2014). It was noted that epigenetic analyses are underway with samples collected on the Auckland Island calving ground, to inform close-kin mark recapture assessments of abundance.

[11] *https://www.flukebook.org/*.

[12] Three IWC-SORP Working Groups are now active: (i) a circumpolar southern right whale photo-ID consortium, which aims to develop standardised processes and protocols for photo-ID matching and sightings databases, to enable southern right whale photo-ID data to be rendered comparable on a circumpolar level; (ii) the Southern Hemisphere Committee working group through the 'multi-ocean assessment of demographics and links to environmental correlates' (SC/68B/SH/15); and (iii) the right whale necropsy working group, which collates existing necropsy and sample archive protocols for North Atlantic and southern right whales and develops guidelines for conducting necropsies at different levels of local capacity.

The Committee noted that this approach is of greatest value where relative, rather than absolute, age is required. For example, information on age order between related individuals, rather than absolute age, can provide information useful for both close kin and kinship analyses (see item 6.2 in IWC, 2018e). The Committee looked forward to further updates on the development of this method.

Regional health assessments, identified as a high priority during the recent southern right whale Workshop to better understand the links between health, reproduction and climate, are in progress (see Items 8.2.3.2, 8.2.3.3 and 8.2.3.5 and SC/68B/SH/07). In 2019, recognising that health assessments are most effectively conducted in a standardised manner, e.g. Christansen *et al.* (2020), the Committee encouraged development of a global, standardised, IWC-endorsed body condition assessment protocol (IWC, 2020a). An Intersessional Correspondence Group (see Annex K) will provide a report at the 2021 meeting (see Item 8.2.9).

In discussion, the value of collecting southern right whale photo-IDs from high latitude non-calving areas was also highlighted. Opportunistic photo-IDs are regularly collected by national research programmes and tour operators and the Committee encouraged submission of these photo-IDs to platforms such as *http://www.happywhale.com*, so that they can then be shared with low-latitude right whale catalogues for matching.

The catch history Workshop to update regional pre-modern catch estimates for southern right whales and estimate pre-exploitation levels supported by the IWC could not be held in 2020 and work on pre-modern catch estimates will now be progressed via an Intersessional Correspondence Group (Item 8.2.9, and see Annex K).

Attention: SC, G, R

The Committee **endorses** *the priorities identified for the IWC-SORP Theme 6 on southern right whales given in the Workshop report (SC/68B/SH/07), noting in particular the value of the data collection and demography-related activities for informing the upcoming In-Depth Assessments of southern right whales, and the importance of understanding threats via health assessments. The Committee also* **encourages** *further development of the common population dynamic model for discussion at SC68C in 2021.*

As last year (IWC, 2019c, p.28), to progress regional population and health assessments of southern right whales, the Committee **encourages**: *(i) the ongoing development of a common life-history model whose aims include the estimation of demographic parameters and facilitating the investigation commonalities in southern right whale population dynamics on their wintering grounds; and (ii) the development of a global, standardised, IWC-endorsed health assessment protocol to assist a synoptic assessment of southern right whale health across calving grounds.*

8.2.4 North Pacific blue whales (NH)

The Committee is at the pre-assessment stage for blue whales in this large region (the full process is described in IWC, 2019c, pp. 18-19). There are at least two populations of blue whales in the North Pacific, and possibly three, based mainly on song type. The status of the eastern North Pacific population was assessed by the Committee in 2016 as 'almost recovered' (IWC, 2017d). In recent years, the Committee has been evaluating the data available to assess blue whales in the less studied central and western North Pacific. Given the time constraints this year and the existence of an Intersessional Correspondence Group to advance the work, discussion of this topic is postponed until SC68C.

Attention: SC, R

The Committee is continuing its work to assess blue whales in the North Pacific, especially in the central and western areas. The Scientific Committee **agrees** *that this work should continue intersessionally under Branch. The Committee also* **reiterates** *its previous recommendations (IWC, 2020a, p.29) for data and analyses to be reported at the next Annual Meeting.*

8.2.5 North Atlantic sei whales (NH)

The Committee is at the pre-assessment stage for sei whales in this area (the full process is described in IWC, 2019c, pp.18-19). Given the time constraints this year, discussion of this topic is postponed until next year. Information gathering for a future Comprehensive Assessment will continue through the Intersessional Correspondence Group convened by Cholewiak and which will report at SC68C (see Annex K).

Attention: SC

The Committee is advancing its work to ascertain when sufficient information is available to assess sei whales in the North Atlantic. The Committee **agrees** *that the Intersessional Correspondence Group under Cholewiak should continue to review data needs for a Comprehensive Assessment.*

8.2.6 North Atlantic right whales (NH)

In response to the Committee's request (IWC, 2020a), an update was provided by the US National Marine Fisheries Service regarding North Atlantic right whale population status and management initiatives. As reported in SC/68B/NH/05, North Atlantic right whales continue to decline, with a best population estimate of 412 individuals at the start of 2018. Ten calves

were documented in the winter of 2019-20; however, one calf was injured from a vessel strike and is presumed dead. The Unusual Mortality Event declared in 2017 is ongoing; ten deaths were documented between the USA and Canada in 2019. Of particular concern is that females aged 5 years and older are estimated to have lower survival rates than males, and survival rates have declined since 2010. A population viability analysis is being developed to characterise extinction risk based on reduction in human-related mortality by different percentages. It indicates that a large reduction in entanglement-related and vessel-related deaths and serious injuries is necessary to see positive population growth.

With regard to management initiatives (SC/68B/NH/04), the US Atlantic Large Whale Take Reduction Team reached near consensus in 2019 on a suite of measures that are estimated to reduce right whale mortality by up to 60%; these include: (i) measures to reduce vertical buoy lines; and (ii) gear modifications to reduce the breaking strength of line. NOAA Fisheries is currently developing a proposed rule to implement the recommendations of the team, which is expected to be published in summer 2020. NOAA Fisheries continue to review the North Atlantic right whale vessel speed rule, which includes assessments of biological effectiveness, compliance, economic impacts, and navigational safety impacts, as well as the effectiveness of the Dynamic Management Program. The US Northeast and Southeast Implementation Teams convened a meeting in 2019, with the primary objective of providing input on coast-wide priorities for a 5-year action plan under the US Endangered Species Act (ESA) and the new right whale 'Species in the Spotlight' designation. In addition, two Workshops were convened in 2019, one on Health Assessment and the other on Monitoring and Surveillance. Reports from both are forthcoming, and NOAA is working to develop a longer-term science health assessment plan, as well as assess its surveillance effort strategy. A US/Canada Bilateral Working Group continues to meet up to twice yearly, to advance collaboration on research and management topics.

In response to the apparent change in North Atlantic right whale distribution, Canada's Department of Fisheries and Oceans (DFO) has provided significantly more funding and personnel in research and monitoring to protect and support the recovery of this species. SC/68B/NH/02 summarises the monitoring and research initiatives that have been underway for multiple years and are planned to continue in 2020. Efforts include: aerial and vessel surveys, passive acoustic monitoring, underwater noise impact studies, assessment of risk of entanglements in fishing gear and vessel strikes, prey studies, satellite tagging, habitat modelling, and investigations of novel right whale detection technologies. Right whale monitoring and research includes multiple government, university and stakeholder partners across four Atlantic regions.

Palka reported that there are forthcoming updates to the spatio-temporal habitat-based density models produced by Roberts *et al.* (2016). These primarily cover North Atlantic right whales in US waters and existing maps are available online[13]. Eight individuals (both sexes) were observed feeding off the coast of Virginia in April 2018 during aerial and vessel surveys conducted as part of the US Navy Marine Species Monitoring efforts[14]. This area is thought to be a migratory corridor between primary feeding and calving grounds (Cotter, 2019).

The Committee thanks the US and Canada for providing updates about North Atlantic right whales, recognising the intensity, breadth and collaborative nature of efforts underway to study and protect those animals.

Attention: C, CG, G, SC, R, S

The Committee **strongly reiterates***: (1) its* **serious concern** *over the status of right whales in the western North Atlantic, noting that it is probably the only viable population of this species; and (2) that the US and Canada make every effort to reduce human-induced injury and mortality in the population to zero, recognising that two primary threats to North Atlantic right whale recovery are entanglement in fishing gear and vessel strikes.*

Whilst noting that the COVID-19 situation may have unavoidable impacts on population monitoring efforts in 2020, the Committee:

(1) **recognises** *the significant efforts underway in both the USA and Canada to understand North Atlantic right whale status and to mitigate human impacts and* **encourages** *the submission of further updates on these efforts and their outcomes at SC68C in 2021;*
(2) **encourages** *continued US/Canada collaborations to understand the seasonal movement and distribution of North Atlantic right whales and the ecological factors driving these; and*
(3) **requests** *that the IWC Executive Secretary notify the US and Canada of the Committee's willingness to share expertise and to participate in on-going or planned processes to assess North Atlantic right whales and their threats.*

8.2.7 Gulf of Mexico Bryde's whales

The Gulf of Mexico Bryde's whale is a small, isolated population that was listed as an Endangered subspecies of *B. edeni* under the US Endangered Species Act (ESA) in 2019. SC/68B/NH/02 provided an update on US field research, restoration

[13] *https://www.northeastoceandata.org/.*
[14] *https://www.navymarinespeciesmonitoring.us/.*

projects and management advances that occurred during 2019-20. As part of the NOAA RESTORE Science Program study on trophic ecology and habitat use, a research cruise was conducted during the summer of 2019 in the north-eastern Gulf of Mexico. In addition, a variety of passive acoustic studies are ongoing. There are two restoration projects planned in the Gulf of Mexico that have direct bearing on Bryde's whales: the Open Ocean Marine Mammal Vessel Collision Mitigation and the Noise Mitigation projects. Regarding management advances, a draft recovery outline has been developed, NOAA has been conducting ESA Section 7 consultations on several projects, and preparations are underway for two Workshops.

The Committee noted its on-going interest in the outcome of genetic studies on evolutionary relationships and taxonomic status, and Leslie reported that a new phylogenetic study was expected to be available next year. The Committee also discussed Federal protections to these whales related to oil and gas development in the Eastern Gulf of Mexico and the potential expiration of restrictions under the Gulf of Mexico Energy Security Act in 2022.

Attention: SC, CG, R
The Committee **reiterates** *its serious continuing concern (IWC, 2019c, p.26; 2020a, p.31) about the possible impacts of anthropogenic threats on this small and isolated lineage of Bryde's whales in the Gulf of Mexico, numbering approximately 30 animals and thus far known to occur only in US waters. The Committee:*

(1) **welcomes** *the information received from the USA this year and* **encourages** *the USA to provide any new information on population abundance, status and critical habitats at SC68C in 2021, including an update on research on phylogenetics and taxonomic status;*
(2) **emphasises** *the importance of maximising protection for this population, including reducing human-induced injury and mortality to zero, given their precarious status; and*
(3) **encourages** *further updates on legal protections afforded in regard to seismic surveys and other anthropogenic threats - including information on the potential expiration in 2022 of oil and gas lease restrictions in the Eastern Gulf of Mexico under the Gulf of Mexico Energy Security Act (GOMESA).*

8.2.8 Work plan

The Committee continues to prioritise North Pacific blue whales and North Atlantic sei whales for intersessional work to accumulate data for future assessments. The Committee also plans to review any new information on North Atlantic right whales and Gulf of Mexico Bryde's whales in the light of concerns about their population status and recent implementation of protective management efforts. The work plan for these two stocks involves two Intersessional Correspondence Groups under Branch (North Pacific blue whale stock structure) and Cholewiak (North Atlantic sei whale data evaluation) (see Annex K).

8.2.9 Work plan and budget requests for 2020/21

For the work plan see Table 9. For details of Intersessional Correspondence Groups, see Annex K.

8.3 New information and work plan for other northern stocks (NH)

8.3.1 North Atlantic blue whales

No new information was received on this topic.

8.3.2 North Atlantic common minke whales

New information on Unusual Mortality Events (UMEs) is discussed under Item 14.3.2. The common minke whale is one of three species in the western North Atlantic that are currently experiencing unusual levels of mortality[15] - the others (the North Atlantic right whale and the humpback whale) are already being closely scrutinised for potential assessment. For other Northern Hemisphere populations, UMEs may warrant further work to determine possible population effects (the modelling work undertaken as part of the RMP and AWMP work focuses mainly on West Greenland and the Central and north-eastern Atlantic, e.g. see Item 6.1). It is also conceivable that one or more UME warrant changes in assessment priorities.

Attention: SC
The Committee **expresses concern** *about the Unusual Mortality Events affecting North Atlantic common minke right and humpback whales in the western North Atlantic. Information from such events is important for assessments and may have implications for assessment priority. The Committee:*

(1) **encourages** *additional information on the North Atlantic common minke whale UME at SC68C; and*
(2) **agrees** *to form an Intersessional Correspondence Group under Cholewiak to further examine available information on UMEs involving Northern Hemisphere populations and prepare to discuss them in the context of population status and assessments at the next Annual Meeting.*

[15] *https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2020-minke-whale-unusual-mortality-event-along-atlantic-coast.*

Table 9
Proposed work plan for SH: blue and right whales.

Item	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Southern Hemisphere non-Antarctic blue whales (Item 8.2.1)		
Population structure (Item 8.2.1.1)	Compare morphometric blue whale data between northeast and southeast Pacific to assess overall similarity (Branch).	Report
	Compare blue whale genetic data between northeast and southeast Pacific to assess population connectivity (Lang).	Report
Catalogue matching (Item 8.2.1.6)	(i) Finalise photo-ID matching within the southeast Pacific; (ii) add metadata from Australian catalogues to associate photo-IDs with sighting date and location; (iii) quality control southwest, southeast Pacific and southeast Indian Ocean photographs; (iv) assess suitability of central Indian Ocean blue whale dataset for mark recapture analysis; and (v) review and compile photo-ID data from Madagascar within the SHBWC (Galletti and Olson). Funding is required to complete this work.	Report
Catalogue matching (Item 8.2.1.1)	Reconcile Blue Whale Center blue whale catalogue from Chile for intersessional submission to SHBWC (Torres Florez and Hucke Gaete). Funding is required to complete this work.	Report
Acoustic monitoring (Item 8.2.1.5)	Conduct passive acoustic monitoring off Oman in order to characterise the distribution and seasonal movements of the NWIO blue whales (Cerchio). Funding is required to complete this work.	Report
Abundance estimation (Item 8.2.1.6)	Generate population abundance estimate using southwest Pacific Ocean (New Zealand) mark resight data from SHBWC (Jackson).	Report for ASI review at SC69A
	Generate population abundance estimate using southeast Indian Ocean (Australian) mark resight data from SHBWC (Jackson).	Report for ASI review at SC69A
	Generate population abundance estimate using southeast Pacific Ocean (Chilean) mark resight data from SHBWC (Jackson).	Report for ASI review at SC69A
Prepare for in-depth assessment (Item 8.2.1.6)	Finalise regional catch scenarios and construct preliminary population assessment models for southwest and southeast Indian Ocean, southwest Pacific and central Indian Ocean blue whales (Branch). Funding is required to complete this work.	Report
Antarctic blue whales (Item 8.2.2)		
Population structure (Item 8.2.1.1)	Review Antarctic blue whale photographs from Antarctic Area III and SG/GS to identify any that visually resemble non-Antarctic blue whales (Olson).	Add information to SHBWC; report
	Compare frequency and temporal features of Antarctic blue whale song at mid to low latitudes to assess regional variation (Buchan). Funding is required to complete this item.	Report
Acoustic monitoring (Item 8.2.1.2)	Conduct passive acoustic monitoring off the west coast of South Africa and off Durban, in order to characterise the density, distribution and seasonal movements of Antarctic blue whales (Shabangu). Funding is required to complete this item.	Report
Population abundance (Item 8.2.2.3)	Capture recapture modelling work to update Olson *et al.* (2018) (Olson).	Report one month ahead of SC68C for ASI review
Population trend estimation (Item 8.2.2.3)	Provide regional Antarctic blue whale trend estimates using song density patterns (Miller).	Report for ASI review at SC68C
Southern right whales (Item 8.2.3)		
Population structure (Item 8.2.3.5)	Multi-state mark recapture and population dynamic analysis of Brazil-Argentina photo-ID data to assess movement rates between regions (two-year project led by Agrelo including Groch, Rowntree, Sironi, Vilches, Cooke).	Progress report
Population abundance (Item 8.2.3.5)	Population modelling of South African right whale abundance and trend (Brandão, Butterworth)	Report for SH/ASI review at SC68C
	Development of a common model to jointly assess population dynamics of multiple calving grounds (pending availability of IWC-SORP funding) (Butterworth, Brandão, Ross-Gillespie, Cooke).	Report for SH/ASI review at SC68C
Body condition (Item 8.2.3.5)	Develop a protocol to use for conducting body condition and visual health assessments of southern right whales using overhead images (Vermeulen, Christiansen)	Protocol in report, requesting endorsement by IWC at SC68C
Catch records (Item 8.2.3.5)	Right whale catch series discussion to update regional catch estimates from IWC (2013b) (Jackson and Carroll)	Report

8.3.3 East Greenland-Svalbard-Barents Sea (Spitsbergen) bowhead whales

The East Greenland-Svalbard-Barents Sea (Spitsbergen) population of bowhead whales is endangered and poorly understood. SC/68B/NH/03 reported on the acoustic presence of bowhead whales in eastern Fram Strait (78-79°N, 0-7°E). Passive acoustic data recorded in 2012 and 2016/17 revealed that bowhead whales were present from autumn, throughout the winter months (October-February) and occasionally in spring (March-June), supporting the hypothesis that Fram Strait is an important overwintering area. Peak acoustic presence occurred between mid-November and mid-December, coinciding with the presumed mating period of bowhead whales and indicating that Fram Strait may also serve as a mating area. Detailed analyses of recordings for a single year and location revealed eight distinct bowhead whale song types comprising simple songs and call sequences. No bowhead whales were recorded in summer (July-September), indicating

that they either were not vocalising or had migrated to summering areas. In comparison to earlier studies in western Fram Strait, bowhead whale detections were less frequent and the sounds less complex. The observed regional differences may represent the eastern boundary of bowhead whale overwintering.

The Committee welcomes this new information, which complements other recent research in western Fram Strait (e.g. de Boer *et al.*, 2019; Stafford *et al.*, 2018). The Committee encourages further acoustic, sighting and satellite telemetry research to provide a synoptic picture of the year-round seasonal distribution of this population throughout its range.

8.3.4 Work plan

The Committee will continue to receive new information on other Northern Hemisphere stocks that are not subject to directed takes. It will also review information available on Unusual Mortality Events involving Northern Hemisphere populations in relation to population status and potential implications for assessment priorities. The work plan for UMEs involves an Intersessional Correspondence Group under Cholewiak (see Annex K).

8.4 New information for other southern stocks

8.4.1 Southern Hemisphere fin whales

The Committee is currently conducting a pre-assessment of Southern Hemisphere fin whales.

8.4.1.1 Population Structure

To date, genetic evidence received by the Committee does not suggest that fin whale populations are structured within the Southern Hemisphere, (item 4.1 in IWC, 2019f). The Committee was informed that the IWC-SORP Acoustic Trends Working Group (see SC/68B/SH/04) has been working on a coordinated analysis approach to investigate fin whale song characteristics, in an attempt to identify song features that could help distinguish population biogeographic patterns for this species (SC/68B/SH/05). The group has already identified several datasets from across the Southern Ocean (collected during 2010-20) to start this analysis. Additional data sets from lower latitudes in the Southern Hemisphere will be identified in the future (additional details in SC/68B/O/01). When available, pre-2010 data will also be analysed to evaluate persistence of these song features. A fuller update on progress will be presented to the Committee in 2021.

A sample of the *B. physalus patachonica* holotype held at the MACN in Buenos Aires is being sent to Archer for genetic comparison to the current set of Southern Hemisphere fin whale mtDNA sequences. The Committee looks forward to an update on this analysis.

In 2018, the Committee agreed that a review of all Discovery mark data published on fin whales should be conducted, to assess population connectivity patterns (item 4.1 in IWC, 2019f). This review has not yet been provided and was encouraged for the 2021 meeting.

Attention: SC, CG, R, S

Knowledge of population structure is essential to future efforts to assess Southern Hemisphere fin whales. The Committee **reiterates** *its* **recommendations** *from 2018 and 2019 regarding: (i) analysis of fin whale acoustic recordings to assess song variation; (ii) strategic biopsy sampling and analysis to measure fin whale genetic differentiation; and (iii) a review of all Discovery mark data published on fin whales, to assess population connectivity patterns.*

8.4.1.2 Distribution and Abundance

The Committee was informed that data on fin whales have been compiled for a joint analysis of fin whale occurrence along the Western Antarctic Peninsula and the Scotia Sea region, and that analyses are now underway. The Committee **agreed** that this should also include additional fin whale distributional information provided by Japanese Scouting Vessels (Butterworth and Geromont, 1995). In April/May 2019 a dedicated survey for fin whales was conducted around the islands at 54°-55°S, 36°-38'W and those at 56°18'-59°27'S, 26°23'-28°08'W on *RV Polarstern*, contributing additional data to the collection (SC/68B/SH/05).

SC/68B/ASI/17 reported the results of the 2019/20 JASS-A dedicated sighting survey program, which was conducted in the western part of Area III (000°-015°E; south of 60°S). The total searching distance was 1,447 n.miles during which 72 schools (136 individuals) of fin whales were observed. A total of 11 biopsy samples (individuals) was collected and 10 satellite tags were deployed during the entire cruise (see Appendix 2, SC/68B/ASI/17). Data obtained will be analysed for abundance estimate,and stock structure studies at the Institute of Cetacean Research.

SC/68B/SH/08 reported on the low latitude occurrence of baleen whale song off northwest Madagascar at 13.3°S over 28 months, indicating that fin whale song was present yearly during the late austral winter, from early August to mid-September. The timing of fin whale song suggests a later arrival than Antarctic blue whales and a lower rate of occurrence and occupancy in the same region, and potentially indicates the northern extent of breeding habitat.

The Committee was informed about research recently published by the Brazilian Antarctic Program (PROANTAR) on fin whale distribution across the Drake Passage and northern Antarctic Peninsula (Bassoi *et al.*, 2020) and contaminant loads in the Peninsula region (Taniguchi *et al.*, 2019). PROANTAR conducted cetacean surveys off the Antarctic Peninsula from 1997-2019, but funding for this program was discontinued in 2019.

Table 10
Proposed work plan for SH: fin and humpback whales.

Item	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Southern Hemisphere fin whales		
Population structure	Review available published and unpublished Discovery mark data on fin whales (Pastene and Jackson).	Report
Catch densities	Update fin whale catch model to include Soviet catch data (de la Mare).	Report
Population abundance	Abundance estimate using IDCR-SOWER data (Matsuoka).	Report one month ahead of SC68C for ASI review
	Develop common survey protocol to assist comparable future data gathering via IWC-SORP fin whale theme (Herr, Convenor).	Report
Southern Hemisphere humpback whales		
Survey feasibility for Breeding Stock D (west Australia)	Reanalyse pilot study to assess feasibility of future West Australia surveys (Kelly).	Report

A new circumpolar fin whale abundance estimate using IDCR-SOWER data is being finalised. The Committee **agreed** that this should be reviewed by the ASI SWG at the 2021 meeting.

Attention: SC, CG, R
The Committee notes the great value of the fin whale (and other species) data received over the years from the Brazilian Antarctic Program. It **expresses concern** *about the loss of funding for the cetacean programme and* **strongly encourages** *continued work towards the understanding of fin whale population structure, movements and habitat use.*

In order to estimate fin whale abundance for the upcoming assessment, the Committee **reiterates** *(IWC, 2019c, p.23) that it* **encourages**:

(1) *the completion of a new circumpolar fin whale abundance estimate;*
(2) *analysis of fin whale distribution and geographic aggregations using catches; and*
(3) *completion of the meta-analysis of the Antarctic Peninsula and Scotia Sea sightings data, to measure contemporary fin whale distribution and density patterns.*

To maximise the value of fin whale sightings datasets, the Committee also **recommends** *that a sightings survey protocol be developed to assist researchers to collect sightings data in a comparable way across survey platforms.*

8.4.2 Southern Hemisphere humpback whales

An assessment of the Breeding Stocks D (West Australia), E1 (East Australia) and Oceania was completed in 2014 (IWC, 2015b), but there were difficulties in obtaining a reliable estimate of absolute abundance for Breeding Stock D (IWC, 2017e; 2018e). Assessment of the feasibility of a new survey is underway, and a report is anticipated for the 2021 SC meeting.

Attention: SC, G, CG
The Committee **agrees** *that obtaining a reliable estimate of absolute abundance for Breeding Stock D (west Australia) is a priority for any future In-Depth Assessment of humpback whales. The Committee therefore* **reiterates** *(IWC, 2019c) its recommendation that an evaluation of survey feasibility be carried out, with a view to implementing a new survey of this population.*

8.4.3 Work plan for 2020/21

For the work plan see Table 10.

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

Conservation Management Plans (CMPs) are an important conservation initiative of the IWC. They provide a framework for countries within the range of vulnerable cetacean populations to work together, and in collaboration with other relevant stakeholders, to protect and rebuild those populations. 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 addressed stocks that have previously been considered as potential CMPs, recognising the Commission's interest that range states support IWC CMPs.

9.1 Stocks with existing CMPs: new information and progress with previous recommendations

9.1.1 Southeast Pacific Southern right whales (CMP, SH)

The Committee received new information about Southeast (SE) Pacific southern right whales, including advances on the CMP Implementation Strategy during 2019-20. SC/68B/CMP/18 provided updates on the Passive Acoustic Monitoring project, photo-ID matching efforts, new insights into the genetic identity of the population, educational lectures and Workshops, and media outreach programs. The Government of Peru offered to host the third coordination meeting and Workshop exchanging information about experiences with whale watching and research permits. Due to COVID-19 these activities are on hold. The Workshop on whale watching and research permits has been identified as a priority action under the CMP and is discussed in more detail under Item 17.6.

Since 2016, the Committee has been supporting passive acoustic monitoring (PAM) of SE Pacific right whales to identify potential breeding areas along the coast of Chile and Peru, given the small population. Progress made under this project (SC/68B/CMP/12) included successful collection of one year of data from southern Chile. Acoustic monitoring is ongoing off central Chile, but equipment maintenance was not possible in April 2020 due to COVID-19. Therefore, data will stop being collected when the instruments run out of battery power. PAM is expected to start at the third selected location site (Mejillones, in northern Chile) in January 2021. The authors suggest it is critical to continue to collect data at the selected sites along the range of this population's known distribution to better understand its distribution. Between site comparisons are needed to document spatio-temporal patterns of occurrence and possibly generate acoustic-based density estimations. An automatic detector for southern right whale calls is under development and the first southern right whale calls have been documented in December 2019 from the southern Chile site. The performance of the detector requires improvements, which will be made in 2021 by adding more right whale example calls to the call library and by including a humpback whale call detector to avoid call misclassification.

The Commissioner from Peru commended the ongoing efforts by the authors of SC/68B/CMP/12 and highlighted the importance of the protection of this species to both Chile and Peru, exemplified by the Memorandum of Understanding and close collaboration between the two countries. The Commissioner also expressed the need for the Workshop on impacts from whale watching and research, and specifically noted expanding capacity with IMARPE, fisherman, and Government authorities. The Committee expressed strong support for the collaborative efforts between Chile and Peru. Funding is necessary to continue the PAM fieldwork and acoustic data analysis, thus this will have funding implications to the Committee. It was noted that there are upcoming plans to identify Important Marine Mammal Areas (IMMAs) in South America and the Committee highlighted the importance of the work presented and research proposed for SE Pacific right whales that will help inform the IMMA process.

Attention: SC, CC, CG

The Committee **reiterates** *the importance of the CMP for the conservation of the critically endangered SE Pacific right whale population (IWC, 2019c, p.28). The Committee* **welcomes** *the progress made and* **draws attention** *to the need for funding to continue the passive acoustic monitoring study.*

The Committee:

(1) **commends** *the efforts made by Chile and Peru to advance the conservation and management of this population and* **encourages** *the continued coordination between Peru and Chile under the Memorandum of Understanding to protect SE Pacific southern right whales in line with the CMP; and*

(2) **commends** *the scientific work and international cooperation involved in the passive acoustic monitoring project and* **looks forward** *to receiving additional results that could assist in designing future research and providing baseline information on the location of breeding grounds.*

9.1.2 Southwest Atlantic southern right whales (CMP, SH)

The Committee received new information on southwest (SW) Atlantic southern right whales and welcomed an update on progress with CMP actions (SC/68B/CMP/19). A satellite telemetry study was initiated in 2014 (Zerbini *et al.*, 2018). In 2019, a total of 23 satellite tags were deployed on southern right whales in Golfo Nuevo, Península Valdés, Argentina. A new design of transmitters resulted in improvement in tag retention (median duration=164 days). In addition, a new 'blubber-only' tag is under development and first deployments of this design were attempted (median duration 16 days). Tagged whales were followed for a period of 10 weeks post tag implantation to assess effects of both tag designs and the results of this study will be presented in the future. This research continues to provide novel information on movements of southern right whales along the coast of eastern South America and towards their feeding destinations in the western South Atlantic and Antarctic Ocean. Satellite tracks for southern right whales tagged in 2019 in Argentina can be found online[16].

[16] *http://siguiendoballenas.org/en/home/.*

Comparisons between photo-ID catalogues from Brazil (1,021 individuals, period 1987-2019) and Argentina (3,813 individuals, 1971-2017) resulted in 124 matches from 1971 to 2017 (SC/68B/CMP/20). No whales were seen on both the calving grounds within the same year. The proportion of whales in the Brazilian catalogue that was seen off Argentina is 13.8% and the proportion of whales in the Argentine catalogue that was seen off Brazil is 3.25%. In 2019, new individuals (*n*=99) were added to the Brazilian catalogue described in SC/68B/CMP/20. Three aerial surveys conducted off Brazil in each year in 2018 and 2019 documented 408 individuals, including 176 calves (includes possible double counting). A total of 273 different individuals were sighted in September 2018, the highest number of sightings for the species since 1982. In Brazil a total of 13 and 2 right whale strandings were recorded in 2018 and 2019, respectively.

The Committee received new information on aerial surveys conducted to monitor trends in abundance, document distribution, and to collect photo-identification data (SC/68B/CMP/03 and SC/68B/CMP/20). Although the number of whales around Península Valdés tripled from 1999 to 2019, the rate of population growth decreased from approximately 8% in 2007 to 0.61% for the total number of whales and from 7.5% in 2007 to 3.09% for calves. Aerial surveys flown in September 2019 documented 607 sightings (214 calves) and 74 sightings (50 individuals photographed) in Golfo Nuevo and Golfo San José, respectively. More information on the aerial surveys and other research projects in Argentina can be found online[17].

In September 2019, 944 gull attacks were recorded on 206 mother/calf pairs around Península Valdés (84% on calves and 16% on mothers). In 2019, *ca* 1,700 body condition measurements were carried out and the data are being analysed. Measured levels of glucocorticoids (CG) and thyroid hormone T3 in southern right whale calves revealed that the former correlated positively with kelp gull wounding and harassment, while the latter did not. During discussion, an update was provided on a pilot experiment underway for gull management with the aim to determine whether there was a significant difference in frequency of attacks when gulls were culled. It was noted that additional reports of gulls attacking whales have been documented from New Zealand (humpback whales), South Africa (southern right whales) and the Azores (sperm whales).

In 2019, a total of 17 stranded dead whales were recorded around Península Valdés by the Southern Right Whale Health Monitoring Program (SRWHMP), including ten calves (59%), six adults (35%) and one juvenile (6%). The total number of dead calves was similar to those seasons with the lowest mortality (13, 15 and 18 in 2004, 2016 and 2006, respectively). This is significantly lower than the average 55/year occurring over the past decade. However, the six adults represent the highest mortality for this age class recorded around Península Valdés since 2005.

The Committee received information on a 23-day cetacean survey conducted in waters around the Antarctic islands between about 53-55°S and 35-39°W in January/February 2020 (SC/68B/CMP/22). As part of this study, directional acoustics and visual surveys were used to localise right whales. A total of 10 encounters with 11 individuals were documented. Multiple skin biopsies, photographs for individual identification, and blow samples were collected. Two right whales were instrumented with satellite tags. Southern right whale sightings were scarce during the 2019 and 2020 summer surveys there compared to some other years.

In discussion it was noted that in Brazil, with support of the government, a right whale week and season was instituted. Systematic land-based research continues in Torres, southern Brazil and results from the 2018 and 2019 calving seasons is expected to be presented to the Committee next year. The continuation of this work in the 2020 season will depend on the situation with COVID-19. The Committee also welcomed news of an ongoing project focused on reconstructing the population trajectory of southern right whales. Additional work will use modelling to investigate population expansion and results will be available over the next two years.

Finally, the Committee was pleased to be informed about two disentanglement Workshops held in Puerto Madryn and Mar del Plata in 2019 with 72 participants, including researchers from Uruguay. The Workshops were supported by the IWC, the Government of Argentina, and the Cetacean Society International (CSI).

Attention: SC, CC, CG

The Committee **reiterates** *the importance of the CMP for SW Atlantic southern right whales and* **welcomes** *the progress made since its implementation. The Committee therefore:*

(1) **commends** *the impressive array of research being undertaken and the collaborative efforts of the researchers that highlight the impact of the CMP and the extensive collaboration among CMP member countries to undertake this research;*

(2) **recommends** *continued collaboration among range states to generate new information and* **encourages** *additional effort from Brazil given the additional funding received;*

[17] *https://ballenas.org.ar/investigar/proyectos-cientificos/.*

(3) **reiterates** *the importance of continuing the long-term monitoring programme, noting that the COVID-19 pandemic is causing major problems for such long-term programmes and* **encourages** *governments to do all they can to avoid interruptions to these important long-term efforts;*
(4) **encourages** *the continuation of existing aerial coastal surveys and* **recommends** *expanding the surveyed area to include deeper waters to assess whether whales are using new habitats, and that a monitoring programme and aerial surveys are developed for Uruguay;*
(5) **encourages** *the continuation of telemetry studies in Argentina and* **recommends** *satellite tagging in Brazil, Uruguay and Chile; it* **respectfully requests** *that the IWC Commissioners for these countries facilitate the internal permit process for the right whale tagging programme;*
(6) **encourages** *studies of stress hormones in baleen and the presentation of results to the Committee when they become available;*
(7) **encourages** *comparisons of photo-identification catalogues between Argentina, Brazil, Chile, and Uruguay; and*
(8) **recognises** t*hat coordination and staff time for disentanglement trainings is voluntary and* **encourages** *agencies involved to continue to allow their employees to participate.*

9.1.3 North Pacific gray whales

The Committee has a long-standing cooperation with the IUCN Western Gray Whale Advisory Panel (WGWAP) and there is a joint IUCN/IWC draft CMP for western gray whales. Reeves provided a summary of work conducted by the IUCN Western Gray Whale Advisory Panel (WGWAP) since the last Committee meeting (SC/68B/CMP/07Rev1). In brief, the work of the WGWAP continued by way of several formal meetings and the drafting of a suite of 'legacy papers' including publication of the population assessment modelling that has also been reported to the Scientific Committee. The importance of the ongoing work of the Russian Gray Whale Project (RGWP) has provided the long time series of photo-identification and genetic data used in the assessments. Unfortunately, Alexander Burdin, who leads the Russian project, had reported earlier this month that his team could not go into the field this year because of the lack of funding.

WGWAP also reiterated its disappointment at the reduction of the Sakhalin Energy and Exxon Neftegas Limited (ENL) joint monitoring programme for gray whales off Sakhalin Island. This includes ceasing work on three key annual elements: (i) behaviour monitoring; (ii) acoustic monitoring; and (iii) benthic sampling in the near-shore (Piltun) feeding area. Recent amphipod biomass in the Piltun feeding area was in steep decline, yet no sampling has been done since 2016. In July 2019, the Panel posted an Open Statement of Concern, noting two concerns likely related to the decline in amphipod biomass : (i) a continued decrease in the number of whales using the Piltun feeding area; and (ii) a southward shift in whale distribution.

Reeves noted that the Panel and the IWC Scientific Committee has repeatedly emphasised the great value of ensuring that a 'joint catalogue' and associated database on western gray whales is finally established and functioning as intended under the auspices of the IWC; this would provide a valuable and enduring legacy of the entire Panel process.

In April 2020, an updated status was assigned in the Red Data Book of the Russian Federation the 'Okhotsk Sea population of the gray whale'. The population is considered Critically Endangered and with a conservation status of 'Priority 1', which calls for immediate implementation of comprehensive conservation measures including the development and implementation of a species conservation strategy, species recovery program and an action plan.

Donovan briefly reported on issues related to the CMP and the Memorandum of Cooperation on western gray whales signed by several range states. Considerable monitoring research actions have been undertaken on gray whales throughout the range as well as past work related to mitigation actions. Last year, the Committee supported a Workshop (including some modelling to focus on particular conservation questions) to be held during the year to finish working on the update to the scientific components of the joint IWC/IUCN CMP and associated actions. The plan had been for that work to feed into a proposed stakeholder Workshop to be co-sponsored by the IWC and IUCN after the Committee meeting and before the 2020 Commission meeting. Because it proved impossible to hold the Committee Workshop (and thus the associated modelling), limited progress was made with respect to the subsequent stakeholder Workshop although informal and positive discussions had begun with Japan about hosting the stakeholder Workshop.

Discussions were also held this year (Items 6.2 and 10.4.1) with respect to the gray whale *Implementation Review* including clarifying some issues on stock structure hypotheses. As noted under Item 6.2, it was agreed that the postponed Workshop/modelling proposal (funds are already available) should be supported and the work be undertaken as soon as the COVID-19 situation is resolved. The idea is to continue working with range states, IUCN and the CMP group within the Conservation Committee to develop plans for the joint stakeholder Workshop towards the end of 2021, ideally, if virus circumstances permit, in time for the report to be submitted to the Commission meeting that is now expected for Autumn 2021.

In discussion, Moronuki explained that although Japan had been willing to consider hosting a stakeholder Workshop it had not been possible to follow through with this with the IWC and IUCN given the postponement of the scientific Workshop noted above. He explained that the possibility of holding such a Workshop in 2021 would have to be re-examined by Japan in light of its budget and the aftermath of the COVID-19 situation.

Attention: C, CC, IGO, S, I, R
In light of the continued importance of the joint IUCN/IWC CMP for western gray whale, the associated research at Sakhalin and elsewhere in the range and the long-standing co-operation with the IUCN Western Gray Whale Advisory Panel, the Committee:

(1) **supports** *the updated plans to update the scientific components of the CMP via a scientific Workshop that will report to SC68C;*
(2) **encourages** *the range states and signatories of the Memorandum of Co-operation on Western Gray Whales to continue to work with the CMP Steering Group and the Secretariats of IWC and IUCN to facilitate the holding of a stakeholder Workshop after SC68C in light of the results of the above scientific Workshop;*
(3) **notes** *with concern the reported benthic biomass declines in the gray whale feeding area in Piltun, and potentially related changes in whale numbers and distribution, and* **reiterates** *previous recommendations that the benthic sampling programme be reinitiated by the oil and gas companies (or other capable parties) working in the area;*
(4) **strongly reiterates** *its previous recommendation for a consolidated photo-identification catalogue for the western North Pacific under the auspices of the IWC and urges the relevant data holders to finalise this process with the IWC and IUCN; and*
(5) **recommends** *that every effort be undertaken to try and facilitate the continuation of the Russia Gray Whale Project so as to preserve the several decade time series upon which the assessment of the population relies including the provision of partial funding by the IWC for 2020.*

The Committee was pleased to receive recent information from long-term studies of gray whale on the wintering grounds in Mexico (SC/68B/CMP/09; SC/68B/CMP/13; SC/68B/CMP/14). The authors reported high mortality rates, poor body condition and low calf production of the gray whale in the breeding lagoons in Mexico, similar to the previous winter season in 2019. The Committee also received recent information about body condition and photo-identification from the summer feeding grounds off Sakhalin Island, Russia (SC/68B/CMP/24) and sightings and stranding records from Japan (SC/68B/CMP/15).

