Report of the Scientific Committee

Virtual meeting, 25 April – 13 May 2022

This report is presented as it was at SC/68D.
There may be further editorial changes (e.g. updated references, tables, figures) made before publication.

International Whaling Commission Cambridge, UK, 2022

Report of the Scientific Committee (SC68D)

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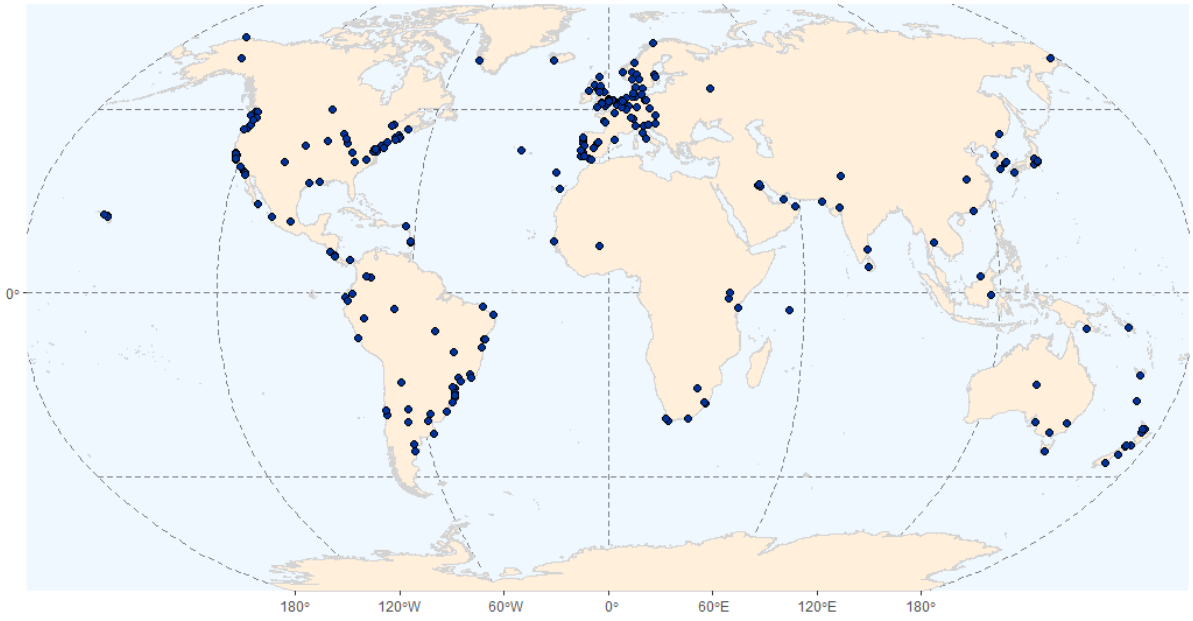
1. INTRODUCTORY ITEMS

The 2022 meeting of the Scientific Committee (henceforth 'Committee' or 'SC') was held 25 April to 13 May 2022. As in 2020 and 2021, it was held virtually due to the global coronavirus pandemic (COVID-19). The Chair (Zerbini) and vice-Chair (Porter) of the Committee worked with the Convenors and the Secretariat to plan a series of pre-meetings and workshops prior to and after the main Committee meeting.

1.1 Chair's welcome and opening remarks

The incoming Chair, Zerbini welcomed participants to the meeting and introduced the new vice-Chair, Porter. In welcoming participants, he noted that as in the two previous years, the meeting was again being held virtually. He also stated that as was successfully implemented last year, the meeting would be held over a three-week period, rather than the usual two but the Committee would only meet Monday to Friday and there would be no meetings on weekends. This would allow national delegates, Invited Participants and observers to attend to work and home responsibilities during the meeting. He expressed his pleasure at the global distribution of participants (see map) and noted that over 500 people were participating in the meeting. Due to the broad range of time zones, some participants would need to be in Committee meetings late at night or early in the morning. He apologised that this was consistently the case for some members but greatly appreciated those who worked at atypical times of the day. Zerbini thanked the Secretariat for its hard work in the lead up to this virtual Scientific Committee meeting, in particular Creek, Duff, Lent, Staniland and Tandy.



Zerbini noted that it may be difficult to discuss highly technical issues during virtual sessions. Some of those discussions may need to wait until the Committee meeting in 2023 or at an intersessional in-person meeting. The number of sessions allocated was still less than half that of a typical in-person meeting.

The Committee's leadership established a plan for developing, reviewing and agreeing the Committee's 2022 report and the 2022/23 budget requests and workplans. The agreed report, budget request and workplan represent the Committee's decisions and recommendations.

The Committee reviewed and agreed the 2022 report in a manner similar to the process used for the two previous virtual meetings. Each sub-group summarised, reviewed and approved their discussions and recommendations and these were subsumed into the main Committee report. In contrast to typical in-person meetings there were no sub-group annexes, although more technical or complicated issues were appended as necessary. A technical meeting

convened by the sub-committee on Implementation Reviews and Simulation Trials was held shortly after the main Committee meeting, 25-27 May, and its report was summarised and included in the Committee report. The full Committee was provided with the opportunity to comment on all sections of the draft report. Final review and approval of the 2022 Committee report was conducted by the Heads of Delegation. The 2022 recommendations will be presented to the Commission at its planned in-person meeting in October 2022.

The IWC Executive Secretary, Lent, thanked the Committee Chair and vice-Chair as well as the Convenors, rapporteurs, reviewers of funding requests and all participants for their efforts to advance the work of the Committee in these challenging circumstances. Lent took the opportunity to introduce four new members of staff who had joined the Secretariat since the last meeting. Details of the forthcoming in-person Commission meeting to be held 14-21 October 2022 in Portorož, Slovenia, were outlined. Lent noted that two major topics to be discussed at the Commission meeting are the governance review and the work of the Working Group on Operational Effectiveness.

The list of meeting participants is given as Annex A. This year 503 participants and 33 member countries were represented.

1.2 Remembrances

Zerbini provided a remembrance of Dr. Fabio Hazin from Brazil, who passed away in June 2021 due to COVID-19. He specialised in the study of sharks, rays and Atlantic tuna and chaired both the FAO Committee on Fisheries and the International Commission for the Conservation of the Atlantic Tunas. Even though he did not participate in SC discussions, he recently played a key role in reviewing the work of the Committee as one of the members of the governance review panel.

Seiji Ohsumi, an eminent whale scientist and key IWC member passed away in November 2019 (IWC, 2020b). A special volume of the journal Cetacean Population Studies (CPOPS), dedicated to his legacy, was recently published[1].

The Committee paused in silence and respect for these scientists.

1.3 Appointment of rapporteurs

Members of the Secretariat, led by Staniland, were appointed rapporteurs for Plenary items 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 schedule

Participants were provided with a comprehensive set of documents, which outlined the organisation of the Committee and its meetings. The Chair provided information to Committee participants on the proposed process; Three concurrent sessions were held within two fixed time slots each day. To accommodate agenda items that were region-specific, sub-groups scheduled additional sessions that were more conducive to the region/time zone of participants. A timetable of virtual sessions was made available approximately a week in advance and regularly updated on the meeting's SharePoint. Zoom instructions were prepared for Committee participants and posted on the SharePoint in advance of the meeting and each session was recorded and made available throughout the meeting. The purpose of the recordings was to assist those whose first language is not English and those who could not attend a session due to challenges associated with time zones (i.e., meetings held late at night or early in the morning).

1.5 Establishment of sub-committees and Working Groups

Table 1 lists the sub-committees and Working Groups of the Committee that met in 2022, and the relevant Convenor, co-Convenor, and rapporteur(s). The Committee is grateful for the commitment of these individuals, without which the Committee could not advance its work.

Table 1
Committee sub-groups and Convenors/rapporteurs for 2022

Sub-committees/Working Group name	Convenor	Co-Convenor	Rapporteur(s)

[1] **https://cpops.jp/archive/pdf/CPOPS003.pdf**

Scientific Committee Plenary	Alex Zerbini	Lindsay Porter	IWC Secretariat
Ad hoc Working group on Photo-ID, PH	Paula Olson	-	
Standing Working Group on Abundance Estimates, Stock Status and International Cruises, ASI	Geof Givens	Leslie New	Thomas Doniol-Valcroze Nat Kelly
Ad hoc Working Group on Sanctuaries, SAN	Chris Parsons	-	Convener
Ad Hoc Working Group on Databases and Related Issues, GDR	Mike Double	-	IWC Secretariat
Sub-committee on *Implementation Reviews* and Simulation Trials, IST	Greg Donovan	John Brandon-	David Miller Mike Wilberg
Sub-committee on Aboriginal Subsistence Whaling, ASW	Lars Walløe	Thomas Nelson-	Lars Walloe
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	Phil Clapham Kristin Privitera-Johnson Andre Punt
Sub-Committee on the Other Northern Hemisphere Whale Stocks, NH	Jooke Robbins	-	Kim Goetz
Sub-Committee on the Other Southern Hemisphere Whale Stocks, SH[2]	Jen Jackson	Elanor Bell	Elisa Seyboth Danielle Buss Trevor Branch
Sub-Committee on Conservation Management Plans, CMP	Bob Brownell	Dave Weller	Sarah Mallette
Sub-Committee on Non-deliberate Human-Induced Mortality of Cetaceans, HIM	Russell Leaper	Gianna Minton	David Mattila
Sub-Committee on Environmental Concerns, E	Patricia Holm	Danielle Cholewiak	Tilen Genov Penny Clarke Gaby Hernandez Rocio Gonzalez Stephanie Plön
Standing Working Group on Ecosystem Modelling, EM	Toshihide Kitakado	Megan Ferguson	Conveners
Sub-Committee on Small Cetaceans, SM	Lindsay Porter	Fernando Trujillo	Frank Cipriano Maria Clara Jimenez Naomi Brannan Peter Thomas
Sub-Committee on Whale Watching, WW	Robert Suydam	Jorge Urban-Ramirez	Naomi Rose

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. 113 primary papers and three intersessional meeting and workshop reports were available.

3.2 National Progress Reports on research

[2] **Helena Herr, Els Vermeulen and Ana Sirovic chaired sessions during SC68D**

All member nations are urged by the Commission to provide Progress Reports to the 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 Progress Reports should be submitted electronically through the IWC Progress Reports data portal. The Secretariat noted that improvements have been made to the on-line process in order to facilitate the submission of data, including more detailed instructions. Countries were reminded on 28 February 2022 (IWC.ALL.413) of the critical importance of providing National Progress Reports as well as any data relevant to the work of the Commission. The Secretariat reported that it had received 13 National Progress Reports thus far this year (Argentina, Australia, Brazil, Croatia, Colombia Germany, Italy, Mauritania, Mexico, Netherlands, New Zealand, United Kingdom, USA), which is the same number as in 2021 and a decrease from the 17 received in 2020. The Secretariat is investigating ways of making the data entry easier and welcomes any suggestions or feedback from all countries.

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 2021 meeting. Details of large whale catches from the 2021 season are listed in SC/68D/O/06Rev1.

3.3.2 Progress of data coding projects and computing tasks

The catch database v7.1 was released in December 2020 and is available on request. Allison and Burkett are finalising a new version of the database that is expected to be released soon.

The table of assessed abundance estimates has been updated from the 2021 Committee meeting and after report approval, the 2022 assessments will be added.

Programming work has concentrated on updating the control programme for the North Pacific common minke whale trials (see Item 8.1.3) and adjusting the mixing matrices to improve model fit.

Table 2

Date received	From	IWC ref.	Details
Catch data from the 2021 season			
22/03/2022	Canada: R. Apro	E146 Cat2021	Details of the Canadian bowhead harvest for the 2021 season.
31/03/2022	Japan: T.Iida	E146 Cat2021	Individual data for commercial catches by Japan in the N. Pacific in 2021.
12/04/2022	St Vincent & Grenadines: J. Cruickshank-Howard	E146 Cat2021	Information on the St Vincent and the Grenadines aboriginal hunt 2021-22
14/04/2022	Russia: D. Litovka	E146 Cat2021	Individual data from Russia aboriginal hunt 2021
18/04/2022	USA: J.J. Citta	E146 Cat2021	Individual records from USA Alaska aboriginal bowhead hunt 2021
21/04/2022	Iceland: G. Vikingsson	E146 Cat2021	Individual record of 1 common minke whale caught by Iceland 2021
23/04/2022	Norway: N. Øien	E146 Cat2021	Individual minke records from the Norwegian 2021 commercial catch.
Catch and other data from earlier seasons			
18/10-2/11/2021	Japan: L. Pastene	E134	Updates to the table of North Pacific minke whale abundance estimates, including revised abundance estimates, area coverage and sizes.
Sightings data			
31/12/2021	Japan: K. Matsuoka	E148	2021 POWER sightings cruise data (including photographs and sightings data)

22/04/2022	Japan: K. Matsuoka	E147	Sighting data from the 2021 Japanese dedicated sighting survey in the North Pacific, and 2021/2022 JASS-A survey (weather, effort, sighting, distance & angle experiment records). For access, apply through the Institute of Cetacean Research's data access protocol.

3.4 Guidance for the format of the Database of Recommendations

Webster briefly explained the background to the Database of Recommendations (DoR). Its establishment was requested by the Commission in 2016 and after extensive work it is now available online. The DoR includes recommendations from the Scientific Committee, Conservation Committee (CC) and Commission from 2000 to 2021 (SC/68D/GDR/01). Regarding back-data entry, Commission resolutions and Committee workshop recommendations are currently being prioritised. It is hoped that by reviewing previous recommendations, the Scientific and Conservation Committees can improve those made in the future. Recommendations for 2020 and 2021 were provided to each sub-committee at this meeting as well as guidance on their drafting. A well-constructed recommendation should: (1) be concise; (2) stand alone; (3) give specific instructions on who it is targeted at; (4) give details of others who should be aware of it; (5) have a single action; and (6); have a clear timeline.

A template is being developed to allow progress on recommendations to be easily displayed in reports and also to update the DoR.

4. COOPERATION WITH OTHER ORGANISATIONS

4.1 Summary of cooperation with other organisations

The reports of observers representing the Commission at the meetings of other international organisations were provided in paper SC/68D/O/05rev1. The report by members of the Secretariat on cooperation with other organisations is also presented in this paper.

The Commission and the Scientific and Conservation Committees have adopted numerous recommendations for strengthening engagement with other organisations. The IWC Secretariat, in collaboration with members of the SC, CC and Standing Working Groups (SWGs) have been working to fulfil these mandates, in addition to exploring emerging opportunities. The pandemic has altered the ability of the Secretariat, CC and SC to engage with other IGOs with participation possible at a greater number of virtual meetings but less opportunities for In-depth work. Whilst the number of meetings has proliferated in order to continue IGO work, staff time continues to be stretched given the usual constraints of FTEs and budget. This has underscored the need to establish priorities for engagement and representation by other means, such as through virtual participation in meetings as well as engaging members of the IWC community, particularly those who may already have delegations at these meetings of other international organisations. The Secretariat regularly updates Contracting Governments and observers on the relevant activities in other IGOs and these include requests for assistance in preparation for IWC engagement, whether by the Secretariat or member country representatives.

Table 3
Organisations

ORGANISATION	OBSERVER
ACCOBAMS	*Donovan (IWC-SC representative)*
Arctic Council	*Vacant*
ASCOBANS	*Simmonds (UK)*
CBD	*Vacant*
CCAMLR	*Kelly (Australia)*
CITES	*Secretariat*
CMS	*Lent (Secretariat)*
COMHAFAT/ATLAFCO	*Staniland (Secretariat)*
FAO	*Lent (Secretariat)and Passadore (Secretariat)*
IATTC	*Vacant*
ICES	*Haug (Norway)*
IMO	*Leaper (UK)*
IOTC	*Lent (Secretariat)and Passadore (Secretariat)*
IUCN	*Reeves/Cooke (IWC-SC representatives)*
Marine Mammal Protected Areas (ICMMPAS)	*Rojas Bracho (Mexico)*
Marine Traffic	*Vacant*

NAMMCO Council Meeting	*Lent (Secretariat) and Secretariat staff*
NAMMCO Scientific Committee	*Haug (Norway)*
PICES	*Tamura (Japan)*
Protocol on Specially Protected Areas and Wildlife (SPAW)	*Mattila (Secretariat)*
SPREP	*Mattila (Secretariat)*

4.2 African States Bordering the Atlantic Ocean (ATLAFCO)

The Secretariat maintains regular communication with ATLAFCO as a means to ensure effective outreach and increased engagement of the IWC member countries in Africa. ATLAFCO served as host for its members to join the Virtual Special Meeting of the Commission in September 2021. The Secretariat continues to collaborate with ATLAFCO to provide regular updates for the Commissioners in Africa on intersessional activities of the IWC, encourage engagement in the WG-OE process for the governance review, and join on-line meetings of the Scientific and Conservation Committees. ATLAFCO also hosted a call with the Secretariat to encourage and enhance engagement of African countries in the provision of National Progress Reports. During SC68C, the SC agreed to establish an intersessional working group to pursue the design and implementation of capacity building workshops in West Africa, focused on at-sea surveys and abundance estimation for cetaceans in the waters off West Africa (Diallo *et al.*, 2021). A steering Group was established and charged with follow-up work. A list of topics of interest to ATLAFCO where the IWC could offer expertise and training was agreed. The next steps are to identify suitable experts to address these topics, schedule workshops and seek funding to accomplish specific objectives. Finally, the IWC Secretariat and ATLAFCO have agreed to an internship programme that will allow scientists and other staff engaged in cetacean work from ATLAFCO member countries to participate in a short-term internship with the IWC Secretariat. At its meeting in April 2022, the IWC Bureau supported the use of Voluntary Assistance Funds to launch this programme.

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 invited to participate in its various discussions on the development of the post 2020 framework for biodiversity and associated targets and indicators. The Secretariat has organised and hosted several BLG virtual meetings and has provided interventions on behalf of the BLG at a number of events, including the recent meeting of the Open-Ended Working Group of the CBD.

The Secretariat seeks to raise awareness within the CBD and other relevant organisations of the scientific and conservation programmes of IWC that are already underway in order to ensure that this work is made available for as broad a range of needs by CBD and other organisations as possible. Given the significant investments made through the SC research budget and a range of programmes supported by voluntary funds, ensuring the proper dissemination and use of this information is fundamental to ensuring healthy cetacean stocks, particularly for those threats whose mitigation is not under the purview of IWC. Sharing the IWC's outcomes also helps avoid duplication in an era of ever-shrinking budgets and ensures maximum impact of IWC's products. Along these lines, in November 2021 the Secretariat contributed comments and text to the CBD Technical Series on Anthropogenic Underwater Noise, and the Convenor of HIM participated in a webinar in May 2022 that launched this study.

The Secretariat has compiled the information on potential elements of the post-2020 CBD process in terms of indicators and programmes. These include, for example, the IWC compilation of population estimates, and status as provided on the IWC website, the SC and CC work on the BMI, ship strikes, underwater noise, pollution, and other programmes. The IWC Secretariat also notes the key role of IWC in working with ASW countries to establish whaling quotas.

The Chair of IWC and several members of the Secretariat have participated in various virtual meetings of the CBD, including its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and post-2020 preparatory meetings in the autumn of 2021. In May 2022, the Chair and the Executive Secretary of the IWC attended a series of in-person meetings held at the UN facilities in Geneva. Additional preparatory meetings are planned both in-person and virtually and the venue for the CBD COP will likely be an in-person event in China in late 2022. Another round of CBD's Open-Ended Working Group (OEWG) discussions will be held in Nairobi in July 2022. Further information will be provided to IWC Contracting Governments when this timeline is clear. The latest Zero draft of the post-2020 framework can be found here.

The Secretariat continues to engage with this process based primarily on how the IWC's ongoing scientific and

stewardship work can contribute to tracking and reaching the post-2020 goals and targets. The IWC Secretariat is also exploring the possibility of working with the Biodiversity Indicators Partnership (BIP) and the IUCN GSAP initiative to facilitate this coordination with the overall CBD process.

When engaging in this process, the Secretariat will continue to highlight issues most directly relevant to healthy cetacean populations. These include key threats to cetaceans and any opportunities for these to be addressed or strengthened in the framework and promoting opportunities to address these threats including through increased cooperation, capacity building, engagement of key sectors (e.g. shipping and fisheries) and data management and reporting. These efforts will highlight opportunities for IWC scientific information to support monitoring of progress in achieving the new framework of targets. IWC68 would bring an opportunity for the Commission to welcome the Post 2020 Framework for Biodiversity and to make any observations on the role of the IWC in delivering relevant objectives in the framework. The Secretariat will draw this opportunity to the attention of the Contracting Governments nearer the time but proposes that the development of any proposals to the Commission should be led by Contracting Governments.

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

Scientists at the British Antarctic Survey (BAS) have been in contact with the IWC Secretariat regarding opportunities to enhance scientific collaboration through the Scientific Committee of CCAMLR. A draft work plan has been developed, based on an independent review of the terms of reference for each Scientific Committee. However, the implementation of this work plan has been delayed due to COVID-19 and the requirement to meet virtually with focused agendas. There was discussion of this plan at the recent meeting of CCAMLR's Scientific Committee and plans are underway for Executive Secretary follow-up correspondence to encourage consideration at the respective Commission meetings. This may include the possible development of an MoU or other formal agreement. There have also been ongoing discussions between the science leads as well as the two Executive Secretaries (including an in-person meeting in February 2022 at the Red House) in regard to practical ways to increase scientific collaboration.

The Chair of the CCAMLR Scientific Committee outlined areas of mutual interest with the IWC SC including bycatch, interactions between whales and krill, the role of cetaceans in the ecosystem, climate change and other threats (Cavanagh *et al.*). In particular, there was an interest in bringing relevant experts from the two committees into each other's work (see item 12.2.2). In discussion, the Committee welcomed closer collaboration between the two Secretariats and Kelly was nominated as an observer for both Committees.

4.6 Convention on the Conservation of Migratory Species (CMS)

The Secretariat and representatives from the IWC SC have continued ongoing co-operation with the CMS on a wide range of common challenges, including bycatch, strandings, CMPs, ship strikes, ecosystem functioning and whale watching. The IWC has an MoU with the CMS and also collaborates with the daughter agreements ASOCBANS and ACCOBAMS. Joint work has continued with CMS on the IWC Whale Watching Handbook (particularly translations). In February 2022, both the CC and SC whale watching groups provided input to the CMS Guidelines for in-water interactions with wildlife and the revised CMS Guidelines will be published in the near future.

4.6.1 Scientific Council

The Fifth Meeting of the Sessional Committee of the CMS Scientific Council (ScC-SC5) took place online from 28 June to 9 July 2021. The Scientific Council decided to establish a Working Group on Ecological Connectivity, with the aims of enhancing the scientific understanding of connectivity issues and providing advice on these in relation to migratory species. ScC-SC5 also agreed on reactivating the Working Group on Migratory Species and Health. The Group will provide a mechanism to increase attention to the issue, define a key role for CMS, and advise Parties on the risk of zoonotic events , future disease outbreaks and pandemics, and responding to wildlife disease and diseases of zoonotic origin. An Intersessional Working Group on Linear Infrastructure and Migratory Species was also established. Though it is mainly focusing on terrestrial and avian species issues, it is also relevant to aquatic species. One of its tasks is to develop a workplan and identify priority tasks based on the existing information, such as standards, guidelines and best practices related to addressing the impact of linear infrastructure development.

An Intersessional Working Group was also established investigating the Maltreatment and Mutilation of Seabirds in Fisheries. Specifically, its mandate is to investigate the nature and extent of this emerging threat and to gather information on what actions relevant authorities are taking to prevent this issue. In addition, ScC-SC5 established intersessional working groups on the Definition of the Terms "Range State" and "Vagrant"; and on the Disaggregation of Higher Taxa listed on Appendix II. All Terms of Reference for the groups can be found on the ScC-SC5 webpage. If anyone is interested in participating in any of these working groups, kindly approach the CMS Secretariat.

4.6.2 Conference of Parties

The dates and the host for the 14th Meeting of the Conference of the Parties (COP14) to CMS have not yet been confirmed. It is expected, however, that COP14 would take place in the 3rd or 4th quarter of 2023.

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

ASCOBANS held a virtual meeting on 23 September 2021 to discuss the potential for a global strandings database. In addition to IWC, ACCOBAMS and the Baltic Marine Environment Protection Commission – also known as the Helsinki Commission (HELCOM) - were in attendance. It was agreed that a platform should be developed that gathers data from multiple sources and visualises the data in one location for increased data access. The scale and size of this proposed platform will be discussed in a workshop, the details of which are still to be finalised.

Numerous ASCOBANS meetings and activities have been ongoing , including workshops on the management of MPAs for small cetaceans, two Jastarnia Group workshops (harbour porpoise in the Baltic Sea), and the North Sea Group. The ASCOBANS Secretariat welcomes IWC participation in the following working groups: Data deficient taxa, *Lagenorhynchus* species, and Cetacean-friendly Marine Spatial Planning (MSP).

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

There is a strong, long-standing collaboration between IWC and ACCOBAMS on many issues including matters related to population assessment, ship strikes, bycatch, whale watching, noise, chemical pollution and CMPs. The need to continue and improve co-operation has continually been underscored and opportunities for further collaboration were recently discussed in a virtual meeting between the IWC and ACCOBAMS Secretariats. Members of the IWC Secretariat attended the 14th Meeting of the ACCOBAMS Scientific Committee 22 to 26 November, as observers. The shared interests and synergies between the two committees were apparent throughout discussions and in the subsequent report. The former Bycatch Coordinator was a member of Joint ACCOBAMS/ASCOBANS working group on bycatch and it is hoped that the new Coordinator will be able to continue in this position.

ACCOBAMS requested that the IWC nominate an SC participant to serve on the ACCOBAMS Scientific Committee. The next Meeting of the Parties of ACCOBAMS will take place in November 2022, when membership of their SC will be formalised for the next triennium. The IWC SC nominated Donovan to continue representing the Committee on the ACCOBAMS SC.

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

No report was received under this item.

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

The IWC Secretariat has continued to engage with the FAO Secretariat in relation to potential collaboration to promote the cetacean bycatch guidelines, including: through capacity building efforts; in pilot projects; review and updated technical information on mitigation measures; and in development of outreach material such as technical factsheets and audio visual materials explaining different mitigation measures in the guidelines.

The IWC Secretariat is also collaborating with the FAO, providing annual statistics on anthropogenic cetacean mortality, including direct takes, bycatch and ship strikes for their annual publication of fishery data, using information from the IWC Progress Reports or submitted directly to the IWC. The IWC Secretariat participates in several task groups under the Coordinating Working Party on Fishery Statistics, including the ad-hoc task group on reference harmonisation standard, the ad-hoc task group on fishing effort concepts and the ad-hoc task group on catch concepts. In a process connected to the COFI meeting, the FAO hosts the Regional Secretariat's Network (RSN) which is an organisation of Executive Secretaries/Directors of Regional Fishery Management Organisations and other Regional Bodies, including IWC. The RSN is an excellent opportunity for the IWC to exchange information on Secretariat-level administrative issues (such as the mechanics for virtual meetings) and is particularly important for collaboration on bycatch with RFMOs. It is through the RSN that the IWC has been invited to participate in a June 2022 FAO meeting that will convene representatives from several relevant regional organisations in the Indian Ocean, including the Indian Ocean Tuna Commission, the Southwest Indian Ocean Fisheries Agreement, the Southern Indian Ocean Fisheries Agreement and the Indian Ocean Rim Association. This will be an opportunity to review and discuss the policies and practices of these RFBs, with the overall objective of promoting and establishing effective regional and sub-regional cooperative frameworks among RFBs, with collaborative approaches on matters of common concern. The theme areas to be explored include addressing fisheries impacts on biodiversity, especially through bycatch.

The IWC Secretariat has contracted with the FAO to prepare Fact Sheets that support the implementation of the

marine mammal bycatch guidelines. These will be prepared in 2022 and reviewed by the Bycatch Expert Panel. The work will be carried out via a sub-contract with the former IWC Bycatch Coordinator (Tarzia).

The FAO Committee on Fisheries (COFI) is planning to meet 5-9 September, 2022. The Regional Fishery Body Secretariats' Network (RSN) will meet one day prior to and one day following the COFI meetings. The IWC Secretariat will attend these meetings as part of the mandate to address monitoring and mitigation of cetacean bycatch in active and ghost fishing gear, along with other biodiversity and ecosystem impacts of fishing.

4.9 Regional Fisheries Management Organizations (RFMOs)

Working in collaboration with RFMOs, SPREP and other partners, the IWC Secretariat was part of the development team that prepared the GEF/FAO Common Oceans ABNJ Tuna Phase 2 project. The IWC's role in this project is to advance efforts to assess and mitigate cetacean bycatch in tuna fisheries across two ocean basins - the Indian Ocean (with possible collaboration with IOTC and other partners) and the Pacific Ocean (with possible collaboration with SPREP, WCPFC, and other partners). The project will also lay the foundation to scale up to other regions and fisheries. At a regional level, the proposed activities fall across three themes: (1) assessing cetacean bycatch, and data gaps across an ocean basin to inform RFMOs on the scale and scope of issues in relevant fisheries and provide a baseline; (2) building regional capacity and awareness on cetacean bycatch and available solutions; working with key countries to train fishers, fisheries managers and observers in cetacean bycatch mitigation, monitoring, safe handling and release and the review and dissemination of relevant information on best practices to address bycatch; and (3) collaboratively developing recommendations to address cetacean bycatch across multi-lateral environmental and fisheries agreements. The IWC will focus on developing recommendations for cetacean conservation through its own Committees and Commission processes and build a coordinated and collaborative approach with national governments participating in both IWC and the relevant RFMOs. The project is due to begin on 1 July 2022.

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

The ICES Working Group on Marine Mammal Ecology (WGMME) met online 1-4 February 2021. New and updated information on cetacean (and seal) population abundance, population/stock structure, management frameworks as well as anthropogenic threats to individual health and population status were reviewed, along with findings on threats to marine mammals such as bycatch, pollution, marine debris and noise. Species-specific foraging distributions were reviewed (considering horizontal and vertical dimensions depending on data availability) and consumption by representative marine mammal species in case study areas was estimated.

Regulations for acoustic deterrent devices to mitigate marine mammal bycatch and legislation requirements for monitoring of bycatch were reviewed along with updated information on bycatch. A questionnaire survey of European stranding networks mapped information pertinent to bycatch assessments.

The ICES WorKshop on estimation of MOrtality of Marine MAmmals due to Bycatch (WKMOMA) met by correspondence during 13-15 and 20-21 September 2021. The WKMOMA addressed a special request from the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) regarding the bycatch mortality of harbour porpoise, common dolphin (and grey seal) within the OSPAR maritime area. The objective of the workshop was to generate bycatch rates and associated confidence intervals for static and towed gears for relevant species within the three species assessment areas defined by OSPAR. Subsequently, the species-specific bycatch mortality estimates in the defined assessment area were also requested. OSPAR provided thresholds for the relevant species/assessment units and ICES were tasked to compare the mortality estimates to the provided thresholds and identify any critical issues relevant for the comparison. As recommended by the ICES Working Group on Bycatch of Protected Species (WGBYC) 2020, a modelling procedure was carried out to generate bycatch rates.

Figures were generated for common dolphin and harbour porpoise, with comparisons across gear types, fishing area, and years of study. Estimated bycatch rates were extrapolated to fishing effort to give a total number of animals caught in a year, e.g., 64,040 common dolphins in 2020.

The Working Group on Bycatch of Protected Species (WGBYC) met by correspondence on 28 September - 1 October 2021. In 2021, WGYC addressed eight Terms of Reference (ToR), including a data scoping exercise as part of a special request on seabird bycatch from the North East Atlantic Fisheries Commission (NEAFC), which concluded that there was insufficient bycatch monitoring data from NEAFC waters to warrant further analyses at this time. The report also provides an overview of monitoring and fishing effort data contained in the WGBYC database for 2019 and 2020. This showed that during 2020, in most geographical areas of relevance, at-sea monitoring effort was significantly affected by the COVID-19 pandemic.

Data used by WGBYC on fishing effort, at-sea monitoring effort and bycatch records are primarily acquired

through an ICES dedicated data call which has been issued annually to all ICES member states since 2018, and all non-ICES EU coastal states from 2021. Although data quality and quantity are improving, WGBYC reiterated that significant gaps remain in data collection efforts and in data resolution and this limits the Working Group's ability to provide useful assessments of the likely impacts of fishing activity across a wide range of protected species and areas. WGBYC note that broadscale low level monitoring programmes may be insufficient to highlight rare bycatch occurrences for populations at low abundance and/or low susceptibility to bycatch, but which could have significant population level impacts.

Due to the COVID-19 pandemic, the 2021 ICES Annual Science Conference (ASC) was held as a virtual conference 6-10 September 2021. More information is available on the ICES website[3].

4.11 International Maritime Organisation (IMO)

The Secretariat and members of the Committee have continued to work with IMO particularly on underwater noise and ship strikes.

Underwater noise: The IMO adopted its Guidelines for the reduction of underwater noise from commercial shipping to address adverse impacts on marine life in 2014, however, there has been very little uptake on the guidelines and there is wide recognition that further work is needed at IMO to address the issue of underwater noise from shipping. Following the postponement of the IMO Marine Environment Protection Committee (MEPC 75) due to the COVID-19 pandemic, noise issues were not discussed until MEPC 76 in June 2021. IWC submitted a short paper (MEPC 76-12) in response to a proposal for further work on underwater noise, noting that the IWC would welcome the opportunity to contribute through the work of its Scientific and Conservation Committees. At MEPC 76, the IMO agreed to review the 2014 Guidelines and identify next steps. This was addressed in the Ship Design and Construction Sub-Committee (SDC 8) in January 2022 which IWC contributed a paper to (SDC 8/14/5). An outcome from this meeting was the establishment of a correspondence group, coordinated by Canada, to work on updating the IMO noise guidelines and to identify next steps. IWC is a member of the correspondence group and will continue to provide input over the coming year.

Ship strikes: France, Monaco, Spain and Italy submitted an information paper to MEPC 77 in November 2021 on 'Identification of Western Mediterranean Sea as PSSA to minimise the risk of ship strikes with cetaceans' (MEPC77.inf27). This paper was intended to start the consultation process for designation of a Particularly Sensitive Sea Area (PSSA) with associated measures to reduce ship strike risks to fin and sperm whales. It is expected that the full proposal will be submitted in June 2022 for consideration at MEPC 79 in December 2022.

The IWC Secretariat and HIM convenor met with the IMO secretariat in February 2022 to discuss ongoing requests from the shipping industry for a new Traffic Separation Scheme south of Sri Lanka which would improve maritime safety and reduce ship strike risks to blue whales.

4.12 International Union for the Conservation of Nature (IUCN)

IUCN has been directly involved in cetacean research and conservation in three main work streams: (i) for the past half-century, activities undertaken under the aegis of the Species Survival Commission's Cetacean Specialist Group, which notably includes overseeing Red List assessments; (ii) since 2013, the Marine Mammal Protected Areas Task Force, a joint project of the International Committee on Marine Mammal Protected Areas, World Commission on Protected Areas and Species Survival Commission; and (iii) since 2004 and through March 2022, independent review panels to advise on western gray whale conservation. Progress since SC68C is summarised briefly below. More information on the three work streams can be found on the Cetacean Specialist Group web site[4], the Important Marine Mammal Areas web site[5] and the Western Gray Whale Advisory Panel web site[6]. Of particular interest to many is the evidence regularly posted on the Cetacean Specialist Group web site (e.g., reports, videos, photographs) of continued illegal fishing in critical vaquita habitat[7].

The Committee noted that there are multiple areas of collaboration between IUCN and the IWC SC (e.g., cetacean Red List assessments, Integrated Cetacean Conservation Planning [ICPC], Marine Mammal Protected Areas Task Force, Status of Stocks Initiative). At last year's meeting, the Committee encouraged efforts to enhance coordination and communication between research programmes under the auspices of the Committee, IUCN/ICPC, NGOs such as WWF, and other fora (such as CMS) involved in cetacean conservation (IWC, 2022). The Committee also agreed that

[3] **https://www.ices.dk/events/asc/ASC2021/Pages/default.aspx**
[4] **iucn-csg.org**
[5] **https://www.marinemammalhabitat.org/immas/**
[6] **https://www.iucn.org/western-gray-whale-advisory-panel**
[7] **https://iucn-csg.org/illegal-fishing-remains-the-sole-immediate-threat-to-vaquitas/**

a mechanism is needed to enhance communication among the different parties involved in conservation planning and actions for cetaceans, such as an annual meeting to provide updates on progress on the issues. The Committee established an intersessional email group to enhance coordination among the parties. The terms of reference of this group are provided in Table 4.

4.12.1. IUCN Red List status of cetaceans

Barbara Taylor serves as the Red List Authority Coordinator for cetaceans and she is regularly assisted in this work by Gill Braulik and Gianna Minton (Deputy Chairs of the Cetacean Specialist Group) and other members of the Cetacean Red List Authority. Progress on and plans for Red List work are summarised in SC/68D/01.

The next edition of the Red List (version 2022-1), scheduled for publication in July 2022, will include an assessment of Rice's whale, *Balaenoptera ricei*, as Critically Endangered and assessments of the Indus River and Ganges River dolphins, *Platanista minor* and *P. gangetica*, both as Endangered, as well as an updated assessment of the Critically Endangered vaquita, *Phocoena sinus*. Also included will be ten new or updated assessments of Mediterranean subpopulations of small and large cetaceans.

4.12.2. Integrated Conservation Planning for Cetaceans

Integrated Conservation planning was developed by the IUCN Species Survival Commission's (SCC) Conservation Planning Specialist Group. This approach uses multidisciplinary teams to devise and implement an integrated conservation plan, involving as many stakeholders as possible in the conservation planning process, including local community members. In 2020, the Integrated Conservation Planning for Cetaceans (ICPC)[8] was established as a sub-group within the IUCN SSC Cetacean Specialist Group in in response to concerns over the increasing number of endangered riverine and coastal dolphin and porpoise species and populations. The ICPC has six ongoing projects that aim to fill critical knowledge gaps for several species of small cetaceans. An update on these projects was presented to the Small Cetacean sub-committee (Item 16.8)

4.12.3. IUCN Task Force on Marine Mammal Protected Areas (formerly ICMMPA)

Giuseppe Notarbartolo di Sciara (Deputy Chair of the Cetacean Specialist Group) and Erich Hoyt continue to lead ongoing efforts to identify, describe and formally list Important Marine Mammal Areas (IMMAs)[9]. A thorough summary of the IMMA programme and process was published in March 2022 (Tetley *et al.*, 2022).

As noted at SC68C, the most recent regional workshop, covering the Caspian and Black Seas and the Sea of Marmara and connecting straits, was held in February 2021. The next workshop will cover the South East Temperate and Tropical Pacific Ocean and is planned to take place in Costa Rica (dates not yet announced).

Western Gray Whale Panels: As noted at last year's SC meeting (Reeves *et al.*, 2021), the Western Gray Whale Advisory Panel's work was expected to be concluded by the end of 2021. The final meeting of the panel took place in Gland, Switzerland in November 2021. Although the report of that meeting was finalised in January 2022, it has yet to be released and posted on the IUCN web site. Some panel work continued through most of February 2022 and more work was planned through March 2022, however, due to the Russian invasion of Ukraine which began on 24 February 2022, all work stopped. A 'closing statement' by the panel is given in SC/68D/CMP/13.

Table 4
Terms of Reference of the IUCN/IWC Coordination Group

SC Agenda item	Terms of Reference	Members
4.12	(1) Develop a process to enhance coordination among IUCN, the IWC SC, and other relevant parties involved in conservation actions for cetaceans (2) Facilitate coordination between those responsible for managing IUCN Red List assessments for cetaceans and developers of the IWC Status of Stocks Initiative, including: (a) Providing input to the Status of Stocks Steering Group regarding prioritisation of cases to consider.	Braulik, Porter (Co-convenors), Abel, Allison, Andriolo, Cipriano, Cooke, Donovan, Fortuna, Givens, Panigada, Punt, Reeves, Staniland, Taylor, Trujillo, Víkingsson, Zerbini

[8] **https://iucn-csg.org/integrated-conservation-planning-for-cetaceans-icpc/**
[9] **marinemammalhabitat.org/imma-eatlas**

	(b) Assisting the Status of Stocks Group on Language, terminology, and content development in drafting website text for comparison of IUCN Red List and IWC Status of Stocks assessments. (c) Advising all groups working on this project, as necessary, to help avoid duplication of effort, the appearance of conflicting results, and public confusion about whale statuses.	

4.13 North Atlantic Marine Mammal Commission (NAMMCO) - Tore Haug (Norway)

The 27th meeting (SC27) of the NAMMCO Scientific Committee (SC) was held online 25-29 January 2021.

The NAMMCO By-catch Working Group (BYCWG) met online 28 May 2020. Estimates for by-catch of marine mammals in Icelandic lumpsucker gillnets were reviewed, and the NAMMCO SC *endorsed* the stratified estimates and *recommended* the estimates with stratification by management area for use in assessments. The limitations and lack of reliability of self-reporting for estimating by-catch were again underlined and the NAMMCO SC *endorsed* the BYCWG recommendation that additional sources of information always be sought. The NAMMCO SC also *recommended* that the BYCWG provide to the next NAMMCO SC meeting an update on the effectiveness of video monitoring systems (being trialled in Norway and in use elsewhere), together with an update on the use of pingers as a by-catch mitigation measure. The NAMMCO SC *endorsed* all the recommendations for research from the BYCWG. The NAMMCO SC also agreed with the proposal of the WG to continue fulfilling its ToRs by reviewing the extent of all fisheries and associated by-catch risks.

Recording ecosystem issues, updates from recently published research on determining the weight of minke whales was presented, as well as ongoing work on a joint study estimating consumption done by marine mammals in the entire North Atlantic.

The NAMMCO SC received an update on the Mary River mine project, noting that Greenland and Denmark had brought issues related to transport and shipping. The NAMMCO SC recommended that a workshop be held to assess the impacts of disturbance from the Mary River mine on narwhals, belugas and walrus. Updated research on harp seals as monitors of change and ongoing research projects on human activities and stressors in the Barents Sea and along the Norwegian coast were also provided. The NAMMCO SC recommended that all NAMMCO member countries ensure that relevant information from seismic surveys be made available to enable proper sound estimation and impact assessment.

Updates were provided on the following species: narwhals, belugas, humpback whales, bottlenose dolphins, killer whales, pilot whales, dolphins, harbour porpoise, and bowhead whales. All the abundance estimates that could be generated for species covered by the previous NASS have now been completed and published, finalising data analysis from 30 years of survey effort. The NAMMCO SC agreed that based on the new information provided by member countries, 2024 was now the most appropriate year for the next coordinated survey.

In discussion it was noted that there was a need for greater coordination over estimates of abundance used by NAMMCO and the IWC. The Committee also noted that a mechanism could be developed to inform the respective Secretariats when estimates are revised.

4.14 North Pacific Marine Science Organisation (PICES) - Tsutomu Tamuta (Japan)

The North Pacific Marine Science Organisation (PICES) is an inter-governmental organisation in which Canada, China, Japan, Korea, Russia and the United States participate. PICES meets once a year for its regular meeting and its associated symposium with over 500 participants. Since 1997, PICES has addressed marine birds and marine mammals as relevant ecosystem components in the North Pacific, and has established a special working group to assess the impact of feeding by marine birds and marine mammals upon ecosystems (WG11). There was also a marine birds and marine mammals advisory panel (AP-MBM) under the BIO to examine the relationship between climate change and ecosystem fluctuation in the North Pacific Ocean, and compare the situation with those in other ocean basins. Since 2016, the AP-MBM is under Section-MBM (S-MBM) under the BIO. The PICES-2021 meeting was held online between 13 and 30 October 2021.

At the PICES business meeting held on 29 September, Tamura (Institute of Cetacean Research, Japan), as the representative of the IWC-SC, presented the observer report of the 2021 IWC/SC meeting on topics related to the North Pacific (e.g., the Research Plan for the IWC/POWER cruise). It was decided to extend the MBM project due to COVID-19. The revised future five-year project (2022-2026) focuses on the "Interaction between MBMs and other ecosystem components and stressors". This will include important sub-themes such as: forecasting changes in forage

species and response of top predators and marine birds and marine mammals as ecological indicators and predictors of changing marine ecosystems. The 2022 annual meeting of the PICES will be held at Busan, Korea. The meeting will be held between 23 September and 2 October 2022.

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

The Secretariat has continued working with counterparts in SPAW on a draft MoU to facilitate collaboration in areas of common interest in cetacean science and stewardship, particularly in small scale coastal fisheries. A revised version of the draft MoU has just been received from the SPAW and this will be followed up with the development of a work plan for the next year or two. The Secretariat will present the draft MoU to the Bureau and then to the Commission at IWC68 if it is ready.

Areas of common interest and possible collaboration include small scale fishery bycatch, ship strikes, strandings response, entanglement response training, whale watching and swim-with programmes. In the spirit of this cooperation, the Secretariat has participated in several virtual meetings of various SPAW activities, including technical meetings of SPAW-STAC (Scientific and Technical Advisory Committee) and their COP. In addition, members of the Secretariat have continued to engage with stranding, entanglement and research initiatives in the Region. The CARI'MAM project hosted the Marine Mammal Stranding Workshop virtually on 17 November 2021. IWC Secretariat was invited to participate in the workshop and the Ship Strikes and Strandings Data Manager provided a brief overview on the scoping for a joint strandings database.

4.16 Secretariat of the Pacific Regional Environmental Programme (SPREP)

SPREP hosted the Chair's IWC Regional Meeting in the Pacific Islands in April 2021. As with COMHAFAT, this was an opportunity to update the Commissioners in the Pacific Islands region on intersessional activities of the IWC, encourage engagement in the WG-OE process for the governance review, and join on-line meetings of the Scientific and Conservation communities. At this Chair's Regional meeting it was noted that in August 2021 there will be a meeting of signatories to the CMS MoU on the Conservation of Pacific Islands Cetaceans and Their Habitats. As many SPREP members are also members of IWC, SPREP is exploring the opportunity for a member of the IWC Secretariat to join this meeting. The IWC Secretariat has held a number of meetings with the SPREP Secretariat in relation to work areas of common interest and overlap, including bycatch and whale watching. As noted in the FAO Section 4.8 above, the IWC is planning to collaborate with SPREP and other regional organisations on the GEF/FAO ABNJ Bycatch concept as part of the Common Oceans Programme. SPREP is currently involved in an EU-funded project through its Pacific-European Union Marine Partnership (PEUMP), which includes a multi-taxa bycatch component focused on coastal fisheries. The SPREP Secretariat is also actively engaged in raising awareness on cetacean bycatch in the Western Central Pacific Fisheries Commission (WCPFC).

4.17 Marine Traffic

The Secretariat continue to work with the SC HIM Convenor to request AIS data as needed for scientific research. The plan to develop an MoU between IWC and Marine Traffic has been set aside for now, however, the provision of data on shipping for scientific studies is still possible, for which the IWC is most grateful. An MoU would allow the IWC to serve as a single point for data requests in a standardised format, minimising work for the data provider. Should it eventually be possible to prepare a draft MoU, the IWC Secretariat will take it forward to the IWC.

5. GENERAL ASSESSMENT AND MODELLING ISSUES

5.1 Use of ISTs for consideration of species' and populations' status

This Item is dealt with under Item 11.5 (Provide advice to the Commission on the status of stocks).

5.2 Progress on previous recommendations

Progress under previous recommendations is dealt with under Item 11.5 (Provide advice to the Commission on the status of stocks) and Item 12.8 (Consider definition of r_{max} for small cetaceans for use by the Scientific Committee).

5.3 Biennial workplan

No specific work was identified under this Item although aspects are covered under Items 11.5 and 12.8.

6. AWMP AND RMP IMPLEMENTATION-RELATED MATTERS (IST)

The technical nature of the AWMP and RMP Implementation Related-Matters (IST) required an in-person meeting, which was kindly hosted at the Greenlandic Representation in Copenhagen, Denmark from 25-27 May 2022. The meeting was attended by 18 participants and was open for limited online attendance.

The primary objectives of both an AWMP and an RMP *Implementation Review* are to:

(1) review any new information (including data relevant to stock structure, biological data and abundance) to ascertain whether the present situation is as expected (i.e., within the space tested during the development of a *Strike Limit Algorithm* (*SLA*)) or the previous RMP *implementation* or *Implementation Review*) and to determine whether new simulation trials are required to ensure that the Commission's conservation objectives are met; and

(2) review information required for the *SLA* or *Catch Limit Algorithm*, i.e., catch data and, when available at the time of the *Review*, new abundance estimates (note that receiving new abundance estimates can also occur outside an *Implementation Review* at an Annual Meeting).

More information on RMP *Implementations* and *Implementation Reviews* can be found in (IWC, 2012d) and for the AWMP in IWC (IWC, 2019d).

6.1 AWMP *Implementation Review* for the West Greenland bowhead whale hunt

The *West Greenland Bowhead SLA* was agreed in 2015 and this, the first *Implementation Review* was initiated in 2021 (IWC, 2022).

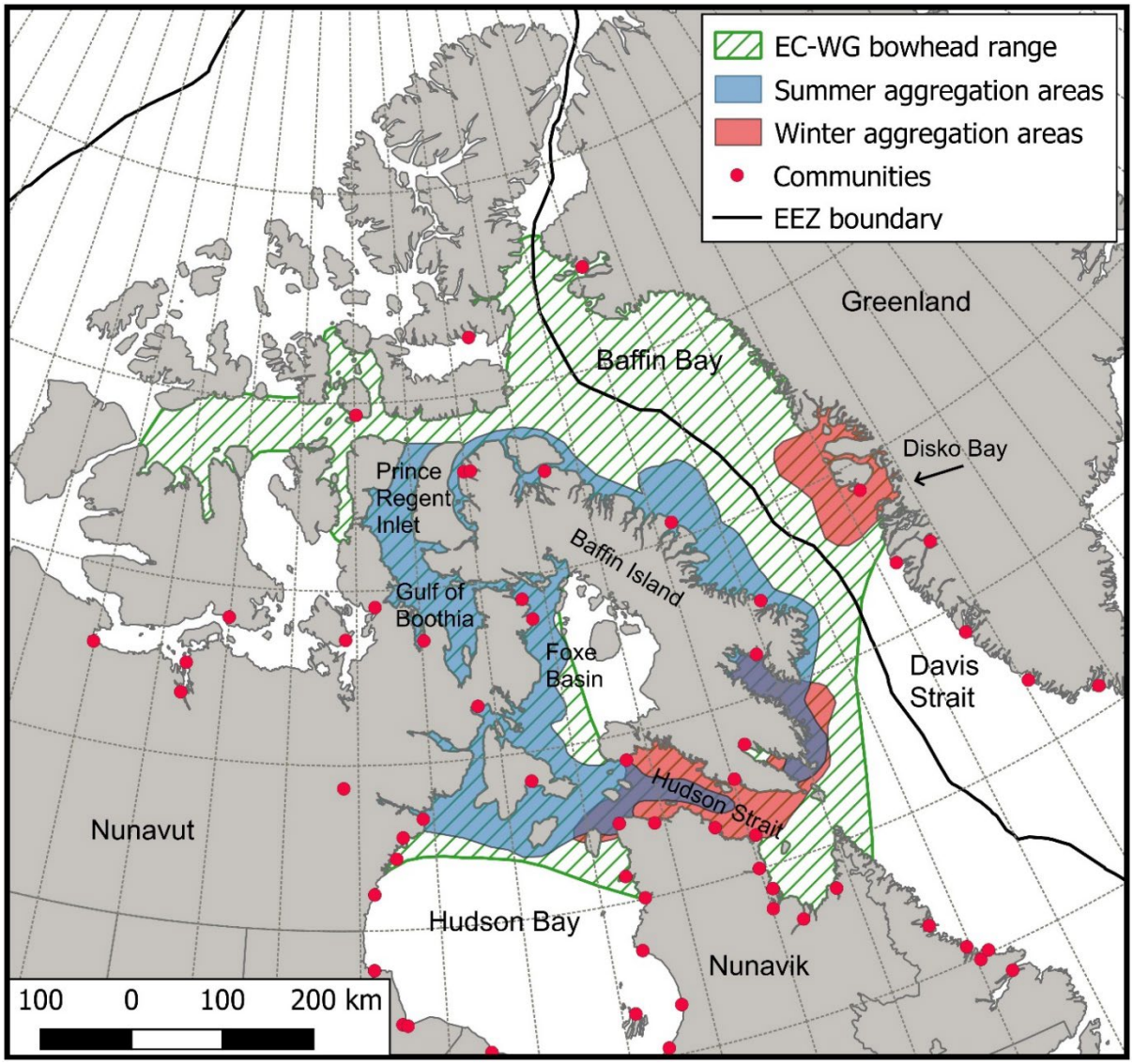


Fig. 1. Approximate geographic range of the Eastern Canada-West Greenland bowhead whale population, with important aggregation areas during the open-water ("summer") and ice-covered ("winter") seasons. Taken from Ferguson *et al.* (2021)

6.1.1 New information

6.1.1.1 STOCK STRUCTURE

In 2015, although it was clear that the West Greenland aggregation was part of the much larger East Canada/West Greenland population, the conservative (and simpler to model) assumption used when the developing the *SLA* i.e. that the West Greenland aggregation be treated as a separate management unit, allows both the conservation and need objectives of the Commission and hunters to be met using the *West Greenland Bowhead SLA*, even assuming all Canadian catches were from the West Greenland aggregation (Canada is a non-member nation that sets its own catch limits).

Attn: SC, C

The Committee notes that knowledge of the stock structure of East Canada and West Greenland bowhead whale populations is based on both genetic and non-genetic (especially telemetric) information. It further notes that many bowhead whales have been genotyped for genetic mark-recapture studies. Given that the present conservative assumption, of treating the West Greenland aggregation as a separate management unit, did not lead to problems in either conservation or need satisfaction, the Committee:

(1) ***agrees*** *that the stock structure hypotheses shall remain unchanged for the current* Implementation Review; *and*

(2) ***encourages*** *genetic and other studies, prior to the next Implementation Review, that will provide new information on stock structure and movements of bowhead whales in Eastern Canada and Greenland.*

6.1.1.2 ABUNDANCE

The Committee reviewed the list of relevant abundance estimates for the West Greenland aggregation (Table 5). This table omits several estimates, archived by the Secretariat, that had been deemed unsuitable for use in conditioning or replaced by subsequent updated analyses. The most recent abundance estimate for the spring aggregation of bowhead whales in West Greenland is from 2012: an aerial survey estimate of 744 (CV=0.34) and a genetic mark-recapture estimate of 1,274 (CV=0.12; Rekdal *et al.*, 2015). An aerial survey for bowhead whales in West Greenland took place in spring 2022 and the results will be available prior to the 2024 annual meeting. It is also anticipated that an updated genetic mark-recapture estimate will also be available in 2023. These estimates will allow the *West Greenland Bowhead SLA* to be used to provide management advice to the Commission in 2024, in accordance with the Aboriginal Whaling Scheme (ASW, IWC, 2019h).

The most recent estimates for the entire population in East Canada/West Greenland are 6,446 (CV=0.26; Doniol-Valcroze *et al.*, 2015) from an aerial survey in 2013, and a genetic mark-recapture estimate of 13,899 in 2010 (95% CI: 7,782-30,602; Frasier *et al.*, 2020). The latter estimate has been endorsed by the ASI-WG as Category 3, indicating that it provides only a general indication of abundance and is not suitable for use in *SLA* calculations (although should it be necessary, may be used for conditioning). In discussion, it was noted that the magnitude of 2010 estimate highlights the degree of conservativism used when developing the *West Greenland Bowhead SLA*.

Table 5

Summary of estimates of abundance for the spring aggregation of bowhead whales in West Greenland endorsed by the Committee. Additional background and notes are provided in the full table available from the Secretariat. The mark-recapture (MR) estimate time-stamped 2012 is considered the best estimate of the number of animals visiting West Greenland. LT=Line Transect.

Area	Cat.	Date	Method	Estimate	CV	Approx. 95% CI	Reference
W. Greenland	1A	2006	LT	1,229	0.47	495-2,939	(Heide-Jørgensen *et al.*, 2007; IWC, 2008b, p.36)
W. Greenland		2012	LT	744	0.34	357-1,461	(IWC, 2015a, p.436; 2015e, p.154; Rekdal *et al.*, 2015)
W. Greenland	1A	2012	MR	1,274	0.12	967-1,581	(IWC, 2015a, p.436; 2015e, p154; Rekdal *et al.*, 2015)

6.1.1.3 REMOVALS

The Committee noted that all the necessary catch data, since 2015, has been provided to the Secretariat, including data kindly provided voluntarily by Canada (Table 6).

Table 6

Direct catches of bowhead whales (aboriginal-type whaling) in West Greenland and Canada. No reported bycatches off Canada were found.

	West Greenland Direct				West Greenland Bycatch				Canada Direct			
Year	Total	M	F	U	Total	M	F	U	Total	M	F	U

2015	1		1	0					2	0	1	1
2016	0								2	0	2	0
2017	0				1		1		1	0	1	0
2018	0								3	0	3	0
2019	0								4	0	3	1
2020	0								1	1		0
2021	0								2	1	1	0
Total	**1**	**0**	**1**	**0**	**1**	**0**	**1**	**0**	**15**	**2**	**11**	**2**

6.1.2 Consideration of need for new simulation trials

After reviewing the new information, the Committee agrees that there is no need to conduct additional simulation trials. Although it was clear that the West Greenland aggregation was part of the much larger East Canada/West Greenland population, the conservative (and simpler to model) assumption used when developing the *SLA*, i.e., that the West Greenland aggregation be treated as a separate management unit, allows the conservation and need objectives of both the Commission and the hunters to be met, even assuming all Canadian catches were from the West Greenland aggregation. Should the Greenland request for bowhead whales increase, and/or Canadian removals increase, above a total of 10 individuals (IWC, 2016b), then the option to model the full East Canada/West Greenland population may be required.

6..1.3 Conclusion

Attn: SC, C, ASW, CG

The Committee ***concludes*** *that the* Implementation Review *for the West Greenland bowhead whale hunt is complete and* ***agrees*** *that the current* West Greenland Bowhead SLA *remains the appropriate tool to provide management advice to the Commission.*

6.2 RMP *Implementation Review* for North Atlantic common minke whales

The initial *Implementation* for North Atlantic common minke whale was conducted in 1993 and was reviewed in 2017. The 2017 *Implementation Review* incorporated a major review of stock structure that was initiated by a joint AWMP/RMP workshop in 2014 (IWC, 2015b).

6.2.1 New information

6.2.1.1 STOCK STRUCTURE

During the preparation for the 2017 RMP *Implementation Review*, the Committee undertook a major review of stock structure hypotheses for North Atlantic common minke whales, including the development of new analyses. At that time, it was concluded that two previous hypotheses III and IV could be dismissed and that there remained two plausible stock structure hypotheses (see Fig 2):

- Hypothesis (I): three breeding stocks (W, C, E), two with two sub-stocks (W1, W2; E1, E2).
- Hypothesis (II): three breeding stocks (W, C, E), one with two sub-stocks (E1, E2).