The Committee was informed that no signs or symptoms of Unusual Mortality Event related impacts on gray whales off Sakhalin were reported in 2019 as were observed off the west coast of North America. NOAA/SWFSC successfully completed an abundance survey of eastern North Pacific gray whales in 2019/20 (December-February) and had planned to repeat this survey again in 2020/21. Unfortunately, the NOAA/SWFSC calf production survey, conducted annually (1994-2019) was not undertaken in 2020 to due to concerns related to COVID-19.

Several sightings from platforms of opportunity (SC/68B/CMP/15) were reported from the coast of Ishikawa Prefecture, in the Sea of Japan in May-June 2019 including a resighting of one individual during March 2019 in Ishikawa and Fukui Prefectures. No new cases of strandings or anthropogenic mortality due to entanglement were reported.

Attention: CG-R, SC, G, I, CC
The Committee **reiterates** *the importance of long-term monitoring of gray whales,* **strongly recommends** *that Range States and others support this work and* **welcomes** *the new information provided by Mexico, Russia and Japan. In particular, the Committee:*

(1) **commends** *the work in the wintering lagoons of Mexico,* **urges** *its continuation and* **expresses** *concern about the high number of strandings, poor body condition and low calf counts observed off Mexico in 2019-20 as related to the broader population-level mortality event;*
(2) **commends** *work on the feeding ground off Russia by the Russian Gray Whale Project and urges its continuation;*
(3) **welcomes** *the continued provision of information from Japan and encourages researchers to continue to collect as much information on sightings as possible, including, if feasible, attempting to obtain biopsy samples and photographs; and*
(4) *highlights the importance of data collected on gray whale abundance and calf production off central California, particularly in light of the ongoing 2019-20 unusual mortality event and* **recommends** *that these two long time series surveys continue in 2020/21 and into the future as possible.*

9.1.4 Franciscana (CMP, SM)

Progress to complete the review of the status of the franciscana dolphin included an initial assessment of population structure (Item 10.4.2) and of abundance estimates (Item 11.1.4). A funding proposal to organise a Workshop to complete the review was received by the Committee (see Item 22).

Attention: SC, CC
The Committee **agrees** *that the review of the franciscana continue during the intersessional period and at next year's meeting. The Committee* **recommends** *that a Workshop to advance the review be organised prior to SC68C.*

9.2 Progress with identified priorities

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

Humpback whales in the Arabian sea are non-migratory, genetically distinct, endangered (Minton *et al.*, 2008), and are believed to number <100 animals off the coast of Oman (Minton *et al.*, 2011). The population is subject to multiple threats, including ship strikes, entanglement in fishing gear, and coastal development. These whales have been identified as a candidate for a future CMP (IWC, 2019e, p.31).

The Committee welcomed information on the activities of the Arabian Sea Whale Network (ASWN) that coordinates humpback whale research and conservation efforts across the Arabian Sea. Progress and recent developments under the umbrella of the ASWN was reported in SC/68B/CMP/11Rev1. At the regional level, progress included refining work on the Flukebook regional online data platform, maintenance of a website and email group to foster exchange among group members, and progression and extension of the CMS Concerted Action on Arabian Sea humpback whales. Work conducted by ASWN members at local and national levels in Oman, Pakistan, India, Sri Lanka, Iran, and the UAE, ranged from awareness-raising activities and reporting networks to dedicated research efforts using passive acoustic monitoring, photo-identification, and Unmanned Aerial Systems (UAS) and other techniques. Of particular note is the acoustic work that has commenced, with a recorder in place, and already recording humpback whale song off of Netrani Island on the west coast of India.

In discussion it was noted that one year of deep water passive acoustic monitoring was planned (2020-21) off Oman, with the aim to clarify temporal distribution of NWIO blue whale song (Oman song-type), and assess potential presence of other song-types such as CIO (the Sri Lanka song-type was highlighted and this is discussed in more detail under Item 8.2.1.5, and see Cerchio *et al.* (2020).

An annual update on baleen whale sightings (SC/68B/CMP/08) reported by crew members on board tuna gillnet vessels operating out of the port of Karachi in Pakistan was presented. Sightings included blue whales, Bryde's whales, sperm whales, Cuvier's beaked whales, and seven Arabian Sea humpback whales (ASHW). There were fewer sightings reported in 2019 than in previous years, due to a number of factors including a shorter fishing season related to low tuna prices, reduced catch per unit of effort (possibly linked to sea surface temperature anomalies and a jellyfish bloom), and the termination of the funding that supported the project in recent years. While 45 observers have agreed to continue collecting data on a volunteer basis, it is uncertain how long they will be able to continue doing so without compensation.

Results of an IWC-SC funded study (SC/68B/CMP/16Rev1) assessing over 33,000 images of humpback whales from Oman obtained between 2000 and 2018 were presented. Tattoo-like skin disease was detected in 43.4% of 83 adult whales, while killer whale tooth rakes were detected on the tail flukes of only 12% of 77 whales examined. Of 42 whales represented by suitable caudal peduncle photos, 67% bore scarring assumed to be consistent with entanglement, and prevalence of propeller scars and other vessel strike injuries in 96 examined whales was 4.16% and 2.1%, respectively. Unlike Southern Indian Ocean humpback whale populations that the authors have worked with, 97.5% of ASHW had <10% of the ventral surface of their tail flukes covered by barnacles or barnacle scars, potentially providing a proxy measure to distinguish between ASHW and Southern Hemisphere populations.

A study (SC/68B/CMP/23Rev1) used UAS photogrammetry to compare the body condition of nine adult ASHWs, measured in Oman with migratory humpback whales from Western Australia (Breeding Stock D). The ASHWs were in similar condition to Australian adult whales at the beginning of the breeding season, with Omani females (n=3) being similar to Australian lactating females shortly after birth. The authors highlight the importance of continued research towards assessing the health of ASHWs, together with continued monitoring of scarring rates and skin disease to determine the relationship between anthropogenic stressors, body condition and reproduction.

During discussion, it was clarified that the photos collected opportunistically from Pakistan fishing vessels were generally not of high enough resolution for individual identification, but that a few opportunistically collected photos from Pakistan and India had been compared to the Oman catalogue. Only one positive photo-ID match was made between Oman and Netrani Island, India (see SC/68B/CMP/11Rev1). It was noted that managing threats to ASHW requires improved understanding of human activity, including fishing effort, in this region, through, for example the use of tracking devices on vessels in the Pakistan Observer Programme, or the use of AIS and satellite imagery to map vessel density.

Efforts by the Government of India (GoI) to promote ASHW conservation in India were presented. In 2018 ASHW were placed on the Endangered Species Recovery List. The GoI has requested west coast Indian States and Union territories to develop Action Plans that are aligned with the CMS Concerted Action on ASHW. India's Government-led ASHW efforts focused on: (1) addressing data gaps; (2) awareness programmes; (3) capacity building; and (4) bycatch monitoring and mitigation. Furthermore, the GoI welcomes the identification of several Important Marine Mammal Areas (IMMAs) in Indian waters and hopes to incorporate these under a Maritime Act.

Rosenbaum informed the Committee that genetic analyses from a humpback whale baleen sample collected in Pakistan in the early 2000s was analysed to compare to mtDNA data of Oman samples. The Pakistan sample matched the most common Oman haplotype, but this was also a haplotype found in 9 of 12 sampling sites in the Indian Ocean.

The Committee noted that images of Oman ASHW that were deemed to be indicative of ship strike injury be submitted to the IWC ship strikes database for review and inclusion in the database. Data holders confirmed that this should be possible, and that the assessment (SC/68B/CMP/16Rev1) included a distinction between injuries consistent with blunt-force trauma from large vessels and propeller scars more likely inflicted by small vessels.

Only four calves were documented in the ASHW catalogue during 2000-18. Combined with the small population estimate (*ca* 100 individuals off Oman), this raised questions related to body condition, an assumed low reproductive rate or high adult mortality. Abundance estimates are being updated and may shed more light on current abundance and trends. These results will be reported at SC68C.

In apparent contrast to the results reported (SC/68B/CMP/23Rev1), experienced researchers conducting tagging work in Oman noted that ASHW appeared to have a thinner blubber layer than whales they had tagged elsewhere, because tags were difficult to implant. Possible explanations were considered, including a reduced need for fat stores in a population that does not undertake long migrations or fast for long periods, and fluctuating prey availability. It was noted that future hormone studies would be of interest to assess pregnancy rates and to allow integration of a bioenergetic framework to determine how anthropogenic stressors may affect population and individual health.

There was strong support for continued collaboration under the ASWN. The Committee highlighted the immense value of data being collected that can inform ASHW conservation management, and provided strong support for continuing the programme, while recognising that new funds were required to do so.

Two budget proposals were submitted on ASHW. The first directly addresses recommendations that arose from discussion of documents (SC/68B/CMP/16Rev1 and SC/68B/CMP/23Rev1), and proposes to map human activity in ASHW habitat, as well as expand drone work to assess body condition of ASHW in Oman. The second proposes to continue and expand the passive acoustic monitoring work off the west coast of India in order to confirm presence/absence of song and allow further comparison of song samples from India with song being collected simultaneously off the coast of Oman. These are discussed under Item 22.

The Committee **welcomes** the measures put in place by the Ministry of Environment, Forests and Climate Change, India and the coastal State Governments in India along with local research teams, to promote research, awareness-raising, capacity building and bycatch reduction, and offers technical and scientific support for these efforts where appropriate.

Attention: SC, CG, G, I, R, S

The Committee **reiterates** *that Arabian Sea humpback whales (ASHW) are a priority candidate for a CMP (IWC, 2019c, p.31) and* **recommends** *that the IWC Secretariat and SWG-CMP continue efforts with Oman and India towards development of a CMP in partnership with CMS, which already hosts a Concerted Action for the population. It* **commends** *the efforts of scientists within the region and especially the Arabian Sea Whale Network (ASWN) for developing a strong scientific basis to guide the development of a CMP and* **recommends** *continuation of research presented at this meeting and the network's regional collaboration.*

Furthermore, the Committee:

(1) **recommends** *that the work of the crew-based observer programme in Pakistan (SC/68B/CMP/08) continue, if possible, mapping fishing effort as well as sightings, and that it be replicated throughout the region where possible, especially in areas where systematic cetacean surveys are not feasible;*

(2) **encourages** *continued collaboration between the Pakistan observer programme and the IWC Bycatch Mitigation Initiative (BMI), and also encourages broader collaboration between relevant national governments, researchers and the BMI including through pilot projects on bycatch management, knowledge exchange or requests for capacity building initiatives;*

(3) **recommends** *that the use of passive acoustic monitoring to document whale presence and to analyse song be continued in Oman, on the west coast of India, and commences off the Sindh and Balochistan coasts of Pakistan; making every effort to ensure simultaneous recordings in all three countries, so that song comparisons can be made across the Arabian Sea;*

(4) **recommends** *the continued use of unmanned aerial systems (UAS) and other photographic methods (systematic assessment of images for evidence of disease, epizoites and anthropogenic scarring) to assess body condition and health of ASHW off the coast of Oman with the objective of adopting these metrics as proxy indicators of some of the key ecological attributes related to on-going population trend assessment and conservation planning for ASHWs;*

(5) **recommends** *that fishing effort and location of gear that may cause entanglements of ASHW are more accurately mapped throughout ASHW range, especially in the most dense and critical habitat, to assess co-occurrence and risk, in order to better inform mitigation measures; and*

(6) **recommends** *that a comparative study be conducted between the Oman ASHW catalogue and other Southern Hemisphere (SH) Indian Ocean catalogues to assess prevalence and coverage of barnacle scarring and colonisation, to determine whether this can be used as a proxy measure for distinguishing ASHW from SH whales.*

9.2.2 Central American humpback whales

The Committee received new information on the endangered Central American humpback whale population. SC/68B/CMP/26Rev1 presented evidence, based on photo-ID and mtDNA, on the similarities between the humpback whales from Central America and Southern México (Guerrero and Oaxaca states). The authors conclude that the humpback whales from southern Mexico belong to the endangered 'Central America' Distinct Population Segment (DPS).

SC/68B/CMP/25Rev1 presented the report of a Workshop on the Central America Humpback Whale Population that took place from 9-10 March 2020 in Panama City, Panama. The Workshop reviewed information that was available on population structure, abundance, distribution, and threats of the humpback whales of the Central America population and discussed the development of a CMP for this population. The Workshop was attended by 21 participants from eight countries (US, Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama), and was hosted by the Minister of Environment of Panama and supported by the Secretaría Nacional de Ciencia, Tecnología e Innovación (SENACYT) de Panamá and the Cetacean Society International (CSI). The participants propose to conduct a second workshop with the representation of the proponent countries to develop the CMP of the Central America Humpback Whale Population, in February 2021.

Attention: SC, CC, CG

The Committee reiterates the recommendation of last year (IWC, 2020a) that the Central American humpback whale population be treated as a 'priority population' for the purpose of the CMP development process.

Regarding the Workshop on the Central America Humpback Whales' population' at Panama City, Panama, the Committee **recommends** *the continuation and increased collaboration of the Range States. The Committee also* **recommends** *that the report of a second workshop to develop a draft CMP to be presented at the SC68C meeting.*

9.2.3 Mediterranean sperm whales

The Committee received information on the ACCOBAMS Scientific Committee meeting held in February 2020 that acknowledged the need to start work on an IWC-ACCOBAMS CMP for sperm whales.

Following the ACCOBAMS Survey Initiative, an update of the IUCN Red List assessment of the Mediterranean sperm whales is currently underway as part of a joint effort by ACCOBAMS, IUCN Mediterranean in Malaga, and a larger group of Mediterranean scientists. This new regional assessment should be ready by the end of 2020.

The Committee **welcomes** that ACCOBAMS is considering the development of a CMP for Mediterranean sperm whales which are threatened by various anthropogenic threats including ship strikes and bycatch, and since 2019 have been subject to an UME (SC/68B/E/10Rev1), which is discussed in detail under Item 14.3.3.

Attention: CG, CC, IGO

ACCOBAMS is considering drafting a CMP for sperm whales in the near future and the Committee **agrees** *that consideration should be given to this being a joint ACCOBAMS/IWC CMP; it* **reiterates** *the recommendations of last year (IWC, 2020a) that the Mediterranean sperm whale be treated as a 'priority population' for the purpose of the CMP development process.*

9.2.4 Mediterranean fin whales

The Committee received information that a CMP Workshop funded and organised by ACCOBAMS was held in Barcelona, Spain, to develop an initial draft CMP for Mediterranean fin whales and to stimulate discussion within the region. The CMP was an initiative of ACCOBAMS member countries, all of whom are also range states. The ACCOBAMS plan is: (1) the initial draft be examined by the ACCOBAMS SC; (2) the IWC SC review the CMP from a scientific perspective; (3) the revised CMP be sent to member states; and (4) a stakeholder Workshop be held to develop a final CMP (to which IWC as well as other IGOS, NGOs, local and national authorities will be invited).

Stock structure is the main scientific issue with respect to fin whales in the region. New published and unpublished evidence (i.e. genetics, stable isotope and telemetry data) suggest that the ACCOBAMS region contains a single 'Mediterranean' population of fin whales, with some whales moving out through the Strait of Gibraltar into the adjacent North Atlantic in summer and returning in the winter.

The first ever, basin-wide survey was completed in summer 2018 and the full set of analytical results (i.e. abundance and relative density throughout the region) is expected soon. These results will need to be taken into account in the draft CMP when they become available. A predictive model for local and seasonal occurrence/density of fin whales has been developed and is being tested (so far for the summer only). This may prove to be a valuable tool for identifying winter distribution and habitats (of which relatively little is known, especially in the east) and from a CMP perspective assisting with prioritising spatio-temporal mitigation actions. This will also link in with the IMMA (Important Marine Mammal Areas) work under IUCN.

Mediterranean fin whales face a number of both direct and indirect threats. Direct threats (i.e. those that may cause instantaneous or near instantaneous death of the animal) include vessel strikes, and, rarely, severe blasts of extremely loud

noise. Fin whales appear less vulnerable to fishery entanglements. Indirect threats that may affect survival or reproduction but at a longer timescale, include: (1) anthropogenic noise from different sources (e.g. industrial, extractive, prospective or military activities, or even from approaching vessels, such as during whale watching or research); (2) chemical pollution including micro- and nano-plastic ingestion (both fin whales and/or their prey); and (3) physical disturbance (e.g. intrusive whale watching and research). Climate change may influence/exacerbate several of these, especially abundance and distribution of prey (and hence whales). The need to consider threats cumulatively as well as individually is important for conservation and management.

The work of the IWC Scientific and Conservation Committees on the threats faced by Mediterranean fin whales was highlighted, especially with respect to previous joint IWC/ACCOBAMS Workshops on ship strike mitigation and work on anthropogenic noise, marine debris and whale watching. In all cases, the need to co-operate with a wide range of stakeholders including IGOs, local and national authorities, NGOs and industry, was stressed. This included the need for public awareness and capacity building.

The need for a full-time co-ordinator under the guidance of a Steering Group representing key stakeholders was emphasised. Ongoing effort is aimed at integrating the draft CMP with actions targeting acoustic work, which was not included in the drafting effort in Barcelona.

Attention: CG, CC, IGO
The Committee **notes** *that ACCOBAMS has adopted the IWC guidelines for its CMPs. It* **welcomes** *progress made in developing a CMP for Mediterranean fin whales and* **reiterates** *the recommendations of last year (IWC, 2020a) that the Mediterranean fin whale be treated as a 'priority population' for the purpose of the CMP development process.*

The Committee **encourages** *the relevant IWC and ACCOBAMS Range States to work towards finalising a draft CMP for fin whales for presentation at SC68C.*

9.2.5 South American river dolphins

The Commissioner from Colombia, on behalf of the Governments of Brazil, Colombia, Ecuador and Peru presented the proposed CMP nomination for South American river dolphins (SC/68B/CMP/21). The main objective of the CMP is to promote the conservation of river dolphin species (*Inia geoffrensis, Inia boliviensis, Inia araguaiaensis* and *Sotalia fluviatilis*) in the Amazon, Orinoco, and Tocantins/Araguaia basins through a regional concerted strategy. The proposed CMP will facilitate prioritisation of research and conservation actions among the different South American countries where these species live, as well as guide national and regional actions. The CMP nomination was a very complete and well drafted document, with clear collaboration and support from range states, four governments, researchers and NGOs with many years of experience in the region. The Committee thanked the Commissioner for this new initiative.

The Committee welcomed this initiative and full consideration will be given to the scientific aspects of the CMP and any related intersessional work at SC68C.

In discussion, it was noted that the Chair of the SWG-CMP (Australia) usually works in a supporting role for CMP development. Australia noted that it was pleased to see this nomination considered by the Committee and offered assistance to the proponents to seek Conservation Committee consideration. It welcomed the opportunity to work with the drafting countries to refine and clarify some of the text of the nomination.

The Committee **congratulates** the four countries of Colombia, Brazil, Ecuador, and Peru for submitting an excellent nomination for a CMP for South American river dolphins; such international collaboration at governmental, environmental and scientific levels is exemplary. It notes that the proposal will be considered by the Conservation SWG on CMPs during the intersessional period.

Attention: SC, CC
The Committee:

(1) **strongly endorses** *the scientific components of the South American river dolphins CMP nomination in principle this year;*
(2) **encourages** *the proponents to prepare a draft CMP, pending consideration and endorsement of the nomination by the Conservation Committee;*
(3) **establishes** *an Intersessional Correspondence Group to examine the scientific components and interact with the proponents on scientific matters and priorities to be included in the draft CMP;*
(4) **agrees** *to fully consider the scientific aspects of a draft CMP and the intersessional work at its 2021 meeting (SC68C);*
(5) **encourages** *the range states to work with the IWC's Bycatch Mitigation Initiative since bycatch was identified in the presentation as a key threat for river dolphins; and*
(6) **encourages** *the proponents to appoint a full-time co-ordinator for the plan and ultimately the CMP, as soon as possible.*

Table 11
Summary of the work plan for the sub-committee on conservation management plans (CMPs) for intersessional 2020/21 and 2021 Annual Meeting.

Item	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Southeast Pacific right whale	- Complete recording of PAM on Arauco Gulf; - start passive acoustic monitoring near Antogafasta for one full year; and - conduct the 3-day CMP coordination meeting	Review progress on scientific aspects of CMP
Southwest Atlantic right whale	Workshop to review priority actions	Review progress on scientific aspects of CMP
Gray whale	Scientific workshop (pending safe travel given the situation with COVID-19)	Review progress on scientific aspects of CMP
Franciscana	Workshop to finalise the review	Review the intersessional workshop report and new information
Arabian Sea humpback whale	Complete the revised abundance and trend estimates; complete genetic analyses to provide clarity on the taxonomic status of ASHW, continue PAM along the west coast of India	Review progress on identified priorities for research and conservation
Mediterranean fin whale	Coordinate with ACCOBAMS SC to prepare final draft CMP including updating research priorities and actions for initial email review by range states and others	Review the draft CMP and progress on scientific aspects
Mediterranean sperm whale	Coordinate work with ACCOBAMS to identify drafting working group and streamline development process	Review new information
South American river dolphin	Establish Intersessional Correspondence Group (see Annex K) to examine the scientific aspects of the proposed CMP for South American river dolphins	Review report of the ICG and the draft CMP
Central American humpback whale	Coordinate CMP strategic planning (via email) and workshop	Review of the draft CMP

9.2.6 South Asia river dolphins (not covered in CMP)

The role of a CMP to improve conservation of South Asia river dolphins (SC/68B/CMP/10) was discussed in Item 16.1.7, as was the report of the intersessional Workshop held in Malaysia in July 2019 (SC/68B/REP/04).

9.3 Budget requests

The Committee recommended the funding of four research proposals and three workshops and these are discussed under Item 22.

9.4 Work plan

The work plan is detailed in Table 11.

10. STOCK DEFINITION AND DNA TESTING

During the present meeting, the Committee via the Stock Definition and DNA Testing Working Group received voluntarily submitted information on the DNA registers maintained by Iceland, Norway, and Japan (Item 10.1); discussed recommendations to avoid the depletion of tissue samples in existing collections (Item 10.3); and provided advice on stock structure to other sub-committees (Item 10.4).

10.1 DNA testing

10.1.1 Reference databases and standards for DNA registries

This year, the Committee received voluntary updates of the DNA registers from Iceland, Norway, and Japan. Details are given in Annex E for each country, respectively. The Japanese and Norwegian registers cover the period up to and including 2019. The Icelandic register covers the period up to 2018; no whales were taken in 2019. Almost all samples in the Japanese and Icelandic registers have been analysed for mitochondrial DNA (mtDNA) and a standard set of microsatellites. Norway discontinued mtDNA analyses of samples in 2016. Almost all of the samples in the Norwegian register have been analysed for a standard set of microsatellites, and almost all of the samples collected in 2016 or later have also been genotyped for SNPs.

Representatives of the three countries submitting voluntary reports this year (Iceland, Norway and Japan) reiterated the statements made at previous meetings on DNA registers (e.g. IWC, 2019g).

The Committee **thanks** Japan, Norway and Iceland for voluntarily providing updates to their DNA registers using the standard format agreed in 2011 and providing the detailed information contained in their DNA registers.

10.1.2 New techniques for species, stock, and individual identification

Discussion on this topic was postponed until SC68C.

10.2 DNA data quality and genetic analysis guidelines

Two sets of guidelines have been developed for reference in the Committee's discussions of stock structure: (1) the DNA quality guidelines, which provide advice on best practices for ensuring the quality of data produced for genetic analyses; and (2) the genetic analyses guidelines, which provide advice on genetic analyses commonly used in the Committee's work.

10.2.1 Updates to DNA quality guidelines

The DNA data quality guidelines address DNA validation and systematic quality control in genetic studies and are currently available as a 'living document' on the IWC website[18]. In recent years, it has become common for the Committee to review papers using data derived from Next Generation Sequencing approaches, including Single Nucleotide Polymorphisms (SNPs), to address stock structure questions. Further discussion of this topic was postponed until SC68C, although the Committee agreed to continue work on these guidelines intersessionally (see Table 12).

10.2.2 Consideration of need to update analysis guidelines

The Committee is pleased to note that the most recent version of the guidelines for genetic data analyses has been published in the *J. Cetacean Res. Manage.* (Waples *et al.*, 2018). No sections of these guidelines were identified as in need of updating this year.

Attention: SC, S
The Committee **reiterates** *the importance of keeping its guidelines related to genetic data quality and analyses up to date. It therefore:*

(1) **encourages** *that the guidelines be followed in papers reporting the results of DNA analyses to the Committee;*
(2) **emphasises** *the need to update these guidelines to incorporate the discussion of data quality measures used for Next Generation Sequencing;*
(3) **agrees** *to continue the Intersessional Correspondence Group review of revised sections of the DNA data quality guidelines that apply to data generated from next generation sequencing platforms, including SNPs and whole genome sequencing; and*
(4) **recommends** *that the guidelines be made available on the main Scientific Committee webpage to ensure that they can be easily found by researchers.*

10.3 Recommendations on the avoidance of sample depletion

Last year (IWC, 2020d), the Committee received a summary of intersessional work that had been compiled on the general advantages and disadvantages associated with three broad categories of high throughput sequencing approaches, including whole genome sequencing (WGS), reduced-representation sequencing, and high-throughput targeted capture. Following discussion, the Committee had agreed that WGS is the best approach to maximise the value and avoid depletion of tissue samples and agreed that requests for projects using this approach (WGS) will be prioritised. The resulting sequence data should be submitted to a public database (e.g. *GenBank*) and interested parties could then retrieve the data rather than request use of the tissue sample.

The Committee had also noted that while WGS could provide genome sequences that would be valuable in addressing a wide range of questions, it is also important to preserve some tissue for use with other emerging technologies. The need to consider preserving tissue for alternative approaches was highlighted in the discussion of Antarctic blue whale population structure (see Item 8.2.2), where it was noted that analyses of stable isotopes and skin microbiomes collected from blue whales on Antarctic feeding grounds could potentially provide insight into whether sampled individuals share a common wintering ground, a question that genetic analyses have thus far failed to answer. Epigenetic analyses constitute a further valuable approach, e.g. in the context of age estimation.

In discussion, it was agreed that while WGS data is the 'gold standard' given that complete genomic data is produced, other considerations may also be important when evaluating tissue and/or DNA requests. Some questions of interest to the Committee can be adequately answered with traditional methods (i.e. microsatellites and mitochondrial control region sequencing). In other cases, genome-wide survey methods like DNA capture, which can generate thousands of SNP genotypes while using markedly lower amounts of DNA, can provide sufficient power to address Committee-relevant questions. One possibility would be to ensure that sufficient DNA is retained from each sample that a WGS with reasonable read depth could be generated, but the remaining tissue and/or DNA would be made available for other approaches, perhaps with the requirement that sample requesters accompany their proposals with a power analysis demonstrating that the number of samples requested (and otherwise available from other sources) is sufficient to answer the question.

[18] *http://iwc.int/scientific-committee-handbook#ten.*

Attention: SC

In reviewing the results of stock structure analyses, the Committee **reiterates** *its concern regarding the depletion of tissue samples in existing collections (including those collected during the IWC SOWER and POWER surveys). Given recent advances in high throughput sequencing technology, the Committee* **agrees** *that:*

(1) *sample depletion should be avoided, such that sample requests will be fulfilled only with those samples for which substantial tissue remains;*
(2) *whole genome sequencing (WGS) is generally the best approach to maximise the value and avoid depletion of tissue samples, and requests for projects using this approach (WGS) should usually be prioritised;*
(3) *in some circumstances use of other genetic approaches may be justified (e.g. by demonstrating sufficient power can be provided to address the question of interest); and*
(4) *preserving some tissue for emerging genomic technologies (e.g. epigenetics, microbiome analysis) or alternative techniques (e.g. stable isotopes) should be considered when evaluating sample requests.*

The Committee **agrees** *that the intersessional working group should continue its work to provide recommendations on genomic approaches to maximise the utility of these samples for future studies. The Committee also* **encourages** *submission of reports detailing the current status of genome sequencing of cetaceans and implications for tissue collection and preservation.*

10.4 Advice on stock structure to other groups

The Working Group has the task of discussing high-priority stock related papers from other sub-committees and working groups, and then providing them with stock structure related feedback and recommendations. These discussions often refer to the genetic analysis guidelines and genetic data quality documents.

10.4.1 Gray whale stock structure

Seven alternative hypotheses, some of which include multiple variants, were initially proposed to describe the stock structure of gray whales in the North Pacific (IWC, 2015d). In light of the results of a series of intersessional workshops on the status and population structure of gray whales in the North Pacific (IWC, 2015d; 2016d; 2017g; 2018c; 2019b), the Committee had agreed that two of the hypotheses (3a and 5a) should be considered high plausibility, while trials to evaluate stock status would also be conducted for four additional stock structure hypotheses or variants (3b, 3c, 3e and 6b). This year, the Committee reviewed five papers relevant to gray whale stock structure (SC/68B/SDDNA/01-03, Brykov *et al.*, 2019; SC/68B/ASI/01) that were submitted for consideration under the 2020 *Implementation Review* of gray whales (see Item 6.2).

SC/68B/ASI/01 extends the analyses of Calambokidis *et al.* (2017) to include photo-identification data collected from whales within the Pacific Coast Feeding Group (PCFG) study area between 1996-2017. The results are similar to those presented previously and thus are consistent with the stock structure hypotheses currently being considered.

SC/68B/SDDNA/01 incorporates previous advice from the Committee (IWC, 2019g) to combine photo-identification and genetic data to evaluate stock structure of gray whales. Mitochondrial and nuclear genetic differentiation was found between whales that feed off Sakhalin Island (SI), Russia, and those feeding in the Bering and Chukchi Seas (the North Feeding Group, NFG), indicating high internal recruitment of whales to the SI feeding area and a lack of random mating between SI and NFG whales. Clustering analysis identified two distinct genetic groups among the SI samples, one of which was genetically similar to the NFG whales, and both groups contained individuals known from photo-identification data to have travelled from SI to the Mexican wintering ground. Comparison of samples collected from whales off the southeastern coast of Kamchatka with SI and NFG whales revealed greater similarity between the SI and Kamchatka whales than between the Kamchatka and NFG whales.

Similar to results presented in Brüniche-Olsen *et al.* (2018), which was reviewed by the Committee in 2018 (IWC, 2019c), the paper identified two genetic clusters when SNP data generated for whales biopsied off SI were analysed, one which was more similar to the genotypes of whales sampled off Mexico ('eastern genotype') and one that was found primarily among Sakhalin whales ('western genotype'). The analyses in Brykov *et al.* (2019) separated the SI samples into groups that corresponded with the two genetic clusters and then compared the sequences of four mitochondrial genes between groups. Statistically significant differences in mtDNA haplotype frequencies were identified between groups, and a haplotype network did not reveal clear evidence of structure between these groups.

The study reported in SC/68B/SDDNA/02 sequenced the full mitogenomes of samples collected from gray whales on the SI feeding ground and on the Mexican wintering ground. The two strata had a high degree of haplotype sharing but significantly differed in the distribution of haplotypes. Evidence for a recent population size change was not detected, suggesting that mtDNA diversity was already reduced prior to commercial whaling.

SC/68B/SDDNA/03 reviewed the results of studies using genetic and genomic data to evaluate the stock structure of gray whales, with a focus on evidence providing insight into the relationship of the SI whales that currently feed in the area to the population of whales that was historically hunted in the western North Pacific. The authors conclude that the whales using Sakhalin are comprised of two groups, both of which are likely to have been derived from eastern North Pacific gray whales.

In discussion, the Committee noted that deep divergence is present in the mtDNA network and phylogenetic tree presented in SC/68B/SDDNA/02, which could be concordant with the pattern expected if a remnant of the historically hunted WNP whales were present. While this highly divergent branch contains one mitogenome haplotype that is found in high frequency among whales sampled off SI, it has also been identified among whales sampled in Mexico. This divergent branch also includes two mitogenome haplotypes found only among Mexican whales and one mitogenome haplotype found only in SI whales. While the divergence is less prominent (due to a more limited amount of sequence data), the divergent branch can also be seen in the mtDNA network presented in Brykov *et al.* (2019), where the majority of Sakhalin whales containing the high frequency haplotype belong to the 'western genotype' cluster with a much lower proportion belonging to the 'eastern genotype' cluster. Thus, this pattern is likely driven by the stochastic maintenance of ancestral diversity. However, the Committee **agrees** that possible existence of separate western lineages should be re-evaluated in the future when more gray whale genetic and/or genomic data is expected to become available.

The Committee evaluated whether any of the new information presented in the reviewed papers suggested that changes to the plausibility rankings of the stock structure hypotheses were needed (see Annex F for details of the hypotheses). Hypothesis 3a describes a scenario where the Western Feeding Group (WFG) of whales show matrilineally-driven fidelity to the feeding ground off SI, Russia, but interbreed with whales from both the NFG and the PCFG, such that only one panmictic breeding stock exists. The results presented in SC/68B/SDDNA/01, as well as those in Brüniche-Olsen *et al.* (2018), reviewed in IWC (2019g), and Lang *et al.* (2010b) and Lang *et al.* (2010a), both reviewed in IWC (2011a) indicate that the whales that feed off Sakhalin do not interbreed at random with the whales considered part of the NFG or the PCFG, probably because some and perhaps most mating occurs before the migratory path used by SI whales converges with that of the whales migrating south from Arctic feeding grounds.

Hypothesis 4a is identical to Hypothesis 3a except that in 4a the whales feeding off SI primarily mate with one another while on migration to Mexico, implying the existence of two breeding stocks that use the same wintering ground. Hypothesis 4a was previously considered low priority in part because the underlying modelling structure and input parameters are identical to those of 3a, although under 3a the Eastern Breeding Stock (EBS) would include the WFG, NFG, and PCFG while under 4a the EBS contains only NFG and PCFG. While this implies that conservation metrics based on the projections of the two models could differ slightly for the EBS, the Committee's evaluation of conservation metrics has focused on the PCFG, WFG, and Western Breeding Stock (WBS, which does not exist in hypotheses 3a and 4a), all of which have markedly lower abundance (~ two orders of magnitude different) than the NFG.

Given that the underlying structure and model inputs are the same for Hypotheses 3a and 4a, simulations based on 3a would identify trials that would result in depletion of the WFG under 3a as well as those that would result in depletion of the breeding stock (demographically the same as the WFG in 3a) under 4a. Since Hypothesis 4a is functionally the same as 3a, elevating its plausibility to high would not entail including additional trials for testing under the gray whale *Implementation Review*. The Committee noted, however, that it was important to maintain clarity regarding the biological scenarios being evaluated for the purposes of the rangewide review of the status and population structure of North Pacific gray whales. An Intersessional Correspondence Group was formed to address this issue; their Terms of Reference are laid out in Annex K.

Details on the hypotheses considered to be of high or medium plausibility are included in Annex F.

Attention: SC

Upon reviewing new information relevant to evaluating the plausibility of the hypotheses that have been proposed to describe the stock structure of gray whales in the North Pacific (IWC, 2015d), the Committee **agrees** *that for the purposes of the Rangewide Review of the Status and Population Structure of Gray Whales:*

(1) *Hypothesis 4a should be given high plausibility while Hypothesis 4b should be given medium plausibility;*
(2) *additional medium plausibility variants (4c and 4e) should be added that are functionally the same as 3c and 3e but incorporate a lack of random mating between the Western Feeding Group whales and other whales considered part of the Eastern Breeding Stock under Hypothesis 3;*
(3) *the plausibility of Hypothesis 3a and its variants will remain unchanged; but*
(4) *an Intersessional Correspondence Group will be formed to clarify the terminology used to describe the hypotheses and to assess if further changes are needed to ensure that all plausible scenarios and their respective plausibilities are represented. A report summarising the group's discussions will be provided at SC68C as well as being presented to the proposed scientific Workshop.*

10.4.2 Franciscana population structure

The franciscana is a small dolphin endemic to the southwestern Atlantic that has been classified as vulnerable by the IUCN due to fishing-related mortality at levels believed to be unsustainable (Zerbini *et al.*, 2017). Four 'Franciscana Management Areas' (FMAs) were initially defined using a phylogeographic approach and incorporating multiple lines of evidence (Secchi *et al.*, 2003). When the Committee last reviewed franciscana population structure (IWC, 2015c), analyses of a more extensive

sample set (Cunha *et al.*, 2014) suggested that strong quantitative mtDNA differentiation in AMOVA analysis separated the FMA I population in the North from FMAs II-IV in the South at a level of differentiation consistent with an Evolutionarily Significant Unit (ESU). In addition, the analyses suggested that the existing FMAs should be further subdivided into separate management units (designated as FMA Ia, Ib, IIa, IIb, IIIa, IIIb, IVa, IVb, and IVc) to reflect the genetic differentiation found within each ESU (Cunha *et al.*, 2014). Following the 2015 review, the Committee recommended that (1) additional analyses using nuclear markers be conducted to evaluate management unit boundaries for both males and females; (2) additional samples be included in future analyses if available, in order to improve resolution of FMAs; and (3) attempts be made to resolve the biologically critical dispersal rates in terms of management goals, and determine what levels of genetic differentiation such dispersal rates are expected to generate.

Several papers have been published subsequently that address the first two recommendations for analysis of nuclear markers and use of additional samples to evaluate franciscana management units (Gariboldi *et al.*, 2015; 2016; Negri *et al.*, 2016). This year, the Committee reviewed three additional papers.

SC/68B/SDDNA/04 investigated population structure within FMA IIb by comparing samples collected from a small group of franciscana that inhabits Babitonga Bay in southern Brazil with those collected from franciscana in nearby coastal areas. Significant nuclear and mitochondrial genetic differences were identified, suggesting that population structure occurs at small geographic scales (<20km) in this area. In discussion, the Committee noted that three of the seven microsatellite alleles used in the nuclear analyses showed evidence of departure from Hardy Weinberg equilibrium (HWE). This could indicate the presence of null alleles, which can lead to biased estimates of genetic differentiation (Waples *et al.*, 2018). The Committee suggested that the nuclear analyses of genetic differentiation be repeated after excluding the loci that deviated from HWE. While reducing the number of loci analysed will decrease the power to detect genetic differences, greater confidence can be placed on the findings if the nuclear genetic differences between the groups remained apparent.

SC/68B/SDDNA/05 analysed additional samples collected within FMA IIa. Comparison of this data with previously published data collected throughout FMA II provided additional support for the separation of FMA IIa from the other areas compared (FMA IIb, FMA III, FMA IV). Comparison of stable isotope signatures and contaminant profiles between FMA IIa and FMA IIb also supported the separation of these two areas.

Finally, SC/68B/SDDNA/07 provided an overview of the results of published and unpublished genetic analyses of population structure within the range of the franciscana. Eleven putative management units were proposed, and recommendations for future analyses were provided.

The Committee thanked the authors for their work, which followed the first two recommendations made at the last review. The Committee further noted the value of the summary provided in SC/68B/SDDNA/07, which pulled together the results from multiple different sources, not all of which are easily accessible.

How to relate dispersal rates and genetic differentiation to 'operational definitions of stock' and to 'evaluate stock structure, based on the management context in which they are to be used' was one of the needs recognised in the creation of the Committee's Stock Definition Working Group in 1998 (IWC, 1999b). Developing a single quantitative threshold for differentiation that indicates management as separate stocks is difficult in natural systems as that threshold can vary substantially depending on a variety of factors (e.g. relative population sizes, productivity, migration rates, Waples *et al.*, 2018). Thus, identifying biologically critical dispersal rates in terms of management goals, which was the third recommendation to come out of the 2015 review, has remained a challenge both for franciscana and for the work of the Committee more broadly. Within the range of the franciscana, there is evidence for deep divergence (e.g. the North and South ESUs) as well as more shallow structure, which in some cases is at very small geographic scales (e.g. within FMA IV; Gariboldi *et al.*, 2016). Given the high levels of bycatch that occur, however, defining management units at these small scales is the most risk-averse strategy.