New information on stock structure, using microsatellite/mtDNA, was presented and discussed under Item 10.1.2.2 (SC/68D/SDDNA/O4). In summary, the study, which was based on a data set of >4,000 samples and only 10 microsatellite loci, included the subareas used by E stock. The study found no indication of substructure within the E stock and, in light of this result, the Committee agrees that the hypothesis of a single E-stock was also plausible:

- Hypothesis (V): three breeding stocks (W, C, E) without sub-stocks

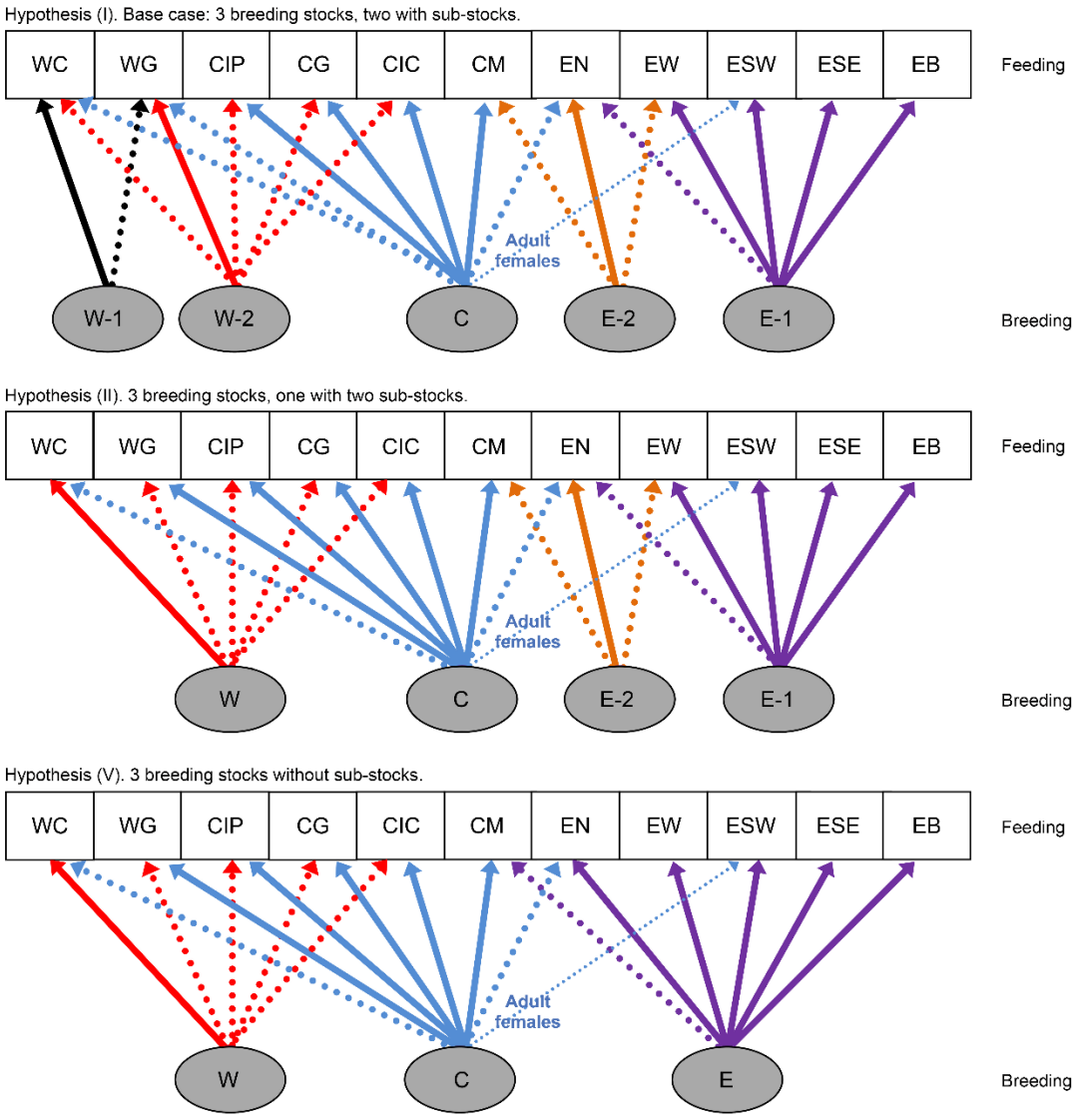


Fig. 2. Stock hypotheses considered high priority for the implementation review of North Atlantic common minke whales.

The Committee noted that a genome-wide stock structure analysis on North Atlantic common minke whales is currently underway and includes Whole-Genome-Resequencing (WGS) on a representative subset of samples with the aim of developing a population/stock-informative Single Nucleotide Polymorphism (SNP)-panel to facilitate genetic stock assessment in a larger set of samples. This approach is expected to provide improved resolution for stock definition/assignment. The Committee welcomes information from the forthcoming genome-wide study and anticipates that the results will be available for the proposed 2026 AWMP *Implementation Review* for common

minke whales off Greenland and for the next RMP Implementation Review for the entire North Atlantic in 2028 (see Item 6.6).

Attn: SC

*The Committee **draws attention** to the new information presented on stock structure for North Atlantic common minke whale (Item 10.1.2.2) as it supports a new hypothesis that no sub-stocks exist within breeding stocks W, C and E. The Committee notes that this new hypothesis has no negative conservation implications (i.e. is more conservative) and **agrees** that it does not warrant testing during the present* Implementation Review*;*

The Committee further notes that a new study is underway that is expected to provide improved resolution of stock structure for North Atlantic common minke whales for the proposed 2029 RMP Implementation Review *(see Item 6.6) and strongly **encourages** all the laboratories involved to consolidate a Single Nucleotide Polymorphism (SNP)-panel to facilitate genetic stock assessment.*

6.2.1.2 ABUNDANCE

The Committee reviewed the list of relevant abundance estimates used for conditioning and previous *Implementation Reviews* (Table 7). This table omits several estimates, archived by the Secretariat, that were deemed unsuitable for use in conditioning or replaced by subsequent, updated analyses.

Table 7
Estimates of abundance for North Atlantic common minke whales endorsed by the Committee and deemed suitable at least for use in trial conditioning. Additional background and notes are provided in the full table available from the Secretariat.

Sub-area	Cat.	Year	Estimate	CV	References
EB	1A	1989	21,868	0.21	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EB	1A	1995	29,712	0.18	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EB	1A	2000	25,885	0.24	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EB	1A	2007	28,625	0.23	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EB	1A	2013	34,125	0.34	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
EB	1A	2017	55,165	0.153	(Solvang *et al.*, 2021; SC2022)
EN	1A	1989	8,318	0.25	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EN	1A	1995	22,536	0.23	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EN	1A	1998	13,673	0.25	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EN	1A	2004	6,246	0.47	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EN	1A	2009	6,891	0.31	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
EN	1A	2018	17,792	0.242	(Solvang *et al.*, 2021; SC2022)
ES	1A	1989	13,070	0.13	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
ES	1A	1995	24,891	0.10	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
ES	1A	1999	17,406	0.14	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
ES	1A	2003	19,377	0.28	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
ES	1A	2008	27,390	0.29	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
ES	1A	2014	23,059	0.156	(Solvang *et al.*, 2021; SC2022)
ES	1A	2019	15,693	0.190	(Solvang *et al.*, 2021; SC2022)
EW	1A	1989	20,991	0.17	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EW	1A	1995	34,986	0.12	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EW	1A	1996	23,522	0.13	(Bøthun and Øien, 2011; IWC, 2011b, p.95)
EW	1A	2006	27,152	0.22	(Bøthun and Øien, 2011; Bøthun *et al.*, 2009; IWC, 2011b, p.95)
EW	1A	2011	21,218	0.32	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
EW	1A	2015	12,595	0.252	(Solvang *et al.*, 2021; SC2022)
CM	1A	1988	4,732	0.229	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
CM	1A	1995	12,043	0.277	(Borchers *et al.*, 1998; IWC, 2009a, p.135)
CM	1A	1997	26,718	0.140	(Bøthun and Øien, 2011; IWC, 2009a, p.135; 2011b, p.95; Skaug *et al.*, 2004)
CM	1A	2005	26,739	0.390	(Bøthun and Øien, 2011; Bøthun *et al.*, 2009; IWC, 2011b, p.95; 2013c, p.115)
CM	1A	2010	10,991	0.360	(IWC, 2016b, p120-1; Solvang *et al.*, 2015)
CM	1A	2016	37,020	0.261	(Solvang *et al.*, 2021; SC2022)
CIC	1A	1987	24,532	0.32	(Borchers *et al.*, 2009; IWC, 2009a, p.135)
CIC	1A	2001	43,633	0.19	(Borchers *et al.*, 2009; IWC, 2009a, p.135)
CIC	1A	2007	20,834	0.35	(IWC, 2015d, p.117-9; Pike *et al.*, 2011)
CIC	1A	2009	9,588	0.24	(IWC, 2015d, p.117-9; Pike *et al.*, 2011)
CIC	1A	2015	12,710	0.53	(IWC, 2017c, p.132; Pike *et al.*, 2019; Pike *et al.*, 2016)
CIP	1A	1988	8,431	0.245	(IWC, 1993, p.66, 128-9)

Sub-area	Cat.	Year	Estimate	CV	References
CIP		2001	4,705	?	(Pike *et al.*, 2009)
CIP	1A	2007	1,350	0.38	(IWC, 2011b, p.95; Pike *et al.*, 2010)
CIP	1A	2015	8,497	0.326	(SC2022; Pike *et al.*, 2019)
CG	1A	1987	1,555	0.26	(IWC, 1993, p.66, 128-9)
CG+CIP	1A	1995	4,854	0.268	(IWC, 2009a, p.134-4; Pike *et al.*, 2002)
CG		2001	7,990	0.29	(Pike *et al.*, 2009)
CG	1A	2007	1,048	0.60	(IWC, 2011b, p.95; Pike *et al.*, 2010)
CG	1A	2015	5,368	0.350	(Hansen *et al.*, 2018; IWC, 2018e, Item 4.2; Pike *et al.*, 2019; Pike *et al.*, 2016). Combined estimate (2,606 cv 0.52 + 2,762 cv 0.47)
WG	2	1988	3,266	0.31	(IWC, 1990, p.43; 2009a, p.135)
WG	2	1993	8,371	0.43	(IWC, 2009a, p.135; Larsen, 1995)
WG	2	2005	10,792	0.59	(Heide-Jørgensen *et al.*, 2008; IWC, 2008c, p.126)
WG	1A	2007	9,066	0.39	(Hansen *et al.*, 2018; IWC, 2019g, p.400-1)
WG	1A	2015	5,095	0.46	(Hansen *et al.*, 2018; IWC, 2019g, p.400-1)
WC	?	2007	20,741	0.30	(Lawson and Gosselin, 2009) (ref NOAA, 2015)

Since the 2017 *Implementation Review*, the Committee has endorsed new estimates obtained from Norwegian surveys for several sub-areas (Solvang et. al., 2021; Item 11.1.2). Several minor revisions and updates to previous estimates have also been agreed (Item 11.2.2) following revised stratification and inclusion of data missing from the FW block in the previous estimate. The 2015 estimate for the CIP sub-area is a sum of the estimates for blocks FW, IQ, IR + IW and differs from the estimate archived by NAMMCO as they use different area definitions. Furthermore, it was noted that the 2015 estimate for the CIP sub-area differs from the estimate archived by NAMMCO as it was updated using revised stratification and included new data from block FW. It was noted that new abundance estimates for common minke whales in the WC sub-area are available (Palka, 2020). Although these are not required for the current RMP *Implementation Review*, the information will be valuable for the next AWMP *Implementation Review* for common minke whales off West Greenland scheduled to begin in 2026 (Item 6.6).

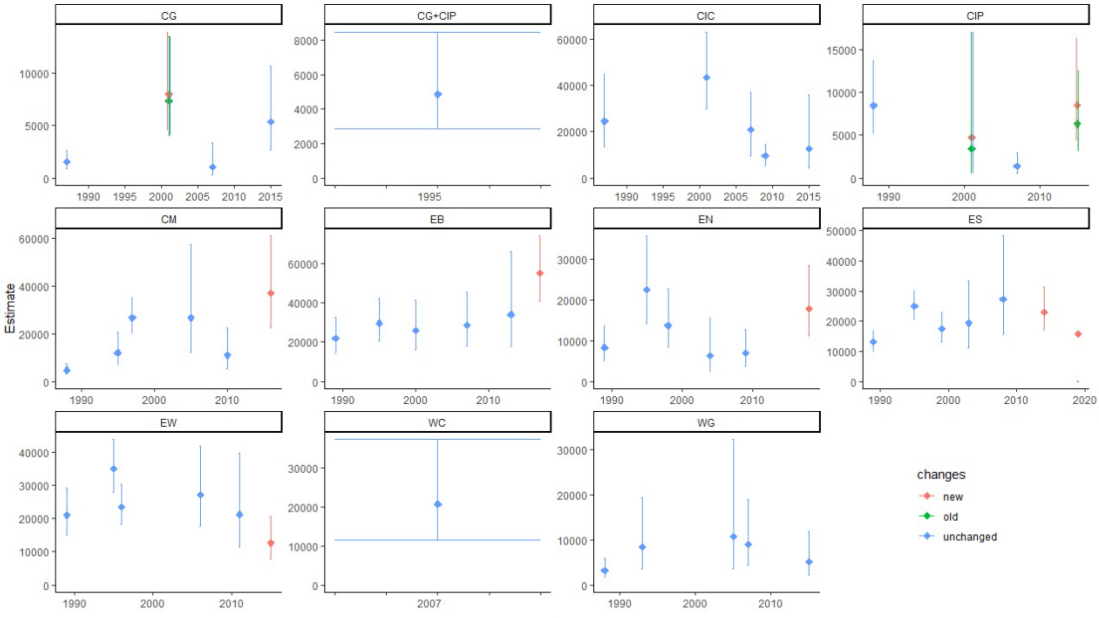


Fig. 3. plots of the available abundance estimates, by sub-area and year, including an indication of which estimates are new for this *Implementation Review*. The new abundance estimates are consistent with previous data and thus provide no reason to pursue new simulation testing. Furthermore, the most recent estimate for the CIP sub-area (8,497 in 2015) was notably higher than the previous one (1,350 in 2007), alleviating any concern about the apparently anomalous low estimate.

The 2015 abundance estimate from an Icelandic survey for the CM sub-area covered only a portion of the CM sub-area and it was agreed that this estimate should be omitted from the trials and the 2016 estimate for CM (that covers the entire CM area) should be used.

The previous *Implementation Review* incorporated a *catch cascading* option within the E *Medium Area*. The *IST*s for the North Atlantic common minke whales include additional variance for the estimates of abundance for the E

Medium Area based on a regression (through the origin) of survey CVs with additional variance on survey CVs ignoring additional variance (fig. 3 of IWC, 2017c). The estimate of the ratio of the survey CV for the 2014-2019 period (Solvang *et al.*, 2021) including additional variance to that without additional variance is 1.67 (i.e. 0.172/0.103), which is within the range of data used to characterise additional variance in the current *IST*s. There is thus no reason to change the trials to update how additional variance is generated.

Attn: SC

The Committee noted the available information on abundance estimates and the additional variance and ***agrees*** *that the new abundance estimates are consistent with previous data and thus provide no reason to pursue new simulation testing.*

The Committee further requests that new estimates for the WC sub-area (Palka, 2020) are reviewed by ASI by the 2024 Annual Meeting to facilitate the 2026 AWMP Implementation Review.

6.2.1.3 REMOVALS

The Committee noted that all the necessary catch data since 2017 has been provided to the Secretariat Table 8.

Table 8

Summary of catch information on North Atlantic common minke whales by sub-area since the last RMP *Implementation Review*

	M	F	U	M	F	U	M	F	U	M	F	U
Year	WG	WG	WG	CG	CG	CG	CIC	CIC	CIC			
2017	33	95	5	3	6	1	12	5	0			
2018	21	91	4	1	1	0	3	3	0			
2019	36	116	8	1	8	2	0	0	0			
2020	26	129	7	5	15	0	0	0	0			
2021	30	137	10	8	12	1	0	1	0			
	EN	EN	EN	EW	EW	EW	ESE	ESE	ESE	EB	EB	EB
2017	5	2	0	9	24	1	43	332	0	2	14	0
2018	0	0	0	28	86	2	29	184	1	45	79	0
2019	1	2	0	19	56	0	59	180	2	42	68	0
2020	10	24	0	22	38	1	33	197	0	76	101	1
2021	17	22	2	16	57	1	23	80	0	75	278	6

6.2.2 Consideration of need for new simulation trials and Conclusion

Attn: SC, C, CG

After review of the new information, the Committee ***concludes*** *that the RMP* Implementation Review *for common minke whales is completed and that no new simulation trials are required. It was noted that consideration of the scenario with no sub-stocks within the E stock will occur in the context of the 'Status of Stocks' project (see Item 11.5). The Committee further notes that considerable new information on stock structure will be available prior to the AWMP* Implementation Review *for common minke whales off West Greenland scheduled for 2026 (see Item 6.6)*

6.3 Planning for the RMP *Implementation Review* for North Atlantic fin whales

The next RMP *Implementation Review* for North Atlantic fin whales is scheduled to start in 2023.

6.3.1 Stock structure

At the last *Implementation Review* eight stock structure hypotheses were considered (IWC, 2016b, p.138). At that time, there were relatively few genetic data available and each hypothesis was evaluated using other types of information including ageing data and Discovery mark tagging data. Three hypotheses (IV, VII, and VIII) were ranked 'low plausibility' and were omitted as they were considered incompatible with tagging data.

Víkingsson reported that considerable new genetic data from Iceland and Greenland are now available (samples from areas outside those covered by Iceland/Greenland may be scarce but efforts are underway to track any down) and will be analysed in time for the 2023 Annual Meeting, along with proposed kinship analyses, this will facilitate a comprehensive review of the present hypotheses.

Attn: SC

*The Committee **welcomes** the information on new genetic analyses on North Atlantic fin whales and **agrees** to establish an intersessional correspondence group (Tiedemann [convenor], Øien, Pampoulie and Witting) to coordinate the compilation of a stock-structure-informative genetic data set and analyses for North Atlantic fin whales to be discussed by the SDDNA working group prior to the* Implementation Review *proposed for 2023 (see Item 6.6).*

6.3.2 Abundance

The Committee noted that the most recent abundance estimates for the EG, EI/F, WG and WI sub-areas were from 2015 and that new estimates from Iceland were expected to be available by 2024-25.

(Leonard and Øien, 2020a; 2020b) presented estimates of fin whale abundance in the eastern North Atlantic based on data collected during sighting surveys between 2002-18. The surveys were designed with common minke whales as target species so some recalculations will be necessary to allocate estimates to the agreed fin whale RMP areas as part of the *Implementation Review*.

The Committee noted that new fin whale abundance estimates from surveys in US and Canadian waters may be available. In discussion it was further noted that some of these estimates, in particular for the Gulf of Maine, may cover only a portion of the sub-area WC and although may not provide useful information on absolute abundance, but may provide an index of relative abundance that could be used for conditioning models. It was agreed that Donovan will enquire about the availability of such estimates for the Committee to consider further and to investigate whether there may be new estimates for other sub-areas as well.

The Committee also noted that new estimates were available from the other surveys (e.g., SCANS and CODA) and that Donovan will also enquire if these data might be available for the planned *Implementation Review*.

6.3.3 Removals

The Secretariat summarised the available data (direct catches and bycatches) available since the last *Implementation Review* (Table 9).

Table 9

Summary of catch and reported bycatch information on North Atlantic fin whales since the last RMP *Implementation Review*

	West Greenland									Iceland				
		Landed			Lost	Bycatch					Landed		Lost	
Year	Total	M	F	U	U	Total	M	F	U	Total	M	F	U	Notes
2015	12	2	8	0	2	0				155	87	67	1	
2016	9	4	4	0	1	1	1							
2017	8	2	5	9	1	0								
2018	7	3	3	0	1	0				146	67	79		Incl. 2 hybrid blue/fin
2019	8	2	3	2	1	0								
2020	3	2	1	0	3									
2021	2	1	1	0	0									

6.3.4 Future work

The Committee agrees that the intersessional steering group under Donovan continue and a new SharePoint site was established[10] to store relevant publications and primary papers written for the purpose of the forthcoming review.

6.5 Biennial workplan

[10] **(https://iwcoffice.sharepoint.com/teams/rmpnafin)**

The work plan aims to complete the RMP and AWMP *Implementation Reviews* for North Atlantic fin whales and, in addition to the work on stock structure outlined above, additional component will include integrating the operating models/control programme. Specifically the tasks are to:

(1) incorporate the *SLA* into the control program to set the aboriginal catch in West Greenland (Katara, Secretariat);
(2) revise the control program to be able to run using different compilers (Katara, Secretariat);
(3) consider how stochastic mixing can be incorporated to mimic fluctuations in abundance in the West Greenland sub-area (Punt);
(4) replicate the most recent methods to run the trials. (Katara, Secretariat); and
(5) investigate the availability of additional fin whale abundance estimates from Canada/USA and the SCANS and CODA surveys (Donovan) and their use as either absolute estimates or indices of abundance (Steering Group, ASI).

6.6 Long-term workplan

6.6.1 Provision of advice to the Commission on ASW hunts in 2024

The Committee noted that the Schedule currently states that AWMP strike limits shall be renewed by the Commission in 2024 under certain conditions, provided that "the Scientific Committee advises in 2024, and every six years thereafter, that such limits will not harm that stock." If the Commission cannot support a Committee meeting in 2024 (and potentially schedules biennial Committee meetings in odd years thereafter), the Commission and the Committee will need to determine how this Schedule requirement will be met.

Attn: C, ASW

*The Committee **recommends** that the Commission evaluate how Schedule requirements for the management of aboriginal subsistence whaling and the provision of scientific advice in 2024 and beyond can be achieved before making a budget decision that impacts the timing and/or frequency of Committee meetings. This is elaborated further under Item 6.6.2.*

6.6.2 Update of the long-term workplan in the light of potential changes to the Committee methods of working.

There is considerable uncertainty about the timing/frequency of Committee meetings and workshops. In updating its long-term workplan (Table 10) assumes no changes – any other scenarios will involve significant delays as explained below.

Table 10

Schedule for future *Implementation Reviews* assuming adequate resources are available for an annual in-person meeting and intersessional workshops

Species/area in order	Year *Implementation* (*IR*s) completed	Next *Implementation Review* assuming resources provided
North Atlantic fin whales (RMP)	2009 (2016)	Estimated start 2023/24
West Greenland fin whales (AWMP)	2018	Estimated start 2023/24
Alaskan and Chukotka bowhead whale hunts (AWMP)	2000 (2007, 2012, 2018)	Estimated start 2025
West Greenland humpback whales (AWMP)	2014	After completion of North Atlantic humpback whale In-depth assessment – estimated start 2025
Common minke whales off Greenland (AWMP)	2019	Estimated start 2026
Chukotka and Makah gray whales hunt (AWMP)	2004 (2010, 2020)	Estimated start 2027
West Greenland bowhead whales (AWMP)	2015 (2022)	Estimated start 2028
North Atlantic common minke whales (RMP)	1993 (2003, 2008, 2017, 2022)	Estimated start 2029

Attn: C, ASW

*The Committee **stresses** that its ability to provide timely management advice will be severely impaired by changes to the Committee meeting structure considered in the Commission's budget planning. In particular,* Implementation Reviews *are not only required under the Commission's agreed RMP and AWMP processes but provide continued scientific and international confidence in IWC management.*

Currently, with annual Committee meetings and intersessional workshops (usually one in-person intersessional IST workshop per year), the Committee has successfully achieved the Commission's requirement of completing individual IRs normally every 6 years, on a rolling schedule such that only one Implementation Review *is undertaken per year (for human resource reasons). Clearly with half the meetings, the Committee will only be able to complete IRs for each case every 12 years.*

The Committee ***highlights*** *that most* Implementation Review *work has been (and can only be) accomplished at in-person intersessional workshops (the technical work cannot be efficiently completed virtually). If the Commission decides to reduce Committee meetings to biennial and eliminate in-person intersessional workshops, this will lead to an* Implementation Review *completion cycle of at least 18 years such that the next West Greenland bowhead whale* Implementation Review *would occur in 2041. Such a proportionally long review cycle is not ideal to provide robust management advice.*

In addition, the RMP and the Aboriginal Whaling Scheme include a provision for Unscheduled Implementation Reviews *in unanticipated situations where new data indicate that there is a significant conservation concern that had not been accounted for in previous work (e.g. a new, exceptionally low abundance estimate, or evidence of an unexplained large-scale mortality event). This will exacerbate the delays in* Implementation Reviews*.*

Considering these scenarios and the importance of providing robust management advice, whilst recognising the economic situation and the potential for virtual meetings in some circumstances, the Committee ***strongly recommends*** *that the Commission retain sufficient funding for annual in-person meetings and intersessional workshops for complex matters such as those related to* Implementation Reviews *(including abundance estimation and stock structure). The Committee* ***cannot*** *provide timely conservation and management advice as currently required by the Commission without the time and budget to develop that advice. The alternative is that Commission, in the knowledge that this will severely impact the ability to provide robust and timely advice, instructs the Committee to increase greatly the required time span between IRs.*

7. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING (ASW)

7.1 New information and progress on recommendations

7.1.1 Eastern Canada/West Greenland bowhead whales

SC/68D/O/06Rev1 reported on the Canadian subsistence hunt of Eastern Canada-West Greenland (EC-WG) bowhead whales for the year 2021 within the Nunavut Settlement Area (NSA) and the Nunavik Marine Region (NMR).

Department of Fisheries and Oceans Canada licenses bowhead whale hunts upon written confirmation that the appropriate Regional Wildlife Organization has approved the hunt plan. The combined maximum allowed take is seven EC-WG bowhead whales per year.

For the 2021 season, a total of two bowhead whales were reported taken for EC-WG, both of which were reported for the NSA. Of the two whales reported, one was a male and one a female. DNA samples were taken through the community harvest in Baker Lake, Nunavut, and provided to the Department of Fisheries and Oceans Canada for analysis; these were used to investigate stable isotopes, genetics, age, and physiological factors.

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 2021 (SC/68D/O/06Rev1).

The Committee noted that an annual review of management advice was not required and agreed that the new information provided did not require calling for an early Implementation Review (IWC, 2019f). The Canadian Scientific Committee report on the hunt of bowhead whales is taken into account within the West Greenland (WG) Bowhead Strike Limit Algorithm (SLA).

7.1.2 Bering-Chukchi-Beaufort Seas bowhead whales

The bowhead harvest report SC/68C/ASW/01 provides an annual summary of the Alaskan Native subsistence harvest of bowhead whales (*Balaena mysticetus*). In 2021, 70 bowhead whales were struck, of which 57 were landed. The total number of whales struck and the number landed in 2021 was higher than the averages for the previous 10 years (2011-2020: mean struck = 56.7, *SD* = 10.5 and mean landed = 44.3, *SD* = 8; respectively). The harvest efficiency (# landed / # struck) in 2021 (81%) was slightly higher than over the past 10 years (2011-2020: mean of efficiency = 78%; *SD* = 5.4). Spring hunts are logistically more difficult than autumn hunts because of the

difficulty in accessing open water and changing sea ice thickness and dynamics. The hunting efficiency during spring is usually lower than in autumn, which was the case in 2021. The efficiency of the 2021 spring hunt (77%) was higher than the previous 10-yr average (2011-2020; mean spring efficiency = 70%; *SD* = 10) but lower than the 2021 autumn hunt (87%). The efficiency of the 2021 autumn hunt (87%) was lower than the average autumn hunting efficiency over the past ten years (2011-2020; mean autumn efficiency = 92%; *SD* = 9). Thirteen whales were struck and lost in 2021. Of those 13 whales, four were lost due to equipment malfunction (i.e., harpoon failure), six whales were lost when they swam under the ice, four whales sank, and three whales were lost for other or unknown reasons. Some whales had more than one reason attributed to their loss. Of the harvested whales, 27 were females and 30 were males. Based on total length (≥13.7m in length), seven of the females were presumed mature. One whale was pregnant with a midterm male foetus, which was 1.7m long.

During the discussion, it was asked whether the scientists advising the hunters considered if the number of struck and lost could be reduced. The response was that this number had considerably reduced from twenty years ago, and that further reduction was difficult given the equipment and weapons used by the hunters. The lack of information about genetic samples in the report was raised. It was noted that samples had been collected and this information would be presented next year together with similar information about samples from the 2023 catch.

Clarke *et al.* (2022) presented a summary of Bering-Chukchi-Beaufort (BCB) bowhead whale (*Balaena mysticetus*) calf distribution, ratio of calf to adult sightings, and encounter rate from data collected during line–transect aerial surveys conducted from July to October 2012-2019 in the western Beaufort Sea (140°W-157°W). During 223,000km of survey effort, a total of 274 calves were seen: 100 in summer (July-August) and 174 in autumn (September-October), compared with nearly 3,200 non-calves. Calves were widely distributed in the study area in August and September, with a distribution in July largely east of 150°W and a distribution in October west of 143°W. Based on visual examination of a histogram summarising the data, the authors believed that calf ratios and encounter rates appear to follow a 3-4 year cycle. Most calves (240/274; 88%) were seen near an adult assumed to be the maternal female, but 9% (26/274) of all calves were observed unaccompanied at the surface and 3% (8/274) were observed with large whales at the surface but not close by. Of the total calves detected, 60% (165/274) were observed after circling was initiated, highlighting the importance of closely investigating all bowhead whale sightings if identification of calves is critical to project goals. Bowhead whale calf data from the eastern Beaufort Sea and Amundsen Gulf in August 2019 were also summarised.

During the discussion, it was pointed out that the data on calves were very valuable and that the committee hoped that similar data would be collected also in the future.

The fourth BCB bowhead health report (SC/68D/ASW/03) summarises general information on population indices, whale health and hunter observations of bowhead whales for 2020 and 2021. Briefly, two recent surveys (ice-based; aerial) provide new abundance estimates for the BCB stock. Both estimates are thought to be biased low (Givens *et al.*, 2021; SC/68D/ASI/01) but nevertheless provide confidence intervals for abundance that wholly encompass the 2011 interval (Givens *et al.*, 2016; Givens *et al.*, 2021). Furthermore, the 2019 abundance estimates do not substantially reduce estimated population growth. Plans for both a future ice-based visual/acoustic survey and a new aerial survey are at early stages, with a first attempt at the ice-based survey tentatively planned for spring 2024 or 2025. Other bowhead whale productivity indices, including calf production and body condition trends in sub-adults, remain within previous ranges and no large deviations are evident (Clarke *et al.*, 2022; George *et al.*, 2015; George *et al.*, 2018). An updated pregnancy rate estimate using data from 1973-2021 will be available next year (George et al. in prep). Preliminary results using pregnancy data for all whales (spring; autumn) and only autumn-harvested whales show that both estimates are consistent with the 1976-2016 estimate of 0.317, 95% CI [0.25, 0.39] with a minimum 3-year calving interval (Stimmelmayr *et al.*, 2020). General findings from post-mortem examination of whales suggest that the overall health of the population and individual bowhead whales remains good. Metrics of body condition are currently within the long-term range of variation. Assessment of evidence for fishing-gear entanglement, injuries from killer whales and ship strikes during 2020 - 2021, suggests that both line entanglement (3-13%) and killer whale predation attempts (~ 9%) are chronic, but low-level concerns for BCB bowhead whales. Although long-term data suggests vessel strikes are exceedingly rare (~2%) among BCB bowhead whales, during 2021 the vessel strike incidence (~6%) exceeded previous baseline data (George *et al.*, 2017). An analysis of a long time-series of floating and beach-cast bowhead whale carcasses detected during standardised line-transect, and 2021 beach, surveys confirm that killer whale predation of immature bowhead whales continues to occur (Willoughby *et al.*, 2020). Population indices and general health assessment findings reiterate that the general health of whales remains good and that the harvest is sustainable. Given the ongoing transformation of the Pacific Arctic ecosystem and the increasing complexity of environmental, ecological and anthropogenic stressors being present within the bowhead whale core habitat, continued monitoring of health and population indices will remain important to aid in our general

understanding of how the BCB bowhead whale will continue to respond to these ongoing changes.

The Committee welcomes the new information and encourages further work on calf productivity, density, mortality, seasonality and other health issues in the future. The Committee noted that an annual review of management advice was not required and agreed that the new information provided did not require an early Implementation Review (IWC, 2020). The next AWMP Implementation review of the Alaskan and Chukotka bowhead whale hunt is scheduled to start in 2025.

No bowhead whales were harvested by the Indigenous people of Chukotka, Russia, in 2021, and no bowhead whales were struck and lost (SC/68D/ASW/02).

7.1.3 North Pacific gray whales

Information on the 2021 subsistence hunt of gray whales in Russia was presented in SC/68D/ASW/02. In 2021, the Association of Indigenous Peoples of Chukotka distributed the Russian part of the block quota among the communities and 17 local whaling communities were involved in whaling.

During the 2021 season, 127 gray whales were struck and 126 whales were landed. Of all the gray whales landed, there were 66 males and 60 females – four of these 127 were 'stinky' whales [i.e., whales with a strong medicinal smell that are inedible]. Only one gray whale was struck and lost with harpoons due to the sudden outbreak of a storm.

The mean body length of gray whales taken was 10.4m, mean blubber thickness of 109 mm and mean body weight was 13.4 tons. In 2020, the mean length and weight were 10.4m and 13.1 tons, respectively. The largest whale taken was a 14.9 m female weighing 35.3 tons and the smallest was a 7.96m female weighing 5.9 tons. The smallest whale was not accompanied by large whales and there were no signs of milk in its stomach. No females were lactating and three had a foetus. Thirteen of the whales landed had various injuries/traumas mainly attributed to interactions with killer whales.

The Committee welcomed the information on gray whales and noted that an annual review of management advice was not required and agreed that the *Gray Whale SLA* and the Makah Management Plan remain the best way to provide management advice, while noting that 'stinky whales' are accounted for in the Gray Whale SLA that calculates the aboriginal subsistence hunting strike limit.

Attention: SC, CG, ASW

With respect to matters related to hunts of North Pacific gray whales, the Committee:

(1) ***reiterates*** *previous advice that biological data, genetic samples and photographic data from Russia continue to be collected from live and harvested whales and analysed to provide information on stock structure and biology;*

(2) ***recommends*** *collaborative sharing and integration of data from all ASW countries (e.g. photo-id catalogues, genetic samples) to inform conservation and management actions.*

7.1.4 Common minke whale stocks off East Greenland

Twenty-one minke whales (8 males, 12 females, 1 unknown sex) were landed in 2021 (SC/68D/O/06Rev1). None were struck and lost. These numbers include carry-over from 2019 to 2020 of two minke whales.

7.1.5 Common minke whale stocks off West Greenland

One hundred sixty-seven minke whales (30 males and 137 females) were landed in 2021 (SC/68D/O/06Rev1). Ten were struck and lost with 177 strikes. These numbers include carry-over from 2019 to 2020 of 52 minke whales in West Greenland.

The Committee agrees that an annual review of management advice is not required and noted that the review of the performance of the common minke SLA indicated that it is appropriate to provide management advice to the Commission on both the West and East Greenland common minke whale hunts.

7.1.6 Fin whales off West Greenland

Two fin whales (1 male and 1 female) were landed in 2021 (SC/68D/O/06Rev1). None were struck and lost. The Committee noted that an annual review of management advice was not required and agreed that the new information provided did not require calling for an early Implementation Review (IWC, 2020c).

7.1.7 Humpback whales off West Greenland (see Items 8.2.7)

Five humpback whales (2 males and 3 females) were landed in 2021 (SC/68D/O/06Rev1). None were struck and lost. Two whales were also bycaught in snow crab fishing gear. The Committee noted that an annual review of management advice was not required and agreed that the new information provided did not require calling for an early Implementation Review (IWC, 2020c).

7.1.8 Humpback whales off St. Vincent and the Grenadines (see Items 8.2.7)
Information on the subsistence hunt of humpback whales off St. Vincent and the Grenadines for 2021 and the first quarter of 2022 was presented in SC/68D/O/06Rev1.

One humpback whale was taken in 2021. The whale was a male with a length from mouth to tail 28ft, mouth to blowhole 6ft, width/girth 18ft, tail span 10ft and tail to hump 12ft. A sample of the muscle and blubber was collected.

For the first quarter of 2022, no humpback whale was taken. One humpback was struck and lost in the waters surrounding Bequia.

The Committee noted that an annual review of management advice is not required and agreed that the new information provided did not require any change to its existing management advice (IWC, 2020c).

7.2 Biennial workplan
In 2023, the Committee will review new biological information and catch information on species and stocks subject to aboriginal subsistence whaling.

8. WHALE STOCKS NOT SUBJECT TO DIRECTED TAKES BY CONTRACTING GOVERNMENTS

8.1 Comprehensive or In-depth Assessments (IA)

8.1.1 Comprehensive Assessment of North Pacific humpback whales
The Comprehensive Assessment of North Pacific humpback whales began in 2016 (IWC, 2017e) with an intersessional workshop held in 2017 (IWC, 2018a). Since then, the type of assessment model to be applied has been refined (simplified given the nature of the available data; IWC, 2018a), additional analyses of abundance and genetic data have been undertaken, the structure of the areas included in the modelling and data analyses have been modified, and commercial catch series have been updated. In addition, the set of stock structure link assumptions (number of breeding stocks and the feeding areas to which they migrate) have been updated during discussions of the Scientific Committee. SC/68D/IA/02 provided a summary of the areas on which the Comprehensive Assessment will be based, the current set of stock-structure hypotheses, and the data currently available for inclusion in preliminary model runs. Available data include commercial catches, limited bycatch data, indices of absolute and relative abundance based upon photo-ID methods and estimates of mixing rates based on photo-ID and genetic samples.

8.1.1.1 Review Progress from intersessional work
IWC (2022) reported the latest changes to the regions and the boundaries among them, together with the rationale for those changes. At the time of SC68C, there were still questions regarding the location of the boundary between the Mexican and Central American winter breeding grounds, but no changes to the boundaries are proposed at present. Fig. 4 shows all the regions considered in the modelling; how they are combined into strata (combinations of regions that will form the basis for the modelling) is shown in SC/68D/IA/02 table 1.

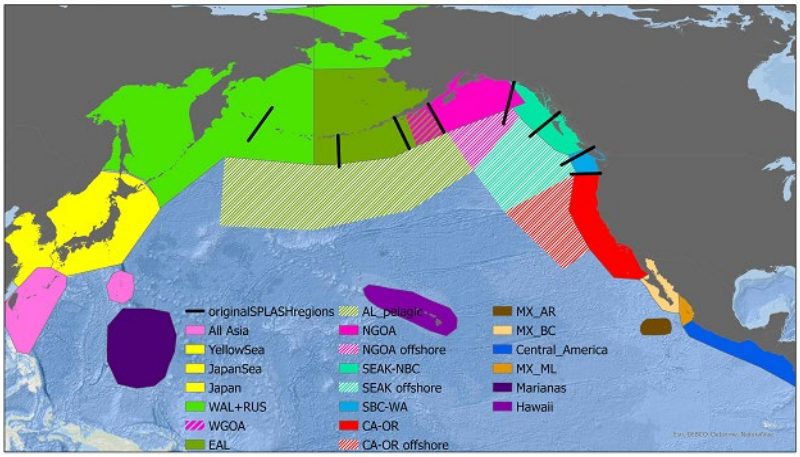


Fig. 4. Regions and region boundaries agreed by the Working Group on 20 April 2021; dark lines represent the boundaries from the original SPLASH project (as shown in (as shown in Calambokidis *et al.*, 2008).

Two stock structure hypotheses are considered: B1, in which there are five stocks, i.e., all the whales that breed off Mexico are treated as a single stock; including Mainland (ML), the Archipiélago de Revillagigedo (AR) and Baja California (BC); and B2, in which the whales that winter off Mexico are divided into two breeding stocks, MX-AR and MX-ML. The whales found off Baja California are excluded from scenario B2 based on evidence of mixing with MX-AR and MX-ML. There are two hypotheses regarding how the feeding grounds are combined for modelling: F1 and F2. These hypotheses differ in terms of whether the WGOA region is included with the NGOA region (F1) or with the Bering Sea and eastern Aleutians regions (F2). The hypotheses regarding breeding stocks and feeding grounds lead to four "cases" (B1F1, B2F1, B1F2, B2F2). Note that the nomenclature for these scenarios differs somewhat from that reported in Lizewski *et al.* (2021).

Estimates of removals are available by type (commercial, bycatch, aboriginal) by stratum, with a set of "high" and "medium" catches for the Asian breeding group and CA-OR feeding ground. The availability of non-whaling bycatch data varies considerably by area. Estimates of removals from sources such as fishing gear entanglements and ship strikes are comparatively good but still very much incomplete for the United States (west coast and Alaska); these data come primarily from U.S. Stock Assessment Reports, although these data do not extend back farther than, at most, the 1990s. A review of large whale mortalities from fishery interactions from 1982 to 2017 was recently published (Saez *et al.*, 2020). This summary will be very useful for the assessment, but it does not include ship-strike mortalities. Allocating bycatch from some US areas to breeding stocks is difficult given the mixing of multiple stocks, although photo-id and genetic data can be used to assume mixing proportions and stratify accordingly. The assessment model is structured to assign catches (commercial and bycatch) to a breeding stock based on estimated mixing rates. Japanese and Korean bycatch data are available for the last several decades, but these require careful parsing (with assistance from local colleagues) to assess the nature of the events. Since the number of removals from non-whaling sources is substantial in some areas, it will be important for the assessment to undertake as much of a review of existing data as is possible.

Aboriginal catches of humpback whales from North America are likely insignificant, though few or no data exist to estimate the degree of any such removals. Midden data showed that the Makah took humpback whales in similar proportions as gray whales. The Nuu-chah-nulth (southern Vancouver Island) had about 80% of their catch as humpback whales and 20% as gray whales. However, projecting the absolute numbers will be difficult for several reasons. The aboriginal catches could potentially be addressed with sensitivity testing as part of the modelling work.

Whaling catches offshore often do not fall spatially within one of the designated areas for the assessment, but for the model are assigned to one or more of these (Ivashchenko and Clapham, 2021).

Several sources of abundance estimates are available based on photo-ID data. Table 3 of SC/68D/IA/02 lists the estimates of abundance for the summer (feeding) and winter (breeding) periods based on SPLASH, which are assumed to refer to the years 2003-2006 in the population model. A time-series of photo-ID-based abundance for the OR-CA stratum using the methodology of Calambokidis and Barlow (2020) was extended to 2020 (SC/68D/IA/02, table 4), and estimates of abundance for Mexico were also available (SC/68D/IA/02, table 5).

A photo-ID based dataset of 184,500 identified encounters of 30,100 individuals has been gathered by

Cheeseman from a broad research collaboration and public citizen science contributions. This dataset will be used to model population status from 2004, the start of the SPLASH study (Calambokidis *et al.*, 2008), to the present. Photo-ID images have been identified and reconciled using automated image recognition (Cheeseman *et al.*, 2021). A Chapman-Peterson population model will be applied to estimate year-by-year population status for the full North Pacific as well as eastern North Pacific populations where sample sizes are largest. Other available abundance estimates are given in SC/68D/IA/02 table 6.

A key input to the model is the proportion of each breeding stock on each feeding ground (which is assumed in the modelling to be time-invariant), and the proportions that each breeding stock constitutes of the animals on each feeding ground (which can change over time owing to changes over time in numbers by breeding stock). There are two sources of information on mixing rates (photo-ID and genetic). SC68D/IA/02 also gives estimates of mixing proportions for each case based on photo-ID data (table 7) and genetic analyses (table 8).

8.1.1.2 REVIEW NEW INFORMATION

Previously, photo-ID data were collected by the SPLASH project for three years (2004-2006) in winter areas and for two years (2005-2006) in summer areas. In addition, the total abundance for the entire North Pacific was estimated by Barlow *et al.* (2011) to be 21,808 (CV=0.04) in this period. SC/68D/IA/03rev1 provided revised estimates of abundance and migratory destinations/exchange rates for North Pacific humpback whales in summer feeding areas and winter mating/calving areas. Based on genetic analyses (Baker *et al.*, 2013) and an examination of migratory destinations, winter areas were defined to be (1) Asia (including Ogasawara, Okinawa, and the Philippines), (2) Hawai'i, (3) Mexico, and (4) Central America. A second scenario was run specifying five winter areas, with Mexico split into two areas, the Revillagigedo Islands and mainland Mexico. Based primarily on interchange (or lack thereof) between adjacent areas, and an examination of migratory destinations, summer areas were defined to be (1) Russia/western Aleutian Islands, (2) the eastern Aleutian Islands and the Bering Sea, (3) the Gulf of Alaska, (4) Southeast Alaska and northern British Columbia, (5) southern British Columbia and Washington, and (6) California and Oregon. A second scenario was run, also with six areas, with the western Gulf of Alaska sampling area (primarily the Shumagin Islands) pooled with the eastern Aleutian Islands/Bering Sea. A multi-state mark-recapture model was fit to the photo-ID data using a six-month time-step, with the four or five winter areas and the six summer areas defined to be the sample strata. Results showed a strong migratory connection between the Russia feeding area (abundance estimated at N=1,382, CV=0.23) and the Asia winter area (N=1,110, CV=0.09). The feeding areas in Alaska, as well as northern British Columbia, support the majority of the North Pacific population, including the eastern Aleutian Islands and Bering Sea (N=7,947, CV=0.21), the Gulf of Alaska (2,140, CV=0.08), and Southeast Alaska and northern British Columbia (N=5,925, CV=0.08). Those feeding areas all have a strong migratory link to Hawai'i (N=11,501, CV=0.04), with the link between Southeast Alaska/northern British Columbia and Hawai'i (0.98) particularly high. On their return, nearly all Hawai'ian whales migrate to Alaska and northern British Columbia. The migratory destination of whales that winter in Mexico (N=2,943, CV=0.07) is the most diverse, with whales going to all feeding areas. Nearly all Central American whales (N=750, CV=0.25) migrate to California and Oregon to feed (0.96), but the California/Oregon feeding area (N=1,500, CV=0.13) represents a mix of whales from Mexico and Central America. It was noted that the high precision of many of the CVs associated with the abundance estimates likely only reflect sampling error, where modelling uncertainty has not been accounted for in the analysis.

The Wade multi-strata model fixes parameters for areas of potential interchange where SPLASH found none and the model of SC/68D/IA/06 is based on the linkages on which SC/68D/IA/03rev was based. Potential linkages between breeding and feeding grounds can be based on interchanges detected in the much larger dataset of approximately 184,000 identified encounters of more than 30,000 individuals gathered through the Cheeseman *et al.* North Pacific Photo-ID collaboration. Parameters can be fixed as zero for regions that show interchange rates of zero or below a threshold determined to have no significance to the model.

The allocation of catches from the feeding grounds to breeding stocks is one of the objectives of the Comprehensive Assessment of humpback whales in the North Pacific. This catch allocation is complicated by the mixing of individuals from different breeding stocks on shared feeding grounds. Previously (Lizewski *et al.*, 2021; SC68C/IA/01), mixed-stock analyses of mtDNA haplotypes were used to estimate the apportionment of humpback whales from feeding areas to breeding regions (i.e., source stocks), as a proxy for allocation of historical catches. SC/68D/IA/05 updated the frequencies of mtDNA haplotypes from regional samples collected during the SPLASH project from 2004 to 2006, adding nearly 1,000 additional samples to the 1,800 published previously (Baker *et al.*, 2013). Following a review of initial modelling efforts following SC68C, and subsequent discussion by the Intersessional Steering Group on the Comprehensive Assessment, these mixed-stock analyses were updated to include microsatellite genotypes and to focus on four scenarios: two for stratification of breeding regions and two for stratification of feeding areas. SC/68D/IA/05 also included a "reverse" mixed-stock analysis with mtDNA, in which the

feeding areas were considered to be the source stocks. The results of the mixed-stock analysis using mtDNA replicate results reported previously (SC68C/IA/01) together with the previous data were made available for modelling efforts intended for the Comprehensive Assessment, and results are summarised in SC/68D/IA/02.

The mixed stock analysis in SC/68D/IA/05 recommended that the strata of B3/F2 be proposed as a preferred base case scenario for the Comprehensive Assessment. In particular, when the Bering Sea, the Western Aleutians and the Western Gulf of Alaska are combined in the F2 stratum [BER+WAL+WGOA], all pair-wise comparisons of the feeding areas are highly significant. Meanwhile, the B3 stratum recognises mainland Mexico and the offshore Revillagigedo Archipelago as different breeding stocks based on significant differences in haplotype frequencies from biopsy samples.

In the Wade model (SC/68D/IA/03rev1), F2 (B1/F2) is favoured over F1 because it stabilises the results, and is more consistent with the genetic analysis. It would be useful to investigate the practicality of running the assessment model with five breeding areas, by splitting Mexico into two breeding areas (a B3 strata).

From 1995 to 2019, Oregon State University conducted satellite tagging and tracking studies of humpback whales at several locations in the North Pacific with the goal of describing their movement ecology across foraging grounds from the eastern Aleutian Islands to Southern California, and in the breeding ground of the Hawai'ian Islands. A total of 189 skin biopsy samples were collected from tagged whales for stable isotope and genetic analyses (SC/68D/IA01). Preliminary results showed the following (i) high isotopic niche width for samples collected in the Hawai'ian breeding ground compared to the foraging grounds, indicating that this region is visited by a mix of whales from different foraging grounds; (ii) there was little overlap in the niche width among several foraging grounds, indicating regional variation in prey preferences (e.g., trophic level) and/or differences in baseline isotopic values among foraging grounds; (iii) foraging grounds varied in niche width from low (northern Washington) to high (Oregon – northern California), likely a reflection of the extent to which the whales remain within a limited foraging area. These results agree with satellite tagging data in terms of the diversity of migratory routes to foraging grounds followed by animals tagged in Hawai'i, and the regional differences in movement behaviour and patterns of habitat use by whales tagged in the foraging grounds.

It was noted that the turnover rate of skin is an important factor to consider when interpreting the stable isotope results. For blue whales, this rate was estimated at 90-169 days (Busquets-Vass *et al.*, 2017), but a turnover rate has not been determined for humpback whales. Timing of sample acquisition (e.g., early or later in the feeding season) is also important to consider. It is currently not clear how the stable isotope data can be used to help estimate mixing rates, but a qualitative (rather than quantitative) approach might be useful. The Oregon State study will attempt to access a large body of additional stable isotope data from Bree Witteveen to further refine their analysis.

A preliminary run of the assessment model was conducted during the meeting, with results provided in SC/68D/IA06. The population model is an age-aggregated population dynamics model in which density dependence is a function of the relative abundance by feeding ground. The model also tracks abundance by breeding stock for each feeding ground. The version of the model applied here assumes feeding ground fidelity, although a version of the model exists that allows for straying between feeding grounds. The model assumes that animals are uniformly distributed across feeding and breeding grounds. Catches are consequently removed in proportion to the stocks found in the areas concerned. The analyses are based on the "medium" catch series. The genetics data on which these analyses are based are the combination of mtDNA and microsatellite data (Lizewski *et al.*, 2021). The abundance estimates for the OR-CA feeding ground are restricted to years 1989 to 2007 due to convergence issues. Mixing proportions that do not match the presence-absence matrix were ignored during model fitting. New data should be able to help clarify this, and ultimately a decision will need to be made regarding the extent to which "rare" movements (e.g., Hawai'i to Mexico) should be included or ignored in future work. The data for the model are outlined in full in SC/68D/IA02.

In general, the model trajectory overlaps with the confidence intervals of the abundance estimates, although this is not the case for the unused estimates of abundance (notably the estimate for Mexico for 2003-2006). The model is unable to fit the change in abundance for the OR-CA feeding ground since 2005, and particularly after 2014 when the estimates increase markedly to the point where the rate of increase becomes biologically impossible if the OR-CA is demographically closed. Fits of the model to the mixing proportions are generally adequate but there are some obvious cases in which the mark-recapture-based estimates and the genetics-based estimates appear inconsistent (e.g., the fits to the data on the split of the OR-CA feeding ground to breeding stocks).

The model suggests that the total population was never substantially depleted because the large Hawai'ian component of the population was never subject to catches on the breeding grounds. In contrast to the other breeding

stocks, the Mexican and Asian breeding stocks have yet to recover. The Hawaii breeding stock is actually estimated to be larger now than at pre-exploitation equilibrium; this is a consequence of the assumption that density-dependence operates at the feeding and not breeding ground level. There is considerable variation in when and to what extent individual feeding and breeding grounds were depleted and then rebuilt.

The inability of the model to mimic the estimates of abundance for the OR-CA feeding ground, with unrealistic rates of growth exhibited in the results after 2014 potentially highlights a broader issue with regard to North Pacific whales during this time period. Beginning in 2014, a marine heatwave in the eastern Pacific had significant impacts on prey availability and was accompanied by a dramatic decline in sightings of humpback whales in Southeast Alaska (Gabriele *et al.*, 2022) where many known individuals disappeared despite often very long histories in the area. Unusually low sighting rates were also observed in Hawai'i. The mortality rate from this event is unknown, but will likely become clearer over the next few years from long-term studies in Alaska and elsewhere. Some individuals very likely died, while others may have shifted foraging grounds to unstudied areas (notably to offshore waters in the Gulf of Alaska, which were once the site of large whaling catches). The event had known impacts on humpback whale reproductive rates and probably on survival, particularly among calves and yearlings.

8.1.2 Comprehensive Assessment of North Pacific sei whales

The Comprehensive Assessment of North Pacific sei whales has been structured around attempts to integrate information from the following sources of data: (a) historical commercial catches; (b) estimates of recent absolute abundance from POWER and other surveys; (c) indices of relative abundance derived from other surveys and scouting vessels extending back to 1965; and (d) data from Discovery marks and recoveries. A multi-area age-structured population model has been developed by Punt that integrates the above sources of data into a common likelihood framework. The work to date has proceeded on the basis of two working hypotheses regarding the population structure: (i) a single stock of sei whales distributed throughout the North Pacific; and (ii) five stocks, centred on five designated sub-areas, but with some overlap in their summering grounds (Fig. 5). The sub-areas are Western Coastal, Aleutian, Pelagic, Eastern North Pacific and Eastern Coastal. A mixing sub-area was also defined in the Gulf of Alaska containing whales from Aleutian, Pelagic and Eastern North Pacific. There has not been a consensus on the relative plausibility of the two hypotheses.

In 2021, the Committee agreed that the catch series can now be considered sufficiently complete for assessment purposes. Furthermore, the Committee agreed that no further refinements to the catch, marking and relative abundance data were required. The Committee also agreed that it may not be possible to find an assessment that reconciles all the available information due to fundamental conflicts in the data, identified by the Committee in previous years, i.e., the absolute recent abundance for the Pelagic sub-area suggests a population that is much less depleted than indicated by the relative abundance and mark-recapture data. The point estimate of abundance for the Pelagic sub-area (approx. 30,000 whales) exceeds the inferred pre-exploitation size of the population in that sub-area.

The Committee reiterates that it is important that: (1) the input data and the model fits that were explored be documented in one place; and (2) the available information on sei whales in each area of the North Pacific be summarised to provide a general picture of the status of the historical and current status of the species in each sub-area.

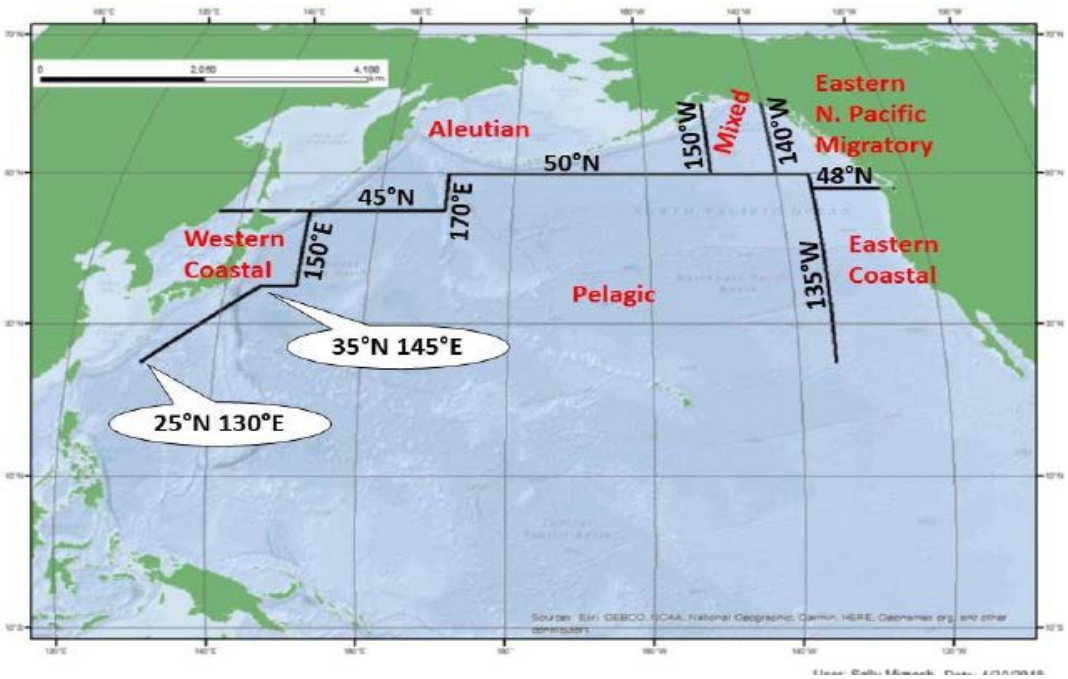


Fig. 5. The 6 sub-areas used in the Comprehensive Assessment for North Pacific sei whales

8.1.2.1 Review Progress from Intersessional Work

The Intersessional Steering Group reported that work on the summary document is not yet complete and work will have to be continued during the next intersessional period. The Committee agrees frequent virtual meetings of the Intersessional Steering Group ar required to progress this work in the intersessional period.

8.1.2.2 Review New Information

SC/68D/IA/04 reported on systematic distance sampling surveys conducted in offshore waters of the Canadian Exclusive Economic Zone in 2018, 2019 and 2021. During these surveys, four groups of sei whales (five individuals) were observed in 2018 and 37 groups (93 individuals) were observed in 2021, while no sei whales were sighted in 2019. A large, dispersed aggregation of 25-30 sei whales was observed during the 2021 survey and skin samples were collected from two individuals. Most sightings in 2018 and 2021 were made in an area characterised by the presence of large seamounts. Differences across years are reminiscent of observations from whalers that sei whales could abruptly appear or disappear from certain areas.

The Committee welcomes this new information representing proof of sei whale summer presence in Canadian coastal waters. It was noted that the expansion of the surveys into Canadian waters a little further offshore than previous surveys probably led to sightings of sei whales. The Committee encourages abundance analysis of the survey data to provide an estimate for use in the assessment.

Furthermore, in discussion it was noted that until now genetic samples had only been available for analysis from the Pelagic area and that genetic information from coastal areas could provide valuable insights. The Committee strongly recommends that samples from coastal areas of Canada and Japan be made available for genetic analysis to help progress the Comprehensive Assessment.

The abundance estimates by Hakamada *et al.* (2009) and Hakamada and Matsuoka (2016b) were reviewed by the ASG group (Item 3.8. ASG pre-meeting report) and the ASI group (Item 11.1.6). The ASG initially proposed to recommend endorsement as Category 1A for all of the estimates, including those given by subarea and their subdivisions, while emphasising that these estimates are only representative of specific locations and periods. Subarea-yearly estimates are the level needed for the assessment model. During discussions in ASI, concerns were raised regarding the appropriateness of combining survey data from multiple years especially when based on small sample sizes with the potential biases due to migration. The Committee created an Intersessional Correspondence Group under ASI to investigate these issues and noted that continued revisions could change the final input data for the assessment. Due to the importance of the conclusions of this group to the North Pacific sei whale assessment, this Intersessional Correspondence Group has now been assigned to the In-depth Assessment sub-committee.

In discussion, a discrepancy between delineations of survey strata in Hakamada *et al.* (2009) and Hakamada and Matsuoka (2016b) and those of the sub-areas of the assessment was noted. It was explained that for assessment

purposes data often had to be aggregated differently than originally provided by a survey analysis. It has previously been concluded that re-organising the information from the surveys for purposes of the assessment was appropriate as long as the original input data were reviewed and approved by ASI. Furthermore, it was noted that abundance estimates in both papers reviewed by ASI referred to different years than those currently used in the assessment and that some clarification was needed. The Committee agrees that a check for consistency between the numbers and years from the surveys and those currently used in the assessment should be part of the work towards the summary document. Furthermore, the Committee strongly recommends documentation of all data manipulation and steps taken towards the assessment for future replicability be included in the assessment summary paper.

The Committee was informed about the ongoing efforts to obtain information on bycatch and strandings of North Pacific sei whales and encourages detailed time series to be developed intersessionally so they can be used in the assessment.

Environmental change as a potential cause for a change in habitat use of sei whales was discussed. It was noted that a project under Kitakado had looked into environmental factors affecting the distribution of sei whale sightings in the Pelagic area. Kitakado agreed to summarise the latest status of the project for presentation during the next meeting. The Committee welcomes this information and looks forward to receiving the update in 2023.

8.1.3 Western North Pacific Common Minke Whales

The In-depth assessment of western North Pacific common minke whales is based on three stock hypotheses (see Fig. 6 for a map of the sub-areas):

(1) there is a single J-stock distributed to the west of Japan (sub-areas 1W, 1E, 5, 6W, 6E, 10W and 10E), the Pacific coast of Japan (sub-areas 2C, 7CS, 7CN) and the Okhotsk Sea (sub-areas 11 and 12SW), and a single O-stock in sub-areas to the east and north of Japan (2C, 2R, 3, 4, 7CS, 7CN, 7WR, 7E, 8, 9, 9N, 10E, 11, 12SW and 12NE) (referred to as hypothesis A);
(2) as for hypothesis A, but there is a third stock (Y) that resides around the Korean peninsula (sub-areas 1W, 5 and 6W) and overlaps with J-stock in the southern part of sub-area 6W (referred to as hypothesis B); and
(3) there are four stocks, referred to Y, J, P, and O, two of which (Y and J) occur to the west of Japan, and three of which (J, P, and O) are found to the east of Japan and in the Okhotsk Sea (referred to as hypothesis E). Stock P is a coastal stock.

The operating models for western North Pacific common minke whales were originally developed as part of an RMP *Implementation Review*, but following Japan leaving the IWC, the Committee had agreed that it was appropriate to continue the work in the form of an In-depth assessment (IWC, 2021c, p.22) that will include a focus on the effects of bycatch, particularly on the J-stock, whilst recognising that Japan could continue whaling using domestically-set catch limits. During the intersessional period Allison, de Moor and Katara continued to finalise the development of the operating models on which the In-depth assessment will be based, including conducting preliminary fits of base-case versions of these models for each of the three stock hypotheses. The work was assisted by a Steering Group established at last year's (2021) annual meeting.

The changes recommended at last year's meeting (section 8.1.3 of IWC, 2022) were implemented as agreed. These involved:

(1) treating estimates of abundance for areas with less than 70% survey coverage as 'minimum abundance estimates'(except in sub-areas where there are no other estimates);
(2) changing how the 'minimum abundance estimates' are generated;
(3) refining the maximum sizes for each survey estimate for sub-areas 5 and 6W;
(4) revising how zero abundance estimates are included in the likelihood function;
(5) updating the data on effort used when calculating historical bycatches off Japan and Korea; and
(6) revising the way that projections of bycatch are conducted.

The Committee had also requested that the model expectation for an abundance estimate based on a survey conducted during multiple months should be based on weighting the model predictions using the proportion of the months during which the survey occurred. However, this was not possible owing to a lack of data in some cases. Consequently, in all cases, if fewer than 20% of the days of any survey occurred during a given month, that month was not used as part of the survey-time-period in the likelihood equation.

Allison reported that the abundance estimates for sub-areas 10E (2002, 2003, 2005 and 2007), 12SW (1990), 12NE (1990, 1992) and 9 (1990) were revised based on updated information received from Japan on sub-area size (sub-areas 10E, 12SW, 12NE) and an inconsistency between the agreed total estimate for the northwest Pacific of

5,841 (Buckland et al., 1992) and the abundance estimates computed for sub-areas 7, 8 and 9. Allison advised that some abundance estimates used for the 2003 and 2007 *Implementation Simulation Trials* had been omitted from those used in the 2013 trials (sub-areas 6 and 10 in 1992; sub-area 10E in 2007), but are now used, following endorsement of their inclusion by the Steering Group. Any estimates that are new or revised are being or will need to be reviewed by the sub-committee on ASI (see Item X). Updates of the numbers of nets and bycatches off Japan received at SC68C have been incorporated into the assessment.

de Moor summarised key changes to the model structure, the model fitting process and how the data sets are generated (see SC/68D/IA/07 appendix A for the latest specifications for the trials). Specifically, the actual rather than model-predicted bycatches are now removed from the population when actual estimates of bycatch are available. The mixing matrices have been updated to improve the fits to the data and introduce constraints to implement an upper bound on the abundance in sub-areas 2C, 2R, 3 and 4 (sub-areas for which there are no abundance estimates and for which abundance is inferred based on the mixing matrices). The constraints implemented were a maximum of 300 individuals (all months in 2009) for sub-area 2C and 500 individuals (August and September in 2009) for sub-area 2R. The model-predicted proportions are now based on the 1+ (rather than recruited) population when the basic data are based on bycatch samples. The approach for generating pseudo abundance estimates now involves setting the mean of the overdispersed Poisson distribution assumed to the expected (model-predicted) abundance (based on the fit of the deterministic operating model to the actual data) rather than to the observed value when the actual abundance estimates are zero.

de Moor provided summaries of the model fits to the data for hypothesis B. All model estimates of abundance that relate to minimum abundance estimates are now above or within the 90% intervals for the data. The Committee noted that there were some cases where fits are not ideal, but that the fits are generally adequate. It was noted that the abundance estimates and mixing proportions are fitted ignoring additional variance. The need to account for additional variance in survey estimates will be revised once final conditioning results are available, but the results for stock hypothesis B provide little evidence to suggest that incorporating additional variance is required. In contrast, the preliminary fits to the mixing proportions for stock hypothesis B are either suggestive of appreciable additional variance or of model misspecification (see Appendix B in SC/68D/IA/07). While the fits to these data may improve with further work, the Committee agrees that mixing proportions by year (the model is fit to genetic assignment data aggregated over multiple years) should be included on the plots (achieved during the meeting) and that the data based on bycatch samples and scientific permit catches should be distinguished in the plots. The data on mixing proportions should be used to: (1) estimate additional variance if the mean proportions vary over time and allow for additional variance during conditioning and when generating bootstrap data sets (perhaps using a beta-binomial distribution or by fitting to the annual proportions); and (2) determine if there are trends in mixing rates over time.

Allison, de Moor and Katara developed new diagnostic plots to assist with the review of whether the distributions of abundance spatially and over time match expectations. The Committee agrees that the maps of pie charts showing the numbers of age/sex categories were useful to understand the model predictions of changes over time and will provide a useful basis to assess the plausibility of the model outputs (see Appendix B in SC/68D/IA/07 for examples). The Committee noted that the population model did not fit some of the proportion data well, partially due to changing the mixing matrices to impose constraints on the size of the populations in sub-areas 2C, 2R, 3 and 4. It was agreed that some (limited) further modification to which of the parameters of the mixing matrix parameters are estimated should be undertaken to attempt to improve the fits to the mixing proportion data.

The Committee agrees that the population model should be fitted to mixing proportions in sub-area 11 that are disaggregated between samples from bycatches and from special permit catches to assist the Committee to evaluate model fit. It noted that this evaluation should account for sample sizes, which can be low. The Committee agrees that the trial specifications for Hypothesis E should be updated to allow P-stock to be found in sub-area 11 from October-December, given data that suggest this is the case (3 of 10 male and 1 of 11 female bycatch samples in Oct-Nov assigned as P-stock).

Once conditioning is complete, the results of the projections of the operating model should be summarised using the relevant performance statistics for *Implementation Simulation Trials* along with summaries of total removals and those due to bycatch. Projections should be conducted for: (1) no future removals; (2) future Korean bycatch only; (3) future Japanese bycatch only; (4) future Korean and Japanese bycatch; (5) as for (4) plus the current annual catch limit by Japan of 167 minke whales; and (6) as for (5) except that the commercial catch limit by Japan doubles over the 100-year projection period. The Committee agrees that additional removal scenarios could be explored (e.g. levels of reduction in bycatch, Japanese catch limits linked to abundance) once the first set of results become available.

The Committee noted that substantial progress has been made towards completing the In-depth assessment and

thanked Allison, de Moor and Katara for their considerable work during the intersessional period as well as during the current meeting in response to requests from the Committee for revisions to the diagnostic plots. It expressed appreciation to the Steering Group for reviewing material during the intersessional period and reviewing proposed changes to the data and model structure.

The next steps for the In-depth assessment are:

- Finalise the conditioning and check that this has been achieved satisfactorily.
- Assess if there are any data, not used for conditioning, that could be used to assess whether the results are realistic/plausible.
- Project the population forward under scenarios for realistic levels of future bycatch and commercial removals.
- Determine the statistics and plots to be used to review the results of the projections and to develop advice on the status and the need, if any, for provision of bycatch management advice.

Three years ago, the Committee had approved funds to hold an intersessional workshop to further this In-depth assessment, but it had not been possible to hold the workshop this year prior to the Scientific Committee meeting. The ideal way to complete the In-depth assessment is through an in-person meeting during which it will be much easier to efficiently and effectively review the many diagnostic plots and tables related to conditioning, finalise plots and tables to summarise model outputs, and draw conclusions regarding the consequences of alternative removal scenarios. The Committee, therefore, reiterates its support for holding the workshop prior to the next SC meeting provided sufficient intersessional progress has been made to warrant holding the workshop before the next Annual Meeting. The workshop should also examine evidence regarding dispersal rates among stocks for stock hypothesis E, including information from parent-offspring pairs and the results of the BayesAss analyses. Bayesian posterior distributions for assignments can be used to estimate contemporary migration, but such estimates need to be understood within the context of the strength of assignments using Geneland. Taguchi reminded the Committee that if new analyses using ICR data are to be undertaken the ICR Data Sharing Protocol must be followed.

The Committee agrees that progress on the In-depth assessment will be enhanced by virtual meetings of the Steering Committee before the intersessional workshop. It further agreed that after the meeting and prior to the proposed workshop, priority should be given to conditioning the baseline trials. These trials should each be based on 100 parameter vectors obtained by bootstrapping. Whether it is necessary to capture parameter uncertainty using bootstrapping for the sensitivity tests should be decided by the Steering Group during a virtual meeting by comparing results for the fits to the actual data and those based on the 100 parameter vectors for the baseline trials. The Committee also agreed that the Steering Group should prioritise the current set of sensitivity tests using the differences in the estimates of current J- and O-stock depletion from the 2013 *Implementation*.

The Committee noted that the resulting distributions by stock, age and sex generally matched the qualitative patterns expected from existing data on changes in catches and length frequency. However, there was insufficient time during the meeting to explore the distribution plots in detail and the Committee agreed that the distributions for the three baseline stock hypotheses for the two MSY rates based on fitting to the actual data (not the 100 bootstrap data sets) should be examined further by the Steering Group in roughly a month from the present meeting at a virtual meeting. Involvement by Japanese and Korean scientists familiar with the population dynamics and distribution of western North Pacific minke whales would assist in the review progress. Unrealistic model predictions of stock distributions by sex and age could lead to a stock hypothesis being assigned a low plausibility. The Steering Group may advise that the focus of work for the intersessional workshop (running sensitivity tests and the fitting to bootstrap replicates) should be on those stock hypotheses that appear to be consistent with the actual data and the general understanding of movement and distribution patterns, but the final decisions regarding the plausibility of stock hypotheses will be made by the Committee at the next meeting based on recommendations from the intersessional workshop.

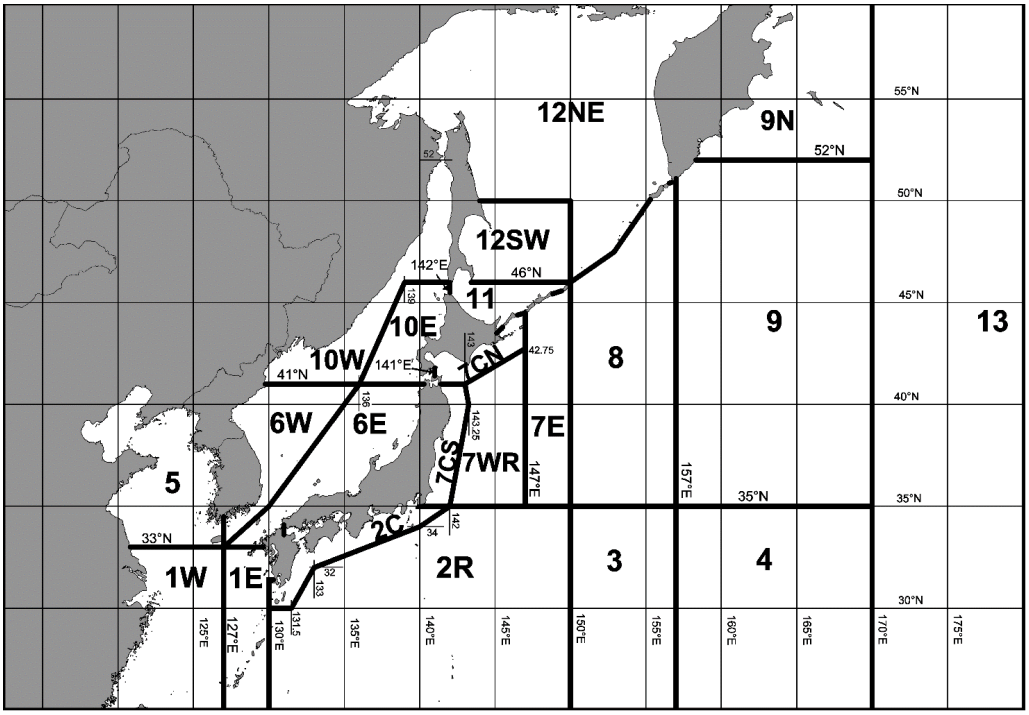


Fig. 6. The 22 sub-areas used in the In-depth assessment for western North Pacific common minke whales

8.1.4 Biennial Workplan and budget requests

The IA sub-committee is currently assessing three species (Items 8.1.1-8.1.3), where the status of the assessments are at different stages of completion. The Northern Hemisphere (NH) and Southern Hemisphere (SH) sub-committees are compiling and reviewing data from many species that may be used in future assessments (agenda item 8.2). Sufficient progress within these sub-committees has been made such that several species may be candidates for assessments within the next few years (Table 1). In other parts of this report, the Committee recommended the work needed to be completed to ensure the start of the assessment process. Some of this work has funding implications (Item 8.2).

To complete the Comprehensive Assessment of the North Pacific humpback whale by 2024 the Committee recommended that the Intersessional Steering Group be re-established under Cheeseman (Tables 2 and 3). The terms of reference are to further the work towards the assessment, organise an in-person intersessional Workshop in late 2022 or early 2023 (location to be determined), and complete the assessment modelling. The intersessional work plan over the next two years would be aimed at further refining the input data, addressing outstanding issues for the assessment, and completing the development of the assessment model, including:

(1) gather better data on bycatch from as many areas and from as far back as possible, as described above (Palka, Wade, Brownell, Scordino);

(2) consider the incorporation of other abundance estimates, notably those to be developed by Cheeseman from the large-scale photo-id collaboration (Cheeseman, Wade);

(3) refine the presence/absence matrix and assess how to deal with low but non-zero rates of exchange;

(4) determine how much additional model structure is required, and develop the model accordingly;

(5) assess the satellite tagging data to inform the assessment model regarding the presence/absence matrix among strata, the timing of occurrence, residency times and travel speed (Palacios);

(6) further the development of the assessment model and sensitivity scenarios (Punt and Privitera-Johnson); and

(7) arrange a Workshop in 2022 to further the assessment (Cheeseman).

Attention: SC, R

*The Committee is undertaking a Comprehensive Assessment of North Pacific humpback whales. To complete the matching of the large-scale photo-ID effort, the Committee **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.

*The Committee **agrees** that to complete the Assessment by 2024 the input data should be finalised, reviewed, and incorporated into the assessment model.*

To facilitate this work, the Committee:

- ***re-establishes** an Intersessional Steering Group, convened under Cheeseman and **endorses** its work plan;*
- ***reconfirms its previous endorsement** for holding an intersessional workshop to complete or appreciably advance the progress of the assessment using funds allocated previously;*
- ***endorses** the funding request for the assessment model analyses that are essential to this assessment.*

To complete the Comprehensive Assessment of North Pacific sei whales by 2023, the Committee recommends that the Intersessional Steering Group be re-established under Palka. The terms of reference are to further the work towards the assessment and document the previous work in the form of a synthesis document. The intersessional work plan would be aimed to create a synthesis document by:

(1) checking and documenting all input data;
(2) checking and documenting the final results of the model fitting;
(3) summarising the hypotheses explored to account for the lack of model fit; and
(4) summarising the status of sei whales in each area of the North Pacific, as possible.

Attn: SC

*The Committee **agrees** that to complete the Comprehensive Assessment of North Pacific sei whales by 2023 the input data and model fits previously explored be documented and the available information on sei whales in each sub-area of the North Pacific be summarised to provide a general picture of the status of the historical and current status of the species in each sub-area.*

To facilitate this work, the Committee:

- ***re-establishes** an Intersessional Steering Group, convened under Palka and **endorses** its work plan; and*
- ***reconfirms its previous endorsement** that the remaining budget allocation for the North Pacific sei whale population modelling work be carried over to allow Punt to complete and document the modelling work.*

To complete the In-depth Assessment of western North Pacific common minke whales by 2023, the Committee recommended that the Intersessional Steering Group be re-established under Donovan (Tables 2 and 3). The terms of reference are to further the work towards the assessment, organise an in-person intersessional Workshop in late 2022 or early 2023 (location to be determined), and complete the assessment modelling. The intersessional work plan is detailed in Item 8.1.3.

Attn: SC

*The Committee **reiterates** the need to conduct an In-depth assessment of western North Pacific common minke whales with a focus on bycatch levels and the status of J-stock(s). Recognising the difficulties in holding the workshop agreed last year prior to SC68D, the Committee **reiterates** the importance of the workshop and:*

(1) recommends that the funds allocated two years ago are used to hold a workshop by spring 2023;
(2) agrees that the primary objectives of the workshop are to: (a) build upon the work undertaken thus far on finalising and conditioning the operating models; (b) confirm or update levels of dispersal to include in the trials; (c) review the results of the conditioning and determine the necessary scenarios for future projections; and (c) develop a work plan that will allow for results to be presented to the 2023 Committee meeting, ideally enabling the In-depth assessment to be completed at that time;
(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 of the workshop that will be held by spring 2023, and the list of invited participants; and (b) coordinate the pre-workshop work, including commenting on trial specifications and conditioning results; and
(4) establishes an Intersessional Correspondence Group under Kitakado to: (a) review the applicability of the accepted g(0) estimate from one cruise to other cruises; (b) investigate the possibility of estimation of additional variance; and (c) develop robust estimates for use in the In-depth assessments and/or provide management advice and/or to provide broader estimates for the public.

Table 11
Status of current and future Comprehensive and In-depth Assessments

Species	Previous assessment	Subgroup currently working on species	Expectation where assessment will be completed	Expectation of when to start assessment	Report sections with more information
North Pacific sei whale		IA	2023	-	8.1.2
North Pacific humpback whale	2005	IA	2024	-	8.1.1
western North Pacific common minke whale	2013[a]	IA	2023	-	8.1.3
Antarctic blue whale		SH	-	2023	8.2.2
North Atlantic humpback whale		NH	-	2023	7.1.7, 7.1.8, 8.2.7
non-Antarctic blue whales		SH	-	2024	8.2.1
Southern right whales	2011/2012[b]	SH	-	2025 or 2026	8.2.3

[a] IWC, 2014 Supp15, 112-188
[b] Report of the IWC Workshop on the Assessment of Southern Right Whales (2013) Journal of Cetacean Research and Management (Supplement) 2013 (14): 439-462

Table 12
Work plan for Comprehensive and In-depth Assessments

Item	Intersessional	Next Meeting	Intersessional	Subsequent meeting
Comprehensive Assessment of North Pacific humpback whales (Item 8.1.1)	Re-establish the ISG to further data preparation, development of the assessment model and hold a Workshop	Review progress of intersessional work and finalise/continue the assessment	If needed, re-establish the ISG to further data preparation, development of the assessment model	Review progress of intersessional work and finalise the assessment
Comprehensive Assessment of North Pacific sei whales (Item 8.1.2)	Re-establish the ISG to finalise assessment model, summarise the assessment process and status in a single synthesis document	Review progress of intersessional work and finalise the assessment		
In-depth Assessment of western North Pacific common minke whales (Item 8.1.3)	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	If needed, re-establish the ISG to further development of the assessment model and hold a Workshop	If needed, review progress of intersessional work and finalise the assessment
Comprehensive or In-depth assessment of other species		Determine for which species have sufficient available data to start an assessment	Establish ISG to commence the assessment process	Review progress of recently started assessments and determine if other species are ready to start an assessment

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

8.2.1 Non-Antarctic blue whales in the Southern Hemisphere (SH)

The Committee is preparing for an In-depth assessment of non-Antarctic Southern Hemisphere blue whales. The pre-assessment was originally intended to be finalised in 2022 for handover to IA in 2023. Due to mainly pandemic-related difficulties in completing required actions, currently a completion in 2023 is envisaged for a hand-over to IA in 2024.

In the Southern Hemisphere and Indian Ocean, non-Antarctic blue whales are currently distinguished primarily by song-type and occur in the north-west Indian Ocean (NWIO, Oman), central Indian Ocean (CIO, Sri Lanka), south-

west Indian Ocean (SWIO, Madagascar to Kerguelen), south-east Indian Ocean (SEIO, Australia to Indonesia), south-west Pacific Ocean (SWPO, New Zealand) and south-east Pacific (SEPO, Chile to Peru). In 2022, the Committee received new information on distribution, population structure, abundance and photo-ID matching.

8.2.1.1 DISTRIBUTION

Thums *et al.* (2022) investigated migration and habitat use of SEIO pygmy blue whales (Western Australia to Indonesia) using satellite telemetry and passive acoustic monitoring. Data from 22 satellite transmitter deployments from 2009 to 2021 and from 46 acoustic recording devices (2006 to 2019) were used to quantify spatial and temporal pygmy blue whale distribution and to identify important areas for foraging, potential breeding and migration. Extensive slope habitat use and minimal use of shelf habitat along the West Australian coast were revealed with whales mostly engaged in migration, interrupted by short periods of foraging only. The whales stayed for prolonged periods of time (34% of the annual cycle) in Indonesian waters, where calving grounds may be located.

The Committee welcomed this information which provides valuable insights into spatiotemporal habitat use of SEIO blue whales, and noted that the detailed information on movement and distribution are in line with historical catch allocations which have been developed to support the upcoming blue whale assessment (Branch *et al.*, 2021).

In 2021, the Committee agreed to provide partial funding towards a field expedition to gather information on blue whales in the poorly studied low latitudes of the southwest Indian Ocean, organised by Cerchio (IWC, 2022, item 8.2.1.3). This was intended to be an offshore expedition between Mayotte and Madagascar, including transect-based surveys as well as collecting acoustic, biopsy and photo-ID data and satellite tracking individuals with implantable tags. Due to a severe delay of co-funding, the team had to make major adaptations to their research plan. Instead of supporting an offshore expedition, the funds will now go towards coastal surveys (within a 30-40km range offshore of the northwest coast of Madagascar) within the migratory range of Antarctic and SWIO blue whales during the documented period of overlap of the two subspecies. The expedition is also collecting the acoustic, biopsy and photo-ID data described above, as well as satellite tracking individuals for shorter periods with LIMPET tags.

The Committee endorsed this revision to the survey design and considers this an effective way to maximise the use of limited resources.

New information was presented to the Committee about blue whale research being conducted off the Santos Basin in south-eastern Brazil. The monitoring program includes photo-ID, biopsy samples, and satellite tag deployments. Within the data collection period (2017 to 2021) ten blue whales were sighted along the shelf break, and five biopsy samples and six photo-IDs were collected. Comparison of photographs of four of the IDs to the Antarctic Blue Whale Catalogue did not reveal any matches. Two adult females were tagged with satellite transmitters during the austral winter (July). Both tagged individuals maintained trajectories parallel to the continental margin. One of the tagged whales stayed for some days in the area before beginning its migration south until ~30ºS. The other whale began its migration south just a few days after being tagged, reaching ~45.2ºS by the end of August, after which both tags stopped transmitting. Acoustic data has also been collected using sensors on gliders in different years in the Santos Basin region. The genetic samples collected by this program are expected to be analysed to determine the most likely population of origin by Sremba at Oregon State University.

The Committee welcomed this information from a region where information on blue whales is rare, and the subspecies identity is unknown. It was noted that the acoustic data presented on blue whales from Brazil is most suggestive of the presence of Antarctic blue whales, given the "Z" calls detected in the study site. The sub-committee strongly encouraged the continuation this research, the contribution of photo-ID data to the Antarctic blue whale catalogue and presentation of a full report to the Committee at the next meeting.

8.2.1.2 POPULATION STRUCTURE

A good understanding of population structure and migration patterns is necessary to conduct population assessments.

SC/68D/SH/10 reviewed the movements of blue whales from the Chilean coast and into the Eastern Tropical Pacific (ETP) using 872 photo-identified blue whales collected by six different research groups working in southern and northern Chile and the ETP, as well as opportunistic sightings. This effort provided 38 re-sightings within and between regions. One match was made between southern Chile and the southern ETP. Other matches were found within southern Chile (n=22) and within northern Chile (n=15, including 7 intra-seasonal matches), providing further evidence for strong site fidelity within feeding areas off Chile. No matches were found between northern and southern Chilean waters. The longest period between re-sightings was 18 years and one animal was seen 11 times in six different years, both times in southern Chile.

The Committee thanked the authors for this update and commended them on the additional matches, particularly in northern Chile, where previously only two matches had been found (Torres-Florez *et al.*, 2015). The matches between Chilean waters and the ETP, along with recent genotype matching and satellite tracking of whales between both locations (Hucke-Gaete *et al.*, 2018; Torres-Florez *et al.*, 2014b), add further support to the hypothesis that the southern ETP is an important wintering ground for Chilean blue whales. The Committee agreed that the continued lack of matches between northern and southern Chile and high number of resights within each of these two regions support strong site fidelity of Chilean blue whales during their feeding season (IWC, 2022, item 8.1.2.1). The Committee encourages collection of biopsy samples off northern Chile for analyses (genetic, stable isotope, contaminants) to further clarify the relationships between blue whales in northern and southern Chile.

Attention: SC, R

*To test if southeast Pacific blue whales exhibit persistent site fidelity to local feeding grounds, the Committee **reiterates** that they **encourage** further collection of biopsy samples off northern Chile, as well as analysis of stable isotopes and contaminant profiles of individual whales off northern and southern Chile.*

8.2.1.3 ABUNDANCE

Intersessionally, the ASI Standing Working Group reviewed four available abundance estimates for SEPO Chilean blue whales and agreed abundance categories for each estimate (Item 3.10, Annex E).

Table 13
ASI categories agreed for Southern Hemisphere blue whales

Population	Location	Method	Time series	Abundance	ASI category[1]	Reference
Southeast Pacific Ocean	Chilean Northern Patagonia 41°00'S–45°30'S	Line transect survey	2009	356 (95% CI 191-625)	2	Bedriñana-Romano *et al.,* (2018)
	Isla Chiloé 42°00'S–43°00'S	Mark recapture analysis	2004-2012	762 (left side) (95% CI 638-933) 570 (right side) (95% CI 475-705)	3	Galletti-Vernazzani *et al.,* (2017)
	Isla Chiloé	Mark recapture analysis	2004-2012	450 (CV = 0.17)	2	Cooke and Jackson (2017)
	Chilean waters 18°30´S - 38°S	Line transect survey	1997	303 (95% CI 176-625)	2	Williams *et al.,* (2011)

[1]Abundance estimates are categorised in terms of their intended use, following the procedure described in Item 4.3 of the ASG report. Category 1: acceptable for use in In-depth assessments or for providing management advice. Category 2: An estimate for a stock or study area for which conservative management is acceptable but is likely negatively biased. Category 3: An estimate which is potentially informative but not acceptable for use in an assessment context. This category includes estimates with a bias which is too severe to allow inclusion in Category 2

Of the abundance estimates reviewed, three were approved for use in upcoming In-depth assessments as indicated by assigned ASI category 2 (Table 13: (1) the Bedriñana-Romano *et al.* (2021) 2009 estimate of 356 (95% CI 191-625) for blue whales in Chilean Northern Patagonia, noting that the survey region was unlikely to cover the summer geographic extent for this stock; (2) the Williams *et al.* (2011) 1997/1998 estimate of 303 (95% CI 176-625) for blue whales along the Chilean coast (18°30´S to 38°S, between the 12nm boundary out to a boundary delineated by a combination of historical catch limits, the 200 nautical mile EEZ and time limits of the survey), noting that the estimate is likely to be substantially negatively biased for the full population due to the location of the survey area; and (3) the Cooke and Jackson (2017) estimate of 450 (CV=0.17) blue whales around Isla Chiloé and Isla Chañaral, noting that a review of the full details of the modelling will be required before this abundance estimate can be used for management advice.

An ASI category 3 was assigned to the Galletti Vernazzani *et al.* (2017) estimate, reflecting a concern that transient whales (whales encountered once, a large proportion of the encounter histories) had not been distinguished from residents within the mark-recapture analysis. The Cooke and Jackson (2017) estimate represents a re-analysis of the Galletti Vernazzani *et al.* (2017) data, addressing this problem by using a model differentiating between resident and transient whales.

The Committee thanks its ASI Standing Working Group for the advice and categorisation provided and agreed that the Cooke and Jackson (2017) estimate currently represents the best available estimate for population modelling,

because this long-term photo-ID dataset is likely to encompass more of the population than the line-transect estimate (Williams *et al.*, 2011), and the Cooke and Jackson (2017) estimate is an improvement on Galletti Vernazzani *et al.* (2017) to account for resident and transient whales. However, an updated mark-recapture estimate with a larger Chilean mark-recapture dataset is anticipated for the 2023 meeting.

8.2.1.4 PROGRESS TOWARDS IN-DEPTH ASSESSMENT

In preparation for the In-depth assessment of non-Antarctic Southern Hemisphere blue whales, the Committee has supported ongoing work compiling the Southern Hemisphere blue whale catalogue (SHBWC) to identify re-sightings of use in mark-recapture analysis of abundance. SC/68D/SH/04 presented an update on the SHBWC. The SHBWC currently comprises 2,209 blue whales (1,584 right sides, 1,630 left sides, 90 flukes). From April 2021 to March 2022, new photo-IDs (+80 IDs) have been received from the Costa Rica Dome, Galapagos, and New Zealand. Intersessional work has focussed on matching within populations off Australia, New Zealand and Chile – Eastern Tropical Pacific, to be used for assessment purposes. All matching and quality control of photographs uploaded before January 2018 (Australia) and March 2021 (New Zealand and Chile-ETP) for these regions have been completed.

The Committee welcomed these updates, congratulated Galletti and contributors on the large amount of work conducted and noted that the SHBWC is a long-term initiative financially supported by the Committee in order to deliver regional photo-ID based mark recapture estimates of blue whale abundance. The Committee noted that the presented work addressed recommendations made previously by the IWC (completion of matching of SEPO and SWPO (IWC, 2021c, item 9.2.1.1).

In relation to SEPO datasets, the sub-committee recalled that in 2021, Torres-Florez *et al.* (2021) reported the compilation of a photo-ID dataset from northern Patagonia (Chile) from 2003-2015, comprised of 206 individuals. The lead author intends to submit these data to the SHBWC by the end of May 2022, matching and quality coding within the SHBWC will then be completed before the next Scientific Committee meeting. The Committee endorses: (1) inclusion of these new data within the agreed time frame; and (2) their reconciliation prior to the next meeting, so that these data can be included in a combined mark-recapture abundance estimate for the In-Depth assessment.

In relation to SEIO datasets, photo-ID matching and quality control is nearly complete for the Australian datasets submitted to the SHBWC up until 2018. Additional metadata from Australian catalogue holders are urgently required in order to complete this dataset (Item 8.2.1.3; this work will proceed via an intersessional correspondence group). However, there are an additional 100+ photo-IDs submitted from Timor Leste (a lower-latitude part of the SE Indian Ocean population) which have yet to be matched. The Committee was also informed that the Centre for Whale Research in Australia has updated its database with 115 new photo-IDs and plans to submit these to the SHBWC.

In relation to SWPO datasets, photo-ID matching and quality control is complete for the New Zealand datasets submitted to the SHBWC. All catalogue holders contributing to this dataset have agreed to proceed with a combined mark recapture analysis of whale abundance using these data, to be done through a data sharing agreement. Mark recapture analysis will be conducted intersessionally by Professor Rachel Fewster at the University of Auckland, and reported at the 2023 meeting.

In discussion, the Committee agreed that, in order to proceed with timely assessments of the SEPO, SEIO, and SWPO blue whale populations, only photo-ID data collected up to 2018 will be used, and priority will be given to matching within-region photo-IDs that will provide mark recapture data for abundance estimation, rather than those from connected areas, and that will further understanding of population connectivity and migratory destinations. The Committee therefore endorses the following priorities for finalising photo-ID matching: (1) for SEPO, catalogues within Chile, with lower priority for matching new photos from the Costa Rica Dome, Eastern Tropical Pacific and Galapagos; (2) for SEIO, catalogues within Australia, with lower priority for matching with new photos from Timor Leste. No new priorities for SWPO were identified, as this dataset is now ready for mark recapture analysis.

Insufficient data are currently available in the SHBWC for abundance estimates to be generated for the CIO (Sri Lanka), SWIO, or NWIO (Oman) populations. The Committee re-iterated their encouragement for submission of data from these populations to the SHBWC.

To complete pre-assessments of Southern Hemisphere non-Antarctic and southeast Pacific blue whales, the Committee previously encouraged regional catch scenarios for non-Antarctic Southern Hemisphere blue whales (Branch *et al.*, 2021) to be finalised, to be able to proceed to an In-depth assessment of these populations. These scenarios will be reported at the next meeting.

Attention: SC, R

*To complete pre-assessments of Southern Hemisphere non-Antarctic and southeast Pacific blue whales, the Committee **reiterates** its recommendations (IWC, 2022, item 8.2.1.6):*

(1) that the new photo-ID catalogue from Chilean Patagonia is submitted to the Southern Hemisphere Blue whale catalogue (SHBWC) (IWC, 2022, item 9.2.1.1) by May 31st 2022;

(2) that development of the Southern Hemisphere Blue Whale Catalogue continue, with a priority focus on: (i) finalisation of photo-ID matching and quality control within the southeast Pacific Chilean datasets (ii) addition of southeast Indian Ocean (Australian) metadata to associate photo-IDs with sighting date and location; and

(3) that the regional catch scenarios for non-Antarctic Southern Hemisphere blue whales be finalised, in order to proceed to an In-Depth assessment of these populations.

*The Committee **encourages** intersessional mark-recapture analysis of the NZ blue whale dataset for endorsement of an abundance estimate at the 2023 meeting.*

*The Committee also **encourages** submission of new photo-IDs from the Central Indian Ocean, southwest Indian Ocean and Northwest Indian Ocean areas to the SHBWC, to support future mark recapture analyses of regional abundance.*

8.2.2 Antarctic blue whales

The Committee is preparing for a new population assessment of Antarctic blue whales; the last assessment (Branch, 2008) concluded that, whilst increasing, in 1997 Antarctic blue whales were only at 0.9% (95% Probability Intervals 0.7-1.0%) of their pre-exploitation level (IWC, 2009b, item 3.2). In 2019, the Sub-Committee developed a four-year timeframe for a new Antarctic blue whale assessment (IWC, 2020e, item 3.1.4). This is now due to be handed over to IA after 2023.

The Committee was informed about a sighting of an Antarctic blue whale cow-calf pair in the South-East Atlantic Ocean (30°05'02.4"S, 14°24'53.2"E) off the continental shelf of South Africa in November 2019. Photo-ID images of the calf were compared to the Antarctic blue whale catalogue but revealed no match. This is the first sighting of an Antarctic blue whale cow-calf pair in South African waters post whaling, indicating that animals might still use this area as a calving or nursing ground.

The Committee welcomed this information, especially given the paucity of recent information on breeding off the west coast of southern Africa.

Drinkwater and Branch (2022) investigated the rate of twin pregnancies in 16 cetacean species using whaling data held by the IWC. They found that overall 0.87% (2,197 out of 252,651) pregnancies included multiple foetuses, 0.81% in blue whales (244 out of 30,969). To infer survival rates of twins to term, models were fitted to the proportion of twins by foetal length, finding that the probability of surviving twins declined exponentially to near zero with increasing foetal length. The authors conclude that few multiple pregnancies (<1 in 500) end in live birth, and even these pregnancies experience high mortality after birth.

The Committee welcomed this information and noted that the low proportion of twins at near-birth lengths suggests that twin pregnancies do not need to be accounted for in population models.

8.2.2.1 POPULATION STRUCTURE

A good understanding of population structure and connectivity is necessary to conduct population assessments. Whether the population structure of Antarctic blue whales consists of one or multiple populations is unresolved. Breeding grounds have not been identified, although they are assumed to be in lower latitudes, with Antarctic blue whale song heard throughout the Southern Hemisphere during winter months. Antarctic blue whales produce a single song type (McDonald *et al.*, 2006; Rankin *et al.*, 2005), lending support to the hypothesis of a single population. The song type is detected throughout the Southern Ocean in summer (Branch, 2007) and has also been detected in the lower latitudes of the Atlantic, Indian, and Pacific Oceans during the winter months (Buchan *et al.*, 2021; Samaran *et al.*, 2019).

A project led by Buchan and funded by the Committee (IWC, 2021c, item 8.2.1.1) is currently comparing the characteristics of Antarctic blue whale song calls from mid- and low-latitude regions in order to assess any regional variation in blue whale song calls as potential signs of population structuring. To date, data from Chile have been compiled and analysed. Full Z-calls were manually annotated from three study sites off the coast of Chile (Juan Fernandez and two sites in Chilean Patagonia), and measurements were made for Signal-to-Noise ratio of each unit of the Z-call, as well as duration (s), frequency bandwidth and peak frequency (Hz). Datasets from other sites (Australia, the Indian Ocean, New Zealand and South Africa) are currently being analysed in preparation for the comparison between sites. Further information is detailed in this year's IWC-SORP report (SC/68D/SH/07 and

SC/68D/SH/08).

The Committee commended the project group on their progress, recognising the importance of this work for insights into population structure. The Committee looks forward to receiving further updates at the 2023 meeting.

SC/68D/SH/09 presented an analysis of a dataset combining Discovery tag (45) and photo-ID (17) inter-seasonal recaptures to investigate ocean basin fidelity and evidence of separate populations. The majority of Antarctic blue whales were recaptured within the ocean basin where they were marked (50-79%) except for the eastern Indian Ocean sector where only 20% of marked whales were recaptured. Six of seven whales with locations north of 60°S were marked and recaptured in the same ocean basin. Four of seven whales with both intra- and inter-seasonal recaptures were always recaptured within the same ocean basin as the original mark. The Antarctic Peninsula may represent a barrier of some sort in the movement patterns of blue whales south of 60°S, based on the shortest distance between mark and recapture points. Only one whale was linked between the Atlantic and the Pacific Oceans. The mark-recapture distances for individual Antarctic blue whales on the summer feeding grounds were highly variable. Both short and long distances between locations were exhibited by intra-seasonal recaptures. Two satellite tagged whales moved extensively during the summer season, despite periods of area-restricted search behaviour assumed to be foraging. Overall, while there was a trend for ocean basin fidelity, due to small sample size these results do not discriminate between a single or multiple population structure for Antarctic blue whales.

SC/68D/SH/13 analysed historical Discovery mark data with Bayesian mark-recovery models to test the hypothesis of a single population of Antarctic blue whales by estimating inter-season movement rates among the three ocean basins in the Southern Ocean (Atlantic, Indian, and Pacific). The study found high probabilities of inter-season movement in almost all directions (median 0.08 to 0.28 yr-1). An estimated 59% of blue whales in the Atlantic Ocean remained there while 16% (95% interval: 1-33%) moved to the Indian Ocean and 27% (11-34%) to the Pacific; 58% in the Indian Ocean remained there, 16% (5-31%) moved to the Atlantic and 26% (13-34%) moved to the Pacific; and 65% remained in the Pacific Ocean while 28% (18-34%) moved to the Indian Ocean, and 8% (1-19%) to the Atlantic Ocean. The authors conclude that these high rates of movement suggest little evidence for population structure arising from geographic separation between Antarctic blue whales in the Southern Ocean.

The Committee welcomed the information presented in both papers, which addressed recommendations made previously by the IWC (IWC, 2021c, item 8.2.2.1). The Committee agrees that these data strongly support limited population structuring across Antarctic blue whale feeding grounds, as concluded in a previous review (Lang *et al.*, 2020), and endorses conducting assessments that assume a single circumpolar population of Antarctic blue whales.

No agreement was reached on whether additional hypotheses for population structure should also be advanced for consideration in an In-depth assessment. As yet, no genetic, Discovery mark, or photo-ID recaptures directly link Antarctic blue whales to low-latitude breeding sites in the Southern Hemisphere. However, there is very little known about Antarctic blue whale breeding sites in general. An intersessional working group was created to consider options for proposing alternative population structure hypotheses, including the possibility of a migration barrier at the Antarctic Peninsula, and separate breeding populations in Atlantic, Pacific and Indian ocean basins that fully mix in the Antarctic.

8.2.2.2 POPULATION ABUNDANCE

The Committee previously noted that an updated population assessment requires the IWC endorsement of a new abundance estimate for Antarctic blue whales. In the intersessional period, the ASI Standing Working Group reviewed five available abundance estimates of Antarctic blue whales and agreed abundance categories for each estimate (Item 3.11, Annex E). These discussions were summarised in Item 11.1.10.

Table 14
ASI categories agreed for Antarctic blue whales

Population	Location	Method	Time series	Abundance	ASI category[1]	Reference
Antarctic blue whales	35°E-145°W south of 60°S	Line transect survey	1995/96	300 (CV=0.308)	1A	Matsuoka & Hakamada (2014)
			2008/09	1,223 (CV=0.345)	1A	
	Circumpolar south of 60°S	Line transect survey	1981 (CPI)	453 (CV=0.40)	1A	Branch *et al.* (2007)
		Line transect survey	1988 (CPII)	559 (CV=0.47)	1A	

1998 (CPIII)	2,280 (CV=0.36)	1A

[1]Abundance estimates are categorised in terms of their intended use, following the procedure described in Item 4.3 of the ASG report. Category 1A: suitable for use in the Sub-Committee's Revised Management Procedure for commercial whaling. 1: acceptable for use in In-depth assessments or for providing management advice. Category 2: An estimate for a stock or study area for which conservative management is acceptable but is likely negatively biased. Category 3: An estimate which is potentially informative but not acceptable for use in an assessment context. This category includes estimates with a bias which is too severe to allow inclusion in Category 2.

All the abundance estimates reviewed were approved for use in upcoming In-depth assessments as indicated by assigned ASI category 1A (Table 14): the two abundance estimates by Matsuoka and Hakamada (2014) for the area 35°E-145°W south of 60°S, of 300 (CV=0.308) for the 1995/96 summer season and of 1,223 (CV=0.345) for the 2008/09 summer season; and the three abundance estimates by Branch (2007) for the circumpolar region south of 60°S of 453 (CV=0.40) blue whales for CPI (1978/79-1983/84; mid-year 1981), 559 (CV=0.47) for CPII (1985/86-1990/91; mid-year 1988) and 2,280 (CV=0.36) for CPIII (1991/92-2003/04; mid-year 1998).

The Committee thanked the ASI Standing Working Group for their advice and categorisation of the abundance estimates and noted that, given their 1A categorisation, these abundance estimates are now ready for use in an updated assessment. The sub-committee agreed that in an assessment the Branch (2007) estimates be used as absolute estimates of abundance, while those in Matsuoka and Hakamada (2014) be treated as relative estimates since they covered about half of the longitude range of the Antarctic.

SC/68D/ASI/10 reported the results of 2021/22 JASS-A dedicated sighting survey programme, which was conducted in the eastern part of Area IV East (130°W-120°W; south of 60°S). The total searching distance was 1,333.5 nautical miles during which five schools (six individuals) of Antarctic blue whales were observed. In total (including transit) seven individuals were photographed and a total of two biopsy samples (from different individuals) were collected. Data obtained will be analysed to provide abundance estimates and for stock structure studies at the Institute of Cetacean Research.

The Committee welcomes this update and noted the value of the information in relation to the upcoming In-depth assessment, highlighting that photo-IDs collected on these expeditions are contributing toward a new circumpolar wide abundance estimate for Antarctic blue whales (IWC, 2021c, item 8.2.2.2).

The Committee received an update on the intersessional work of the Acoustic Trends Working Group (ATWG, IWC-SORP Report SC/68D/SH/07). During a revision and standardisation of new Terms of Reference and the Mission statement, the group has broadened the spatial scope of its work to include the entire distribution range of Southern Hemisphere blue and fin whales. Previously the ATWG had restricted the scope of work to acoustic data south of 60°S. When taken together, the improved detection algorithms, development of a data analysis framework, continued long-term data collection, and other work of the group represent a step-change in the ATWG's ability to deliver on the promise of using passive acoustics to monitor trends in Antarctic blue and fin whales throughout the Southern Hemisphere.

The Committee welcomes this information, recognising that the broadened spatial scope of the work of the ATWG will deliver trend information on non-Antarctic Southern Hemisphere blue whales as well as Antarctic blue whales.

8.2.2.3 PROGRESS TOWARDS POPULATION ASSESSMENT

In 2020, the Committee agreed to progress two items to help understand possible sub-structuring of Antarctic blue whales around the Southern Hemisphere. These were: (1) a quantitative review of Discovery mark deployment and recovery patterns to assess inter-oceanic movements; and (2) a quantitative comparison of Antarctic blue whale songs from different low-latitude regions using recordings with high signal-to-noise ratios, to evaluate if there are inter-oceanic differences in song. SC/68C/SH/09 and SC/68C/SH/13 presented the results towards objective (1), and work towards objective (2) is ongoing, with a progress report presented to the Sub-Committee this year (Item 8.2.2.1).

A project led by Shabangu is collecting acoustic data off the South African coast with the objective to use contemporary blue whale detections to infer level of occurrence of both sub-species and therefore help apportion historic blue whale catches among Antarctic and pygmy blue whales. One AURAL-M2 hydrophone was successfully deployed off the South African coast (off Durban; at 30° 08' 55.5"S, 31° 50'12.2"S E) at a water depth of 284m on 7th February 2022. The device is programmed to record the first 17 minutes of every hour of the day at a sampling rate of 32kHz and will be retrieved in February 2023.

The Committee welcomes this information and noted the importance of this work in separating historical catches caught off Durban (to date it has been uncertain which sub-species these catch data refer to). The Committee looks forward to receiving a report on this study at its next meeting.

In 2023, the Committee also anticipates receiving a revised mark-recapture abundance estimate (from Olson *et al.*, 2021) for ASI review, as well as the reports mentioned above. Antarctic blue whales will then be ready to be handed to IA to conduct a population assessment in 2024.

8.2.3 Southern right whales not subject of CMP

The Scientific Committee agreed in 2016 to commence gathering pre-assessment information (e.g. catch data, population abundance, structure, trend), to progress towards a regional In-depth assessment of southern right whales (IWC, 2017f, item 10.8.1.5). In 2021, the Committee received new information on southern right whale body condition and how this can provide proxy information on foraging conditions, and therefore relate to population dynamics (Item 8.2.3.6, IWC In press); this work is still ongoing (see Annex K). In 2022, the Committee was provided with updates on regional population trends, habitat use and offshore distributions.

8.2.3.1 SOUTH AFRICA

SC/68D/SH/02 presented the results of the 2021 annual aerial survey of southern right whales as part of the long-term monitoring of the South African population. A total of 191 cow-calf pairs were recorded during the survey, which represents a slight increase from the numbers of cow-calf pairs seen in 2020, but still far below the numbers to be expected based on the projected population growth rate. Low numbers of unaccompanied adults were seen (n=31), the fifth-lowest count since the start of these surveys in 1979. The analysis indicated that, like in 2020, the largest proportions of cows calving in 2021 had a 3-year (19%), 6-year (17%) and 7-year (16%) calving interval. Additional survey data continues to indicate a shift in peak presence to September, earlier in the year than the historical peak observed in October.

The Committee welcomes this update and noted that the data continue the trend of extreme fluctuations in the coastal prevalence of cow-calf pairs along the South African coast since 2015. They were informed that a similar departure from historical trends has been observed on the calving ground in Península Valdés, Argentina, with longer calving intervals and an earlier peak in the occurrence of the individuals (Crespo and Coscarella, 2019). The Committee reiterated the importance of continued long-term studies to monitor population parameters and identify the factors influencing the observed changes over time.

The Committee was informed that the population dynamic model described in Brandão *et al.* (2021) has been updated intersessionally (Item 3.7, Annex E) and is in review for publication. It encourages the authors to provide, as soon as practicable, the publication of this model for review and endorsement by the ASI Standing Working Group.

8.2.3.2 SOUTH AND SOUTH-WEST AUSTRALIA

Smith *et al.* (2021) provided southern right whale abundance and trend estimates from the long-running aerial surveys for southern right whales along the south-west coast of Australia (Cape Leeuwin to Ceduna). This report was previously discussed in 2021 (Item 8.2.3.2, IWC In press) and reviewed by the ASI Standing Working Group (Item 3.7, Annex E).

The Committee encourages the authors to conduct a consolidated analysis of Australian southern right whale abundance and trend, for review in ASI and endorsement by the Committee. It also looks forward to the estimates of abundance and connectivity resulting from a recent photo-ID analysis of movements between calving areas (Evans, 2021, as discussed in Item 8.2.3.3, IWC, 2022, see Workplan).

Attention: SC, CG, R

*The Committee **encourages** Australian researchers to address comments made by the ASI Standing Working Group (Item 3.7, Annex E) and generate consolidated estimates of Australian right whale abundance and trend for endorsement by the Scientific Committee.*

8.2.3.3 NEW ZEALAND

The Committee received a report on the habitat use of southern right whales in Port Ross, Auckland Islands, with data collected in 2020 and 2021, and a comparison to similar data collected in 1998 (Carroll and Jackson, 2020). The study highlighted Port Ross as a key habitat for all demographic classes of New Zealand southern right whales, with an increase in the proportion of cow-calf pairs being observed over time, from 20% in 1998 to 50% in 2020/21, consistent with a growing population undergoing strong recruitment.

The Committee welcomes this update, and recognised the importance of this long-term monitoring, as habitat use is known to shift with increasing density, which can affect data collection relevant to population assessments. The Committee further noted the observed increase in cow-calf pairs in the area, in contrast to the decreasing numbers of cow-calf pairs observed in recent years in other calving grounds e.g. South Africa (SC/68D/SH/02,

Vermeulen *et al.*, 2021) and Argentina (Crespo and Coscarella, 2019).

SC/68D/SH/12 reports on a collaboration established with the developers of SPACEWHALE to assess the effectiveness of automatically detecting southern right whales in satellite images. The study showed the same number of whales was detected by both the satellite and boat-based surveys of Port Ross, Auckland Islands, despite a 12-hour difference between the timing of data collection. The authors explained the algorithm is very sensitive for the automated detection of southern right whales, with a higher number of false positives compared to false negatives, both of which are removed manually in a second step.

The Committee welcomed this report, recognising the potential of the approach for remotely monitoring the presence of southern right whales. However, the Committee noted the challenges related to the use of satellite imagery for the detection of whales, including the costs of satellite tasking and the influence of adverse weather conditions on the quality of images and detection of whales. It was further noted that multiple research groups are developing projects with this tool (Corrêa *et al.*, 2021; Fretwell *et al.*, 2014; Houegnigan *et al.*, In review), and that a large open-access dataset of southern right whale sightings in satellite imagery will shortly be published (Cubaynes *et al.*, 2017).

The Committee therefore encouraged collaboration among the different groups, including data and code sharing, to facilitate open access development of the approach where possible, while minimising duplication of effort (see Workplan). In this regard, it was commented that the technology is increasingly being used in wildlife research across the globe[11], and that coordination between research groups when approaching satellite imagery providers may lead to a substantial reduction in associated costs. The suggestion of developing partnerships with satellite providers has previously been encouraged by the Committee (IWC, 2022, item 14.3.2).

Attention: SC, R

*Recognising the value of Very High Resolution satellite imagery for monitoring whales in remote habitats, the Committee **encourages** coordinated data and code sharing among active research groups where possible, to facilitate development of automated methods, avoid duplication of effort, and negotiate better tasking opportunities with satellite providers.*

SC/68D/SH/11 investigated the use of carbon and nitrogen isotopes of amino acids (AA) in skin samples of southern right whales to identify reproductive status in female southern right whales. A Linear Discriminant Analysis (LDA) of AA $\delta^{15}N$ showed that the classification success rate was 87% for cows and calves, 62% for adult females without calves, and 67% for adult males. The LDA of AA $\delta^{13}C$ showed a classification success rate of 73% for cows, 75% for calves, 27% for adult females without calves and 37% for adult males. In contrast, both $\delta^{15}N$ and $\delta^{13}C$ of bulk tissue and its constituent AA did not differ between adult females without calves and adult males. This classification method could be used to identify periods of reproduction, including in baleen plates or other metabolically inert tissue, and is based on the hypothesis that the identified patterns are associated with differences in energetic requirements and nutrient allocation.

The Committee welcomed the information presented and noted continued work on the classification system is needed to fully specify the reproductive physiology of the whales and identify nutrient allocation strategies. The Committee further noted its relevance as a potential new monitoring tool to assess reproductive state and monitor the effects of environmental change on reproduction and population dynamics (IWC, 2019b, item 9.2.4.5 and item 8.2.3.6).

8.2.3.4 SOUTHWEST ATLANTIC

This population is subject to a Conservation Management Plan, see Item 9.1.2.

SC/68D/CMP/02 estimated population increase rates, relative abundance and distribution changes of southern right whales at Península Valdés and Golfo San Matías, Argentina between 2007 and 2021, and identified a substantial reduction in population growth in Península Valdés from 7% to 0.5% (all individuals), and from 7.5% to 2.91% (numbers of calves), with associated changes in distribution and density along the Argentine coast.

The Committee also received a report on the historical reconstruction of the population dynamics of southern right whales in the Southwest Atlantic (Romero *et al.*, 2022). The report used a Bayesian state-space approach to estimate population trends and recovery level after depletion, based on the modelling of the whaling catch history for the period 1670-1973. The model estimated the pre-exploitation levels for the Southwest Atlantic at ~58,000

[11] **For example, the Remote Sensing Action Group of the Scientific Committee for Antarctic Research SCAR**

individuals, with model-predicted abundance in 2021 at less than 10% of pre-exploitation levels. The model predicted that close to 36% of the current population visits Península Valdés each year.

The Committee welcomes both reports which represent significant progress in understanding regional southern right whale recovery. In discussion, it was noted that in the standard IWC population dynamic framework for reconstructing historical abundance, only low r_{max} (maximum population growth rate) values (r_{max} < 0.05) are compatible with the extended bottleneck experienced by southern right whales, and that a model incorporating an Allee effect (allowing r_{max} to vary) may provide a better fit (IWC, 2022, item 8.2.3.8); the Committee noted that such models will need to be considered when constructing population assessments of southern right whale recovery. It was further noted that pre-modern catches are likely to be substantially under-estimated due to missing or patchy data (IWC, 2022, item 8.2.3.8). This aspect is discussed further under Item 8.2.3.6.

Agrelo *et al.* (2021a) measured the effects of El Niño events on the survival probability of female southern right whales in the Southwest Atlantic over the period 1971-2017. An increased mortality rate after a strong El Niño event was observed, from ~1% in years without El Niño to 4.2% in the 1997/98 El Niño event, and 4.9% in the 2015/16 El Niño event. Predictions of future population recovery under different climate change scenarios (CMIP5 - RCP scenarios) were also presented.

The Committee welcomes this work which relates demographic parameters to environmental drivers, a key topic the Committee has identified as important for upcoming assessments (IWC, 2019b, item 9.2.4.5 and item 8.2.3.6). The authors were asked if they had examined whether the demographic parameters were influenced by time-dependent variability in reproductive parameters (e.g. the female calving cycle, Carroll *et al.*, 2013). The authors clarified that the reproductive success was not considered as the study focussed primarily on examining the influence of climate change on adult survival probabilities. The committee encourages future work taking into account the influence of time-dependent environmental variables on survival probabilities when assessing population dynamics.

In 2021, the Committee received a photo-ID based mark recapture study from Brazil, spanning the period 2004-2018 (IWC, 2022, item 9.1.2). Renault-Braga *et al.* (2021) assessed the probability of survival, capture and recruitment of southern right whales wintering in the area. In total, 520 whales were identified - 345 females and 175 adults; for both datasets, best-fitting Pradel models provided an annual population growth rate of 4.8% ±1.2%. Best-fitting POPAN models provided super-population estimates of 569 (±38) for females and 2,626 (±737) for wintering adults over 2004-2018 (middle year 2011).