The value of combining the genetic data with other lines of evidence (e.g. movement data, morphology, contaminants) when investigating population structure, as was done in SC/68B/SDDNA/05, has long been recognised by the Committee (Donovan, 1991). Several other data sources exist (Barbato *et al.*, 2012; do Amaral *et al.*, 2018; Henning *et al.*, 2018; Lázaro *et al.*, 2004; Ramos *et al.*, 2002; Wells *et al.*, 2013). Integrating these with the genetic data could build support for delineating management units in areas where genetic data are sparse and provide insight into what constitutes biologically meaningful units that have been identified at fine scales using the genetic data.

The Committee noted that efforts are ongoing to combine available genetic datasets and conduct an integrated range-wide analysis of structure. This work would provide a better understanding of patterns of structure across the range to be explored and would aid in determining where boundaries between management units should be placed. The combined dataset would also allow patterns of isolation by distance, as well as isolation by environmental distance, to be explored, both of which have proven useful in understanding franciscana population structure within parts of its range (Mendez *et al.*, 2010).

It was noted that some of the FMA delineations are well-supported. For example, recognition of the division of FMA Ia and FMA Ib was suggested in the Report of 8th Workshop for Research On and Conservation of the Franciscana (Fransicana Consortium, 2016) which was endorsed in 2016 (IWC, 2017f). Others, however, are less robust. Although SC/68B/SDDNA/07

provided a valuable summary of the available genetic data, evaluating the level of confidence in each subdivision will require examining the results presented in individual papers as well as the integration of non-genetic data sources. An Intersessional Correspondence Group was formed to conduct this task; their Terms of Reference are outlined in Annex K.

While recognising that additional information could be useful in better understanding the population structure of franciscana, the Committee noted that an extensive dataset is already available. Over 700 samples have been collected, sequenced for mtDNA control region, and genotyped at microsatellite loci, seven of which are common to samples from Brazil, Uruguay, and Argentina and four that are common across all datasets and could be combined after calibration between laboratories.

Attention: SC, R
Since the Committee last reviewed population structure in franciscana (IWC, 2015a), considerable new information has become available, leading to a proposal to recognise eleven management areas within the range of the species.

In reviewing the available evidence relating to population structure in franciscana, the Committee:

(1) **commends** *ongoing collaborative efforts to combine available genetic and other datasets to conduct an integrated rangewide analysis of population structure of franciscana and* **encourages** *the continuation of this project; and*
(2) **agrees** *to form an Intersessional Correspondence Group to further evaluate the strength of currently available evidence (genetic and other, e.g. stable isotopes, contaminants, etc.) supporting the proposed management units and report on its findings at SC68C.*

10.4.3 Sotalia guianensis population structure

Sotalia guianensis is a small coastal delphinid that ranges from Nicaragua to southern Brazil (Flores and Da Silva, 2009). This species faces anthropogenic threats throughout most of its distribution and is listed as Near Threatened by the IUCN (Secchi *et al.*, 2018). SC/68B/SDDNA/06 provided a review of population structure studies of *Sotalia guianensis* and a proposal for delineating management units. Due to limited time, the Committee was unable to review this paper this year and has established an Intersessional Correspondence Group (see Annex K) to make progress intersessionally.

Attention: SC
The Committee notes the importance of understanding the population structure of Sotalia guianensis in order to delineate management units within the species' range. It **agrees** *to establish an Intersessional Correspondence Group to review genetic and other evidence relating to population structure in this species and to provide advice on the proposed management unit delineations. A summary of this group's progress will be reported at SC68C.*

10.4.4 Overview of stock structure analyses based on POWER biopsy samples

The Committee reviewed SC/68B/ASI/16, which responds to a recommendation of the IWC-POWER's Technical Advisory Group (SC/68B/REP/01) to summarise the results of genetic studies that have included data from IWC-POWER and to develop proposals for additional analyses to infer stock structure using the POWER and other available samples. The genetic analyses of North Pacific sei (Pastene *et al.*, 2016a; 2016b), Bryde's (Pastene *et al.*, 2016a; 2016c; Taguchi *et al.*, 2017), and right whales (Pastene *et al.*, 2018) that are summarised in SC/68B/ASI/16 have been reviewed by the Committee in the past (IWC, 2017d; 2018d; 2019c), and thus no further discussion on these topics was needed.

Attention: SC
Upon reviewing a summary of genetic studies that have used samples collected as part of the IWC-POWER surveys, the Committee:

(1) **recognises** *the value of past work in which biopsies collected as part of the IWC-POWER surveys have been used to understand the stock structure of large whales in the North Pacific;*
(2) **expresses** *appreciation to the authors for providing the summary, which responds to a recommendation made by the IWC-POWER's Technical Advisory Group;*
(3) **encourages** *the inclusion of IWC-POWER samples, including those from blue and fin whales, in future studies to infer population structure; and*
(4) **encourages** *the continuation of IWC-POWER and the collection of samples on all future surveys.*

10.5 New genetic approaches of use to the Scientific Committee in addition to stock structure issues

Discussion on this topic was postponed until SC68C.

Attention: SC
The Committee **welcomes** *the opportunity to review papers that take advantage of technological advances to improve the ability to detect and identify species, subspecies, stocks, and individual cetaceans. As in previous years, it* **encourages** *the submission of similar papers in the future and* **recognises** *the relevance of these techniques to the Committee's work.*

Table 12

Work plan for the working group on stock definition and DNA.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
2.1. DNA quality guidelines	Intersessional email group to review recent revisions to the DNA quality guidelines that pertain to data produced using NGS approaches.	Report and finalise updated guidelines
3. Recommendations to avoid sample depletion	Intersessional email group to provide recommendations on genomic approaches to maximise the utility of tissue samples that are in danger of becoming depleted in the future.	Report and provide advice
4.1 Gray whale population structure	Intersessional email group to clarify terminology associated with the gray whale stock structure hypotheses and, where needed, to further evaluate plausibility of hypothesis in preparation for the Range-wide Review of the Status and Population Structure of Gray Whales.	Report and provide advice
4.2. Franciscana population structure	Intersessional email group to evaluate stock structure in franciscana.	Report and provide advice
4.3. *Sotalia guianensis* population structure	Intersessional email group to evaluate stock structure in *Sotalia guianensis*.	Report and provide advice
6.2. Terminology	Intersessional email group to continue discussions of the use of stock structure-related terms within the SC.	Report

10.6 Other

10.6.1 Simulation tools for spatial structuring

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, 2014; IWC, 2017d, p.48), and in 2016 the Committee agreed to expand this item (formerly specific to the Testing of Spatial Structure Models, or TOSSM) to include a broader range of tools (IWC, 2016a, p.44). Discussion of this item was postponed until SC68C.

Attention: SC

The Committee **notes** *that while simulation-based approaches have been particularly valuable in informing the interpretation of results of stock structure-related analyses, they have not been broadly used within the Committee for this purpose. The Committee therefore* **encourages** *the submission of papers using simulation-based approaches to address questions of interest to the Committee and* **reiterates** *(IWC, 2019c, p.34) that consideration should be given to bring in invited expertise to present an overview of the applicability of such approaches in order to expedite progress on this agenda item.*

10.6.2 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, 2014). Discussion of this item was postponed until SC68C.

Attention: SC

The Committee **agrees** *that the intersessional email group to review terminology with specific reference to the implications of inferred stock structure in other sub-committees should continue, with a focus this year on terms used in large whale assessments, including those used to describe gene flow among stocks versus the movements of whales between areas.*

10.6.3 Epigenetic ageing and close-kin mark-recapture

In previous meetings, the Committee reviewed novel methods that use genetics to estimate age (IWC, 2019c, p.34) and to estimate abundance, life history parameters, gene flow and stock structure (IWC, 2018d, p.40). Discussion of this item was postponed until SC68C.

Attention: SC

The Committee **agrees** *that the utility of epigenetic age estimation (Polanowski et al., 2014) to the Committee should be further evaluated with regard to the degree of precision needed for the specific application of interest. The Committee* **encourages** *future submission of papers using epigenetic ageing and/or close-kin mark-recapture (Bravington et al., 2016) in light of the potential of both approaches to inform many aspects of the Committee's work.*

10.7 Annual work plan for SDDNA

The details of the work plan are given in Table 12. Terms of Reference are outlined in Annex K.

11. CETACEAN ABUNDANCE ESTIMATES AND STOCK STATUS (ASI)

Since 2017, to ensure consistency in the way the Committee reviews and categorises them, all abundance estimates have been reviewed by a Standing Working Group (SWG) on Abundance Estimates, Stock Status and International Cruises (ASI), and the advice passed on to the relevant sub-group early in the meeting or at a future meeting as necessary (IWC, 2017d, p.94; 2018j, p.394). The ASI is also tasked to: (a) compile an agreed set of abundance estimates for use by the Committee; (b) produce a broader biennial document of abundance estimates for the Commission and the public by species and usually by ocean basin, and by specific areas if appropriate; and (c) provide a biennial overview of the status of whale stocks, largely based upon completed Comprehensive Assessments, In-depth Assessments and/or RMP/AWMP *Implementations* or *Implementation Reviews*.

11.1 Review of abundance estimates and update of IWC consolidated table

11.1.1 Eastern North Pacific gray whale

SC/68B/ASI/01 updated information on the abundance and population structure of the Pacific Coast Feeding Group (PCFG) of gray whales in the eastern North Pacific using photographic identification. Gray whales using coastal waters from Northern California to Northern British Columbia in summer and autumn generally include two groups: (1) whales that return frequently and account for the majority of the sightings; and (2) transient individuals seen in only one year, generally for shorter periods of time and in more limited areas. A time series of abundance estimates of the non-transients for 1996-2017 was constructed based on a mark-recapture model for the region from 41° to 52°N, excluding sightings in the Puget Sound region and adjacent areas i.e. the region defined by the IWC to represent the range of the PCFG for the summer and autumn feeding season (June-November). The fitted model indicates that the abundance in this region was relatively stable in the early 2000s but increased from 2010 to 2015 before decreasing slightly in 2016.

This document was reviewed by three independent experts as part of the review process established by the Committee last year (IWC, 2020j) and the Committee thanked the reviewers for their work. The paper is an update (and a more comprehensive data analysis) of Calambokidis *et al.* (2017), which used similar methods and obtained similar results and was previously reviewed; the estimates provided there were accepted by the Committee (IWC, 2018i, p.380).

As part of the review, it was noted that since the analysis uses a model-based mark-recapture method, adding new data and increasing the length of the time series impacts the estimates of abundance for earlier years (in addition to producing estimates for the subsequent years). Documentation and an explanation of this would be helpful for understanding the model fit and the consequences of the new data better.

The review also raised an issue that warrants additional consideration by the Committee. The model used effectively defines the population to be estimated by reference to the dataset itself. A whale is considered to have joined the PCFG when it has been seen there at least once (the PCFG population definition is such that it includes all whales that are seen there two or more times plus some of those seen exactly once, but no unknown whales). Thus, the population is not an entity that exists independently of the data but is partly defined by the same data used to estimate abundance. This gives the abundance estimate a certain tautological character. If the sampling effort changes, this will impact the population so defined. The model assumption that if a whale returns to the PCFG region in more than one year then it is part of the PCFG population also means that temporary emigration is not considered. If some whales occasionally do not return to the area, but then come back in a later year, they would be a part of the abundance estimate, so the abundance estimate would represent the population of whales that have ever used the area (more than in just one year), but not necessarily an estimate of the number of whales actually there in any given year.

The Committee agreed with the reviewers' conclusion that the technical aspects of the analysis were implemented correctly, and that the resulting time series of estimates (Table 13) starting in 1998 and ending with an abundance of 232 whales (SE = 25) in 2017 can be used, at least provisionally, as an estimate of abundance of the PCFG population for the *Implementation Review* discussed under Item 6.2.

Table 13

Abundance estimates of PCFG gray whales (see SC/68B/ASI/01).
The estimates for 1996 and 1997 are not considered to represent total abundance; see the text.

Year	N	SE(N)	Year	N	SE(N)	Year	N	SE(N)
1996	38	2.7	2004	216	16.6	2012	220	12.3
1997	80	10.4	2005	216	26.1	2013	240	14.1
1998	125	10.9	2006	199	21.5	2014	243	18.7
1999	146	14.2	2007	195	26.0	2015	250	18.2
2000	147	14.2	2008	214	19.0	2016	246	24.3
2001	179	13.4	2009	211	21.4	2017	232	25.2
2002	197	13.9	2010	203	19.6			
2003	207	17.3	2011	208	16.2			

The Committee noted that the estimates for 1996 and 1997 are biased low because the survey coverage area was much smaller, but those data were included in the analysis to improve model estimates later in the time series (IWC, 2015d, p.504). As noted below the Committee agreed that the time series of abundance estimates in Table 13 should be accepted as Category 1 and Evaluation Extent 2. The Committee noted that where a time-series of abundance estimates is provided, it has adopted the practice of tabling the most recent estimate and one earlier estimate sufficiently long in the past that the two are not strongly correlated. However, in discussion it was recognised that in cases where a long time-series of abundance estimates is provided, choosing the earliest year for which there is an acceptable estimate may not always be the best choice and alternatives (e.g. selecting an estimate from 10 years prior to the most recent) should be considered next year.

Attention: SC, ASW
With respect to the abundance estimates of the Pacific Coast Feeding Group (PCFG) of gray whales provided in SC/68B/ASI/01, the Committee **agrees** *that:*

(1) *the issue of estimating abundance for a population whose definition is derived from the same data used to estimate abundance has more general implications than for just the PCFG analysis and should be addressed in the future;*
(2) *the time series of abundance estimates for PCFG gray whales from 1998 through 2017 given in table 1 of SC/68B/ASI/01 be accepted as Category 1 (acceptable for use in In-depth Assessments or for providing management advice), and Evaluation Extent 2 (partially examined by the Committee but method has been previously reviewed);*
(3) *in accordance with past practice the IWC Consolidated Table of Abundance Estimates should include years 1998 and 2017 of the time series; and*
(4) *the most appropriate years to include in the IWC Consolidated Table for long time series of estimates will be reconsidered at SC68C.*

11.1.2 Bering-Chukchi-Beaufort Bowhead whales

SC/68B/ASI/02 presented results of an ice-based visual survey of the Bering-Chukchi-Beaufort (B-C-B) Seas stock of bowhead whales conducted in spring 2019 near Utqiaġvik (formerly Barrow), Alaska. Field and analysis methods largely as used in 2011, but unlike 2011 (and some other past years), the correction for availability bias (proportion of whales passing within visual range, P_4) was based on past surveys instead of being estimated from acoustic data collected concurrently. The estimated abundance of 12,505 (CV=0.228; 95% CI=7,994, 19,560) was markedly lower than the 2011 estimate of 16,820 (Givens *et al.*, 2016), but the 2019 confidence interval wholly encompassed the 2011 interval. The authors provided several reasons as to why the 2019 estimate was biased downwards and thus did not provide strong evidence of a decline including: highly unusual ice conditions; an unusual migration route that was sometimes too distant from observers; failure to keep watch because of closed lead conditions during the early weeks of the migration when many whales probably passed; and hunters' unprecedented heavy use of powered skiffs which disturbed the whales during the survey.

The discussion emphasised the particular challenges of the 2019 survey. Questions were raised about the future of the ice-based survey, which has been considered to provide more precise results than any other approach but has become increasingly difficult to conduct due to changes in sea ice conditions and concerns about safety. Line-transect aerial surveys (see below) are among the alternative options being considered but a fully successful ice-based census is likely to provide a smaller CV than an aerial survey.

In response to a question on the reliability of using past P_4 estimates to correct the 2019 ice-based counts, the authors explained that there is a strong correlation between perch location and P_4 (ocean depth was not a significant factor). The approach used in SC/68B/ASI/02 for P_4 was an improvement over the past simple averaging that has previously been considered sufficiently precise by the Committee to provide abundance estimates for years without acoustic data. Moreover, the acoustic data collection and analysis required to estimate P_4 concurrently with the visual census represents a large undertaking and increases survey costs substantially. If the past relationship between perch location and P_4 did not hold in 2019 (e.g. because of the anomalous ice/lead conditions), then this could have a substantial impact on the abundance estimate. It was also noted that using the standard error of prediction rather than the error of estimation represents the inherent uncertainty about P_4 more correctly. Finally, the Committee noted that the level of biases used in testing the *SLA* make it robust to potential biases of the magnitude expected to apply in this abundance estimate.

Attention: SC, ASW
The Committee **endorses** *the abundance estimate of 12,505 (95% CI=7,994;19,560) provided in SC/68B/ASI/02 for B-C-B bowhead whales in 2019 and* **agrees** *that it meets the definitions of Evaluation Extent of 1 (examined in detail) and Category 1 (acceptable for use in In-depth Assessments or for providing management advice). A note should be added to indicate that several sources of negative bias contribute to this estimate.*

SC/68B/ASI/09 presented results from aerial line-transect surveys conducted over the Beaufort Sea shelf and Amundsen Gulf during August 2019. A preliminary estimate for B-C-B bowhead whales, based on a geographically stratified analysis with parametric and non-parametric bootstrap estimates of uncertainty, was around 14,500 with a CV of 0.54. The estimate incorporated correction factors for trackline detection probability, availability bias, and the effects of distance and other covariates on the probability of detecting available whales. Trackline detection probability was estimated using mark-recapture distance-sampling methods for trial configurations of observers, with independent data from imagery collected concurrently from a belly port camera during some line-transect aerial surveys. Availability bias was derived from estimates of observation time based on specialised field-of-view experimental flights and estimates of bowhead whale surface and dive duration from Robertson *et al.* (2015). A bootstrap sensitivity analysis suggested that the largest contributors to CV(N) were sampling variance in the line-transect encounter rates and the estimate of trackline detection probability.

The Committee commended the scope and complexity of the study and the efforts made to correct the results for multiple sources of bias. Clarification was sought on several sources of uncertainty such as variation in survey altitudes (which is used as a covariate) due to low cloud ceilings, different levels of left truncation for the two aircraft because of bubble window designs and differences across observers. It was noted that diving behaviour and detectability likely differ when whales are in groups, which suggests that the availability correction factor varies with group size. Telemetry studies also show that availability bias differs by activity state and region.

The author noted that the paper represented an initial effort and that future work will include explicit spatial modelling to reduce the uncertainty of the abundance estimate. When that analysis is complete, the author will present the updated result and seek Committee endorsement for it.

The Committee noted that, if the line-transect survey estimate is eventually endorsed, there will be two independent estimates for 2019 abundance of Bering-Chukchi-Beaufort (B-C-B) bowhead whales. SC/68B/ASI/10 summarises the differences between the two approaches using the new standards adopted in 2019 by the Committee for the presentation of abundance estimates (IWC, 2020j). Computing an average of these two estimates prior to *SLA* input, or inputting both estimates to the *SLA* are possible approaches that require formal consideration by the Committee.

Attention: SC
The Committee welcomed the preliminary estimates of B-C-B bowhead whale numbers using aerial survey techniques (SC/68B/ASI/09). The Committee:

(1) **recognises** *the value of the approach used, and the additional work proposed;*
(2) **encourages** *the author to submit a revised estimate to next year's meeting (SC68C); and*
(3) **agrees** *to consider the appropriate way to incorporate two independent abundance estimates for the same year in SLA calculations at SC68C.*

11.1.3 Eastern Canada/Western Greenland bowhead whales

The Committee received an abundance estimate for Eastern Canada-Western Greenland bowhead whales computed using genetic mark-recapture methods (Frasier *et al.*, 2020). There was insufficient time to consider this paper fully.

Attention: SC
The Committee **agrees** *that a review of the estimate of abundance computed using genetic mark-recapture methods provided by Frasier et al. (2020) be coordinated by the Abundance Steering Group (ASG).*

11.1.4 Franciscana

Several documents on abundance estimation of franciscana dolphins (SC/68B/ASI/03-08; Cremer and Simões-Lopes, 2008; Crespo *et al.*, 2010; Danilewicz *et al.*, 2010; Secchi *et al.*, 2001; Sucunza *et al.*, 2018; 2020; Weyn, 2016) were received by the Committee as part of the ongoing review of the status of this species. Time constraints precluded a review of these documents.

Attention: SC
The Committee **agrees** *that to complete the review of franciscana abundance estimates, an Intersessional Working Group should be established with the following Terms of Reference:*

(1) *review estimates of abundance of franciscanas following the process agreed by the Committee (IWC, 2020j), and;*
(2) *provide advice on future work (e.g. additional analyses) that could be conducted to improve these estimates.*

The Committee **recommends** *that the report of the Intersessional Working Group should be provided prior to completion of the review of the status of the franciscana in 2021.*

11.1.5 Update of the IWC Table of Consolidated Abundance Estimates

Abundance estimates recommended for inclusion in the IWC Consolidated Table of Accepted Abundance Estimates during the 2020 meeting include the time series of estimates for the PCFG gray whales (Item 11.1.1) and the shore-based 2019 estimate for B-C-B bowhead whales (Item 11.1.2).

Attention: SC, S, C-A

The Committee **recognises** *that the IWC Table of Abundance Estimates is an important tool for the work of the Committee including facilitating the provision of advice to the Commission on the status of whale stocks. It* **agrees** *that estimates endorsed during the 2020 meeting should be incorporated into that Table and uploaded to the IWC website and that Allison continues to update the Table intersessionally.*

11.2 Review and provide advice on surveys (past and future)

The Committee did not receive any requests for advice on abundance surveys.

11.3 Methodological issues

11.3.1 Amendments of the RMP Guidelines to consider model-based abundance estimates

The Committee agreed in 2018 (IWC, 2019k) that the 'Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme' (referred to there as the RMP Guidelines; IWC, 2012b) needed to be modified to incorporate spatial model approaches to estimate abundance. A Steering Group was established to: (1) develop a set of specific instructions for the amendment of the RMP guidelines to consider model-based abundance estimates; and (2) select a candidate to conduct this work. David Miller from CREEM (Centre for Research into Ecological and Environmental Modelling, University of St. Andrews) was selected to make proposals to modify the Guidelines.

Attention: SC

The 'Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme' need to be modified to consider estimates of abundance computed using model-based methods. The Committee **agrees** *that the Steering Group established to oversee this process should continue its intersessional work to develop instructions to amend the Guidelines.*

11.4 Consideration of the status of stocks

The Scientific Committee has been asked to provide advice to the Commission on the status of whale stocks (IWC, 2017a). An approach to convey the relevant information was developed at last year's meeting (IWC, 2020j) and reviewed at a virtual pre-meeting this year.

11.4.1 Review of previously agreed-upon approach

The Committee had agreed on a two-step process to summarise the status of stocks. The first step included analyses for internal use by the Committee. The following three statistics (with 90% intervals as specified in IWC, 2020j, p.282) would be produced for a set of *Implementation Simulation Trials* (*IST*s) for stocks that have been the subject of RMP or AWMP *Implementations* and *Implementation Reviews*:

(1) current depletion (number of animals aged 1+ relative to 1+ carrying capacity, if available);
(2) current 1+ abundance; and
(3) a pointwise median trajectory plot of 1+ abundance from pre-exploitation or the first year used in the simulations to the present.

Results will be provided for $MSYR_{1+}$=1% and $MSYR_{mat}$=4% unless the base-case trials were based on a higher value for the lowest plausible value for MSY rate or if MSY rate had been estimated and there is an agreed value. Results will be summarised across simulations and trials (medians over simulations and averages across base-case trials) and reported by area normally for Ocean Basin and 'Medium Area' (some flexibility is allowed depending on circumstances).

The second step is to consolidate and simplify this information for reporting to the Commission by providing only average values (and 90% intervals) for current 1+ abundance and depletion (if available), for the appropriate stocks/areas. A qualitative statement on recovery in the past several decades will be provided based on the trajectory plot.

For stocks that have been the subject of a Comprehensive or In-depth Assessment, the same outputs as identified above (internal and final) will be produced. For stocks with an agreed abundance estimate but no assessment, some case-specific adjustments will be provided.

Punt and Allison had prepared examples of the stock status outputs in the format proposed above for most RMP/AWMP cases. Producing these outputs required changes to control programs, but no serious difficulties were encountered. The results had not yet been made available to and considered by the intersessional group established last year because of time constraints exacerbated by the coronavirus pandemic. The Committee thanked Punt and Allison for their work, noting that the results will be examined intersessionally (see below).

Table 14
Simple summary of assessment information for large whales at a broad regional level (key below).

Region	Assessment information	Type*	Removals**	Refer to ISG this year?
Blue whale ('true')				
North Pacific	Pre-assessment stage	2c	F	No
North Atlantic	No assessment plans	3b	F	No
Southern Hemisphere	Work ongoing towards new assessment	2c	E	Yes
Blue whale (other sub-species)				
North Indian Ocean	Central and Eastern: in progress	2b	D	No
	Northwest: no assessment plans	3a	D	No
Southern Hemisphere	Southeast Pacific, southwest Pacific: in progress	2b	F	No
	Southeast Indian, southwest Indian Ocean: in progress	2b	F	No
Sei whales				
North Pacific	Ongoing *In-Depth Assessment*	2b	B, E	No
North Atlantic	Request for RMP *Implementation* postponed	3d	E	No
Southern Hemisphere	No assessment plans	3d	E	No
Fin whales				
North Pacific	No assessment plans.	3b	E	No
North Atlantic	*Implementation Reviews* completed. *SLA* for Greenland	1a	A, B, E	Yes
Southern Hemisphere	No assessment plans	3d	F	No
Omura's whale				
Indian and Pacific Ocean	No assessment plans	3d	E	No
Gray whale				
North Pacific	Range-wide review and *Implementation Review* in progress	1b	A, C	No
	Western North Pacific (CMP)	3a	C	TBD[1]
Common minke whale				
North Pacific	Overall - no			No
Western	In-depth assessment underway	2b	B, C	No
North Atlantic	RMP/AWMP completed	1a	A, B, E	Yes
Southern Hemisphere	No assessment plans for dwarf minke whales	3d	F	No
Antarctic minke whale				
Southern Hemisphere	Overall – no assessment but abundance estimates available for 1st and 2nd circumpolar surveys	-	F	No
	Assessment completed for Indo-Pacific in 2014	2a	F	Yes
Bryde's whale				
North Pacific	Overall - no assessment plans	-	-	No
Western	*Implementation Review* completed	1a	B	Yes
North Atlantic	No assessment plans	3c	F	No
Gulf of Mexico	No assessment plans	3a	F	Yes
S. Hemisphere	No assessment plans	3c	F	No
Right whale species				
North Pacific	No assessment plans – critical especially in the east	3a	C, D	Yes
North Atlantic	Overall: no but critical (and see western below)	3a	C. D	Yes
Western	New assessment required - critical	2b	C, D	Yes
S. Hemisphere	Assessment completed in 2010.	2a	C, D	Yes
	Regional assessments considered (SE Pacific critical)	2c	C, D	No
Bowhead whale				
North Atlantic	Overall no – but critical apart from below.	3a	C, D	No
Eastern Arctic	*SLA* developed for Greenland hunt.	1a	A, B	Yes
North Pacific	Overall no - but see below	-	-	-
B-C-B	*Implementation Review* completed	1a	A	Yes
Eastern	No assessment plans	3a	C, D	Yes
Okhotsk Sea	Receive new information	3b	C, D	Yes
Humpback whale				
North Pacific	Subject to *In-Depth Assessment*	2b	C	No
North Atlantic	Due a new assessment (last one completed in 2002)	2c	A, C	No
Southern Hemisphere	Assessment completed in 2015	2a	C, D	Yes
Arabian Sea	Pre-assessment	3a	C, D	Yes
Sperm whale				
Global	Reviewing assessment plans	3d	F	No

[1]Decision on whether this stock will be referred to the ISG will depend on the results of the intersessional IST/CMP workshop and modelling.

***Key to Types:**

Type 1=RMP/AWMP 'stocks': Type 1a=*Implementation* or *Implementation Review* completed within the last 6 years. Type 1b=*Implementation Review* underway.

Type 2=IA 'stocks': Type 2a=Comprehensive Assessment or in-depth assessment completed within last 6 years. Type 2b=Assessment expected to be complete within 2 years. Type 2c=Assessment expected to be complete within 4 years.

Type 3='Other' stocks: Type 3a=No assessment but broadly recognised as 'critical'. Type 3b=No assessment but abundance estimate available and catch history suggests might be depleted. Type 3c=No assessment but abundance estimate available and catch history suggests might not be depleted. Type 3d=No assessment and little or no current information.

****Key to removals:**

A=IWC regulated catches; B=nationally regulated catches; C=bycatches are/might be important at regional level; D=ship strikes are/might be important at regional level; E=neither bycatches or ship strikes believed to be important at the regional level; F=unknown.

Although some concern was expressed over the use of averages if the trial set was unbalanced (i.e. primarily focussed on conservation concerns in an RMP or AWMP management context), it was noted that this issue is alleviated by using only two values for MSYR and by only integrating across stocks for a single base case (thus not including all sensitivity trials). Multiple base case trials would be used only when necessary (e.g. for multiple stock structure hypotheses).

The Committee concluded that the approach developed last year was appropriate and should be implemented intersessionally (see Item 11.4.3 below), recognising that adjustments may need to be made in the light of experience, and that suggested modifications be brought back to the Committee next year.

11.4.2 Listing of stocks for which the approach may be applied

Table 14 summarises, at a broad regional level, the assessment information available for large whales, and highlights those which will be examined intersessionally.

11.4.3 Priority for undertaking the work and establishment of an Intersessional Working Group

In order to progress this work the Committee established an Intersessional Working Group under Donovan.

Attention: SC

The Committee **agrees** *that to provide advice on stock status to the Commission, an Intersessional Working Group should follow the process described in IWC (2020j, item 3.3).*

The Committee also **recommends** *that the results of the Intersessional Working Group should be reviewed at a 3-day pre-meeting prior to SC68C where they will be used to develop draft text for the Commission for review by the Committee at SC68C.*

11.5 Progress on previous recommendations

The cancellation of the 2020 in-person meeting severely impacted the Committee's work on abundance estimates and status. Future cancellations are not sustainable given the technical nature of the review of abundance estimates, an in-person meeting is essential. Nevertheless, progress was made with respect to some recommendations from last year's meeting. An item that had been in the agenda for the past two years, the provision of advice to the Commission on status of stocks (Item 11.4), was addressed during the virtual pre-meeting and the Committee established an Intersessional Steering Group to further advance this work.

Last year, the Committee developed a process to review and validate abundance estimates (IWC, 2020j) and this was followed at this year's meeting to the extent possible; the process facilitated productive reviews by the Committee. The Committee **reiterates** that review of abundance estimates and the update of the IWC Consolidated Table of Abundance Estimates represent important recurring tasks for the work of the Committee.

Last year, the Committee also agreed that the work required to: (a) address issues related to estimation of $g(0)$; and (b) develop robust estimates of abundance for North Pacific minke whales should be referred to an Intersessional Correspondence Group (IWC, 2020j). There was insufficient time to review the work of this group and the Committee **agrees** that a report by this ICG be reviewed in 2021 at SC68C.

The Committee also **agrees** that the amendment of the RMP Guidelines is a priority for completion within the next two years (Item 11.3.1 above). This work will continue intersessionally led by a Steering Group.

Simulated datasets are valuable to test new methods for abundance estimation and the Committee has recommended that existing computer code previously developed for simulating line transect data be updated (IWC, 2019k). The Committee **agrees** that this ongoing project should be continued, and that progress be reviewed at next year's meeting.

The Committee also **agrees** that intersessional work on priority tasks identified in the work plan should continue and progress be reviewed at SC68C.

11.6 Work plan

The Committee **agrees** to the work plan provided in Table 15. The proposed pre-meeting has financial implications for the Committee and this is discussed under Item 22. For details of Intersessional Correspondence Groups, see Annex K.

12. BYCATCH AND ENTANGLEMENTS (HIM)

12.1 IWC's Bycatch Mitigation Initiative

SC/68B/HIM/12 provided an update on the progress of the IWC's Bycatch Mitigation Initiative (BMI). The BMI efforts have focused on identifying priority countries for pilot project development and engaging with priority Regional Fisheries Management Organisations (RFMOs) and the Food and Agriculture Organization of the United Nations (FAO). Pilot projects are intended to allow the BMI to apply multi-disciplinary, experimental approaches to bycatch mitigation, monitoring and management. Seven countries (India, Kenya, Pakistan, Republic of Congo, Thailand, Peru, and Indonesian/Malaysian Borneo) were identified for pilot project development, and a longer list of countries has been identified for possible future project development. The BMI will continue to engage with national governments and local experts to discuss collaboration on pilot projects, develop the scope of projects and project concepts for fundraising efforts. The BMI has continued to engage with the FAO on the development of Technical Guidelines to reduce bycatch of marine mammals in capture fisheries and with priority RFMOs including the Indian Ocean Tuna Commission (IOTC) regarding bycatch in the Indian Ocean and the joint tuna-RFMO bycatch working group.

Table 15

Work plan for the review of abundance estimates and provision of advice to the Commission on status of stocks for the period 2020/21.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
11.1 Review of abundance estimates	ASG to coordinate the review of the abundance estimates with priorities to include: (1) franciscana; (2) non-Antarctic blue whales in the Southern Hemisphere; (3) North Pacific humpback whales; (4) North Pacific sei whales; (5) Eastern Canada/Western Greenland bowhead whales; and (6) Southeast Australian southern right whales.	Review intersessional progress, estimate reviews or new estimates available at SC68C
11.1.4 Franciscana abundance review	ISG to coordinate a review of estimates of franciscana abundance to complete the review of the status of the species by the SC in 2021.	Provide report to an intersessional workshop or to SC68C
11.1.5 Upload the estimates accepted at the annual meeting to the IWC website and continue to update the IWC Abundance Table	Update the table with estimates accepted at SC68B (Allison).	Review progress
11.1 Address issues (including *g*(0)) related to estimates of abundance of western North Pacific minke whale abundance estimates for use in the current in-depth assessment and the provision of regional estimates	ICG to coordinate intersessional work.	Review progress
11.3.1 Amend the RMP Guidelines to consider abundance estimates computed with model-based methods	Develop a set of specific instructions for the amendment of the RMP Guidelines to consider model-based abundance estimates (SG Amendment of RMP Guidelines and Miller).	Review an updated document of the RMP Guidelines
11.3 Develop simulation software to evaluate methods for abundance estimates	Continue development of software (Palka and Smith).	Review Progress
11.3 Consider diagnostic methods (e.g. model fit) for mark-recapture models to estimate abundance	ASG identify an expert group.	Review progress
11.4 Provide Commission with advice on status of stocks.	Develop a draft report for provision of advice to the Commission for review by the Committee at SC68C using the guidelines developed by the Committee for advising on status of stocks. The draft should include recommendations to improve the guidelines in light of the experience gained, and advice on how to extend this approach to small cetaceans.	Review Progress
11.4 Host a pre-meeting for the Abundance Steering Group (ASG) and the Intersessional Working Group on Status of Stocks	ISG and ASG to review necessary information in making preparations for the pre-meeting.	Host pre-meeting

Discussion of general collaboration with FAO and RFMOs is given under Item 12.5 and with IOTC under Item 12.2.

The BMI is developing a new four-year work plan for 2021-24, to be considered by the Conservation Committee at its next meeting. During this period, the BMI will continue to focus on bycatch in gillnets and other fixed fishing gears and prioritise information gathering in currently identified and future priority pilot project locations.

The Committee welcomed the report given in SC/68B/HIM/12 and thanked Tarzia and the Expert Panel for their work.

Attention: C, CG, CC, SC, S

The Committee strongly **endorses** *the work of the IWC's Bycatch Mitigation Initiative (BMI) as reported in SC/68B/HIM/12,* **recommends** *continuation of this work and* **encourages** *the creation of a separate BMI budget line to support priority bycatch research, including for pilot project implementation.*

To further support the work of the BMI, the Committee **agrees** *to:*

(1) *request new bycatch information in advance of annual Committee meetings from priority locations for the BMI (and for focal species within pilot project countries/region);*
(2) *review new information with a view to providing recommendations for fisheries or locations which should be prioritised for BMI work (e.g. pilot projects or capacity building);*
(3) *assist the BMI to identify bycatch hotspots and review existing data available on cetacean distribution, bycatch and fishing effort; and*
(4) *continue to review mitigation and monitoring strategies and provide appropriate technical advice including assisting the BMI intersessionally on reviews of mitigation measures.*

The Committee also **encourages** *the ongoing collaboration among the BMI, RMFOs, independent researchers and NGOs. It* **requests** *that relevant NGOs and researchers contact the BMI regarding their specific geographical interests and expertise.*

Campos provided a statement on behalf of the Government of Peru requesting to be considered as a location for a BMI pilot project to monitor and mitigate the incidental capture of dolphins. She noted that a constant concern for Peru's artisanal fisherman and Government entities has been the interactions between cetaceans and the artisanal fishery, given that cetaceans are protected species. This conflict is a complex and multi-faceted issue. The interaction is reciprocal, in that cetaceans have an effect on the fishery (e.g. damage to gear, loss of catches) and the fishery has an effect on cetaceans (e.g. bycatch mortality, directed catch and decrease in food availability). The IWC Bycatch Mitigation Initiative's pilot projects will be focusing on monitoring and mitigating the incidental capture of cetaceans in artisanal fisheries.

12.2 Review new methods and estimates of entanglement rates, risks and mortality

Anderson *et al.* (2020) used the limited data available to make rough estimates of cetacean bycatch in Indian Ocean tuna gillnet fisheries. Cumulative total bycatch, 1950-2018, was estimated to be about 4.1 million small cetaceans (±50%) with annual bycatch peaking at about 100,000 individuals per year (±40%) during 2004-06. These levels of removal appear to be unsustainable, with some populations currently estimated to be at 10-20% of pre-fishery levels. Iran, Indonesia, India, Sri Lanka and Pakistan have the largest gillnet fleets in this area and the highest estimated cetacean bycatch.

The convention area of the Indian Ocean Tuna Commission (IOTC) has the highest gillnet fishing effort of tuna-RFMOs, and the type of regional level analysis of bycatch conducted by Anderson *et al.* (2020) has generally not previously been carried out for other regions. The analysis did not include any information on deliberate, directed catch of dolphins by tuna fisheries (some directed catch for consumption has occurred in Sri Lanka and parts of the Indian coastline). Recent anecdotal evidence suggests that many Indian Ocean tuna gillnet fleets are moving towards sub-surface setting of nets, which has been found to lead to bycatch reductions of some cetaceans and other taxa. For future analyses, it was suggested the effects of sub-surface setting (particularly post 2016 and the impacts of climate change in relation to changes in tuna distribution, abundance and fishery yields over time should be considered.

The IWC held a Workshop entitled 'Bycatch Mitigation Opportunities in the Western Indian Ocean and Arabian Sea' in Nairobi in May 2019. The report of the Workshop will be presented to the next Conservation Committee later in the year for consideration at IWC68 in 2021[19]. The Workshop identified known and potential cetacean bycatch hotspots across the region and recognised that bycatch is one of the most significant conservation threats to species and populations.

Discussions highlighted the limited data available for assessing bycatch throughout the Indian Ocean, the opportunities for the BMI to contribute towards mitigation trials and the potential for further collaboration with IOTC.

Attention: CG, CC, SC, S

The Committee **endorses** *the recommendations in the Report of the Workshop on Bycatch Mitigation Opportunities in the Western Indian Ocean and Arabian Sea,* **agrees** *on the need for integration of social and economic information and factors into bycatch reduction efforts and* **welcomes** *a multi-disciplinary approach to bycatch reduction efforts. It particularly highlights recommendations that:*

(1) *national governments should strengthen bycatch assessment, monitoring and reduction programmes as a matter of urgency;*
(2) *that the BMI explore means of more consistent and sustainable approaches for funding bycatch mitigation efforts;*
(3) *multi-disciplinary efforts are needed; and*
(4) *the IWC and IOTC should collaborate more closely to address cetacean bycatch.*

SC/68B/HIM/01 described estimates of entanglements of humpback and common minke whales in the Scottish creel fishery based on face-to-face interviews with fishers and examination of strandings data and disentanglement efforts. Two independent data sources were used for a capture-recapture approach to estimate the number of entanglements. Estimates were also made by extrapolating results from the interviews to the entire active fleet. The results suggest that the Scottish creel fishery may be responsible for considerably more whale entanglements than previously thought, with estimates of around five humpback whales and 30 common minke whales becoming entangled each year. The two independent datasets (strandings and interviews) and analysis methods (capture-recapture and extrapolation) were subject to many potential biases. However, the similarity of the estimates provided some confidence in the results. Given that over 80% of the common minke whales and 60% of the humpback whales were reported entangled in the ground lines, fishers suggested using sinking line, and some have been participating in informal trials of rope-less technologies. It was noted that the scale of the problem may surprise fishers since most individuals only occasionally encounter entangled whales. Fishers' engagement on this issue may have been facilitated by the fact that aside from the issue of bycatch, creel fishing is perceived as less environmentally damaging than some other fishing gears. During the IWC disentanglement training, some of the fishers commented that fleet-wide changes in fishing operations would only occur if regulations were implemented.