Following intersessional review by ASI (Item 11.1.11), the abundance estimates in this paper were allocated ASI Category P, provisional. The authors were encouraged to investigate how variation in individual behaviour (for example the calving cycle) influences capture probability, to ensure that parameter uncertainty is adequately captured, to explore POPAN models that incorporate both abundance and population growth[12] and to work with the independent ASG reviewers to implement these changes.

The Committee welcomes this review, noting that analysis of regional photo-ID datasets for abundance and trend is a long-term Committee priority (IWC, 2018c, item 3.2.4; 2020d, item 3.2). Matching between photo-ID datasets in the southwest Atlantic is also a Committee priority (IWC, 2020b, item 9.2.4.5), as it can provide a synoptic picture of southern right whale abundance and trend across the wintering grounds. Noting that Uruguayan researchers have not yet compared photographs with Brazil and Argentina, the Committee encourages researchers in Brazil, Argentina and Uruguay to match catalogues between areas where feasible (see Workplan). The Committee also reiterates its encouragement that further progress on the Workplan discussed in 2021 related to the application of mark-recapture multi-state models to assess movement rates between the Argentine and Brazilian calving grounds (see Agrelo *et al.*, 2021b; IWC, 2022 item, 8.2.3.5), and region-specific survival, as detailed in 2019 (IWC, 2020b, item 9.2.4.5), providing an update at the 2023 meeting.

[12] **https://catchit.co.nz/apps/capow/**

Attention: SC, R

*The Committee **encourages** researchers to consider the influence of environmental variables in future modelling procedures when assessing southern right whale population dynamics.*

Attention: SC, CG, R

*The Committee **encourages** researchers in Brazil, Argentina and Uruguay to compare photo-ID catalogues for matches and **reiterates** its encouragement to apply a mark-recapture multi-state model to assess movement rates and region-specific survival of southern right whales in the southwest Atlantic.*

8.2.3.5 Offshore Areas

The Committee received results from a desktop study which collated data on the global occurrence of southern right whales offshore and south of 40°S over the period 1980-2020 into a comprehensive review (SC/68D/SH/03) collating 357 sightings of 699 southern right whales, most of which were located in the Southwest Atlantic. Data were mapped per season and region and showed that the majority of sightings were from the Southwest Atlantic and the Antarctic between 90°E and 120°E. Absence data were also presented where possible, indicating survey effort in the Southern Ocean where no southern right whales were sighted.

Recognising the value of this database, the Committee encourages the authors to continue collating sightings, to investigate how environmental conditions on the identified foraging grounds influence southern right whale population dynamics (IWC, 2019b item 9.2.4.5), and to compare how these grounds relate to historical catch distributions (IWC, 2022, item 8.2.3.8). In relation to offshore foraging patterns, the Committee reiterates its previous suggestion that the offshore hydrophone networks and voyage data be reviewed (IWC, 2021c, item 8.2.3.4), to identify acoustic detections of right whales south of 40°S, and proposed to re-establish an Intersessional Correspondence Group to progress this discussion (IWC, 2021e, item 8.2.9).

Attention: SC, R

*The Committee **encourages** continued collation of data on southern right whale offshore sightings and acoustic detections, to investigate stock structure and assess how environmental conditions on the identified foraging grounds influence southern right whale population dynamics.*

Matsuoka and Hakamada (2014) used sightings survey data from JARPA and JARPAII to produce abundance and trend estimates of southern right whales in Antarctic Area IV, south of 60°S for the period 1989/90 and 2007/08. This paper was presented to the Committee in 2017 (IWC, 2017f, item 4.2). Blue whale sightings data collected in the same surveys were reviewed in ASI (Item 11.1.10) and assigned category 1A (Item 8.2.2.2, acceptable for use in In-Depth assessments or for providing management advice).

The Committee noted that genetic mark-recapture estimates of abundance from the same area (Pastene *et al.*, 2018) were similar to those obtained by the sighting survey (IWC, 2019e, item 5.1.4), and that genetic and photographic recaptures indicated this area is associated with the Australian calving ground (Pastene *et al.*, 2021). However, it may not necessarily represent the only offshore destination for Australian right whales, and it is not known how much of that population frequent this feeding ground. The Committee agrees to review this abundance estimate again when preparing for an In-Depth assessment of Australian southern right whales.

8.2.3.6 Progress towards In-depth assessment

In 2018, the Committee encouraged the development of a common modelling framework to integrate southern right whale demographic data from all the calving grounds (IWC, 2019b, item 9.2.4.5). An update in this regard was provided in SC/68D/SH/06 (and in SC/68D/SH/08), which reports that the specifications of the common biological model are now complete and include an "unsuccessful mother" component to account better for late abortions or early calf deaths. The coding of the final common model is finalised and model-fitting has commenced on the South African dataset. The report advised that the first trial runs will be undertaken using the long-term datasets from South Africa and probably Argentina/Brazil, as these datasets are well known to the modelling team. The following step will be to include the datasets from the Australia and New Zealand wintering grounds (see Workplan).

The Committee welcomes this progress update and recognised the importance of this work in obtaining comparative data on population dynamics across wintering grounds. The Committee therefore encourages the inclusion of all datasets for a Southern Hemisphere wide assessment of population parameters, and that an update be provided to the next meeting.

Attention: SC, R

*To progress the In-depth regional population assessments, the Committee **encourages** the application of the finalised common modelling framework to all available regional long-term datasets (South Africa, Argentina/Brazil, New Zealand and South Australia), to assess southern right whale population parameters on a hemisphere wide scale.*

El-Gabbas *et al.* (2021b) reported on the use of dynamic Species Distribution Models to capture the dynamic species-environment relationships. There was insufficient time to discuss this document Recognising these models may minimise the temporal mismatch between species distribution and environmental conditions, the Committee noted its possible relevance for the ongoing work on the effects of environmental variability on population recovery of southern right whales (IWC, 2019b, item 9.2.4.5).

In order to progress with an In-depth assessment of southern right whale population demographics, the Committee has agreed in 2016 (IWC, 2017f) that southern right whale catch allocations need to be reviewed together with historical and contemporary breeding stocks of the species. This was encouraged again in 2021 (IWC, 2022, item 8.2.3.8). Two hybrid (in-person and online) workshops were proposed in order to progress on this matter in 2023 and 2024. The objectives of the first workshop are to: (i) update catch estimates; (ii) identify data gaps; and (iii) identify methods of filling the identified gaps. The second workshop will focus on: (i) reviewing the available historical and contemporary evidence for Southern Hemisphere stock structuring, updating previous reviews of SRW stock identity (1986, 2001, 2013); (ii) developing catch allocation hypotheses for review and ranking, based on available evidence; and (iii) identifying data gaps where further work is required to discriminate hypotheses. This is an item with funding implications for the Scientific Committee (see Workplan).

8.2.4 North Pacific blue whales

There are at least two populations of blue whales in the North Pacific, 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, 2017b). In recent years, the Committee has been evaluating the data available to assess blue whales in the less studied central and western North Pacific. The Committee remains in the pre-assessment stage for blue whales in this large region (the full process is described in IWC, 2019b pp.18-19).

Due to time limitations, discussion of this topic was postponed. However, the Committee did conduct a technical review of two sets of abundance estimates that would be relevant to an assessment (see Item 11.1.12).

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 (Annex T) with updates to be provided at the next meeting.*

8.2.5 North Atlantic sei whales

The Committee is at the pre-assessment stage for sei whales in the North Atlantic (the full process is described in IWC, 2019b, pp.18-19). Given the time constraints of SC68D, detailed discussion of this topic was postponed. However, Cholewiak reported on passive acoustic work initiated in 2021 to provide new information on baleen whale seasonal occurrence off the coast of Senegal which may also inform stock structure of North Atlantic sei whales (see Item 8.2.7). A proposal to continue that work has budget implications for the Committee (see Item 12.3). Information gathering for a future Comprehensive Assessment will continue through the intersessional correspondence group convened by Cholewiak, with progress to be reported at the next meeting.

Attention: SC

*The Committee is continuing its work to ascertain the availability of information to assess sei whales in the North Atlantic. The Committee **agrees** that the intersessional correspondence group under Cholewiak (Annex T) should continue to review data for a future Comprehensive Assessment.*

8.2.6 North Atlantic right whales

In response to the Committee's request (IWC, 2021d p.46), the U.S. provided an update on North Atlantic right whale population status and management initiatives.

SC/68D/NH/01 provided an update on North Atlantic right whale population status from the U.S. National Marine Fisheries Service (NMFS). This population continues to decline, with an estimated 340 animals (credible interval 328-352) in the year 2020. The population appears to be at its lowest level in approximately the last 20 years, and the model continues to indicate a decline in survival rates in the period 2011-2019. For the period 2015-2019, a total of 37 mortalities were observed, with ship strike and entanglement attributed as the cause for 10 of those deaths each; the cause of death for the remaining 17 cases was undetermined. However, based on the abundance model, an estimated 156 animals (121-195) died during this same period, four times the observed number of carcasses. In the 2022 calving season, 15 females were observed with calves, all of whom had calved previously. Based on the population model, only 70 females who are known to have previously reproduced are estimated to still be alive. Two studies were published utilising detailed analyses of mark-recapture sightings data. Crowe *et al.* (2021) examined sightings from the Gulf of St. Lawrence, Canada, during the period 2015-2019, and demonstrated high rates of inter-annual return, with approximately 40% of the population using that habitat. Quintana-Rizzo *et al.* (2021) examined sightings in and around wind energy development areas in southern New England, US, and demonstrated near year-round utilisation of that habitat, with 87% of the population sighted in the region during the study period.

At SC68C, the Committee discussed evidence that North Atlantic right whales were declining and that adult females have lower survival rates, and therefore abundance, than males (IWC, 2021d, p.44). This year, the Committee conducted a technical review of abundance estimates of the catalogued population from 1980 through to 2019 (Pace *et al.*, 2017; 2021) and found them to be suitable for management advice. Details of that discussion can be found in Item 11.1.9.

The Committee thanked the U.S. for providing new information on North Atlantic right whales but expressed grave concern about the status of this population and the on-going impact of human activities on its recovery. It further noted evidence that cryptic mortality is potentially four times higher than observed mortality (Pace *et al.*,

2021).

SC/68D/NH/02 reported on U.S. management efforts to recover North Atlantic right whales. NMFS continues to pursue various management approaches to reduce entanglements in fishing gear and vessel strikes and reverse the population decline of this species. NMFS also continues to collaborate with Canada and assess the potential impacts of emerging threats like offshore aquaculture and wind energy development. The latest preliminary estimate suggests there are fewer than 350 individuals and an unusual mortality event (UME), declared in 2017, is ongoing. The UME has documented 50 known cases - 34 dead and 16 seriously injured right whales. SC/68D/NH/02 further highlighted a few notable management efforts including final regulations to amend the Atlantic Large Whale Take Reduction Plan in September 2021. The amendment includes various mitigation measures to reduce risk in Northeast U.S. lobster and Jonah crab trap/pot fisheries, which represent about 93% of the buoy lines in all fisheries addressed by the Plan; gear modifications became effective May 1, 2022. Additionally, the U.S. released the Right Whale Speed Rule Assessment in January 2021 and the findings led to an investigation of potential options to modify the current right whale vessel speed regulations; the US anticipates release of a proposed rule in late Spring 2022. Finally, SC/68D/NH/02 reported that leadership from NMFS, Department of Fisheries Oceans Canada and Transport Canada continue to meet and share innovative techniques and solutions that foster healthy fisheries, reduce the risk of entanglements, and create whale-safe maritime practices.

The Committee welcomes the new information presented in SC/68D/NH/02 but noted that there have been decades-long efforts to mitigate impacts on this population from entanglement and ship strikes, and these measures to date have not been effective. In this light, the Committee inquired what additional management steps might yet be considered. Long stated that there had been some success in reducing vessel strikes and that an iterative approach is being taken to produce a broad-based solution along with a phased approach to fishing regulations which are expected to reduce entanglements. The Committee also discussed the critical importance of bilateral collaboration between the U.S. and Canada to protect North Atlantic right whales.

The Committee went on to discuss that little is known about this species beyond U.S. and Canadian waters and that a full understanding of animal movement and habitat use are critical for effective protection. The Committee discussed existing passive acoustic monitoring efforts that have the potential to collect occurrence data in some areas where animals were historically present. Cholewiak expressed interest in collaborating to enhance and expand such monitoring networks. The Committee also discussed that satellite tagging, although an invasive procedure, has been cautiously employed in other populations of management concern, such as North Pacific right whales (Zerbini *et al.*, 2015), western gray whales (Mate *et al.*, 2015) and humpback whales in the Arabian Sea (Willson *et al.*, 2015, see also Item 9.2.1). The Committee was updated on work that is underway by Zerbini and colleagues to evaluate the impacts of modern satellite tags and to develop less impactful designs. One such design is currently being evaluated in right whales off Argentina (see details in SC/68C/SH/07rev). The Committee noted that stakeholders should consider the potential scientific and management value of satellite tagging North Atlantic right whales, particularly in light of these new developments in tagging technology and information from impact assessments.

The Committee thanked the U.S. for providing updates about North Atlantic right whales, recognising the breadth and collaborative nature of efforts underway to study and protect this species. The Committee welcomed these updates and reiterated its strong concern over the status of this species, which has been declining despite decades of research and management efforts. Given documented changes in the distribution of this species, the Committee agreed that strong transboundary collaboration continues to be essential to fully understand and protect North Atlantic right whales. Further updates on status, management initiatives, and bilateral cooperation were encouraged for next year.

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, the only known viable population of this species; and (2) that the U.S. 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 (IWC, 2020b, p.41; 2021d, p46).*

The Committee:

*(1) **expresses grave concern** that*

(a) North Atlantic right whales are declining, despite the significant long-term efforts to understand this species and to mitigate human impacts; and

(b) human-caused deaths are likely under-estimated and are potentially four times higher than observed cases (Pace et al., 2021).

(c) Current mitigation measures are inadequate, and a much larger effort is required to address the severe threats of entanglement and vessel-strike to this species.

(2) ***recognises*** *that successful protection depends on understanding of movements and habitat use and therefore:*

(a) ***strongly encourages*** *the U.S. and Canada to continue to strengthen trans-boundary collaborations to understand and protect this species in their waters; and*

(b) ***encourages*** *stakeholders to consider research techniques such as satellite tagging and passive acoustic monitoring in order to facilitate the detection of unknown habitats and unexpected movements both within and outside of the currently known range.*

(3) ***encourages*** *the U.S. to provide further updates on its efforts and their outcomes at the next meeting; and*

(4) ***recommends*** *that the IWC Secretariat invite Canada to present its research and management initiatives at the next meeting.*

8.2.7 North Atlantic humpback whales (and see Items 6.1, 7.1.7 and 7.1.8) (NH)

The Comprehensive Assessment of North Atlantic humpback whales was completed in 2002 (IWC, 2002a; 2003b). In 2018, the Committee agreed that it was timely to consider a range-wide In-depth assessment (IWC, 2019b, p.133) and has since been collecting and evaluating available data.

The intersessional e-mail correspondence group to advance the assessment reported that ocean-scale analyses continue for photo-ID, genetics and telemetry data. Aspects of these studies were delayed by the pandemic, and results are now expected to be available for discussion before the next meeting. The Committee recommends the continuation of the e-mail correspondence group to review this information and continue to gather other data. A virtual intersessional workshop, and a funded in-person meeting (IWC, 2021d, p.176), are anticipated to advance this work.

The Committee also conducted a technical review of several abundance estimates in the context of their use in a future assessment. These included estimates from Eastern Canada (Lawson and Gosselin, 2018), Norway (Leonard and Øien, 2020a; 2020b) and the Cape Verde Islands (Wenzel *et al.*, 2020). Details of those discussions can be found in Item 11.1.12. The Committee agrees that available mark-recapture and line transect estimates for the Gulf of Maine and adjacent waters should be reviewed by the ASI Standing Working Group in preparation for assessment. There is no recent estimate of population abundance for the overall North Atlantic, nor for the West Indies breeding ground. The MONAH project (2003-2005) was intended to estimate the latter, but further analysis and interpretation are still needed (IWC, 2019c, Item 5.8.2). Clapham reported that he has identified a mechanism to advance this work intersessionally.

The Committee reiterates the importance of obtaining data in areas that are either under-sampled or at sites of mixing, such as the south-eastern Caribbean and the eastern North Atlantic. In that context, the Committee was advised that photo-ID research resumed this year at the Cape Verde Islands and 2022 data would be available to extend the abundance series for this small breeding ground in the Eastern North Atlantic. Cholewiak reported that her analysis of passive acoustic data from the south-eastern and western Caribbean had been completed and the results suggested a degree of subpopulation segregation. Detailed results of that study will be available intersessionally. Cholewiak also discussed a new passive acoustic monitoring project that was initiated this past year off the coast of Senegal. The coasts of Mauritania and Senegal are potentially important winter habitats for North Atlantic humpback whales and other baleen whales. In June 2021, two passive acoustic recorders were deployed at the head of the Dakar Canyon. The spatiotemporal occurrence of humpback whale song will be used to determine whether different hemispherical populations may be utilising Senegalese waters at opposing times of year, as well as to inform stock structure within the North Atlantic. In addition, resulting acoustic data will be analysed for the presence of sei, Bryde's and other baleen whale species. The Committee received a proposal from Cholewiak in further support of this work and agreed that it would help to address a data need for the planned North Atlantic humpback assessment. This work has budgetary implications for the Committee (see Item 23).

Finally, last year, the Committee discussed evidence for, and interpretation of, humpback whale presence at high latitudes in winter. Mattmüller *et al.* (2022) provided new information on this topic based on passive acoustic research off Tasiilaq, Southeast Greenland. Humpback whale acoustic presence was recorded mainly during open water conditions from July to December, with a peak in October and November. Non-song social calls were detected in

summer, while song fragments were recorded from September until December.

The Committee welcomes this new information and noted that the results add to information on the seasonality of humpback whales along a portion of the Greenland coast that was historically inaccessible to this species due to persistent sea ice.

Attention: C, CG, SC, R

The Committee notes the importance of continued progress toward an In-depth assessment for North Atlantic humpback whales. To this end, the Committee:

(1) ***agrees*** *to the continuation of the intersessional correspondence group under Robbins to compile and evaluate information available for assessment.*
(2) ***reiterates*** *that there are several important ocean-scale analyses (photo-ID, genetic, acoustic and telemetry) still underway and* ***agrees*** *to a virtual intersessional workshop and an in-person meeting, as needed, to receive and evaluate new information in the context of an assessment.*
(3) ***reiterates*** *the importance of new information from the understudied areas in the south-eastern Caribbean and eastern North Atlantic (IWC, 2020b, p.131; 2021d, p.47) and* ***recommends*** *proposed passive acoustic research off Senegal by Cholewiak and colleagues.*
(4) ***encourages*** *plans by the U.S. to conduct further analysis of MONAH project data from the West Indies to estimate humpback whale abundance (IWC, 2019b, p.18, 134; 2020b, p.131; 2021d, p.47), and to receive an update from Clapham at the next meeting.*
(5) ***agrees*** *that, in preparation for assessment, the ASI Standing Working Group should be requested to review abundance estimates for the Gulf of Maine and other areas of the North Atlantic, as needed.*

8.2.8 Rice's whale (Gulf of Mexico Bryde's whales)

In response to last year's request, the U.S. provided updates on Rice's whale (*Balaenoptera ricei*, Rosel *et al.*, 2021), formerly known as Gulf of Mexico Bryde's whale.

SC/68D/NH/03 provided an update on U.S. research and conservation of Rice's whales for the period March 2021 through 2022. There has been no update to the population estimate since the 2017-18 estimate of approximately 50 individuals (Garrison *et al.*, 2020). Because Rice's whales are well documented to occur in the north-eastern Gulf of Mexico, the greatest priority has been understanding their broader distribution in the central and western Gulf where they are most likely to overlap with human activities. The majority of research has focused on passive acoustic monitoring to better understand habitat use and spatial occurrence. Results from passive acoustic monitoring in the north-central Gulf found that Rice's whales were intermittently present on 16% of days with no apparent seasonality. There were notable differences in moan characteristics between Rice's whales in the eastern and western Gulf, which suggests that different individuals may be using different areas. With support from the U.S. Navy, NMFS deployed a sparse passive acoustic array consisting of 17 monitoring units in the Rice's whale core habitat. Units will be deployed for a total of 12 months, and ongoing analyses will be presented at the next meeting. Other highlighted research included: (1) modelling the relationship between Rice's whale distribution and areas of upwelling and high productivity and the development of a spatial density model to predict habitat within the Gulf of Mexico; (2) using a combination of echosounder data, stable isotopes, and trawl data to identify the primary prey base of Rice's whales as *Ariomma bondi*, a demersal fish species; and (3) analysing kinematic tag data to better understand foraging behaviour and energetics. Restoration plans from the *Deepwater Horizon* oil spill include vessel strike and noise mitigation. Finally, management activities included developing a recovery plan and the designation of critical habitat (as defined under the U.S. Endangered Species Act) as well as incorporating information on Rice's whale occurrence and distribution into the spatial planning process for proposed human activities such as the development of windfarms and aquaculture to better mitigate risks to Rice's whales.

The Committee welcomes this new information from the U.S. and encouraged an update on research efforts in the next meeting. In discussion, Garrison clarified that they are confident that they are correctly assigning vocalisations to Rice's whales based on a validation study in the core habitat; other balaenopterid species are rarely seen and calls associated with Rice's whales have been linked to their physical presence.

The Committee also inquired about future genetics work and plans for collecting additional biopsy samples to examine levels of inbreeding and demographic history. Rosel noted that there is an ongoing collaboration with the Vertebrate Genome Project and the SWFSC to create a fully annotated genome as well as a whole genome to better understand demographics and inbreeding. The Committee discussed the importance of looking at mutation load present in the population, which Rosel confirmed was being explored.

The Committee learned that there is no dedicated funding for the resumption of fieldwork, nor for some on-going and planned analytical work. This applies to both fundamental research on Rice's whales as well as certain other studies that are important for understanding this species. It was noted that one example of the latter was an on-going analysis of large genomic and mitogenomic datasets to test phylogenetic hypotheses and date divergence events within the Balaenopteridae family. The last field season was in 2019, but resuming those efforts would be important for the collection of additional biopsy samples for genetics as well as for a variety of other analyses such as health status and hormonal state. The Committee agreed upon the critical importance of sustained research funding and on-water data collection to advance research on Rice's whales, including photographs and drone-based imagery, eDNA and prey sampling.

Members also inquired about the possibility that there may yet be other cryptic or unknown species to be discovered in the Gulf of Mexico, given the recent 'discovery' of the Rice's whale. It was clarified that Rice's whales were known since the early 1990's and that the recent genetic and morphological work only confirmed that they were a distinct species. With regard to potential additional cryptic species, passive acoustic recordings have detected rare species such as an unknown beaked whale which is currently being investigated. There may also be additional population structure for some oceanic species with multiple populations occurring in the Gulf of Mexico.

Finally, the Committee acknowledged the management actions undertaken by the U.S. to protect Rice's whales but noted that this species also likely occurs in Mexican waters and this highlights the importance of fostering existing and new partnerships with Mexican colleagues.

Attention: SC, CC, CG, R, S

*The Committee has previously **expressed serious concern** about Rice's whale, an isolated population in the Gulf of Mexico with an estimated abundance of only around 50 animals (IWC, 2019b, p.26; 2020b, p.31; 2021d, p.48). This makes Rice's whale one of the world's most endangered large whales. The Committee:*

*(1) **welcomes** the information provided by the U.S. this year and **encourages** further updates at the next SC meeting;*
*(2) **encourages** the continuation and expansion of research efforts, including:*

(a) resuming on-water monitoring to obtain data such as photographs, UAS imagery, biopsy, eDNA and prey samples in support of mark-recapture, health/human interaction assessments, genetics and foraging ecology;
(b) understanding the distribution and habitat use of Rice's whales in the western and southern Gulf of Mexico where the overlap with industry is greatest;
(c) using spatial planning tools to better understand how emerging human activities may affect Rice's whales;

*(3) **encourages** stakeholders to coordinate efforts and to identify long-term support for both the field monitoring and the analytical work, including genetics, that are essential for understanding this species;*
*(4) **recognises** management initiatives being undertaken to protect this species in US waters;*
*(5) **requests** that the IWC Executive Secretary notify the U.S., Mexico and other range states of its willingness to facilitate international collaborations to better understand and protect these whales across their range.*

8.2.9 Biennial workplans

The Committee plans to review any new information on Rice's whale and North Atlantic right whales in light of concerns about their population status and on-going protective management efforts. Work will continue intersessionally to accumulate data for future assessments of North Atlantic humpback whales, North Pacific blue whales and North Atlantic sei whales. The Committee agrees that passive acoustic monitoring off Senegal is important to its work, and this has budgetary implications (Item 12.3).

The Committee further noted the importance of all of the long-term research efforts that are critical to its work to conduct assessments for whale stocks. The Committee encourages member countries and other stakeholders to prioritise and support field research for such stocks in all parts of their range, as well as the fundamental analytical work that ultimately informs assessments.

Table 15
Workplan

SC Agenda Item	Intersessional work	Next meeting
Item 8.2.4 NP blue whales	Accumulate data for future assessment	Review new information

SC Agenda Item	Intersessional work	Next meeting
Item 8.2.5 NA sei whales	Accumulate data for future assessment	Review new information
Item 8.2.6 NA right whales		Review new information
Item 8.2.7 NA humpback whales	Accumulate data and plan for In-depth assessment	Review new information
Item 8.2.8 Rice's whale		Review new information

8.3 New information for other northern stocks *(NH)*

8.3.1 North Atlantic blue whales

Aguilar and Borrell (2022) reviewed the blue whale catch data for the companies that operated from the 1920s to 1985 in Spain and provided insight into trends in abundance of the species in the region. Data were compiled from the internal documentation of the main companies that operated locally (catcher boat logbooks, land station logbooks, correspondence) as well as from seven line-transect cruises that had been carried out by the University of Barcelona in the 1980s. Despite IWC protection in 1954, the authors found that a total of 60 catches were made until 1979 with an additional one to two whales likely struck and lost. From these, 29 individuals had been correctly reported to the IWC as blue whales but 31 were mislabelled as fin whales. The data from the 1950s showed some oversized fin whales but it is unclear whether they reflect incorrect species reporting or incorrect measurements, so it is possible that the actual number of blue whales caught was slightly higher than estimated. The mean body length of reported catches was smaller than at higher latitudes of the North Atlantic, probably reflecting geographical stratification with a higher proportion of immature animals in the region. The ratio between catches or sightings of blue whales and those of fin whales was 5.9% prior to exploitation, declined to 0.02-0.18% in the 1920s, and increased thereafter up to 1.6% in the 1980-1990s. Using the population size of fin whales for reference, the abundance of blue whales in the waters off the Iberian Peninsula at the end of the 1980s was estimated at approximately 337-497 individuals, with an apparent increase across the studied period. If the rates of increase observed in the northern North Atlantic are applied to these numbers, it can be derived that the current number of blue whales in the region may be over a thousand individuals. These results appear consistent with the increase in abundance of the species reported in northwest Spain and its progressive occupation of inshore waters.

The Committee welcomes this new information, as well as a proposal from Aguilar to reconcile Spanish catch records for all species with the IWC catch database. The Committee agrees that there would be great long-term value in having the most complete and accurate record of catches possible for future assessments and implementation simulation trials. The proposed work has budgetary implications for the Committee (see Item 12.3).

In further discussion, Víkingsson noted that a blue whale estimate from NASS surveys in Iceland in 2015 (Pike *et al.*, 2019) was considerably higher than previous NASS estimates, although not significantly so due to relatively low estimate precision. The Committee recommends that this estimate be reviewed by the ASI Standing Working Group when possible (see procedure at IWC, 2020b, Annex P).

Attention: SC, R

The Committee:

(1) ***recommends*** *work to be led by Aguilar to reconcile records available for Spanish whaling catches with the IWC catch database.*

(2) ***recommends*** *that the ASI Standing Working Group review the abundance estimate of blue whales off Iceland in 2015 (Pike et al., 2019)*

8.3.2. North Atlantic common minke whales (NH)

Due to time limitations, discussion of this topic was postponed.

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

Mattmüller *et al.* (2022) reported on the occasional acoustic presence of bowhead whales off Tasiilaq, Southeast Greenland. Simple call sequences were detected on three days (in November, January and March), with moderate to heavy daily sea ice concentrations (between 30% and 61%) at the recording location. The authors concluded that the occasional acoustic presence of bowhead whales in their study supports previous observations that bowhead whales do not regularly inhabit the waters of Tasiilaq but move through the area occasionally. Bowhead whales recorded there might belong to the Spitsbergen population which is known to migrate south along East Greenland.

They concluded that changing sea ice conditions caused by climate change are likely to affect habitat suitability of the Tasiilaq area and thus bowhead whale occurrence in the future.

The Committee welcomes this new information which has the potential to improve understanding of the distribution and seasonality of Spitsbergen bowhead whales.

8.3.4 Unusual mortality events affecting northern stocks (NH; also see Item 14.3.2)
Due to time limitations, discussion of this topic was postponed.

Attention: SC, R

*The Committee **agrees** to the continuation of the intersessional e-mail group under Cholewiak (Annex T) to review information on Unusual Mortality Events for relevance to potential future assessments of Northern Hemisphere populations.*

8.3.5 North Pacific right whales
The Committee briefly discussed the importance of receiving new information on this small stock and that it would be prioritised in the next meeting.

8.3.6 Workplan
The Committee will continue to receive new information on other Northern Hemisphere stocks that are not subject to directed takes. Specifically, the Committee will prioritise new information on North Pacific right whales, North Atlantic blue whales, and East Greenland-Svalbard-Barents Sea (Spitsbergen) bowhead whales. 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. Proposed work to reconcile Spanish catch records with the IWC catch database was recommended by the Committee and has budgetary implications (Item 12.3).

8.4 New information (if provided) for other Southern stocks *(SH)*

8.4.1 Southern Hemisphere humpback whales
The first Comprehensive Assessment of Southern Hemisphere humpback whales was concluded in 2016. The Committee agrees to revisit species assessment priorities at the next meeting including those for humpback whales, recognising that substantial new information is available since the last assessment.

The assessment of the breeding stocks D (West Australia), E1 (East Australia) and Oceania was completed in 2014 (IWC, 2015f), but there were difficulties in obtaining a reliable estimate of absolute abundance for breeding stock D (IWC, 2017f; 2018c). Assessment of the feasibility of a new survey is underway in Australia. In 2018, the Committee recommended a review of methods to survey humpback whales migrating along the west coast of Western Australia (IWC, 2019b, p.27). Kelly reported that she had made some intersessional progress on this task but could not complete the planned work due to the COVID-19 global pandemic; a report on this task is anticipated at the next meeting.

Humpback whale breeding stock G spans the northwestern coast of South America, southwestern Central America and feeding grounds around the Antarctic Peninsula and southern Chile. A new mark recapture estimate of abundance was submitted to the Committee in 2021 (Félix *et al.*, 2021) combining mark-resight data from multiple regions across the migratory range of this population. This was reviewed intersessionally by the ASI Standing Working Group (see Item 3.3, Annex E. The ASG recommended that the 1991-2018 abundance estimate for Eastern South Pacific humpback whales (Breeding Stock G) of 11,784 (SE = 266) be endorsed as Category 3 (see Item 11.1.12). Noting the extraordinary work involved in collating this dataset and the great potential of the dataset for use in management, the ASI agreed to form a small intersessional group to help the authors of Félix et al. (2021) improve their analyses, and also to develop expertise within the Committee to advise on similar future work.

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, 2019b, p.27) its recommendation that an evaluation of survey feasibility be completed intersessionally, with a view to implementing a new survey of this population in the future.*

8.4.2 Southern Hemisphere fin whales

The Committee is currently conducting a pre-assessment of Southern Hemisphere fin whales. No updates were invited in 2021 due to the limited discussion time available at the meeting. In 2022, the Committee was provided with updates on analysis of passive acoustic data contributing towards understanding of fin whale distribution and stock structure.

Aulich *et al.* (2022) presented results of the seasonal distribution of fin whales at five Antarctic locations between 70°E and 180°E, two sub-Antarctic locations (53° 0.0' S and 76° 8.8'E; 53° 44.4'S and 141° 46.2'E) and seven locations in Australian waters from 2002-2019 based on acoustic recordings. Fin whale presence in Antarctic waters was generally seasonal, from late austral summer to autumn (February to June). In Australian waters, seasonal presence from austral autumn to mid-spring (May to October) was noted. Based on spatial patterns in fin whale calling occurrence, notably low detections at Casey in the Antarctic and along the south coast of Australia, the authors proposed two distinct populations with two distinct migratory pathways: from the Indian sector of Antarctica to the west coast of Australia and from the Pacific sector of Antarctica to the east coast of Australia.

The Committee was informed that song structure analysis is underway for these data and results should be available at the next meeting. The Committee welcomes future updates on this work, specifically regarding detailed song analysis and inter-regional comparisons. The Committee encourages the authors to consider conducting an analysis of fin whale song features in a manner that would make it directly comparable to the results presented in Wood and Sirovic (2022) and SC/68D/SH/01.

Burkhardt *et al.* (2021) reports on the seasonality of fin whales near Elephant Island (EI) over three years (2013-2016) from acoustic data. Their acoustic presence lasts from February to August, with a peak in May. The features of the high frequency component of the fin whale songs led to a hypothesis that these whales migrate to the South Pacific Ocean waters off Chile. The authors also noted that three more years of data (2016 - 2019) have been reviewed, with consistent seasonality patterns to those presented in Burkhardt *et al.* (2021). Additionally, acoustic data has been recorded successfully from 2019 - 2022 from the same region. The Committee thanked the authors for this update and welcomed future updates on this work.

Wood and Sirovic (2022) analysed the patterns in fin whale song from the Western Antarctic Peninsula (WAP) from 2001 and 2004 and compared it with song recorded in the same area in 2014-16. A single song type was identified in this location over this period. Even though the interpulse intervals increased slightly and frequency of the higher frequency component decreased slightly over time, the song remained identifiable. It was noted in the discussion that unlike fin whale song in the North Pacific, which tends to vary over time and thus might be challenging to use for determining population structure from non-concurrent recordings, the apparent stability of the song in the Southern Hemisphere will make it easier to develop hypotheses on possible population structure in this region.

SC/68D/SH/01 reported on a difference in fin whale songs (both in interpulse interval and its high frequency component) between those recorded at EI between 2013-2015 and those recorded at Greenwich Meridian (59.167°S) between 2009-2011, indicating two distinct acoustic populations. The song from EI had features that made it comparable to the song reported in Wood and Sirovic (2022) at a nearby location in the WAP.

It was noted that SC/68D/SH/08 reports on tagging efforts from WAP that show tracks from two fin whales that were tagged off EI traveling northward into the South Pacific, potentially on seasonal migration to lower latitudes. The Committee was also informed of unpublished fin whales tagging efforts off Brazil (approx. 27°S); tagged whales appeared to indicate movement towards central South Atlantic feeding grounds (islands at 54°-55°S, 36°-38°W). The Committee encourages these researchers to present this work in more detail at the 2023 meeting.

The Committee welcomes these updates on fin whale population identity and movements and acknowledged the substantial effort involved. It was noted that data in these studies span Antarctic Areas I-V, constituting a substantial circumpolar effort. In discussion of data gaps, the Committee were informed that new acoustic recordings were being collected in the South Atlantic (associated to Areas I and II), including from South Africa, Marion Island, and off southeastern and northeastern Brazil, as well as additional recordings from islands at 60°30'-60°48'S, 44°25'S-46°43'W. The Committee encourages researchers to analyse the fin whale song characteristics from these locations.

It was noted that patterns of differentiation in acoustic and genetic data are not always concordant, for example acoustics may provide an early indication of stock structure that suggest occurrence of assortative mating not yet resulting in genetic differentiation. Considering this and the new information on long-term song stability, the Committee encourages a multi-area analysis focusing on inter-regional comparisons of fin whale song types. This could use the variation in fin whale song characteristics to guide stock structure hypotheses that could then be tested with other datasets (e.g. genetics, morphometrics, isotopes).

Matsuoka and Hakamada (2014) presented abundance estimates for fin whales based on Antarctic sighting surveys from the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA and JARPAII) in the 1989/90–2008/09 seasons. The abundance estimates for Indian Ocean Antarctic Areas IIIE and IV were 3,087 (CV 0.191) and 2,610 (CV 0.285) at the start and end seasons, respectively. The abundance estimates for Western South Pacific Ocean Antarctic Areas V and VIW were 1,879 (CV 0.226) and 14,981 (CV 0.298) at the start and end seasons, respectively. It was noted that fin whales were widely dispersed in the research area and tended to be found more in Area V than Area IV.

The Committee noted that these surveys span large Antarctic areas and could be very valuable for future regional assessments. They therefore agreed to review these abundance estimates for endorsement, once fin whale stock structuring across these areas is better understood.

SC/68D/ASI/10 reported the results of 2021/2022 JASS-A dedicated sighting survey program, which was conducted in the eastern part of Area VI East (130°W-120°W; south of 60°S). The total searching distance was 1,333.5 n.miles during which 44 schools (64 individuals) of fin whales were observed. In total (including transit), 12 biopsy samples (from different individuals) were collected, and nine satellite tags were deployed. Based on preliminary satellite tracks, all tagged whales moved west from their tagging locations, as far as Area V, but none entered Area I. Data obtained will be analysed to provide abundance estimates and for stock structure studies at the Institute of Cetacean Research. The Committee thanked the authors for this new information and welcomed updates at the next meeting.

The sub-committee welcomed an update on the efforts to obtain a sample of the *B. physalus patachonica* holotype from MACN in Buenos Aires (IWC, 2020d, item 4.1). The Committee was informed that the Society of Taxonomy no longer recognises *B. p. patachonica* as a separate subspecies[13], but still encourages continuation of this effort, as this type specimen has never been genetically identified. The museum has agreed to allow the sampling, and logistics and permits are being organised as the museum is just starting to reopen after COVID-19 related closures.

8.4.3 Biennial workplan

Table 16
Workplan[14]

Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting
Southern Hemisphere non-Antarctic blue whales (Item 8.2.1)				
Distribution (8.2.1.1)	Assess the stock identity and movements of blue whales in the Mozambique Channel (Cerchio).	Report		
Progress towards In-depth assessment (8.2.1.4)	Submit the Blue Whale Centre blue whale catalogue from Chile to SHBWC for matching (Torres Florez and Hucke Gaete).	Report		
	Finalise photo-ID matching within the southeast Pacific (Galletti). This item has financial implications for the Scientific Committee.	Report		
	Generate abundance estimate by mark recapture analysis of New Zealand (SWPO) blue whale datasets (Fewster, Galletti, Torres, Olson, Goetz, Barlow, Lundquist, Double, Jackson)	Report		
	Generate abundance estimate by mark recapture analysis of Australia (SEIO) and Chile (SEPO) blue whale datasets (Fewster, Galletti, Salgado-Kent, Jackson). This item has financial implications for the Scientific Committee.	Report		
	Final report on regional catch allocations for non-Antarctic Southern Hemisphere blue whales (Branch)	Report		
Antarctic blue whales (Item 8.2.2)				
Population abundance (8.2.2.2)	Provide regional Antarctic blue whale trend estimates using song density patterns (Miller)	Report 6 weeks ahead of the next meeting for ASI review		

[13] https://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/

[14] Note that the blue whale pre-assessment work is anticipated to be completed in 2023, hence reporting is mostly in year one of the biennial Workplan.

Progress towards population assessment (8.2.2.1)	Conduct passive acoustic monitoring off the west coast of South Africa and off Durban, to characterise the density, distribution and seasonal movements of Antarctic blue whales (Shabangu). This item has financial implications for the Scientific Committee.	Report		
	Compare frequency and temporal features of Antarctic blue whale song at mid to low latitudes to assess regional variation (Buchan).	Report		
	Mark recapture modelling work following recommendations from the ASI Standing Working Group on SC/68C/ASI15 (Olson).	Report 6 weeks ahead the next meeting for ASI review		
			Initiate assessment of Antarctic blue whales (Branch, Rand). This item has financial implications for the Scientific Committee.	Report
Southern right whales not subject to CMP (Item 8.2.3)				
Population monitoring (8.2.3.3)	Establish a collaborative agreement among marine mammal research groups in regards to coordinated data in regards to the use of satellite imagery to monitoring southern right whales in remote areas (Vermeulen, under SRWC umbrella)	Report		
Population structure (8.2.3.4)	Multi-state mark recapture and population dynamic analysis of Brazil-Argentina photo-ID data to assess movement rates between regions (led by Agrelo, including Groch, Rowntree, Sironi, Vilches, Marón, Renault-Braga, Cooke). This item has financial implications for the Scientific Committee.	Progress report	Continue Workplan.	Report
	Photo-ID matching between Uruguay with Brazil and Argentina catalogues (Groch).	Progress report	Continue Workplan.	Progress report
	Continued collation of offshore sightings of southern right whales, and review of offshore hydrophone network and voyage data for southern right whale detections south of 40°S (Vermeulen and Carroll).	Progress report	Continue Workplan.	Report
Progress towards In-depth assessment (8.2.3.6)	Application of the common modelling framework on South African, and likely South American datasets to assess southern right whale population parameters (Butterworth and Cooke).	Progress report	Continue Workplan.	Report
	Workshop on southern right whale catch series review, to update regional catch estimates from IWC (2013) (Findlay and Vermeulen)	Meeting report		
			Workshop on the population structure and catch allocation (intersessional 2023/24) (Vermeulen and Jackson)	Meeting report
Southern Hemisphere fin whales (8.4.2)				
Population structure (8.4.2)	Re-assess the use of available published and unpublished Discovery mark data on fin whales (Pastene, Jackson, Mizroch, Olson).	Report		
	Analyse fin whale song from recordings collected by Australian Antarctic Division in Australian, Antarctic and sub-Antarctic locations (Aulich).	Report		

Analyse fin whale song from recordings collected off South Africa and Marion Island (Shabangu). This is an item with funding implications for the Committee.	Report		
Working group to conduct inter-regional comparisons of Southern Hemisphere fin whale songs: compile existing analyses (Širović).	Report	Continue Working Group	Report

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 of scientific work and information) that are either: (1) the subject of existing CMPs; or (2) are high priority candidates for a CMP. This report also addresses 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 SE Pacific southern right whales (CMP, SH)

The Committee received a report on advances made under the implementation strategy 2021-23 of the Chile-Peru southern right whale CMP (SC/68D/CMP/06). Last year, the Committee endorsed a CMP 6+ year review for 2022. Considerable new scientific information has been collected and actions taken by the Governments of Chile and Peru.

A workshop on 'experience exchange' aimed at reviewing whale watching regulations and scientific research permits (for stranded and live animals), as well as entanglement response procedures was initially planned for 2020 but was postponed, in response to COVID-19. It has now been rescheduled as an in-person meeting to be held in August 2022 in Lima, Peru. This workshop has the support of the Whale Watching sub-committee and is focused on exchanging experience among participants, reviewing procedures for responsible whale watching and documenting and reporting, for example, whale entanglements and injury. The 4th in-person coordination meeting to review the entire CMP is planned concurrent with the whale watching workshop in August 2022.

A virtual workshop is also planned for July 2022 to update data on the CMP. This expert workshop will review historical and recent data on Chile-Peru southern right whales to inform and update the scientific information in the CMP. Topics to be covered at the workshop include historical catches, population structure, distribution, migration and movements, basic biology, abundance and trends, as well as their threats, risk assessment and possible mitigation measures. Invited participants include researchers from Chile and Peru as well as other experts that have conducted or are involved with southern right whale research/conservation. Funding for each of these workshops and meetings has been secured. Reports from these workshops will be presented to the next meeting of the Committee.

SC/68D/CMP/06 highlighted new sightings of southern right whales during summer 2022 at northwestern Isla de Chiloé. There was a proposal to utilise new technology to improve photo-ID collection and assess the health status of this population. The Committee has been supporting a Passive Acoustic Monitoring (PAM) project to assist in the identification of possible breeding areas along the coast of Chile and Peru. Six sites have been initially selected. Two of them, Isla de Chiloé and Arauco Gulf have already been monitored. The PAM project is currently being implemented at Antofagasta region, northern Chile, but additional funding is needed to cover its entire year-cycle. Funding has already been secured to monitor southern Peru during 2022-23. A new opportunity to monitor Golfo de Penas, one of the six selected locations and one that is difficult to access is currently becoming available. Centro de Estudios Avanzados en Zonas Aridas (CEAZA) is offering to contribute with a new hydrophone - that requires limited annual maintenance. The Research Centre of Patagonian Ecosystems (CIEP) can provide logistics for the first deployment of the acoustic equipment. The Chilean Navy may also provide logistical assistance to the area.

The Committee received a progress report on the Passive Acoustic Monitoring (PAM) project with Chile-Peru southern right whales (SC/68D/CMP/01). The Committee has provided long-term support for the PAM project since its inception. The Arauco Gulf of Chile was the location of a former whaling station where SRWs were hunted. Cow-calf pairs were also reported in this same area from the whaling operations. Isla de Chiloé has been proposed as part of the breeding area based on the number of sightings, observation of reproductive behaviours in surface-active groups (SAGs), and presence of mothers with calves. Therefore, this area is identified as strategic site for long-term monitoring.

Twelve months of continuous recordings were collected between 2018 and 2019 off northwestern Isla de Chiloé,

austral Chile and five months between 2019 and 2020 off Arauco Gulf, southern Chile. A Soundtrap hydrophone deployment was used to acoustically monitor these sites. Acoustic data were analysed using an automatic detector specially developed under this project for right whale upcall vocalisations in the Low-frequency detection and classification system (LFDCS) software. The detections were reviewed and validated by an analyst, and the false negative rate of the detector was calculated by the manual annotation of days with true detections and aleatory days (*n*=100 days) selected from the Puñihuil dataset.

Off Chiloé, 189 true positive detections were recorded in the 2018-19 period, with calls present during the austral summer, autumn and winter with no clear seasonal trend. While in the Arauco Gulf, no true positive detections were found. Gunshot calls were found along with upcalls during March 2019, which is of relevance, because they have been associated with mating or agonistic behaviour between males in other populations. The presence of upcalls in almost all seasons suggest that northwestern Chiloé Island is potentially used by some individuals, as a non-migratory habitat, but this could also mean the population is so small that seasonality cannot be detected. These acoustic findings and behavioural observations (Galletti Vernazzani *et al.*, 2014), highlight the importance of the southern Chile area to this critically endangered Southeast Pacific southern right whale population and for its long-term monitoring. Moreover, recent sightings of mother-calf pairs at Golfo de Penas (approx. 500km south) suggest this remote area could also be part of a larger southern Chile breeding area, so more directed survey efforts should be concentrated here. Due to missing months of data, southern right whales off Arauco Gulf could have been missed so better temporal coverage at this site is necessary. Currently northern Chile is being monitored and future data collection efforts will be centred on southern Peru and Golfo de Penas.

Attention: SC, CC, CG

The Committee **reiterates** *the importance of the CMP for the conservation of the critically endangered Southeast Pacific southern right whale population (IWC, 2019b, p.28). The Committee* **welcomes** *the progress made and* **draws attention** *to:*

1) *the need for funding to continue to conduct the passive acoustic monitoring field work and;*
2) *notes the importance of increasing information about the presence of the species in southern Chile, especially the Golfo de Penas which could merit funding for additional monitoring efforts.*

9.1.2 SW Atlantic southern right whales (CMP, SH)

The existing CMP was adopted in 2012 and subsequently implemented in 2013. The last review of the Southwest (SW) Atlantic southern right whale CMP occurred in 2016. At SC68C the Report of the Intersessional Workshop on the IWC CMP for the Southwest Atlantic Southern Right Whale (SRW) Population (SC/68C/CMP/20) was reviewed. The workshop reviewed research, monitoring, and mitigation actions, identified the status of each action, including an evaluation of the necessary steps to accomplish incomplete actions, evaluate the continuity of accomplished actions and established new actions as necessary. With this extensive new information and the last formal review occurring over six years ago, a formal review of this CMP is merited. A workshop will be held 1-3 June 2022 in Curitiba, Brazil which is sponsored by the Committee, Fundo Brasileiro para a Biodiversidade/Brazilian Fund for Biodiversity (FUNBIO), and Instituto Chico Mendes de Conservaçao da Biodiversidade/Chico Mendes Institute for Biodiversity Conservation (ICMBio). The main objective is to review the actions (progress, difficulties and, if applicable, propose new actions) and update the CMP for the SW Atlantic southern right whale population.

The Committee encourages the continuation of existing and long-term monitoring efforts which support both SH and CMP priorities (e.g. photo-ID based mark recapture efforts: Item 9.1.2, IWC, 2022; telemetry efforts from Argentina: See Item 8.2.3.4; SC/68D/SH/07Rev1). Additionally, Agrelo *et al.* (2021a) relates to ongoing work to progress regional assessments of southern right whales and was discussed under Item 8.2.3.4. These long-term monitoring efforts provide support for the Committee's recommendations in support of the SWA SRW CMP.

One paper was received by the Committee, SC/68D/CMP/02, which estimated population increase rates, relative abundance and distribution shifts of SWA SRWs around Peninsula Valdes and in the Golfo San Matias. This paper was discussed in more detail under Item 9.1.2. The need to compare population rates among SRW populations was noted, although the SH and ASI sub-committees are better equipped to handle such a discussion.

The Committee encourages the continuation of all existing long-term studies on SRWs in Brazil and Argentina that are valuable to the work of the CMP sub-committee. In discussion, it was noted that additional satellite telemetry studies would continue to provide important data regarding movements, migration routes, and the location of feeding grounds. The Committee encourages the continuing this work.

A budget proposal to assess movement rates of SRWs between regions (see Item 8.2.3.4 and Item 22) using multi-

state mark recapture models was assessed by both the SH and CMP sub-committees. This work supports actions of the SW Atlantic SRW CMP and the SH sub-committee's work, by developing theoretical models for population growth and abundance assessment and a better understanding of movement between countries. Data from photo-ID catalogues of SWA-SRW off Peninsula Valdés and Brazil and matching between both regions brings an opportunity to increase knowledge on SWA-SRW movement rates. Expected outcomes include estimating movement probabilities between calving grounds in Argentina and Brazil, estimating survival and recapture probabilities, the influence of biological processes on movement probabilities (e.g., gull harassment, calf mortality, and density-dependence), and encouraging future SRW parameter assessments using this method.

Attention: SC, CC, CG

*The Committee **reiterates** the importance of the CMP for Southwest Atlantic southern right whales and welcomes the progress made since its implementation. To support the Actions outlined in the CMP and continued progress on these actions, the Committee:*

*(1) **recommends** continued collaboration among range states to generate new information and encourages additional effort from Brazil given the additional funding received;*
*(2) **reiterates** the importance of continuing the long-term monitoring programmes, 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;*
*(3) **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;*
*(4) **encourages** the continuation of telemetry studies in Argentina and recommends satellite tagging in Brazil and Uruguay;*
(5) respectfully requests that the IWC Commissioners for these countries (Brazil, Uruguay and Argentina) continue facilitating the internal permit process for right whale tagging programmes;
*(6) highlights the importance of research utilising baleen from stranded whales to investigate stress hormone profiles, **encourages** future studies and the presentation of results to the Committee when they become available; and*
*(7) **encourages** comparisons of photo-ID catalogues between Argentina, Brazil, Chile, and Uruguay, especially Argentina and Brazil.*

9.1.3 North Pacific Gray Whales (CMP, IST, ASW)

In February 2022 a gray whale was sighted on two consecutive days off Hawai'i Island (SC/68D/CMP/05). This is the first record of this species in Hawaiian waters and in the central tropical Pacific. Images from Hawaii were compared to several photo-ID catalogues from the eastern and western North Pacific, but no matches were found.

Information on research and conservation of gray whales off Japan for the period from May 2021 to April 2022 was presented in SC/68D/CMP/07. No sightings, strandings or anthropogenic mortality due to entanglement or other causes were reported from the coast of Japan during the reporting period.

During the winter 2022 breeding season in Laguna San Ignacio, Baja California Sur, Mexico, 788 gray whales were photographed, of which 626 individuals (male or female without a calf) and 42 mothers with calves (Mc) were evaluated for body condition (SC/68D/CMP/08). The proportion of individuals with 'good' body condition was 43%, 'fair' 37.5% and 'poor' 19.5%. The body condition of mothers with calves in 2022 was 'good' 90.5%, 'fair' 9.5% with 0% 'poor'. The percentage of Mc pairs with 'good' body condition was similar to those observed during the UME period 2019-21. Finally, the number of Mother calf pairs observed in 2022 was very low, similar to numbers reported in 2019-2021.

SC/68D/CMP/09 provided an update on the movements of gray whales identified in western North Pacific (WNP) feeding areas and eastern North Pacific (ENP) wintering lagoons in Baja California, Mexico. Images of 378 whales identified on the WNP feeding areas off Russia (229 from Sakhalin; 63 from Kamchatka and 86 registered in both areas) were compared to 11,000 individuals photographed in the ENP wintering areas. A total of 48 matches of individuals between the WNP and ENP were found, including 21 females, 14 males, and 13 whales of unknown sex. These matches included 13 Sakhalin-Kamchatka-Mexico, 28 Sakhalin-Mexico and seven Kamchatka-Mexico. Movements between the WNP and ENP represent about 12.6% of gray whales identified off Sakhalin Island and Kamchatka and 0.4% of the gray whales identified in the wintering lagoons. Sixteen of the 48 grey whales observed migrating between the WNP and the ENP (Mexico) did so in at least two years (range = 2 to 5 years).

Weller advised the Committee that substantial progress had been made since the last meeting with using machine learning/artificial intelligence for photographic matching of gray whales. This effort is being undertaken by NOAA/SWFSC in collaboration with Wild Me[15] and several external data contributors. The objective of this initiative is to increase efficiency of matching between and within photo-ID catalogues (e.g., Mexico to Sakhalin) by way of automated computer routines and thereby to aid in projects such as that described in SC/68D/CMP/09.

Strandings of at least 47 gray whales were reported along the Pacific coast of Baja California, Mexico between 1 January and 7 April 2022 (SC/68D/CMP/10). As in previous years, most of the strandings (n=32) occurred in Laguna Ojo de Liebre (LOL) and the surrounding areas. Of the 47 documented strandings, 26 were males, 19 females and two of undetermined sex. The age classes of the dead whales were: 33 adults, six subadults, 5 yearlings and 3 calves. The number of strandings in 2022 is lower than 2021, but the winter season and associated field search effort had not yet concluded when this summary was completed.

The winter of 2022 was the fifth consecutive gray whale winter season (2018-2022) in Laguna San Ignacio and Bahía Magdalena, with whales leaving both areas approximately two weeks earlier than expected (SC/68D/CMP/12). The highest number of individual adult whales counted during vessel surveys in Laguna San Ignacio was 172 whales on 19 February, which was similar to counts observed in previous winters. Counts of females with calves remained low throughout the 2022 winter season, with the highest count of 18 pairs observed on 9 March 2022. The highest counts in Bahía Magdalena were obtained on 9 February in the most southerly aggregation area of Bahía Almejas with 173 adult whales and no female-calf pairs observed. In central Bahía Magdalena, counts were greatest on 23 January with 42 adult whales and no calves. In the northern Canal de Santo Domingo, 36 single whales and two female-calf pairs were counted on 7 February.

As indicated at the 2021 SC meeting, the IUCN Western Gray Whale Advisory Panel (WGWAP) was to be dissolved at the end of December 2021 (Reeves *et al.*, 2021). SC/68D/CMP/13 reported that the panel's final meeting was held at IUCN headquarters in Gland, Switzerland, on 9-10 November 2021. An extension of the closure date to 31 March 2022 was meant to allow panel members time to bring several documents closer to completion and to continue supporting the development of a mechanism within Minprirody (Ministry of Natural Resources and Environment of the Russian Federation) that would continue at least some of the WGWAP's assessment and oversight functions in relation to impacts on gray whales of industrial activities on the Sakhalin Shelf. Unfortunately, the Russian invasion of Ukraine, which began 24 February, disrupted IUCN's and the panel's efforts and plans.

Although the report of the panel's November 2021 meeting (WGWAP-22) was finalised, as of 28 April 2022 it had not been posted on the IUCN website[16]. It is impossible to know at this point which outcomes and materials from the 17 years of western gray whale panel activities will remain available, and where they will be archived, given that IUCN is undergoing a major overhaul of its online capabilities and priorities. The WGWAP-22 report states, in regard to potential alternate sites:

One potential repository site for at least portions of WGWAP materials is the IWC Secretariat, which Staniland (attending WGWAP-22 virtually) noted has considerable experience with, and the capability to organise and manage, scientific and conservation-related data and literature. He offered to assist as much as possible in any future discussions.

The WGWAP-22 report also states:

> The IWC is currently updating the joint IWC/IUCN western gray whale Conservation Management Plan (CMP)[17], to be based in part on the outcome of a postponed Scientific Committee workshop to finalise rangewide considerations into an updated CMP. The workshop is now planned for 2022. This will in turn feed into a stakeholder workshop (including country representatives, NGOs, businesses) and consideration at the upcoming Commission meeting in October 2022 (IWC68). After working closely with the WGWAP throughout its existence, the IWC will continue its work on gray whales through its various committees.

Finally, the WGWAP-22 report states the panel's belief that an updated[18] and revitalised 'Memorandum of Cooperation concerning Conservation Measures for the Western Gray Whale', initially developed in 2014 and signed so far by the IWC Commissioners of five of the eight or nine range states (Japan, Republic of Korea, Russian Federation, USA and Mexico), could become a valuable mechanism for supporting range wide work.

Considering the WGWAP is no longer being convened by IUCN and the further geopolitical complications caused

[15] https://www.wildme.org
[16] https://www.iucn.org/western-gray-whale-advisory-panel
[17] https://iwc.int/western-gray-whale-cmp
[18] The update is necessary *inter alia* given the many references to the WGWAP in the existing document.

by the Russian invasion of Ukraine, the Committee discussed potential impacts on the science, and in turn conservation, of WNP gray whales. Three central themes were raised: (1) the possibility that at least some of the work carried out by the WGWAP would be taken up by Minprirody with continued input from some past members of the WGWAP and advisory support from IUCN. Given the Russian invasion of Ukraine, at present it seems questionable that this will happen; (2) the foreign oil and gas companies operating near the WNP gray whale feeding areas off Sakhalin had long funded a research and monitoring programme (2002-2022) but in response to the Russian invasion of Ukraine, these companies ceased their business interests at Sakhalin and elsewhere in the country. With that, the Committee expressed concern that industry-funded research on gray whales off Sakhalin will be seriously affected and quite possibly end. This same concern was expressed by the Committee regarding the ability of independent groups, like the Russian Gray Whale Project, to continue conducting research. Scordino raised the issue of how future population modelling, such as that conducted by Justin Cooke et al., would be handled if the traditional sampling effort (industry plus Russian Gray Whale Project) is disrupted. By way of example, he mentioned that sensitivity tests on estimates of abundance, in terms of accuracy and precision, may be necessary. It is possible that no research on WNP gray whales occurs in summer 2022 and beyond, making future population modelling impossible; and (3) in light of the geopolitical implications caused by the Russian invasion of Ukraine, the Committee expressed great concern that conservation actions and especially international collaborative scientific studies in Russia, including those related to marine mammals will be seriously compromised and permanently damaged and result in intractable consequences on population assessment.

Finally, it was agreed that the workshop to incorporate scientific considerations in an updated western gray whale CMP should be held in La Jolla before the next SC meeting.

SC/68D/CMP/14 reported on the 2019-2022 Unusual Mortality Event (UME) of eastern North Pacific (ENP) gray whales. While this UME has continued in 2022, the numbers of stranded whales appear to be decreasing compared with the same period in 2019 and 2021. From 17 December 2018 through 06 April 2022, a total of about 534 stranded ENP whales was documented along the Pacific coast across three countries (Canada, Mexico, and United States). Two hundred and fourteen dead whales were reported in 2019 (including two whales from December 2018), 172 in 2020, 114 in 2021, and 32 in 2022 as of 06 April. Strandings occurred along the entire ENP range of gray whales, including wintering, migratory and feeding areas, with most of the dead whales in the U.S. documented in spring and early summer when gray whales are near the end of their seasonal fast. The abundance estimates of ENP gray whales showed a ~24% decrease between 2016 and 2020, which spans the UME (Stewart and Weller, 2021a). Total calf production in 2021 was estimated at 380 individuals (95% CI 296-493) – among the lowest calf production estimates on record (Stewart and Weller, 2021b). Two of the three recorded periods of low calf production have coincided with UMEs, the 1999-2000 UME and the current event. This suggests that the factors driving or mediating gray whale fecundity and mortality rates are similar.

The most recent surveys conducted by NOAA/SWFSC took place in 2020 and 2022 for abundance (southbound migration observed from Granite Canyon, California) and 2021 and 2022 for calf production (northbound migration observed from Piedras Blancas, California). Data from these surveys will continue to be important for understanding population-level impacts of the current UME. Weller informed the Committee that personal communications with Russian scientists working off Sakhalin and Chukotka indicated that no signs or symptoms of the aforementioned UME were being observed in the western North Pacific.

The Russian Gray Whale Project (RGWP) has provided a long time-series of photo-id and genetic data used in the assessments by the Scientific Committee and others. In 2021, research on gray whales off northeastern Sakhalin Island and off the southeastern coast of Kamchatka (Kronotsky Bay) was conducted by the project (SC/68D/CMP/15). Off Sakhalin, research was conducted from 7 July to 8 September during which time 20 boat surveys were completed. A total of 146 whale groups was encountered (with repeated sightings) and 42 unique whales were identified. Fourteen mother-calf pairs and three new whales (older than one year) not previously seen in the study area were observed in the nearshore feeding area off Sakhalin. The catalogue of whales summering off Sakhalin between 1994-2021 includes 331 individuals (SC/68D/CMP/16).

In 2021, a survey of gray whales off the Kamchatka Peninsula (Olga Bay, Kronotsky Gulf) was conducted on 23 August, encountering nine whales of which three were known to have occurred off Sakhalin in at least one previous year.

Photo-ID of gray whales feeding off northeastern Sakhalin Island in summer and autumn has been a principal component of two long-running (1995-2021 and 2002-2021) scientific projects (SC/68D/CMP/16). The RGWP (formerly called the Russia-US Research Program) was the first to initiate photo-ID studies off Sakhalin in 1995. A second photo-ID project, funded directly by offshore oil and gas companies, was initiated in 2002. These two research

projects have collected photo-ID data on gray whales from small boats, large vessels, shore and more recently aerial drone systems.

Recognising that information derived from the datasets of these two research projects is critical for population assessment, the Scientific Committee of the IWC has highlighted for more than a decade the importance of combining these two photo-ID (and genetic) data holdings. While those involved in western gray whale research and conservation have expected for many years that a common (joint) photo-ID catalogue and database would become available, to be controlled and managed under the auspices of the IWC, this objective has not been met. Clearly, failing to combine the two catalogues works to counter the concept of using all available science (and data) to support conservation.

As a good faith gesture and to partially offset the effects of the aforementioned lack of progress in integrating western gray whale photo-ID data, the 1994-2021 catalogue maintained by the Russia Gray Whale Project (Dr. Alexander Burdin, PI) will be made available via the IWC Secretariat following SC68D. It is the intent of the authors to follow the guidelines set out in Olson *et al.* (2017), including a data availability agreement that facilitates access to the catalogue for Scientific Committee members. As an initial step, the catalogue will be provided to the IWC Secretariat in PDF form, followed in time with more complete sighting information and related digital type-specimen images.

Attention: CG-R, SC, G, I, CC

*The Committee **reiterates** the importance of long-term monitoring of gray whales and **strongly recommends** that Range States and Industry support this work and welcomes the new information provided by Mexico, U.S., Russia and Japan. In particular, the Committee:*

*(1) **commends** the work in the wintering areas of Mexico, **urges** its continuation and **expresses concern** about the high number of strandings, poor body condition and low calf counts observed in Mexico in 2019-2022 as related to the UME event;*

*(2) **welcomes** the continued provision of information from Japan and encourages researchers there to continue to collect as much information on sightings and strandings as possible, including attempting to obtain biopsies or tissues and photographs whenever feasible;*

*(3) **recommends** that every effort be undertaken to enable continuation of the Russian Gray Whale Project in order to maintain the several-decades-long time-series upon which assessment of the population relies;*

*(4) **commends** the Russian Gray Whale Project for making available its 25+ year photo-ID catalogue, providing access for Scientific Committee members, and **recommends** that other research programmes focused on WNP gray whales make their catalogues and related data available via the IWC, with particular emphasis on the industry funded-effort (2002-2021) off Sakhalin; and*

*(5) **highlights** the importance of data collected by NOAA/SWFSC on abundance and calf production off central California, particularly in light of the ongoing 2019-2022 unusual mortality event, and **strongly recommends** that these two surveys and related investigations on the UME continue in 2022/2023 and into the future.*

9.1.4 Franciscana (CMP, SM)

In 2020, the Committee established two intersessional correspondence groups (ICGs) to: (1) review population structure of the franciscana (*Pontoporia blainvillei*), including the level of support for each of the proposed stock subdivisions based on genetic and other lines of evidence (*e.g.,* morphology and contaminant); (2) review abundance estimates and factors to correct for potential sources of bias in these estimates. As part of these activities, the review of the species continues.

Aerial surveys, partly funded by the SC, were conducted in 2019 and 2022 to estimate abundance of franciscana dolphins in Buenos Aires Province, Argentina (SC/68D/CMP/17). A total of nine coastal surveys were flown in visibility conditions allowing for the sighting of several species of cetaceans. The two series of surveys (2019-2022) were carried out separately due to the COVID-19 pandemic. In 2019, 41 sightings of franciscana dolphins were made, totalling 68 individuals. During the 2022 survey, 55 sighting were recorded comprising 80 franciscana dolphins. The preliminary abundance of franciscana within the Buenos Aires Province was estimated at 13,598 (95%CI 5,392-33,683) dolphins considering the estimation obtained in 2022. In 2004 abundance in the southern area was estimated at 5,896 dolphins. This area was not surveyed during 2019 and 2022 flights, however, under the assumption that the southern area remained constant – which is the most conservative hypothesis, it was estimated that the abundance between the coast and the 30 metres isobath could be roughly 20,000 individuals. Franciscanas beyond the 30 metre isobath were not considered here. As the flights were not all carried out during the same season the results obtained here cannot be directly compared to those from 2003/2004 (Crespo *et al.*, 2010). It was not possible to investigate

possible trends with only two estimates of density. More surveys would be necessary to estimate a trend. However, it is believed that the population did not decline and that at least 20,000 animals inhabit Argentine waters. In discussion, the importance of continued surveys to estimate trends in abundance was noted. The work described in SC/68D/CMP/17 adds to previous research presented at SC and addresses partially the Committee's previous recommendations specifically monitoring abundance, trends, and bycatch. The estimate of abundance provided in SC/68D/CMP/17 should be reviewed by ASI intersessionally as part of the Committee's effort to conclude the review of the status of the franciscana and to update the franciscana CMP actions.

Last year, the plan to conduct a joint Uruguay-Brazil aerial survey in Uruguay waters was discussed. A survey, partly funded by the SC, to estimate abundance of franciscana in Uruguay could not be carried out, in part due to COVID-19. In discussion, it was noted that a special permit is required for the aircraft from Brazil to survey Uruguayan waters and that efforts are being made to expedite this process by the governments of Brazil, Uruguay and the CMP coordinator.

An information dissemination campaign "Our Neighbour the Franciscana" has been one of the priority actions identified from the inception of the CMP. Various multi-lingual (English, Portuguese and Spanish) outreach materials (*e.g.,* infographics, videos, and posters) were produced for use by the three range countries increasing the campaign's reach and impact. The Committee was shown a sample of an infographic and praised the efforts and products available to visually articulate the franciscana's conservation challenges in multiple languages. These materials will be uploaded to the IWC website. The campaign is expected to launch during the 68th Meeting of the IWC.

A book on the franciscana, edited by Paulo Simões-Lopes and Marta Cremer, will be published in the coming months. The book's 19 chapters compile information on the ecology and conservation of the species in Argentina, Brazil and Uruguay. This information will be useful for future CMP updates because several of the actions identified by the IWC have been addressed in this book. In addition, to commemorate the 75th anniversary of the IWC, an article on the franciscana CMP was prepared for publication in the ECO magazine (Environment, Coastal & Offshore magazine, which showcases "international ocean science, innovation, and exploration" stories).

A workshop is planned for June 2022 in Curitiba, Brazil, to discuss the population structure and abundance estimation of franciscana. Once the species review is completed, the actions identified in the CMP, which has been in place for six years, will be updated. The IWC, FUNBIO, and ICMBio all contribute financially to it.

Attention: SC, CC

The Committee:

(1) **agrees** *that the review of the franciscana continue during the intersessional period and updates be presented at the next meeting,*

(2) ***welcomes*** *updates from the Curitiba Workshop report at the next meeting ,*

(3) applauds progress made under the information dissemination campaign "Our Neighbour the Franciscana", and welcomes any updates at the next meeting; and

(4) **recommends** *that the proposed aerial survey off Uruguay be completed prior to the next meeting, if possible, and respectfully requests the government of Uruguay to issue a permit for the Brazilian aircraft to conduct the survey.*

9.1.5 South American river dolphins (CMP, SM)

The Governments of Colombia, Brazil, Peru and Ecuador appointed Fernando Trujillo as coordinator of the South American river dolphin CMP. The Committee received information from the South American River Dolphin Initiative (SARDI) on *Inia spp.* and *Sotalia fluviatilis* from eighteen scientific expeditions conducted last year in Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela. The surveys focused on assessing habitat use and threats, and on estimating river dolphin abundance. Information and progress on actions proposed by the CMP was consolidated from all participating countries. The experimental use of pingers to reduce dolphin bycatch, satellite tagging of eight *Inia spp.* dolphins, and contaminant studies assessing levels of mercury in these cetaceans were reported as updates on progress during SC68D. Additionally, a work plan has been developed for the period 2022-2023, which focuses on consolidating scientific information relevant to river dolphins to meet the goals proposed in the CMP. As part of this process and to address recommendations from SC68C, efforts are underway to elucidate how many species, subspecies or subpopulations exist to inform and track progress on conservation priorities. It will also identify national and regional policies that allow linking the CMP with concurrent goals of deforestation control and tackling challenges related to climate change, fisheries management, hydro-energy development, mining and prohibition of mercury use.

The Committee was informed that the piracatinga fishing ban in Brazil will be lifted in June of 2022. This was a

topic of concern for the Committee because of the intentional killing of river dolphins for use as bait in the piractinga fisheries. The ban initially was implemented for five years (2015- 2020), and since then working groups were established to renew the ban annually in 2020-2021 and 2021-2022. The Committee recognises the importance of this ban for the conservation of Amazon river dolphins and recommended it be extended.

Attention: SC, CC

The Committee **recognises** *the range States revisions following the Committee's recommendations from SC68B and SC/68C for the CMP for South American river dolphins and* **commends** *the range States for the appointment of a full-time coordinator.*
The Committee:

(1) **encourages** *the range states to work with the IWC's Bycatch Mitigation Initiative (BMI; SC68D, IWC Item 12.1) since bycatch was identified as a key threat for river dolphins;*
(2) ***recognises*** *the importance of the piracatinga fishing ban to the recovery of the Amazon River dolphin populations and strongly* ***recommends*** *a renewal of the piracatinga fishing ban for more than one year, and*
(3) ***encourages*** *the proponents to explore potential funding opportunities within the IWC (e.g. Voluntary Fund for Conservation[19], joint Conservation/Small Cetacean Research Fund2[20], through the BMI) to help support the SARDI and the CMP development.*

9.2 Progress with identified priorities

9.2.1 Humpback whales in the northern Indian Ocean including the Arabian Sea (CMP, SH)

SC/68D/CMP/04Rev1 provides an overview of activities undertaken by the Arabian Sea Whale Network (ASWN), collectively at a regional level and by ASWN members at national and local levels. Formed in 2015, the ASWN is an informal collaboration of researchers and conservation bodies interested in the conservation of whale populations throughout the Northern Indian Ocean[21]. The Arabian Sea humpback whale acts as a flagship species, but members collaborate on all aspects of cetacean research and conservation. This progress report includes updates on regional-level collaborative activities undertaken between May 2021 and April 2022, as well as updates on project- or national-level activities undertaken by partners in the region. Regional-level activities have been limited due to the lack of funding for coordination, as well as world events that demand more immediate attention. In particular, there has been little progress on the formal establishment of a joint CMS-IWC Conservation Management Plan. However, ASWN members are in regular communication and provide continued technical support to each other through an email forum. A webinar held in July 2021, focused on the regional Flukebook platform for ASWN members, and one working group is focusing on the development of region-specific resources for stranding response, while another planned working group will focus on regional support for passive acoustic research.

Summaries of national-level activities in Oman, Pakistan, India, Sri Lanka, the Maldives, Iran, the United Arab Emirates and Kuwait provide insight into ASWN members' efforts to advance cetacean research and conservation throughout the ASHW range. In addition to the work from Oman and Pakistan reported in SC/68D/CMP/03 and SC/68D/CMP/11, there is ongoing acoustic research in India, where acoustic recorders have been deployed on the Arabian Sea coast and analysis of collected data is currently underway. In general, the national and project-level updates demonstrate a clear trend toward increased capacity for systematic cetacean research in most ASWN member countries, with several peer-reviewed publications emerging from the region over the past year. The updates also demonstrate that many ASWN partners are applying knowledge gained from cetacean research to outreach, awareness raising, threat-mitigation and engagement with the relevant stakeholders responsible for conservation policy and management. These efforts will help to advance management and conservation throughout the region until such time as an effective regional conservation management plan can finally be implemented.

SC/68D/CMP/03 reviewed whale sightings in the northern Arabian Sea along the coast of Pakistan reported in 2021 from observers previously engaged in the observer programme for tuna gillnet operations. In 2012, WWF-Pakistan initiated an observer programme to monitor tuna gillnet operations in the coastal and offshore waters of Pakistan. In addition to collecting information about tuna and tuna-like species, observers were assigned to report observations of whales encountered during fishing operations. Funding for the programme expired in September 2019. However, some of the observers are still providing information on a voluntary basis, enabling WWF-Pakistan to document sightings of whales in the coastal and offshore waters of Pakistan, in the northern Arabian Sea. During 2021, four sightings of humpback whales, one sighting of a blue whale, one stranding of a Bryde's whale and 28

[19] **https://iwc.int/voluntary-fund-for-conservation**
[20] **https://iwc.int/sm_fund**
[21] **https://arabianseawhalenetwork.org/**

sightings of unidentified whales were reported. The number of whales reported during 2021 (34 reports) is higher than reported sightings from 2019 (26 reports) and 2020 (19 reports). These differences could be attributed to more active outreach among volunteer observers and/or a major shift in tuna gillnet vessels operating in coastal waters over the continental shelf during 2021, as compared to previous years, when most vessels were operating in deeper oceanic waters. Since the start of this program in 2016, 256 sightings of whales including 237 baleen whales have been reported from northern Arabian Sea. This also includes 83 confirmed sightings of humpback whales, presumed to be Arabian Sea humpback whales.

Document SC/68D/CMP/11 presented the updates on research and conservation activities in Oman for the 2021-2022 period, and their alignment with previous IWC recommendations and the CMP sub-committee agenda. Activities are motivated by the requirement for urgent action given the small population size (N=82, 95% CI 60-111), genetic distinctiveness and endangered status of ASHW's, as well as the evidence of increasing threats from maritime industries (Baldwin *et al.*, 2010; Convention on Migratory Species, 2017; Minton *et al.*, 2011a; Minton *et al.*, 2008). UAV and vessel based photographic methods were used to investigate body condition and conduct health assessment (partially funded by the IWC) of whales encountered over a 17-day period in November 2021. These surveys resulted in over 20 encounters with individual whales and the body condition metrics will contribute to interannual assessments. Results from previous studies (Minton *et al.*, 2022) and those in the publication process at the time of the SC68D meeting (Leslie *et al.*, In Prep.) demonstrate techniques that contribute to assessment of key ecological attributes for ASHWs, addressing important components of the CMS Concerted Action for ASWH.

SC/68D/CMP/11 also reported on IWC-funded field deployments of archival recorders and analysis of passive acoustic monitoring (PAM) data aimed at detecting ASHW and blue whale (*Balaenoptera musculus*) song off the coast of Oman, which continued in 2021-2022. An In-depth analysis of 10 years of ASHW song from archival and boat-based recordings between 2010 and 2020 is currently being finalised; results indicate consistency in song phrase lineages and a general lack of introduction of novel song material across the decade, strengthening the conclusion of isolation of ASHW from the Southern Hemisphere populations. Initial evaluation of the 2020 and 2021 archival data indicated extensive presence of Northwest Indian Ocean blue whale and intermittent periods of Central Indian Ocean blue whale song detected off Hasik, Hallaniyat Bay. Analysis has also been expanded to characterise and evaluate temporal variation of sperm whale codas from Oman acoustic data archives (Ashok *et al.*, 2022). Ship strike risk assessments derived from previous satellite telemetry studies have been used to engage authorities in Oman to address management mitigation measures for ASHWs and were also used to inform global priorities of threats to large whales on migratory pathways (Johnson *et al.*, 2022; Willson, 2021). Satellite-based, remote sensing risk assessment of artisanal fisheries for bycatch related work (funded by IWC SC in 2020) is still underway.

The authors of SC/68D/CMP/11 have also begun behaviour change experiments with artisanal fishing communities in a core ASHW habitat near Masirah Island, Oman to address lost and abandoned nets that are considered a threat to AHSWs (Sarrouf Willson *et al.*, 2021). Multi-taxa fisheries risk assessments and mitigation experiments are also planned, guided by expertise from previous studies in the Indian Ocean, including those from Pakistan bycatch reduction experiments (Hines *et al.*, 2020; Kiszka *et al.*, 2021; Verutes *et al.*, 2020). Awareness-raising materials published in the reporting period include the Marine Mammal Atlas of Oman (5OES and Environment Society of Oman, 2021) a whale and dolphin field guide produced by the Environment Authority, and distribution of whale and dolphin viewing guidelines for tour operators.

UAV-guided body condition surveys, visual health assessment and PAM deployment activities will continue in the 2022-2023 period and include field survey training exercises with NGOs, governments, and private entities (partially funded by the IWC). Funding has also been secured by the Environment Society of Oman to host an Oman-based national-level CMP workshop in 2022/2023. This will be supported by dedicated engagement with authorities and industry to evaluate shipping and fisheries threats and mitigation options.

Technical guidance is requested from the SC and IWC Secretariat to support CMP workshop activities and to evaluate options to address threats in areas of critical habitat. Additionally, financial support is requested from the IWC SC Research Fund for continuation of PAM studies. Proposed costs include the analysis of recordings from three sites where recorders are currently being deployed from May 2022 to April 2023 (partially funded by IWC in 2021) to document the occurrence of ASHW and blue whale song, and the continued deployment of recorders along an approximately 1,000km stretch of Oman coast during April 2023 to April 2024.

The committee welcomed the rationale presented by Willson to recommence satellite telemetry studies (tagging) of ASHW along the Arabian Sea coast of Oman to address temporal and sex biases evident in the existing dataset of 14 whales tagged between 2014 and 2017. It was proposed that outputs of this work would support updates to species distribution modelling and associated ship strike and bycatch risk assessment work that is currently under

discussion with government authorities. Tagging of ASHW in Oman was first proposed at SC65A with recommendations to limit tagging to 20% of the population, to engage experienced tagging experts and to await final review of a health assessment of proposed tagging instruments that was due at the time (IWC, 2013b; Robbins *et al.*, 2013). For future studies, the proponents requested the support of SC members to initiate a proposal review process as outlined in Andrews *et al.* (2019). It was agreed that an intersessional group, composed of ASHW experts, veterinarians and tagging practitioners would be convened by Willson, and that the review process would be completed by end of June 2022. This would enable sufficient time to mobilise for a tagging survey in November 2022.

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

The Committee **reiterates** *that the Arabian Sea humpback whales are priority candidates for a CMP and* **welcomes** *efforts to encourage range states to develop a joint CMS-IWC CMP, and to consider its benefits for other whale populations, such as Northern Indian Ocean blue whales, which may be similarly distinct and threatened. It commends the efforts of scientists within the region and especially the Arabian Sea Whale Network for developing a strong scientific basis to guide the development of a CMP and recommends continuation of those studies. The Committee commends members of the Arabian Sea Whale Network for having achieved important conservation work despite the challenges of the pandemic over the past year. The Committee* **encourages** *continued regional collaboration among ASWN members, particularly the work proposed being conducted by the stranding working group and the acoustics working group.*

Furthermore, the Committee:

(1) **recommends** *that ASWN members and relevant ASHW range states, undertake and support the work proposed in the CMS Concerted Action, especially those actions needed to address knowledge gaps and assess the Key Ecological Attributes (KEAs), and apply them to practical management measures;*

(2) **recommends** *that the work of the crew-based observer programme in Pakistan (SC/68D/CMP/03) continue, and where possible, be replicated throughout the region, especially in areas where systematic cetacean surveys are not feasible;*

(3) **recommends** *that: (a) once the Pakistan gillnet fleet has been mapped and characterised, the map(s) be overlain with models of ASHW distribution based on WWF Pakistan crew-based observer data (e.g. SC/68D/CMP/03 and similar papers from previous years) and models derived from satellite tracking of whales off the coast of Oman (e.g., SC/67A/CMP/15) to determine potentially high-risk areas for fishery interactions; (b) where and if species-specific bycatch data from WWF-Pakistan and other Arabian Sea fishing nations allow, humpback whale bycatch rates be calculated; and (c) this approach be applied to other Arabian Sea gillnet fisheries, including those in the Gulf of Aden and off Somalia, to generate coarse bycatch estimates where data allow, especially for humpback whales.*

(4) **encourages***: (a) that research include continuous and simultaneous passive acoustic monitoring in identified ASHW habitat in both the western Arabian Sea (different parts of Oman's waters, Socotra and the Gulf of Aden) and eastern Arabian Sea (Pakistan, India, Sri Lanka and the Maldives) to improve current understanding the population's spatiotemporal distribution and potential connectivity across a larger area of suspected range, as well as to understand if range or distribution shifts begin to emerge as a result of climate change and other threats (noting that this technique also yields valuable data on other whale species, e.g. blue whales); (b) that research include the use of UAVs to assess body condition, and that body condition indices be used together with other metrics to assess seasonal and annual variation and to evaluate health, scarring, and foraging success (e.g. Ramp et al., 2021); (c) that future research include further satellite telemetry studies and methods to assess (model) whale distribution in relation to shipping traffic, oceanographic variables and data on fisheries and likely prey species, to better understand the drivers of distribution for ASHW, as well as the risk associated with anthropogenic threats; (d) that revised abundance and trend estimates are completed with the most updated available mark-recapture data; and (e) that genetic analyses to provide clarity on the taxonomic status of ASHW be completed;*

(5) **recommends** *that continued efforts are made to simultaneously collect humpback whale song samples from the western and eastern Arabian Sea to allow further analysis of (a) how Arabian Sea humpback whales change their songs over time on both sides of the Arabian Sea; and (b) yearly variation in song similarity between the subregions, and what that might imply about long-term trends in exchange of animals across the Arabian Sea;*

(6) **encourages** *the opportunistic collection of sightings data, acoustic recordings, and genetic samples and/or the implementation of cetacean surveys in regions in the suspected ASHW range where little or no current data is available on distribution or abundance. These areas include (from West to East) the Horn of Africa and the Gulf of Aden, the Arabian/Persian Gulf, the Arabian Sea coast of Iran, Arabian Gulf and the Arabian Sea coasts of Pakistan and India; and*

(7) applauds *the planned stakeholder engagement workshop being held in Oman to discuss ASHW conservation and the potential benefits of a CMP, and also* **encourages** *scientists in the region to use the results of research conducted to date to develop resources and conduct activities that enhance capacity and support for the design and implementation of national-level management measures as well as a regional CMP. These resources and activities should take into account the economic and social costs and benefits of management options in relation to intensification of fisheries, shipping and coastal development in the region.*

9.2.2 Central American humpback whales (CMP)

A CMP workshop, organised by Mexico with representation from eight countries (US, Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama), was held virtually on 6-7 April 2021. The objective of the workshop was the preparation of the IWC Template nomination for the endangered Central America humpback whale (CAHW) population. The CAHW CMP nomination was presented to the Committee in Government of Costa Rica *et al.* (2021). The main objective of the CMP is to conserve the CAHW population and its habitat through collaborative regional actions to reduce anthropogenic threats throughout its range. Additional objectives include improving habitat connectivity and conservation and improving knowledge about population size, trends, movement patterns, and habitat use of CAHWs. There was broad support for the comprehensive information included and the nomination of the CAHW CMP. In addition, IA is continuing their work on an assessment of all North Pacific humpback whales, including CAHW.

The CMP will include the recommendations made during SC68C and SC68D along with comments made by the participating governments. After revision the CMP will be submitted to the Conservation Committee´s meeting in October 2022 for endorsement.

A third workshop was planned for March 2022 at La Paz, Mexico with the objective of reviewing and updating available information on the population biology of CAHWs throughout its range. Considering the: 1) important research effort dedicated during the winter season in Central America and Mexico (mainly supported by the Project SPLASH 2 from NOAA); and 2) travel restrictions in some countries within the region due to the COVID-19 pandemic, the workshop was postponed until October 2022 in the same venue (La Paz) to discuss the biological aspects of this stock.

Attention: SC, CC, CG

At SC68B and SC68D, the Committee **reiterated** *the recommendation that the Central American humpback whale population be treated as a '***priority population'** *for the purpose of the CMP development process. Therefore, the Committee* **recommends***the continuation and increased collaboration of the Range States and continues to* **recommend** *its suitability for endorsement. The Committee also* **recommends** *that the revised CMP be presented at the next meeting.*

9.2.3 *Mediterranean sperm whales (CMP)*

Mediterranean sperm whales are considered as 'Endangered' under the IUCN Red List. The IWC Scientific Committee has recommended in 2020 and 2021 that Mediterranean sperm whales be treated as a 'priority population' for the purpose of the CMP development process. In addition to ship strikes, anthropogenic noise, and bycatch, it has been noted that sperm whales may be also particularly vulnerable to marine litter. The range states include Albania; Algeria; Cyprus; Egypt; France; Greece; Italy; Libya; Malta; Monaco; Morocco; Spain; Tunisia; Turkey. Progress has been all but impossible due to COVID-19. In discussion it was noted that the sperm whale CMP development is about to start its drafting stage but after the November 2022, Meeting of the Parties (MOP), additional effort/progress will be made.

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. The Committee* **reiterates** *the recommendation from SC68C (SC2149) 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 - and other Mediterranean species (CMP)

In accordance with ACCOBAMS Resolution 6.2.1, the ACCOBAMS Scientific Committee has devoted significant effort during the past triennium (2020-2022) to develop draft CMPs for Mediterranean fin whales, Risso's dolphins, common dolphins and bottlenose dolphins. Despite delays due to COVID-19, the drafts have been completed from

the perspective of the Scientific Committee at a workshop in March 2022 (bottlenose and common dolphins) and in December 2019 (Risso's dolphins and fin whales).

In discussion it was noted that ACCOBAMS currently recognises four CMPs. A draft resolution is in place to move the CMP development process forward and provide support (and hopefully funding) to organise two stakeholder workshops. The plan is to start organising and planning two stakeholder workshops in 2023 for fin and Risso's dolphin CMP development.

The ACCOBAMS Scientific Committee has highlighted the importance of full-time CMP coordinators acting under the guidance of CMP Steering Groups that represent key stakeholders. The need for stakeholder workshops to finalise each CMP is an essential part of the process, since reaching agreement amongst the primary stakeholders is key to the effectiveness of CMPs and the successful implementation of the actions.

The ACCOBAMS Scientific Committee recommends that Parties support the holding of such workshops, if possible before the 2022 Meeting of Parties (MoP8) or soon after. Participation should include relevant IGOs, especially the IWC who developed the CMP approach, local and national authorities, industry and NGOs.

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 recommendation of last year (SC2150) 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 members and ACCOBAMS parties to work towards finalising a draft CMP for fin whales for presentation at the next meeting.*

The ACCOBAMS Scientific Committee recognises that whilst ideally there would be CMPs for all species and coherent units of the ACCOBAMS regions, priorities must be set. The Committee draws attention to recent IUCN Red List assessments in this context. Based upon this, the Committee recommends that the Parties consider that the species/populations listed below would benefit from CMPs for the upcoming triennium (2023-2025) and recommends that the relevant range states consider proposing them through ACCOBAMS for the CMP process. The inclusion of additional species aligns with an earlier IWC recommendation.

Mediterranean Cuvier's beaked whales
Mediterranean Cuvier's beaked whales are considered 'Vulnerable' under the IUCN Red List. Threats include anthropogenic noise, habitat degradation, chemical pollution, bycatch and ingestion of marine litter. The range states include Albania, Algeria, Croatia, Cyprus, France, Greece, Israel, Italy, Monaco, Montenegro, Morocco, Spain, and Turkey.

Black Sea cetaceans
Harbour porpoises and bottlenose dolphins in the Black Sea are listed as 'Endangered' by the IUCN Red List, and common dolphins are considered 'Vulnerable'. The Black Sea Commission (Sub-Regional Coordination Unit) recommended in 2021 to develop the updated Conservation Plan for Black Sea Cetaceans as separate Conservation Plans for each of the three species. Their threats include bycatch (particularly for the harbour porpoise), habitat degradation (including prey depletion), illegal takes of bottlenose dolphin from the wild to captivity and consequences of bio-invasions by alien species. The range states include Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine.

9.3 Budget requests
Budget requests are discussed under Item 23.

9.4 Biennial workplan
The workplan is detailed in Table 17.

Table 17

Workplan for CMP

Item	Intersessional	Next meeting
Southeast Pacific southern right whale	Continue Passive acoustic monitoring; and scientific workshop July 2022 and coordination meeting to review CMP-August 2022	Review workshop reports & progress on scientific aspects of CMP
Southwest Atlantic southern right whale	Workshop June 2022 to review and update CMP actions	Review intersessional workshop report and new information

Gray whale	Scientific workshop in La Jolla or Seattle	Review progress on scientific aspects of CMP
Franciscana	Workshop June 2022 on continue review of the status of the species, conduct aerial surveys in Uruguay	Review 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	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 the development process	Review new information
South American river dolphins	Continue work on CMP	Review new material for CMP
Central American humpback whale	Workshop on population, in La Paz, Mexico, October 2022	Review revised CMP proposal

10. STOCK DEFINITION AND DNA TESTING (SD-DNA)

During the meeting, the Stock Definition and DNA Testing Working Group received voluntarily submitted information on the DNA registers maintained by Iceland and Japan (item 10.1.1); provided advice on stock structure to other sub-committees (item 10.1.2), discussed updating and supplementing the genetic data quality and analysis guidelines (item 10.2), considered recommendations to avoid the depletion of tissue samples in existing collections (item 10.3), and discussed whether newly proposed terminology for describing the stock structure of baleen whales might be useful to the Committee's work (item 10.4).

10.1 DNA Testing and advice on stock structure to other groups as required

10.1.1 DNA registers

The Committee received voluntary updates of the DNA registers from Iceland and Japan that cover the period up to and including 2021. Details are given in Annex O. Almost all samples in both registers have been analysed for mitochondrial DNA (mtDNA) and a standard set of microsatellites.

Representatives of Iceland and Norway submitted a statement reasserting the position of the Governments of Iceland, Norway and Japan on DNA registers (see Annex O).

Attention: CG-A
The Committee **thanks** Japan and Iceland for providing updates to their DNA registers using the standard format agreed in 2011 and providing the detailed information contained in their DNA registers. The Committee looks forward to receiving the voluntary update from Norway in 2023.

10.1.2 Providing advice on stock structure to other groups

The SD-DNA Working Group has been tasked with reviewing 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 data quality and genetic analysis guidelines (see 10.2).

10.1.2.1 NORTH PACIFIC GRAY WHALES

Two stock structure hypotheses (4a and 7a in Fig. 7 below with additional details in (4a and 7a in Fig. 7 below with additional details in IWC, 2022, Annex G) are currently considered high priority for inclusion in the modelling framework used to evaluate the status of North Pacific gray whales. These result from the Rangewide Workshops on the Population Structure and Status of Gray Whales in the North Pacific that were held between 2014-2018 (IWC, 2018b) as well as subsequent discussion by the Committee (IWC, 2019f; 2021c; 2022).

In Hypothesis 4a, two breeding stocks of gray whales exist: an eastern breeding stock (EBS) that consists of the northern feeding group (NFG) and Pacific Coast feeding group (PCFG), both of which overwinter in the lagoons and coastal waters of Mexico; and a second unnamed breeding stock that consists of the western feeding group (WFG) of whales, which also overwinter off Mexico. Under this hypothesis, the southern Kamchatka and northern Kuril Islands feeding area (SKNK) is used by both WFG and NFG whales.

In Hypothesis 7a, a third breeding stock (the Western Breeding Stock, WBS) exists that includes some whales feeding in the western North Pacific feeding areas (including SKNK, which is also used by the WFG and NFG whales) that migrate to the waters off Vietnam and the South China Sea (VSC). Additional hypotheses (detailed in IWC, 2022, Annex G) are included with medium priority and have been considered as sensitivity tests.

As part of the Committee's discussion on these gray whale stock structure hypotheses, an intersessional correspondence group (ICG) was formed at SC68B to re-evaluate the plausibility of all hypotheses under consideration and to consider issues relating to the terminology being used in discussions of gray whale stock structure (IWC, 2020b). During SC68C the Committee received a report of this ICG but did not have time to consider some of the issues raised. Thus, the Committee considered these additional issues during SC68D.

One of the issues flagged by the ICG relates to how the WFG is defined in the stock structure hypotheses versus how it is implemented in the modelling framework. The WFG is defined as including the whales that feed off Sakhalin Island (SI), Russia, according to photo-ID data. Based on this definition, under some hypotheses (e.g., Hypothesis 7a), the WFG could include members of two different breeding stocks (the unnamed breeding stock of whales that migrate between feeding areas in the western North Pacific (WNP) and wintering areas off Mexico and the WBS). However, in the stock structure diagrams and mixing matrices that inform the modelling framework, the WFG includes only those whales that migrate between the western North Pacific feeding areas and the Mexico wintering area (i.e., only a single breeding stock).

It was suggested that replacing the feeding group terminology with the newly proposed migratory herd terminology (see item 10.4 below) could be helpful. This would not change the breeding stock terminology, as the breeding stocks would then be defined by which migratory herds they include. While the results of the modelling effort have primarily been reported by area, the modelling framework that currently exists is able to provide output by migratory herd and/or breeding stock(s). In addition, given that within the modelling framework the WFG includes only those whales migrating between WNP feeding areas and the Mexican wintering ground, using the migratory herd terminology would not change the interpretation of the modelling outcomes that were considered under the Rangewide Review. The Committee agrees that this should be discussed further by the Intersessional Correspondence Group.

The report of the ICG also discussed whether additional stock structure hypotheses should be considered under the modelling framework. Cooke (2018) estimated the abundance of the WBS and the WFG under various stock structure hypotheses, noting that none of the hypotheses under consideration include the possibility that all whales seen off Kamchatka belong to the WFG (i.e., in all cases NFG whales also fed off Kamchatka). Thus, Cooke (2018) put forward two hypotheses to account for this possibility. In the first (Hypothesis 8 in Cooke, 2018), all of the whales that feed off SI and SKNK are part of the WFG and form a single breeding stock. Cooke (2018) does not explicitly specify what the migratory destination of this breeding stock is, and consequently this hypothesis could be modelled either as a variant of hypothesis 4a, where all WFG whales migrate to Mexico; and/or as a variant of hypothesis 6b, where the whales feeding off SI and SKNK may use either of the two wintering areas (showing no fidelity to either). If modelled as a variant of 6b, this hypothesis would seem equivalent to the way that western gray whales are defined under the IUCN assessment of western gray whales and in the joint IWC-IUCN CMP, where 'western' gray whales are considered to be gray whales that spend all or part of their lives in the western North Pacific – the IUCN/CMP approach considers the animals that feed off Sakhalin as demographically independent but notes that the proportions of animals that migrate to the west or to the eastern North Pacific are unknown although there is some evidence to suggest that the majority migrate at least some of the time to Mexico.

In the second hypothesis put forward by Cooke (2018) (hypothesis 9), a WBS exists that overwinter off VSC and feeds off SI and SKNK, where they overlap with whales that are part of the WFG that overwinters off Mexico. This hypothesis could be modelled as a variant of hypothesis 7a, which differs from the original hypotheses only in that no NFG whales feed off Kamchatka.

The Committee noted that with respect to the parameterisation of the modelling framework, these new hypotheses would differ from those currently under consideration primarily with respect to an increase in the abundance of the WFG given that NFG whales were no longer included in abundance estimates for the WFG. In referring to Table 5 of Cooke (2018), which provides estimates of abundance of the WFG and the WBS by stock structure hypothesis, the increase in abundance is seen only in the WFG whales (the WBS estimate is the same for both hypothesis 7a, which is denoted as 5a in Cooke 2018, and hypothesis 9), which in 2015 increases from 200 (±6SD) under hypothesis 5a (denoted as hypothesis 3a in Cooke 2018) to 287 (±12SD) under the Cooke hypothesis 8 and from 132 (±14SD) under hypothesis 7a (denoted as hypothesis 5a in Cooke 2018) to 218 (±19SD) under Cooke hypothesis 9. Although the population dynamics are expected to be adequately captured under the stock hypotheses

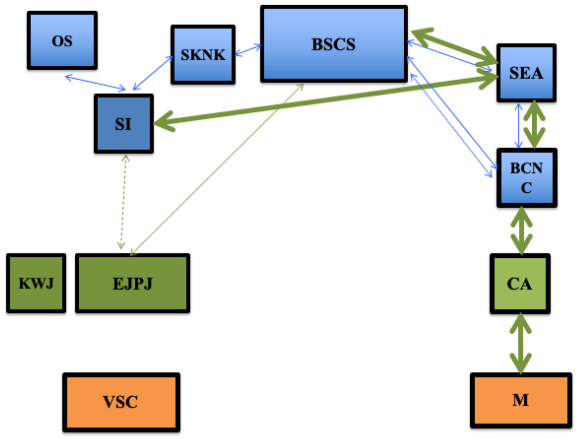
currently included in the modelling framework, the Committee noted that additional testing would be needed to confirm that incorporating the new hypotheses would not change any of the outcomes.

Attention: SC

In considering the hypotheses used to describe the stock structure of North Pacific gray whales within the modelling framework used in the Rangewide Review of the Status and Population Structure of Gray Whales (IWC, 2015g), the Committee ***agrees*** *that the intersessional correspondence group that was formed in 2020 will continue its work and will focus on:*

(1) evaluating the utility of the migratory herd terminology in descriptions of the gray whale stock structure hypotheses; and
(2) describing and creating mixing matrices for the new stock structure hypotheses put forward in Cooke (2018), for further consideration as sensitivity tests within the Rangewide Review.

a) Hypothesis 4a: All stocks



b) Hypothesis 7a: All stocks

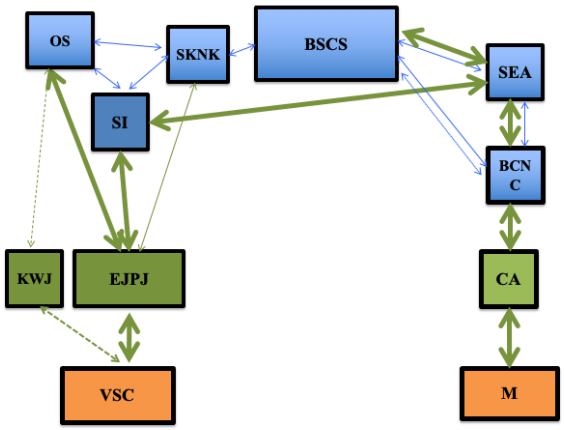


Fig. 7. Stock structure diagrams of the two hypotheses (4a and 7a) considered high priority for inclusion in the modelling framework used to evaluate the status of North Pacific gray whales. Sub-areas shown include Mexico (M); California (CA); British Columbia to northern California (BCNC); southeastern Alaska (SEA); northern Bering Sea and Chukchi Sea (BSCS); southern Kamchatka and northern Kurils (SKNK); Sakhalin Island, Russia (SI); areas of the Okhotsk Sea not otherwise specified (OS); eastern side of the Sea of Japan and the Pacific coast of Japan (EJPJ); Korea and the western side of Japan (KWJ); and Vietnam-South China Sea (VSC). Arrows denote movements of individuals between sub-areas, with thick solid lines indicating movements of a significant proportion of whales, solid thin lines indicating limited movements, and dashed thin lines indicating occasional movements of a small number of individuals. Blue arrows represent movements between feeding areas and green arrows represent migratory movements.

10.1.2.2 North Atlantic common minke whales

The Committee last discussed the stock structure of North Atlantic common minke whales in 2018, when the report of an intersessional workshop focused on the development of SLAs (Strike Limit Algorithms) for the Greenlandic hunt (IWC, 2019a) was reviewed. While four stock structure hypotheses were initially considered during this Workshop, two were determined to be inconsistent with the results of genetic analyses that were presented during the workshop (Tiedemann *et al.*, 2018). The remaining two hypotheses include the base case scenario where three breeding stocks (Eastern, Central, and Western) exist, two of which (Eastern and Western) are subdivided into two sub-stocks (Hypothesis I); and a second scenario where only the Eastern breeding stock is subdivided into two sub-stocks (Hypothesis II).

The Committee received an update (SC68D/SDDNA/04) on the analyses in Quintela *et al.* (2014) at SC68D. The updated analysis included 7,775 samples collected from five small management areas in the central and eastern North Atlantic between 2004 and 2020. Samples were genotyped at ten loci. Similar to previous results, significant temporal or spatial differentiation was not detected when samples were stratified a priori by small management area. Further, PCA and DAPC did not detect any clustering among the genotype data. Thus the updated results continue to support panmixia throughout these areas.

In discussion, the Committee noted that a strength of this analysis is the large number of samples that were analysed. However, additional samples are available, including some from West Greenland and areas not covered in the updated analysis, and are held by other research groups (e.g., Anderwald *et al.*, 2011; Tiedemann *et al.*, 2018). Inclusion of these samples in a range-wide comprehensive analysis would increase the power to detect subtle or cryptic stock structure should either exist. Genomic approaches could be used to generate datasets that would be straightforward to combine across labs. Such collaboration could be achieved most efficiently and cost-effectively by conducting whole genome resequencing on a representative subset of the available samples and then using these data to design an informative panel of SNP loci that could be genotyped on all available samples. Such a project is beyond the scope of what could be achieved prior to the current Implementation Review (IR) of North Atlantic common minke whales. However, it may be feasible to complete prior to the following IR, scheduled for six years' time.

The Committee noted that the results of the updated analysis in SC/68D/SDDNA/04 were very similar to those previously reviewed in Quintela *et al.* (2014) and thus were consistent with previous evaluation of the stock structure hypotheses. It was noted, however, that the data suggest a lack of subdivision within the eastern breeding stock. While hypothesis II includes a western breeding stock that is not further subdivided, both hypotheses (I and II) currently under consideration assume two sub-stocks of the eastern breeding stock. While this scenario would be more conservative when assessing potential depletion, the addition of a stock structure hypothesis incorporating a single eastern breeding stock may be worth additional consideration at the upcoming Workshop.

Attention: SC

*The Committee **welcomes** the new information regarding stock structure among North Atlantic common minke whales. After reviewing the results of the updated genetic analysis of a large number of samples collected in the eastern North Atlantic, the Committee **agrees** that the results are similar to those reviewed previously and thus do not require consideration of additional hypotheses in the upcoming IST Workshop that includes the next Implementation Review.*

To advance understanding of the stock structure of North Atlantic common minke whales prior to future assessments, noting that additional samples from other geographic areas (e.g., West Greenland) are available, the Committee:

(1) ***recommends** that genomic approaches be used to identify a panel of informative SNP loci, which would facilitate production of datasets that can be easily integrated across laboratories and over time; and*
(2) ***encourages** collaboration among sample holders in the design of such a panel and in efforts to provide an updated range-wide analysis of stock structure.*

10.1.2.3 SMALL CETACEAN STOCK STRUCTURE

The Committee formed two intersessional correspondence groups in 2020 that were focused on understanding stock structure among small dolphins inhabiting the Southwestern Atlantic (IWC, 2021c). One of the focal species is the franciscana (*Pontoporia blainvillei*), a small dolphin endemic to the Southwestern Atlantic classified as vulnerable by the IUCN due to fishing-related mortality at levels believed to be unsustainable (Zerbini *et al.*, 2017). The objectives of this intersessional correspondence group are to (1) summarise the data available from genetic and other (i.e., non-genetic) lines of evidence that could be used to infer population structure; (2) evaluate the level of support for each of the proposed subdivisions based on these combined data; and (3) provide advice on future work to address remaining questions. During a Workshop on the Review of the Status of the franciscana (IWC, 2021f) that was held in April 2021, genetic evidence compiled by the ICG was reviewed. The Workshop participants agreed that a review of other (non-genetic) lines of evidence was needed before drawing any conclusions about the newly proposed management units. Intersessionally, the ICG members drafted text summarising the data available from these non-genetic lines of evidence. This summary was not reviewed by the Committee during SC68D, but it will be reviewed as part of an upcoming workshop to be held in Curitiba, Brazil, in June 2022.

The second small cetacean species whose stock structure is being evaluated by an intersessional correspondence group is the Guiana dolphin (*Sotalia guianensis*), a small coastal delphinid that ranges from Nicaragua to southern Brazil (Flores & Da Silva 2009). This species is listed as Near Threatened by the IUCN (Secchi *et al.*, 2018) and faces anthropogenic threats throughout most of its distribution. In 2020, the Committee received a proposal to identify 12 management units within the Guiana dolphin's range (Cunha *et al.*, 2020). A review of the support for these proposed management units, including that outlined in Cunha *et al.* (2020) is being conducted through an Intersessional Correspondence Group (ICG) formed in 2020 (IWC, 2021c). The ICG's terms of reference are to review the genetic and other evidence relating to population structure in Sotalia guianensis and to provide advice on the proposed management unit delineations. Intersessionally, the ICG updated a list of references that may have implications for

understanding population structure in this species, but summaries of the relevant data have not yet been completed.

Attention: SC

*The Committee recognises the need to better understand the population structure of the franciscana and the Guiana dolphin, two species of dolphins that are found in the southwest Atlantic. For both species, the Committee **agrees** to continue its evaluation of the available genetic and other (e.g., stable isotopes, contaminants) evidence pertaining to population structure via intersessional correspondence groups (ICGs) in order to provide advice on proposed management unit delineations. In addition, the Committee looks forward to further evaluating the population structure of franciscana during a workshop to be held in June 2020 and to reviewing the report of the Workshop at the next SC meeting.*

10.1.2.4 SOUTHERN HEMISPHERE BLUE WHALES

The Committee discussed the population structure of non-Antarctic blue whales in the Southern Hemisphere, including a review of the movements of blue whales from the Chilean coast and the eastern Tropical Pacific based on photo-ID data (SC/68D/SH/10). Details of this discussion can be found under Item 8.2.1.2.

The Committee also discussed the population structure of Antarctic blue whales, including an update on the comparison of Antarctic blue whale calls from mid- and low-latitude regions, an evaluation of the fidelity of Antarctic blue whales to ocean basins based on analysis of Discovery mark and photo-ID recaptures (SC/68D/SH/09), and an analysis of historical Discovery mark data with Bayesian mark-recovery models (SC/68D/SH/13). Details of this discussion can be found under item 8.2.2.1.

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. Both documents are intended to be 'living documents' that are updated as analytical approaches and technologies evolve.

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 on the IWC website[22]. In past years, the Committee identified a need to update these guidelines to address issues related to the generation of data using Next Generation Sequencing approaches (e.g., Single Nucleotide Polymorphisms, Whole Genome Sequencing and Resequencing). The Committee agrees to continue such work intersessionally.

10.2.2 Updates to data analyses guidelines

Guidelines for genetic data analyses relevant to the management of cetacean species were published in the Journal of Cetacean Research and Management (Waples *et al.*, 2018). This document includes valuable information in support of genetic data collection and analysis that can help ensure clear interpretation and high quality. However, it is a substantial document and necessarily reflects the technology available at that time. Last year the Committee proposed that a relatively short 'bridge' document be generated that would (1) provide a checklist of key aspects of data quality and analysis that could aid interpretation of documents reviewed by the Committee, and (2) update aspects of the guidelines, particularly with respect to genomic methodologies and analysis. An intersessional correspondence group (ICG) was formed to discuss and generate this document (IWC, 2022).

Intersessionally, the ICG put together an outline of the methodologies that will need to be updated, particularly with reference to advances in genomic approaches. In discussion, the Committee identified additional topics for consideration in the update and potential strategies for increasing the visibility of both sets of guidelines in the future.

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) **agrees** to continue the intersessional correspondence group to review revised sections of the DNA data quality guidelines that apply to data generated from next generation sequencing platforms, including SNPs and whole genome sequencing;*

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

*(2) **agrees** to continue the work of the intersessional correspondence group to produce a short document containing a checklist of key aspects of the genetic data analysis guidelines in order to facilitate their use; and*

*(3) **agrees** to consider approaches to increase the visibility of both sets of guidelines as part of the terms of reference for both ICGs.*

10.3 Recommendations on the avoidance of sample depletion

This agenda item was established based on concerns about the depletion of tissue samples collected from Antarctic blue whales during the SOWER surveys, which were subject to requests from multiple researchers for their use in a variety of studies (IWC, 2019f). Since that time, discussion has primarily focused on providing advice on genomic approaches, such as Whole Genome Sequencing, that would maximise the value of the tissue used.

During SC68D, the Committee broadened the scope of these discussions to evaluate approaches to best maximise the value of collected tissue samples prior to their use in analyses. SC/68D/SDDNA/03 summarises best practices for the collection, preservation, curation and archiving of tissue samples for use in 'Omics studies of marine mammals. While 'gold standard' methods of preservation (e.g., cryopreservation) are highlighted, the authors also note the strengths and limitations of a wide range of sample preservation strategies, as some preservation methods are not logistically feasible in all situations. This paper provides a resource for scientists interested in exploring collaborative studies and preserving samples in a suitable manner for a broad spectrum of analyses.

The Committee noted that the Data Quality Guidelines (see 10.2.1 above), which deal primarily with the awareness, minimisation and control of DNA typing errors, do include a section on assessing sample quality prior to genetic analyses. However, they do not provide advice on 'best practices' for collecting and storing samples, which are key factors influencing sample quality.

The Committee discussed the value of storing samples in replicate – i.e., subsampling tissues so that each subsample is stored in more than one vial. This approach has a number of advantages, including (1) creating redundancy, such that if a tissue stored in one vial is compromised, a second tissue exists; (2) allowing for storage in different media and/or conditions (e.g., RNAlater, ethanol, ethanol + freezing), some of which may be more advantageous for one application versus another; and (3) minimising the number of freeze/thaw cycles that each subsample is exposed to, which may compromise tissue quality or sample data (as noted in SC/68D/SDDNA/03).

Attention: SC

*The Committee **welcomes** the new information summarising the best practices for the collection, preservation, curation and archiving of tissue samples for use in 'Omics studies of marine mammals. The Committee:*

*(1) **agrees** that this information represents a good resource for researchers planning sample collection efforts as well as for those storing tissue samples, and that a reference to the advice provided should be included in the DNA data quality guidelines (see 10.2.1);*

*(2) **encourages** sample collectors to consider subsampling tissue prior to archiving in long-term storage, with consideration given to maintaining redundant resources that have broad utility for a range of 'Omic and other (e.g., stable isotopes, contaminants) applications; and*

(3) ***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.*

10.4 Review terminology used for stock structure related terms used within the IWC

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, 2014a).

At SC68D, the Committee was apprised of terminology that has been proposed to describe units-to-conserve among migratory large whales. SC/68D/SDDNA/02 defines the term 'migratory whale herd' as including conspecific whales that migrate between the same wintering and feeding grounds, not as a single cohesive group but simply sharing the same destinations. Recruitment into migratory whale herds is based on maternally directed learning of the migratory route. Thus in cases where individuals show strong fidelity to both migratory destinations, dispersal between migratory whale herds may be low enough to render them demographically independent, suggesting that the migratory herd may be the appropriate unit for management over ecological time scales (as described in Waples and Gaggiotti, 2006). This terminology is particularly useful in species where individuals from different feeding grounds use the same wintering ground, or those from different wintering grounds use the same feeding area,

thereby limiting the ability to geographically stratify individuals based on either the feeding or wintering area alone. Of note, given that multiple migratory herds may share the same breeding ground, they are not presumed to be reproductively isolated. In these cases, recruitment through learned migratory behaviour from the mother will still result in demographic independence. SC/68D/SDDNA/02 describes how the terminology could be applied to humpback and gray whales, both of which are subject to assessment by the Committee.

The Committee noted that this concept is in effect being applied in the assessment of North Pacific humpback whales (see item 8.1.1). The hypotheses describing stock structure in gray whales (see item 10.1.2.1) also define units with reference to their feeding and wintering destinations. Thus modelling efforts are already converging on this concept, highlighting its utility to the Committee.

It was noted that one challenge in applying this concept is that identifying migratory herds requires that sufficient data has been collected on both the feeding and wintering areas that define each herd. In cases where there are few or no data from one of the migratory destinations (e.g., the Vietnam-South China Sea wintering ground used by the Western Breeding Stock of gray whales), assigning individuals to a migratory herd may be difficult. However, the advent of rapid image processing algorithms, such as those currently implemented in Happywhale (www.happywhale.com), have allowed data collected via citizen scientists to be integrated into understanding of connections between areas. As use of this or similar technology increases, defining migratory herds may become more broadly feasible.

Changes in the historical versus contemporary use of an area could also represent a challenge to applying the migratory herd concept. For example, a feeding area may have been used by two migratory herds historically, with one herd subject to greater depletion than the other while on unshared wintering areas or migratory routes. In such a case, allocation of catches may have varied greatly over time, but there are no direct data to assess that change. Comparison of historical and contemporary mtDNA, where available, might provide some insight into temporal changes in herd composition, but historical data are not available from most areas.

It was noted that the influence of cultural traditions in shaping genetic structure in migratory baleen whales has been discussed previously by the Committee (e.g., discussion of Carroll *et al.*, 2015 in IWC 2017 Annex I). The interaction of social learning and animal culture with processes important to conservation management of baleen whales has also been discussed as part of other platforms (e.g., the Convention on Migratory Species Expert Group on Culture and Social Complexity, see Brakes *et al.*, 2021). Consideration of this broader range of literature may be warranted in the future.

Attention: SC

*The Committee **welcomes** discussion of the how the migratory whale herd terminology could be useful in the work of the Scientific Committee. The Committee **agrees** that the intersessional correspondence 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 how the migratory whale herd terminology relates to existing terminology used in Committee discussions.*

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

No papers on new genetic approaches were received.

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.*

10.6 Annual Workplan for SD-DNA

Table 18

Workplan

Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting
10.1.2.1 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	Report and provide advice		

	preparation for the Range-wide Review of the Status and Population Structure of Gray Whales			
10.1.2.3 Franciscana population structure	Intersessional email group to evaluate stock structure in franciscana	Report and provide advice		
10.1.2.3 *Sotalia guianensis* population structure	Intersessional email group to evaluate stock structure in *Sotalia guianensis*	Report and provide advice		
10.2.1 DNA quality guidelines	Intersessional email group to review recent revisions to the DNA quality guidelines that pertain to data produced using next generation sequencing (NGS) approaches.	Report and finalise updated guidelines		
10.2.2 Analysis guidelines checklist	Intersessional email group to generate a short document providing a checklist of key aspects of the genetic data analysis guidelines and to identify aspects of these guidelines that may need updating, particularly in the context of genomic methodologies and analysis.	Report and provide advice		
10.3 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		
10.4 Terminology	Intersessional email group to continue discussions of the use of stock structure related terms within the SC	Report		

11. CETACEAN ABUNDANCE ESTIMATES AND STOCK STATUS (ASI)

The Standing Working Group on Abundance Estimates, Stock Status, and International Cruises (ASI) has evolved since its inception in 2016 and continues to evaluate how it can best serve the Committee. ASI describes its role as follows.

> ASI was established to provide consistent, rigorous reviews of abundance estimates submitted to the Committee. It was also instructed to provide a broad overview of the abundance and status of whale stocks for the Commission and the public. Finally, ASI offers advice on survey design, new technologies, data collection and analysis for abundance surveys coordinated by the IWC (e.g., POWER and SORP) and national research programmes. ASI provides an advisory service for other sub-groups of the Committee upon request by individual Convenors. Not all abundance estimates require review by ASI. Primarily, ASI will review estimates that need to be endorsed for a specific purpose such as: (i) inclusion in the IWC Table of Accepted Abundance Estimates, including those on the IWC website; (ii) use in an assessment, other mission-critical modelling, or with RMP/AWMP calculations; (iii) informing the Commission on the status of stocks/species; or (iv) use as the basis for providing management advice and Scientific Committee recommendations. However, there are circumstances where information on abundance can be used by the Committee's subgroups to progress their work without review by ASI.