[19]See copy available at *https://archive.iwc.int/pages/view.php?ref=9612&k=*.

However, there was willingness to trial mitigation measures if there was financial support. The Committee **commends** the Scottish Entanglement Alliance (SEA) for its successful engagement with the Scottish creel fishing community, who have shown a strong willingness to try to address the entanglement problem.

Attention: CG
The Committee **recommends** *continuation of the SEA project, including ongoing outreach with fishermen and creel entanglement mitigation trials.*

SC/68B/HIM/08 described a study initially funded by the IWC Small Cetacean Voluntary Fund which conducted fisher interviews in Kuching Bay, Sarawak (Malaysian Borneo) between 2011-14 and 2016-19. In total, 36% of respondents reported having experienced an entanglement of a cetacean in their own gear sometime in the past year. In the second interview period, of the 62 respondents who had experienced cetacean bycatch in their nets, 58% reported finding animals alive and releasing them. Irrawaddy dolphins were the most frequently reported species entangled.

The BMI has identified Malaysian (and Indonesian) Borneo as a priority location for pilot project development and the Committee **welcomes** this new information on bycatch in artisanal fisheries in Sarawak and **encourages** further collaboration between the authors and the BMI to determine whether the data can be used to extrapolate mortality rates for local cetacean populations, and to test bycatch mitigation methods in these fisheries. The newly developed 'Guidelines for the Safe and Humane Handling and Release of Bycaught Small Cetaceans from Fishing Gear' (Hamer and Minton, 2020) should prove useful in these situations, and in some locations there might be a way to combine training for large whale disentanglement with safe handling and release of small cetaceans. There might also be opportunities for joint efforts with CMS who have recently developed a Concerted Action Plan for Irrawaddy dolphin which considers bycatch.

SC/68B/HIM/07 provided new information on the Baltic Sea harbour porpoise, which is listed by IUCN and HELCOM as critically endangered. Its current geographical range is significantly smaller than its historic one and there are only a few hundred animals left. The most recent abundance estimate (Amundin *et al.*, 2016) is 497 (95% CI 80-1,091). While pollution and disturbance through underwater noise may be contributing to the population failing to recover, bycatch is the most acute threat causing direct mortalities. Given the small size of the population, the sex ratio, age distribution, and the proportion of females that are potentially infertile due to high contaminant load, there may be fewer than 100 fertile females remaining in the Baltic Proper. The authors note that losing even one female could have a serious effect on the ability of the population to recover or even remain stable but initiatives from EU Member States to minimise bycatch are limited with no area closures to gillnets to protect the porpoise. While Sweden designated the main part of the porpoise breeding area in the central Baltic Proper as a Natura 2000 site in December 2017, the lack of progress to protect the porpoises due to the extended process for EU Member States to agree on joint measures is threatening the survival of the population.

The Committee discussed a number of recommendations made by the authors of SC/68B/HIM/07 and also noted its previous recommendations calling for urgent conservation action for the Baltic porpoise. Last year (IWC, 2020a, p.46) the Committee reiterated its concern and agreed that listing the harbour porpoise population of the Baltic Proper in Appendix I of CMS would greatly assist in conservation efforts. However, this did not happen at the CMS Conference of the Parties (CoP) in February 2020, although an NGO-sponsored 'Concerted Action' was approved by the Parties.

Attention: CG, CC, SC, S
The Committee has repeatedly stated its serious concern for the critically endangered harbour porpoise population of the Baltic Proper (e.g. see IWC, 2020a, p.46). The Committee again **recommends***, as a matter of urgency, that all countries adjoining the Baltic Proper immediately act to eliminate bycatch of the Baltic porpoise.*

In addition, the Committee:

(1) **encourages** *further research into stranded and/or bycaught porpoises to investigate all factors negatively impacting on the population, including pollution and prey depletion;*
(2) **notes** *that ICES, at the request of the European Commission, is in the process of providing advice on fishery emergency measures for the Baltic porpoise and looks forward to seeing its advice;*
(3) **notes** *the recent statement from the European Commission and urges it to act on the latest advice and information and ensure that appropriate measures are implemented and are in place for the longer term until population recovery is achieved;*
(4) *again* **encourages** *the Baltic range states to propose the Baltic porpoise for listing on CMS Appendix 1 at the earliest opportunity and calls on CMS Parties to support this process; and*
(5) **requests** *the IWC Executive Secretary to write to all the range states informing them of the Committee's concerns.*

12.3 Review mitigation measures for preventing bycatch and entanglement

Omeyer *et al.* (2020) described a study to assess the effects of a Banana Pinger (Fishtek Marine Limited) on harbour porpoises near Cornwall, UK between August 2012 and March 2013. Two passive acoustic loggers recorded cetacean

activity during cycles of active and inactive pinger periods. Harbour porpoises were 37% less likely to be detected near the pinger when the pinger was active, while they were only 9% less likely to be detected 100m further away. The results suggested that harbour porpoises did not habituate to the pinger over an 8-month period, that the pinger effect was localised, and that pinger use did not lead to harbour porpoise displacement.

Clay *et al.* (2019) examined the effect of pingers on the behaviour of Burmeister's porpoise in the vicinity of the Peruvian small-scale driftnet fleet, investigated over a four-year period. The use of pingers led to an 86% reduction in porpoise activity around nets. The results suggested that pingers are likely to be effective at deterring Burmeister's porpoises from fishing nets. Given the large capacity of this and other fleets in the region, pingers may substantially reduce mortality.

Bielli *et al.* (2019) examined the use of light emitting diodes (LEDs) deployed on the floatlines of paired (control vs illuminated net) gillnets, to provide a visual cue, during 864 fishing sets on small-scale vessels departing from three Peruvian ports between 2015 and 2018. For the illuminated nets, bycatch probability per set was reduced by up to 74.4% for sea turtles and 70.8% for small cetaceans. Target species CPUE was not negatively affected by the presence of LEDs.

It was noted that Bielli *et al.* (2019) demonstrated the efficacy of net illumination to reduce bycatch for Peruvian small-scale gillnet fisheries and that there could be wider applications given the ubiquity of small-scale net fisheries, the relatively low cost of LEDs and the current lack of solutions to bycatch. However, the effectiveness of LEDs as a mitigation measure may depend on the area, habitat characteristics, fishery, time of day (the Peruvian trials were overnight), target species and bycaught species. Further trials are needed to assess the effects of LEDs, particularly during the day and in different natural light conditions.

SC/68B/HIM/02 described a comprehensive design guide to enable the construction of gillnets that are efficient for target catch but acoustically visible to specified frequencies of echolocation signals. Species-specific resonators that substantially increase the acoustic visibility of gillnets were systematically identified through simulation and experimental testing. For example, 8mm acrylic glass spheres appear as large as table tennis balls at 130kHz, the frequency used by harbour porpoises. The authors suggested experiments to examine the behaviour of odontocetes in the vicinity of modified gillnets, and commercial fishing trials to investigate whether bycatch is reduced with modified nets. If successful there would then be a need to develop an automated process to build gillnets with acrylic spheres attached.

In discussion, Kratzer noted that an initial small commercial trial resulted in fewer bycaught porpoises in the modified nets, but the results were not yet conclusive. The prototype nets as well as the nets for the commercial trials were built by hand, but automated production would be needed for longer nets. Although the spheres are cheap, the engineering challenge during manufacture is to either attach the spheres automatically to a standard net or to integrate them into the filament as it is made. Trials conducted with a different type of reflector had not been able to detect changes in harbour porpoise behaviour around nets.

SC/68B/HIM/11 reported the results of trial of a low-cost bycatch reduction method in a small-scale drift gillnet fishery in Peru ('glass bottle alarms' a glass drink bottle with a bolt inside thought to produce a sound similar to that of a commercial 'pinger'). This should allow dolphins to more effectively detect a gillnet and avoid capture but the authors found that it did not significantly reduce bycatch of dolphins or turtles in gillnets (or target fish catch captures aside from a reduction in shark catch). Another potential low-cost technology, plastic bottle acoustic reflectors, will be tested in the coming months in the same fishery.

The Committee noted that the mean sound pressure level (SPL) of the 'glass bottle alarm' (120dB re 1µPa/√Hz at 1m) is much lower than a commercial 10kHz pinger (132dB), and that commercial pingers have been found to reduce bycatch in the same fishery as the glass bottle alarm tests. Berggren noted that it was probably easier to have closer spacing of the bottles rather than trying to increase the SPL with different materials. In the trials, the spacing had ended up being greater than intended because the easiest place to attach the bottles was between the net panels. Some sensory ecology or fine scale behavioural studies around the bottle alarms may be useful and could be compared with pingers. Another approach would be to repeat the experiment with a closer spacing. Tarzia noted that there may be possibilities within a BMI pilot project to help test these low-cost mitigation options further. The Committee **welcomes** the presentation of results of trials of technical mitigation measures which attempt to reduce cetacean bycatch in gillnets.

Attention: CG, CC, SC

The Committee **draws attention** *to previous discussions that in many situations there may be no technical option that can be implemented effectively and the only solution is to stop using high risk fishing gears; this can include situations involving critically endangered cetacean populations or difficult socio-economic circumstances.*

The Committee **recommends** *the further development and testing of simple technology and low-cost devices that might reduce cetacean bycatch. This includes lights (LEDs), 'glass bottle alarms' and simple reflectors discussed this year. In all cases, trials need to determine the effectiveness for reducing bycatch for the species of most concern, while also assessing consequences for other species and taxa, as well as on catches of the target species. Such tests should be conducted in conditions as close as possible to those in the fishery where they are intended to be implemented. For example, LEDs should be tested in a variety of different natural light and turbidity conditions across a range of fisheries.*

12.4 Reporting of bycatch (including small cetaceans) and large whale entanglements

12.4.1 Review progress on the global entanglement database

Last year, the Committee had agreed to request that members of the Global Whale Entanglement Response Network (GWERN) collect data using the consensus data form (see Annex D of IWC, 2013c) in order to assess the feasibility of creating a global entanglement database based on reports from GWERN. Mattila provided an update on the use of the data form. Eleven countries or regions responded to a survey on the use of the form, representing more than 150 entanglement response incidents. Most found the data form was helpful and many of the networks had already incorporated most of the data fields in their national or regional databases. However, most of the responding countries/regions already have a national or regional database and did not feel that there was a need for the IWC to develop a global database. In view of this, the Committee **welcomes** the ongoing efforts on data collection but **agrees** to defer a decision on developing a global database.

12.4.2 National Progress Reports

There was some discussion of National Progress Reports in the context of BMI work to identify the main barriers to reporting, gaps in IWC bycatch data, and opportunities to collaborate with other inter-governmental organisations collecting bycatch information. The Committee noted previous discussions regarding National Progress Reports and the challenges faced by many countries due to lack of resources. The Progress Reports only include reported bycatch and thus not estimates of the total. The new US import restrictions under the MMPA may incentivise some countries to improve their estimates. The Committee **agrees** to continue to encourage improved reporting and estimation of bycatch and notes that estimates of all anthropogenic removals are required for assessments. Double noted that for Australia, the national reporting process results in the only annual national synthesis of cetacean bycatch and entanglement.

A summary of the entries into the Progress Reports database for the past year is available as Annex G.

12.5 Collaboration on bycatch mitigation with IGOs (including FAO, Regional Fisheries Management Organisations and others)

The Bycatch Coordinator, Tarzia, briefly outlined the ongoing engagement between the IWC Secretariat and FAO, and efforts to develop a collaborative work programme on cetacean bycatch (see SC/68B/HIM/12). This has included participation in FAO expert workshops and coordination of comments from the BMI on FAO's draft technical guidelines to reduce marine mammal bycatch in fisheries. Tarzia has also engaged with FAO on the Common Oceans Areas Beyond National Jurisdiction (ABNJ) project (Phase 2 development) and she also remotely participated in the 2019 IOTC Working Party on Ecosystems and Bycatch meeting, presenting the IWC Indian Ocean bycatch Workshop report (to be presented to the IWC Conservation Committee at its next meeting[20]). Tarzia and Lent also attended the 2019 joint-tuna RFMO bycatch working group meeting and held a side event on cetacean bycatch. The Committee welcomed the participation in the meeting of the FAO, IOTC and ICCAT Secretariats.

Einarrson presented an outline of the development of the FAO's Technical Guidelines to reduce bycatch of marine mammals in capture fisheries, including two expert workshops (2018 and 2019) and the incorporation of feedback from national governments and IGOs and experts. FAO appreciated the input from both the Committee and the BMI and looks forward to further cooperation. FAO had planned to publish the final version of the Technical Guidelines in advance of its Committee on Fisheries meeting (July 2020), however due to the meeting being postponed it is currently uncertain if the guidelines will be published in the timeframe planned or with a slight delay (February 2021). The Committee noted the importance of the Guidelines and welcomed their publication in the coming months.

The Secretariat commissioned an analysis of RFMO efforts and policies related to cetacean bycatch to help inform the IWC and the BMI on which of the RFMOs should be prioritised for collaboration on bycatch reduction. The report (SC/68B/HIM/05) focuses on the following RFMO components: legally-binding conservation and management measures, observer programmes, data analyses and other voluntary progress (e.g. workshops and special collaborative projects). This information was analysed to generate a semi-quantitative 'bycatch mitigation effort' score, coupled with a 'potential for bycatch risk', to calculate an overall 'average bycatch performance' score for tuna RFMOs. The analysis was limited in scope to efforts on paper rather than in practice. Based on the assessment, the author recommended that IWC prioritise engagement with ICCAT, IOTC, the South Pacific Regional Fisheries Management Organisation (SPRFMO), and the Southern Indian Ocean Fisheries Agreement (SIOFA).

The Committee welcomed SC/68B/HIM/05 and thanked Elliot for this work which will be valuable to the BMI for long-term monitoring of RFMO progress in cetacean bycatch management. There is not currently an activity within the BMI's

[20] *https://archive.iwc.int/pages/view.php?ref=9612&k=.*

work plan to refine or expand on the methodology, but members of the Committee are encouraged to collaborate directly with Elliot on this.

Although some RFMOs may have conservation management measures relevant to cetaceans, compliance with these measures is often low and this is an important factor to consider in any future work. It was also noted that to bring about change within RFMOs, recommendations generally need to be made at the RFMO Commission level, either through a 'science channel' or a 'political channel'. The Committee noted that the Kobe[21] Bycatch Working Group might be the ideal forum to discuss the review and that this could initiate further collaborations with tuna RFMOs. It was noted that the draft review had been discussed at the ICCAT Ecosystems meeting, but that there had not been time to formulate a recommendation. The Committee looks forward to further discussion at SC68C.

Although in many regions the RFMOs are less relevant to the small-scale fisheries that are the priority of the BMI, a component of the BMI work plan does include engagement with RFMOs. In discussion, it was suggested that tuna RFMOs were already struggling with their primary tasks of fisheries management, with little attention to cetacean bycatch, and that engaging directly with member states might be more effective. However, others pointed to collaborations with RFMOs which had led to productive advances to address bycatch of other taxa (e.g. sea turtles and IATTC, seabirds and a number of RFMOs). Management measures within RFMOs for cetacean bycatch had been limited by a lack of expertise within the RFMOs, but the situation is improving. There was agreement on the need for long-term engagement with RFMOs. In particular, following the Indian Ocean bycatch Workshop in 2019[22], Tarzia has been trying to progress a research-based work plan with IOTC.

SC/68B/HIM/05 also proposed a Workshop to improve knowledge of cetacean bycatch levels and population-level impacts within RFMOs. There is a need to gather data at a regional level which could be facilitated by regional workshops and/or making use of existing meetings. The Ocean Modelling Forum (Punt *et al.*, 2019) also has ongoing projects to address setting and applying bycatch standards including estimating abundance and assessing bycatch rates. Tarzia will continue to explore opportunities for the BMI to enhance data gathering and understanding of bycatch impacts in collaboration with these other initiatives. It was suggested that there might also be an opportunity for a meeting associated with the IOTC Working Party on Billfish (WPB) and Working Party on Ecosystems and Bycatch in September 2020 to scope out a future technical Workshop on cetacean bycatch.

The Western and Central Pacific Fisheries Commission (WCPFC) hosts an online Bycatch Management Information System (BMIS) for fisheries managers, scientists, fishers, educators and the public (SC/68B/HIM/04). The database consolidates information on the mitigation and management of incidental catches of species of special interest in pelagic tuna and billfish fisheries. The BMIS information on mitigation techniques and RFMO regulations is updated frequently and regular peer review helps to ensure its consistency with international best practice. The BMIS team is seeking advice from the Committee and the BMI on periodic peer review of cetacean related BMIS content. The BMIS team are also interested in collaborative efforts to improve the availability of standardised regional bycatch data through the tuna-RFMOs Bycatch Data Exchange Protocol (BDEP).

There are several opportunities for coordinating international efforts to provide publicly accessible information on cetacean bycatch and mitigation and the Committee **agrees** that the IWC should continue to build collaborations with existing platforms, efforts and existing or potential linkages among initiatives. The FAO's 2019 workshop to develop Technical Guidelines (SC/68B/HIM/11) recommended that the FAO maintain updates on mitigation measures potentially through the BMIS platform.

BMI collaboration with the BMIS to review existing information and provide new information on mitigation could help to fill the large knowledge gap regarding large whale entanglement on the high seas. The Bycatch Coordinator is also engaging with many other global initiatives working on bycatch mitigation (including CMS, ACCOBAMS, SPREP, see *https//:www.bycatch.org*) and many of these are included in the BMI draft work plan. The Committee will continue to review new mitigation studies and consider how best to provide advice on specific mitigation options. An Intersessional Correspondence Group has been established (see Annex K) to assist Tarzia and the Expert Panel in addressing the requested review by BMIS including: (i) review of each mitigation technique description relevant to cetaceans; (ii) advice on prioritising cetacean mitigation techniques according to gear type; and (iii) review of descriptions of cetacean interactions by fishing gear/method employed in pelagic tuna and billfish fisheries.

[21]The 'Kobe process' is a collaboration between tuna RFMOs which started with the first meeting in Kobe, Japan, in January 2007.

[22]*https://archive.iwc.int/pages/view.php?ref=9612&k=.*

Attention: C, CG, CC, SC, S

The Committee notes the broad scope of work which would be needed to understand and address cetacean bycatch in all the regions covered by RFMOs. In relation to engagement at RFMO level, the Committee **recommends** *that the BMI:*

(1) *prioritises collaboration with IOTC, ICCAT, SPRFMO, and SIOFA, with further scoping of work plan activities;*
(2) *works alongside other RFMOs, in collaboration with the FAO, to develop baseline cetacean bycatch-related requirements;*
(3) *further develops its collaboration with the BMIS to review existing information, provide new information on mitigation and provides the BMIS with access to safe handling and release guides/information/material and species identification guides.*

The Committee also **recommends**:

(1) *collaboration with the FAO and RFMOs to build awareness and capacity to implement the FAO Technical Guidelines to reduce bycatch of marine mammals in capture fisheries;*
(2) *collaboration with the FAO and Western and Central Pacific Fisheries Commission (WCPFC) and the South Pacific Community (SPC) to contribute technical information for BMIS and BDEP; and*
(3) *raising awareness within the IWC Community of these tools.*

The Committee **endorses** *the 'Guidelines for the Safe and Humane Handling and Release of Bycaught Small Cetaceans from Fishing Gear' (Hamer and Minton, 2020).*

SC/68B/HIM/14 described the Marine Stewardship Council (MSC) Fisheries Standard Review which is conducted every five years. The Fisheries Standard requirements for Endangered, Threatened, or Protected (ETP) species considers a fishery's impact, both direct and indirect, on species listed as ETP in certain national or international agreements. The current review includes the requirements fisheries must meet for 'ETP species' and 'preventing lost gear and ghost fishing'. MSC has determined that changes to the Fisheries Standard may include the scope of what is eligible for assessment, ETP scoring requirements and supporting guidance. The authors noted that there can be inconsistencies between the designation of ETP species among fisheries assessments and they were trying to ensure that ETP species are designated consistently.

To facilitate the review, MSC held a Workshop in 2019 on incentivising consistent data collection and transparent reporting of marine mammal bycatch in fisheries (Gummery and Currey, 2020). The Workshop had been a good example of collaboration and similar cross-disciplinary workshops at future marine mammal conferences were encouraged.

There was some discussion about the connection between MSC standards and requirements under the US Marine Mammal Protection Act (MMPA) with respect to cetacean bycatch for fish products imported into the US. Gummery noted that the intention was that any MSC certified fishery should comply with the MMPA regulations, but the details of how this would be achieved remain to be resolved. It was noted that the classification of fisheries by the US Government under the MMPA regulations may still be subject to legal challenges.

It was suggested that observer programmes, or electronic monitoring that had been established as effective for monitoring bycatch, should be required for any fishery with a risk of bycatch, to be certified by MSC. In addition, observer coverage should be high enough to achieve a coefficient of variation (CV) of 30% or better on the bycatch estimate. Gummery noted that the MSC currently has guidance but not requirements for bycatch related information and that MSC would welcome input on this aspect. It was also suggested that the IUCN Red List should be used where relevant to help ensure consistency in designation of ETP species.

12.6 Provide advice on observer schemes in South Africa

In 2019, the Committee received a request from South Africa for advice on development of a national programme to monitor and mitigate marine mammal bycatch in national fisheries and recommended the Bycatch Expert Panel provide advice on the development of the national programme. Discussions on the issue in South Africa are currently ongoing and this topic will receive more thorough discussion intersessionally and in 2021 (SC68C).

12.7 Progress on previous recommendations

Last year, the Committee noted limitations of cetacean bycatch estimates and mitigation programmes across the EU and recommended that improved monitoring programmes be established (IWC, 2020a, p.32). The Committee had also expressed concern that the bycatch of common dolphins in the Bay of Biscay may threaten the conservation status of the population. This year the Committee discussed the specific situation regarding the Iberian (see Item 16.1.2) and Baltic (see Item 12.2) populations of harbour porpoise. Taking account these previous discussions and recommendations and the specific new information, the Committee elaborated on these with respect to more general recommendations to address bycatch in European waters.

Attention: C, CG, CC, SC
In addition to the new information discussed this year on cetacean bycatch within a number of EU countries and the specific recommendations related to small populations of harbour porpoises and large whale entanglement mitigation, the Committee **recalls** *its previous recommendations related to bycatch of harbour porpoises and common dolphins in the North Atlantic and on the limitations of cetacean bycatch estimates and mitigation programmes across the EU. Improved monitoring programmes should be established.*

The Committee also **notes** *with appreciation the recent statement made by EU Commissioner Sinkivičius on 'EU action on bycatch of dolphins and other marine animals' and urges EU Member States and relevant IWC member states to act on the latest advice and information to ensure that appropriate bycatch measures are implemented effectively and are in place for the longer term throughout European waters.*

The Committee **recommends** *a focus on cross-border and cross-agency cooperation with fishers and among countries on bycatch monitoring and mitigation, building on the expert advice of ICES and other relevant regional organisations (e.g. FAO, GFCM, EU STEFC). To enable this and to allow a consistent approach across regions, bycatch risk assessments should be undertaken, within the appropriate regional management framework, for each European marine region, including the Mediterranean and Black Sea.*

The Committee **emphasises** *the need for increased and robust monitoring and attention to the reliable and consistent collection of fishing effort per fleet and bycatch per unit effort in all fleets. The European Commission, with the support of relevant advisory groups, should provide guidance to ensure improved collection of data for use in bycatch-estimation, including at-sea sampling, metrics of fishing effort and sampling design.*

In 2019, the Committee recognised the potential for the Ecuadorian artisanal drift gillnet fishery to be a BMI pilot project and also encouraged the IWC's large whale entanglement initiative to provide entanglement response training in Ecuador. The IWC entanglement initiative and BMI have been in discussions with Ecuador and potential funders to explore opportunities for training and projects.

Last year, the Committee reiterated its continued grave concerns regarding Māui dolphins (IWC, 2020a, p.34). The Committee proposed an intersessional process for reviewing the spatial risk assessment model for Māui and Hector's dolphins presented in Roberts *et al.* (2019). However, New Zealand is currently in the process of revising its management measures to protect Māui dolphins, and therefore elected to defer the proposed intersessional review of the Māui dolphin modelling work until after the revision is completed.

12.8 Work plan

In addition to the work related to the BMI (see Item 12.1) the Committee **agrees** to maintain current agenda items:

(1) review new methods and estimates of entanglement rates, risks and mortality;
(2) review mitigation measures for preventing bycatch and entanglement;
(3) reporting of bycatch (including small cetaceans) and large whale entanglements; and
(4) collaboration on bycatch mitigation.

The Committee **agrees** to include an agenda item on bycatch risk assessment and to encourage papers on rapid risk assessments and approaches to assess bycatch risk (e.g. Bycatch Rapid Risk Assessment Toolkit, ICES, work by Ocean Modelling Forum).

The Committee also noted a recent paper (Myers and Moore, 2020) that examined changes to the economics of a fishery in response to measures to reduce large whale entanglements through effort reduction. Although there was not time to discuss this paper, the Committee **agrees** to include an agenda item to review studies examining the implications of effort reductions on cetacean bycatch, fisheries economics and yields.

13. SHIP STRIKES (HIM)

13.1 Review new methods and estimates of rates of ship strikes, risk of ship strikes and mortality (including review progress on ship strike database)

SC/68B/HIM/10Rev1 summarises the work carried out by the IWC ship strike data coordinators between May 2019 and April 2020. The focus over the last two years has been on data validation and assessing new reports. The review process is now complete, and all records have been categorised and consolidated, resulting in 933 separate cases including 250 new reports in the last year. Facilities to enable bulk uploads of data to the database are being developed and the coordinators are currently waiting on several hundred records from other sources to be integrated into the IWC database. A summary of the complete data set held in the ship strike database is given in SC/68B/HIM/09. This was a result of a collaboration between the IWC and Christina Winkler at the Galway-Mayo Institute for Technology (GMIT). Winkler also entered a large number of new incidents into the database.

The Committee thanked Ritter and Panigada for their years of work on the IWC ship strike database and welcomes the summary analyses provided in SC/68B/HIM/09. The Committee noted the caveats highlighted by the authors, and in particular that any regional or temporal comparisons should be treated with caution due to differences in reporting rates.

In discussion, it was again noted that the IWC database, and any analyses using the data, such as those presented, would be greatly improved by the addition of two known large databases of ship strikes from Australia and the USA. Weller indicated that the USA fully recognised the importance of its potential contribution, and that there is an ongoing effort to organise the many regional databases in the USA into a format that can be submitted to the IWC database. Discussion of how to progress this work is given under Item 13.6.

National Progress reports provide a summary list of ship strike incidents and a contact person that should then facilitate more detailed reports being entered into the ship strikes database. However, this process had not always worked efficiently and sometimes the additional information needed was not easy to find. At the time of discussion, only 17 member countries had submitted National Progress Reports in 2020. The small proportion of IWC member countries submitting data limits their overall value. This issue will be considered by the Intersessional Correspondence Group discussing National Progress Reports.

13.2 Mitigation of ship strikes in high risk areas

SC/68B/HIM/03 presented the results of a collaborative study commissioned by WWF and implemented in collaboration with the IWC and the IUCN Marine Mammal Protected Area Task Force. The study assessed vessel traffic based on Automatic Identification System (AIS) signals in the 114 Important Marine Mammal Areas (IMMAs) that had been identified as of September 2019. Tables and graphs were based on unique vessel identities over the period of a year or by month within IMMAs, while 'heatmaps' were based on the total number of AIS signals transmitted in each IMMA. Two case studies, in the Mascarene Islands and the Savu Sea, examined vessel traffic in relation to what is known about cetacean distribution, identifying potential high-risk areas for humpback and sperm whales in the Mascarene Islands and blue whales in the Savu Sea.

The Committee thanked WWF and collaborators for advancing this work which was in response to previous recommendations made by the Committee and at the joint IWC-ACCOBAMS-IUCN Workshop in 2019 (IWC, 2019a). A primary objective was to investigate the feasibility and value of such a systematic approach to identifying possible areas of high risk for ship strikes. The Committee recognised its potential value and noted that a similar approach is underway using data of shipping route overlays with Ecologically or Biologically Significant Areas (EBSAs)[23]. In discussion it was noted that the metrics used in the tables would underestimate repeat traffic from the same vessel (e.g. ferries), while those in the heatmaps would be biased towards slower vessels (where density was represented by the number of AIS signals received). Other ship strike risk analyses considered by the Committee have generally expressed shipping density in km travelled per km^2 or the number of transits across a specified area (IWC, 2012a), often also stratified by speed and vessel type. The authors of SC/68B/HIM/03 indicated that further analyses might be possible to update the present study as well as for a similar study for newly identified IMMAs in the Southern Ocean and around Australia and New Zealand, but this work would require further funding.

The Committee also noted the need for data from other sources on vessel traffic in areas where a high proportion of smaller vessels were not equipped with AIS (Cope *et al.*, 2020; Greig *et al.*, 2020) also considered some of the data quality issues associated with AIS data received from satellites. In addition, the speed and type of vessel were re-iterated as useful variables to include in any analysis of shipping density with respect to ship strike risk.

SC/68B/HIM/15 described ongoing work by WWF to summarise information on the impacts on cetaceans of ship strikes and shipping-generated underwater noise, mitigation measures available and in use, and recommendations for best practice. The aim was to produce a report that is accessible for non-scientists including shipping regulators and policy makers. WWF is seeking engagement from the Committee to review the report which could then potentially be used by the IWC to support outreach and engagement related to mitigating shipping impacts on cetaceans. An Intersessional Correspondence Group was established to provide comments on the draft text.

Rodriguez-Fonseca informed the Committee of regulations enacted by Costa Rica that were intended to mitigate ship strikes, primarily with humpback whales, when ships transited to and from two major ports on their coastline. The Committee noted the table of ship strike mitigation measures on the IWC website and encourages information on any new measures to be sent to the Secretariat in order to keep this up to date.

It was also noted that reviewing existing, implemented mitigation measures is an activity under the IWC Ship Strikes Strategic Plan and that the Committee would **welcome** such reviews.

[23] *https://www.acops.org.uk/wp-content/uploads/2019/11/Report_EBSA-to-inform-application-for-IMO-Measures_24Nov2019_ForComments.pdf.*

13.3 Co-operation with IMO Secretariat and relevant IMO committees

The Secretariat and members of the Committee have continued to work with IMO on ship strike related issues. This is reported under Item 4.14. The Committee has an intersessional ship routeing group to consider any intersessional requests with regard to impacts on cetaceans of any changes in routeing measures proposed at IMO.

13.4 Approach for requesting/providing marine traffic data

The Committee has previously recommended that the Secretariat and the HIM Convenor explore possibilities for developing a Memorandum of Understanding between IWC and an AIS data provider. IWC could then pass on data requests in a standardised format which would minimise the work for the data provider. The first company approached was MarineTraffic which has generously donated data for previous papers that have been discussed by the Committee and has continued to provide data for ship strike related analyses. The Secretariat and the HIM Convenor have recently met with MarineTraffic and a MoU is currently being developed.

13.5 Progress on previous recommendations

Last year (IWC, 2020e), the Committee drew attention to the high level of ship strikes in the Canary Islands and re-iterated previous Committee recommendations on the need to immediately implement mitigation measures that will reduce the risk of vessel-whale collisions in the Canary Islands archipelago. Garcia-Bellido reported that the Ministry for Ecological Transition commissioned the official body CEDEX to analyse maritime traffic from AIS data around the Canary Islands to identify inter-island routes and compared these to the available data on cetacean distribution and habitat use. This work will be used to identify areas of high collision risk. Meetings have also taken place with other Ministries in the Canary Islands and with one of the major ferry companies, Fred. Olsen Express. Work is planned to test the use of thermal cameras for collision avoidance on Fred Olsen vessels in collaboration with La Laguna University. Fernandez reported that there had been no reports or strandings showing evidence of ship strikes since May 2019.

In 2018, the Committee recommended continued work to develop and evaluate mitigation measures, such as speed restrictions, that might be associated with the designation of a Particularly Sensitive Sea Area (PSSA) in the Pelagos Sanctuary. Last year (IWC, 2020e), the Committee also encouraged the ACCOBAMS Secretariat and ACCOBAMS Parties to further develop the process for the designation of a PSSA at a scale that includes the North West Mediterranean Sea, Slope and Canyon IMMA, plus potentially the Spanish corridor. Contacts with the ACCOBAMS and the Pelagos Sanctuary Executive Secretariats, as well as ASCOBANS, have been maintained to discuss possible synergies in assessing and mitigating ship strikes (see SC/68B/HIM/10). Panigada noted an ongoing project funded by the Pelagos Agreement on ship strikes in the Pelagos Sanctuary which will assess ship strikes and evaluate mitigation measures which could be applied there and in other areas of the Mediterranean. Garcia-Bellido also noted that similar work to that being undertaken in the Canary Islands on ship strike risk assessment is planned in the IMMA of the South East of the Balearic Islands, as well as in the southern sector of the 'Mediterranean Cetacean Migration Corridor' Marine Protected Area.

Noting previous concerns and recommendations regarding the situation for the northern Indian Ocean blue whales and ship strikes off Sri Lanka, the Committee recommended in 2019 (IWC, 2020a) that the Secretariat should maintain the ongoing dialogue regarding re-routing shipping off southern Sri Lanka with the IMO Secretariat and Sri Lankan officials. A meeting was held at the Sri Lankan High Commission in London (see Item 4.14). Sri Lanka had a presidential election in November 2019 and is due to have parliamentary elections in June 2020. Further engagement will be resumed when the new government is in place.

Recognising that ship strikes are a significant threat to the eastern sub-population of sperm whales in the Mediterranean and taking account of its previous recommendations, the Committee encouraged risk reduction measures in the Hellenic Trench through a formal proposal to the IMO by 2020 (IWC, 2020a). Leaper noted that a number of meetings had been held between the scientists involved and the relevant Greek ministries, and also with the European Commission, but a number of issues still need to be overcome.

In 2019 (IWC, 2020a), the Committee welcomed the decision of the International Association of Antarctic Tour Operators (IAATO) to adopt mandatory measures to mitigate ship strike risk from ship operations around the Antarctic Peninsula. These came into effect on 1 January 2020 until the end of the season (IWC, 2019h). IAATO informed the Committee that all operators complied, with approximately 80% choosing to travel at 10 knots in the designated areas. Vessel speeds were spot checked by the IAATO Secretariat using platforms such as MarineTraffic and RedPort. Operators reported challenges principally related to itinerary planning. IAATO will continue monitoring and collating information to promote best operational practice in the vicinity of whales. One whale strike in the Antarctic (a fin whale) was reported to the IWC database from the 2019-20 season. This happened outside the designated areas and involved a vessel travelling at 10 knots. The Committee welcomed the new information for IAATO and looked forward to further updates. The Committee also drew attention to its Ship Routeing Intersessional Correspondence Group which has been established to provide advice on any further proposed measures if requested (see Annex K).

Attention: CG, CC, S
With regard to ship strikes in identified high risk areas, the Committee:

(1) **encourages** *scientifically rigorous trials of thermal cameras to examine their efficacy in assisting in collision avoidance for ferries in the Canary Islands;*
(2) **welcomes** *further consideration by Spain, France, Monaco, Italy and ACCOBAMS of a proposal for an IMO Particularly Sensitive Sea Area (PSSA) including the Mediterranean coast of Spain, along with the Pelagos Sanctuary and identified migratory corridor;*
(3) **requests** *the Secretariat to contact the new Government of Sri Lanka following the 2020 elections to repeat the offer of help and advice made to the previous government; and*
(4) **requests** *the Secretariat to request an update from the relevant ministries in Greece regarding any progress with consideration of mitigation measures in the Hellenic Trench.*

13.6 Work plan

The Committee discussed proposals for the progression of work by the IWC on ship strikes (SC/68B/HIM/13). In a broader context, the IWC has identified the need to address the effects of ship strikes on cetacean populations, and especially large whale populations, as a conservation concern worldwide. Both the Conservation Committee and Scientific Committee are working to understand and reduce the threat posed by ship strikes. The Conservation Committee progresses its work through its Working Group on Ship Strikes. The Scientific Committee progresses its work through: (a) its sub-committee on Non-deliberate Human Induced Mortality (HIM); and (b) the ship strikes database coordinators contracted to the IWC. The Secretariat (including the Human Impact Reduction Technical Advisor) supports work across both Committees, particularly in support of the database and co-operation with other organisations.

The existing 2017-20 IWC Strategic Plan to Mitigate the Impacts of Ship Strikes expires in 2020 and the Committee **supports** the proposal that the existing Strategic Plan be retained with its timeline extended for two more years and that any revisions to the Strategic Plan be presented for endorsement of the Commission at IWC/69 (or a suitable future date). The current Ship Strikes work plan underpins the Strategic Plan and as such a new Ship Strikes work plan for 2020-22 is being developed by the Conservation Committee Ship Strikes Working Group. The proposed work plan sets out priority activities in support of the objectives of the strategic plan, establishes timelines, and proposes roles and responsibilities including a ship strikes co-ordinator.

In discussion, it was suggested that the work of the proposed co-ordinator might also take into consideration ship noise, its impacts and mitigation measures because many of the actions to address ship strikes also had implications for underwater noise. It was noted that the proposed ship strike coordinator would liaise between the IWC and IMO, and that both ship strikes and underwater noise have been considered by the IMO MEPC. Ritter noted that a dedicated ship strike coordinator might be able to overcome some of the obstacles that he and Panigada had encountered, including stimulating the ship strike data review group to greater efficiency and facilitating the entry of data from other databases.

Attention: CG, CC, S
The Committee **endorses** *the proposed structure for supporting IWC work on ship strikes outlined in SC/68B/HIM/13 including the following.*

(1) *The Ship Strikes Working Group, reporting to the Conservation Committee and Commission that is tasked with developing a work programme and overseeing the work conducted.*
(2) *The Scientific Committee, including its HIM sub-committee which would continue to implement the Committee work programme relevant to ship strikes.*
(3) *An Expert Panel, established by the Ship Strikes Working Group in consultation with the Scientific Committee to provide scientific and technical advice in support of implementation of the Ship Strikes work plan.*
(4) *A Ships Strikes Coordinator within the Secretariat of IWC who will implement the programme of work and represent the IWC.*

The Committee **agrees** to maintain current agenda items.

(1) Review new methods and estimates of rates of ship strikes, risk of ship strikes and mortality.
(2) Mitigation of ship strikes in high risk areas.

In addition, the Committee **agrees** to include an agenda item to review methods of estimating vessel traffic for vessel types that are not equipped with AIS. The HIM Convenor was tasked with identifying relevant papers on this issue for SC68C.

The Committee has previously considered papers providing advice on reducing ship strike risks for specific shipping sectors. It was noted that the draft Ship Strikes Work Plan includes developing specific advice for fast ferries and support vessels for the oil and gas or renewable energy industries. The Committee **agrees** to encourage papers on specific advice for these sectors at SC68C.

14. ENVIRONMENTAL CONCERNS

The Commission and the 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 1994-12 (IWC, 1994b) and it has subsequently passed additional Resolutions on environmental matters (IWC, 1997; 1998; 1999a; 2000; 2004; 2010; 2013a; 2017c), and 2018-4 (unpublished).