ASI developed further guidance for Convenors of subgroups of the Committee who intend to submit abundance estimates for ASI review (item 11.3.5), which also serves to clarify ASI's role:

> Abundance estimates are submitted to ASI for review by Convenors. It is the responsibility of the Convenor to ensure that the estimates submitted cover geographical areas that are of sufficient size, appropriate location and surveyed during a suitable time period to be useful to the Scientific Committee in the context of the endorsement categories used by the Committee (see 11.3.1). Therefore, estimates that do not cover the full range of the population are acceptable in all categories. The request for review from the Convenor should specify the area to which the estimate(s) are intended to apply, and, if appropriate, the population(s) to which the estimate(s) pertain. The task of ASI is to review the estimates themselves, and not to consider the implications of those estimates which is the responsibility of the relevant sub-committees. Convenors may wish to request a review of estimates for smaller areas when this would improve the capacity for local management, e.g., of potential human-induced mortality, entanglement, or whale watching impacts.

11.1 Review of Abundance Estimates

ASI review of abundance estimates was greatly aided by reference to the report of the pre-meeting of the Abundance Steering Group (ASG) (Annex E), which is referred to hereafter as the ASG Report. For each abundance estimate reviewed, the ASG Report contains a summary of the paper, a list of concerns and comments from independent reviewers, and the ASG's discussion and recommendation about the paper. Decisions in the ASG Report are considered to be recommendations to ASI.

The Committee agrees that all papers endorsed below should be assigned an Evaluation Extent of 1 (estimate was considered in detail by the sub-committee) in the IWC Table of Accepted Abundance Estimates, except for Cooke and Jackson (2017), which should be given an Evaluation Extent of 4 (estimate was partially considered by the sub-committee and a new method was used). The Evaluation Extent metric is discussed further by IWC (2014b).

The classification system used by the Committee to categorise abundance estimates is explained in item 11.3.1. The Committee noted that although the categories have numeric labels (and one is 'Not Suitable'), they are not intended to rank the scientific quality or importance of studies. These categories are used only to identify how estimates can be used most appropriately by the Committee and its subgroups since many of the studies reviewed were not designed explicitly to inform the tasks undertaken by the Committee. Section 3 of the ASG Report lists several examples illustrating how studies yielding estimates with diverse category assignments have all been very useful in the appropriate contexts and represent important scientific advancements. All estimates accepted by the Committee are included in the Table of Accepted Abundance estimates.

11.1.1 Bering-Chukchi-Beaufort Seas bowhead whales

SC/68D/ASI/01 provides an abundance estimate for Bering-Chukchi-Beaufort Seas (BCB) bowhead whales based on aerial line transect survey data collected in the Beaufort Sea and the Amundsen Gulf during August 2019 and analysed with a density surface model. Estimates of bowhead whale abundance by activity state, fully corrected for availability and perception bias, were derived using a hierarchical generalised additive model, with full variance propagation from the detection functions to the spatial model.

The Committee discussed the number of bowhead whales that might have been outside of the covered area at the time of the survey, which represented a source of downward bias for the abundance estimate, and how this compared to the number of whales missed by the spring ice-based surveys conducted near Utqiaġvik (e.g., Givens *et al.*, 2021). Neither survey encompasses all the whales, both surveys miss a small number of whales that occasionally migrate along Chukotka, and each survey likely includes some whales that are missed by the other survey. It is unclear which survey includes a greater percentage of the overall population. Further discussion pertained to the potential use of satellite telemetry data to estimate this bias and derive a correction factor. Large interannual variability in the distribution of satellite-tagged whales implies that telemetry data in a given year might not be appropriate to correct for another year. However, the data accumulated by the North Slope Borough over several decades could help improve the estimation of a correction factor and quantify the corresponding uncertainty.

The Committee agrees that the 2019 abundance estimate of 17,175 (CV=0.237, 95% CI 10,793-27,330) should be endorsed as Category 1A. It noted that this means there are two entirely independent endorsed Category 1A estimates of 2019 abundance for this stock, a situation discussed in item 11.7.

11.1.2 North Atlantic common minke whales

Solvang *et al.* (2021) presented abundance estimates of common minke whales in the northeast Atlantic based on Norwegian survey data collected over the period 2014-2019, the fourth survey cycle after a synoptic survey of the area in 1995. Cetaceans were searched for by naked eye from two independent platforms each manned by two observers following the protocols established for these surveys and also used in previous survey cycles. Estimation relied on a hazard probability model parameterised using a GLM approach (Skaug *et al.*, 2004), with variance estimation based on the delta method for combining uncertainty in the detection function and the encounter rate. The latter variance was estimated using a Markov modulated Poisson process (MMPP) model, as described by Skaug and Solvang (2015).

Additional information about the evolution of the variance estimator method used in the analyses was presented after queries were raised by the ASG. Initially, variance estimation was based on parametric bootstrap, which accounted for fine-scale spatial clustering (via a Neyman-Scott process), encounter rate variance, and uncertainty in the detection function (Skaug *et al.*, 2004). The variance estimation approach was then updated to replace the Neyman-Scott process with an MMPP, as described in Skaug and Solvang (2015); the update was reviewed and endorsed by the Committee in 2015 (item 6.2.3; IWC, 2016b). The Committee thanked the authors for this helpful information and encouraged that all components of the hazard probability approach, in addition to the new variance estimation methods, be published to document the Norwegian approach for surveying and estimating the abundance

of North Atlantic common minke whales.

In discussion, it was noted that abundance results will be included in the upcoming *Implementation Review* (*IR*) for North Atlantic minke whales, which is starting in 2022 (IWC, 2022, section 11.1.11). The authors clarified that the total abundance estimate for the combined *Medium Area* E, and the *Medium Area* E + *SMA* CM area, both contain additional variance, but that the abundance estimates for the single survey blocks do not contain additional variance. Table 5 of Solvang *et al.* (2021) provided the necessary details about which areas had and had not been surveyed in various years over the four survey cycles, in addition to the corresponding abundance and variance estimates. They also noted that their abundance estimates are independent through time, and whilst the additional variance is estimated using data from all years, the uncertainty in the additional variance is not included. The Committee noted that this information would aid the upcoming *IR*, and that the IST sub-committee may wish to re-examine the assumption of zero covariance over time.

The Committee considered the question of what to report in the IWC Table of Accepted Abundance Estimates when additional variance has been estimated. This is primarily important for the future use of the estimates (e.g., for an *IR*), but it might be helpful for that information to be tabled. The Committee agrees to resolve this question next year.

It was noted that for each time a *Medium Area* survey was completed, an updated additional variance estimate was produced, which encompassed the current and all previous surveys. The authors were asked if these updated additional variance estimates were applied to the older surveys. The authors confirmed that whilst additional variance estimates were updated each survey cycle, these were not applied retrospectively. The Committee considered that retrospective updating would be preferred (noting however that there was no need to alter *Small Management Area* estimates), but, at the very least, the IWC Table of Accepted Abundance Estimates should be annotated to indicate which survey cycle data were used to estimate additional variance for the estimates for the various periods. It was noted that a full retrospective update was unlikely to be feasible, given the complexity and long history of past analyses.

The Committee agrees that the 2014-2019 summer abundance estimate for common minke whales for *Medium Area* E + *Small Management Area* CM of 149,722 (CV = 0.15), the estimate for the CM *Small Management Area* of 37,020 (CV = 0.261) for the year 2016, and the estimate for the E *Medium Area* of 104,692 (CV = 0.17) covering the years 2014-2019, should be endorsed as Category 1A and included in the IWC Table of Accepted Abundance Estimates. The separate *Small Management Area* estimates (tables 2 and 5 of Solvang *et al.*, 2021) are also endorsed as Category 1A. The abundance estimate for *Medium Area* E and the total abundance estimate from *Medium Area* E + *Small Management Area* CM should be annotated to reflect that the CVs account for additional variance, which was estimated with survey data from all five survey cycles, beginning in 1995.

11.1.3 North Atlantic humpback whales

Leonard and Øien (2020; 2020b) report on shipboard line-transect surveys of the northeast Atlantic targeting common minke whales, but with abundance estimates presented for other species as well. ASI was requested to review only the humpback whale estimates.

The Committee agrees that humpback whale abundance estimates from Leonard and Øien (2020a) of 9,749 (CV=0.34, 95% CI: 4,947-19,210) for the 2002-2007 period, and 12,411 (CV=0.30, 95% CI: 6,847-22,497) for the 2008-2013 period, should be endorsed as Category 1A. The Committee also agreed that the humpback whale abundance estimate from Leonard and Øien (2020b) of 10,708 (CV=0.38, 95% CI: 4,906-23,370) for 2014-2018 should be endorsed as Category 1A. The three time periods were analysed separately (i.e. no pooling of data) and thus can be considered independent.

Wenzel *et al.* (2020) uses photographic sighting histories of humpback whales in the Cape Verde Islands to estimate population size, survival and recruitment using a Jolly-Seber mark-recapture model. The Committee agrees that while stock identification questions still need to be resolved and there was potential for bias in the estimates due to issues with detectability and spatial and temporal heterogeneity in sampling effort that cannot be accounted for by the Jolly-Seber model, this estimate represents a valuable improvement over previously available information. Further noting the suspected small size of this stock, the Committee agrees that the estimate of 272 (CV 0.037, 95% CI 253-292) should be endorsed as Category 1B.

Lawson and Gosselin (2018) describes a multi-species aerial survey of the Canadian waters of the Atlantic in Aug-Sept 2016. Abundance estimates were generated for two regions: 1) Newfoundland and Labrador, and 2) Gulf of St Lawrence, Scotian Shelf and Bay of Fundy.

The ASG had asked for clarification on whether an availability correction had been applied to both regions. The authors confirmed that the availability component had been inadvertently omitted for one region and provided an updated estimate. The Committee thanked the authors and noted that both estimates were now fully corrected and that questions raised by the ASG about the extent to which the surveyed areas corresponded to stock definitions were a matter for consideration by NH; therefore, the Committee amended the ASG recommendation.

The Committee agrees that the humpback whale abundance estimate of 10,471 (CV = 0.51) for Aug-Sept 2016 for the Newfoundland and Labrador region, and the abundance estimate of 1,854 (CV = 0.40) for the Gulf of St Lawrence, Scotian Shelf and Bay of Fundy region, should be endorsed as Category 1A. It also agreed that the entries in the Table of Accepted Abundance Estimates should include a note stating that the abundance estimates only apply to the survey regions and not the entire eastern Canadian feeding stock.

11.1.4 North Atlantic right whales

Pace *et al.* (2017) used a state-space mark-recapture model with Jolly-Seber assumptions about birth and immigration to estimate the abundance and trends of North Atlantic right whales. Pace (2021) extended the data time series to 2019 and used a newer version of the model to test the hypothesis that expected survival changed following shifts in distribution patterns beginning in 2011 (the 'regime model'). North Atlantic right whales' abundance increased from 1990 to 2011 and then declined through 2019.

The Committee reviewed the 'regime model' and noted that the retrospective analysis in Pace (2021) supported the conclusions about the regime shift, in the sense that the breakpoint in the data was adequately informed by independent information. The Committee also noted that the statistically significant drop in adult survival documented in Pace (2021) relates to total survival rates, which include both natural factors and impacts of anthropogenic effects. There is already clear evidence that ship strikes and entanglement are affecting the survival of North Atlantic right whales, but such a large change in adult survival rate should be brought to the attention of NH and HIM as it raises serious concern about the viability of the population. Finally, the Committee also commended the authors for including the code for the analysis, which facilitates review.

The Committee preferred the 'regime model' analysis of Pace (2021), which also included more recent years of data, so it amended the advice from the ASG. The Committee agrees that the medians of the posterior distributions and the 95% credibility intervals from Pace (2021) should be endorsed as Category 1A and included in the IWC Table of Accepted Abundance Estimates. These estimates are: 263 (95% CI 260-269) in 1990, 308 (307-311) in 2000, 476 (472-478) in 2010 and 368 (356-378) in 2019. The Committee noted that its abundance estimate category definitions did not require all endorsed small population estimates to be categorised as 1B, and agreed that the 1A categorisation is appropriate for the estimate provided by Pace (2021).

11.1.5 – Eastern North Pacific gray whales

Stewart and Weller (2021a) provides updated results from shore-based surveys of eastern North Pacific gray whales conducted regularly off central California between December and February during the gray whale southward migration, adding to a time series that began in 1967. A 23.7% decline in abundance from 2016 to 2020 coincides with the unusual mortality event that started in 2019.

The Committee noted that the 2019/20 estimate was the newest in a long time series of estimates from surveys using similar field methods and, often, consistent analyses. It noted that endorsement of such estimates might be more efficiently achieved by aggregating several years of such estimates for periodic review. This is discussed in item 11.3.5.

The Committee noted that covariance information is available for the first part of the time series of abundance estimates (Laake *et al.*, 2012) but not for recent years nor for the covariance between the Laake *et al.* (2012) and the Durban *et al.* (2015; Durban *et al.* (2017) series. The Committee requests that Katara inquire with the authors as to whether the missing covariance information was available to add to the IWC Table of Agreed Abundance Estimates

Concurring with the ASG, the Committee agrees that the 2019/20 abundance estimate of 20,580 (95% CI 18,700 – 22,870) should be endorsed as Category 1A.

Attention: S

*The Committee **requests** that Katara contact the authors of Laake et al. (2012) and Durban et al. (2015; Durban et al. (2017) to obtain as much covariance information as is available for the complete time series of abundance estimates for eastern North Pacific gray whales.*

11.1.6 North Pacific sei whales

Hakamada *et al.* (2009) report on abundance estimates for sei whales in the JARPNII offshore survey area (east of the Japanese coast, west of 170°E, north of 35°N, south of the Russian and US EEZs), based on ship-based multi-species sighting surveys. Due to the migration pattern of sei whales in the area suggested by the sighting survey data, abundance was estimated separately for the early and late seasons.

Similarly, Hakamada and Matsuoka (2016a) presented abundance estimates for sei whales in the JARPNII survey area for the years 2008, 2009, and 2011-2012. Again, the numbers of whales were estimated separately for the early and late seasons. These estimates represent only a part of the population considered.

These two documents were originally reviewed in the 2020-21 intersessional period, and considered by ASG and ASI at SC68C (item 11.1.6 of IWC (2022)). At that time, the Committee concluded that additional information was required before the estimates could be fully evaluated. Information provided by the authors was reassessed during the 2021-2022 intersessional period and was deemed to have clarified the methodological questions that had been raised, although some concerns remained.

Discussion by the Committee focused on Hakamada *et al.* (2009) as it was recognised that the two papers have similar methods but differ in some aspects (sample size, detection functions) and that separate evaluations should be made for each. It was also noted that the endorsement category for the estimates might depend on what level of spatial resolution might be required for their intended use (e.g., at the subdivision level or for combined strata).

One concern was that each estimate should be valid if treated separately for each combination of year and area, but when summing estimates for different years and/or areas, additional variance components need to be estimated. In theory, this additional variance can be assessed by using these small areas in a population model but potential biases due to the interaction between the survey design and migration patterns need to be clarified.

A second important concern was that sample sizes by year might be sufficient at broad scales, but they become small when divided by strata, at least in some of the subdivisions. The Committee noted that this uncertainty should be reflected in the coefficients of variation of each estimate and can be dealt with within the population models being used by the IA and IST sub-committees. Small sample size is not necessarily an impediment to endorsing the estimates at a fine level of granularity in the case that a survey yields a reliable estimate of the total abundance that is then statistically partitioned to smaller sub-areas where few or zero sightings were made. However, concerns remained as to whether that case applied here: it was unclear whether the data were analysed at a scale consistent with the survey design. Moreover, clarifications were sought on the methods and raw data, as concerns were raised about inconsistencies between the abundances and years presented in Hakamada *et al.* (2009) and those in the current models used by the IA sub-committee (item 8.1.1.2). The IA sub-committee has included an investigation of this issue in its workplan.

Notwithstanding these caveats, the ASG had initially proposed to recommend endorsing all of these estimates. However, additional concerns were raised in ASG discussions regarding the appropriateness of combining survey data from multiple years (e.g., 2002/2003, 2004/2005) when inter-annual variability is unknown but potentially high, particularly within relatively small areas (e.g., SA8 and SA9 had their subdivisions surveyed in different years), and considering that the survey vessels moved in the same or opposite direction as migrating whales in various time periods and regions. The Committee considered that it would be extremely important to resolve such concerns before making any endorsements.

The Committee thanked the authors and the reviewers for their detailed work. However, the possible confounding effects of these issues (combining estimates based on small sample sizes across areas and years with potential biases due to migration) prevented the Committee from endorsing these estimates. Recognising that the IA sub-committee is unlikely to require these endorsed estimates in the near term, the Committee established an intersessional correspondence group to investigate these issues (Table 2 item 11.1.6). Japanese scientists offered to be available for questions from this group. This group will examine each paper separately to better understand how the data were analysed, recommend at which level the estimates should be endorsed (and for which categories), and assess whether and how best to combine estimates across space and time, to endorse and include such estimates in the IWC Table of Accepted Abundance Estimates.

11.1.7 – North Pacific blue whales

Bradford *et al.* (2021) report on abundance estimates for 21 species of cetaceans in the U.S. Exclusive Economic Zone of the Hawaiian Islands (Hawaiian EEZ) using ship-based, line-transect surveys conducted in 2002, 2010, and 2017. Only one blue whale sighting was made on effort over 3 years, resulting in abundance estimates of 0, 137 (CV 1.12), and 0 in 2002, 2010, and 2017, respectively.

The ASG initially recommended endorsing all three estimates (as Category 3) and using the weighted average of the three estimates as the best estimate for the overall abundance of blue whales in the Hawaiian EEZ for the summer-autumn period. However, renewed attention from ASI was focused on the fact that the non-zero abundance estimate was based on a single on-effort sighting. The Committee believed that an estimate of total abundance over such a broad area requires more than one sighting to produce a reliable estimate. This situation differs from the case when a survey yields many sightings and a reliable estimate of total abundance, but this estimate is then statistically partitioned to smaller subareas where few or zero sightings were made. Indeed, zero estimates in small sub-areas have been endorsed before for use in RMP *Implementations* (e.g., for North Pacific minke whales). The Committee considered that while the survey methods and analysis of Bradford *et al.* (2021) were excellent, a single sighting was insufficient to provide reliable inference and that averaging the three estimates would introduce additional issues of concern while not resolving the primary underlying problem.

Therefore, the Committee concluded that Bradford *et al.* (2021) show that blue whales are very scarce in this region at this time of year, but agreed that the estimates should be classified as 'Not Suitable'.

Calambokidis and Barlow (2020) provide updated abundance estimates for blue and humpback whales on the US West Coast from mark-recapture estimates based on photo-IDs through 2018. ASI had been asked to consider only the blue whale estimates.

The Committee agrees that the abundance estimates for the entire time series should be endorsed as Category 1A, and that estimates of 1,422 (CV 0.093) for 1998, 1,397 (CV 0.075) for 2008, and 1,898 (CV 0.085) for 2018 be added to the IWC Table of Accepted Abundance Estimates. These years were chosen to reduce correlation among tabled estimates.

11.1.8 North Pacific humpback whales

The paper provided for ASI review under this agenda item was withdrawn by the requesting convenor intersessionally after notification that the authors intended to conduct a re-analysis.

11.1.9 – Southern Hemisphere non-Antarctic blue whales

Williams *et al.* (2011) present a model-based abundance estimate of Chilean blue whales using effort and sightings from a survey along the Chilean coastline undertaken by the SOWER programme in December 1997-January 1998. This project was first considered by SH in 2009 (item 3.1 of IWC (2010)), at which time only a preliminary estimate was available.

The Committee agrees that the December 1997-January 1998 abundance estimate of 303 (95% CI 176-625) for the survey area should be endorsed as Category 2. It is further agrees that when this estimate is included in the IWC Table of Accepted Abundance Estimates, a note should be added to indicate that the estimate is likely to be substantially negatively biased for this population of blue whales due to the boundaries of the survey area.

Bedrinana-Romano *et al.* (2018) describe a study of blue whale abundance and distribution in Chilean Northern Patagonia, within 25km of the coast. The Committee noted that the survey region was unlikely to cover the summer geographic extent for this stock. Concurring with the ASG, the Committee agrees that the 2009 summer abundance estimate of 356 (95% CRI 191-652) for blue whales in Chilean Northern Patagonia should be endorsed as Category 2.

Galletti Vernazzani *et al.* (2017) reported on photo-ID surveys conducted in the waters off Isla Grande de Chiloé, southern Chile from 2004 to 2012 and Isla Chañaral, northern Chile, in 2012. Preliminary results from Galletti Vernazzani *et al.* (2017) were presented to SH in 2016 (item 5.3.1 of IWC (2017f)). At that time, SH noted that, given that most of the data were collected from the Chiloé feeding ground, the abundance estimate should only apply to this region and not the broader Chilean blue whale population.

In determining the category for this estimate, the Committee noted that the authors summarised their work as follows: "nine years of data reveal that the Chiloé feeding ground is used by a small number of whales in the mid-hundreds which have high inter-annual fidelity to this region", which would seem to match the definition of a Category 3 estimate, in that it gives only a broad impression of the abundance. Therefore, the Committee agrees that the superpopulation abundance estimates of 762 (95%CI 638-933; left side) and 570 (95%CI 475-705; right side) for the survey area for the period 2004-2012 should be endorsed as Category 3.

Cooke and Jackson (2017) present a brief reanalysis of the 2006-2011 data described in Galletti Vernazzani *et al.* (2017) intended to account for the possibility of a transient/resident mixture in the population. This analysis was undertaken during the 2016 SC meeting (item 5.3.2 of IWC (2017f)). There were previous applications of this approach to southern right whales and gray whales in the western North Pacific, although IWC (2016c; item 4) and IWC (2017d; item 3.2.2) focus on modelling outputs. It was noted then, as now, that there was insufficient detail in the paper to

evaluate the modelling fully, although further information on the modelling may be available in the future. The Committee's familiarity with the approach is reassuring, although it falls short of full evaluation and endorsement. Therefore, the Committee concurred with the ASG and agrees that the abundance estimate of 450 (CV=0.17) for the survey area for the period 2006-2011 should be endorsed as Category 2, but that it should be given an Evaluation Extent of 4 (estimate was partially considered by the sub-committee and a new method was used). A review of the full details of the modelling is required before this abundance estimate might be used for management advice.

11.1.10 – Antarctic blue whales

Matsuoka and Hakamada (2014) describe abundance estimates for Antarctic blue whales south of 60°S for regions across the IWC Management Areas III-E+IV+V+VI-W (i.e., 35°E-145°W) using sighting data collected during 1995/96-2008/09 from Antarctic sighting surveys from the Japanese Whale Research Program under Special Permit in the Antarctic (JARPA) and JARPAII.

The results in Matsuoka and Hakamada (2014) were originally presented as part of the review of the JARPAII Special Permit Research Programme (item 6.3.1 of IWC (2015c)). Various abundance estimates arising from the 1995/96-2004/05 surveys (Matsuoka *et al.*, 2006) were reviewed in 2006, but the blue whale abundance estimates were not mentioned specifically (item 2.4.2 and 2.5.2 of IWC (2008a)). The Committee agrees that the abundance estimate of 300 (CV=0.308) for the 1995/96 summer season, for the combined IWC Management Areas III-E+IV+V+VI-W (i.e., 35°E-145°W, south of 60°S), and an abundance estimate of 1,223 (CV=0.345) for the IWC Management Areas III-E+IV+V+VI-W for the 2008/09 summer season, should be endorsed as Category 1A. The Committee also agrees that the abundance estimates for the individual IWC *Management Areas* and corresponding years (as given in Table 4a of the paper) should be categorised as 1A, but that those numbers are not included in the IWC Table of Accepted Abundance Estimates for the sake of simplicity. However, a footnote to the Table should be added to highlight the endorsement, and category, of those IWC *Management Area* abundance estimates. A further footnote should be added to highlight that the CVs for the combined *Management Area* abundances do not account for additional variance, which is information that would be required to weight time series of non-synoptic combined-area abundance estimates for assessment purposes.

Branch (2007) presented a study of Antarctic blue whale sightings during the three complete circumpolar surveys of IWC's IDCR/SOWER programme. The Committee agrees that the circumpolar (and south of 60°S) abundance estimates of 453 (CV=0.40) for CPI (1978/79-1983/84; mid-year 1981), 559 (CV=0.47) for CPII (1985/86-1990/91; mid-year 1988) and 2,280 (CV=0.36) for CPIII (1991/92-2003/04; mid-year 1998) should be endorsed as Category 1A. These estimates should also be footnoted with comments that: 1) the survey designs and sighting protocols for CPI differed somewhat from those of CPII and CPIII, and 2) the CVs do not account for additional variation. The Committee also agrees that the circumpolar abundance estimates for 'comparable areas' (Table 4 of the paper), and IWC *Management Area* estimates (Table 5), should be endorsed as Category 1A, but that those numbers should not be included in the IWC Table of Accepted Abundance Estimates for the sake of simplicity. However, a footnote to the Table should be added to indicate the endorsement, and category, of those IWC circumpolar comparable area and *Management Area* abundance estimates, and that the circumpolar 'comparable areas' estimates do not account for additional variance.

11.1.11 – Southern Hemisphere right whales

Renault-Braga *et al.* (2021) present a study of southern right whales wintering along the Brazilian coastline using photo-id data from 2004 to 2018. The study was discussed by the Sub-Committee on Conservation Management Plans, CMP, in 2021 (item 9.1.2 of IWC (2022), where it was noted that this is the first update of the population trends for southern right whales in the Brazilian breeding ground since 2010.

It was noted in the ASG Report that heterogeneity in capture probability was not accounted for, in part because of the small sample size in the study, and that this study remains a work in progress. The authors of this paper have expressed an interest in collaborating with other Committee scientists to improve their analyses. The Committee suggested that the authors might work with the independent reviewers, noting that addressing the reviewers' comments would be an excellent start. New agreed to facilitate this potential collaboration. The Committee agrees that the abundance estimates, 569 (±38) for females and 2,626 (±737) for adults during winter 2004-2018 (2011), should be categorised as Category P. The Committee also noted that before finalised estimates are considered for endorsement in the future, the "±" notation for uncertainty should be clarified by replacing it with a standard error, CV, or confidence interval.

Smith *et al.* (2021) was presented to the Committee in 2021 (item 8.2.3.2 of IWC (2022)) and reported on aerial surveys for southern right whales along the southwest coast of Australia (Cape Leeuwin to Ceduna) between 1993 and 2020. The Committee noted three primary concerns regarding the analysis in Smith *et al.* (2021): (i) the use of

the simple correction factor (IWC, 2013a) to convert cow/calf counts to total abundance (noting that the Committee recommends updated review of this factor and its usage), (ii) the manner of extrapolation to areas not surveyed in 2020 due to covid-19 restrictions, and, most importantly, (iii) the lack of a measure of uncertainty associated with the resulting total abundance estimate. Therefore, the Committee agrees that the 2020 total abundance estimate should be categorised as Not Suitable. However, the Committee agrees that the time series of relative abundance indices is nonetheless potentially useful for assessment purposes and should be endorsed as Category 3, with a note added to the IWC Table of Accepted Abundance Estimates that this time series represents an index of relative (not total) abundance. Moreover, the Committee noted that a project funded by Australia is currently undertaking research to provide a comprehensive understanding of the population abundance and degree of spatial connectivity of southern right whales in Australian waters. This will provide the first abundance estimate of the total Australian population of southern right whales and investigate the connectedness of whales utilising breeding areas on the eastern, southern and western coasts of Australia. The Committee encouraged those efforts. Finally, the Committee recognised the memory and outstanding contributions of John Bannister to this project, and cetacean science broadly, over many decades.

Attention: SC-SH, SC-ASI

*The Committee **recommends** that the multiplier developed from Argentinian and South African data and adopted at the International Right Whale Workshop held in Buenos Aires, Argentina, in September 2011 to convert southern right whale cow/calf counts to total abundance (IWC, 2013a) be reviewed and potentially updated to reflect any new data and a corresponding measure of uncertainty.*

Brandão *et al.* (2021) had been submitted for ASI review intersessionally. Jackson noted that the authors had subsequently advised her that the intent of Brandão *et al.* (2021) was to investigate how to remove model misspecification, not to provide abundance estimates that would be suitable for Committee use in the context of the categories the Committee applies when endorsing estimates. Therefore, she had withdrawn her request that ASI reviews this paper at this time. New noted that another convenor had requested a withdrawal intersessionally upon learning of an author's intent to reanalyse their data. Accordingly, the Committee did not discuss this paper further.

The Committee noted, however, that the authors' ongoing modelling work for this project (a component of SORP), using the important long-term dataset for southern right whales off South Africa, represents a potentially valuable contribution that could advance progress in the SH sub-committee and other Committee subgroups, after the resultant abundance estimates are fully reviewed and endorsed by the Committee through its agreed processes for the purposes articulated in the statement of ASI's role (item 11 above). The Committee encouraged the authors to provide, as soon as practicable, an appropriate paper to the SH sub-committee for consideration for forwarding to ASI for such a review. That would allow this modelling work to contribute to the management and conservation efforts of the Committee as a primary basis for recommendations. The authors subsequently advised that their most recent modelling work on this assessment would enable the provision of such a paper very soon.

11.1.12 Southern Hemisphere humpback whales

Félix *et al.* (2021) describe a new population estimate for eastern South Pacific humpback whales (Breeding Stock G; BSG) based on mark-recapture models and fluke catalogues from 23 research groups. Félix et al. (2021) was originally presented to the Committee in 2021 (items 8.4.1 and 11.1.9 of IWC (2022)), at which point concerns were raised about the assumptions of a closed population, sources of the samples, and that some of the CVs seemed unrealistically small.

The Committee concurred with the comments and concerns discussed in the ASG Report. After discussion, concerns remained regarding the authors' assumptions of a closed population for such a lengthy dataset (i.e., 27 years), as well as the failure to account for variation in sampling effort, and therefore in capture probabilities. These factors have the potential to introduce a strong positive bias, although this could be mitigated in part, because (i) these analyses were undertaken when adult humpback whale survival rates were extremely high and the population experienced steady growth, and (ii) the bulk of sightings data were collected during the latter half of the survey period. The Committee considered whether these potential factors were better accounted for during population modelling undertaken by the SH sub-committee, or addressed by the authors through a reanalysis applying a more appropriate model. Without resolving this question, the Committee concluded that, on balance, the abundance estimate is expected to be positively biased, by some unknown amount, due to a number of features of the data and the mark-recapture model selected.

The Committee agrees that the 1991-2018 abundance estimate for Eastern South Pacific humpback whales (Breeding Stock G) of 11,784 (SE=266) should be endorsed as Category 3 and that the entry in the IWC Table of

Accepted Abundance Estimates should include a note outlining the expectation that this abundance estimate is positively biased to some unknown degree. The Committee encourages the authors to continue their work, noting the significance of the data they have collated, and the value of abundance estimates for this population for future assessments.

The Committee further noted that the scope and complexity of such mark-recapture analyses is something the Committee may need to consider again in the near future for other stocks and species. The Committee agrees that Givens should raise this issue with the convenors of the NH and SH sub-committees, and seek their advice on the level of priority that might be assigned to developing better guidance for such analyses. The Committee established an intersessional correspondence group to address various matters related to mark-recapture abundance estimates (Table 2 item 11.2.2). This group might offer help to the paper's authors to improve their work and begin consideration of guidance for complex mark-recapture analyses, thereby developing further expertise within the Committee for similar future work.

11.1.13 Franciscana

Last year, the Committee reviewed several abundance estimates for franciscana and recommended revisions to some analyses (IWC, 2021f; 2022, item 11.1.2). The authors of some of these papers had made revisions intersessionally and will be presenting their new analyses to the Workshop on the Status of the franciscana scheduled for June 2022. After the workshop, the convenor of the SM and CMP sub-committees will consider requesting ASI review of these revised papers so that the new estimates may be considered for endorsement at the next meeting.

CMP received SC/68D/CMP/17 estimating franciscana abundance and requested that ASI review it intersessionally (item 9.1.4).

11.1.14 – Indo-Pacific finless porpoise near Hong Kong

Jefferson and Moore (2020) presented estimates of the density and abundance of Indo-Pacific finless porpoises in waters to the south and east of Hong Kong, the first abundance estimate since the early 2000s. The presentation of a long time series of estimates in this study prompted the Committee to consider the question of how to summarise such long series (i.e., for the IWC's Table of Agreed Abundance Estimates); see item 11.3.6. Based on those discussions and considering the high interannual and seasonal variability of the finless porpoise estimates, the Committee calculated inverse-variance weighted averages for three-year periods at the start, middle and end of the series, for the wet and dry seasons separately, using the uncorrected estimates. The ASG Report provides further details.

The Committee endorsed these weighted averages of uncorrected abundance for Indo-Pacific finless porpoise in Hong Kong waters during the wet season: 37 (CV =0.303) in 1996-1998, 67 (CV=0.184) in 2007-2009, and 77 (CV=0.207) in 2017-2019; and during the dry season: 65 (CV =0.223) in 1996-1998, 121 (CV=0.144) in 2007-2009, and 108 (CV=0.140) in 2017-2019. Given that the porpoises in the survey area comprise only a fraction of the larger population in the South China Sea, the Committee agrees to classify these as Category 2 and include them in the IWC Table of Accepted Abundance Estimates. The entire time series of seasonal annual uncorrected estimates would also be archived as discussed in item 11.3.6.

11.2 Update and review abundance table maintained by the IWC

11.2.1 Additions to the IWC Table of Accepted Abundance Estimates

Abundance estimates recommended for inclusion in the IWC Table of Accepted Abundance Estimates during the meeting are listed below.

Attention: SC, S, C

*The Committee **recognises** that the IWC Table of Accepted Abundance Estimates is an important tool for the work of the Committee and the Commission.*

*The Committee **recommends** that estimates endorsed during the 2022 meeting (SC68D) should be incorporated intersessionally into that table, uploaded to the IWC website, and endorsed by the Commission. Specifically, these estimates are:*

- *Bering-Chukchi-Beaufort Seas bowhead whales in 2019: 17,175 (CV=0.237), Category 1A*
- *North Atlantic common minke whales in Medium Area E + Small Management Area CM in 2014-2019: 149,722 (CV=0.15); in Small Management Area CM in 2014-2019: 37,020 (CV=0.261); and in Medium Area E in 2014-2019: 104,692 (CV=0.17); all Category 1A*

- *Humpback whales in the northeast Atlantic in 2002-2007: 9,749 (CV=0.34); in 2008-2013: 12,411 (CV=0.30); in 2014-2018: 10,708 (CV=0.38); all Category 1A*
- *Humpback whales in Newfoundland and Labrador region in Aug-Sept 2016: 10,471 (CV=0.51); Category 1A*
- *Humpback whales in Gulf of St. Lawrence, Scotian Shelf, and Bay of Fundy region, in Aug-Sept 2016: 1,854 (CV=0.400); Category 1A*
- *Humpback whales in the Cape Verde Islands in 2010-2018: 272 (CV=0.037); Category 1B*
- *Western Atlantic right whales in 1990: 263 (95% CI 260—269); in 2000: 308 (95% CI 307—311); in 2010 476 (95% CI 472—478); in 2019, 368 (95% CI 356—378); all Category 1A*
- *Eastern North Pacific gray whales in 2019/20: 20,580 (95% CI 18,700—22,870); Category 1A*
- *Blue whales in the eastern North Pacific in 1998: 1,422 (CV=0.093); in 2008: 1,397 (CV=0.075); in 2018 1,898 (CV=0.085); all Category 1A*
- *Chilean blue whales off the coast of Chile, in December 1997 – January 1998: 303 (95% CI 176—625); Category 2*
- *Blue whales in Chilean Northern Patagonia, summer 2009: 356 (95% CRI 191—652); Category 2*
- *Blue whales off Isla Grande de Chiloé, southern Chile, in 2004-2012: 762 (95% CI 638—933) and 570 (95% CI 476—705); Category 3*
- *Blue whales off Isla Grande de Chiloé, southern Chile, in 2004-2012: 450 (CV=0.17); Category 2 and Evaluation Extent 4*
- *Antarctic blue whales in combined IWC Management Areas IIIE+IV+V+VIW in summer 1995/96: 300 (CV=0.308); in summer 2008/09: 1,223 (CV=0.345; both Category 1A*
- *Antarctic blue whales, circumpolar, in 1978/79-1983/84: 453 (CV=0.40); in 1985/86-1990/91: 559 (CV=0.47); in 1991/92-2003/04: 2,280 (CV=0.36); all Category 1A*
- *Southern right whales along the southwest coast of Australia, time series of relative abundance estimates as cited in Smith et al. (2021, item 11.1.12); Category 3, noting these are an index of relative (not total) abundance*
- *Eastern South Pacific humpback whales (Breeding Stock G) in 1991-2018: 11,784 (SE=266); Category 3*
- *Indo-Pacific finless porpoise in Hong Kong waters in the wet season in 1996-98: 37 (CV=0.303); in 2007-09: 67 (CV=0.184); in 2017-2019: 77 (CV=0.207); all Category 2*
- *Indo-Pacific finless porpoise in Hong Kong waters in the dry season in 1996-98: 65 (CV=0.223); in 2007-09: 121 (CV=0.114); in 2017-2019: 108 (CV=0.140); all Category 2*

*The Committee **recommends** that all of these abundance estimates meet the definition of an Evaluation Extent of 1 ('examined in detail by the Committee') except for one estimate noted above, which is Evaluation Extent of 4 ('estimate was partially considered by the sub-committee and a new method was used'). The Committee also **requests** that Katara update the table intersessionally to include these estimates.*

The Committee also discussed which of the estimates endorsed at SC68D should be added to the IWC website. Recognising that there are no fixed criteria, the Committee identified those estimates that represent very large areas or nearly complete populations, and are believed to have no severe biases. An intersessional correspondence group was established to finalise the choices identified by the Committee and to review the estimates already on the website to ensure a consistent approach (Table 2, item 11.2.1).

11.2.2 Revisions to the IWC Table of Accepted Abundance Estimates

Allison and Katara presented changes made to the IWC Table of Accepted Abundance Estimates since SC68C. All estimates endorsed and categorised during the 2021 meeting (11.1.12 in IWC, 2022) have been incorporated into the table as recommended last year.

During SC68C, a new category (1B) was added to the list of options for abundance estimates endorsed by the Committee (IWC, 2022, item 11.1.1). This created the need to recategorise some previously accepted estimates to adhere to the new category definitions. The Committee reviewed a list of candidates for recategorisation. Although category 1B is intended for some small estimates, it is unnecessary for others. Thus, the Committee agrees that

estimates previously endorsed as Category 1 (using the prior system) having an Evaluation Extent of 1 should be recategorised as 1A, except for a few cases. The exceptions were several estimates for small populations of gray whales, Maui dolphins, and bowhead whales that the Committee agrees should be recategorised as 1B. The Committee noted that, for Okhotsk Sea bowhead whales, only the 2016 estimate had been placed in the table, although a longer time series was available. The Committee requests Katara to check whether additional estimates could be included.

Attention: SC, S, C

*The Committee **recommends** that the following, previously endorsed estimates should be recategorised as 1B and endorsed by the Commission:*

- *Western Feeding Group gray whales in 1995 and 2015: 74 (CV=0.05) and 200 (CV=0.03)*
- *Maui dolphins in New Zealand (North Island) in 2001 and 2016: 96 (CV=0.20) and 57 (CV=0.10)*
- *Gray whales from the Sakhalin and Kamchatka Feeding Group in 1995 and 2015: 129 (CV=0.08 and 282 (CV=0.05)*
- *Bowhead whales in the Okhotsk Sea in 2016: 218 (CV=0.22)*
- *Bowhead whales in Svalbard in 2015: 343 (CV=0.49)*

*The Committee **requests** that Katara revise the IWC Table of Accepted Abundance Estimates accordingly, retaining the original Evaluation Extent in each case.*

The abundance estimate for BS B2 humpback whales was also considered for category 1B. Concerns were raised about potential policymaker misunderstandings related to the area to which this mark-recapture estimate applied, given that another, larger stock is nearby. This is potentially a more general problem. The Committee agrees that the IWC Table of Accepted Abundance Estimates should be supplemented with some text explaining the differences between abundance estimates based on line transect surveys and those based on mark-recapture models, in terms of how they apply to the area and stock being estimated. ASI established an intersessional correspondence group to propose such text for the next SC meeting (Table 2 item 11.2.2).

The Committee agreed to defer recategorisation of the BS B2 humpback estimate until the next meeting so such text could also be considered then.

Finally, the Committee noted that the categories and evaluation extent for several humpback whale estimates in the Antarctic were unclear and agreed that the categorisation of these should be reconsidered at the next SC meeting.

Allison and Katara presented minor updates to the IWC Table of Agreed Abundance Estimates that were proposed during the previous intersessional period. Almost all the estimates from the Iceland/Faroes component of the "NASS2015" surveys were revised following the identification of a slight issue with the stratification used in the analyses, but there was no change to the models used to obtain the estimates (details provided in Annex 1 of NAMMCO (2018)). Therefore, the Committee agreed that these changes to the IWC Table of Accepted Abundance Estimates for the relevant North Atlantic humpback, minke and fin whale estimates should be made.

Attention: SC, S, C

*The Committee **recommends** that the following estimates for areas within the NASS survey (NAMMCO, 2018), which had been previously endorsed by the Committee but have been revised by NAMMCO, should be endorsed by the Commission:*

- *Humpback whales in Iceland/Faroes in 2015: 9,687 (CV=0.37); Category 1A*
- *Minke whales in CIP, in 2015: 8,497 (CV=0.326); Category 1A*
- *Fin whales in WI, in 2015: 16,862 (CV=0.22); Category 1A*
- *Fin whales in EI/F, in 2015: 7,357 (CV=0.53); Category 1A*
- *Fin whales in EG (Blocks IG_EG + IP, no overlap with East Greenland survey below), in 2015: 12,779 (CV=0.21); Category 1A*
- *Fin whales in EG, in 2015: 6,440 (CV=0.26); Category 1A*

*The Committee **requests** that Katara revise the IWC Table of Accepted Abundance Estimates accordingly, retaining the original Evaluation Extent in each case.*

Allison and Katara also presented updates to the agreed North Pacific minke whale estimates. The Steering Group for the North Pacific Minke Whale In-depth Assessment considered these estimates suitable for use in conditioning

trials, but the Committee agreed in 2021 (item 8.1.3) that ASI would conduct an intersessional review. Several estimates have been recalculated by Miyashita and Hakamada to use the exact sizes of the relevant sub-areas and were presented to the Committee. The Steering Group also noted that three additional estimates of abundance previously agreed upon but not used in conditioning the 2013 trials should be added, and one of these included the exact size recalculation. In discussion, the Committee requests Katara and Allison to work with Miyashita and Hakamada to clarify the methodology being applied to these subareas but agrees that these recalculated abundance estimates for North Pacific minke whales should be endorsed in the same Categories that had originally been assigned and that the new, uncategorised estimates should be endorsed as Category 2 with Evaluation Extent 3 ('degree to which the estimate was considered by the sub-committee is unclear but method standard').

Attention: SC, S, C

*The Committee **recommends** that the following estimates, which had been previously endorsed by the Committee but have been revised by Miyashita and Hakamada, should be endorsed by the Commission:*

- *North Pacific minke whales, sub-area 10E, in 2002 (May-June): 1,192 (CV=0.66); Category 1A*
- *North Pacific minke whales, sub-area 10E, in 2003 (May-June): 591 (CV=0.57); Category 1A*
- *North Pacific minke whales, sub-area 10E, in 2005 (May-June): 875 (CV=0.44); Category 1A*
- *North Pacific minke whales, sub-area 9, in 1990 (August): 3,287 (CV=0.819); Category 1A*
- *North Pacific minke whales, sub-area 9(S), in 2011 (May): 0; Category 1A*
- *North Pacific minke whales, sub-area 9(N), in 2011 (May): 115 (CV=1.05); Category 1A*
- *North Pacific minke whales, sub-area 9, in 2011 (May): 115 (CV=1.025); Category 1A*
- *North Pacific minke whales, sub-area 12SW, in 1990 (August-September): 4,774 (CV=0.51); Category 2*
- *North Pacific minke whales, sub-area 12NE, in 1990 (August-September): 11,805 (CV=0.38); Category 2*
- *North Pacific minke whales, sub-area 12NE, in 1992 (August-September): 11,051 (CV=0.705); Category 2*

*The Committee **requests** that Katara revise the IWC Table of Accepted Abundance Estimates accordingly, retaining the original Evaluation Extent in each case.*

Attention: SC, S, C

*The Committee **recommends** that the following revised or uncategorised estimates in the IWC Table of Accepted Abundance Estimates be recategorised and endorsed by the Commission:*

- *North Pacific minke whales, sub-area 10E, in 2007 (May-June): 672 (CV=0.33); Category 3, Evaluation Extent 1*
- *North Pacific minke whales, sub-area 6E, in 1992 (Jul-Sept): 893 (CV=0.67); Category 2, Evaluation Extent 3*
- *North Pacific minke whales, sub-area 10E, in 1992 (Jul-Sept): 707 (CV=0.57); Category 2, Evaluation Extent 3*

*The Committee **requests** that Katara revise the IWC Table of Accepted Abundance Estimates accordingly, and that Katara and Allison work with Miyashita and Hakamada to clarify the methodology used for these abundance estimates.*

The Committee thanked Katara and Allison for these updates and requested that such information be provided in advance of each ASI meeting. The Committee encouraged researchers who update abundance estimates endorsed by the Committee to notify the Secretariat so that the IWC Table of Accepted Abundance Estimates can be updated accordingly.

Attention: SC, S

*The Committee **requests** that Katara annually provide the Committee, in advance of each ASI meeting, with a list of suggested revisions to the IWC Table of Accepted Abundance Estimates arising when authors make minor changes to estimates previously endorsed.*

Attention: SC, S, R

*The Committee **encourages** researchers who update abundance estimates endorsed by the Committee to notify the Secretariat so that the IWC Table of Accepted Abundance Estimates can be updated accordingly.*

11.3 Review and refine the abundance review process

11.3.1 Edits to category descriptions, supplemental wording, and examples

Last year, the Committee revised the list of categories it uses for abundance estimates endorsed and included in the IWC Table of Accepted Abundance Estimates. An ICG was established to discuss how best to draw a distinction between categories 2 and 3, and to develop supplementary wording that explains how estimates in categories 1A, 1B, 2 and 3 might be used. The group was also tasked to provide examples of the reasoning for choosing one category over another in various circumstances. Intersessionally, the ICG Convenor also asked it to consider any edits it believed were needed to clarify the wording for all category descriptions.

The Committee received the suggested wording, revised it, and agrees to adopt the following category descriptions:

- Category 1A: An estimate which is acceptable for use in In-depth assessments or for providing management advice using the RMP, AWMP or other modelling or analysis. This (and category 1B) may include estimates with minor or possibly competing small biases (e.g. assuming $g(0)=1$ when it may be slightly less), provided that these biases are recognised.
- Category 1B: An estimate which pertains to a 'very small' population, and is acceptable for providing management advice in that context, which includes situations where no sophisticated modelling or analysis is required.
- Category 2: An estimate which may be acceptable for 'conservative' management (e.g., in the AWMP where the user objective is expressed as an absolute number of catches/strikes with no need to eventually maximise catches/strikes, or in an assessment of whether a given level of bycatch will lead to recovery or further depletion of a population). The estimate may be subject to considerable negative bias for reasons such as limited spatial coverage (compared to the range of the population for the season in question) or lack of correction factor(s) (e.g. related to $g(0)$).
- Category 3: An estimate which is informative, but not acceptable for inclusion in (1A), (1B) or (2). This category includes estimates with an unquantified bias which is likely to be too severe to allow inclusion in Category 2, as well as relatively unbiased estimates that are adequate to provide some general indication of abundance while still not qualifying for (1A) or (1B). Such estimates may be used when fitting population models, but not for use as estimates in actual implementations of IWC management procedures (i.e., the RMP *CLA* or AWMP *SLA*s).
- Category P: A preliminary estimate, not suitable for use at the time of review, but which may provide an acceptable estimate once finalised. It will be omitted from published tables until finalised and assigned a category from (1) to (3).
- Category X1: Category 1A or 1B estimates that have since been superseded by revised estimates for the same area and time period. They will be omitted from published tables.
- Category ND: An estimate which has not yet been discussed by ASI, but which may be discussed in future. These will be omitted from published tables.
- Category NS: An estimate reviewed by the Scientific Committee, but agreed not to be suitable for acceptance due to factors such as: insufficient data (including inadequate coverage achieved of the area planned to be surveyed); insufficient methodological information presented; concerns about survey design; concerns about conduct or interpretation of analyses; lack of an appropriate measure of uncertainty; failure to account for large potential biases; or assumptions that are unreasonable or clearly violated. These will be omitted from published tables.

The Committee did not receive suggested supplementary wording or examples, but looks forward to progress on this from the Abundance Review Process ICG next year (Table 2, item 11.8).

Attention: SC, SC-ASI

*The Committee **recommends** that the abundance estimate category descriptions finalised at SC68D be used to categorise estimates that are reviewed by the Committee, including those input into the IWC Table of Accepted Abundance Estimates.*

11.3.2 Adding CMP Convenor to the Abundance Steering Group

The Abundance Steering Group (ASG) carries out the intersessional review of abundance estimation papers on behalf of ASI, and occasionally advises ASI on other matters. When established, the ASG was formally comprised of the Chair and Vice-Chair of the SC; the Head of Science, Conservation and Management from the Secretariat; the Head of Modelling and Statistics from the Secretariat; and the convenors of the following sub-committees and standing working groups: ASI, NH, SH, SM, ASW, IST, IA, EM (IWC, 2020b).

The Committee **agreed** to add the Convenor of the Subcommittee on Conservation Management Plans (CMP) to the ASG membership list.

Attention: SC, SC-ASI

*The Committee **agrees** that the membership of the Abundance Steering Group be expanded to include the Convenor of CMP.*

11.3.3 Deadline for intersessional review of abundance estimates by the Abundance Steering Group

Last year, the Committee noted that there are two pathways for papers to be reviewed by ASI: (i) traditional in-person consideration at the annual meeting by participants at an ASI session after an author presentation, and (ii) intersessional written reviews by independent reviewers, followed by ASG consideration, then final recommendation by ASI. The Committee expressed a preference for the second path, as much as possible, even though it is slower (IWC, 2022, item 11.1.1). However, the second path is not practical for papers received immediately before the ASG pre-meeting or the Committee meeting. Therefore, the Committee established a deadline that, for papers to receive path (ii) review, the paper must be sent to ASG by the requesting Convenor at least one month before the next Committee meeting (IWC, 2020c). In the 2021-22 intersessional period, the ASG tried to respect the Committee's preference for path (ii) as much as possible. Accordingly, 26 papers were processed through path (ii), and zero through path (i). Consideration of one paper was postponed so that path (ii) could be taken next year, rather than following path (i) now.

In submitting papers to the ASG, three problems were encountered. First, it was difficult to ensure that the deadline was known and abided by. Second, the ASG pre-meeting started about 1 week before the Committee meeting, so the deadline actually gave ASG only 3 weeks to solicit two independent reviews, get an author response, and consolidate everything into a working paper to be reviewed at the ASG pre-meeting, or in advance, as is preferred by some ASG participants. This is extremely burdensome on reviewers and authors participating in the process and discourages them from participating in the process in the future. Reviewers are already hard to recruit, so it is counterproductive to treat them poorly. Third, the Committee may be forced to begin biennial meetings, due to budget considerations. In this case, tying the submission deadline to the start of a Committee meeting gives the unintended implication of a two-year review cycle. Instead, the deadline should be tied to the start of an ASG meeting, which is likely to occur annually, in some manner, even without a concomitant Committee meeting.

Therefore, the Committee agrees that the deadline for submission of an abundance estimate for ASI review will be 6 weeks before the start of the next ASG meeting.

Attention: SC, SC-ASI

*The Committee **agrees** that the Scientific Committee Procedures for Submission, Review, and Validation of Abundance Estimates (IWC, 2020f) should be amended so that the deadline for submission of an abundance estimate for ASI review is 6 weeks prior to the start of the next ASG meeting.*

11.3.4 Process for reviewing papers revised in response to ASI review

Sometimes ASI recommends revisions to the analysis of an abundance estimate it has reviewed, often aiming to help the authors improve their estimate so that it can be endorsed by the Committee in a category that corresponds to Committee intentions for the estimate (e.g., 1A or 2, instead of 3 or P).

For example, this situation occurred with several estimates of franciscana abundance, from various authors, which were first considered at the 2021 Workshop on the Status of the franciscana (IWC, 2021f). Estimates were reviewed, suggestions for improvements were offered, and subsequently reviewed and endorsed by the Committee (IWC, 2022, item 11.1.2). In a follow-up franciscana workshop planned for June 2022, some revised and improved estimates that take into account those suggestions will be considered. Those estimates will subsequently be forwarded to ASG for intersessional review.

The Committee considered what level of review should be required for estimates that have undergone such revisions. It noted that sometimes, the authors provide a detailed explanation of how the methodological suggestions

were addressed, but that the complexity of the revisions and the comprehensiveness and clarity of the authors' response will differ from case to case.

The ASG Convenor expressed his intention that, if such cases are addressed individually, ASG would bias the process in the direction of less review. If a detailed author response was provided and the revisions were not too complex, he would prefer to bring such a paper, including the original reviews and new author response, directly to the ASG pre-meeting without further review. Additional independent reviews of the revised paper would be solicited for the next ASG meeting only if it was necessary, and in such cases, the preference would be to use the same reviewers as previously.

The Committee considered that a blanket policy for revised papers would be ineffective. Therefore, it agreed that such situations should continue to be handled by the Convenor of ASG on a case-by-case basis in the manner he described.

11.3.5 Guidance for Convenors about submitting abundance estimates for ASI review

Convenors remain uncertain about which papers to refer to ASI for review. ASI has reiterated its role (item 11, above) as a point of reference for Convenors. The Convenor of ASI agreed to engage with other subgroup Convenors intersessionally to help further clarify any confusion. Greater communication among ASI, requesting Convenors, and authors would help ensure that the most relevant papers are provided for review with sufficient guidance for ASI and reviewers to do a good job.

The Committee also noted that much cetacean research involves projects spanning many years, and it drew attention to the importance of the long time series of data generated by such work, including whale (or calf) counts, abundance estimates, and photo-id databases. For some long projects, regular abundance estimates are routinely provided (e.g., annually) as more data are collected, using the same survey and analysis methods as in prior years. In such cases, it may not be necessary for ASI to review each new estimate when it is done. For example, perhaps such estimates could accumulate for three years before receiving a review by ASI. After review, the set of recent prior estimates would all be added to the IWC Table of Accepted Abundance estimates, if they are endorsed. There would be some complexities introduced by this approach. The relevant convenor might be unsure whether the methodology had changed enough to warrant stopping the aggregation. If methodology did change in the middle of an aggregation period, multiple sets of reviews would be needed. Also, an aggregated set of papers may reduce the workload for ASG at the expense of increasing it for reviewers. There was insufficient time to consider fully whether this approach was advisable, so the Committee recommended that ASI consider the potential aggregated review of routinely updated abundance estimates at the next meeting.

Attention: SC, SC-ASI

*The Committee **recommends** that ASI consider the best manner to review abundance estimates that are routinely updated (e.g., annually) using the same survey and analysis methods with new data.*

A common point raised in the discussion of papers was the difficulty in categorising endorsed estimates when the survey area and stock boundaries did not coincide, especially when the purpose of a survey was to produce results for a specific area—often one relevant for management. The ICG revising category wording (item 11.3.1) addressed this by providing guidance for Convenors requesting that they consider (and communicate to ASI) the stock and/or area relevant for evaluation of the estimate. The Committee endorses this guidance, which is provided in item 11 above.

Finally, the Committee noted that many analyses submitted for ASI review, use methods that are not described in detail in the submitted paper, requiring reviewers to access previous papers to make a full evaluation. This situation is quite common, given the long-term nature of many important cetacean research projects. This issue is compounded by the increasing need to recruit new reviewers who might not necessarily be fully aware of the long history of some of these studies and their consideration by the Committee. While additional background papers could be provided to reviewers, this has the potential to add to their burden substantially. To reduce the burden, the senior author of each submission could be asked to provide one other document with detailed methods, if needed. However, not all papers submitted for review involve authors who choose to be engaged in the ASI review process. Therefore, the Committee agrees that it should be the responsibility of the Convenor requesting ASI review of a paper to provide the paper and sufficient other background material to facilitate the review.

11.3.6 Choice of years to add to IWC Table of Accepted Abundance Estimates when the analysis provides a long time series of estimates

The Committee noted that the question of selecting years a long time series of estimates for inclusion into the IWC Table of Accepted Abundance Estimates arose in ASG and ASI discussions on numerous occasions (e.g., eastern North Pacific gray whales, item 11.1.5). Including only the final abundance estimate might be misleading, and endorsing the entire series would ignore potential correlation. Overall, the current approach has been to select the earliest and most recent estimates as well as one in the middle of the time series, but this can result in estimates more than a decade apart. This can be advantageous, as estimates close in time can be correlated with one another, but this may not always capture important trends. Building on discussions from IWC (2021c, item 11.1.1) and recognising that the Table contains a link to the full time series to provide more details when needed, the Committee agreed that selecting one estimate roughly every 10 years should be an informal rule of thumb, with exceptions decided on a case-by-case basis.

11.4 Methodological issues

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

The Committee agreed in 2018 (IWC, 2019g) that the 'Requirements and Guidelines for Conducting Surveys and Analysing Data within the Revised Management Scheme' (referred to as the RMP Guidelines, IWC, 2012c) need to incorporate spatial modelling approaches to estimate abundance from line transect surveys. Such work has been undertaken by Miller, and, intersessionally, oversight of this project was transferred to IST.

11.4.2 Progress on simulation software to evaluate methods for abundance estimates from surveys

Smith and Palka (2021) provided an update on the modernisation of visual survey simulation programs. The Committee has used simulated data to evaluate novel analysis methods for line transect abundance surveys in the past. These datasets have been archived with the Secretariat, but the original executable code used to create those simulated data was generated using compilers that are now outdated. The Committee provided financial support for a project to document, update and streamline the code so that it is compatible with current compilers. This document describes the updating process, now complete, and provides guidelines and examples showing how to use the programs to create new simulated data scenarios, and how to re-compile the code after further development. The existing simulated datasets, together with others that may be generated with the updated programs, could comprise a library of datasets for use by the Scientific Committee in evaluating future novel analysis methods for line transect data. During the 2021-22 intersessional period, this contract was renewed to facilitate the completion of the project, specifically to continue to make the code user friendly and functioning on modern Windows computers, and to make the code accessible via GitHub. The Committee noted the value of such simulations to advance the work of the SC and looks forward to receiving a report on the completion of this project at the next meeting. The Committee agrees that the best use of this software by the Committee should be discussed next year.

11.4.3 Consider diagnostic methods for mark-recapture models

In 2019, the ASI established an ICG to consider diagnostic methods (e.g., model fit) for mark-recapture models to estimate abundance (IWC, 2020b). Although this group has been renewed annually since then, the Committee has not received information from it but continues to recognise the importance of this topic.

This year, the Committee identified several other issues related to mark-recapture abundance estimation that warrant consideration. Appropriate approaches to deal with the scope and complexity of strongly heterogeneous mark-recapture data (e.g., combining data from dedicated photo-id surveys with citizen-based data from platforms of opportunity) were identified as a concern in item 11.1.12. Several studies reviewed in item 11.1 raised the concern that it was difficult to suitably endorse or use estimates from mark-recapture studies conducted over very long time periods (e.g., decades), especially if a closed population model is used.

The Committee agrees that all these issues could be addressed by the same ICG (Table 2 item 11.4.3). This group might also offer guidance to the authors of Félix *et al.* (2021), should they desire it, as suggested in item 11.1.12.

11.5 Provide advice to the Commission on the status of stocks

The Committee has been asked to provide information on the status of whale stocks for the Commission and the general public. Recent work on this project is summarised by IWC (2018d; 2020g; 2021c; 2022). Originally planned as a biennial document, a Status of Stocks Website was deemed more practical and useful in recent Committee discussions, and ASI has begun its development.

An intersessional correspondence group was formed last year to progress this work (items 11.4 and 11.6 of IWC (2022)). The goal of the proposed Status of Stocks Website is not to replace or contradict existing IWC web pages, nor to replicate either the intent of or the material contained in, other sources of information such as the IUCN Red List. Instead, the Committee wishes to highlight its quantitative assessments, which provide a view of status that is

different to those provided elsewhere. Specifically, the Committee intends that the information provided in the Status of Stocks Website should be based on the Committee's In-depth Assessments, *Implementations* and *Implementation Reviews* for the RMP and AWMP, modelling used for the development of AWMP SLAs, and other *Comprehensive Assessments*.

On behalf of the ICG, Givens, Punt and Allison developed a detailed proposal, including examples for three assessed stocks and several unassessed stocks that illustrated other issues that would arise. This proposal was shared with communications and IT specialists from the Secretariat, who presented a proposal for how that content could be interwoven with the IWC website, www.iwc.int. These two proposals, and a lengthy discussion thereof, are presented in the ASG Report. A summary follows.

The ICG proposal makes no appreciable changes to the mathematical modelling and statistical summary of the assessments that ASI has developed for the Status of Stocks project. Introductory content would be presented as a single page providing an overall summary of the status for all assessed stocks that could be understood at a glance without reference to technical detail. To achieve this, simple indicators of depletion (referred to as 'relative abundance' in the proposed website content) and population change for each stock or species would be displayed using radial colour 'thermometer' graphs. These would indicate, on a continuous scale, the estimated values and uncertainty ranges for relative abundance and change, which supplement the discrete categories and labels discussed last year. The new thermometer graph emphasises the continuum of the estimates and their uncertainty. Within this introductory page, links would provide access to status summary pages for each species that contain introductory level information on their assessment, including a definition of relevant stocks, recent exploitation and abundance, the pooled assessment results and uncertainty ranges derived in the manner developed by IWC (2018d; 2020g; 2021c; 2022), stock trajectory plots, a list of threats, data quality classification, and additional material listed in the ASG Report. Further links on the status summary page would provide access to case-specific pages with technical details about the assessment methods and results, and a generic page with a technical explanation of: fundamental concepts of population dynamics, stock definition, and other important issues in stock assessment; the Committee's assessment methods; and the statistical calculations used to summarise status on these pages. Some of the more detailed or technical content might be better provided by linked PDFs instead of lengthy web pages.

On behalf of the Secretariat, Wilson explained how the ICG's proposed pages could be integrated with the existing content on status at www.iwc.int. The ICG's work would be used to build on the existing introductory level information, developing a new sub-section on status comprising an introduction, background information, and stock assessment pages. Noting that this is an evolving project and that the number of assessments available would grow gradually, the Secretariat proposed short- and longer-term approaches to the stock assessment pages. In the short term, the content would be divided into separate pages containing status summaries, status tables and assessment details. In the longer term, they proposed that all the available stock assessment information for each stock would be merged onto a single page, beginning with the simple summary and graphics, and moving through to the more detailed and technical content. The aim of this longer-term approach is to simplify the site, assist user navigation and encourage users toward more technical information. The Secretariat highlighted that status is one of the most frequently sought topics on the website, and the aims of the Status of the Stocks project appear entirely compatible with the Secretariat's aim of updating and improving existing website content. The Secretariat welcomed the opportunity to work with the Committee on this initiative.

While there was considerable discussion, the consensus of the Committee was that, overall, the Status of Stocks Website project was welcome, and has the potential to provide an excellent extension of the existing IWC website, facilitating the communication of some of the IWC's core work, and helping answer one of the most common questions about whales posed to the IWC by the concerned public.

In discussion, it was noted that the Status of Stocks project links to other initiatives within the Committee and the Commission, such as the Extinction Initiative, related efforts within the Conservation Committee, and the development of CMPs and task teams. It was further noted that ASI is not particularly well placed to develop small cetacean assessments, providing an opportunity for experts in the SM sub-committee to contribute to the Status of Stocks project, particularly considering that an existing group with the SM sub-committee coordinates with Integrated Conservation Planning for Cetaceans (ICPC) group within IUCN. It was suggested that this SM group might help demarcate assessment roles and integrate expertise in assessments. Finally, it was noted that the Committee has well-established procedures for developing stock assessments, and any circumvention of that process by ASI would require further consideration.

In response, Givens concurred that such other groups and procedures were critical for the success of this project, which is focused on presenting Committee work, not conducting new assessments. The Status of Stocks Website

project currently includes no plans to conduct stock assessments outside normal Committee processes. The goal is to summarise completed Committee work for the website, the Commission, and the public, using the types of Committee outputs cited above. The ASG Report contemplates the inclusion of model-based assessments published in the scientific literature but external to the IWC, but processes to incorporate such content—especially for Committee review of these—would need to be considered before pursuing such an approach. Thus, in the near term, the included stocks are likely to comprise large whales, many of which are, or have been, the focus of RMP or AWMP considerations or In-depth assessments. Table 14 of IWC (2021c) lists those stocks considered to be ready for this project.

11.5.1 Coordinating with the IUCN Red List

There was much discussion comparing the IWC Scientific Committee and IUCN Red List assessments. The ASG Report identified the need for clear text on the Status of Stocks Website to explain the differences, and the complementary nature of, the two types of assessment and why the IWC presents both. The Committee agrees that drafting the proposed website text for this purpose should be tasked to an intersessional correspondence group in collaboration with the IUCN/IWC coordination group established under Item 4.12. The ASG had formed a small group to begin considering issues relevant to such text.

The small group noted that the two approaches have somewhat different objectives: the IWC seeks to provide advice on status at the population level based upon rigorous model-based assessments; and the IUCN Red List approach is primarily species based (although sometimes smaller units are used) and has categories that are designed to apply to all organisms. The Red List approach seeks to avoid, where possible, classification as 'Data Deficient', in part by allowing a greater degree of expert opinion and a coarser level of assessment (see https://www.iucnredlist.org/about/uses for more information). The primary intention of the IUCN Red List is to provide an indicator of the status of the world's biodiversity and its changes over time, raising alarms where needed or suspected. Inevitable differences in the data quality and analytical approaches used for the wide variety of species broadly cancel out to give an important, albeit coarse, overview. In some ways, the IUCN approach can be seen as identifying where there are concerns and a more detailed population-level assessment is needed.

The Committee has stressed for many years the importance of assessing populations, rather than species, from a conservation and management perspective. Whilst valuable, the broad Red List approach can lead to certain peculiarities such as:

- Fin whales as a species are classified as 'Vulnerable' by the IUCN based on what they describe as necessarily crude modelling. According to the IUCN website Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) species are 'considered to be threatened with global extinction'. However, detailed work under the RMP (and AWMP) for the North Atlantic fin whale has shown the population is capable of sustained removals and thus is in no danger of extinction. It is therefore somewhat incongruous to suggest that the species as a whole is in danger of extinction if the population in the North Atlantic is not.
- The broad IUCN criteria include the concept of comparing present abundance to that three generations ago. Whilst the logic for unexploited species or populations is clear, this can lead to a situation for long-lived animals, such as baleen whales, that were heavily depleted (e.g., by whaling in the Antarctic up to the 1970s) where an improved classification may occur not due to improved data showing an increase, but rather simply to the fact that the depletion from severe whaling is no longer applicable because three generations have passed. Conversely, a species that is increasing substantially following conservation actions in response to a threat that had reduced them may be classified as Vulnerable if 'three generations ago' includes the period when the species was essentially unexploited. The focus on abundance three generations ago intends to recognise that, for most taxa, it is impossible to estimate (or perhaps even conceptualise) the 'unexploited level' and thus the approach provides a measure of consistency amongst listings in line with IUCN objectives. It should be noted that this is an active field of research (e.g., Rodrigues *et al.*, 2019).

The small group emphasised that the points they raised were not to criticise the IUCN system but rather to recognise that given the different objectives and resources available, the IWC population-based approach is more refined, rigorous and able to focus on cetaceans only. As such, the IWC approach should thus be the primary source of information on the IWC website on status, in cases where an IWC assessment has been completed. Whilst the detailed justifications for the IUCN Red List classifications frequently refer to the work of the IWC Scientific Committee, these details are rarely referenced by the general public (or even scientists).

Taylor noted that the IUCN Red List approach required assessments to be undertaken at the species level before population/sub-population-level assessments can be attempted, even though conservation does not happen on a

global scale. Taylor also reported that the IUCN is moving into a prioritisation process during which it will choose which subpopulations are subject to assessment. In particular, the IUCN prioritisation process consisted of deciding whether a potential subpopulation: 1) was a demographically independent unit; 2) was of evolutionary significance to the species; 3) had been determined to be in a category of threat based on a preliminary assessment, and 4) would benefit from a conservation perspective from receiving an IUCN assessment (see SC/68D/O/01 for more details). Taylor further noted that most of the proposed species being considered for the initial phase of the IWC's Status of Stocks project would be viewed by IUCN as being of 'Least Concern' and therefore would not be considered as priorities. However, western North Pacific gray whales have been considered a species of concern at the subpopulation level by the IUCN, and an assessment of those whales might be an example of where the IUCN and IWC could coordinate efforts.

Taylor further noted that efforts of IWC and the IUCN should be coordinated and complementary, so that as many whale populations are assessed as possible, as efficiently as possible. She noted that the IUCN Cetacean Specialist Group does many assessments and that this enormous task is helped by having a large body of contributing experts. Taylor further stressed that it is unrealistic to expect assessments of every population of cetacean in the world, particularly if the IWC and IUCN are duplicating assessment work. For example, the IUCN process might be better placed to consider many small cetacean populations, whilst the IWC focussed on large whales.

11.5.2 Language for the website

The proposal, developed intersessionally, and the subsequent discussions by ASG and ASI, noted that it would be essential to develop clear text, at the introductory level, explaining a variety of concepts important for assessment modelling such as carrying capacity (or other reference levels); depletion; the notion of populations, stocks, substocks or other units to be conserved; the principle of scientific uncertainty; and other matters. An intersessional correspondence group was formed to begin drafting needed text (Table 2 item 11.1.5). This ICG would also draft text explaining the relationship between IWC and IUCN Red List assessments, in collaboration with the IUCN/IWC coordination group established in item 4.12.

In discussion, it was noted that although the word 'stock' had been used thus far during the project, primarily because 'Status of Stocks' is in the name of ASI. However, the Committee might prefer another term, such a 'population', especially if the animals have never been, or are now not, subject to takes. Furthermore, the term 'stock' is rarely applied to other marine mammals. However, it was also noted that much of the assessment work undertaken by the IWC was for a 'stock' as opposed to a population. It would also be important to consider the desirability of having consistency in terminology for units like 'populations' or 'subpopulations' between the IWC and the IUCN. The Committee noted that stock definition was a concept that has developed over time, and the concepts and terminology used by the IWC are a combination of historical notions (e.g., as introduced in the Schedule of the ICRW) and developing concepts in science and wildlife management. This context about the language used by the IWC would likely need to be explained in the website materials at an appropriate level.

Lang noted that a small group in the SDDNA working group has worked on such questions of terminology, and she offered to help with this aspect of the project. ASI appreciated that offer and noted that the completed assessments used for this project had been based on stock definition determinations by the SDDNA working group when available. Therefore, in collaboration with Wilson, it would be helpful for members of that group to review the proposed wording for the species-level status summary pages describing population structure to ensure that such information was correct and consistent across www.iwc.int.

The ASG Report reflects disagreement as to the extent to which the language summarising status should adopt a 'bland' scientific tone or advocacy language. It was noted that some members of the Committee might wish to see advocacy language, particularly when stocks/populations are facing dire outcomes; others were concerned, however, that use of such language might decrease respect for the authoritative nature of the science-based results provided. The appropriate tone for the website would be considered by the ICG.

11.5.3 Status and depletion

Witting presented his thoughts on the proposal to include a depletion ratio on the IWC Status of Stocks website. Depletion is intended to describe the abundance relative to the equilibrium abundance in the absence of harvest, typically referred to as the pre-exploitation abundance or carrying capacity. However, carrying capacity may change over time, so the depletion ratios relative to the pre-exploitation abundance and carrying capacity differ; and presenting both may be confusing. The underlying problem is that the typical density regulated assessment models used by the IWC SC often cannot describe the delayed recovery of large whales following the commercial exploitation in past centuries (Witting, 2003; 2013). This may be because natural populations regulate their abundance not only by density regulation but also by density frequency-dependent selection (where density

changes natural selection by a change in the distribution of consumed resources). Selection regulated models often reconcile the long-term dynamics of whale populations. These models have no changes in equilibrium abundance, and thus have a stable reference point for the depletion ratio over time, removing the need for an ad hoc explanation of a change in carrying capacity. Witting suggested that the Committee did not develop a Stock Status framework based on the hypothesis of density regulated growth.

In discussion, it was also noted that while the limitations of the current density regulated assessment models have been acknowledged, there has been little appetite to revisit those assessments. In some cases, the assessment framework was developed as much as two decades ago, and data accumulated in the years since then lead to poorer model performance now. Such problems arise most often for stocks with long catch histories, that have been depleted to a large extent, for which there may be inaccuracies in catch histories, and which may have experienced changes in carrying capacity, e.g., due to climate change. However, the recognition of such imperfections in the assessment models should in no way be taken to suggest that the Committee has concerns about the overall reliability of the RMP, AWMP, or the Committee's assessment conclusions.

The main impediment to pursuing Witting's recommendation is that the Status of Stocks project is not planning to undertake further assessment work or to re-do analyses, so any change in the type of dynamics model used for assessment would best be initiated by Committee subgroups undertaking new assessments or updating completed ones. It was suggested that care is needed when considering the implications of not using density-regulated models, which include both technical issues and questions about how to communicate conclusions to the public.

The Committee concluded that what might be needed is careful website text explaining (a) that there are many ways of looking at population dynamics, and whilst the Committee uses one way to model it, there are other valuable ways to approach the problem, and (b) sometimes the IWC's population models do not fully capture population dynamics, and imperfect model fit is a very common problem in many scientific contexts without being a reason for undue scepticism about the model results. Such wording would be considered by the appropriate ICG (item 11.8). In the future, the Committee may wish to consider using different dynamics models for its assessments, but that is a matter for future discussions in the appropriate Committee subgroups.

11.5.4 Statistics and terminology

It was noted that the approach of summarising status by citing population depletion and trend, and the method for calculating the associated summary statistics, had been previously decided (2018d; 2020g; 2021c; 2022). However, the names for these statistics ('Relative Abundance' and '30-Year-Change') were new suggestions in the ICG proposal. In discussion, 'Relative Abundance' was viewed favourably. 'Recent Change' was proposed as an alternative to '30-Year-Change' in case different species or populations required different time spans.

A time-span of 30 years for Recent Change was originally proposed during SC68C, but it was suggested that a shorter time span of 10-20 years, or even something more specific, such as generational time for a species, might be more appropriate. Summarising over 30 years might hide informative dynamics occurring on shorter time scales, such as the very recent decline in North Atlantic right whales. Moreover, the proposed 30-year time frame is very different to that of the IUCN, which uses species-specific generational time scales. It was further noted that the choice of that time frame could bring about very different conclusions in assessments. An idea of using a human generation time (~25 years) as a time span was offered, with a particular reference to its relatability. It was noted that three decades is a reasonable period of time over which to detect and summarise recovery, but that population declines can occur and need to be identified, much more quickly. A final suggestion offered was that the Commission and the public may be interested in even shorter time scales, such as during the past decade, and species-specific decisions may be required.

The Committee also noted that care should be taken to check that the model-estimated trend is evident in the data themselves. It was further noted that trends over different time scales might be offered to cater to a variety of interests. In response, reference was made to the proposed trajectory plot to be included on the status summary page, which would provide a clear visual indication of trends on different time scales. The Committee concluded that a 20-year period would be a reasonable general standard, but that in some cases an alternative choice might be used if it was more appropriate.

Givens noted that the Recent Change statistic was defined as cumulative change, not an annual rate. Therefore, if different time spans were used to calculate Recent Change for different species, the thermometers would be incomparable, which would defeat the purpose of having a single page to summarise the status of many species at a glance. He, therefore, recommended that the definition of Recent Change be revised to be an annual rate of change, instead of the cumulative change, so that the thermometers would remain comparable across cases. The Committee

agrees with this suggestion, but also noted that the importance of small Recent Change rates, and small differences between them, might not be clear to non-specialists, so some associated text might be helpful.

In regards to the category thresholds and single-word labels for thermometers (e.g., the lowest Relative Abundance values being labelled 'critical'), concern has previously been raised about whether such labels should carry a value weighting. This is particularly challenging because there are differing views, for example, on how severe depletion would have to be before it is considered 'bad' for the population. This topic is also important in the context of working collaboratively with IUCN. It was noted that there were already implicit value judgments inherent in targets set by the RMP and to a lesser extent the AWMP SLAs. This issue will be considered by the appropriate ICG (item 11.8).

Concern was raised about basing the proposed category labels on the value of the point estimate, without consideration of the corresponding uncertainty. In response, it was noted that the proposed thermometers do show uncertainty, but it is not straightforward to capture that in a single-word category label. It was also noted that uncertainty had already been accounted for in the two assessment summaries since they are pooled over several scenarios.

Attention was also drawn to the need to consider both Relative Abundance and Recent Change together because they can be misleading individually. The Committee agrees that an integrative statement about status and recovery should be included on the status summary page for each species.

11.5.5 Future work

In the ASG Report, Givens expressed concern about the degree to which progress on this project was currently contingent on very heavy contributions from the ASI Convenors, Punt, and Allison. Without a broader and deeper commitment of effort from Committee members, the project was, in his view, unlikely to be completed. Accordingly, he had advertised the project broadly at this meeting, and he thanked members of the Committee who do not usually attend ASG/ASI sessions, but who contributed to the Status of Stocks discussion this year, noting their contributions had been extremely helpful.

Givens noted that during the 2021/22 intersessional period two ICGs were working on very similar terms of reference and that this had been a source of confusion. The Committee agrees to reorganise work by establishing three ICGs (item 11.8). The Status of Stocks Model-based Assessment Group (Table 2 item 11.1.5) would focus on the technical aspects of assessment modelling and summary of results. The Status of Stocks Group on Language, Terminology, and Content Development (Table 2 item 11.1.5) would focus on drafting careful, accessible wording about stock assessment topics and conclusions for each species. This group would also address the remaining questions about labels and terminology. Finally, the Status of Stocks Steering Group (item 11.8) would oversee the project, focusing on priorities, consistency, and accessibility. In discussion, it was noted that for consistency and continuity, it would be important to have several people belong to all of the groups, with a suggestion that this includes the Convenors of ASI. Givens agreed to serve in this role but highlighted his need to step back from most content creation work and assume more of an oversight role. Wilson, New, Staniland, and Punt also agreed to help ensure consistency by joining more than one group.

Givens expressed his hope that some content for the IWC website might be approved by the Committee by the end of the next meeting. It was noted that the upcoming Commission meeting might provide an opportunity to better inform the Commission about progress with this project and to receive feedback. The potential connection to the Communications Initiative was also raised: the Status of Stocks project would be a strong candidate for ASI to convey to the Commission, showing that the Committee is working to fulfil the Commission's desire for more, and clearer, information about stock status that can be communicated effectively to the general public.

Attention: C, SC, SC-ASI

*The Committee **recognises** that the provision of information on the status of stocks to the Commission and the general public is a priority. The Committee **agrees** that the Status of Stocks Website project developed in recent years will be an effective approach to address this priority, and **recommends** that this work continues under the guidance of ASI and its intersessional correspondence groups.*

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

Hammond *et al.* (2021) was presented to the Committee by Punt. This paper was motivated by the need to estimate the abundance of marine mammal populations to inform conservation assessments, especially relating to fishery bycatch. It provides background on abundance estimation and reviews the various methods available for pinnipeds, cetaceans and sirenians and complements Wade *et al.* (2021) and Moore (2021) that respectively outline best

practices for assessing and managing bycatch of marine mammals and evaluating bycatch mortality. The paper should assist countries who are preparing to conduct bycatch assessments in response to implementing regulations of the US Marine Mammal Protection Act (MMPA) that require that the fisheries that lead to fish and fish products that are imported into the US have a regulatory program that is comparable in effectiveness to that in place for US commercial fisheries. Hammond *et al.* (2021) outline general principles related to abundance estimation, including definitions for abundance and population. It then summarises the most common methods used to estimate abundance for marine mammals. For cetaceans, these are the collection and analysis of visual data from ships and planes, data from passive acoustics (ships and static/drifting hydrophones), individual recognition data, and land-based counts. For each method the paper reviews it summarises common challenges in implementation, based on strengths and weaknesses concerning a range of logistical and practical issues and the assumptions made, violation of which can lead to bias. The paper concludes with a discussion of some practical issues, given the various challenges that arise during implementation.

The Committee commended the authors of Hammond *et al.* (2021) for this important and useful contribution that will provide much needed, high-level guidance to a number of countries faced with the new MMPA regulations.

11.7 Progress on previous recommendations

The Committee recognises that cancellation of the 2020, 2021, and 2022 in-person meetings severely impacted its work. The technical nature of the review of abundance estimates and providing information on the status of stocks is such that annual in-person meetings are essential in combination with intersessional work. Also, many recommendations relevant to ASI are ongoing, with work in progress toward their completion. Nevertheless, progress was made for some recommendations from previous meetings.

The IWC Table of Accepted Abundance Estimates was updated during the intersessional period and estimates requested by various of the Committee's sub-groups were reviewed intersessionally, during the ASG meeting and the present meeting (Item 11.1 above). More than fifty reviews were received. The Committee reiterates that the review of abundance estimates and the update of the IWC Table represent important recurring tasks for the work of the Committee, and many review requests for the next intersessional period have already been received.

Progress was also made on the provision of advice to the Commission on the status of stocks (item 11.5) and a workplan and several ICGs have been developed (item 11.8). Amendments to the description of categories for abundance estimates were agreed upon (item 11.3.1), and an ICG will complete supplementary wording and examples intersessionally (item 11.8).

In 2019, the Committee agreed that work required to: (a) address issues related to the estimation of $g(0)$; and (b) develop robust estimates of abundance for North Pacific minke whales, be referred to an intersessional correspondence group under ASI (IWC, 2020g). This year, the Committee transferred this ICG to the IA sub-committee and looks forward to reviewing progress next year.

In 2020, the Committee recommended consideration of incorporating two or more independent abundance estimates for the same year in a management procedure calculation (IWC, 2021c, item 11.1.2). This question was motivated by the case of Bering-Chukchi-Beaufort Seas bowhead whales, where the Committee has endorsed two completely independent estimates of abundance for 2019 (SC/68D/ASI/01 and Givens *et al.*, 2021). One comes from a spring ice-based visual survey near Utqiaġvik. The other comes from a summer aerial survey across the Beaufort Sea. Both are endorsed as category 1A. It is not obvious that either estimate is clearly superior to the other. The Committee agrees that this is primarily a matter for the IST sub-committee. However, ASI believed that if estimates are independent, they should all be incorporated into the calculation for management. Specifically, in such cases, ASI supported the strategy of incorporating both estimates into AWMP/RMP calculations, either directly, or by using an inverse-variance weighted average of the individual estimates to produce a single number if the management procedure requires that. The Committee endorses this view and referred the matter to the IST sub-committee.

In 2019, the Committee recommended the development of RMP guidelines for model-based abundance estimates (IWC, 2020b, item 12.2.3). Intersessionally, responsibility for this task was transferred from ASI to the IST sub-committee.

11.8 Biennial workplan

The Committee agrees to the workplan provided in Table 19. Intersessional email groups for 2022-2023 are provided in Table 2. Two intersessional email groups from 2021-2022 (IWC, 2022, item 11.6) continue their work but have been transferred to other Committee subgroups as noted in item 11.7.

Table 19
Work Plan for the review of abundance estimates and provision of advice to the Commission on status of stocks for the period 2022-2024

Item	Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting	Agenda Item
1	Review of Abundance Estimates.	ASG to coordinate the review of the abundance estimates as requested by SC sub-group convenors	Review abundance estimates following the ASG/ASI process	ASG to coordinate the review of the abundance estimates as requested by SC sub-group convenors	Review abundance estimates following the ASG/ASI process	11.1
2	Update the IWC Table of Accepted Abundance Estimates	Update the table with estimates accepted at SC68D and receive any intersessional revisions to past entries for consideration by the next meeting (Katara).	Review progress and endorse intersessional revisions	Update the table with estimates accepted at the next meeting and receive any intersessional revisions to past entries for consideration by the meeting in 2024 (Katara).	Review progress and endorse intersessional revisions	11.2
3	Abundance Review Process	ICG will develop supplemental wording and examples explaining the choice of categories for endorsed abundance estimates	Review progress and endorse new wording			11.3
4	Franciscana Abundance Review	ICG will continue coordination of the review of estimates of franciscana abundance to complete the review of the status of the species by the next SC meeting.	Review ICG report and complete the review of franciscana abundance estimates			11.1.13
5	Develop simulation software to evaluate methods for abundance estimates.	Finish development of software to make the code user friendly and functioning on modern Windows computers, and to make the code accessible via GitHub (Palka and Smith)	Review progress			11.4.2
6	Consider matters related to mark-recapture models for abundance estimation	ASI establish an ICG, and ICG to begin work	Review progress	ICG continue work	Review progress	11.4.3
7	Provide Commission with advice on status of stocks.	Develop content for the Status of Stocks Website	Review progress and endorse content for any stocks completed	Develop content for the Status of Stocks Website	Review progress and endorse content for any stocks completed	11.5
8	Host a three-day pre-meeting for the Abundance Steering Group	Make preliminary recommendations to ASI on papers reviewed by ASG intersessionally, and develop content for the Status of Stocks Website in collaboration with ICGs	Host pre-meeting	Make preliminary recommendations to ASI on papers reviewed by ASG intersessionally, and develop content for the Status of Stocks Website in collaboration with ICGs	Host pre-meeting	11.1 and 11.5

12. BYCATCH AND ENTANGLEMENTS

12.1 IWC's Bycatch Mitigation Initiative

Lent provided an overview of progress on the IWC's Bycatch Mitigation Initiative (BMI), which is summarised in SC/68D/HIM/09. Marguerite Tarzia, who had fulfilled the role of Bycatch Coordinator from January 2018 onward, left the role in January 2022, and the IWC Secretariat is currently in the process of recruiting a replacement. In the meantime, IWC Secretariat staff and the BMI Expert Panel on Bycatch are maintaining momentum on a number of core elements of the BMI.

The Bycatch Mitigation Initiative's (BMI) new four-year work plan (2020-2024) was endorsed by the Conservation Committee in October 2020 and is now being implemented. In 2021-2022 the focus has been on the following ongoing activities:

- The IWC Secretariat has been contracted by the FAO to develop a series of factsheets to summarise and illustrate the most important elements of the FAO Technical Guidelines to prevent and reduce bycatch of marine mammals in capture fisheries (FAO, 2021)[23]. These factsheets are intended to improve awareness and uptake of the guidelines among a wide range of stakeholders responsible for fisheries management. The factsheets will be developed in collaboration with the BMI Expert Panel and should be completed by September 2022.
- The IWC Secretariat will be a formal partner in the Global Environment Facility, the Common Oceans Areas Beyond National Jurisdiction project, which is due to begin in June 2022. The project will provide funding to the Secretariat over four years to undertake a gap analysis, a spatial bycatch risk assessment and address other information gaps related to cetacean bycatch in tuna fisheries. It also aims to address the mitigation of cetacean bycatch by working collaboratively with Regional Fisheries Management Organisations (RFMOs), national governments, experts and the fishing industry to raise awareness of practical solutions.
- The Terms of Reference for the Expert Panel were updated, reviewed and agreed by the SWG in September 2021, including a procedure for rolling over membership for existing panel members willing to serve another four-year term. The panel membership is currently being reviewed to fill expertise and geographical gaps.
- The IWC Secretariat is actively engaged in external fundraising, which will be essential for implementation of plans for capacity building and pilot projects. The Bycatch Coordinator will work with the Chair of the Bycatch SWG and the Chair of the VCF fund to consider applications to the VCF funding.
- The IWC BMI continues to progress planning for pilot projects. Seven different countries/locations have been prioritised for pilot project development: Peru, Republic of Congo, Kenya, Pakistan, India, Thailand, Malaysian and Indonesian Borneo. Each pilot project is particularly focused on small scale fisheries using gillnets, and proven, practical and novel approaches to monitoring, mitigating and managing bycatch. The focus during 2022 is to continue developing project concepts, applying for external funding, and beginning some activities with existing 'seed funding'.

The Committee expressed its thanks and appreciation for Tarzia's work on the BMI over the past four years. Of particular note was the support on proposal development for participants seeking funding for bycatch work (e.g. pilot projects, capacity building), as well as the truly interdisciplinary approach to monitoring and mitigating bycatch.

Participants expressed some concern that the envisaged programme of work is extremely comprehensive and far-reaching, and will require a team, rather than a single individual to coordinate and implement. The Committee agreed that fundraising for this programme of work to combat the most significant threat to cetacean populations should be prioritised, especially at a time when the Secretariat is affected by budget cuts. It therefore encouraged those who work in government bodies with a mandate to manage fisheries, cetaceans and bycatch to collaborate across ministries and/or agencies and mobilise and consolidate the necessary resources and expertise required to address this issue.

Participants also welcomed the planned factsheets, and hoped that they will become another product, like the IWC Whale Watching Handbook, that can bear the IWC logo and demonstrate the IWC's meaningful engagement in conservation initiatives.

[23] **https://www.fao.org/documents/card/en/c/cb2887en/**

12.2 Collaboration on bycatch mitigation with IGOs

12.2.1 IOTC and other RFMOs

Following the Committee endorsement of a strategy to engage RFMOs during SC68B (see SC/68B/HIM/05 and SC/68B/HIM/06), the IWC Secretariat has been actively pursuing collaboration with two of the tuna RFMOs prioritised in the strategy, the IOTC and the Pacific Community (SPC), which hosts the Bycatch Management Information System. Collaboration between the IWC and the IOTC is expected to be formalised through a Letter of Intent to be discussed at the IOTC Commission meeting in 2022.

12.2.2 CCAMLR

SC/68D/HIM/04 provided details of three entanglements of humpback whales (*Megaptera novaeangliae*) in the Antarctic krill trawl fishery. The accidental captures took place in CCAMLR management areas 48.1 and 48.2 between 27/01/2021 and 17/06/2021. They were documented by a CCAMLR Scientific Observer, appointed by the UK under the CCAMLR Scheme of International Scientific Observation. The vessel in question was a Norwegian registered factory trawler, fitted with trawl nets that use a suction system to continuously trawl for multiple days (e.g., 5-10), with the krill catch being continuously pumped to the ship through a hose connected to the cod end of the trawl. The nets are fitted with excluder devices that were designed to keep pinnipeds from entering the nets. In two of the three instances, humpback whales had somehow entered the net despite these seal excluders, and were dead and bloated by the time they were discovered, documented, and freed from the nets. These are the first reports of whale bycatch in this fishery.

SC-CAMLR seeks to better understand the reasons for these bycatch events and to mitigate them in the future. CCAMLR therefore requested the Committee to provide scientific feedback on these incidents and to nominate scientists to attend the SC-CAMLR working group "Incidental Mortality Associated with Fishing" (IMAF) in October 2022 in Hobart.

During discussion, several IWC SC participants, including veterinary pathologists, fishing gear specialists, and entanglement response specialists, expressed the opinion that it was highly unlikely that the whales entered the trawls after death. Reasons include: (1) whale carcasses float very soon after the time of death, and the trawls are towed mid-water (median depth 30-100m); (2) the probability of three whale carcasses becoming trapped in trawls in the same season seems unfeasibly small – and would require a very high density of carcasses in the area, which was not reported or observed by the vessel in question; (3) by contrast, whales were seen following trawls, and thus appear to be interested in engaging with the deployed gear, increasing the likelihood that animals tried to enter the trawls in search of prey. In addition, the reported lengths of the entangled whales (7-10m) are consistent with the lengths of dependent, or newly independent calves of the year (Clapham *et al.*, 1999). Juvenile humpback whales have been shown in other studies to demonstrate higher levels of 'curiosity' and to be more likely to interact with fishing gear than mature adults.

An intersessional group was formed to further consider a number of issues with the terms of reference to provide further advice on the following:

(1) Understanding likely causes of trawl – whale interactions
   a) What factors likely contributed to the incidents (spatial, temporal, operational, behavioural factors of both whales and vessels)?
   b) How should future incidents be investigated and what information should be recorded? (e.g. documenting incidents and specimens, biological sampling, crew and/or observer roles)
   c) Routine data collection to put bycatch incidents into context (e.g. whale sightings, net monitoring devices)

(2) Considerations for developing effective mitigation, including:
   a) Vessel actions such as avoidance of whales
   b) Technologies such as exclusion devices
   c) Management measures such as move-on rules

The group will also nominate participants to attend the CCAMLR IMAF meeting on behalf of the Committee. Members include: Parker, Favero and Walker (CCAMLR), Biuw, Hines, Söffker, Heinemann, Stimmelmayr, Landry, S. Reeves, Mattila, Meyer, Johnson and Leaper (HIM Convenor).

12.3 Review of new methods and estimates of bycatch and entanglement rates, risks, and mortality

Wade *et al.* (2021) was developed by the Ocean Modeling Forum's Marine Mammal Bycatch Working Group to address gaps in the available resources available for managers and fisheries scientists wishing to ensure that their fisheries comply with the United States Marine Mammal Protection Act Import Provision regulation (NOAA, 2016). This paper provides a road map, including decision trees and diagrams that clearly present each phase of marine

mammal bycatch assessment and management, ranging from planning, to data collection, to risk assessment, and selection of appropriate management actions.

Moore (2021) provided more In-depth guidance on methods to estimate bycatch mortality, introducing concepts such as bycatch per unit of effort, bycatch mortality rates, and total fishing effort with descriptions of methods to calculate or estimate these parameters. This paper is intended to be accessible to managers and fisheries scientists without previous cetacean research experience. It includes flowcharts and an analysis of the strengths and weakness of different bycatch monitoring methods, ranging from observer schemes to self-reporting (including interviews with fishers), and electronic monitoring.

Course (2021) is intended to provide managers within the ASCOBANS area with information regarding methods to monitor fisheries and fisheries bycatch. The report includes descriptions of different monitoring techniques, including VMS, AIS, Fishing Activity Sensors, E-logs, CCTV, remote electronic monitoring (REM), and self-reporting. Several case studies are described that examine how these different methods have been implemented in various European fisheries. Following a comparison of these case studies, and analysis of costs vs. benefits, the author concludes that given the current state of REM technology, a combination of REM with on-board observers can provide an ideal combination for the most accurate and cost-effective fisheries monitoring.

In discussion, participants noted that the proportion of the fleet to be monitored by on-board observers where lower-cost REM is used (or mandated) in order to 'ground truth' REM observations will be dependent on the fishery and the cetacean species that interact with it. While onboard observers may detect 'drop outs' of cetacean bycatch that fall out of a net before it is hauled into the view of an REM camera, REM video, which may include multiple cameras, can be reviewed by multiple observers and may be more reliable at detecting bycatch incidents than human observers in some instances.

Attention: S, R, ASCOBANS

The Committee welcomed the resources shared by the Ocean Modeling Forum's Marine Mammal Bycatch Working Group and ASCOBANS, and applauded their value in providing managers with accessible, but scientifically rigorous tools for bycatch monitoring, and management. The Committee ***recommends*** *that these resources be used by the IWC BMI in future capacity building work, and that where possible the IWC, the Ocean Modeling Forum, and ASCOBANS seek opportunities for synergy and/or collaboration in fundraising for and implementation of capacity building activities.*

12.4 Reporting of bycatch and entanglements (both small and large cetaceans) including National Progress Reports

A summary of the entries into the Progress Reports database for the past year with respect to bycatch and ship strikes is available as Annex H & I.

SC/68D/SM/16 presented recently collected data on bycatch of Australian snubfin dolphins (*Orcaella heinsonii*) in the Kikori Delta of Papua New Guinea. Dolphins are caught in large mesh (5-7 inch) gillnets that are increasingly targeting fish for a newly emerging market in swim bladders. Fisheries interviews and reports from community dolphin monitors indicate that 3-4 snubfin dolphins per month are bycaught in a small population. Fishers in the area use dolphins to help locate fish, and intentionally set nets in close proximity to them, but are very keen to reduce entanglements. Fishers have themselves suggested reducing soak times so that they would be more likely to detect entangled dolphins before they die, and would almost certainly be open to training and/or resources on safe and humane handling and release techniques (e.g. Hamer and Minton, 2020). The authors would also welcome guidance and support from the IWC SC and the IWC BMI on ways to engage local fishing communities, as local land use rights will necessitate a 'bottom-up' approach, rather than a top-down approach.

It was suggested that the authors consider collaborating with the Consortium for the Conservation of the Atlantic Humpback Dolphin (CCAHD)[24], an organisation that is also trying to work with range-country NGOs and other stakeholders to raise awareness of and reduce bycatch in small-scale artisanal fisheries.

12.5 Review mitigation measures for preventing bycatch and entanglement

Pace et al. (2021) describes methods to examine the proportion of deaths of North Atlantic right whales that were detected as carcasses vs the estimated true levels of mortality in the population. This follows similar work to estimate cryptic mortality in other areas (e.g., Williams et al. 2011). Based on a population model it was estimated

[24] **https://www.sousateuszii.org/**

that observed carcasses accounted for only 36% of all estimated North Atlantic right whale deaths during 1990–2017. Entanglement accounted for 87% of serious injuries of whales that were observed but never seen again and assumed to have died, but was identified as the cause of death in only 49% of examined carcasses. This suggests a higher proportion of cryptic mortality due to entanglements compared to other sources.

The Committee welcomed this information and noted that this type of analysis was already being used in some US Stock Assessments. It was also noted that the North Atlantic right whale is particularly well studied with a large effort to detect and recover carcasses. Cryptic mortality in other cetacean populations may be much higher. It was recognised that the approach could help inform estimates of total mortality from bycatch or ships strikes elsewhere.

SC/68D/HIM/07 describes work in the US to develop 'ropeless' gear technology, which is becoming known as "on-demand" gear technology. This technology reduces entanglement risk for not only North Atlantic right whales, but other species as well, and allows fishermen to avoid time/area closures for gear with static buoy lines by using alternative modes of deploying and retrieving trap/pot gear. To retrieve the gear without a traditional buoy line, fishers either use manual grapples, or a remote release mechanism that lifts gear from the ocean bottom to the surface for recovery using a pop-up buoy, inflatable lift bag, or a buoyant spool. Eliminating buoys requires alternative methods to locate fishing gear, and Long noted this geolocation aspect is probably the biggest hurdle to implementing ropeless in the US lobster/crab fisheries. The US is testing various geolocation approaches with developers and software experts. To facilitate trials, NOAA has curated a "Gear Library", funded by the US government, several NGOs, and other collaborations, that allows users to borrow a system and provide feedback on gear operability and suggestions for improvement. Overall, 10 models of ropeless systems have been tested or are being developed for use in the northeast US.

The Committee welcomed this update on the progress being made in the USA with regard to this technology and members were pleased to hear that the "ropeless roadmap" mentioned in the report should be available by the end of May 2022. In addition, the Committee applauded the development of the "gear library".

Attention: S, CG

It was noted that the IWC BMI had submitted a proposal to host a similar library of bycatch mitigation equipment, especially for use in developing countries, but the proposal was not funded. The sub-committee ***recommends*** *that the IWC continue to seek support for this initiative, as it would be useful to many countries.*

In discussion of grappling as a low-cost alternative to on demand systems, and whether this might encourage more floating loops of groundline, Long noted that sinking ground line is currently mandatory in some east coast fisheries and fishers in those areas still seem to be grappling successfully. In the USA it is not currently clear whether fishers will be subsidised to make the switch to on demand technology if it is mandated. It is most likely that the costs would be shared by fishers but supported by government subsidies.

Segre *et al.* (2022) focused on the inshore Bryde's whale population in South Africa, classified as Vulnerable on the national Red List. Recent changes in static gear fisheries resulted in a high rate of Bryde's whale entanglements. Between 2014 and December 2021, 17 Bryde's whales were entangled in octopus and rock lobster gear, with at least 10 resulting fatalities, deemed to be an unsustainable level of mortality for the population. All entanglements occurred near the seafloor and likely while whales were feeding. Bio-logging tags were deployed on 12 inshore Bryde's whales revealing high-speed seafloor chases providing a likely explanation of how Bryde's whales encounter both the looped floating groundlines (connecting traps) and the vertical lines to surface buoys. In 2019, after three whales died, a temporary moratorium was placed on the octopus fishery, followed by a ruling that octopus gear must now include sinking groundlines, redesigned vertical lines, and acoustic or time release mechanisms. Grappling can be used to recover gear. Additionally, the fishery will be temporarily halted if there are two additional nonfatal entanglements of humpback or right whales, or a single entanglement of a Bryde's whale. The fishery will be permanently halted following a fatality from any of the three species.

Meyer noted that since November 2019, there have been no Bryde's whale entanglements in octopus fishing gear. It remains to be seen whether the regulations will be effective in reducing whale entanglement, and whether the government will allow the large-scale expansion of the octopus fishery.

The sub-committee thanked Meyer and co-authors and commended South Africa for its prompt identification of the problem, collection and analysis of data, and subsequent rapid initiation of what appear to be successful mitigation measures. While recognising that the interaction of cetaceans with ground lines between pots/traps will vary depending on species, fishery, and prey, some species including Bryde's and minke whales have been more frequently reported entangled in ground lines than vertical lines. The Committee agrees that switching to sinking

ground lines appears to be a very useful tool in reducing large whale entanglement in appropriate circumstances.

Lee presented a summary of SC/68D/HIM/11. The Korean National Institute of Fishery Science (NIFS) set a five-year plan (beginning in 2022) to develop bycatch mitigation methods for five main fishing gears known to cause bycatch. These include stow nets, pots, gill nets, trawl and set nets. Except for the stow net, for which mitigation modifications are already being trialled (see below), each gear improvement process starts with a literature review, followed by the design of gear modifications and development of equipment during the first two years. The following three years are then dedicated to laboratory and field tests with at sea monitoring.

A project to modify stow nets to reduce bycatch of narrow-ridged finless porpoises in Korean waters of the Yellow sea was started in 2017 (SC/68D/HIM/12). In 2021, field tests were implemented comprising three groups; (1) control (gear without an escape hatch), (2) test groups with escape hatches and (3) varying mesh sizes on the panels to guide porpoises out of the net. In total, 18 vessels participated in the monitoring for a combined total of 1,076 days. Three porpoises were bycaught from three different control group vessels and no bycatch occurred in either test group. A camera and sound recording system was installed to monitor whether the escape hatch was used by the porpoises. This showed large jelly fish species passing through the hatch, but no porpoises. However, acoustic recordings did indicate the presence of porpoises around the test net. In 2022, a further 11 vessels have joined the monitoring programme.

The Committee welcomed this information and commended Korea for these initiatives.

Guidino *et al.* (2022) describes the testing of pingers to determine their effectiveness in reducing bycatch of small cetaceans in a small-scale gillnet fishery targeting sharks, but also catching tuna, dolphinfish, and rays in northern Peru. Over a 16-month period, 60 trips were monitored, with 30 bycatch events involving pilot whales, common dolphins, and other unidentified delphinids. Bycatch of small cetaceans in experimental nets was reduced by 83% when compared to control nets. Pingers had no effect on the catch per unit of effort (CPUE) of fishes or rays. However, shark CPUE was 33% lower in experimental sets. The use of pingers had no effect on whale entanglement rates. With 16 observed entanglement events, humpback whales were the species that most commonly interacted with the fishery, and these incidents raise safety and economic concerns for the fishermen involved, who are interested in participating in bycatch mitigation efforts.

In response to a question about the cost and affordability of current pingers for artisanal fishers along the coast of Peru, Campbell noted that there would likely need to be subsides, or a significant cost reduction through mass production, or in-country manufacturing.

Attention: S, R, CG (Peru)

*Given the fishers' expressed motivation to reduce whale interactions, the Committee **recommends** further collaboration with the IWC BMI and the Expert Advisory Panel on Entanglement Response to design and trial effective mitigation measures, and further promote training on safe disentanglement practices.*

Read (2021) reviews bycatch mitigation measures (acoustic deterrent devices, porpoise alerting devices, reflective nets, acrylic echo enhancers, lights and various technical modifications and changes to fishing practices) that have been trialled in the ASCOBANS region. The report also reviews the options for alternative fishing methods (e.g. seine nets, jigging machines, longlines, fish pots and fish traps) to replace static nets. The costs of technical mitigation equipment and for changing to alternative gears were examined.

The Committee welcomes this review and noted that it should be added to the resources listed in 12.3 for use by the BMI when supporting individuals and countries seeking to understand and mitigate marine mammal bycatch.

SC/68D/HIM/02 also included an update on entanglements in the Scottish creel (pot/trap) fishery that the Committee had discussed in 2020 (SC/68B/HIM/02). Entanglements of minke and humpback whales were mainly reported in the floating ground lines between pots.

Attention: CG (United Kingdom), I, R

*Given the apparent success of the South African initiative to switch to sinking ground lines in the octopus fishery, and following its previous recommendation that the work of the Scottish Entanglement Alliance should continue, the Committee **recommends** trials using sinking ground line in Scottish creel fisheries.*

Macaulay *et al.* (2022) describes a passive acoustic monitoring (PAM) system for tracking the fine-scale three-dimensional movements of echolocating cetaceans around actively fishing nets by localising their acoustic clicks. The

system can be deployed during normal fishing operations by a trained researcher or experienced fisheries observer. Tracks of harbour porpoise showed a variety of behaviours, including multiple instances of animals actively foraging in close proximity to the fishing net. The authors concluded that a relatively inexpensive passive acoustic monitoring system, which is practical to deploy from active fishing vessels, is capable of providing highly detailed data on harbour porpoise behaviour around nets.

The Committee thanked Macaulay for presenting this work and noted the importance of behavioural studies to understanding bycatch risk. The methods described have potential to inform a better understanding whether modifications to gillnets in an attempt to make them more visible to cetaceans, such as lights or acoustic reflectors, are likely to be effective. This could help potentially overcome some of the challenges of mitigation trials in obtaining sufficient sample sizes.

The IWC entanglement initiative coordinator noted that he and the Entanglement Expert Panel were convened to address responding to entangled large whales. However, requests for advice on releasing free-swimming, entangled, small cetaceans are almost as frequent as those for large whales. In most cases these requests have been forwarded to Dr Randall Wells, who has several decades of experience responding to free-swimming, entangled small cetaceans. The Committee agrees that a small group (Minton, Trujillo, Simmonds, Marmontel, Rennell, Aranha, Baird, Porter, Wells and Mattila (convener)) should work with Dr. Wells intersessionally to develop best practice protocols for releasing free-swimming, entangled small cetaceans that would complement the guidance for releasing bycaught small cetaceans developed by WWF and CMS, and endorsed by the Scientific Committee (Hamer and Minton, 2020).

This group should take into consideration;

(1) Variation in species response to both entanglement and human intervention;
(2) Cultural and/or governmental perspectives and regulations;
(3) Proper care for positive biological and welfare outcomes, through consultation with knowledgeable veterinarians;
(4) Data collection for understanding and improving both short term and long-term success; and
(5) Consideration of plausible actions for moribund entangled individuals.

The Committee looks forward to reviewing the protocols at next year's meeting.

12.6 Review studies examining the implications of effort reductions on cetacean bycatch, fisheries economics and yields

Myers and Moore (2020) examined the inshore and offshore trap fishery for American lobster (*Homarus americanus*) in Northeastern U.S. and Canadian waters. The U.S. lobster fishery in Maine expends approximately 7.5 times as much effort as the equivalent Canadian fishery which has much higher lobster catches per trap than their counterparts in Maine. From 2007 to 2013 the number of traps deployed in Maine decreased but landings per trap increased with a doubling in total lobster landings. In the state of Massachusetts record high landings have been achieved since trap/pot seasonal closures have been implemented to protect right whales, especially within the Statistical Reporting Areas most affected by the closures. The authors conclude that a negative economic impact should not be assumed with effort reduction. In fact, reducing effort may serve to increase fishing profits while supporting the protection of endangered North Atlantic right whales and the long-term sustainability of the lobster fishery.

The Committee thanked Myers for presenting this work, noted that effort reduction was often the most effective way to reduce bycatch, and emphasised the importance of inter-disciplinary and multi-disciplinary research in finding solutions to reduce bycatch risks. In discussion it was noted that in some areas, pot limitation schemes have been proposed by the fishers themselves, but this is often a contentious issue, and many fishers oppose regulation and effort restrictions. In some fisheries there is clear evidence that longer nets or more gear are not efficient, but it has often not been possible to convince fishers of this. There are many reasons why individual fishers may deploy more gear than is optimal from an economic perspective. This includes setting gear to maintain access to fishing grounds and the lack of perceived benefit for fishers who reduce effort unilaterally. Myers noted that the fisheries data used in Myers and Moore (2020) were publicly available and the Committee encouraged similar economic studies in other areas for fisheries where there is a high bycatch concern.

12.7 Review of topics related to Hectors and Maui dolphins in New Zealand

In 2019, the Committee recommended a detailed independent review of a 'Spatial risk assessment of threats to Hector's and Māui dolphins' (Roberts *et al.*, 2019) with respect to this document's use for informing management measures to address anthropogenic threats to Hector's and Māui dolphins off New Zealand. Five specific topics were identified in 2021 for the risk assessment review based on discussions within the Committee. Each of these would

form the subject of short review papers by independent experts with the appropriate background which will be reviewed at a dedicated workshop. Funding issues limited intersessional progress, but Lundquist announced that New Zealand intends to provide funding to complete the agreed review process.

The Committee welcomes this news, and thanked Lundquist and the Government of New Zealand. The Steering Committee established in 2021 to guide this process, chaired by Staniland was re-established to approach independent experts and organise the workshop. The terms of reference for the review and criteria for independent experts will remain the same as agreed in 2021 (IWC, 2021c, item 12.8.1). However, Lundquist noted that the additional fishing effort data (IWC,2021c, Table 11, item 5.4) would not be available and so it would not be possible to address task 5.4.

Attention: SC-HIM, SM; CG-New Zealand

Between 2021 and 2021, the Committee has made a number of recommendations related to management measures to protect populations of Hector's and Māui dolphins (Annex P).

*In 2021 the Committee **recommends** a process for the review of the information and analysis presented in Roberts et al. (2019), including a list of topics for solicited review papers (see IWC 2021c, Table 11), The Committee also recommended a pre-meeting to:*

(1) Evaluate the design and structure of the multi-threat risk assessment model;
(2) Evaluate the overall sensitivity to model choices, data selection, uncertainties or potential biases identified in the review papers; and
(3) Make recommendations to reduce key uncertainties and improve the utility of the model to inform management decisions.

*The Committee **reiterates** its recommendation for the process of review, **agrees** that this shall now proceed in 2022-23 and **requests** that a report on its results be presented at the next meeting of the Scientific Committee.*

12.8 Consider definition of R_{max} for small cetaceans for use by the Scientific Committee (joint with IST)

In the context of reviewing the spatial risk assessment of threats to Hector's and Māui dolphins in New Zealand waters (Roberts *et al.*, 2019), in 2020 (IWC, 2021c) the Committee formed an Intersessional Correspondence Group to provide a working definition for the population model parameter R_{max} that would help with developing and evaluating population models for small cetaceans.

The tasks of the Intersessional Correspondence Group (chaired ably by Wilberg) were clarified in 2021 (IWC, 2022) as:

(1) develop a definition for the population parameter R_{max}, and conduct a review of approaches for estimating R_{max} with their data requirements, strengths, and weaknesses; and
(2) conduct a review of the estimation and use of R_{max} in the risk assessment for Hector's and Māui dolphins.

The primary focus of the intersessional work was on the definition of R_{max}. The text below is largely based upon the report of the Intersessional Correspondence Group but incorporates discussion made at the 2022 virtual meeting of the Scientific Committee. The Committee noted that consideration of the specific issues surrounding Hector's and Māui dolphins would be dealt with by an independent review being sponsored by the Government of New Zealand as first discussed in 2019 (see Item 12.7).

R_{max} is an important parameter in many population models, including those for small cetaceans. This parameter is key to understanding diverse problems including risk to populations of anthropogenic stressors, success of invasive species and responses of populations under harvest. In the context of risk assessments for small cetaceans, the time needed for recovery of endangered species is intimately linked to the intrinsic rate of population increase (Fagan *et al.*, 2010). R_{max} is often used in calculations which attempt to estimate sustainable levels of human-caused mortality. The symbol R_{max} and its variants sometimes have fundamentally different meanings in sub-disciplines of ecology, stemming in part from inconsistent terminology for quantifying aspects of population growth rate. That complication, coupled with a variety of different approaches for estimating different measures of population growth rate from empirical data, have confounded consistency in the way R_{max} has been used in the literature (see Fagan *et al.,* 2010 for examples and discussion).

After discussion, the Committee adopted the following definition developed by the Working Group:

R_{max} is a theoretical concept represented by a population model parameter that describes the per capita population growth rate at low population size (specifically, at a population level where neither depensatory nor compensatory density

dependence is occurring). R_{max} describes the upper limit for the per capita population growth rate in deterministic models, and the average maximum per capita growth rate in stochastic models.

In adopting this working definition, the Committee noted that there are several caveats surrounding the estimation and use of R_{max}, some of which are listed below.

(1) Only in a severely depleted population will competition for resources be at a minimum, and the rate of population growth at a maximum (assuming monotonic density dependence). Therefore, direct observations of populations that are growing at R_{max} are rare;
(2) With all approaches for estimating R_{max}, there needs to be consideration of uncertainty. The extent of uncertainty will differ depending on characteristics of the data and the method of estimation. How the estimated uncertainty in R_{max} is used will depend on the specific purpose of the modelling effort;
(3) Methods for estimating R_{max} have different levels of accuracy and robustness. Care must be taken in simply using estimates or methods from the literature;
(4) Values for juvenile (and neonatal) mortality are frequently highly uncertain; these can have a substantial influence on R_{max};
(5) Because a population will only grow at a rate of R_{max} at low population size, there is a potential for Allee effects (depensation) to complicate inference;
(6) R_{max} is influenced by the species and its habitat. Because of this interaction, the effect of the environment on R_{max} is an important consideration; and
(7) Sources of human caused mortality including cryptic mortality should be considered when estimating R_{max} because failure to take human caused mortality into account will lead to biased estimates of R_{max}.

The Committee noted that the Intersessional Correspondence Group has begun compiling a list of potential methods for estimating/setting R_{max}:

(1) use of empirical estimates of observed rates of per capita population increases when the population is sufficiently low to be considered unaffected by density dependence;
(2) simulation-based approaches using individual-based models;
(3) calculation based on the Lotka equation / Leslie matrix model-based approaches;
(4) estimation using a population model fitted to data that include estimates of abundance and removals; and
(5) application of allometric/life history relationships that have been developed using meta-analyses. To date, this approach has been used to provide values for R_{max} for species/stocks where direct estimates from the methods listed above are not available i.e. this approach can be used to provide a value of R_{max} in data limited situations.

Attn: SC

The Committee thanked the Intersessional Correspondence Group for its work and ***agrees:***

(1) to adopt the following definition of R_{max}

> R_{max} *is a theoretical concept represented by a population model parameter that describes the per capita population growth rate at low population size (specifically, at a population level where neither depensatory nor compensatory density dependence is occurring).* R_{max} *describes the upper limit for the per capita population growth rate in deterministic models, and the average maximum per capita growth rate in stochastic models*

(2) that the Intersessional Correspondence Group should continue its work on potential methods for estimating/setting R_{max} *and to provide data requirements, strengths, and weaknesses of each approach with the goal of providing a review for the next SC meeting.*

12.9 Progress on previous recommendations

S/68D/HIM/02 provided an update on bycatch issues in Europe including the European Commission's infringement proceedings for cetacean bycatch monitoring and mitigation failings, and other regulatory and policy measures within the EU which aim to improve bycatch measures. Updates were provided for the Baltic, Bay of Biscay, Mediterranean, Black Sea and UK waters. Population level impacts resulting from bycatch have been identified in each of these regions.

The Committee thanked Dolman for presenting the review. In discussion, it was noted that a number of European countries had not established adequate bycatch measures and had been subject to infringement proceedings by the European Commission. However, it was unclear why such proceedings had just been taken against the Netherlands in 2022.

SC/68D/HIM/01 describes progress on the proposal for Coordinated Development and Implementation of Best Practice in Bycatch Reduction in the North Atlantic Region (CIBBRiNA) which has been submitted to the European Union LIFE programme. The project aims to contribute to several treaty and EU objectives in minimising, and where possible eliminating, incidental bycatch of endangered, threatened and protected species of marine mammals, birds, turtles and elasmobranchs. One of the most important objectives is to achieve successful cross-sectoral cooperation between fishers, regulatory authorities, researchers and other key stakeholders, both within and between countries. It had been hoped that a decision on funding would have been made by the time of the end of the meeting, in which case the Committee could have provided advice on implementation options dependent on the amount of funding awarded. However, no decision of funding had been taken. The Committee reiterated its support for the proposal noting that it would address several aspects of recommendations made in 2020 (SC20113).

12.9.1 Harbour porpoise bycatch in Europe (joint with SM)

The Committee has repeatedly stated its serious concern for the survival of the Critically Endangered Baltic Proper harbour porpoise subpopulation. This subpopulation is genetically and morphologically discrete and numbers only a few hundred individuals. The Committee has also noted that climate change is now likely to be exacerbating this situation (SC/68D/Rep01).

SC/68D/HIM/05 evaluates the response of relevant EU member states to the ICES advice regarding measures to minimise bycatch of the Baltic Proper subpopulation of harbour porpoise. In February 2022, a Delegated Act under the EU Technical Measures Framework came into effect, closing static net fisheries in some Natura 2000 areas and other areas deemed as important for the Baltic Proper harbour porpoise.