14.1 Chemical pollution

14.1.1 Final Report of Pollution 2020 Project

SC/68B/E/02 provided a summary of the major activities that occurred during the three phases of the Environmental Concerns Pollution Initiative (2000, 2000+, 2020). Among other important outcomes, an individual based model to assess risks to cetacean populations was developed and is now available as open source model through the IWC website, which also includes a contaminant mapping tool (*https://iwc.int/chemical-pollution*). The Committee **welcomes** the report on the history of the IWC's chemical pollution initiatives, and thanked the author, Hall, for compiling it.

14.1.2 Pollution 2025

In discussion, it was noted that pollutants are often one component of multiple stressors, and the importance of addressing these stressors through a 'One Health' approach was emphasised. The One Health approach recognises that the health of people is closely connected to the health of animals and our shared environment (*https://www.cdc.gov/onehealth/basics/index.html*). The Committee noted the relevance of two former workshops, on habitat degradation in 2004 (IWC, 2006) and on multiple stressors in 2018 (IWC, 2019l) which recommended the development of analytical tools and methods to assess the effects of multiple stressors and the need to further develop case studies. The Committee also recognised the value of understanding the different approaches used between research groups in measuring the effects of stressors, and noted the value of attempting to align methodologies, standardise protocols and improve interpretation of disease occurrence.

It was suggested that the treatment of multiple stressors be taken up within the framework of the Pollution 2025 initiative. The Committee recognised the necessity of a broad, cross-disciplinary approach and that an integrated view of health is needed. Different opinions on the best way forward included: (1) developing a multi-disciplinary review, which would include a summary of recent efforts to address multiple stressors, cumulative effects and new modelling techniques; (2) holding an intersessional workshop to discuss this issue in greater detail; and (3) reviewing a series of papers on long-term health effects of pollutants that are expected to be available over the next few months.

The Committee also noted recent efforts to develop models for specific case studies to understand multiple stressors on marine mammals but cautioned that some of these are in their infancy. Additional time is thus needed to evaluate and validate models. However, future collation by the Committee of those efforts and lessons learned would be beneficial as would a review of recent studies, such as Barratclough *et al.* (2019). The Committee agreed that furthering the issue of multiple stressors under the Pollution 2025 agenda is warranted.

Attention: SC, S

The Committee **endorses** *the value of the contaminant mapping tool in facilitating compilation of data to provide a view of contaminant distribution worldwide. The Committee also* **recognises** *the importance of the 'One Health' approach which recognises that the health of people is closely connected to the health of animals and our shared environment (https://www.cdc.gov/onehealth/basics/index.html). The Committee* **agrees** *that the treatment of multiple stressors should be addressed within the framework of the Pollution 2025 initiative.*

The Committee **recalls** *its previous recommendation on engagement with other organisations on mitigation and* **requests** *the Secretariat to liaise with the Pollution 2025 Intersessional Group as it engages with other organisations on this issue.*

14.2 Diseases of Concern: Focus session on infectious diseases (Part 1 this year, Part 2 in 2021)

The Committee held a virtual focus session on cetacean diseases of concern (a standing topic for the sub-committee on Environmental Concerns). New information on the infection and co-infection of *Morbillivirus*, *Brucella*, *Toxoplasma* and *Herpesvirus* in cetaceans was considered with a particular focus on the latter two. An additional focus session on *Morbillivirus* and *Brucella* will be held in 2021 at SC68C. Infectious diseases remain significant demographic and evolutionary drivers of human, domestic and wildlife populations. Such infections may play an important role in cetacean health and may have public health implications, especially in regions where cetaceans are used for food (i.e. aquatic wildmeat and aboriginal subsistence whaling).

Climate change, through its effects on animal movements and range shifts, is probably an important driver of the emergent geographic distribution of infections of priority pathogens (e.g. *morbillivirus*). Clinical outcome, reflecting the complex host-pathogen interaction (i.e. immune response, ability of pathogen to evade detection by the immune system or manipulate the latter) is also influenced by host nutritional status and contaminant burden. Given these interactions, the prevalence of infection and associated disease among cetacean populations are useful indicators of overall animal health and the health of the regional marine or riverine environments.

Detection of these pathogens relies on molecular determination techniques. Their prevalence in both healthy and diseased animals should be better assessed to understand the effects, especially since different strains of the same pathogen may lead to differing effects. To fill data gaps on pathogen prevalence and disease in under-reported areas, there is a need to enhance sampling and diagnostic capabilities in those regions. A broad surveillance programme and database should be developed. The Committee offers a framework to provide such enhancement through empowering national programmes and developing collaborations amongst biologists, bycatch observers and veterinary laboratories to improve understanding of these emergent public health issues and the concept of 'One Health.'

Attention: SC, CG, C, E
The Committee **draws attention** *to the number of serious outbreaks of cetacean diseases of concern (e.g. morbillivirus) detected since the 1980s, recognising that the prevalence of infectious agents (e.g. viruses, bacteria) and associated animal impacts (i.e. acute to chronic morbidity, mortality) are useful indicators of overall animal and ecosystem health. It therefore* **recommends** *that a pathogen surveillance programme focusing on priority pathogens (e.g. morbillivirus) be developed.*

Such a globally linked surveillance program would require: (i) permits for sample shipping (e.g. CITES, CBD Nagoya Protocol, MMPA); (ii) networks of field samplers and diagnostic laboratories; and (iii) standardised protocols for sample collection, storage and shipping.

14.3 Strandings and mortality events

14.3.1 Update on IWC Strandings Initiative and work plan 2020-22

14.3.1.1 Report on Progress

Mazzariol presented an update on progress with the IWC Strandings Initiative 2019-20 (SC/68B/E/08). A draft new four-year work plan is being developed that will be presented at SC68C. In addition, work is underway to explore the relationship between the IWC Strandings Initiative and the proposed 'Global Strandings Network' which was an outcome of a Workshop at the World Marine Mammal Conference in December 2019 and the 'Barcelona resolution'. Recommendations on the possible synergies and relationships between these two entities will be presented at SC68C. Mazzariol invited the Committee to: provide comments on the development of the new strandings work plan; provide advice on how the Committee can best engage with the development of the new strandings work plan as it proceeds intersessionally; and approve the proposal for expansion in membership of the Strandings Expert Panel to address geographic gaps and gaps in expertise. The Committee **welcomes** the work to develop a new four-year work plan for the Strandings Initiative.

Brownlow provided further information on the development of the four-year work programme for the IWC Strandings Initiative. The review has three main foci: (1) to recognise progress on the initiative so far and lessons learnt; (2) to identify those areas in global strandings response which could be best addressed by the capabilities of the IWC Strandings Initiative; and (3) to develop a costed work plan as to how the IWC Strandings Initiative could develop over the next four years.

The Committee thanked Mazzariol and Brownlow for the updates. It recognised that the Strandings Initiative encompasses a broad range of issues related to cetacean strandings, including responses to both live and dead stranded cetaceans, entrapped or 'out of habitat' animals, scientific investigations to determine causes of strandings, as well as associated welfare implications, and that science related to strandings can improve both cetacean conservation and welfare. Furthermore, it noted that cross-cutting issues spanning the work of different sub-committees needs to be interlinked. A request to carry over the existing strandings funding to 2021 is discussed under Item 22.

Attention: S, CC, C
The Committee **recalls** *previous recommendations stressing the importance of the IWC Strandings Initiative. The Committee:*

(1) **draws attention** *to the need for funding for the Strandings Coordinator position and the Strandings Initiative work programme;*
(2) **encourages** *Contracting Governments and relevant organisations to contribute funding to the initiative; and*
(3) **requests** *the Strandings Expert Panel and Secretariat to pursue wider fundraising opportunities.*

Attention: S, CC, C
Regarding the new four year work plan for the Strandings Initiative, the Committee:

(1) **agrees** *on expanding the scope of the Expert Panel to address geographic gaps and gaps in expertise,*
(2) **requests** *the Strandings Initiative Steering Group to identify appropriate additional members; and*
(3) **encourages** *the Committee members represented on this group to engage with development of the work plan as it proceeds intersessionally.*

14.3.2 Strandings - other issues

The Committee welcomed SC/68B/E/04, which provided an overview of the recent effort of the Indian Ocean Network for Cetacean Research (*IndoCet*) to compile regional strandings data. The effort seeks to coordinate stranding response within *IndoCet* and the Western Indian Ocean region and identify a stranding coordinator to provide assistance and support with

stranding response, documenting injury and mortality stranding data, sample collection, and training. *IndoCet* has collect unpublished stranding data from South Africa, Mozambique, Tanzania, Kenya, Reunion, Seychelles, Mayotte, Mauritius, Comoros, and Madagascar. The authors conclude that a lack of baseline data on animal health in the region is of concern as such data are required to assess the potential impact from anthropogenic activities in the region, as well as concerns regarding possible impacts from consumption of stranded cetaceans on human health. The report highlights the fact that regional capacity building is needed, and that ongoing efforts be focused on establishing geographical areas of response and determining the level of capacity and/or training requirements.

SC/68B/E/06 provided information on an unusual level of cetacean strandings in northern Norway, during spring 2020. A total of 17 animals of at least 7 different species was found stranded in a relatively small area of the coast during a short period of time. Based on meteorological simulations of drift, the carcasses may have originated from the same area in the Norwegian Sea, southwest of the Lofoten Islands. There were also unusually high numbers of reported strandings in Iceland during spring 2020. However, an increase in the frequency or range of species stranding during this period was not noted in Scotland, though there was a cluster of beaked whale strandings in southeast Ireland and the Atlantic coast of the UK in December 2019/January 2020[24]. Anthropogenic causes were not suspected in the latter cases, based on necropsy data.

A high number of strandings was also noted in SC/68B/E/07, which presented information collected during beach monitoring along approximately 1,000km of Brazilian coastline from 2015-19. During this period, 215 baleen whales and 4,162 toothed whales were found. Of toothed whales, 87% were from only three species: franciscana, Guiana dolphin and bottlenose dolphin. The authors believed that the average number of franciscanas stranding each year may indicate a population decline considering the population size estimates for this area. Daily beach monitoring revealed much higher numbers of stranded small cetaceans than previously recorded in the same area when opportunistic or less frequent sampling occurred, suggesting that turnover of carcasses on beaches may be relatively high.

SC/68B/E/09 summarised events involving cetaceans reported to the Strandings Expert Panel of the IWC Stranding Initiative during the period 2018-20 that could be considered atypical or an 'emergency'. An emergency can be defined as 'any event, or combination of events, natural or man-made, which causes a temporary and unusual increase in wildlife casualties, and which threatens to overwhelm local resources'. For cetaceans, this definition includes, but is not limited to, unusual mortality events (UMEs), mass strandings (MSEs), epidemics, live strandings of large cetaceans found dead in countries with no functional stranding response or in unusual places. In total, 53 events were reported, and geospatial mapping of these events was conducted. This summary of recent unusual marine mammal emergencies helps focus the IWC Strandings Initiative efforts and resources for training for emergency response investigations. A retrospective analysis, a standardisation of event reporting and continuous data entry would help the IWC to have a broader understanding of stranding events worldwide. The aim of the paper was not to undertake an exhaustive review of events, but to provide examples from recent years to demonstrate the need for prioritising the training of responders.

The Committee noted the importance of the development and implementation of a database of unusual cetacean stranding events; such a database could be used to extract information on worldwide events in near-real-time. The Committee also discussed the potential value of development of a database that integrates entanglement, ship strikes and strandings data that are collected by the IWC. Integrating databases is a complex issue that needs to be considered in more detail at SC68C. There was a need for detailed discussions with the Secretariat and the Committee's *Ad hoc* Working Group on Databases and Related Issues, which already has the mandate to take an overview of existing IWC databases (including considering the potential for merging databases) and for evaluating proposals for new databases. Furthermore, it was noted that data standardisation and management are critical topics requiring further discussion. Finally, it was suggested that a better definition of the Strandings Initiative Terms of Reference, clarifying which events are classified as novel or emergencies based on long-term 'baseline' datasets versus those that are due to the lack of a stranding network, would facilitate better interpretation of the data and help to focus the efforts of the Stranding Expert Panel. This will be further considered by the Strandings Consultant in development of the new four-year work programme for the Strandings Initiative (see above).

The Committee thanked the authors for their contributions and the new information they provided on stranding events around the world.

Attention: SC, S, E

The Committee **reiterated** *the importance of the IWC Strandings Initiative. Recognising the outstanding needs regarding the data generated through the initiative, the Committee:*

(1) **requests** *that the Secretariat liaise intersessionally with this group to facilitate discussion of existing database development plans, and coordination with the work of the Ad Hoc Working Group on Databases; and*

(2) **agrees** *to further consider the topic of database development and data standardisation at SC68C and coordinate this with the on-going work on database development in the Ad Hoc Working Group on Databases.*

[24]See *https://batchgeo.com/map/9ac1b7d69d89938f6371758ec2127b4e.*

14.3.3 New information on unusual mortality events

SC/68B/E/10 provided information regarding an Unusual Mortality Event of sperm whales in the Mediterranean. Between December 2018 and July 2019, an increase of stranded sperm whales was recorded along the Tyrrhenian coastline of Italy, with 16 individuals found stranded or floating close to shore. Two additional whales were reported in France, and eight in Algeria. Epidemiological and molecular data suggest that cetacean morbillivirus (CeMV) had a role in the deaths. A CeMV related outbreak was reported in bottlenose dolphins living in a contiguous area between July and September, further supporting the circulation of the virus in the Mediterranean Sea. It is not clear if the virus represents a significant threat for the Mediterranean population. Marine debris and fishing gear were considered incidental findings, although it cannot be excluded that the ingestion of marine litter may have had a role in predisposing animals to infection (i.e. reducing food ingestion, transporting chemicals or pathogens). The number of entangled individuals found in a short period stresses the need for constant monitoring and a continuous transboundary dialogue regarding human-related threats to cetacean conservation. In discussion, it was noted that this paper highlights the timeliness of next year's focus session on CeMV, which has been documented over the last 30 years to have caused multiple cetacean mortality events among a variety of cetacean species, across different oceanic basins, and with multiple CeMV strains circulating among different cetacean stocks.

14.4 Noise

14.4.1 Review of Noise Workshop

A virtual meeting was held on 11 May 2020 and attended by 70 participants, including representatives from shipping interests, to discuss advancing efforts to address underwater noise from shipping. The original agenda for a full-day workshop was reduced to a three-hour virtual session. The presentations and discussion focused on ambient sound, noise budgets and indicators, in addition to collaboration with IMO and the Conservation Committee. A meeting of the IMO Marine Environment Protection Committee (MEPC 75) had been postponed due to the COVID-19 pandemic but, when it does meet, they will take up pending proposals on underwater noise. The Conservation Committee was planning a Workshop on noise which would further develop the Conservation Committee work programme. The full report of the virtual workshop can be found as SC/68B/REP/06.

Attention: C, CG, CC, SC

The Committee **reiterates** *the threats posed to cetaceans by underwater noise (SC/19/26) and that this can also have adverse effects on other trophic levels including fish and invertebrates. Recalling Resolution 2018-04, and the Commission's objective to facilitate mitigation of adverse effects of anthropogenic underwater noise, the Committee:*

(1) **agrees** *to revisit the topic of collaboration with the IMO after the Marine Environment Protection Committee (MEPC) takes up pending papers on underwater noise;*
(2) **encourages** *the development of databases of ship source levels; and*
(3) **encourages** *intersessional work to further the collaboration between the Scientific Committee and the Conservation Committee on underwater noise.*

14.5 Review Report of the Workshop on Marine Debris

Simmonds presented the report of the third IWC Workshop on Marine Debris, held in La Garriga in Catalonia, Spain, 3-5 December 2019, with experts from nine countries attending, and supported by the IWC and the government of Netherlands (SC/68B/REP/03)[25].

The Workshop aimed to progress the IWC's work on this threat by: (i) reviewing the latest evidence on interactions with cetaceans (both ingestion and entanglement) and considering evidence for associated toxicology; (ii) identifying best protocols for gross pathology, pathology for microdebris and the standardised classification of recovered plastics and other debris; and (iii) developing liaison with other relevant expert bodies.

The Workshop considered published and unpublished information, including reviews of the latest literature and a comprehensive overview of marine debris-related activities by other international organisations, as well as regional reports (Mediterranean, the Spanish Canary Islands, German and Dutch waters). It was agreed that the scale of the actual and projected increase in plastics is alarming. Cetaceans can die after marine debris ingestion, due to gastric impaction/occlusion, perforation, or the associated lesions. Besides causing direct lethal effects, plastic debris can affect marine mammals' health if they persist in the gastrointestinal tract (GIT), for example by reducing the space for food and, subsequently, reducing their fitness and the nutritional condition. Presence of foreign bodies could also cause inflammatory changes to the GIT and/or induce stress and pain. An additional concern on the health effects of marine debris on cetaceans was related to the potential role of plastic debris as a carrier or vector of toxins and pathogens. The Workshop also considered the relationship between marine debris and entanglement in fishing gear and received new information on Fisheries Aggregation Devices.

[25]The draft report can be found here: *https://archive.iwc.int/?r=17025&k=870ad1ead3.* The final report is published in this volume (pp.273-310).

Noting that approximately 640,000 tonnes of Abandoned, Lost and otherwise Discarded Fishing Gear (ALDFG) enters the oceans every year, the Workshop also called for actions to address this threat, including for bowhead whales in the Bering Sea which may be at particular risk.

The Workshop made a series of detailed recommendations, including emphasising the importance of long-term studies; the need for standardised approaches for post-mortem studies; the importance of strandings networks; the assessment of floating debris during aerial surveys and the integration of marine debris concerns into the IWC's Conservation Management Plans, where appropriate. The vulnerability of some species was highlighted and the potential of some to be used as indicator species. The Workshop also called on the IUCN to consider marine debris in its next assessment of the sperm whale.

Other recommendations covered engagement with international bodies (the Workshop encouraged the establishment of a roster of marine debris experts by the IWC who would help to represent it at key meetings) and the development of a marine debris database of information from post-mortem examinations. A joint ACCOBAMS/ASCOBANS document on 'Best Practice on Cetacean Post-mortem Investigation and Tissue Sampling' was strongly welcomed and commended to the Scientific Committee for its consideration[26].

Communicating this issue was also discussed at the Workshop and it was agreed that this should: (i) take into account the audience; (ii) be accurate about the underpinning scientific information and its limitations; (iii) emphasise upstream solutions in addition to end of life measures; (iv) consider consulting communication professionals or social scientists; and (v) wherever possible, focus on positive, actionable messaging. The report, presented to the Committee as SC/68B/REP/03 contains the full set of recommendations.

The Committee welcomed the report as an insightful, comprehensive and valuable document, and thanked Simmonds for organising and chairing the Workshop and Smith, Frisch-Nwakanma, Creek and Nunny for their support. It endorsed the recommendations from the Workshop, and strongly supported the need to remove netting, including lost netting, from the vaquita habitat in the upper Gulf of California as has been recommended by the Committee for many years (IWC, 2020a, pp.44-45). It was noted that the best practice approaches identified in the report are living documents and interested parties should also look for updates.

It was further noted that in the framework of MARCET Network (2014-20 Interreg V-A MAC - Spain-Portugal [Madeira-Açores-Canarias]), joint work has been carried out between Portugal (Madeira, Açores), Spain (Canary Islands), Cape Verde and Senegal, producing the MARCET-Atlantic Cetacean Necropsy and Sampling Protocol, aimed at harmonising technical procedures related to post-mortem investigations on cetaceans in the Macaronesia region. With respect to Annex 6 of SC/68B/REP/03 (containing a list of definitions from the ASCOBANS/ACCOBAMS Best Practice on Cetacean Post-mortem Investigation and Tissue Sampling document), it was further noted that the IUSA-ULPGC Protocol provides an improved glossary of terms based on the MARCET-Atlantic Protocol.

In discussion, the Committee recognised that the impacts of marine debris on cetaceans are more substantial than was previously thought and further noted the importance of continued work on this topic. It was stressed that marine debris acts synergistically with other stressors (e.g. chemical contaminants, noise pollution, impacts of bycatch). The Committee agreed that the Intersessional Working Group on marine debris should continue and should assess potential mitigation measures, both preventative and curative, taking account of the Workshop's other recommendations and should report back at SC68C.

An update was provided of recent reports of ingestion of debris by cetaceans from the last 16 years (2005-20, SC/68B/E/03). In addition to published sources, information on new cases was kindly provided by: A. Fernandez, R. Puig-Lozano and team at the Animal Health, University of Las Palmas Gran Canaria, Spain; Wayne McFee, National Centers for Coastal Ocean Science, NOAA National Ocean Service; Nick Davison, Scottish Marine Animal Stranding Scheme (SMASS); and others. 74 new cases were reported and, as previously recognised, deep diving cetaceans seem to be particularly vulnerable to marine debris ingestion.

As discussed under Item 14.3.3, an unusual mortality event of Mediterranean sperm whales occurred in 2019 with a total 26 dead animals stranded (IWC/68B/E/10). Epidemiological and molecular data suggest a relevant role of CeMV in the mortality. Marine debris was found in the stomachs of some animals and therefore the possibility of marine debris predisposing the animals to the infection cannot be excluded. The relatively high number of dead individuals within a relatively short period stresses the need to monitor and engage in transboundary cooperation to mitigate human-related threats to this species in the region through common approaches.

In discussion, it was noted that the IWC and ACCOBAMS have initiated a dialogue on producing a Conservation Management Plan for the Mediterranean sperm whale (see Item 9.2.3), highlighting the integration of the work between the E and CMP sub-committees.

[26]see *https://accobams.org/wp-content/uploads/2019/04/MOP7.Doc33_Best-practices-on-cetacean-post-mortem-investigation.pdf* and *https://www.ascobans.org/en/document/best-practice-cetacean-post-mortem-investigation-and-tissue-sampling.*

Attention: SC, CC, CG, C
The Committee **welcomes** *the report of the IWC Workshop on Marine Debris: The Way Forward (SC/68B/REP/03) and* **endorses** *its recommendations. It recognises the impacts of marine debris on cetaceans and encourages the communication and implementation of the Workshop recommendations by all relevant stakeholders.*

Attention: SC, E
The Committee recognises that data collection using appropriate, standardised protocols, including for post-mortem examinations, is of paramount importance and **agrees** *to take forward an intersessional effort, overseen by the existing Intersessional Correspondence Group on marine debris to address:*

(1) *what appropriate data should be collected;*
(2) *how the data might best be sourced and managed; and*
(3) *how this relates to ongoing work on the IWC's various databases.*

14.6 State of the Cetacean Environment Report (SOCER) (Atlantic Ocean)

The State of the Cetacean Environment Report (SOCER) focused this year on the Atlantic Ocean (see also the 5-year compendium: *https://iwc.int/socer-report*) and summarised papers on the full range of recognised threats to cetaceans: bycatch, ship strikes, marine debris, chemical pollution, disease events, harmful algal blooms, oil spills, noise and climate change. Regionally, bycatch exceeded 'maximum sustainable total anthropogenic removals' of harbour porpoises in Sweden. Strandings of common dolphins in France correlated with fishing efforts. The impact of marine debris on a wide range of cetaceans emphasised the need for standardised research methodologies. For North Atlantic right whales, ship strikes continued to pose a serious threat. Proactive conservation measures such as 'ropeless' fishing gear are recommended. Diseases reported in Atlantic cetaceans included pneumonia, brucellosis, toxoplasmosis and morbillivirus. 'Impulsive noise activity' has increased in the Northeast Atlantic, leading to a call for 'noise budgets' within regional seas. The *Deepwater Horizon* oil spill has had long-term impacts on cetaceans, and an ongoing oil spill in Brazil is the most extensive and severe environmental disaster ever recorded in the South Atlantic basin. The Caribbean was highlighted as a case study for pollution problems and other threats in ocean regions bordered by multiple jurisdictions. Globally, research continues to emphasise the impact of bycatch, microplastics and heavy metals on cetaceans. Climate change impacts on cetaceans are also becoming increasingly clear, with impacts on prey potentially leading to local extinction of some cetacean populations. The Committee thanked the editors of SOCER for their report and commended them for compiling this information. The co-editors of SOCER in turn thanked the Committee members for their active input during the remote discussion of this year's report. The full SOCER report can be found as Annex H.

Attention: SC
The Committee **agrees** *that the State of the Cetacean Environment Report for SC68C will focus on the Pacific Ocean (North and South).*

14.7 Progress on previous recommendations

Progress on previous recommendations is summarised in Table 16. This is an updated extract from the IWC database of recommendations.

14.8 Biennial work plan

The work plan for the sub-committee on Environmental Concerns is given in Table 17. The Committee **agreed** that the work plan summarised below should be adopted, with the caveat that emerging issues should be dealt with and a recognition that priorities may change if particular topics require attention because of developments during the year including receiving specific requests from the Commission. The Intersessional Groups (Steering and Correspondence) are given in Annex K.

15. ECOSYSTEM MODELLING

The Working Group on Ecosystem Modelling was first convened in 2007 (IWC, 2008) and was 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 in three areas:

(1) ecosystem modelling 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.

Table 16

Progress on previous recommendations for Environmental Concerns.

Number	Actioned by	Text	Recommendation notes
SC1910	E	The Pollution 2020 initiative is complete and a consolidated final report will be developed by Hall and others for next year's meeting and for the Commission.	A paper was written and was discussed in SC/68B/E/02. Recommendations to be closed post SC68B.
SC1911	SC	A new multidisciplinary pollution/cumulative effects initiative named Pollution 2025 should be developed. A Steering Group under Holm has been established to develop options for such an initiative to be submitted to next year's meeting.	Postponed to 2021. Steering Group met April 2020 and work plan in development to be presented to next meeting.
SC1912	S	The Committee reiterates the importance of engaging with key initiatives and organisations on mitigation and in this regard and offers to assist the Secretariat in engaging with initiatives such as the Stockholm Convention, the Convention on Biological Diversity and the United Nations Environment Assembly to facilitate knowledge exchange about reducing exposure of cetaceans to pollutants.	As Pollution 2025 is further scoped, it would be helpful for the Secretariat to liaise with the intersessional steering group. Follow up recommendations are to be considered.
SC1913	CC	The Committee requests that the Conservation Committee considers how to take forward interactions with relevant fora to reduce cetacean exposure to pollutants.	In part this can now be taken forward by the Secretariat in association with SC1912. CC is also considering this in development of its own work programme but there is no progress on this as of yet. CCPG will discuss how to make progress when it meets on 25 May 2020.
SC1914	E, S	Hold a focus session on disease at next year's [2020] meeting. In addition to the issues identified for this session last year (IWC, 2019h): (1) that the focus session on Brucella and Morbillivirus in cetaceans that is organised for SC68B be expanded to include Toxoplasmosis. and Herpesviruses; and (2) that papers be submitted that address knowledge gaps on cetacean host-pathogen interactions identified by Di Guardo *et al.* (2018), i.e. characterisation of the cell receptors allowing infection; interaction and effects of chemical pollutants on the expression levels of the aforementioned cell receptors; pathogenetic evolution of the concerned infections in T helper 1-dominant *vs* T helper 2-dominant cetacean individuals; and effects of pregnancy-associated immune status on the infectious potential of specific pathogens.	Two virtual focus sessions were held on 15 and 17 May 2020. This recommendation is to be completed at the conclusion of SC68B.
SC1917	E, S	The Committee encourages the Strandings Coordinator and SEP to develop a package of training materials for use in IWC events and for outreach purposes.	Discussion ongoing as to whether IWC should develop its own training materials or act as a repository and disseminator for others. Will be considered in context of development of new SI work programme.
SC1918	Strandings Steering Group, S	Funding be sought for the continued support of the Strandings Coordinator beyond October 2020.	Currently there is no funding for re-appointment of the coordinator and there will need to be focused efforts on fundraising for the coordinator to be reappointed.
SC1920	CG, S	Secretariat to pursue wider fundraising efforts for Strandings Initiative activities.	Fundraising possibilities also being reviewed by the strandings consultant.
SC1922	CG	National coordinators should indicate mass stranding or unusual mortality events in the National Progress Reports.	Work also underway to encourage more countries to submit progress reports.
SC1925	CG	Wherever possible strandings and especially mass strandings events of beaked whales and baleen whales be thoroughly investigated - the Committee can assist in this through the Strandings Initiative and it encourages governments to request help if required.	Support being provided by Strandings Expert Panel. See SC/68B/E/08.
SC1929	E	Agrees that the Steering Group established last year should continue to develop the agenda for next year's pre-meeting including international approaches to noise targets and thresholds (ambient and impulsive) and monitoring and communicating such targets; the contribution of small vessels to coastal soundscapes; collaboration with other IWC bodies and with IMO.	Pre-meeting held 11 May 2020. Follow up in person meeting to be held next year.
SC1930	E	The Committee welcomes the provision of new information on marine debris and its impacts on aquatic ecosystems and cetaceans including papers that will allow estimation of baselines and trends, such as that provided from IWC-POWER cruises this year.	-
SC1933	E	Receive report from the IWC marine debris workshop to be held in December 2019.	See SC/68B/REP/03. This recommendation will be completed at the conclusion of SC68B.
SC1934	E	SOCER 2020 should be compiled as planned for the North and South Atlantic and that any relevant contaminant data identified would be appended to the Contaminant Mapping Tool database.	SOCER report submitted but more discussion needed on input of data for the Contaminant Mapping Tool.

Table 17
Work plan for Environmental Concerns.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Pollution 2025	Planning activities and work priorities for Pollution 2025	Review progress of intersessional work and agree on priorities
Cetacean diseases of concern (Morbilliviruses and Brucella)	Planning of focus session	Hold focus session
Strandings	Develop a four-year work plan	Review progress of intersessional work
Climate change	Workshop on climate change	Review workshop results
Noise	Advance underwater noise topics of interest	Review progress of intersessional work
Marine debris	Follow up on the recommendations from the workshop	Review progress of intersessional work.
SOCER	Report compilation on the Pacific Ocean	Review SOCER Pacific

15.1 Cooperation with CCAMLR on multi-species modelling and progress with related workshop(s)

15.1.1 Plan for postponed Workshop on the Role of Cetaceans in Ecosystem Functioning; Gap Analysis

In response to Resolution 2016-3 (IWC, 2017b) that tasked the Committee with investigating the contribution of cetaceans to ecosystem functioning, the Committee recognised that this was a complex long-term task and agreed to start the process by holding a workshop to: (a) define short- and medium-term objectives to be addressed; and (b) to identify what further research is required in order to begin initial modelling of the contribution of cetaceans to ecosystem functioning (IWC, 2019c, p.46).

Last year, the Committee reiterated the need to hold a Workshop to begin the process of responding to Resolution 2016-3 and agreed a plan for the Workshop including potential hypotheses and questions for consideration, and the need to ultimately compare the ecosystem function of cetaceans amongst different ecosystems (IWC, 2020f; 2020g). To advance the funding and other logistical matters intersessionally, an Intersessional Steering Group (ISG) was re-established under Ritter. Three sub-tasks were accomplished.

(1) A close link was developed between the IWC Secretariat and CMS representatives so as to constantly review budgetary issues.
(2) Cavanagh (British Antarctic Survey, who later joined the ISG) and Kitakado (EM Convenor) were nominated as Chairs for the Workshop.
(3) Two preparatory review papers were commissioned. The first one will deal with the literature that is currently available on the ecosystem function of cetaceans, authored by Roman (University of Vermont). The second one, authored by Wassmann (University of Tromsø), Haug (Institute of Marine Research, IMR) and Biuw (IMR), will evaluate the potential role of whales as ecosystem engineers through estimating the magnitude of their contribution as compared with other species in the ecosystem (the working title is 'A critical evaluation of whales as ecosystem engineers'). This work will largely be based on in-depth knowledge on ecosystem structure and function (including extensive long-term cetacean visual survey datasets) in Arctic regions, particularly the Barents Sea, thus also providing a comparative case study to the Southern Ocean.
(4) It was originally decided that the Workshop would be held in Cambridge (UK) as a pre-meeting to SC68B. The preparation of the Workshop proceeded smoothly, but for reasons related to COVID-19 pandemic, it had to be post-poned to the next intersessional period when it is planned to be held as an in-person meeting.

The Committee was pleased to be advised of the progress made by the ISG intersessionally, and thanked Ritter for his leadership. To further progress the Workshop planning and work toward drafting the Committee's response to the Commission's Resolution, the Committee **agrees** to re-establish the Workshop Steering Group (see Annex K).

Attention: SC, C
The Committee **reiterates** *(IWC, 2019c, p.46) the need to hold a Workshop to assist in responding to Commission Resolution 2016-3 asking for advice on the role of cetaceans in ecosystem functioning. Considerable progress was made towards organising the Workshop, but it had to be postponed due to COVID-19. The Committee* **recommends** *that the Workshop be held during the next intersessional period and the report submitted to the 2021 meeting of the Committee (SC68C). The Committee* **re-establishes** *the Workshop Steering Group under Ritter.*

15.1.2 Finalise response to Commission's request on review of cetaceans to ecosystem functioning (Resolution 2016-3)

The Committee will develop a response to Resolution 2016-3 (IWC, 2017b) on scientific aspects of the role of cetaceans in ecosystem functioning at SC68C.

15.1.3 Planning of the future joint IWC-CCAMLR Workshop(s) and possible MoU

Ecosystem modelling in the Antarctic Ocean is an active area of research of interest to the Committee especially with regard to ecological functions of whales. The Committee noted that the proposed joint IWC-CCAMLR Workshop (IWC, 2018g) is now expected to take place after the results of the Ecosystem Functioning Workshop discussed under Item 15.1.1. A full discussion of this is expected at SC68C that will take into account any progress (since the original plans were developed) made by both the Committee and the CCAMLR Scientific Committee in identifying information gaps and necessary research. The Committee will invite a member of CCAMLR's Scientific Committee to future Committee meetings to strengthen engagement between CCAMLR and the Committee.

As one of the target study areas of the Workshop on ecosystem functioning discussed under Item 15.1.2 is the Southern Ocean, it was agreed that inviting CCAMLR scientist(s) and ecosystem expert(s) to that Workshop will be beneficial. To this end, the Committee will invite a member of the CCAMLR Scientific Committee and Tulloch (University of British Columbia) to the SC68C meeting (and the Ecosystem Functioning Workshop if it is held as a pre-meeting workshop).

Recognising the need for enhanced scientific collaboration between the IWC and CCAMLR, the Committee was informed that the development of a Memorandum of Understanding (MOU) will be discussed by the IWC Bureau. A similar process is underway within CCAMLR and if the development of an MOU is approved by both bodies, it will be presented to the two Commissions next year.

15.2 Progress on species distribution models (SDMs) and ensemble averaging, including preparation of guidelines

The Committee has recognised that species distribution models (SDMs) can help predict species density spatially by quantifying the relationship between the observed species distributions and the factors which influence these. In general, although both statistical models and machine learning methods can be applied as SDMs, there is still an open question regarding the estimation performance of these SDMs. To this end, an Intersessional Correspondence Group led by Murase made good progress to develop guidelines for best practice for the application of SDMs including machine learning methods.

To date, the Committee has focused on single species modelling for 'whale species'. Last year, to evaluate estimation performance amongst the SDMs, new 'simulation' analyses on SDMs were presented with an example for the Antarctic krill, a key prey species of many Southern Ocean baleen whales. Given that spatial and temporal interactions between predators and prey and/or those among predators are of great interest in the Committee, it would be beneficial to extend the scope of the original SDM work to include guidelines for best practices for advance ecosystem modelling. In this regard, the Committee **agrees** to establish a new Intersessional Correspondence Group, with membership of Kitakado (Convenor), Biuw, Burkhardt, Friedlaender, Genov, Herr, McKinlay, Miller, Kelly, Murase, New, Palacios and Palka, for future development of guidelines for analyses, with Terms of Reference as follows:

(1) to finalise the guidelines for single species distribution models (SDMs);
(2) to conduct a literature review of multi-species distribution models (MSDMs); and
(3) to develop possible simulation platforms to evaluate these models.

Attention: SC
The Committee **recognises** *the importance of multi-species distribution models (MSDMs) to its work on ecosystem modelling and* **agrees** *to establish an Intersessional Correspondence Group to work towards the future development of guidelines for such models.*

15.3 Modelling of competition among whales including progress with IBEMs

The Committee did not receive any new information this year, but this is an important research area within the Committee, with close links to ecosystem modelling and future contributions to RMP trial specifications (and see Item 5.1). In this regard, the Committee **agrees** to establish an Intersessional Correspondence Group (see Annex K) with membership of Friedlaender (Convenor), Biuw, Cooke, de la Mare, Donovan, Kitakado, Palacios and Palka to facilitate work on modelling of competition among whales with the following Terms of Reference:

(1) to further develop individual-based energetics models (IBEMs), *inter alia* for progressing the emulator model to use in RMP trial specifications;
(2) to discuss new strategies for model development that utilise new data; and
(3) to infer functional responses using an IBEM for rorqual foraging dives.

The Committee **looks forward** to receiving the progress on this topic at next year's meeting.

Attention: SC
The Committee **recognises** *the importance of further development of IBEMs to account for competitions among whales and* **agrees** *to establish an Intersessional Correspondence Group to facilitate work on modelling competition among whales.*

15.4 Standing topics

15.4.1 Progress on considering effects of long-term environmental variability on whale populations

The issue of variability in baleen whale demographics was last examined at a Workshop held in 2010 (IWC, 2011b).

Given time constraints and that no new papers were available this year, the Committee decided to postpone the discussion on this issue, and re-establishes the Intersessional Correspondence Group (see Annex K).

Attention: SC

The Committee **reiterates** *the importance of understanding baleen whale demographics and long-term environmental variability and re-establishes an Intersessional Correspondence Group.*

15.4.2 Review progress on evaluation of krill distribution and abundance

The Committee has received information on a krill and oceanographic survey conducted in the Southern Ocean for four years between 2015/16 and 2018/19 under the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A). The Committee was also informed that Japan conducted an international ecological survey independently from NEWREP-A in the Indian sector in 2019, which includes research on krill distribution and biomass based on the CCAMLR standard method (CCAMLR, 2019). However, no final results have been produced as yet. It was noted that biomass estimates from the international '2019 Area 48 Survey' covering CCAMLR management area 48 (the Scotia Sea) have been provided to, and approved by, the CCAMLR Scientific Committee (Macaulay *et al.*, 2019). Since the relationship between krill biomass estimates from surveys in the Southern Ocean and consumption rates of baleen whales are of great interest, and further that krill biomass, distribution and aggregation (swarm) characteristics are important variables informing ecosystem models, the Committee **looks forward** to receiving the data related to these from krill surveys in the near future.

15.4.3 Modelling of relationship between whales and prey

Friedlaender advised about his ongoing work to better understand the foraging ecology of baleen whales in relation to their prey, with a focus on quantification of foraging rates and predictions about resource partitioning between Antarctic minke and humpback whales. This work can facilitate more accurate estimates of consumption and feeding rates for individual whale species, and this information can be used to develop better predictive individual-based energetic models (IBEMs). It is also useful when considering krill abundance estimates by determining better what patches or threshold densities are necessary for a patch to be of value to different krill predators in the Antarctic. The Committee welcomed this information and **looks forward** to receiving any updates on this work.

15.5 Progress on previous recommendations

Previously, the Committee recommended that collaboration be enhanced between the SC and CCAMLR (IWC, 2018f). To this end, the Committee **agrees** to invite a member of the CCAMLR Scientific Committee to future SC meetings (and see Item 15.1.3 above).

Regarding the work on the ecosystem functioning, considerable progress has been made and the postponed Workshop will be held intersessionally or as a pre-meeting, with its report to be submitted to the 2021 meeting of the Committee (and see Item 15.1.1 above).

15.6 Work plan

For details of the Intersessional Correspondence Groups for Ecosystem Modelling, see Annex K.

16. SMALL CETACEANS

Summary tables of data on small cetacean bycatch and ship strikes are available as Annex I.

16.1 Previous recommendations

16.1.1 Review and consolidation of previous recommendations

Jimenez and Porter worked intersessionally to compile all recommendations made by the SM sub-committee since 1979 with the purpose of assessing them for inclusion into the new IWC Database of Recommendations. This exercise consolidated all recommendations in one place and identified gaps within previous recommendations with regards to the new format of IWC recommendations. It was suggested that one way forward with the proposed review of past recommendations was to circulate the compiled information to members of the SM for classification of each recommendation as 'high priority', 'needs review', 'completed', 'no longer relevant' and 'do not know'. It was anticipated that this first cut would reveal which of the recommendations required immediate attention, so that high priority species could be explored as candidates for the forthcoming two (and four and six) year work plan. The general opinion of this Committee was that such an exercise may not be adequate as some recommendations, especially the earlier ones, would require review of the relevant committee report to allow correct allocation to the proposed categories. It was suggested that a small Intersessional Correspondence Group, to include past SM Chairs and rapporteurs, be established to better develop a detailed review process (see Annex K). Some members expressed willingness to try the database exercise and provide the resulting summary to the ICG. In later

Table 18
Summary of work plan for ecosystem modelling.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Ecosystem modelling in the Antarctic Ocean	Continue further analyses	Review results of further analyses
Multi-species distribution models (MSDM)	Intersessional Correspondence Group activity	Review progress of Working Group
Effect of long-term environmental variability on whale populations	Intersessional Correspondence Group activity	Review results of further analyses and progress of Working Group on literature review
Further development of individual-based energetic models (IBEMs)	Intersessional Correspondence Group activity	Review results of further analyses
Modelling of competition among whales and relationship between whales and prey	Continue further analyses	Review results of further analyses
Update of any exercises on krill distribution and abundance	Conduct any data analysis	Review results of analyses
Cetacean and ecosystem functioning: a gap analysis workshop	Continue analyses and hold workshop	Review result of analyses and outcomes of workshop

email discussion, there was also support for the proposed review of previous recommendations, however, some concern was raised that there might be a risk of refocusing recommendations rather than bringing them up to date and in the format of current recommendations.

Attention: SC, CC
The Committee **establishes** *an Intersessional Correspondence Group to map a process to ensure previous recommendations reach their intended target and are not 'lost'. This may require finessing the wording to meet the current standards for Scientific Committee recommendations whilst ensuring that the recommendations are neither re-written nor re-focused.*

16.1.2 Harbour porpoise (Phocoena phocoena)

SC/68B/SM/04 and SC/68B/SM/06 discuss the Iberian harbour porpoise (*Phocoena phocoena*) population with a focus on fishery bycatch.

SC/68B/SM/04 reports that this population is genetically and morphologically distinct. It is recognised by ICES as a separate Management Unit that possibly deserves subspecies status. The most recent (2016) systematic abundance estimate is approximately 2,900 animals (CV=0.32; Hammond *et al.*, 2017). This estimate has not yet been reviewed by ASI to meet consistent standards across the Committee but has been forwarded for their consideration. The authors of SC/68B/SM/04 note that recent unpublished genetic evidence suggests a sharp decline in abundance over the last 30 years. The ability of such a small population to sustain high bycatch mortality is limited. A preliminary PBR exercise undertaken at the NAMMCO/IMO Harbour Porpoise Workshop in 2018[27] concluded that a 'safe' limit on removals would be about 25 animals per year.

SC/68B/SM/06 provided an analysis of 313 stranded or bycaught animals from the region between 1990 and 2010. An annual mortality rate of 18% was estimated from age data. Depending on assumptions on how to treat animals for which cause of death was 'undiagnosed', between 4.3% and 11% of the population died annually due to bycatch (129 to 329 animals). The proportion of diagnosed bycatches among strandings increased during 2006-10 and was higher in Portugal than Galicia. Gillnets and beach seines contributed almost equally to make up about half of diagnosed bycatch deaths but the gear responsible for the remaining half could not be determined. A minimum estimate of the annual bycatch (i.e. the sum of catches with a diagnosed cause in Galicia and Portugal) varied between five and 10 in the last 5 years of the series.

SC/68B/SM/04 provided an estimate of annual bycatch mortality for Galicia and concluded that, overall, it represented between 3.1% and 6.8% (90 to 197 porpoises) of the estimated harbour porpoise population. Bycatch data from fishery monitoring were available only for Portugal and were based on observation of a very small proportion of total fishing activity. Extrapolation of official data (communicated to ICES WGBYC) suggested that approximately 380 porpoises were killed annually by a combination of purse seiners and the polyvalent fleet, with project-based observations on beach-seining adding a further 152 animals. Two interview surveys in Galicia generated annual bycatch estimates of 40 and 126 (the latter includes small numbers from other northern Spanish regions), while an interview survey in Portugal estimated 19 bycatches. The average minimum estimate of annual bycatch based on the (patchy) observer data in Portugal (2008-16) was approximately three porpoises while that from strandings in Galicia (1990-2019) was approximately two animals.

The Committee **agreed** that the best estimates suggest that bycatch mortality is unsustainably high. Introduction of Fishery Emergency Measures under the EU is justified, coupled with work on long-term solutions. These might include obligatory use of pingers on fixed nets and trials of modified fishing practices in polyvalent and beach seine nets. Effective monitoring of fishery bycatch in Iberian Peninsula waters by both Spain and Portugal is essential, including monitoring of small-scale fisheries, with a particular emphasis on gillnet and beach seines gears.

[27] *https://nammco.no/wp-content/uploads/2020/03/final-report_hpws_2018_rev2020.pdf.*

During discussion, an update of recent progress in the protection of habitat that Iberian porpoise frequent was presented by Portugal. In January 2019, a Natura 2000 site was established which affords some protection to the population. Between 2011-17, mitigation trials using pingers were conducted and showed a decline in mortality in some net types. Pingers have been provided to beach seine fisheries, however, there is no funding to monitor the impact of this mitigation on bycatch, nor indeed to document how frequently fishermen deploy pingers (see also Item 12.7).

Attention: SC
Given that the level of bycatch of Iberian harbour porpoise is considered unsustainable and will consequently cause a population-level decline, the Committee requests ICES to provide advice on fishery emergency measures for the Iberian porpoise population and looks forward to such advice being implemented.

The Committee **recommends** *the following actions and requests the Secretariat to bring them to the attention of the range states and the European Commission:*

(1) *reduce bycatch throughout Iberian Peninsula waters, using a range of approaches including protected areas, pingers and other mitigation measures;*
(2) *prioritise the transition from gillnet fisheries in the area to the use of gears with no or low levels of cetacean bycatch;*
(3) *ensure existing legal obligations are met (e.g. EU Technical Measures Regulation 2019/1241*), as a minimum;*
(4) *increase surveillance by the relevant authorities to detect illegal fishing activities which contribute to porpoise bycatch;*
(5) *coordinate mitigation actions across relevant national and regional bodies in Spain and Portugal; and*
(6) *initiate a long-term monitoring programme focused on porpoise that is designed and implemented in the Iberian Peninsula, including:*
    (a) *on-board monitoring (e.g. dedicated observers or cameras as appropriate) regardless of vessel size;*
    (b) *monitoring using fisheries inspectors on fisheries patrol vessels and on beaches;*
    (c) *ensuring that fisheries observers are also trained and mandated to recognise and record porpoise, and other marine mammal, bycatch;*
    (d) *monitoring the effectiveness of mitigation measures to reduce porpoise bycatch;*
    (e) *obtaining seasonal estimates of abundance through dedicated survey work; and*
    (f) *implementing nationally funded/coordinated programmes to monitor strandings along the Iberian Atlantic coastline;*
(7) *The Iberian porpoise is added to Appendix 1 of CMS.*

**Regulation 2019/1241 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R1241.*

16.1.3 Vaquita

SC/68B/SM/08 reports on effort in 2019 to locate and photo-identify vaquitas in the intended 'Zero Tolerance Area' (the area where vaquitas have been consistently detected acoustically since 1996, and where the goal has been to remove any illegal net within hours of its deployment). Two surveys took place (2-6 September and 15-27 October 2019) with experienced observers aboard one of two vessels, one from the Museo de la Ballena y Ciencias del Mar and one from the Sea Shepherd Conservation Society. Methods developed to find and track vaquitas in 2017 were used, however, only four days had optimal survey conditions. Photo-ID images were obtained for two individuals, one of which was matched to an individual identified in September 2018. Seven independent sightings were made in 2019. All but one sighting included a relatively small animal that could have been a calf, and all individuals appeared healthy.

Insufficient photo-identification data were obtained to support a mark-recapture estimation of population size and thus an 'expert elicitation' was conducted of the observers. The mean number of vaquitas estimated in 2018 was 9 individuals (range: 6-19), whilst expert elicitation in 2019 estimated a mean of 9.7 individuals (range: 4-17), with at least 3 calves. This is welcome, given the continued rampant illegal gillnet fishing in the vaquita range, including within the Zero Tolerance Area.

SC/68B/SM/08 further reported that planning is under way for future opportunistic and pre-scheduled photo-identification surveys and a refined expert elicitation process. The annual systematic summer deployment of the acoustic monitoring array has been put on hold because of the extent of vandalism of the C-pods and their anchoring systems over the past year. However, acoustic monitoring will be conducted opportunistically at neap tides when fishing effort is much reduced, and as needed to support visual sighting efforts.

The Committee **welcomed** this new information that vaquitas were sighted in 2019, and especially the observation of three calves showing that the few remaining vaquitas are continuing to produce young. This alleviates concerns that reproduction may have been compromised by genetic issues due to small population size, along with the recent genomic analysis that shows low genetic diversity evenly spread through the genome, which is not characteristic of inbreeding, but rather is consistent with a population that has been small for at least a two hundred thousand years and thus could

have purged deleterious alleles (P. Morin, pers. comm.). This underscores the conclusion that mortality in gillnets is still and always has been the primary factor driving this species toward extinction. Overall, the results indicate that recovery should still be possible if there is a rigorous, concerted enforcement effort to prevent illegal fishing and the use of gillnets throughout the vaquita's range

The Committee also **expresses its admiration of and gratitude to** Rojas Bracho, Jaramillo Legorreta, their teams of scientific and conservation collaborators, including co-operating fishermen, and those involved in net-removal operations, for their dedication, determination and persistence as they continue efforts to prevent the vaquita's extinction.

Attention: SC, CC, CG

The Committee yet again **expresses its disappointment and frustration** *that, despite almost three decades of repeated warnings, the vaquita population hovers at the edge of extinction caused by gillnet entanglement and ineffective fisheries management and enforcement measures in the Upper Gulf of California. Accordingly, it* **re-emphasises the grave concerns** *it has raised about the status of the vaquita over many years,* **laments** *the deteriorating social fabric of the communities with rampant illegal fisheries and lack of support for legal alternatives, and* **reiterates** *the urgent recommendations of the past four Committee meetings, especially regarding the need to remove gillnets from the species' range immediately.*

The Committee **notes***, with caution, the encouraging information that the few remaining vaquitas observed appeared healthy and are continuing to produce apparently healthy calves. This indicates that with 100 percent enforcement of the ban on gillnets within at least the Zero Tolerance Area (240 km^2) there is a realistic chance for population recovery. This guarded optimism on the Committee's part is dependent on zero bycatches and it does not change its continuing* **grave concern** *over the vaquita's plight. Therefore, the Committee* **reiterates its previous recommendation** *that the Government of Mexico fully mobilise its enforcement assets to eliminate illegal fishing in at least the Zero Tolerance Area, and* **strongly urges** *that the goal now must be to completely prevent deployment of gillnets in the vaquita habitat of the upper Gulf.*

The Committee also **urges** *the Government of Mexico to fully permit and fund the implementation of alternative fishing gears for shrimp and legal finfish to help communities address the vicious cycle of illegal fishing and provide viable, legal livelihoods that do not endanger vaquitas.*

Furthermore, the Committee **strongly recommends** *that: (i) efforts to photo-ID individuals be continued and that these efforts be supplemented to the extent feasible by the deployment of acoustic devices; and (ii) ideally, the decade-long acoustic monitoring programme be continued to the extent it is safe to do so.*

In addition, the Committee **encourages** *the vaquita science team in Mexico to continue exploring further means to collect acoustic data despite the current conditions of vandalism and personal danger. Acoustics assistance in locating vaquitas is invaluable, for documenting their continued survival and current distribution patterns, and to help visual observers aboard vessels collect photo-identification images and data.*

16.1.4 Lahille's bottlenose dolphin (Tursiops truncatus gephyreus)

SC/68B/SM/11 updated the current conservation status of the Lahille's bottlenose dolphin and summarised progress on previous Committee recommendations. Two populations are recognised, one in Argentina and the other ranging between southern Brazil and Uruguay (SB-U), that comprise five management units (MUs) (Fruet *et al.*, 2014). Previous Committee recommendations included:

(1) an update assessment of the status of the Argentine population;
(2) immediate action to reduce the level of bycatch in the southern Brazil MUs;
(3) continued monitoring and photo-identification work throughout the subspecies' range to refine survival estimates and to assess trends in abundance and the prevalence and etiology of chronic skin disease; and
(4) priority be given to future assessment of the conservation status of the subspecies.

Due to the low number of individuals for the entire subspecies and evidence of decline in parts of its range as a result of bycatch in fisheries and possibly other factors, Lahille's bottlenose dolphin was categorised as 'Vulnerable' on the IUCN Red List (Vermeulen *et al.*, 2019). Brazil and Argentina have classified the subspecies as Endangered on their respective National Red Lists. In Brazil, it is included in the National Action Plan for the Conservation of Marine Cetaceans and special regulations and a local Action Plan aimed at reducing bycatch and other threats to the Laguna MU are in place. However, there has been a lack of compliance and the enforcement actions taken against illegal fishing have been insufficient to reduce bycatch to a sustainable level. An ongoing multi-institutional study in SB-U should provide robust data on population dynamics by 2022 to support future assessments.

SC/68B/SM/10 requests the establishment of an IWC Lahille's bottlenose dolphin Task Team to initiate, guide and coordinate the implementation of conservation strategies for subpopulations in southern Brazil and Uruguay and the further investigation of causes of population declines in Argentina and Uruguay. This would include, but not be limited to, consideration, support and harmonisation with existing agreements, strategies and activities developed in other fora, and

ongoing initiatives at local levels. The Task Team would bring together experts from range states and beyond to instigate targeted field investigations or conservation efforts, provide advice and assist in seeking financial support for priority activities. The Task Team would deliver regular updates on progress to the Scientific Committee.

The Committee **commended** the authors of both papers for the quality of the work presented. It was noted that the distributions of Lahille's dolphin and the franciscana overlap to some extent in some areas and that coordination of effort to strengthen fishery regulations to limit bycatch in gillnets in those areas may benefit both species. It was also noted that a better understanding is needed of the fisheries and the underlying socioeconomic factors responsible for increased fishing effort. It was emphasised that any Committee recommendations must be clearly communicated to fishing communities and enforcement authorities.

Finally, the Committee's attention was drawn to the high concentrations of contaminants such as PCBs, acknowledging that more in-depth studies are needed to support assessment of the health implications for Lahille's dolphins. Planned studies to fill some of the information gaps in regard to conservation status in Argentina have been delayed because of the ongoing pandemic.

Attention: SC, CG
Noting the continuing conservation concerns surrounding the Lahille's bottlenose dolphin, the Committee:

(1) **reiterates** *its previous recommendations for: (a) an assessment of the conservation status of the Argentina population; (b) governments to take immediate action to reduce level of bycatch particularly in the southern Brazil MUs; and (c) continued monitoring throughout its range to increase knowledge of life history parameters, assess trends in abundance and document the prevalence and aetiology of chronic skin disease;*
(2) **recommends** *that a Lahille's Dolphin Task Team is formed and* **encourages** *it to: (i) coordinate regional efforts among Argentina, Uruguay and Brazil; (ii) seek ways to work cooperatively with fishing communities and fisheries authorities to reduce bycatch; and (iii) explore potential synergies with the Franciscana CMP; and*
(3) **recommends** *that a Lahille's dolphin health assessment programme is implemented, including use of the Committee's contaminants mapping tools.*

16.1.5 Indian Ocean humpback dolphin (Sousa plumbea)

This Committee last reviewed the genus *Sousa* in 2016. The IUCN Red List categorises all of the four currently recognised species of *Sousa* as threatened (Jefferson *et al.*, 2017). SC/68B/SM/05 discusses a new initiative focused on the Indian Ocean humpback dolphin (*Sousa plumbea*). The genus is not included in any of the currently available automated photo-ID matching software platforms and it is likely that new algorithms will be required if this genus is to be included in the future. In 2020, a collaboration between more than 35 researchers from seven countries (South Africa, Madagascar, Tanzania, Kenya, UAE, Iran and India) in the Western Indian Ocean was initiated to address this issue for *Sousa plumbea.* At the time of writing, more than 1,200 photos, comprising some 273 individuals, have been contributed to a training dataset. Flukebook (this report, see Item 20.2.2) and finFindR are developing matching algorithms and plans are underway to test these as well as develop a comprehensive plan for matching catalogues throughout the species range. It is hoped that any resulting algorithms will also work on the three other species of *Sousa*, and that ultimately these will help to answer questions regarding movement patterns, home range, etc., for these threatened species. The Committee **welcomes** efforts to develop an automated photo-ID matching package.

The Committee **recognises** that all four species of humpback dolphins (*Sousa* spp.) are threatened due to their extreme coastal distribution, and acknowledges the critical role of individual recognition for better understanding cetacean movement, distribution and abundance, and notes these data are also useful for developing, implementing, and monitoring effective conservation measures. The Committee therefore welcomes this initiative and congratulates the collaborators on progress to date.

Attention: SC
The Committee **recommends:**

(1) *continued collaboration between regional cetacean research consortia and individual researchers in the western Indian Ocean and Arabian Seas to facilitate the development of matching algorithms for Sousa plumbea in Flukebook;*
(2) *continuing collaborative efforts to match catalogues of Sousa plumbea from throughout the range of the species to answer important conservation questions about movements, home range and distribution, and*
(3) *testing of the newly developed Sousa plumbea algorithms on photographs of additional Sousa species for possible inclusion in the Flukebook platform.*

Furthermore, the Committee **encourages** *funding agencies and individuals to provide support for development of the image catalogue and matching software as well as for testing of final algorithms.*

16.1.6 Atlantic humpback dolphin (Sousa teuszii)

Although the conservation status of the critically endangered Atlantic humpback dolphin (*Sousa teuszii*) has been of increasing concern for two decades (SC/68B/SM/07), little progress has been made towards improving this status. A Concerted Action (CA) for the species was adopted by the Convention on Migratory Species (CMS) in 2017 and renewed in 2020, but implementation has stalled thus far due to a lack of funding. A Workshop on *Ex Situ* Options for Cetacean Conservation was held in late 2018 that also included discussion of the Atlantic humpback dolphin with recommended actions to improve conservation status (Taylor *et al.*, 2020). An IWC Africa-Focused *Sousa* Task Team was established in early 2020, with the purpose of reviewing previous IWC recommendations for *S. teuszii* and *S. plumbea* and providing a framework for the Committee to move recommendations forward. The various initiatives overlap in scope, and the authors of SC/68B/SM/07 suggest that wherever possible, co-ordination should be sought to maximise efficiency. The paper further highlights two priority targets that would benefit from immediate funding and could be achieved within a short period, namely: (1) supporting implementation of the CMS CA; and (2) beginning to address knowledge gaps with a *S. teuszii* field survey in Senegal/Gambia, considered a *S. teuszii* stronghold. The latter could be used to establish a standardised and comprehensive framework for assessments elsewhere in the species' range.

For many reasons, representatives from range states have had few opportunities in the past to participate meaningfully, and in a sustained manner, in the Committee's work; however, the Africa-Focused *Sousa* Task Team (see Item 16.3.2) includes members from 14 African countries so it is hoped that future engagement will be better facilitated. Nonetheless it is difficult to see how the Committee can contribute to efforts to save Atlantic humpback dolphins without more direct and regular engagement with institutions and individuals in the range states (Angola to Mauritania). During the brief on-line discussion of SC/68B/SM/07, the importance of local ecological knowledge in helping to identify areas for focussed research and threat mitigation was emphasised.

Attention: SC, G, S

Recognising that the Atlantic humpback dolphin (Sousa teuszii) is listed as Critically Endangered on the IUCN Red List, the Committee **commends** *efforts by a consortium of S. teuszii researchers and others for attempting to 'reinvigorate' conservation efforts and provide a set of prioritised targets, many of which echo previous recommendations by this Committee and other bodies.*

The Committee therefore **welcomes** *and* **supports**, *in principle, the approach proposed in SC/68B/SM/07 and* **recommends** *that the two highest-priority short-term actions: (1) assistance/collaboration in implementing the CMS Concerted Action for Atlantic Humpback Dolphins (with a sense of urgency); and (2) carrying out a field survey in Senegal/Gambia led by an experienced local team of conservation scientists, are pursued without delay.*

16.1.7 Asian freshwater cetaceans (Platanista gangetica, Neophocaena asiaeorientalis asiaeorientalis, Orcaella brevirostris)

In 2017, the Committee reviewed the small cetaceans that inhabit rivers, estuaries and restricted coastal habitats of Asia (IWC, 2018h). As a result, the South Asian River Dolphin Task Team (focusing on both subspecies of *Platanista gangetica*) was formed, the first report of which was presented to this meeting (SC/68B/REP/04; see Item 16.3.1). Previously, the Committee expressed its grave concern over all three species that occur within Asian freshwater habitats (*Platanista gangetica*, *Orcaella brevirostris* and *Neophocaena asiaeorientalis asiaorientalis*) and requested that updates on the status of these genera be provided when available. SC/68B/CMP/10 provides an update on several Asian freshwater cetacean populations and it is clear that all three genera are still subject to multiple threats and that further, more coordinated action is required throughout their range as a matter of priority. The idea of an Asian Freshwater Cetacean CMP was presented, and the Committee concluded that more detailed discussions should be initiated intersessionally and presented to the appropriate sub-committee(s) at SC68C.

Attention: SC, C, CG

The Committee **reiterates** *its previous grave concerns for Platanista gangetica, Orcaella brevirostris (freshwater populations) and Neophocaena asiaeorientalis asiaeorientalis. The Committee* **agrees** *that:*

(1) *these species remain on its agenda as priority species;*
(2) *potential mechanisms to coordinate research and management actions should be explored intersessionally and discussed in detail at SC68C;*
(3) *range states should strive to coordinate research and management actions across the species' ranges, whenever appropriate; and*
(4) *these species should be discussed as possible candidates for a CMP at SC68C.*

16.1.8 Amazon River dolphin

16.1.8.1 An Update on the Piracatinga (*Calophysus Macropterus*) Fishery and its Impact on River Dolphin Conservation

SC/68B/SM/01 provides an update on the use of river dolphins as bait in the piracatinga fishery in the Amazon and Orinoco regions. The fishery for this small (maximum length 40cm) catfish species followed declines in larger species from overfishing. The fishery first developed in Brazil, where caiman and Amazon river dolphin (*Inia geoffrensis*) meat was used to bait traps for the fish, which were primarily exported to Colombia (Brum *et al.*, 2015). The practice has since expanded into Bolivia, Colombia, Ecuador, Peru and Venezuela. The five-year moratorium established in Brazil for the fishery and the piracatinga trade ended in January 2020 and has not yet been reinstated, although actions are being considered to ensure its renewal[28]. Commercial sale of piracatinga was banned in Colombia in 2017 on the basis of high mercury levels in the fish, however, since the moratorium ended, the increased import of this species from Brazil has been noted. At this time, there is no other legislation banning this fishery or the trade of this fish. Monitoring of such a large region is challenging and limited border controls allow both legal and illegal trade to occur, essentially, unregulated. The authors state that integrated fisheries management plans are required to regulate fisheries for different species and that both national and regional regulations are required if effective control of any fishery is to be achieved.

The Committee **commends** the diverse and multinational authorship of SC/68B/SM/01 and the significant cross border collaboration it represents. There was strong support for a collaborative research effort to assess *Inia* (as well as *Sotalia fluviatilis*) abundance and trends, connectivity, movements, habitat use and taxonomy, and to evaluate the impacts of threats (bycatch, deliberate killing for bait, pollution, loss of connectivity). Results of such research can inform public awareness campaigns and decision-making.

Given the myriad of issues that continue to threaten South American river dolphins, the Committee **expresses serious concern** that if decisive action is not taken promptly, these species may follow the same fate as the baiji and vaquita. In addition to national policies, the Committee **draws attention to** the need for regional approaches for coordinated common actions and fisheries management plans.

Attention: SC, CC, CG, S

The Committee **reiterates its previous recommendation** *that a regionally co-ordinated fisheries management plan for the Amazon River basin and a regional strategy for the conservation of river dolphins are established urgently. Further, the Committee* **recommends** *that;*

(1) *alternative sources of income for local communities are developed in areas where the use of dolphins as bait in the piracatinga fishery is prevalent;*
(2) *research efforts are enhanced in areas where threats have been highlighted;*
(3) *enforcement regulations and actions throughout the piracatinga fishing areas are enacted and promoted;*
(4) *cross-border controls are promoted among Peru, Colombia and Brazil to prevent illegal trade in piracatinga; and*
(5) *use of alternative baits (e.g. slaughterhouse or pirarucu fishery waste products) is promoted and encouraged for the piracatinga fishery.*

Given continued concern over the use of dolphins as bait in the piracatinga fishery, the Committee **recommends** *that:*

(1) *the Government of Brazil* **reinstate for another five years** *the moratorium on piracatinga fishing to allow sufficient time to evaluate the effectiveness of protective measures, maintain and enhance the necessary protection of river dolphins and provides a report to the Committee on this matter at the next Committee meeting; and*
(2) *the Commission instructs the IWC Executive Secretary to send a letter drafted by the Chair of the Scientific Committee to the South American members of the IWC Buenos Aires Group highlighting the issue of dolphins being used as bait in the piracatinga fishery and requesting joint efforts to enhance enforcement on wildlife and trade laws.*

16.1.8.2 Amazon River Dolphin in the Mamirauá Sustainable Development Reserve 2017-19

SC/68B/SM/09 presented preliminary results of a monitoring programme for Amazon river dolphins using strip-transect methods from a small boat in three small segments of the Mamirauá Reserve in the western Brazilian Amazon, from 2017 to 2019. Fishing gear along the transects was recorded and the high number of monofilament nets noted suggested that the risk of dolphin bycatch is high. No significant trend in densities of *Inia* or *Sotalia fluviatilis* was found over this period, during which the ban on piracatinga fishing was in force, although the power to detect a trend was low. The authors highlighted the additional analytical steps that will be undertaken as the research progresses.

[28]Editorial note: On 15 June 2020, it was decreed that a new, one-year moratorium on the piracatinga fisheries and trade would come into effect on 1 July 2020 (*http://www.in.gov.br/web/dou/-/instrucao-normativa-n-17-de-10-de-junho-de-2020-261498117*). This falls short of the five-year moratorium recommended by this Committee.

Attention: SC; CG
The Committee **notes** *concern over the high number of monofilament nets recorded in the dolphins' habitat. The Committee* **requests** *that updates on the Amazon River dolphin populations of the Mamirauá Sustainable Development Reserve be provided when available.*

16.2 Poorly documented hunts of small cetaceans for food, bait or cash and changing patterns of use including summary of workshops and databases

The Committee has prioritised the need to better document the take of small cetaceans for consumptive and non-consumptive purposes. The products from small cetaceans are referred to as 'aquatic wildmeat' and defined as:

> *'the products derived from aquatic mammals and reptiles that are used for subsistence food and traditional uses, including shells, bones and organs and also bait for fisheries. Aquatic wildmeat is obtained through unregulated, and sometimes illegal, hunts as well as from stranded (dead or alive) and/or by caught animals.'* (CMS, 2017; IWC, 2019m).

16.2.1 Aquatic Wildmeat Workshop Review

In 2015 (IWC, 2016c), the Committee established an Intersessional Correspondence Group tasked with developing a toolbox of techniques to guide and co-ordinate research into this topic, at both regional and global levels. A series of Workshops were funded by the Government of the Netherlands, which aimed to gather existing information on this issue from three continents: Asia, South America and Africa. Various methods used to gather existing data were discussed within the group and potential new tools identified, e.g. standardised questionnaire surveys, smartphone applications, forensic testing kits. The potential for analysing data at regional and global scales was discussed.

The first Workshop took place in Thailand in 2016, covering South East Asia (and combined with the first IWC Large Whale Entanglement Training Programme in Asia). A second Workshop focussed on South America and included analysis of the use of Amazon dolphins as bait in the piracatinga fishery, was held in Brazil in 2018. The final Workshop in this series focussed on western Africa and was held in Nairobi, Kenya in 2019. The Workshop series aimed to:

(1) identify threats, past and present, with respect to wildmeat, and discuss which techniques can be used to better understand wildmeat issues,
(2) gain a better understanding of the magnitude of small cetacean use as aquatic wildmeat, both nationally and regionally in the three continents, and determine how aquatic wildmeat is usually acquired; and
(3) increase co-ordination and co-operation among countries as well as unify efforts with the Aquatic Wild Meat Working Group of the Convention on Migratory Species (CMS) which also works on wildmeat issues.

The first Workshop in 2017 in Thailand had participants from Thailand, Malaysia, Vietnam, Taiwan China, Myanmar, Sri Lanka, Bangladesh, Cambodia, China and India, as well as experts on tools that may be useful to better document or collate data on aquatic wildmeat. The topic was not an active research topic in Asia at the time and thus an explanation was provided to regional research groups and government agencies with a focus on the potential negative implications for small coastal populations of small cetaceans. Terminology was defined and translated into the common working languages of each country. Information was collated from ecological research, strandings programmes, social studies and, in particular, online media applications. Various 'tools were discussed including the use of community interviews, e.g. how to build a regional framework for data collection that incorporates both fisheries and bycatch elements; forensic methods, e.g. use of instant DNA testing to identify marine mammal meat in markets; extraction of information from existing databases to assess regional patterns, hotspots or trends; and mobile applications to facilitate data collection. Zoonotics was also discussed, especially with regards to disease transmission through the handling and consumption of wild animals. Since the Workshop, the IWC Small Cetacean Voluntary Fund provided a grant to investigate the usefulness of tabulating social media information and to test a regional data collection framework. The Workshop participants populated a database from which regional patterns were mapped. Areas identified as being of particular conservation concern were in Bangladesh, China, India, Indonesia, Japan, Malaysia, South Korea, Sri Lanka and Taiwan.

The Workshop in Brazil (IWC, 2019m) elicited summaries of information from all South American countries except Guyana and Suriname. Products from small cetaceans are used as aquatic wildmeat throughout the region. Tools and techniques for data gathering, including forensic investigation, were discussed. A database of more than 3000 references was used to map existing knowledge and identify data gaps and a framework was established to standardise future data collection. Workshop participants populated a database from which regional patterns were mapped. Areas of concern were highlighted for Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Peru and Venezuela. The use of river dolphins as bait in the piracatinga fishery (see Item 16.1.8.1 above) was reviewed. All range countries of *Inia* and *Sotalia fluviatilis* have laws in place to protect dolphins and prohibit intentional killing. Fishing for piracatinga in Brazil was banned at the time of the Workshop, and trade in piracatinga products was prohibited in Colombia. The practice of using dolphins as bait had recently expanded into Peru, Bolivia and Venezuela, following the restrictions in Brazil. No other range state had taken specific legislative or regulatory action in response to the emergence of this practice beyond the general protection of river dolphins. The Workshop concluded that some species and populations required urgent attention due to both the extent of their use as wildmeat and other threats.

The final Workshop (IWC, 2020h, p.231) focused on western Africa, with information from Benin, Cameroon, Ghana, Republic of Guinea, Mauritania, Nigeria, Senegal and Togo. The focus was on: (i) species of cetaceans perceived to be most at risk; (ii) other threats faced by these species; and (iii) the availability of relevant data. The challenges of gathering data in remote and often challenging environments were highlighted. In general, information was scarce and, in many countries, collected decades ago. Consumption of cetaceans (either bycatch, stranding or deliberate killing) was reported in all countries. It was unusual for coastal communities to consume aquatic wildmeat themselves, but meat obtained from marine mammals was not wasted and was smoked or cured and distributed via the same marketing channels as terrestrial wildmeat to the interior of the continent. In Africa, all wildmeat is referred to as 'bushmeat' when its primary purpose is for human consumption. Areas identified as being of particular conservation concern were Cameroon, Gambia, Ghana, Guinea Bissau, Republic of Guinea, Mauritania, Nigeria and Senegal. The Workshop expressed extreme concern over the conservation status of the Atlantic humpback dolphin (*S. teuszii*).

Attention: SC, ICG
The Committee **draws attention** *to the new information gathered by the Aquatic Wildmeat Workshop series and that several small cetacean species and/or populations are being negatively impacted in Asia, South America, and West Africa. The Workshop series highlighted that in some areas where wildmeat was once supplied from incidental takes, it is now being obtained from targeted hunting and a commercial trade has developed.*

The Committee therefore **recommends** *that the work of the ICG continue intersessionally to synthesise the findings and recommendations of the three workshops and recent research and provide a report to SC68C.*

16.3 Small Cetacean Task Teams

16.3.1 Progress on South Asian River Dolphin (Platanista gangetica) Task Team

The threats to South Asian river dolphins (*Platanista gangetica*, both subspecies) are myriad. Alteration, degradation and loss of habitat affects the entire range of the species across all four range states. The South Asian River Dolphin Task Team (SAR-TT) was formed in 2017 (IWC, 2018h) to assess emerging issues from across the range of *Platanista gangetica*. The IWC creates task teams to provide timely advice on situations where populations of cetaceans are known or suspected to be in danger of significant decline. In July 2019, a Workshop was convened in Kuala Lumpur, Malaysia, that included Committee members and South Asian river dolphin experts and managers from each range state; Bangladesh, India, Nepal and Pakistan (SC/68B/REP/04). The Workshop aimed to:

(1) detail information gaps and list research priorities for *Platanista* populations;
(2) identify research projects that require coordinated effort and sharing of expertise;
(3) initiate the development of a trans-national plan for coordinated research efforts; and
(4) identify key threats across the entire range of the species and any region- or country-specific threats.

The Workshop recognised the importance of communicating the results of the Workshop to government agencies and other bodies concerned with wildlife conservation in freshwater systems (rivers and lakes).

The taxonomy of the species was reviewed. Two independent lines of evidence, morphological and mtDNA, strongly suggest that the two subspecies should be elevated to species status.

The Workshop also found that a substantial part of these dolphins' habitat (>80%) had been altered by river flow regulation or construction. Across all countries, mortality as a result of bycatch was the second major threat, following habitat fragmentation and degradation.

Five themes were discussed in detail: dams, hydro-climatic change and water availability; population surveys and ecological modelling; dolphin bycatch; other types of interactions with fisheries; and human use of the animals (aquatic wildmeat), all with the goal of identifying practical conservation solutions and emerging issues.

16.3.1.1 Recommendations

Following the deliberations of this Workshop, the South Asian River Dolphin Task Team recommended that:

(1) by 2022, all range states identify key sections of national habitat that should be surveyed every five years, so that population trends can be monitored (methodology should be replicated in each identified habitat but need not be standardised throughout the range, as different habitats require different methodological adaptations)[29];

[29]This recommendation was targeted at:
Pakistan: WWF Pakistan (co-ordinator), Punjab Wildlife Department, Sindh Wildlife Department and KPK Wildlife Department.
Nepal: Department of National Parks and Wildlife Conservation, Department of Forest and Soil Conservation, WWF Nepal, Institute of Forestry Pokhara and Hetauda Campus, University of Tribhuvan (co-ordinated by Shambhu Paudel and Usha Thakuri).
Bangladesh: Forestry Department and WCS India: India's Conservation Action Plan for Ganges dolphins, State Forest Departments.
India: already a recommendation in India's Conservation Action Plan for Ganges dolphins and should be co-ordinated through State Forest Departments.

(2) all existing survey methods in use for population estimation are reviewed, and a decision system prepared to guide monitoring agencies and conservationists to identify and implement statistically robust and optimal survey methods based on river conditions and available survey resources;
(3) starting from 2020, surveys to establish population size are initiated as early as possible in the Padma, Jamuna and Meghna mainstems and tributary networks (excluding the Bangladesh Sundarbans), Bangladesh and the Budhi Gandak, Baghmati, Rapti and Mahananda, India;
(4) the review of *Platanista* taxonomy is completed and published;
(5) as a priority, studies are conducted to better understand movements of dolphins across barrages in all countries and the extent of population connectivity and impacts on dolphin populations in fragmented riverine habitats are quantified;
(6) pingers are assessed as an effective tool, both to minimise bycatch and to reduce the risk of dolphins becoming stranded in canals;
(7) a feasibility study is conducted to assess areas and methods to translocate Indus River dolphins (WWF-Pakistan) and to adapt existing marine mammal translocation initiatives specifically for river dolphins (co-ordinated by the Society for Marine Mammalogy and IUCN);
(8) as a priority and with data currently available, the level of dolphin bycatch throughout the species' range is assessed and its impact on local populations evaluated, so that from the outcomes of this assessment, recommendations are provided for future monitoring and actions to mitigate impacts, ranging from technical changes to the revision of fisheries policies; and
(9) assessment is undertaken of the extent of targeted take and the use of dolphins for oil or fishbait (aquatic wildmeat), particularly in India and Bangladesh, by involving social and ecological scientists, as part of co-ordinated survey actions listed above.

16.3.1.2 Work Plan

Task Team members agreed to start working towards fulfilling these recommendations through compiling data sets, taking forward ideas for joint and collaborative work, and planning additional workshops to fill the identified information gaps and research needs for each country.

In discussion, it was noted that the report recommendations mainly identified further research needs. The management of protected areas and the strengthening of fisheries legislation should also be reviewed and considered for future recommendations. In terms of how best to move forward with the SAR-TT itself, the inclusion of interdisciplinary experts and the merits of top-down, bottom-up management were noted.

It was clear from discussion that the Workshop, as the first action of the SAR-TT, was well received and that the team should continue its work intersessionally and consider the suggestions brought up in discussion, including developing a detailed work plan.

The Committee **congratulates** the South Asian River Dolphin Task Team on this excellent start to its work and **endorses** the Workshop report recommendations as provided in SC/68B/REP/04.

Attention: SC, S
The Committee **requests** *that:*

(1) *the Secretariat make the South Asian River Dolphin Task Team report available to the CMS Concerted Action on Asian River Dolphins;*
(2) *the Task Team considers the suggestions made in discussion and expands the group's membership and scope, as necessary, to continue and make its work more effective, including developing a detailed work plan; and*
(3) *the Task Team report on progress to the Task Team Steering Committee intersessionally and to this Committee at SC68C.*

16.3.2 Progress on Africa-focused Sousa Task Team

Given that high-priority areas and populations of *Sousa* in Africa have been identified previously by this Committee, an Africa-focused Sousa Task Team (AFS-TT) was established to develop a comprehensive framework of conservation actions to facilitate and co-ordinate Committee recommendations. In 2019, an email discussion group comprising researchers from Africa, the Task Team Steering Committee and the IWC Head of Science was established and a list of potential AFS-TT participants was compiled. The Secretariat formally invited all identified participants and the AFS-TT now comprises 35 members from 14 African countries. The first online meeting of the AFS-TT was held immediately prior to SC68B. Due to the large number of participants, and the size of the region that the team is tasked to cover, the AFS-TT is currently developing a process for carrying out its work efficiently. The AFS-TT will be divided into three working groups focusing on: (1) *Sousa teuszii*; (2) *Sousa plumbea*; and (3) bycatch. AFS-TT members are invited to participate in any of these working groups.

The Committee **recognises** that the work of the AFS-TT is particularly challenging, given the gravity of the threats that the two *Sousa* species face in Africa. The Committee **thanks** the AFS-TT for its progress to date.

Attention: SC
The Committee **encourages** *members of the Africa-focused Sousa Task Team to:*

(1) *identify a convener or conveners (these could be rotating positions); and*
(2) *consult with the Task Team Steering Committee on a regular basis intersessionally and to report on progress at SC68C.*

16.4 Review of intersessional workshops on *Sotalia guianensis*

The effects of bycatch, directed hunts, and habitat destruction on the river and estuarine dolphins of South America has been of great concern to the Committee for many years and the Committee identified the Guiana dolphin (*Sotalia guianensis*) as a priority species for evaluation of its conservation status in 2018 (IWC, 2019j). To facilitate this, an intersessional process to review current knowledge on the Guiana dolphin was proposed that included two Workshops.

The first Workshop was held in October 2018 in Lima, Peru where an inventory of known research activities/scientists involved in studies on Guiana dolphins was compiled and a participative strategy to compile existing knowledge on the Guiana dolphin developed. Following the Workshop, 35 experts responded to an online questionnaire which included a request to prioritise the locations and the scientific research needs most urgent to inform conservation actions.

The second Workshop was held in Brazil in 2019 with two objectives: (1) gather and analyse information on distribution and population structure, abundance and trends collected by the online questionnaire survey; and (2) compile available information under various population, biological and ecological parameters, as well as threats, for the entire species' distribution, and as delineated by the twelve proposed *Sotalia guianensis* management units (MUs; see SC/68B/SDDNA/06). The 15 participants broadly outlined the conservation and research needs on a region-by-region basis. The Workshop report (SC/68B/REP/05) presents preliminary information on research priorities and recommendations, management and conservation issues.

The Committee **notes** the planned intersessional work on the Action Plan proposed in the Workshop report which includes: (1) prioritisation of the recommendations, with implementation timelines, outlined in the report; and (2) consolidation of information on distribution, abundance, threats and population distinctiveness from Costa Rica, Nicaragua, Panama, Guiana, Suriname, Trinidad and Tobago and areas of Venezuela and Brazil.

The Committee **commends** those involved in the 2018 and 2019 *Sotalia guianensis* Workshops for their work and **endorses** the recommendations within the report (SC/68B/REP/05).

Attention: SC, G, CG-R
The Committee:

(1) **encourages** *the Workshop Steering Group to consult with the IWC's Bycatch Mitigation Initiative intersessionally for advice on implementing the report work plan;*
(2) **agrees** *that the highest priority for the Steering Group should be identification of actions that Governments can implement quickly, particularly with regards to fisheries regulations and bycatch reduction measures, noting the extreme vulnerability of this species to entanglement;*
(3) **notes** *the joint SDDNA/SM Intersessional Correspondence Group (ICG) established to review genetic and other evidence pertaining to population structure in this species and to provide advice on the management unit delineations proposed at the Sotalia guianensis Workshops (SC/68B/SDDNA/06) and* **encourages** *the ICG to provide a summary of that evidence and advice at SC68C; and*
(4) **encourages** *the provision of funding to support genomic analyses to adequately define management units (MU) throughout the species range; and*
(5) **requests** *that a progress report be submitted to SC68C.*

Further, the Committee **notes** *that Sotalia guianensis occurs in several countries with significant knowledge gaps in some regions and the uncertainties over population division will take some time to resolve. Given that the known populations are restricted in range, fragmented, and subject to multiple threats, even without additional scientific work the Committee is* **concerned** *that some populations are in immediate danger.*

The Committee therefore:

(1) **recommends** *that actions are urgently and immediately implemented to reduce bycatch of Sotalia guianensis throughout its range and in particular highlights the need for actions/initiatives to reduce the cumulative impacts and threats/pressures on:*
   (a) *the population from Guanabara Bay, as this population is declining and facing severe threats (as detailed in SC/68B/REP/05); and*
   (b) *similar vulnerable populations found in estuaries and bays along the south and southeast of Brazil; and*
(2) **reiterates** *its previous concerns for the species in Lake Maracaibo, Venezuela, where both directed takes and oil pollution are thought to be having serious population level impacts and* **stresses** *the need for all (including NGOs researchers and authorities) to focus on documenting the threats and working with local communities to mitigate the impacts.*

Table 19

One-year work plan for Small Cetacean (SM) sub-committee.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Franciscana Review (ICG)	ICG to co-ordinate outcomes of CMP across sub-committees.	Report progress
Poorly Documented Takes of Small Cetaceans (ICG)	ICG to synthesis results of past IWC workshops and recommendations and develop a framework for future work.	Report progress
Recommendation Review (ICG)	ICG to review SM recommendations (1979-2017).	Report progress
Sotalia guianensis (ICG)	ICG to continue review of genus *Sotalia guianensis* (continuation of SG-25).	Report progress
Small Cetacean Task Team Steering Committee (AG)	Provide ongoing advice and support to the South Asian River Dolphin Task Team, the Africa Focused Sousa Task Team and the Lahille's Dolphin Task Team; conduct a review of Task Team procedures.	Report progress
South Asian River Dolphin Task Team	Implement the work plan identified in 2019 workshop: work towards fulfilling workshop recommendations through compiling data sets, taking forward ideas for joint and collaborative work, and planning workshops aimed at identifying information gaps and research needs for each country and report progress to the Task Team Steering Committee at regular intervals.	Report progress
Africa Focused *Sousa* Task Team	Develop a framework of conservation actions to inform the SC and report progress to the Task Team Steering Committee at regular intervals.	Report progress
Lahille's Dolphin Task Team	TBC	Report progress
Sotalia guianensis Stock Structure Joint SDDNA (ICG)	Review genetic and other evidence pertaining to population structure in *Sotalia guianensis*; and provide advice on the management unit delineations proposed at SC68B.	Report progress

16.5 Review of direct takes and live captures of small cetaceans

16.5.1 New information on directed catches

SC/68B/O/02 noted that a scientific progress report on small cetaceans from Japan is available online[30]. The online tables summarise data on small cetacean fisheries in the calendar year 2018, as well as research conducted from April 2018 to March 2019 by the National Research Institute of Far Seas Fisheries and the fisheries agencies of the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan. Direct catches of small cetaceans are reported by prefecture and type of fisheries. Catch statistics for Japan cover catches in the calendar year (as for IWC National Progress reports), while catch quotas for small cetacean fisheries are set seasonally in Japan. Thus, in some cases, the calendar yearly catch may exceed the seasonal (yearly) catch in appearance, but in such cases, the actual seasonal catch is aligned with the allocated catch quota. The online report presented a correction for the Dall's porpoise (*dalli* type) takes for the calendar year 2017.

A review of information provided in previous reports of this Committee was conducted with the assistance of the Statistical Department of the IWC Secretariat and researchers from the National Research Institute of Far Seas Fisheries, Japan Fisheries Research and Education Agency. Explanatory text is added to the tables in Annex J in order to facilitate its interpretation and future updating. The tables herein should be used as the correct version in future updates.

The Committee **notes** its great appreciation for all who compiled and reviewed data to update this and previous years information on directed takes.

Attention: SC
As there was little time to discuss the revised direct catches tables or to develop a framework for moving forward with these data, the Committee **agrees** *that the issue will be allocated sufficient discussion time at SC68C.*

16.6 Status of the voluntary fund for small cetacean conservation research

16.6.1 Expenditures and status of the Small Cetaceans Fund

The Voluntary Fund for Small Cetacean Conservation Research currently totals £71,413.00 (SC/68B/O/06: Annex B). There has been no net expenditure in 2020.

All previously funded projects have now been completed and will be reviewed by the Small Cetacean Fund Committee intersessionally. All final reports will be presented at SC68C and posted on the IWC website in due course (*https://iwc.int/sm_fund*).

16.6.2 Progress on a new approach for targeted allocation of the Small Cetaceans Fund

An update on the small cetacean fund was presented at SC68A where the Committee **agreed** to develop a process that is more strategic and targeted to utilise available funds more immediately. The Secretariat's Head of Finance and HR and the Convenors of SM have drafted a strategy to direct the funding in a transparent and consistent manner. This strategy will be presented to the Finance and Administration Committee for review at IWC68. Any new or changed procedures will be reported at SC68C.

[30] *http://www.jfa.maff.go.jp/j/whale/attach/pdf/research-4.pdf.*

16.7 Possible cetacean extinctions

The issue was raised about potential extinctions of cetacean species/populations and the Committee's/Commission's response to such events. As preventing extinctions is a core mission of the IWC, a proposal was forwarded to prepare a short document that provides a template enabling a timely announcement of an extinction. Based on the positive response of SC members, the proposal was expanded to include an IWC website-tailored text that focuses more generally on the topic of extinctions and cetaceans. An Intersessional Correspondence Group was formed under Stachowitsch, and a Secretariat-hosted Zoom meeting for interested participants to advance this initiative was scheduled to take place after the SC68B meeting.

16.8 Work plan

See Table 19 for the work plan for small cetaceans.

17. WHALE WATCHING

17.1 Assess the impacts of whale watching and swim-with-whale operations on cetaceans

17.1.1 Studies on assessing impacts, (i) short-term, (ii) mid- to long-term, (iii) swim-with operations, (iv) emerging areas of concern.

The Committee has considered the issue of assessing the impacts of whale watching, particularly for baleen whales, for some time, and has encouraged submissions on this topic. It was pleased to receive a paper concerning the potential impact of whale watching operations on the survival and reproductive output of Eastern North Pacific blue whales (SC/68B/WW/01). Results from the model used in this study suggested that disturbance from whale watching vessels is likely to primarily affect female reproduction, while individual survival appears to be more robust to disturbances. The Committee noted the importance of clearly distinguishing between model assumptions that are specific to the species, population and spatio-temporal scale under consideration, and those that are general statements about cetaceans more broadly. There is a particular need for precautionary language in such papers and reports when they contain general statements about cetaceans, in order to better facilitate the appropriate use of modelling exercises in management and minimise potential misunderstandings by managers and others regarding a model's assumptions.

The Committee **welcomes** the development of a model for assessing impacts of whale watching operations on baleen whales.

Attention: SC
The Committee **encourages** *the continuation of work on modelling the impact of whale watching operations, given its ability to provide guidance and input to management under the precautionary approach, but recognises that in order to inform management directly, exposure rates and responses would need to be measured in the field.*

The Committee has regularly received updates on the development of a Welfare Assessment Tool for Wild Cetaceans (WATWC), which has now been published (Nicol *et al.*, 2020). The WATWC makes use of the 'Five Domains' model of animal welfare to ensure that all areas of potential welfare impact are considered and Nicol *et al.* (2020) used it to assess real-world impacts of human activity, particularly whale watching, on Southern Resident killer whales. The Committee **welcomed** the publication of Nicol *et al.* (2020), **commended** the authors and was pleased to see that the collaboration initiated within its membership had been fruitful in this regard.

Attention: SC
The Committee **encourages** *further development and testing of the Welfare Assessment Tool for Wild Cetaceans (Nicol et al., 2020), noting that whale watching might provide further examples to be considered.*

The Committee welcomed the information that Parsons continues to work on the annual review of whale watching literature, which will be made available for the IWC's Whale Watching Handbook; more detailed discussion of the review was deferred to SC68C.

17.1.2 Review progress of Modelling and Assessment of Whale Watching Impacts (MAWI)

The Modelling and Assessment of Whale Watching Impacts (MAWI) has been on the Committee's agenda for several years, and a third and final MAWI Workshop was intended to be held intersessionally just before the International Statistical Ecology Conference in June 2020 in Sydney, Australia. Due to the global pandemic, the Workshop could not be held, so a questionnaire is being developed that can be distributed to a wide number of relevant experts, with a Workshop to follow if deemed necessary (see SC/68B/WW/02). Several Committee members offered input on the questionnaire during SC68B. The planning for the questionnaire and potential workshop is ongoing under the guidance of New.

17.2 Finalise IWC's General Principles for Whale Watching

Last year, the Committee recommended the approval and adoption of the revised General Principles for Whale Watching (IWC, 2020i, pp.258-59). The Committee recognises that there may be a formal delay in adoption by the Commission due

to the postponement of the 2020 Commission meeting to 2021 due to the global COVID-19 pandemic. It notes that once the revised principles are approved by the Commission, they will be uploaded to the IWC website.

Attention: C, CC, S, SC
As last year, the Committee **draws the attention** *of the Commission, the Conservation Committee and the Secretariat to the need to update the IWC General Principles for Whale Watching, as they have not been updated since 1996. It* **reiterates** *its recommendation for the approval and adoption of the revised general principles (IWC, 2020i, pp.258-59) at IWC68 in 2021 or earlier by intersessional correspondence if possible.*

17.3 Progress with regional reviews of whale watching

In January 2020, the Government of Timor-Leste invited the IWC (via the Convenors of the SM and WW sub-committees) to visit the country to provide guidance on draft whale watching guidelines that have been developed by the Assosiasaun Turizmu Maritima Timor-Leste (the Marine Tourism Association of Timor-Leste). The two Convenors were invited to attend a meeting with the relevant government departments in March 2020; however, this meeting was postponed due to COVID-19 travel restrictions. It is anticipated that this meeting will go ahead in 2021 and that the outcome of this meeting and draft guidelines for Timor-Leste will be presented at SC68C. Concern was raised regarding the growing number of foreign whale watch operators in Timor-Leste's territorial waters, particularly given reports from ATM-TL of unsafe practices, such as tandem vessels 'leap-frogging' mother and calf pairs for extended periods, and the conduct of swim-with-whale activities.

Attention: CG, SC
The Committee **supports** *the Government of Timor-Leste in their pursuit of sustainable marine tourism and* **encourages** *continued communication with them regarding whale watching guidelines. It* **draws attention to** *reports of rapidly increasing numbers of foreign operators who are violating best principles for whale watching as developed by the IWC and anticipates further updates on this issue at SC68C. The Committee* **agrees** *to establish an Intersessional Correspondence Group to address the outcomes of the scheduled meeting in 2021 between the Government of Timor-Leste and Committee members and to draft comments on the Timor-Leste draft guidelines for whale watching.*

17.3.1 Sri Lanka

Parsons reported that data on Sri Lanka's whale watching situation are available and analysed, ready to present to the Committee, but final approvals for the data's release are pending. He noted that compliance with regulations and regulatory enforcement efforts are both low. It is hoped that a paper will be presented at SC68C.

17.3.2 Latin America

Whale watching has the potential to have substantial positive economic impacts on the regions in which it is occurring, as demonstrated in Peru (Guidino *et al.*, 2020), but requires guidelines and regulations to ensure its sustainability. The Committee welcomed Peru's response to their growing whale watching industry and thanked the Government of Peru for providing Ministerial Resolution Nº 451-2019-PRODUCE, which defines the country's whale watching regulations. The Resolution is strong, providing guidance on group- and behaviour-specific approaches and appropriately conservative approach distances. Furthermore, the Resolution has the potential to be useful as a tool to help raise awareness amongst operators and individuals interested in experiencing whale watching. A question was raised regarding effective enforcement, given the difficulties many locations face with regards to monitoring for violations and applying penalties. Suggestions were also provided of ways in which the Peruvian Government might strengthen the Resolution even further. These included providing comprehensive references to cetacean behaviour, placing the regulations within an adaptive management framework, requiring Captains and Guides to receive training as a condition of a license to operate, setting minimum approach distances to help account for taxonomic differences in behaviour that are irrespective of body size, and specifying the types of vessels and nautical activities to which the regulations are directed.

Attention: C, S, SC, CG
The Committee **commends** *the Government of Peru for its Ministerial Resolution Nº 451-2019-PRODUCE, which defines the country's whale watching guidelines, for its alignment with many other nations' whale watching regulations and recommendations of the IWC, as well as for its mitigation efforts to protect the most vulnerable individuals in the population (i.e. mothers with calves).*

Iñíguez, Urbán and Trujillo have begun work on an update on the state of development of whale watching in Latin America. Representatives from multiple countries are involved, and efforts are being made to standardise the information so as to make comparison across the region possible. The Committee looks forward to the presentation of this effort at SC68C.

The Committee welcomed an update on the whale watching activities in Puerto López, Ecuador (SC/68B/WW/04), which over the last five years has experienced the highest growth in tourism in the region. However, in 2019 non-regulated commercial whale watching activities were reported for the first time since 2012. The increase in illegal activity is likely

to be a result of current economic conditions and lack of enforcement and is of particular concern given practices that place passengers at risk (e.g. exceeding vessel capacity) and violate Ecuador's whale-watching regulations (e.g. approach distances, speed).

Attention: C, CC, CG
The Committee supports the whale watching regulations implemented by the Government of Ecuador but **expresses concern** *regarding the increase in illegal whale watching and current lack of enforcement for said recommendations.*

Given difficulties arising from the COVID-19 pandemic, the Committee was unable to discuss the current status of whale watching in Costa Rica, which remains an important location of interest. The Committee looks forward to papers on newly available data, information on the effects of whale watching and new elements of the industry in Costa Rica, to be presented at SC68C.

17.4 Collaborative work within the IWC

17.4.1 IWC's Whale Watching Handbook

The Whale Watching Handbook was endorsed by the Commission at IWC67 (IWC, 2018d, pp.36-37) and launched in October 2018[31]. The Committee thanked Minton and S. Smith for their hard work on this IWC product and congratulated them on their achievements. Given the importance of the Handbook, the Committee reiterates its support for its continued promotion.

Attention: S, SC, CG
The Committee **recommends** *that the promotion of the IWC's Whale Watching Handbook continue and that Contracting Governments and Scientific Committee members continue to provide relevant and up-to-date information.*

The Committee welcomed the response to their previous recommendation on the establishment of protocols for managing Handbook content, and provided feedback to Minton and S. Smith on the draft Editorial Protocol for Managing Handbook Content (SC/68B/WW/03), for new Country Profiles and Case Studies, factsheets for whale watching guides and the searchable table of literature. Detailed editorial and content suggestions were made on the documents provided, and Minton agreed to work with all relevant individuals, including the Committee and Secretariat where appropriate, to make the proposed changes. The Handbook is a living document that requires input from Contracting Governments, Scientific Committee members and regional experts to ensure that it remains relevant and up to date. Of particular importance is ensuring that the information presented in the Handbook, especially Country Profiles and Case Studies, remain an unbiased and accurate reflection of the current whale watching situation in each area. Last year (IWC, 2020i), concerns were raised with regards to the Canary Islands Case Study, for which Handbook text was overwhelmingly positive in tone, whilst the Committee had previously raised concerns regarding the safety and sustainability of the whale watching operations there. With this example in mind, discussion related to the proposed Editorial Protocol for the Handbook emphasised the need to maintain a balanced perspective in the Handbook Case Studies. Therefore, the Committee requests that, in cases where governments or other stakeholders might wish to emphasise the positive, the Secretariat works toward balanced presentation, consulting with relevant parties, including field scientists, to develop text for Case Studies that highlights adaptive management, acknowledging documented problems, but emphasising measures that are being taken to address those problems.

Attention: C, CC, S, SC
The Committee **endorses** *the Editorial Protocol for Manging Whale Watching Handbook Content presented in SC/68B/WW/03. It highlights the need for discussion and compromise between the Commissioners, Scientific Committee, and regional experts when drafting and approving content for the Handbook, in order for the Handbook to remain neutral and unbiased and* **recommends** *that this continue to be taken into account in the application of the Protocol.*

17.4.2 Work of Conservation Committee Standing Working Group on Whale Watching

The update on the IWC's Whale Watching Handbook served as the report on the work of the Conservation Committee Standing Working Group on Whale Watching for SC68B. Any further discussion on this item will occur when the Scientific Committee is next able to meet in person.

17.4.3 Collaboration with other SC sub-committees on platforms of opportunity and citizen science

Collaboration amongst sub-committees on platforms of opportunity and citizen science remains a priority for the Committee. However, given the complexity of scheduling and greater difficulties in communication resulting from the need to hold SC68B virtually, it was determined that this collaboration could be achieved more effectively if delayed until the Committee could once more meet in person. In order to facilitate this process, the Convenor of whale watching, New, will reach out intersessionally to Convenors and co-Convenors of relevant sub-committees.

[31] *https://iwc.int/whale-watching-handbook.*

Table 20

Summary of the work plan for matters related to whale watching. Several of these items have intersessional correspondence groups (ICG) or intersessional advisory groups (IAG). Those groups will work intersessionally and provide updates at SC68C. For details see Annex K.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Assess the impacts of whale watching on cetaceans – PRIORITY: (i) short-term impacts; (ii) mid- and long-term impacts; (iii) swim-with operations; and (iv) emerging issues of concern, e.g. drones and other emerging technology in the context of whale watching.	Prepare papers	Papers to be presented
MAWI questionnaire	Email correspondence and work	Paper to be presented
Finalise IWC's General Principles for Whale Watching (*https://iwc.int/wwguidelines*).	Convenor to liaise with Conservation Committee and Secretariat	Receive update
Review whale watching in Sri Lanka.	-	Papers to be presented
Review whale watching in Timor-Leste.	Intersessional correspondence and work	Papers to be presented
Review whale watching in Latin America.	Work to prepare review	Papers to be presented
Intersessional correspondence groups.	Email correspondence and work	Receive reports
Conservation Committee Standing Working Group on Whale Watching.	Email correspondence	Receive update
Increased collaboration with other sub-committees, particularly regarding platforms of opportunity and citizen science data.	Email correspondence and work	Receive updates

17.5 Progress on previous recommendations

Since progress on previous recommendations was reviewed last year (IWC, 2020i), the Committee's recommendation that the Secretariat establish protocols for management of the content of the Handbook has been completed admirably by Minton and S. Smith, as detailed under Item 17.4.1. In addition, the Carole Carlson Memorial Fund for Whale Watching has been established and is advertised on the IWC's Voluntary Fund for Conservation webpage[32]. Furthermore, the Intersessional Correspondence Group on swim-with-whale operations has met its Terms of Reference, establishing the prevalence of swim-with-whale operations and their potential effects, and thus the Committee will now include consideration of swim-with-whale impacts in its regular discussions. The majority of the recommendations are on-going, with work in progress toward their completion. Whilst there was the expectation that additional recommendations would be resolved by the present meeting, the COVID-19 pandemic prevented their conclusion. As a result, the Committee looks forward to a report from the Intersessional Correspondence Group on human induced behavioural changes of concern, particularly given on-going issues regarding solitary sociable dolphins and habituation. In addition, S. Smith will take over as Convenor for the Advisory Group on communication with the Indian Ocean Rim Association (IORA) and will report back to the Committee at SC68C, pending communication with Australia, Oman and other relevant parties.

17.6 Work plan

The work plan is given in Table 20. Regarding the General Principles for Whale Watching, the Secretariat acknowledged the urgency to post the updated version to the IWC website and noted the potential to approve and adopt them by correspondence before SC68C, although this is still to be discussed by the Conservation Committee Planning Group and the Bureau (see Item 17.2). With respect to 'increased collaboration with other sub-committees', it was noted that impacts of underwater noise, including that from whale watching vessels, is of particular relevance to the Sub-Committee on Whale Watching, so collaboration with the Sub-Committee on Environmental Concerns is highly relevant. The discussion regarding the Whale Watching Handbook noted, in particular, the need for a new mechanism for offering input to the Handbook, as the contract for the dedicated person responsible for drafting, updating and revising it expires in July 2020. New will liaise with the Secretariat and the Chair of the Conservation Committee's Standing Working Group on Whale Watching to determine the most appropriate way forward and will present the results of these discussions at SC68C.

Attention: S, SC

There is an ongoing need to effectively interact with the Conservation Committee and its Standing Working Group on Whale Watching generally, but with particular regard to the Whale Watching Handbook. The Committee therefore **agrees:**

(1) *to add a standing item on their agenda regarding updates on intersessional communications with the Conservation Committee and its Standing Working Group on Whale Watching; and*

(2) *that updates on the Whale Watching Handbook be included under this agenda item at future meetings.*

[32] *https://iwc.int/voluntary-fund-for-conservation.*

Table 21
Work plan for Sanctuaries, 2021-22.

	2021	2022
Receive relevant information relevant to the SOS management plan	x	x
Receive relevant information relevant to other Sanctuaries	x	x
Discuss progress on previous recommendations related to Sanctuaries	x	x
Discuss two-year work plan		x

Garrido highlighted the importance of a proposed Workshop between Chile and Peru on experience exchange on whale watching regulation and research permit systems, especially the need to standardise methods and monitoring in the region. Chile and Peru would appreciate the participation of multi-lingual experts from the IWC, particularly those who understand the cultural and political context in which whale watching is conducted in Latin America. Peru, in particular, where whale watching is still in its earlier stages, can learn much from Chile's experience. Galletti thanked the Committee for its support and for recommendations for speakers.

Attention: S, SC
The Committee **endorses** *the proposal and funding request for the participation for regional and international whale watching experts in a joint Workshop between Chile and Peru on experience exchange on whale watching regulation and research permit systems, to be held under the umbrella of the Conservation Management Plan for the Eastern South Pacific southern right whale in the region.*

18. WHALE SANCTUARIES (SAN)

Due to the logistical constraints on this year's Committee meeting, in particular the difficulties for many of those working in Sanctuary regions in being unable to attend virtual meetings during the UK working day, the *Ad hoc* Working Group on Sanctuaries made the decision (via e-mail) to postpone the working group's work until the SC68C meeting next year (2021).

18.1 Updates from relevant sub-committees on new information relevant to the SOS management plan

No new information was received, and the Working Group will welcome new information on the Southern Ocean Sanctuary Management Plan at SC68C.

18.2 New information for other sanctuaries

No new information was received. The Working Group will welcome the submission of relevant information on other sanctuaries at SC68C. In particular, the Working Group looks forward to receiving information related to the Indian Ocean Sanctuary, such as the work being undertaken by the IUCN Important Marine Mammal Areas network as well as a report from the IndoCet (Indian Ocean Network for Cetacean Research) meeting next year.

18.3 Work plan

The work plan for Sanctuaries is available in Table 21.

19. IWC LIST OF RECOGNISED SPECIES

At SC68A, the Committee noted that the list of recognised species needed to be updated for consistency with the list of marine mammal species and subspecies of the Society for Marine Mammalogy, which is adopted by the Committee. No time was available to discuss this Item in 2020, thus, the Committee **encourages** Brownell and Malette to prepare a document with proposed updates to the IWC List of Recognised Species for the 2021 Annual Meeting.

Attention: SC
The Committee **encourages** *Brownell and Malette to prepare a document with proposed updates to the IWC List of Recognised Species for the 2021 Annual Meeting (SC68C).*

20. IWC DATABASES AND CATALOGUES

20.1 Guidelines for IWC catalogues and photo-ID databases

The Committee agreed to postpone this item until SC68C in 2021.

20.2 Progress with existing or proposed new catalogues (PH)

20.2.1 Southern Hemisphere right whale photo catalogues

A successful AI algorithm for matching right whale photographs has been developed by the team at WildMe, using the platform Flukebook (SC/68B/PH/03). The algorithm uses vertical perspective photographs, but an algorithm for the lateral

perspective is under development. As of late 2019, after training on the photographs of North Atlantic right whales, the algorithm performed at 88.9% top-1 accuracy and 97.8% top-5 accuracy (meaning that the correct whale was almost always found within the first 5 suggested matches). When tested on catalogues of southern right whales (from South Africa, Argentina, Brazil and New Zealand), initial tests showed a top-1 accuracy of 25.9% and top-5 of 40.0%. These datasets differ from the North Atlantic catalogue in the average re-sight rate of individuals: the northwest Atlantic data have a mean of 88 training photos per individual while the southern right whale datasets have only 4. Despite this, curators of the southern right whale catalogues expressed optimism about the usefulness of the Flukebook algorithm. Further funding and research is anticipated to make the algorithm more generalisable so that the southern right whale model can more closely approach the North Atlantic model in accuracy. The Committee **looks forward** to updates.

20.2.2 Happywhale and Flukebook

SC/68B/PH/01 cross-references the features of two automated photo-ID recognition software platforms: Happywhale[33] and Flukebook[34]. The Happywhale matching algorithm is almost 100% accurate on good quality humpback fluke images. Happywhale maintains a database of images solicited from citizen scientists and research collaborators worldwide. In addition to humpback whales, Happywhale has provided images of southern right whales, Antarctic blue whales and Antarctic killer whales to catalogues relevant to the IWC and IWC-SORP; its application for the *In-Depth Assessment* of North Pacific humpback whales is discussed under Item 8.1.1. Flukebook has developed or integrated algorithms for eight cetacean species to date (humpback whale, sperm whale, North Atlantic right whale, southern right whale, common bottlenose dolphin, Indo-Pacific bottlenose dolphin, common dolphin, spotted dolphin), rapidly improving the time it takes to compare identification photographs. When fully functional, it is expected that these algorithms will transform the matching process for photo-identification catalogues and facilitate the comparison of large regional catalogues for population assessments (and see the discussion under Item 16.1.5 for Indian Ocean humpback dolphins and Item 20.2.1 for right whales). An overview of recent developments of the Flukebook platform, as well as background information on matching algorithms is provided in SC/68B/PH/06.

Attention: SC, R

The Committee **welcomes** *information on the performance of the Flukebook and Happywhale platforms when comparing large photo-identification catalogues (SC/68B/PH/03 and SC/68B/PH/06). It* **draws attention** *to:*

(1) *the swiftness of the matches between regions for population assessments and the value already being shown in some of the Committee's work; and*
(2) *looks forward to receiving updates on developments.*

20.2.3 Arabian Sea Whale Network's Flukebook

SC/68B/PH/06 and SC/68B/CMP/11 reported that the Arabian Sea Whale Network's regional data platform, hosted by Flukebook, is being further refined and developed in collaboration with the Indian Ocean Network for Cetacean Research (Indocet). Current work focuses on the user interface required to facilitate bulk data uploads and exports, as well as systematic comparisons between catalogues held by Flukebook users. Such comparisons have not yet been possible in the Arabian Sea, where the only catalogue with more than 10 photographs is the catalogue held in Oman.

20.2.4 Southern Hemisphere blue whale catalogue (SHBWC)

SC/68B/PH/02 presented the results of comparing photographs of 858 individual blue whales within the southeast Pacific between areas off Chile and the eastern tropical Pacific (ETP; Peru, Ecuador and the Galápagos). About half of the photographs have been compared, yielding 10 matches within southern Chile but no matches between Chile and the ETP, although there is already one known match between Chile and the ETP (Torres-Florez *et al.*, 2015). Information from the completed comparison will facilitate a capture-recapture estimate of abundance integral for population assessment (see also Items 8.2.1.1 and 8.2.1.6). The Universidad Austral de Chile/Centro Ballena Azul also hold photographs, but funding issues have precluded the photographs being completely processed prior to uploading to the SHBWC. Cascadia Research Collective will upload photographs of 68 blue whales from the Costa Rica Dome, in the ETP, to the SHBWC. Whales from the Southern Hemisphere may be found there (e.g. LeDuc *et al.*, 2017; Reilly and Thayer, 1990) and last year the Committee advised the inclusion of photos from this area (IWC, 2020a).

20.2.5 Antarctic blue whale catalogue (ABWC)

The results of the comparison of 62 new individual Antarctic blue whale identification photographs to the ABWC is summarised in SC/68B/PH/04. The five sources of photographs (2015-19) include the Australian Antarctic Division, the

[33] *http://www.happywhale.com.*
[34] *http://www.flukebook.org.*

Institute of Cetacean Research, Tokyo and opportunistic photographs collected by scientists in the Antarctic. Two inter-annual recaptures were found (time intervals of 6 years and 12 years, sighting locations separated by 384km and 3,307km, respectively). The total number of photo-identified Antarctic blue whales is now 517 whales (389 left and 383 right sides). This collection will provide data for capture-recapture estimates of abundance as well as information on the movement of individuals. An updated estimate of abundance is integral to an upcoming population assessment (Item 8.2.2.3).

Attention: SC, SH
The Committee **welcomes** *the work being undertaken with photo-identification catalogues of blue whales, including work funded by the IWC.*

The Committee:

(1) **encourages** *the completion of the matching of southeast Pacific blue whales by the Southern Hemisphere Blue Whale Catalogue so the dataset will be available for a capture-recapture analysis; and*
(2) **agrees** *that data should continue to be added to the Antarctic Blue Whale Catalogue to facilitate the development of abundance estimates of Antarctic blue whales.*

20.2.6 Fin whale catalogues

The results of a long-term photo-ID study conducted in the Pelagos Sanctuary (Western Mediterranean Sea) between 1990 and 2007 were presented in SC/68B/PH/05. The study examined site fidelity, seasonal residence and a number of biological parameters including sex ratio, survival rate, abundance and trends. Images from four research institutes were merged into a single catalogue checked for data consistency. A total of 435 individuals were identified over the 18-year study period, 47 (10.8%) of which were recaptured interannually. Annual within-season recaptures ranged from 1-4 over periods of 1-90 days, indicating that at least some whales use the Pelagos Sanctuary over the entire summer. The analysis implies a stable population although the apparent survival rate was unexpectedly low. The latter may be linked to temporary or permanent emigration, or mortality due to ship strikes. The results confirm site-fidelity to this feeding area and provide sound information to support the conservation of this unique population. As discussed under Item 9.2.4, work is underway to draft a joint ACCOBAMS/IWC CMP for Mediterranean fin whales. That recognises the need to create and maintain a single, centralised photo-ID catalogue (in conjunction with a genetic-ID catalogue) to improve information on population structure and movements, abundance and trends, population parameters, scarring and threats.

Attention: SC, CMP, R
The Committee **encourages** *the creation of a centralised photo-identification catalogue for fin whales in the Mediterranean Sea to be used, inter alia, for future capture-recapture analyses.*

20.2.7 Western gray whale catalogue

This item was presented this year in Item 9.1.3 (SC/68B/CMP/24).

20.2.8 Work plan

The work plan on work related to catalogues is provided in Table 22.

20.3 Progress with existing IWC databases

The IWC's database hosting architecture was reviewed in 2019 by an independent IT consultancy and it was concluded that the IWC has a large and overly complex IT infrastructure on mixed platforms that requires centralisation and simplification in order to mitigate ever-increasing development and data hosting costs and reduce the large server management burden faced by the Secretariat.

At present, the Secretariat is unable to develop any significant database projects in-house due to the challenge of administering the complex hosting servers of existing databases, so recent new projects have been developed externally (adding to the complexity) where funding was available. Otherwise new projects have been delayed. Actioning the review's recommendations would allow the development of such projects in-house and allow for external development with a standardised technical specification template that fits the architecture model if required. Steps have been taken to begin sub-contracting the server administration tasks, which will allow the Secretariat IT department to focus on IWC core development tasks.

The IWC portal, which is heavily utilised by the Committee, has been in service for 8 years and incorporates both the Ship Strikes Database and the National Progress Reporting Database. The underlying architecture is now reaching the end of its shelf life, so this will be redesigned and rebuilt over the course of the next 12 months to fit the needs of the IWC going forward. This presents an opportunity to begin centralising data held by the IWC and integrating workflows. Consequently, the Secretariat will fully engage with the *Ad hoc* Working Group on Databases and Related Issues on any related discussions.

In several sub-committee sessions at SC68B, there was detailed discussion on a wide range of issues surrounding data collection and reporting, and importantly, on the need for databases to store and allow access to this information. The

Table 22
Work plan for Photo-ID, 2020/21.

Topic	Intersessional 2020/21	2021 Annual Meeting (SC68C)
Completion of southeast Pacific blue whale photo comparisons	Continue comparisons within SHBWC	Included in SHBWC report
Addition of blue whale photos from the Costa Rica Dome to the SHBWC	Facilitate the collaboration with Cascadia Research and upload photos to SHBWC	Included in SHBWC report
Prepare dataset from ABWC for capture-recapture analysis	Complete the addition of recent photos and quality code photos	Report

discussions included proposals for new databases as well as the possibility of combining current and future databases. Sub-committees also discussed National Progress Reports (NPR), raising issues such as the low response rate (on average less than 20% of member countries submit reports) and the NPR's relationship to other data submissions (bycatch, ship strikes, strandings, etc.). Given the need to consider the actual needs of the potential users of these databases, there was recognition that these proposals will need further development intersessionally.

The *Ad Hoc* Working Group on Databases and Related Issues (convened by Mike Double) is requested to review the status of existing IWC databases, and to liaise closely with those sub-committee members who are developing ideas for databases as a follow up to their discussions at SC68B. This review will be critical in order to consider new database specifications in light of ongoing work in the Secretariat and the potential for interoperability with existing databases (see Item 20.4.1 below). Background to the history of this database and National Progress Report submissions since the last SC meeting are given under Item 3.2.

The Secretariat arranged two training sessions during SC68B to demonstrate the use of the National Progress Reports database and facilitate discussion on future improvements. The sessions were well attended and provided useful feedback. Over the next year, the Secretariat will continue to work to make the data entry system easier to use, including listing the data fields in advance of entry and investigating the possibility of bulk upload for csv files. Any further feedback is welcomed.

The Committee also noted the role of the *Ad Hoc* Group on Databases and Related Issues in working with the Secretariat to improve the accessibility of data from NPRs and to improve engagement in the reporting process.

Attention: SC, S
The Committee **notes** *the update on databases and National Progress Reports from the Secretariat and the extensive discussion in sub-committees relating to data reporting, collection and management, including proposals for new databases. It therefore* **requests** *that the Ad Hoc Working Group on Databases and Related Issues (convened by Double) develop an intersessional work plan to engage with the Secretariat on IWC databases and related issues, including improvements to National Progress Reports and the review of specifications for new databases in light of ongoing work.*

20.4 Potential future IWC databases (GDR)

20.4.1 Global database for disentanglement activities

The proposal for an entanglement database is discussed under Item 12.4.1.

21. IWC MULTINATIONAL RESEARCH PROGRAMMES AND NATIONAL RESEARCH CRUISES THAT REQUIRE IWC ENDORSEMENT

Multinational research programmes (e.g. IWC-POWER and IWC-SORP) and national research cruises are an integral part of the work of the Committee and provide valuable information to the assessment of whale stocks. These programmes occur in many regions around the world, most notably in the Antarctic and in the North Pacific, including the Bering and the Okhotsk Seas.

21.1 IWC-POWER and co-operation with Japan

21.1.1 Results of the 2019 cruise

The Committee welcomed the results of the 10th annual IWC-POWER cruise conducted between 3 July and 25 September 2019 in the Gulf of Alaska within the US Economic Exclusive Zone (SC/68B/ASI/20). The cruise was carried out on board the R/V *Yushin-Maru No. 2* by researchers from Japan, the USA and the IWC following plans endorsed by the Committee at last year's meeting. The main objective of the survey included obtaining information on distribution, abundance and stock structure of North Pacific sei, humpback, fin, blue, gray and the critically endangered right whales to inform ongoing and future assessments performed by the Committee. The vessel surveyed nearly 2,100 n.miles of survey trackline

and documented a total of 529 sightings of nine cetacean species. Photo-identification data (122 individually identified individuals from five species), acoustic recordings (229 sonobuoys deployed with 820 monitoring hours) and biopsy samples (75 samples from five whale species) were obtained. The cruise also documented the distribution and characteristics of floating marine debris. The survey was successfully completed and provided new information on cetaceans in an area where limited survey effort had been allocated in recent years. The data will be analysed during the coming year and results presented at next year's Committee meeting. Finally, the Committee expresses its sincere thanks to Matsuoka for his excellent leadership in acting as Cruise Leader for 10 years.

21.1.2 Report of the IWC-POWER Steering Group

The Committee received the report of the IWC-POWER Steering Group (SC/68B/ISG/03) that incorporated the work of both the Planning Meeting for the 2020 cruise and the Technical Advisory Group during intersessional meetings in Tokyo in January 2020 (SC/68B/REP/01 and SC/68B/REP/02).

The Steering Group highlighted the achievements of the IWC-POWER programme since 2010, recognising that they cover pelagic waters of the central and eastern North Pacific that have rarely if ever been covered by systematic line transect surveys and have not been surveyed at all in decades. This has important scientific conservation and management value and the results have contributed greatly to the work of the Committee. The IWC agreed (IWC, 2012b) that the long-term IWC-POWER programme:

> *'will provide information to allow determination of the status of populations (and thus stock structure is inherently important) of large whales that are found in North Pacific waters and provide the necessary scientific background for appropriate conservation and management actions. The programme will primarily contribute information on abundance and trends in abundance of populations of large whales and try to identify the causes of any trends should these occur. The programme will learn from both the successes and weaknesses of past national and international programmes and cruises, including the IDCR/SOWER programme.'*

The medium-term objectives were reviewed and updated by the Technical Advisory Group (TAG) in light of the results of the programme thus far. These are given in Table 1 of SC/68B/REP/01.

The Steering Group report also summarised the results of the programme with a focus on the following: stock structure and movements (genetic and individual identification); and distribution, abundance and trends (sightings and acoustics). Some 475 biopsy samples from nine large whale species (including the rare blue and North Pacific right whales) and one small cetacean species have been collected and analysed. The results are summarised in SC/68B/ASI/16 and discussed under Item 10.4.4. Similarly, individual photo-identification data have been collected from over 1,100 individuals (the same ten species). A photographic database of over 100,000 photographs has been coded and keyworded to provide an invaluable resource for a number of potential studies and uses. Abundance estimates have been developed for five large whale species for the first time in the research area covered. The information from the cruises has proved invaluable to the assessment work by the Committee on Bryde's whales, sei whales and humpback whales.

Last year (IWC, 2020j, items 24.1, 27.8) the Committee had reiterated to the Commission:

> *'…the great value of the data contributed by the Committee-designed IWC-POWER cruises which cover many regions of the North Pacific Ocean not surveyed in recent years and addresses an important information gap for several cetaceans species, providing fundamental information on abundance necessary for developing conservation and management advice'*

and

> *'…that it would be valuable for the scientific, conservation, management and assessment work of the Committee for these cruises to continue, particularly in light of the information being provided on the status of species once heavily exploited by whaling including blue, fin, sei, humpback, gray, and right whales.'*

The Committee again **concurred** with these sentiments and reiterated the small cost to the Scientific Committee compared to the donation of a vessel and crew for around 60 days or more.

The Committee also noted the options for the 2020 cruise in light of the unprecedented difficulties posed by the COVID-19 pandemic (Appendix 1 of SC/68B/ISG/03). It **commends** the work undertaken by the Steering Group and Japan to try to ensure that the 2020 cruise goes ahead and **strongly encourages** the efforts being made by Japan and the USA to enable international participation, and conduct maximum photo-identification and biopsy work and at least some acoustic work despite the problems of COVID-19.

The Committee also noted the proposal of the Steering Group and TAG to hold a Workshop or pre-meeting to develop detailed plans for the post-2021 cruises after the identified preparatory work had been undertaken. In addition to the present work, this should have 'an emphasis on participation from all range states and also include consideration of more methodologically focussed cruises in some years (e.g. use of a towed acoustic array, telemetry work, use of SeaGlider)' (SC/68B/REP/01).

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. The programme addresses important information gaps for several species and has already contributed greatly to the ongoing assessment work of the Committee. The Committee* **endorses** *the report of the Technical Advisory Group (SC/68B/REP/01) and* **recommends** *that the programme continues.*

The Committee also:

(1) **thanks** *the government of Japan (which generously supplies the vessel, crew and many of the researchers) and the government of the United States (which generously provides acoustic equipment and acoustic experts), for their continued support of this IWC programme, as well as the scientists from other range states including Korea and Mexico who have participated in these cruises;*
(2) **agrees** *that the 2019 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 2020 POWER cruise and* **looks forward** *to receiving a report from this survey at the next meeting of the Committee;*
(4) **endorses** *the report and work plan set out by the Technical Advisory Group (TAG) for continuation of work related to the IWC-POWER cruises, including the updated medium-term objectives; and*
(5) **endorses** *the proposal for the 2021 cruise in Russian waters in the Bering Sea, the associated TAG Workshop to plan for the post-2021 cruise and the work to incorporate the 2019 photographs into the photographic database.*

21.2 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 programme with the aim of delivering coordinated and cooperative Southern Ocean cetacean science to the IWC. The Partnership currently has 13 member countries: Argentina, Australia, Belgium, Brazil, Chile, France, Germany, Italy, Luxembourg, New Zealand, Norway, South Africa, the United States of America. New members are warmly welcomed.

There are six endorsed 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;
(5) 'Acoustic trends in abundance, distribution, and seasonal presence of Antarctic blue whales and fin whales in the Southern Ocean'; and
(6) 'The right sentinel for climate change: linking foraging ground variability to population recovery in the southern right whale'.

The initiation of a seventh Theme, *Recovery status and ecology of Southern Hemisphere fin whale*s, was agreed by this Committee at SC68A and awaits endorsement by the Commission.

The Committee welcomed the IWC-SORP Annual Report 2019/20 on the continued progress of research undertaken under the auspices of these themes since last year (SC/68B/SH/04). This progress includes the production of 21 peer-reviewed publications during 2019/20, bringing the total number of peer-reviewed publications produced since the start of the initiative to 165. In addition, 145 IWC-SORP related papers have been submitted to the Scientific Committee to date, 12 of them this year.

IWC-SORP members continue to develop, test and implement leading-edge methodology and technology, including neural network algorithms to support the use of long-range UAVs to assess and monitor cetacean populations, and sophisticated acoustic analyses (see SC/68B/SH/04 and SC/68B/SH/05 for details). Updates on new initiatives to progress satellite tag and drone technologies are anticipated in 2021 (see SC/68B/O/01).

A report on the progress of projects funded by the IWC-SORP Research Fund following two open, competitive grants rounds was also received (SC/68B/SH/05). A new Call for Proposals was opened in late 2019; the nine eligible proposals were assessed and six have been recommended for funding totaling £129,955 GBP in 2021 (SC/68B/O/01).

If the Commission agrees to fund the six recommended projects then £25,569 GBP remains unallocated in the IWC-SORP Research Fund. The Committee acknowledged and thanked all contributors to the IWC-SORP Research Fund for their voluntary contributions. The Committee also noted that substantial vessel time has been secured by IWC-SORP researchers for the 2020/21 austral field season, but that expeditions are subject to COVID-19 restrictions being lifted.

Table 23

Work plan for the Southern Ocean Research Partnership.

Item	Intersessional 2020/21	2021 Annual Meeting (SC/68C)
Analyses	Continued analysis of data/samples from previous IWC-SORP voyages/fieldwork	Report
Voyages	- Baleen whale and krill research voyages on ships of opportunity along Western Antarctic Peninsula.	Report
	- *ARA Almirante Irizar*, 2021, to Antarctic Peninsula, islands at 60°30'-60°48'S, 44°25'S-46°43'W and 61°00'-63°37'S, 53°83'-62°83'W and Weddell Sea.	Report
	- *RV Maria S. Merian* voyage to the shelf area from the islands at 60°30'-60°48'S, 44°25'S-46°43'W and 61°00'-63°37'S, 53°83'-62°83'W.	Progress report on rescheduled voyage
Fieldwork	Continued fieldwork around Marion Island.	Report
Acoustics	Retrieval and redeployment of passive acoustic recorders.	Report
Funded research	Progress on IWC-SORP Research Fund funded research projects endorsed by IWC.	Report

Attention: SC, C

Acknowledging the great value of the IWC-SORP (Southern Ocean Research Partnership) programme to its work, the Committee:

(1) **encourages** *the continuation and growth of IWC-SORP;*

(2) **commends** *the researchers involved who are key to the overall success of 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, including photo-ID, to IWC-SORP and the wider Committee.*

21.3 National cruises that require IWC oversight

The Committee welcomed plans for national research cruises to be conducted in 2020 and thereafter. One of the main goals of these cruises is to estimate abundance of various cetacean species. The cruises will be conducted in the Okhotsk Sea in 2020 by Russia (SC/68B/ASI/11), in the North Atlantic Ocean in 2020-25 by Norway (SC/68B/ASI/13), in the western North Pacific Ocean in 2020 by Japan (SC/68B/ASI/14) and in the IWC Area III W in the Antarctic in 2020/21 by Japan (as part of the Japanese Abundance and Stock Structure Surveys in the Antarctic [JASS-A], SC/68B/ASI/19). The Committee appointed the following scientists to provide IWC oversight of these cruises: Matsuoka (Japanese surveys in the western North Pacific and in the Antarctic), Miyashita (Russian cruise in the Okhotsk Sea), and Øien (Norwegian survey in the North Atlantic).

The Committee also received cruise reports from surveys conducted by Russia in the Okhotsk Sea (SC/68B/ASI/12), by Norway in the northern North Atlantic Ocean (Small Management Area ES off Svalbard, SC/68B/ASI/15), and by Japan in the Antarctic (SC/68B/ASI/17) and the western North Pacific (SC/68B/ASI/18). The Committee noted that these cruises provide valuable information for the assessment of whale stocks.

In discussion, the Committee noted the importance of the results for the Okhotsk Sea (an area logistically challenging to survey), in particular the sightings of endangered North Pacific right whales. The Committee also noted that some of the photographs in document SC/68B/ASI/12 were useful for photo-identification of individuals, and that sharing of these images could be useful to assess connectivity of right whales in the eastern and western North Pacific. In response to a question regarding species identification on this cruise, a revised document was provided to the Committee.

21.4 Work plan

The Committee **agrees** to the work plan provided in Table 24. Item 1 in this table (IWC-POWER cruises) has financial implications for the Committee. The Committee **strongly endorses** this proposal. Intersessional Correspondence Groups are detailed in Annex K.

22. SCIENTIFIC COMMITTEE BUDGET FOR 2021

During the May 2020 virtual Committee meeting, the Commission decided to postpone the IWC68 meeting originally planned for September 2020 until 2021 because of the situation with COVID-19. This altered the Committee's plans for developing work plans and budgets. Instead of proposing a biennial work plan and budget, as has become typical, the Bureau directed the Committee to develop a work plan and budget for only 2021 because the Commission would be holding a mail ballot to approve a budget for 2021. At SC68C, the Committee anticipates that it will develop a two-year work plan and budget for 2022 and 2023.

Table 24
Work plan for multinational research programmes and national research cruises that require IWC oversight.

Item	Topic	Intersessional 2019-20	SC68C	Agenda Item
1	IWC-POWER Cruise in the North Pacific Ocean.	Conduct 2020 survey and planning meeting for the 2021 cruise (IWC, Japan, USA)	Review cruise report, report from the planning meeting and new abundance estimates from IWC-POWER cruises.	21.1
2	Review and provide advice on plans for future surveys.	-	Receive, review and provide feedback to research plans to conduct abundance estimates	21.3

22.1 Status of funded research

SC/68B/O/06Rev1 provides information regarding the position on the Committee's research budget at the end of the 2019 financial year, and year-to-date up to 30 April 2020.

Projects undertaken in 2019 were either in line with, or under budget. It should be noted that due to the COVID-19 pandemic, a number of projects had to be postponed and these projects were reviewed by the Committee.

The Committee's Rules of Procedure allow for a contingency fund at a level equivalent to 10% of its core budget to deal with uncertainty on approved projects. At the end of 2019, the balance on the contingency fund was *ca* £33,000, which equates to 14% of the budget. Whilst slightly above target, the minor increase in contingency funds will help to mitigate risk from any potential impact from COVID-19 related to travel in 2021.

In 2019, the Research Fund gratefully received voluntary contributions as follows:

(1) £3,400 from the Government of France to support Invited Participants;
(2) £12,800 from Animal Welfare Institute to fund the preparation of a Pre-Workshop report on cetaceans and ecosystem functioning and to support participants attending the Ecosystem Functioning Workshop (now due to be held in 2021); and
(3) £1,267 (EUR 1,500) from Pro Wildlife to support the Ecosystem Functioning Workshop.

It was noted that a total of approximately £71,000 remained in the Small Cetaceans Fund as at 30 April 2020.

At the 2020 meeting, the Committee approved funding for 6 new projects from the Southern Ocean Research Partnership (IWC-SORP) Research Fund, totalling £129,955. After this allocation, £25,569 remains in the IWC-SORP fund.

22.2 Proposed budget for 2021

The Committee proposed a research programme for 2021 in Table 25. The total amount requested from the Commission is equivalent to **the same level of funding requested in 2020, a budget freeze.**

The proposals noted in Table 26 have already received Commission approval; however, primarily due to COVID-19 these projects have not yet taken place. Work on these projects will continue as soon as possible and this Table is included for information only.

22.2.1 Invited participants

Invited participants (IPs) are a vital component of the working of the Committee. IPs contribute in many ways including as sub-committee and Working Group Convenors, co-Convenors and rapporteurs, subject area experts and Convenors of intersessional groups. All sub-committees and Working Groups benefit from this budget item. The 2021 budget request for IPs is higher than usual due to having only virtual meetings this year, and agenda items being postponed until the 2021 meeting. Additional IPs will be required in order to address these postponed items next year.

22.2.2 Workshops

SC/68B/RP/11 Workshop on the IWC CMP for the Southern Right Whale Southwest Atlantic Population: A Comprehensive Review

During the last Workshop of the SRWSWA CMP held in 2016 in Peninsula Valdes, Argentina, the nine CMP priorities related to research, management, education and monitoring of this plan were reviewed. Notwithstanding, four years have passed since the last CMP revision, therefore, in order to continue increasing the knowledge and conservation of this population, a review of the established actions, as well as the establishment of new actions, if necessary, should be carried out.

SC/68B/RP/12 Workshop to Develop a Proposed CMP on Central American Humpback Whales

Scientists and government personnel of the countries where the humpback whale population of Central America is distributed will participate in a Workshop to develop the humpback whale CMP for this region, which was recommended by the CMP sub-committee at SC68A. A Workshop Steering Group has been established to prepare the Workshop agenda, as well as inviting the scientific community involved in the monitoring of humpback whales in Central America and the appropriate government personnel to provide the support required by the CMP. The Workshop will be held in the City of La Paz, Baja California Sur, Mexico, and will last three days.

Table 25

Summary of budget requests for 2021. For explanation and details of each project see text.

Sub-committee	Project title	Brought forward (£)	Reallocated from other projects (£)	2021 Core Budget (£)	Total (£)		Co-funding/ in-kind
	General						
ALL	Invited Participants 2021	67,809	7,044	**25,147**	100,000		-
ALL	Contingency Fund	32,620	-	**3,284**	35,904		-
	Meetings/Workshops						
CMP	RP11 SWA RW CMP workshop	-	-	**7,600**	7,600		5,660
CMP	RP12 CAHW workshop		-	**11,460**	11,460		-
ASI	RP19 ASI pre meeting	2,000	-	**4,000**	6,000		-
CMP	RP23 Franciscana workshop	-	1,350	**15,250**	16,600		10,000
E	RP24 Climate change workshop	-	13,621	**6,379**	20,000		20,000
IA	RP28 WNP minke IR workshop	14,273	727	**-**	15,000		-
WW	RP30 Chile-Peru whale watching workshop	-	-	**4,210**	4,210		7,400
	Modelling/Computing						
IA	RP15 Computing support WNP minke whales	7,594	-	**5,906**	13,500		-
IA	RP17 NP sei whale assessment	-	-	**2,500**	2,500		-
	Research						
SH	RP01Rev Pygmy blue whale pre-assessments	-	6,582	**7,535**	14,117		-
SH	RP02 Acoustics blue whale Oman	-	-	**12,000**	12,000		34,450
SH	RP05 Acoustic catch separation Durban	-	5,010	**-**	5,010		34,490
SH	RP06 Acoustics Antarctic blue whale west Africa	-	-	**-**	-		-
SH	RP07 Mid latitude Antarctic blue whale acoustics	-	1,040	**3,360**	4,400		-
CMP	RP08 ASHW songs India	-	-	**11,897**	11,897		2,000
CMP	RP09 ASHW body condition and fisheries mapping	-	-	**12,825**	12,825		26,324
CMP	RP10 SEP right whale acoustics	-	-	**20,000**	20,000		-
IA	RP16 NPHW mixed stock analysis	-	-	**13,200**	13,200		-
ASI/IA/NH	RP21 IWC-POWER cruise	32,320	-	**-**	32,320		800,000
SM/CMP	RP27 *Franciscana* aerial survey	-	-	**23,820**	23,820		105,220
	Databases						
HIM	RP29 Ship strike database coordinator	1,114	-	**8,886**	10,000		-
SH	RP03 SH blue whale catalogue	-	2,106	**15,494**	17,600		-
SH	RP33 SH blue whale catalogue (Chile)	-	5,010	**5,418**	10,428		-
SH	RP04 Reconciling Chilean blue whale catalogue	-	2,000	**-**	2,000		-
Secretariat	RP22 Database hosting	-	3,771	**2,229**	6,000		-
	Reports						
E	RP18 SOCER	-	-	**4,000**	4,000		-
	TOTALS	157,730	48,261	**226,400**	432,391		1,045,544

Table 26

Previously funded projects which have been postponed.

Project Title	Budget (£)
RP-13 Ecosystem functioning workshop	20,300
RP-14 NPHW workshop 2	11,040
RP-20 Gray whale workshop	10,500
RP-31 Focused session on disease	3,817
RP-25 Strandings initiative	9,000
Cetacean Diseases of Concern	6,000
MAWI Workshop	17,000
Comparative biology, health, status and future of NA right whales	10,000
Development of Blue Whale Song Reference Library	4,000
Historic catch data	2,988

SC/68B/RP/13 Cetaceans and Ecosystem Functioning: A Gap Analysis
Experts on the role and impact of cetaceans on ecosystem functioning will participate in a Workshop/pre-meeting to discuss the current state of knowledge on the ecosystem functioning provided by cetaceans as requested in Resolution 2016-3 (IWC, 2017b). This Resolution directed 'the Scientific Committee to further incorporate the contribution made by live cetaceans to ecosystem functioning into [its] work' and 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'. This Workshop was due to be held immediately prior to SC68B but was postponed due to COVID-19.

SC/68B/RP/14 Second Workshop on the Comprehensive 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 and reported on at SC67A. The Workshop will continue the work with a view to completing or significantly advancing the assessment, including the relevant population modelling.

SC/68B/RP/19 Pre-meeting of the Abundance Steering Group and the Intersessional Steering Group on Status of Stocks
Funding is required for a pre-meeting prior to SC68C for the Intersessional Steering Group on Status of Stocks and the Abundance Steering Group to meet and evaluate intersessional work and abundance estimates required by the Scientific Committee's various sub-groups during the 2021 Annual Meeting.

SC/68B/RP/20 Workshop to Complete the Updating of the IUCN/IWC CMP on Western Gray Whales
The CMP is over 10 years old and requires updating. Initial work has been undertaken. However, the results of the rangewide Workshops need to be incorporated and conservation-related questions need to be developed that can be addressed within the new population modelling framework developed as a result of the Committee's work.

SC/68B/RP/23 Franciscana Assessment Workshop
The franciscana is considered the most threatened marine cetacean species in South America and is listed as 'Vulnerable' by the IUCN. The Committee first reviewed the status of the franciscana in 2004. A task team for FMA I was established in 2015. A year later, the IWC created a Conservation Management Plan (CMP) for the franciscana. This year a review of the status of the franciscana was begun but, due to the COVID-19 pandemic, it was not possible to complete it. A Workshop will complete the review of the status of the franciscana and make recommendations for future studies and conservation actions.

SC/68B/RP/24 Climate Change Workshop
The Workshop would include representatives from relevant IGOs and selectively review and consolidate the conclusions and recommendations from previous IWC climate change initiatives and Workshops in light of recent new information and developments. The focus would include advice on: (1) how to better integrate this issue into the Scientific Committee's work plan; (2) identification of research programmes/areas to fill priority knowledge gaps; and (3) identify areas/issues for which mitigation and management are likely to be a priority for the IWC and other international and national authorities (e.g. IMO, RFMOs, CMS).

SC/68B/RP/31 Cetacean Diseases of Concern: Morbillivirus and Brucella and their Interaction with Other Immune Suppresive Stressors
A focussed session will be held at SC68C in which participants and SC members will: (1) review the current state of knowledge on the individual and population level impact of two key infectious diseases on cetaceans: morbillivirus and brucella, including the importance of co-infections; (2) identify gaps in our knowledge on their pathological effects, transmission routes, and epidemiological consequences; and (3) determine the potential interactions with other stressors, particularly with contaminants and biotoxins where concomitant exposure is relatively common.

SC/67B/RP/30 Chile-Peru CMP Workshop on Experience Exchange on Whale Watching Regulation and Research Permit Systems
The Workshop will cover all cetacean species and take special emphasis on southern right whales. It will give a general overview of existent whale watching regulations and research permit systems, review research and rescue proceedings in Chile and Peru, identify challenges and propose standardised processes for both States. The government of Peru has kindly offered to host the Workshop.

22.2.3 Modelling/computing
SC/68B/RP/15 Essential Computing Support to the Secretariat
The Committee is currently engaged in an In-depth assessment of Western North Pacific common minke whales. The Committee has developed a complex assessment model structure towards this end. A key task in this process is to develop

and validate the code for this model, together with its variants which are required for the associated sensitivity tests; these are the core components of this process. Experience has shown that the Secretariat staff do not have enough time to complete this process themselves, so computing support is needed.

SC/68B/RP/17 Assessment Modelling for an In-Depth Assessment of North Pacific Sei Whales
The IA sub-committee is currently conducting an *In-Depth Assessment* for North Pacific sei whales. Part of an *In-Depth Assessment* is evaluating the status of a population using some sort of population dynamics model that is specific to the biological and behaviour parameters of that particular population and is fitted to monitoring data. During the intersessional period after the 2020 SC meeting it is expected the population dynamics models will be refined using the existing data. This will result in an assessment of the status of the population.

SC/67B/RP/28 Workshop to Further in In-Depth Assessment of Western North Pacific Minke Whales with a Focus on J-Stock(s)
This Workshop is update of the final year of the already approved RMP Workshop proposal (SC/67B/RP/21) that become an *In-Depth Assessment* Workshop at the end of SC68A in light of Japan's withdrawal from the IWC. The Workshop will provide the support for conducting an *In-Depth Assessment* with a focus on the status of J-stock(s) and bycatches.

22.2.4 Research
SC/68B/RP/01Rev1 Pygmy Blue Whale Pre-assessments
Five pygmy blue whale populations will be assessed under this work. This project will provide crucial catch separation data and the pre-assessments to guide decisions made during *In-Depth Assessments*, for four of the five pygmy blue whale populations.

SC/68B/RP/02 Passive Acoustic Monitoring for Blue Whales and Other Baleen Whales off Oman
The status and population identity of blue whales in the Arabian Sea are poorly understood, and recent acoustic evidence indicates that the whales off Oman belong to an acoustic population that has not been previously described. A year of passive acoustic monitoring will be used in deep water off the coast of Oman to achieve the following goals: (1) commence dedicated research program for NIO blue whales in the waters of Oman; (2) describe seasonal variation in presence of blue whales; and (3) collect acoustic data on Arabian Sea humpback and Bryde's whales and other cetaceans.

SC/68B/RP/05 Using Bioacoustics to Separate Historic Catches of Antarctic and Pygmy Blue Whales from the Former Durban Whaling Ground
Blue whale catches from the former Durban whaling ground, South Africa, are difficult to apportion to subspecies because pygmy blue whales were only identified as a separate subspecies late in the history of exploitation. Available biological data are also insufficient to separate Durban catches. The project will be the first to collect passive acoustic monitoring data off Durban to apportion historic blue whale catches among Antarctic and pygmy blue whales.

SC/68B/RP06 Acoustic Occurrence and Behaviour of Antarctic Blue Whales and Other Whales off the West Coast of South Africa in Relation to Environmental Conditions
This project will use passive acoustic monitoring to investigate the seasonal occurrence and acoustic behaviour of Antarctic blue whales and other whales (e.g. southern right whales, fin whales, minke whales, sperm whales, and humpback whales) off the west coast of South Africa.

SC/68B/RP/07 Assessing Regional Variation in Antarctic Blue Whale Regional Song Calls from Mid-latitude Sites in the Southern Hemisphere
This project will compare the characteristics (frequency, temporal) of Antarctic blue whale song calls from mid- and low-latitude regions in order to assess any regional variation in Antarctic blue whale song calls, with a view to contribute information on Antarctic blue whale population structure.

SC/68B/RP/08 Songs of Arabian Sea Humpback Whales off the West Coast of India
Since the initiation of the IWC funded Arabian Sea humpback whale (ASHW) research in India in 2015, five hotspots for the species have been identified along the west coast of India and two ASHWs from the Oman catalogue have been confirmed from Indian waters. The team plans to deploy acoustic recorders off Kanyakumari, Tamil Nadu and off Dwarka, Gujarat in early 2021. These deployments will allow for comparison of songs during the same season within India, and with Oman as per funding availability for collaborators there.

SC/68B/RP/09 Assessment of Arabian Sea Humpback Whale Body Condition and Co-occurrence with Human Activities in Oman
This project builds on existing funding and planned fieldwork to allow a more thorough assessment of the health and conservation status of endangered Arabian Sea humpback whales, as well as more accurate assessment of human activity,

including fisheries, in their core habitats in Oman. It will address recommendations made in two papers presented to SC68B by: (1) conducting a desk-based study that will use spectral filtering of free sentinel imagery to map the density of human activities, including artisanal gillnet fleets (fishing dhows) in key humpback whale habitat off the coast of Oman; and (2) facilitating fieldwork in either November 2020 or March 2021 that will allow ground truthing of the fisheries mapping exercise, as well as a second assessment of ASHW body condition.

SC/68B/RP/10 Passive Acoustic Monitoring of the Eastern South Pacific Southern Right Whale
Eastern South Pacific southern right whales are considered Critically Endangered by IUCN. In 2012, the IWC adopted a CMP for this population and since 2016 the Committee has supported the Passive Acoustic Monitoring (PAM) project to facilitate the identification of potential breeding areas along the coast of Chile and Peru. This project seeks to obtain temporal coverage over a complete annual cycle and spatial coverage along its known distribution range.

SC/68B/RP/16 Mixed-stock Analysis and Population Assignment of North Pacific Humpback Whales to Assist in Allocation of Catches
Work towards a Comprehensive Assessment of North Pacific humpback whales began in 2016, and included an intersessional Workshop held in April 2017. Included in the work plan from the Workshop and subsequence reports of the intersessional working group is the recommendation to 'Initiate and document genetics-based mixed-stock analysis in the feeding grounds and apply genetic assignments to breeding areas from feeding grounds'. The intent of the mixed-stock analysis and population assignment is to inform the allocation of catches for the assessment model in light of population structure hypotheses. The recommended analyses will be undertaken using available DNA profiles held in an updated 'DNA register' developed for the SPLASH program (Baker *et al.*, 2013).

SC/68B/RP/21 POWER Cruise
The POWER programme has been running since 2010 and has contributed greatly to the work of the Committee and its assessment work. Objectives have been developed for the overall plan and funding will allow for the finalisation 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, which it wishes to do although it has now left the IWC.

SC/68B/RP/25 IWC Strandings Initiative
This funding remains unspent due to its nature of being an emergency response fund and in this biennium no eligible requests being received. This funding will therefore be carried forward to 2021 with the same main purpose. Currently, a consultancy project let by the IWC Secretariat is underway to review the progress of the IWC Strandings Initiative overall and to develop a new four-year work programme. The outcome of this may indicate the need for revised Terms of Reference for the emergency response funding and thus any proposals for change in use of this funding will be made to the next meeting of the Scientific Committee in 2021.

SC/68B/RP/27 Franciscana Aerial Survey in Uruguay
Incidental mortality in the gillnet fisheries is the major threat to the franciscana dolphin. One of the greatest challenges to improve management of the species relates to the difficulty in estimating abundance in the Franciscana Management Area III (FMA III) where bycatch estimates are the highest across the species range. The issue relates to the fact that FMA III is shared between Uruguay and Brazil. The establishment of a Franciscana CMP by the IWC coupled with the current availability of multiple sources of funding provide a unique and unprecedented opportunity to develop an aerial survey to compute an abundance estimate for franciscanas in FMA III (both Brazil and Uruguay). Funds are available to survey the whole Brazilian portion of this area and part of Uruguay. Additional funds are requested to be able to complete a full survey in Uruguay. This estimate would be important for the ongoing review of franciscana status by the Committee and will be used in future assessments of the species.

22.2.5 Databases and catalogues

SC/68B/RP/29 Progressing the Development and Use of the IWC Ship Strikes Database
The purpose of this proposal is to further progress the development of the ship strikes database and to ensure the increased reporting of ship strikes incidents into this IWC database including through: (1) systematic outreach to data providers; (2) review and provision of data; (3) promoting access to information in the database; (4) increase use of the database; and (5) outreach to other organisations.

SC/68B/RP/03 Southern Hemisphere Blue Whale Catalogue
The Southern Hemisphere Blue Whale Catalogue (SHBWC) is an international collaborative effort to facilitate cross regional comparison of blue whale photo-identifications catalogues. To date more than 1,700 individual blue whales have been contributed to the SHBWC from research groups working on areas off Antarctica, Chile, Peru, Ecuador, Galapagos, Eastern Tropical Pacific, Australia, Timor Leste, New Zealand, Indonesia, Sri Lanka and Madagascar. The 2021 project will focus on: (1) matching new photo-IDs received; (2) consolidating Sri Lanka catalogues for future assessments; (3) photo-quality coding of new entries from New Zealand and Chile; and (4) upgrade of the SHBWC software.

SC/68B/RP/33 Southern Hemisphere Blue Whale Catalogue (Chile)
Within the framework of the Southern Hemisphere blue whale catalogue (SHBWC, see SC/67B/RP/03), this project will focus on matching and quality control of ~200 new right-side photo-IDs received from a large blue whale catalogue held by Centro Ballena Azul and Universidad Austral de Chile, in order to proceed towards regional assessment of the Southeast Pacific blue whales.

SC/68B/RP/04 Reconciling a Long-term Photo-ID Database for Blue Whales in Chilean Patagonia
In 2006 the Committee agreed to initiate an *In-Depth Assessment* of Southern Hemisphere blue whales and in 2008, the Committee endorsed a proposal to establish a central web-based catalogue of blue whale identification photographs, known as the Southern Hemisphere Blue Whale Catalogue (SHBWC). This project will reconcile 10+ years of blue whale photo-ID work in northern Patagonia and consolidate these into the SHBWC.

SC/67B/RP/18 Compilation of the State of the Cetacean Environment Report (SOCER)
SOCER is in response to several Commission resolutions requesting regular updates on the state of the world's oceans as relevant to cetaceans. For 2021 the focus will be a regional overview of the state of the Pacific Ocean as relevant to cetaceans, including matters of global concern, based on the published literature in reviewed scientific journals in the period *ca* 2018-21. After the 5-year cycle of regional seas, this information will be incorporated into a 5-year global compendium.

SC/67B/RP/22 Ongoing Database Hosting by the Secretariat
The IWC Secretariat hosts several databases for the Committee. These have annual service costs associated with them including, web/database servers, storage, backups, software licences and other associated infrastructure or costs.

22.2.6 Gray Whale Tagging Fund
The Scientific Committee proposes that unspent voluntary contributions in the Gray Whale Tagging Fund are allocated to 'Research on and Monitoring of Endangered Western North Pacific Gray Whales Feeding off Sakhalin Island in 2020' (SC/68B/RP/32). This does not impact the Commission's core budget.

23. COMMITTEE PRIORITIES FOR THE BIENNIUM 2021-22 AND INITIAL AGENDA FOR 2021

Committee priorities can be found in the work plans incorporated by topic in this report. These will form the basis for the initial agenda for 2021.

24. WORKING METHODS OF THE COMMITTEE

24.1 Scientific Committee Handbook
The Scientific Committee Handbook has been updated by the Chair, vice-Chair and Scientist Emeritus and made ready for upload in a web-friendly manner. Some final technical adjustments are being made to ensure that it functions correctly on the website before going live by August 2020.

Suydam and Zerbini will review the Handbook intersessionally and propose updates at SC68C.

24.2 Biennial reporting to the Commission and related matters
The Committee's report will be made available to the Commission and the public in late June 2020. Because the Commission postponed IWC68 until September 2021, the Chair and vice-Chair will provide a report from the 2019, 2020, and 2021 Committee meetings at IWC68.

24.3 Capacity building and succession plan for Scientific Committee
The work of Punt continues to be followed by Wilberg (University of Maryland Center for Environmental Science) as part of ensuring ongoing expertise within the Committee.

Within the Secretariat, on 9 May 2020 after more than 40 years with the IWC, Donovan moved from Head of Science to Scientist Emeritus, a part-time, one-year position. His primary duty in that role is to complete legacy projects (reports and articles related to SOWER, the RMP, AWMP and ASW). The Committee **expresses deep appreciation** for the many decades of guidance and advice provided by Donovan to the Committee and is pleased that he will continue to be involved in the work of the Committee, including as Convenor for IST, as an independent scientist.

The Committee **welcomes** Staniland, the Secretariat's new Lead for Science in the Secretariat, who took on the role on 9 May 2020. Donovan will provide guidance for Staniland, as needed, during his Emeritus year.

24.4 Update on Data Availability requests and consideration of potential updates/clarifications
The Chair and vice-Chair are expected to propose an update to the Data Availability Agreement at SC68C.

24.5 Committee involvement in the IWC recommendations database
An update on the IWC Database of Recommendations (DoR) is provided in SC/68B/O/03. Further development of the database has been conducted over the past year, including addressing bugs, quality control of data and developing new permission levels for data entry (e.g. by SC Convenors).

The Secretariat has populated the database with all the recommendations from IWC67, including those of the 2017 and 2018 Scientific Committee meetings. Recommendations from SC68A in 2019 have also been entered, along with those of several Workshops. Back data entry is a priority, and options for this might include: (1) back data entry by paid Secretariat interns or casual contracts; (2) data entry by other interns; or (3) data entry by the Secretariat. The Secretariat has actively used the database to review implementation of IWC67 recommendations, particularly those actions directed at the Secretariat and keeps progress against these recommendations updated in the database. Release of the database online remains a high priority and it is anticipated it will be made publicly available on the IWC website in summer 2020. In the meantime, access is available for IWC stakeholders to test the database.

At this meeting, a range of outputs from the database were provided to facilitate the Committee's work including an output of 2017-19 recommendations for each sub-group. The Secretariat will update the database on progress with past recommendations and enter new recommendations. The Committee **welcomed** the progress made with the DoR and noted that several sub-groups had used the outputs from the database to review progress, providing the Secretariat with detailed updates. Feedback had also been given for quality control purposes.

The Committee **agreed** that it would be useful for Convenors to receive outputs from the DoR as soon as possible after recommendations from this meeting had been entered, and an update a month before the next Scientific Committee meeting.

It was noted that a new tool has been developed to allow Convenors and rapporteurs to enter recommendations directly into the database. This was welcomed and several individuals volunteered to enter data for their sub-committees.

Attention: S, SC
The Committee **welcomes** *progress on the IWC Database of Recommendations,* **encourages** *its further development (including back data entry) and its use by sub-committees and Working Groups to review implementation of recommendations.*

24.6 Governance Review: Review of papers from the Working Group on Operational Effectiveness

The Working Group on Operational Effectiveness (WGOE) was tasked at IWC67 to assess the Independent Panel Report (IWC, 2018b) on IWC governance, and review and propose a plan for implementation of appropriate recommendations. This process was established under Commission Resolution 2018-1 at IWC67. The WGOE met in July 2019 in London for a two-day Workshop and a report of that Workshop is available on the IWC website. The Chair of the SC served as a member of the WGOE and participated in the Workshop. Drafting groups were then formed to prepare four documents which were circulated amongst the WGOE members for a final review. Those documents were then posted in three languages on the IWC website[35] on 3 February 2020 for a three-month review. Comments were received from Contracting Governments as well as observers with a deadline of 1 May 2020 which was later extended to 15 May 2020. The WGOE co-Chairs agreed to receive comments from the Committee following the SC68B meeting. During SC68B, the WGOE proposed a new timeline given the postponement of the 2020 Commission meeting to 2021.

DeMaster developed a draft set of comments for consideration by the Committee. Suydam and Zerbini worked with the Heads of Delegation (HoD) and past Committee Chairs to review and modify the draft comments. Interim Committee comments will be submitted to the WGOE after the SC68B report is posted on the IWC website. It is expected that the WGOE will revise its documents and distributed them in September for additional review and another request for comments. Once those revised documents are available, the Chair and vice-Chair will again work with the HoD and past Chairs to review and comment, as appropriate.

24.7 Work plan

The Chair and vice-Chair will review intersessionally the Working Methods of the Committee and will make relevant proposals, in consultation with the Secretariat, for consideration at SC68C.

25. PUBLICATIONS

Publications at the IWC continue to strengthen, with advances being made over the past year to enable greater involvement of the Associate Editors in the editorial process and successful moves to raise the profile of the *Journal of Cetacean Research and Management* (*JCRM*) through the use of social media.

Issue 20 of the *Journal of Cetacean Research and Management* (JCRM 20, 2019) was published at the end of 2019, with papers uploaded throughout the year as they became available. In keeping with *JCRM* policy of open source free download, this volume is freely available online[36].

[35] *https://archive.iwc.int/pages/search.php?search=%21collection29736&k=.*
[36] *https://www.iwc.int/documents.*

A wide variety of papers were published in Issue 20, including notably 'Best practice guidelines for cetacean tagging' by Andrews *et al*. Five papers have already been published online this year in *JCRM* Issue 21, 2020[37]. Submissions to this volume will close on 31 December 2020. At that time papers not yet ready for upload will be rolled over into Issue 22, to be published in 2021. At present over 30 papers are progressing though the system.

The responsibilities of the Associate Editors in their oversight of the peer review process were consolidated during the year through increased use of the Online Journal System chat and e-mail facility, and the offer of individual help to those struggling to use the system. The use of the OJS system continues to be challenging. The Associate Editors are to be highly commended for their hard work and their increasingly proactive approach to their tasks. Regretfully Caterina Fortuna resigned during the year as an Associate Editor, we thank her for her diligence and patience and will miss her contributions. A new Associate Editor, Karen Stockin, has recently joined us. A system of monthly overall updates on progress of papers through the system, in the form of a general 'status report' to the Editorial Board, will soon be forthcoming.

Greater visibility for *JCRM* regular issues has been achieved by use of the IWC Twitter account (@iwc.int) to Tweet new papers as they are published. Authors are encouraged to supply relevant photographs to accompany Tweets and to share and retweet where possible, to further increase *JCRM* exposure on this and associated social media.

Improvements to the IWC's online archiving system (which *JCRM* currently uses to publish its volumes online) are still in the pipeline. The use of the DOI online numbering system to increase the web presence of papers published in *JCRM* as well as for other media such as data and photo-archives is being investigated, but this and other initiatives will require financial support.

The Report of the Scientific Committee (and intersessional Workshops) is published annually as a Supplement to *JCRM*. The report of the 2019 Scientific Committee meeting held in Nairobi, Kenya in 2019 has been made available for free download online as of April 2020[38]. All copies of the Supplement are freely available for download. Printing of the Supplement volume in the traditional way requires a relatively small monetary outlay, and the Secretariat intends to continue to produce a small number of printed copies each year.

The aim continues to be completion and publication of the IDCR/SOWER Cruises Commemorative *Special Issue* of the *JCRM* as soon as possible. It had been intended to have the majority of papers uploaded by the end of 2019 with the printed volume available for May 2020. Due to unforeseen delays, this was not possible and a number of the Editors of the volume (Brownell, Donovan, Palka and Kato) met briefly earlier in the year to develop a work plan to ensure that it is completed by the end of 2020. This will be facilitated by Donovan's transition to Scientist Emeritus. Papers will be uploaded as they become available and the first batch of at least ten will be ready for upload by the end of August 2020. It has also been agreed that the Secretariat will use the data within the IWC-DESS (Database Estimation System Software) to ensure consistency of style for the many maps that have been submitted in different styles and projections by the various authors.

In his capacity as Science Lead, Staniland took up the role of *JCRM* Editor as of May 2020 as part of his recent appointment as the new Lead for Science to the IWC Secretariat. The previous Editor, Greg Donovan, will continue to oversee the publication of the IDCR/SOWER Cruises Commemorative *Special Issue* of *JCRM* in his new role as Scientist Emeritus. The team has also welcomed back Andrea Cooke and Jessica Rowley from their recent maternity leaves. Special thanks to Jessica Haskell and Elsie Whittle for stepping in to temporarily cover *JCRM* system management and production roles last year; their help was much appreciated.

26. ADOPTION OF REPORT

The report was adopted on 7 July 2020.

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