The Committee welcomed this Act as an important first step toward protecting harbour porpoises, but noted that it falls short of the complete ban on static nets or the alternative measure to mandate pingers on all static gear in Baltic harbour porpoise habitat, that was recommended by ICES. The Baltic Sea Regional Fisheries Body (BALTFISH) has proposed dynamic closures in response to reports of porpoise presence as an alternative to gear bans and pingers. However, the Committee considered that this approach is unlikely to reduce bycatch for a number of reasons (i) there is a lack of evidence of similar approaches being effective in other areas, (ii) there are practical and logistical barriers to effectively detecting this inconspicuous species, and (iii) it seems unlikely that it will be possible to effectively communicate detections to fisheries in the area and establish logical geographical and temporal boundaries within which fishing activities would be curtailed in relation to detected porpoises.

The Committee also discussed the apparent impasse with regards to the deployment of pingers in the region due to concerns that pingers could interfere with military operations. Letters were sent by the IWC Secretariat to the relevant contacts in Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Sweden, Poland, Russia, and the EU Commissioner. However, the IWC has thus far been unable to obtain a satisfactory technical explanation of what aspects of pinger operation are considered a security risk, and whether design modifications would adequately address any security risks. It was noted that seal scarers currently used in coastal aquaculture operations emit much louder, higher frequency sounds, but do not appear to be considered a problem for the military. Given current military developments in the region, it may not be realistic to expect to advance this issue in the immediate future, and the Committee sees a clear need for alternative measures for bycatch mitigation in the entire population range.

Attention: CG (Baltic Sea range states), R, European Commission, S

In light of the new information and discussions, the Committee:

*(1) **reiterates** its previous recommendation (SC2097) that, as a matter of urgency, all Baltic Sea range states should act immediately to implement long-term bycatch mitigation measures for the Baltic Proper harbour porpoise until subpopulation recovery is achieved. In lieu of large-scale implementation of pingers in static net fisheries in the Baltic Proper, further closures of fisheries with high bycatch risk, primarily static net fisheries, should be urgently implemented;*

*(2) **encourages** countries whose military forces cannot accept large-scale use of pingers to fully investigate the potential effect of pingers on military underwater acoustic activities as well as possible technical adaptations to pingers to minimise such effects. The Committee is ready to offer technical advice as required and has established an intersessional group to facilitate this; and*

(3) requests the IWC Executive Secretary to maintain the ongoing dialogue with the range states and the EU Commission by writing to inform them of the Committee's ongoing concerns and recommendations.

*The Committee also **reiterates** the following from its recommendations made in 2021:*

*(4) **encourages** further research into stranded and/or bycaught porpoises to investigate all factors negatively impacting the subpopulation, including chemical and noise pollution and prey depletion;*
*(5) **encourages** again the Baltic Sea range states to propose the Baltic Sea harbour porpoise subpopulation for listing on CMS Appendix 1 at the earliest opportunity and calls on CMS Parties to support this process; and*
*(6) **encourages** all stakeholders to work expeditiously to increase public awareness of harbour porpoises and the challenges to their conservation.*

SC/68D/HIM/10, summarised a consolidation of different sources of information used to generate estimates of harbour porpoise bycatch in the waters of Portugal and Spain. Information sources included data from strandings and observer programmes collected between 1998 and 2019. Estimates of annual bycatch mortality rates ranged from 8.0-16.6% of an abundance estimate of roughly 2,900 individuals for the entire Iberian Peninsula.

SC/68D/HIM/14 provided further insight into bycatch mortality data compiled by stranding networks in Portugal and Galicia (Spain). The cause of death was evaluated in 364 out of 756 porpoises stranded between 2000 and 2020. Overall, in Portugal and Galicia, individuals stranded due to confirmed bycatch represented 47% of all analysed porpoises. Although detection of strandings has improved over time with the strengthening of reporting networks, the data indicate an increase in strandings, and an increase in bycatch-related mortality over time, with consistent stranding 'hotspots' in the north of Portugal, and the west coast of Galicia. The authors estimate that an annual average of 125 individuals was removed from Portuguese waters between 2011 and 2015. This number exceeds an estimate of PBR based on abundance estimates for that time period.

SC/68D/HIM/17 presents data from aerial surveys replicated annually over a 5-year period in the Portuguese coast. The overall porpoise abundance estimated between 2011 and 2015 (2254 individuals, CV=22% corrected for g(0) = 0.364 from SCANS III) are low. The highest annual porpoise abundance were estimated in 2012 (2995 individuals) and 2013 (3207 individuals). Abundance and density estimates in 2014 were approximately half the values obtained in the previous year, and corresponded to a higher number of strandings detected in that year. Habitat suitability maps for the harbour porpoise in the study area (including the extent area in Galicia, Spain) emphasise the importance of coastal areas between Nazareì (central coast, Portugal) and the western coast of Galicia (Spain).

The Subcommittee **welcomed** these reports, and the efforts to collect bycatch data from strandings and observer schemes. It was noted that the 2011-2015 abundance estimates upon which bycatch mortality rates and PBR are calculated, are based on a small number of sightings. Efforts to obtain new abundance estimates should be a high priority.

In response to concerns about this population, ASCOBANS has commissioned a study to investigate morphological and demographic parameters in the Iberian harbour porpoise, and to compare the Iberian population to porpoises in the North Sea and the Bay of Biscay. Knowledge of life-history traits can provide important inferences on population status. Life history data from stranded cetaceans can be used to estimate overall mortality and fishery mortality rates as well as provide baseline information required to monitor the status of a population. The results of the ASCOBANS study are expected to be ready by end of June 2023.

Spain's Ministry for Ecological Transition and Demographic Challenge has acted on previous IWC recommendations by conducting annual abundance surveys in habitat considered 'critical areas' for the species in spring and autumn, as well as assessments at 180 fish landing sites, complemented by 215 interviews with fishers to determine the nature of fisheries interactions with porpoises. The Ministry will also test different mitigation measures, including acoustic devices and gear modification. They also plan to conduct a mark-recapture study on bycaught carcasses that will be tagged so that they can be recognised if and when they strand onshore. Future work will be conducted in collaboration with Portuguese counterparts, with an aim toward creating a transboundary Natura 2000 MPA for harbour porpoises.

Sequeira informed the Committee that the Portuguese stranding network was reinforced in 2020 and the entire coastline is now covered by regional stranding networks. The collection of data on strandings (including biological sampling, necropsies and evaluation of bycatch) follows standardised protocols. She also reported that official contacts were already made between the Portuguese and Spanish authorities in order to start developing an action plan for the harbour porpoise. This action plan will address the bycatch problem and mitigation measures will be evaluated and implemented as a matter of urgency in the near future.

Attention: CG (Spain and Portugal), R

The Committee has previously noted that the level of bycatch of Iberian harbour porpoise is considered unsustainable and will consequently cause a population-level decline. The estimates of bycatch and abundance considered this year further reinforce this conclusion. The Committee also notes that the provisional threshold value for anthropogenic removals for this population put forward by the OSPAR Marine Mammal Expert Group is zero (ICES, 2021).

*The Committee therefore **recommends** immediate actions to effectively reduce, and where possible eliminate, bycatch of harbour porpoise throughout Iberian Peninsula waters. This will require close collaboration with the fisheries involved and may require a range of approaches, including; alternative technologies, protected areas with management plans to address bycatch (possibly including the establishment of zones with special regulations for gears posing a risk of bycatch), specific conservation plans for the species with associated mitigation measures, preventing illegal fishing, pingers, and/or other mitigation measures. Such measures are urgently needed for fisheries using gillnets and trammel nets but also for beach seines along the Portuguese coast which are used in some areas of high porpoise density.*

Vrooman *et al.* (2022) presented an assessment of a proposed initiative to begin satellite tagging harbour porpoises off the coast of the Netherlands. The report includes a review of best practice guidelines, different tags that can be used including their strengths and weaknesses in relation to the research questions being posed, and a consideration of the individual welfare of tagged porpoises. The authors advised a cautious start to tagging studies, focusing initially only on rehabilitated and released animals, then using the experience from these efforts to inform a possible wider programme with wild porpoises.

The Committee welcomed this review, including its attention to individual welfare concerns related to tagging. The Committee encouraged the team wherever possible to collect data on capture myopathy during the handling of animals during tagging operations. Questions were also raised about the criteria that would be applied during the first phase of the project to determine whether tagging should proceed with wild animals. These are still being defined and are likely to take into consideration welfare concerns as well as the utility of the data that are expected to be obtained.

12.9.2 Common dolphin bycatch in the Bay of Biscay

SC/68D/HIM/08 presented an analysis of common dolphin strandings and carcass detection in the Bay of Biscay in 2021. Common dolphin strandings between January and March 2021 appeared to be lower than during these same peak months in previous years. Drift modelling demonstrated that during this period, the area from which carcasses would have a stranding probability from 50-100% was about 35% of the area of the Bay of Biscay in January, 25% during the first half of February, 20% during the second half of February, and only 10% at the end of March. To account for the low stranding probability in March, the authors estimate the density of carcasses observed during aerial line-transect surveys using Distance sampling methodology. By combining this carcass density estimate with stranding estimates from January and February, the estimate of overall mortality of small delphinids in the Bay of Biscay in the winter of 2021 was approximately 6,800 individuals.

Rouby *et al.* (2022a) examined the population-level effects of fisheries bycatch on common dolphin in the Bay of Biscay through analysis of carcasses stranded between 1997 and 2019. Population viability was modelled based on age-at death derived from growth layer lines on cross-sectioned teeth (with a sample size of 642 individuals including both males and females) and sexual maturity derived from histology of dolphin gonads (with a sample size of 240 individuals - both male and females). Results indicate that survival has decreased over time, and that animals are reaching sexual maturity at an earlier age now than in 2002. These effects are both attributed to the pressure exerted on the population by high levels of bycatch mortality.

Rouby *et al.* (2022b) describes the application of regularised multilevel regression with post-stratification, to estimate total bycatch from non-representative samples of data reported by fisheries observers on mid-water pair trawlers in 10 ICES fisheries divisions between 2004 and 2020. A fine-scale analysis of bycatch risk, haul duration, and the number of hauls per days at sea, revealed that pair trawlers with long haul durations presented the highest bycatch risk, with risk increasing substantially in trawls longer than 3 hours.

In discussion, it was hypothesised that longer trawl duration is likely to be associated with the seabass and hake fisheries, which other studies have also linked to higher bycatch risk (Peltier *et al.*, 2021). However, it was noted that further research into the relative bycatch risks associated with fisheries targeting different species would be valuable.

The Committee noted that the bycatch levels of common dolphins in the Bay of Biscay did not decrease in the winter 2020-2021 compared to previous years, suggesting that the limited mitigation measures currently in place (pingers on pelagic trawls), had no measurable effect in reducing the total bycatch of common dolphins. Additionally,

the Committee noted that the estimates of vital rates (fecundity and survival) for the common dolphin population present in the Bay of Biscay indicated negative population growth (insufficient to ensure long term survival) that decreased over the period 2000-2020.

Attention: CG, European Commission

The bycatch levels of common dolphins in the Bay of Biscay remain a concern. Therefore, the Committee reiterates and reinforces its previous concerns. The Committee ***recommends*** *urgent action by the European Commission and relevant member states to implement the ICES (2020) advice that there should be a combination of temporal closures of all fishing métiers of concern and application of pingers on pair trawlers to mitigate bycatch outside of the period of closure. The research programs that are either on-going (CetAMBICion and DELMOGES), or awaiting final decision (CIBRRiNA), are extremely welcome as they would help refine long term management options, but should not be a reason to postpone immediate implementation of the management actions proposed by ICES.*

12.10 Biennial workplan

Table 20

Topic	Intersessional	Next Meeting	Intersessional	Subsequent Meeting
Bycatch and entanglements				
Bycatch Mitigation Initiative		Review progress on the Bycatch Mitigation Initiative; aspects relevant to the Committee and requests for advice.		Continue to review and provide input on pilot projects as required.
Rates and risks		Review new estimates of bycatch and entanglement rates, risks and mortality.		Continue to review
Mitigation		Review new information on mitigation measures for preventing bycatch and entanglement		Continue to review
Bycatch and entanglement in critically endangered populations		Review new information on		Continue to review
Collaboration on bycatch mitigation	Continue to support Secretariat on collaboration with FAO, IOTC and others[25].	Continue to review	Continue collaboration with FAO, IOTC and others	Continue to review
Collaboration with CCAMLR on bycatch in Southern Ocean krill fishery	Intersessional group to provide advice and nominate SC representative for CCAMLR IMAF meeting (October 2022).	Review progress from intersessional group and any new information from CCAMLR	Continue collaboration on bycatch issues as required.	Review progress
Collaboration with Baltic range states and European Commission on technical issues associated with acoustic interference of military activities by pingers.	Intersessional group to provide advice as required.	Review any intersessional developments.		
Reviews of topics related to spatial risk assessment for Hector's and Maui dolphins in New Zealand.	Steering Committee request review papers on each topic from independent experts.	Complete review process		

[25] **The Secretariat is also working on a number of initiatives related to collaboration (see 12.1).**

	Hold pre-meeting review.	
Continue developing a list of potential methods for estimating/setting Rmax and an evaluation of the data requirements, strengths, and weaknesses of each approach.	Intersessional group under Wilberg	Review report from intersessional group.
Develop best practice protocols for releasing free-swimming, entangled small cetaceans	Intersessional group under Mattila	Review proposals from intersessional group.

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)

Following recommendations from the Committee at SC68B and also from the Conservation Committee, a dedicated Data Manager has been employed at the Secretariat since April 2021 to oversee further development of the ship strike database and acquisition of new data.

SC/68D/HIM/06 provided an update on progress on the ship strikes database. In addition to identifying areas of improvement for the different stages of data acquisition, entry, archiving and querying, the database manager has been receiving, assessing, and curating new reports. Currently there are a total of 1,154 cases in the database and 58 additional new reports to assign to cases since April 2020. Of those new reports, approximately 45% are ready to be finalised, 10% lack enough data to move forward, and 35% need additional follow-up. The Secretariat has held discussions with relevant ship strike record data holders in the US and Australia to progress the agreed intention to share records that would significantly expand the records included in the database. Over the past year, there have been four requests for data, three of which were successfully fulfilled, and one of which involved an area for which no records were available. The Secretariat also worked with SC members from the Mediterranean to assist with data requests related to the proposal to designate a Particularly Sensitive Sea Area (PSSA) in the North-Western Mediterranean Sea (see item 13.2). All National Progress Reports are examined for possible records but in most cases further follow up is needed to obtain more complete information. A number of proposed actions related to the improvement of reporting of ship strike incidents to the database are also included in the updated Draft Strategic Plan to Mitigate the Impacts of Ship Strikes on Cetacean Populations (SC/68D/HIM/03).

In discussion, it was noted that regional searches of publicly available sources (e.g. online archives of newspapers, trade journals, and other media) had resulted in a number of additional records that had not been previously identified (e.g. Peel *et al.*, 2018). Fortuna noted that her searches for the Mediterranean had also helped verify some records and provided additional information particularly from databases of vessel details. Accessing some of these sources in different languages might require a number of researchers with different language backgrounds and knowledge of primary data sources in different countries. The Secretariat can help facilitate sharing experiences of media searches to support these activities.

Attention: SC, R,G, CG

*The Committee **welcomes** this report of progress and commended the Secretariat for their work to maintain and improve the database. As an important tool for understanding the nature, scope and scale of ship strikes globally the Committee **recommends** that:*

(1) the resources be made available to ensure that work to improve and expand the database continues;
(2) anyone with information on a ship strike continues to use the portal to submit a report; and
(3) The Secretariat and members of the Committee continue efforts to raise awareness among all relevant parties of the value of reporting ship strikes to the database.

The Committee also agrees to maintain its Ship Strike Data Review Group.

13.2 Mitigation of ship strikes in high risk areas

Panigada summarised SC/68D/HIM/15 and SC/68D/HIM/16, which provided background information and updates on a preliminary proposal to designate a Particularly Sensitive Sea Area (PSSA) in the northwest Mediterranean Sea through the IMO (IMO, 2021). The objective of the proposal is to minimise the risk of ship strikes with cetaceans. A draft proposal, following the IMO guidelines, is currently under discussion and negotiation between France, Italy, Monaco and Spain and it is expected to be ready for stakeholders' meetings in May-June 2022. The final goal is to submit a PSSA proposal in time for consideration at IMO MEPC 79 in December 2022. The proposal will specify the boundaries of the PSSA and several tentative associated measures that are currently under discussion.

The conclusion of SC/68D/HIM/15 was that fin whale distribution is widespread and varies inter and intra-annually. This means it is not possible to establish permanent routing measures to reduce risks to fin whales. Sperm whales are more closely associated with permanent bathymetric features and there may be options to reduce risk through routing commercial traffic transiting parallel to depth contours further offshore away from steep slopes, but this may increase risk to fin whales and so it is not considered a viable option. For these reasons, the measures currently under consideration for the proposal focus predominantly on speed reductions in the presence of whales. Voluntary, as opposed to mandatory measures are considered more likely to be accepted in a short timeframe. In discussion, it was noted that AIS data could be used to monitor levels of cooperation with the voluntary measures that are put in place.

Panigada noted the challenges of applying speed reductions to the whole area that is proposed as a PSSA. One option being considered is that the measures will rely on an accurate system for alerting vessels to the presence of whales, and a practical working definition of the geographical and temporal boundaries to which speed restrictions would apply when whales are detected. These measures could draw on the experience from measures taken in North Atlantic Right Whale habitat off the northeast coast of the United States.

Attention: CG, I, SC

*The Committee welcomes the initiative from France, Italy, Monaco and Spain to implement ship strike mitigation measures within a proposed Particularly Sensitive Sea Area (PSSA) and **recommends** that action needs to be taken to reduce ship strike risks to the Mediterranean populations of fin and sperm whales. The Committee also recognises that, in line with its previous recommendations, since routing options do not seem to be possible in the area, the most effective way to reduce risk is through speed reductions. The Committee has established an intersessional group that is ready to help with technical advice related to assessing the expected risk reduction that might be achieved by the measures that are proposed. The Committee **recommends** that any measures that are implemented are fully monitored and evaluated in terms of the risk reduction that is expected to be achieved, including through the use of AIS data to assess levels of industry cooperation, and that measures can be adapted based on this.*

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

SC/68D/HIM/03 provides an update to the IWC Draft Strategic Plan to Mitigate the Impacts of Ship Strikes on Cetacean Populations, covering the period from 2022-2032. The plan outlines seven updated objectives for the mitigation of ship strikes, as well as an update to the list of identified high risk areas along with the current status of research and mitigation efforts for each of these.

In discussion, it was suggested that the Strategy should also emphasise the importance of continuing efforts to identify new potential high risk areas, and offering technical support to stakeholders seeking to conduct the research or analyses required to identify areas of high risk in currently data poor areas.

The Committee noted its previous endorsement of the proposed structure for supporting IWC work on ship strikes outlined in SC/68B/HIM/13 (SC20120). It welcomed and endorsed the revised Strategic Plan (SC/68D/HIM/03) and agreed to maintain its Ship Routing Group to provide technical support to stakeholders seeking advice on assessing routing and other measures that may affect ship strike risks.

Attention: CG, SC, R

*The Committee **recommended** continued work to undertake the necessary research and analysis required to identify potential new high-risk areas.*

13.3 Co-operation with IMO Secretariat and relevant IMO committees

The IWC Secretariat and members of the Committee have continued to engage with the IMO Secretariat and attended IMO meetings (see SC/68D/O3). Discussions have included how to progress efforts to reduce risks to blue

whales off the coast of Sri Lanka (see item 13.5.3). The IWC expects to take part in the IMO MEPC 79 meeting scheduled for December 2022 when the proposal for a PSSA in the NW Mediterranean may be discussed.

13.4 Review progress for obtaining automated Information System (AIS) data

The IWC Secretariat reported that discussions to establish an MoU with Marine Traffic to facilitate data sharing have not progressed, but it is hoped that Marine Traffic will continue to be willing to respond to individual requests for data for work relevant to the Committee.

13.5 Progress on previous recommendations

SC/68D/HIM/13 summarises the WWF 'Protecting Blue Corridors' report, which uses satellite telemetry data collected over 30 years by over 50 research groups to map whale migration routes as well as feeding and breeding areas, and highlight potential overlap with human activities including shipping. Together with reports previously reviewed by the SC (Minton *et al.*, 2021; OceanMind *et al.*, 2020), this new report provides an outreach and communication tool for industry and government stakeholders responsible for managing shipping activities that helps identify areas of potential high risk of ship strikes.

The authors encouraged more engagement with the ongoing negotiations of the United Nations on a new treaty for the high seas (Areas Beyond National Jurisdiction). This is something the Secretariat is actively working on as a formal partner in the GEF, the Common Oceans ABNJ project (see 12.1).

In 2020 the Committee made recommendations regarding previously identified high-risk areas for ship strikes around the Canary Islands, Hellenic Trench and southern Sri Lanka (IWC Recommendations SC20116, SC20117, SC20118, SC20119). No new information was available from the Canary Islands, but Leaper provided updates for Hellenic Trench and southern Sri Lanka.

The Committee has been discussing the risk to the eastern sub-population of sperm whales in the Mediterranean from ship strikes in the Hellenic Trench for a number of years. In 2015 the Committee recommended that interested parties (including Greece, ACCOBAMS and the shipping industry) move forward with Greece in order to develop a proposal for routing measures. In 2021 the Greek authorities issued NAVTEX messages and updates of the pilot books to make mariners aware of the risk of ship strikes in the specific areas considered by the Committee. The Committee noted in 2021 that this was a welcome step forwards in terms of mariner awareness that provides a basis for potential adoption of voluntary measures by the industry.

In January 2022, the Mediterranean Shipping Company (MSC) announced that they would direct their vessels to avoid the areas that have been identified by the Committee. This company accounts for around 25% of the container fleet passing through the area west of the Peloponnese, although container ships are a relatively small proportion of the overall traffic compared to Ro-Ro vessels. The cruise division of MSC has also announced their vessels will avoid the area except for port calls where they will follow a route that crosses the shelf break as close as possible to perpendicular.

The Secretariat had written to the Government in Sri Lanka to follow up on previous correspondence regarding the ship strike risk to the Northern Indian Ocean blue whale population off the southern coast of Sri Lanka, but has not yet received a response. However, shipping industry organisations have been active in trying to follow up on SC recommendations. The World Shipping Council has been coordinating efforts within the shipping industry and has written to the Government of Sri Lanka with sign-on from industry bodies representing 90% of the shipping tonnage passing south of Sri Lanka. The industry organisations have requested an alternative routing scheme in line with the recommendations from the Committee to improve maritime safety and reduce the ship strike risk to blue whales.

The SC commended these industry-led initiatives to reduce ship strike risks to whales, which were directly inspired and supported by work of the Committee and IWC SSWG.

Attention: S, SC, ACCOBAMS

*The Committee **encourages** other companies to implement similar measures to those of MSC in the Hellenic Trench. It **encourages** the Secretariat, ACCOBAMS and members of the Committee to highlight these actions as evidence of the impact that the work of the Committee can have on the design and implementation of practical conservation measures.*

13.6 Biennial workplan

Table 21

Topic	Intersessional	Next Meeting	Intersessional	Subsequent Meeting

Ship strikes			
Rates and risks	Continue ongoing work on database	Review new methods and estimates of rates of ship strikes, risk of ship strikes and mortality including progress on ship strike database	Continue to review
Mitigation		Review new information related to mitigation methods	Continue to review
Reducing risks to fin and sperm whale populations in the Mediterranean	Provide advice on NW Mediterranean PSSA proposal, either to the proponents, should that be requested, or as part of the process of evaluation by IMO. (Ship routing group/Expert Panel)		
Continued co-operation with IMO	Secretariat to maintain dialogue with IMO Secretariat. Attend relevant IMOmeetings. Provide advice as required on any routeing proposals (Ship routing group/Expert Panel)	Review cooperation	Continue to review
Follow up on previous contacts offering IWC assistance regarding high risk areas	Secretariat to maintain contact with relevant authorities in identified high-risk areas	Review progress on identified high risk areas in IWC Ship Strike Strategic Plan	Continue to review

14. ENVIRONMENTAL CONCERNS (E)

14.1 Chemical pollution

14.1.1 Review intersessional work on Pollution 2025 (Report on workshop on cumulative effects)

Holm presented the results of the intersessional workshop on cumulative effects and multiple stressors, conducted by the Pollution 2025 ICG online, in Nov 2021 (SC/68D/Rep/02). The Workshop aimed to discuss new results and evaluate new methods and approaches for assessing the effects of stressors on cetaceans, both at the individual and at the population level. Additional aims were the identification of appropriate study designs and modelling approaches. Different types of conceptual frameworks that currently exist for integrating data of different sources and types and two conceptual frameworks were presented, as well as new methods, e.g. markers of toxicological pathways, 'omics' methods, biologging, telemetry, drones, epigenetic approaches. Several case studies from various species and geographic areas, each unique in its combination of occurring stressors were presented, e.g. the humpback whale sentinel program, the studies on the Deepwater Horizon Oil spill, the characterisation of multiple external stressors of landed Bering-Chukchi-Beaufort (BCB) bowhead whales, the progress of the Spanish project 'Transfers of Anthropogenic and Natural Stressors Involving Trophic Interactions of Ocean Nekton' (TRANSITION), the results of studies on harbour porpoises in the Baltic Sea, and an initial review on the magnitude and impacts of Per- and Polyfluoroalkyl Substance (PFAS) in stranded odontocetes in New Zealand waters. Models to assess, predict and manage population consequences of exposure to multiple effects, and a dynamic energy budget model were explored. In conclusion, the workshop encouraged the SC and wider Research Community to continue the investigation and improve the understanding, of the cumulative impacts of human activity-induced stressors on marine ecosystems. The workshop emphasised the value of an interface between science and policy to consider multiple sources of morbidity and mortality when developing conservation and management plans and address the geopolitical importance.

The Workshop recognised the importance of long-term monitoring studies, and made a series of detailed recommendations, including that vulnerable populations be monitored before stressors occur, including monitoring sub-lethal parameters, that opportunistic samples collected from vulnerable populations be archived, that

uncertainty be incorporated into model frameworks, and that new 'omics' approaches be explored as a means of screening for biomarkers. The Workshop recommended the establishment of an international database and sample archive and requested that the Secretariat communicate with the Stockholm and Minamata Conventions regarding the inclusion of blubber as a core medium for long-term chemical monitoring.

A number of recommendations covered the threats to cetaceans from oil spills, including the need to identify areas of high risk and increase efforts on spill prevention, consider the impacts of oil response activities on the health of cetaceans, and identify means of cleaning oil spills without exacerbating conditions for cetaceans and other marine species. The Workshop drew the attention of the Commissioners to the report and strongly encouraged governments to implement preventative policies. The case study on Arctic monitoring highlighted the need to continue international engagement on debris tracing and prevention, and importance of the precautionary areas in the Bering Sea and Arctic waters.

The Workshop encouraged collaboration across the scientific community to identify shared methodologies for assessing the combined effects of multiple stressors and cumulative impacts from human activities and emphasised the importance of communication and cooperation across stakeholders to inform conservation and management plans.

The Committee welcomes the extensive report and thanked the workshop participants for their efforts. In discussion, it was noted that there are currently several different frameworks for integrating data from different sources and the Committee questioned who will decide which framework or combination of frameworks will be chosen as the standard procedure. Holm replied that several frameworks are developed by research groups in different countries and different populations and applied, which will allow comparison of different frameworks. The feasibility of a framework depends also on the available database. A flowchart approach was suggested as one means of indicating which approach should be used depending on type of data. These flowcharts are already supplied in some of the frameworks e.g. PCOD, PCOM. A comparison of the different approaches and how and when to apply them would need to be pulled together in a paper.

Attention: SC, CC, CG, C

*The Committee **welcomes** the report of the IWC Pollution 2025 Workshop (SC/68D/REP/02) and **endorses** its recommendations. It recognises the importance of understanding cumulative impacts of human-induced stressors on marine ecosystems.*

14.1.2 New information on pollution

SC/68D/E/01 reported on metal concentrations of three dolphin species incidentally caught in nets off South Africa. A comparative approach was used to examine a total of 36 trace elements from 76 muscle tissue samples using inductively coupled plasma mass spectrometry. The three species incidentally caught off the KwaZulu-Natal coastline included the Indian Ocean humpback dolphin (*Sousa plumbea, n*=36), Indo-Pacific bottlenose dolphin (*Tursiops aduncus; n*=32) and the Common dolphin (*Delphinus delphis*, *n*=8). Na, Sb, Sr, and Zn concentrations were significantly higher in *S. plumbea* compared to *T. aduncus*. There were significant differences for Cd, Fe, Se, U and V between all three species; in all cases, *S. plumbea* had the lowest concentrations, and *D. delphis* the highest. Of concern were the concentrations of mercury in all three species, which were generally higher than concentrations reported for similar species elsewhere. *S. plumbea* females were the only group that showed a decrease in mercury with length and mass, suggesting offloading of mercury to calves. These results present the only recent study on metals in cetaceans from South Africa and, together with very high organic pollutant concentrations documented for dolphins from the same location, show that there is a likely threat needing long-term monitoring.

Aznar-Alemany *et al.* (2019) presented information on halogenated and organophosphorus flame retardants in muscle tissue of three dolphin species (*Delphinus delphis*, *Sousa plumbea* and *Tursiops aduncus*) from the southwestern Indian Ocean collected between 2012 and 2015. While the level of some flame retardants were as high as in more industrialised areas, other man-made components were rarely detected or at very low concentrations. Data on flame retardants in biota and environmental samples from the southwestern Indian Ocean are scarce and, as a result, comparisons are difficult. However, data from other marine predators in the region, such as penguins, suggest that further studies are needed to determine if these concentrations are the consequence of a high local contamination or widespread throughout the Indian Ocean.

The Committee thanked the authors for their work. In discussion, the Committee considered potential sources of these pollutants and whether they were linked to agricultural or industrial activities. The authors pointed out that mercury levels were particularly high in comparison to other areas. The Committee also noted the linkage to the One

Health initiative, particularly in cases of human consumption of stranded animals.

Attention: SC, CG, CC, C

*The Committee notes with concern the high levels of some flame retardants reported for several populations of dolphins in South Africa and the western Indian Ocean and **encourages** the relevant authorities to support systematic monitoring of pollutants and additional research to identify and mitigate the sources of pollutants.*

van den Heuvel-Greve *et al.* (2021) studied the transfer of organic contaminants in harbour porpoises from the southern North Sea. Using samples from individuals of all maturity classes and both sexes stranded along the southern North Sea (*n*=121), the authors demonstrated generational transfer of PCBs, PBDEs and HCB from adults to foetuses. Lower halogenated and more toxic contaminants appeared to be readily transferred to calves, exposing them to high levels of contaminants early in life. Among animals included in the study, 38.5% had PCB concentrations exceeding a threshold level for assumed negative health effects (9mg/kg lw). This was particularly true for adult males (92.3%), while adult females had relatively low PCB levels (10.5%) due to maternal offloading. Nutritional stress led to higher offloading in the milk, causing a greater potential for toxicity in calves of nutritionally stressed females. No correlation between PCB concentration and parasite infestation was detected, although the probability of a porpoise dying due to infectious disease or debilitation increased with increasing PCB concentrations, which again points to the risk of cumulative effects.

The Committee welcomed this information and noted the importance of including this new information in the Contaminant Mapping Tool. In discussion, it was noted that information on the potential impacts on reproductive function of organochlorine pollutants in males would be valuable. The Committee also noted the difficulties of comparing concentrations of organochlorine pollutants across studies, due to differences in the congeners analysed and the parameters reported.

14.2 Diseases of concern

14.2.1 Review progress in intersessional work on emerging diseases

Stimmelmayr presented an update on intersessional work on cetacean diseases of concern (CDoC), noting that Morbillivirus (CeMV), Herpes virus, *Brucella ceti*, and *Toxoplasma gondii* have been identified as major diseases of concern for cetaceans. Relevant publications on these topics that had been published in the past two years were highlighted to address outstanding knowledge gaps identified during the previous special focus sessions and provide new details on the pathogens, host susceptibility, pathology and epidemiology.

The Committee welcomes this update and the summary of available new information.

14.2.2 Special primer on coronavirus surveillance in aquatic wildlife

In response to the ongoing global COVID-19 pandemic and the increasing evidence for spillbacks into various terrestrial and a few aquatic animal species the Committee convened a focus session on SARS-CoV-2. Presentations by several experts from various disciplines including virology (Dr. Hon, IP), veterinary medicine (Drs. Martha Delaney, Sandro Mazzariol, Keith Hamilton, Teri Rowles) and marine biology (Dr. Sarah Wilkins) on the current state of knowledge regarding SARS-CoV-2 infection in animals were given, with a special focus on marine mammals and ongoing/future regional surveillance efforts for aquatic wildlife.

Coronaviruses are a group of enveloped viruses with a positive-sense single-stranded RNA genome. Most mammalian coronaviruses belong to the genera of alpha or beta-coronaviruses with mainly respiratory or gastrointestinal tropism and disease presentation. SARS-CoV-2 (beta-coronavirus group) has a very broad tissue tropism with diverse clinical presentation. Delta and Gamma coronaviruses cause mainly infections in birds, but pathogenic mammalian gamma coronaviruses are known. Two alpha coronaviruses have been described in harbour seals and two gamma coronaviruses have been described in aquaria-housed cetaceans including a single beluga, presenting with respiratory disease and liver failure, and in several dolphins (clinically normal), respectively. Both gamma coronaviruses were 99% identical to each other, therefore the name cetacean coronavirus was proposed. SARS-CoV-2 has now been reported in 665 individual animals (as of 18 April 2022) including semi-aquatic and aquatic species such as river otters, mink, hippopotamus and manatees. The potential of SARS-CoV-2 to spill back/over into other marine mammals remains unknown. However, several features of the coronavirus family, such as their high mutation rates, propensity for homologous recombination and a flexible genome size allows this group of viruses to quickly evolve and thus to take advantage of new opportunities and host species.

Cross-species transmission from infected humans and thus the establishment of animal reservoirs and associated spillback potential to humans has been an early ONE health concern during the ongoing global SARS-CoV-2 pandemic.

Genomic, as well as in silico and controlled challenge studies (experimental infections) have examined potential susceptibility of terrestrial and marine mammals. Based on genetic ACE2 sequence, several species including cetaceans are considered high to medium high and some exceeding human risk (e.g. dolphins). It is noteworthy that many of the species (cetacean and terrestrial) with known or suspected susceptibility risk to SARS CoV-2 are also considered vulnerable or endangered. From an ONE health perspective as well as a global wildlife conservation perspective much recent effort has been dedicated to characterising the pathology, clinical presentation, potential of viral shedding (respiratory/faecal) and transmission routes, pathology and pathogenesis in natural infections of domestic, laboratory, zoo and wildlife species. Natural infections have occurred in 10 taxa so far with variable clinical and pathological presentation, including asymptomatic, mild to severe morbidities (mostly respiratory) and mortalities (e.g. mink; ferret; exotic felids). Depending on species, SARS-CoV-2 infections can be asymptomatic. To date, surveillance in the US using RT-PCR testing has been limited to gray whale (25), beluga (6) whale; bottlenose dolphins (5), and killer whale (1). No positive results have been detected.

Given the presence of viable SARS-CoV-2 in faeces and urine, which have been demonstrated in many countries, the potential risk for exposure and transmission of SARS-CoV-2 to marine mammals via environmental contamination of coastal marine habitats through sewage, wastewater etc. was identified early on in the pandemic. For example, metagenomics on SARS-CoV-2 genotypes in the United States and some countries in Europe detected in the sewage are identical to clinical genomes from the region. Currently, the assessment of health risks of water contaminated by faeces is limited by a lack of knowledge regarding the persistence of infectious SARS-CoV-2 in fresh and sea water, but preliminary research indicates that the threat of virus transmission from the aquatic environment is likely low. Although the risk to water supplies is considered low (WHO) the virus can reach river streams, estuaries, and marine habitats and seafood like bivalves have been used as a monitoring tool.

Both the presence of viral genome fragments of SARS-CoV-2 in marine bivalves as well as the spontaneous cases of natural infection in free-ranging manatees (Brazil) with unknown exposure scenarios should give pause before marine exposure can be ruled out. From an epidemiological perspective multiple environmental factors (temperature; salinity, pH, UV, organic loading, marine debris, biofilm matrices; dilution factor, chemicals, water type etc.) will positively and negatively influence virus survival and infectivity and need to be considered together with dynamic virus load input (i.e. regional human case surges) when framing a marine exposure risk scenario. For example, SARS-CoV-2, like other viruses, shows temperature dependence and persists longer in cold environments including water. Accordingly, coastal areas (risk exposure study on Bohai Sea, part of the Yellow Sea) show a higher risk for exposure to SARS-CoV-2 in winter due water-borne transport from outfalls. For the Italian coast, a risk assessment was developed based on the comparison of the presence of Italian wastewater management plans, the coastal exposure to extreme weather events and the presence of susceptible cetacean populations. Study findings showed the potential SARS-CoV-2 exposure for marine mammals inhabiting Italian coastal waters in specific areas. As coastal waters are the ultimate sink for wastewater and given that we are in the third year of this global pandemic, both studies are important in raising awareness about potential regional exposure hot spots as well as emphasising that surveillance for the virus in water remains important from a ONE health perspective. Furthermore, given the potential risk, thorough investigation of stranded marine mammals is recommended in particular in species that feed close to the coastline year-round or during the cold. In the final remarks from a risk assessment perspective, it should be considered that while the virus RNA may be stable in river and sea waters, the presence of RNA alone does not correlate with infectious virus.

The World Health Organization for Animal Health (OIE) has been working with public and wildlife health partners on the human-animal-environment interface for this viral infection. In response multiple guidelines have been developed for professionals working in the animal sector including wildlife. Furthermore, ongoing risk assessments are underway to assess host range, reservoirs, viral evolution, and variant variation, the susceptibility of different species, especially in a natural setting, transmission dynamics (within and between species), and most importantly, the consequences for public and animal health (clinical virus shedding/contamination, viral evolution, mutation, and recombination). SARS-CoV-2 is a showcase for a ONE health approach and knowledge gained will help in preparation for other emerging viruses with pandemic potential.

Regional response and surveillance programs in wildlife and/or domestic species were implemented separately and to differing extents across North America (USA, Canada, Mexico). Ongoing marine mammal coordination on transboundary Unusual Mortality Events (eastern North Pacific gray whales [Mexico, US, Canada], North Atlantic right, humpback, and minke whales in the western Atlantic [Canada and US]) continued through virtual coordination. However, reporting, responses, data collection and analyses may have been impacted by the pandemic. Communication and collaboration regarding the impacts of the pandemic on data collection, analyses, stranding and entanglement responses, and Unusual Mortality Events are being assessed.

In the US, a OneHealth approach through a Center for Disease Control Federal Interagency Coordinating Group was instituted for response to evaluate the health threats across the human-animal-environment interface. Throughout the pandemic, the Wildlife and Zoo subgroup collated and discussed the science and spread awareness on the risks of SARS-CoV-2 transmission between people and animals with emphasis on three primary situations: (1) wild and exotic species in managed care facilities; (2) free-ranging wildlife; and (3) wildlife rehabilitation.

Specific guidelines and biosecurity protocols have been developed for marine mammals stranding responders and rehabilitation facilities by the US Marine Mammal Health and Stranding Response Program (MMHSRP). Briefly, during the first phase of the pandemic, no routine testing of marine mammals was required but samples of nasal, oral, and rectal swabs from animals admitted and released or during necropsy were requested and archived. Samples from phocids (harbour, gray, harp, ringed, spotted, Hawaiian monk, northern elephant seals), otariids (Steller sea lion and California sea lion), and Northern sea otters have been analysed. A small number of cetacean species have been tested including gray whales, belugas, bottlenose dolphins, and killer whale. To date no samples have been positive. Retrospective analysis is ongoing with a special focus on stranded animals during and post covid surges in the local human population. In addition, prospectively samples from marine mammals are being archived and targeted sampling and analysis is ongoing for animals that are showing clinical signs or are part of case-specific investigations. Although SARS-CoV-2 is the focus of these current surveillance efforts, screening for other coronaviruses and CDOCs are ongoing as well. In addition, the MMHSRP has distributed a survey to better understand the impact of the pandemic on the response networks and data collected for 2020-2022.

In a global context surveillance for SARS-CoV-2 and other coronaviruses within Europe and other parts of the world does not scale up to the US effort with only limited testing (Italy; Canary Islands; Netherlands, New Zealand) having been conducted. Given the tasks at hand, greater cooperation among all of the different researchers in this ONE health field is necessary as well as stronger funding support from the various governments for this important work.

Lastly, given the large-scale impact of SARS-CoV-2 on all aspects of the global human workforce (e.g. regional or country-wide lockdowns; quarantines, remote working) it is likely that stranding data collected during this pandemic is biased low. Analysis of US stranding data is ongoing and it is recommended to gather such information from all regional stranding networks. A survey document has been developed by the US Marine Mammal Health and Stranding Response Program and will be shared with the IWC stranding expert group. The new IWC stranding coordinator working in concert with the SEP will modify the survey to meet the needs of assessment of the impacts on stranding programs globally. The revised survey would then be distributed and reported at the next SC meeting.

Attention: SC

*The Committee **recommends** that the Strandings Expert Panel compile a standardised survey on the impacts from the pandemic on regional stranding programs, that could be circulated by the new IWC stranding coordinator to stranding network members.*

The Committee thanked all of the presenters in this focus session for their In-depth and informative presentations.

14.2.3. Review new information on Diseases of Concern (DoC)

SC/68D/E/11 presented information on toxicology research and monitoring of gray whales off Chukotka Peninsula (Russia) between 2008 and 2021. Samples from muscle, kidney, liver and blubber of gray whales were necropsied after aboriginal whaling and landing by Chukotka Natives in 2008-2021, collected by Chukotka scientists. In 2021 concentrations of heavy metals and radioactivity levels did not exceed the Maximum Permissible Level (MPL) in the studied samples of gray whales. Also last year in the Moscow Severtsov Institute the serum-positivity to eight pathogens (*Toxoplasma, Mycoplasma*, *Trichinella*, *Candida*, *Chlamydia*, Morbillivirus, Herpes and Parvovirus) was determined for serum in 33 gray whales, harvested in Chukotka at 2018-2021, all of which were serum-negative to Herpes virus. The highest (10%) positivity level was *Toxoplasma*, which was firstly found in gray whales. Also firstly found was *Trichinella* (6%), *Candida* and Morbillivirus (3% each), *Chlamydia* and *Mycoplasma* (2% each). Isolated cases of lethal toxoplasmosis in marine mammals are often associated with animal immunosuppression as a result of morbillivirus infections. *Toxoplasma* infection can also kill marine mammals, affecting their behaviour and increasing the risk of injury and death from predators and marine mammal hunters. Apparently, the consumption of gray whale meat by Natives can pose a certain danger due to infection with trichinella and toxoplasma with insufficient heat treatment of whaling products. In 2021 Moscow State University scientists analysed the isotopic composition of carbon and nitrogen in 46 skin samples of gray whales collected in different parts of Chukotka. There

were also seven whales that had a medical odour of varying degrees. Despite a significant variation in $\delta^{15}N$ values, the content of heavy nitrogen was significantly lower in 'stinky' whales than in common ones. Moreover, the sample with the strongest medicinal odour had the lowest $\delta^{15}N$ content of all samples in general at 11.5%. It is assumed that 'stinky' whales fed on objects of a lower trophic level than ordinary ones. However, it is possible that changes in the isotope composition may reflect pathological processes or disturbances in the nitrogen metabolism of whales. Possibly, infection with several pathogens at once (i.e. the gray whale female caught on August 16, 2019 was 'stinky', inedible and was positive to Morbillivirus, Chlamydia and Candida) may reflect nitrogen metabolism of whales or may have doubling or even cumulative disturbance effect for health status of gray whales.

In discussion, it was noted that the results are highly relevant in light of the ongoing gray whale UME, and that samples for conducting serology analyses are rare. The author noted that a publication on the results is expected in the coming year, and that future analyses will examine additional pathogens, stable isotope analyses, and stomach contents.

Attention: SC

*The Committee **commends** Litovka for the In-depth health assessments and increasing knowledge on 'stinky' whales. The Committee **encourages** submission of the publication on 'stinky' whales to the next SC meeting.*

SC/68D/ASW/03 summarised general information on population indices, whale health and hunter observations of Bering-Chukchi-Beaufort (BCB) bowhead whales for 2020 and 2021. As in previous years, a number of unusual findings (abnormal; pathological) were observed in subsistence harvested bowhead whales in 2020 and 2021. Abnormal findings ranged from infectious to non-infectious disease conditions including parasitic infections (*Crassicauda spp; Anisakis spp.*), trauma related to anthropogenic factors and killer whales, various developmental anomalies (e.g. shortened jaw), benign masses (hepatic lipomas; Encapsulated fat necrosis; Stimmelmayr *et al.*, 2017; Stimmelmayr and Sheffield, 2021), and inflammatory conditions of the digestive and urinary system. With the exception of the case of the shortened jaw, the majority of non-infectious disease conditions were unlikely to interfere with proper function of the affected structure(s) or impact the health of the individual animal. Prevalence of kidney worm infection (*Crassicauda spp.*) in landed whales in Utqiaġvik remains high (80-100%) and clinical pathological investigations are ongoing to better understand the health impact on individual whales. In conclusion, from a population perspective, population indices and general health assessment findings reiterate that the BCB bowhead whale population remains robust, that general health of whales remains good, and the harvest is sustainable. Given the increasing complexity of environmental, ecological and anthropogenic stressors being present within the bowhead whale core habitat (Stimmelmayr and Sheffield, 2021), continued monitoring of health and population indices will be important to aid in our general understanding of how the BCB bowhead whale will continue to respond to the ongoing transformation of the Pacific Arctic ecosystem.

The Committee discussed that the bowhead whale may be a very resilient species, but that one could not underestimate the large and rapid changes of the Arctic ecosystem. It appears that bowhead whales maintain a high level of health and condition despite Stimmelmayr's reporting and there is probably no reason for concern now. A recent estimate (SC/68D/ASI/01) indicates a population size of 17,000 animals, but there is a need to continue to monitor the situation.

Felipe-Jiménez *et al.* (2021) presented an update on CDOC infections in Cetaceans from the Canary Islands. Fifty-five beaked whales (BW) (294 samples) stranded in the Canary Islands from 1990 to 2017 were analysed by molecular methods (conventional nested polymerase chain reaction). Results showed that eight beaked whales were infected by herpesviruses (HVs), although only three animals displayed lesions indicative of active viral replication. Phylogenetic analysis suggests that HV-BW sequences are species-specific, although more studies are needed to better address this question. In addition, to our knowledge, this is the first description of HV infection in Gervais' and Sowerby's beaked whales. Three out of eight HV-positive beaked whales displayed histopathological lesions indicative of active viral replication.

The Committee recognised the importance of these observations and thanked the authors for presenting this information.

Fernandez *et al.* (2022) reported on harmful algal blooms (HABs), which have been increasingly recorded over the last decades and much work has linked these events to multiple oceanographic and climate disturbances. HABs can affect ecosystems either as events that affect dissolved oxygen, clog fish gills, or smother corals or through the production of biotoxins which affect living marine resources through food web transfers or aerosols. HAB represent a natural driver of decline and potential extinction of aquatic organisms, from invertebrates to mammals, which may

offer little evolutionary adaptation particularly in very high and long-lasting exposures. Despite numerous multispecies mass-mortality events linked to HAB-associated biotoxicosis globally, there are no records in cetaceans off the central eastern Atlantic Ocean. The report highlighted epidemiology, pathologic, microbiologic and toxicologic investigation results attesting to the first documentation of cetacean mass-mortality in European waters associated with brevetoxins. Twelve rough-toothed dolphins (*Steno bredanensis*) were found dead adrift or beached along the southwestern coast of Gran Canaria from April 28th to May 7th, 2008. Although pathologic examinations were limited by moderate to advanced autolysis and decomposition of the carcasses, consistent findings included multisystemic haemorrhage and undigested ingesta within the gastric compartments, mainly salema porgy (*Sarpa salpa*). Toxicologic analysis of gastric contents identified PbTx2 and PbTx3 brevetoxins. Results provided compelling toxicopathologic evidence of fatal brevetoxicosis in a cohort of rough-toothed dolphins. These data add to the limited knowledge on pathology of HAB in cetaceans and provide the first account of brevetoxicosis in European waters. No other mass-mortality or individual fatality of any cetacean species has been linked to brevetoxicosis in the Canary Islands since this event.

In discussion, the Committee noted that there are often mortality events associated with brevetoxin in US waters, and that blooms have increased in duration. Many mortality events in US waters appear to be acute, and respiratory effects have not yet been seen in cetaceans, however they are observed in people and manatees. The Committee noted that Fernandez' work builds on previous IWC efforts and thanked the authors for the presentation.

14.2.4. Other health issues in cetaceans

SC/68D/E/05 presented an update on Injuries, Emaciation and Skin Conditions in Cetaceans of the Strait of Gibraltar (2016 -2020). The Strait of Gibraltar is a heavily used marine region and an important habitat for seven cetacean species. The previous paper SC/66B/E/13 covered the time period from 2001-2015 and documented injuries, malformations, emaciation and dermal diseases in multiple individuals (Selling *et al.,* 2016). The Scientific Committee of the IWC recommended a continued monitoring and a follow-up of individuals to provide information on survivorship and skin lesion progression over time (IWC, 2017a). The authors screened photographs taken during whale watching operations for pathological conditions, such as emaciation, injuries, parasites and dermal diseases. Multiple fin whales were sighted with high numbers of *Pennella balaenoptera*. Dermal diseases included the observation of dark and pale skin patches, spotted lesions, cutaneous nodules and tattoo-like skin lesions. Skin lesions were detected in all species but seemed to affect bottlenose dolphins the most. Newly occurring lesions (annular lesions, target-like lesions) are a reason for concern and might indicate the occurrence of new pathogens. Continued monitoring and quantitative research to determine disease prevalence was recommended, as well as a monitoring of the chemical pollution levels (PCBs, flame retardants, toxic metals; Aznar-Alemany *et al.*, 2019; Jepson *et al.*, 2016; Plön *et al.*, 2022) and blubber concentrations of cetaceans in the Strait of Gibraltar. The report further documented a broad range of anthropogenic traumata. The severity of the injuries ranged from superficial linear marks to severe traumas. The results indicate that the use of illegal driftnets and recreational fisheries are on-going threats. The Spanish legislation established regulations on how close cetaceans may be approached by boat (Ministerio de la Presidencia, 2008). Recreational fishery vessels have been observed to disregard this law. The authors urge for stricter control and enforcement of existing laws and for a collaboration of Moroccan and Spanish authorities to mitigate the observed human impact.

The Committee questioned whether emaciated animals also show higher prevalence of skin disease, which was confirmed by the author. The Committee thanked Hanniger for presenting this information.

14.3 Strandings and Mortality Events

14.3.1 Review progress of steering committee for IWC Strandings Initiative

The work of the Strandings Expert Panel (SEP) from May 2021 - April 2022 was summarised. In the last year, the SEP have revised internal policies; met to review the membership, Terms of Reference and the Chair appointment; and responded to recommendations of the Scientific Committee (SC) in 2021. To address the SC recommendations, the SEP appointed a new part-time Strandings Co-ordinator, Emma Neave-Webb and created regional focal points for Western Africa, Sri Lanka, Eastern Asia, South America and the Central Pacific. The role of the focal points is to enhance and facilitate communication and to help and support engagement with local stakeholders. In the last year, the SEP has continued its provision of emergency support and training, through use of remote tools, successfully engaging with IGOs and stranding networks in Kenya, Sri Lanka, and Cambodia. The SEP successfully supported two emergencies; (1) the implementation of onsite training in Mauritius for an event reported last year; and (2) administration of support in response to a request from Sri Lanka and the incident of the MV Express Pearl. Governmental request for the SEPs official involvement in these incidents is required, and absent requests limit the level of support the SEP can provide. The SEP identified three key aims moving forward; (1) to complete the Steering Group (SG); (2) to engage with the IUCN and other animal health and welfare organisations to find synergies for

future strandings response; and (3) for the SEP to convene in-person at next year's SC meeting to define and implement the next steps of the 4-year workplan.

In discussion, the process for the selection/nomination of the SG members was considered. The Secretariat confirmed the formation of the SG must follow established Rules of Procedure (ROP). The SG must be chaired by a national delegate (two-year term), who is elected by the Steering Group and appointed by the Commission (through the SC Report adoption).

The Secretariat informed the Committee that amendments to the SG can take place following an update to the ROP and Terms of Reference, after the SG is formed and approved. The Chair and VC of SC along with the Chairs of E, CC and WKM&WI nominated four SC members for the SG. Once the SC report has been endorsed by the Committee this group will elect a Chair and meet to discuss next steps.

The Committee suggested the SEP produce visible open-source products providing practical advice and expert knowledge. The Chair of the Expert Panel emphasised the complexity of strandings science and the challenges to summarising the diversity of existing tools. The Chair of the Expert Panel highlighted the SEPs current focus is to evaluate the economics of the materials and tools in existence, and to review their suitability for the capacity of different countries to respond to strandings.

In discussion the absence of local representation and expertise for Africa within the SEP was highlighted. The Chair of the Expert Panel strongly supported local representation from Africa and Asia in future reviews of the SEP membership.

Attention SC, S, C

*The Committee notes the absence of representation and expertise from Africa within the Strandings Expert Panel (SEP). The Committee and the Chair of the Expert Panel therefore **strongly recommends** identifying and recruiting local representation from Africa and Asia in future reviews of the SEP membership.*

14.3.2 New information on unusual mortality events

SC/68D/E/08 presented information on the unusual mortality event of harbour porpoises in the Netherlands. In August 2021, a remarkably high number (~ 200) of dead harbour porpoises (*Phocoena phocoena*) washed ashore on the Dutch Wadden Sea Islands in a period spanning ten days. They all appeared in similar state of advanced decomposition, indicating that they died around the same time. Information derived from a drift-model indicated a location NW of Frisian Front and E of Cleaver Bank as the most likely origin of the carcasses. There were no unusual anthropogenic activities in that area during August (e.g., no Unexploded Explosive Ordnance detonation or military activities). Necropsies were conducted on 22 carcasses and revealed that animals were in good nutritional condition with mild to moderate parasitic loads and most were reproductively active. Despite their relatively good nutritional state, no or few prey remains were found in the stomachs. This is indicative of an overall fair to good health status, and a subacute cause of death. Ancillary testing showed that harmful algae blooms (HABs), Influenzavirus, Morbillivirus, herpesvirus and SARS-CoV-2 were unlikely the cause of the mass mortality. Cultures of liver samples (n=21) and from organs with macroscopic changes (n=3) revealed the presence of *Erysipelothrix rhusiopathiae* in 76% of harbour porpoises tested. This bacterium has not previously been cultured from harbour porpoises investigated in the Netherlands. There are no reports in literature of cetacean mass mortality as a result of *Erysipelothrix* infection. The investigation is ongoing.

The Committee welcomes this information. In discussion, it was noted that investigations of mass mortality of seabirds in the North Sea are currently ongoing, and that results of that investigation should be considered in interpreting the likely causes of the harbour porpoise unusual mortality event, as well as potential effects of any disposals of dead fish at sea, or potential sources of pathogens via river Thames. Committee members pointed out that links between water quality and prevalence of this bacterium have been demonstrated previously and that further efforts may provide further clues about these links and their effects on harbour porpoise health. The Committee also noted that information on such mortality events and their likely causes should be considered in light of cumulative impacts on harbour porpoises in the region (and cetaceans in general), despite bycatch in fishing gear being identified as the primary threat to this species and stressed the importance of the OneHealth approach.

SC/68D/E/03 reported on the bowhead whale (*Balaena mysticetus*) Unusual Mortality Event (UME) in the Gulf of Boothia, Canada, between 1 October 2020 and 14 April 2021. Eleven bowhead whales were discovered, near Kugaaruk, Nunavut. Tissue samples from eight whales were collected to investigate potential causes and extent of the mortalities. In addition, demographic, epidemiologic, pathologic, image analysis, adipocyte, lipid, and contaminant analyses were compiled and reviewed. Due to the remote location and lack of access, sonar/seismic

testing, ship strikes, and infectious disease could not be investigated. No gross indication of vessel or propeller strike was observed. Analysis of environmental, morphometric, histopathologic, and contaminant data did not reveal a definitive cause of the mortality. Unusual oceanographic processes and contaminant exposure were unlikely factors. The strandings were concurrent with sightings of killer whales in the region and predation marks and damage to the carcasses were observed by local Inuit. A contributing factor may have been an interaction between poor body (nutritional) condition and predisposition to predation. Sea ice coverage was low in autumn 2020, which allowed killer whales greater access to the Canadian Arctic and for longer than usual. Most of the dead whales were juveniles, which may enhance the risk of killer whale predation. The mortality event was likely related to broad changes occurring to the Eastern Canada-West Greenland (ECWG) population's habitat, due to complex and dynamic ecologic changes associated with climate warming. Fisheries and Oceans Canada plan to continue to monitor the population, further research will include analysis of; drone-collected images to assess body condition; reproductive history from baleen plates; satellite imagery to assess harmful algal blooms; population modelling to determine carrying capacity; and modelling of physical factors to associate future whale health within a larger environmental context.

In discussion, the Committee considered whether the animals were near moribund when predation occurred, the authors acknowledged this possibility and confirmed that moving forward further drone footage will be collected to better understand changes in the ECWG population body condition over time. The Committee also discussed the challenges associated with the analysis of environmental data, for example harmful algal blooms, using satellites in the coastal zone (<40km to the coast). The authors recognised these challenges and confirmed that further investigations are planned, and satellite analyses will be supported with analysis of ring seal stomach content before and after the event.

The Committee discussed the typical number of bowhead whale strandings that occur annually in the region, and while the numbers were low relative to the population, the occurrence of strandings in this region is unusual. The authors raised possible concerns of an increasing trend of predation by killer whales in the Canadian Arctic and highlighted the need for continued monitoring.

14.3.3 Other information

SC/68D/E/02 presented a first look at strandings data collected between 2000-2020, by various members and collaborators within the Indian Ocean Network for Cetacean Research (IndoCet), covering over 14,815km of coastline belonging to nine countries. The southwestern Indian Ocean (SWIO) is a region of global importance for marine mammal biodiversity, yet our understanding of most of the species and populations found there is still rudimentary. Cetacean stranding patterns and finer scale spatial and spatio-temporal patterns were characterised. Between 2000-2020, there were 398 stranding events, representing 1,259 individual animals, 17 genera, and 27 species, comprising six families: four balaenopterids, one balaenid, one physeterid, two kogiids, six ziphiids and 14 delphinids. Seven mass strandings were recorded: two were composed of three to 20 individuals and five were composed of >20 individuals. Spatial analysis of stranding events indicated local spatio-temporal clusters were present in all countries/territories except for the Comoros; however, the only significant cluster was detected on the southwest coast of Mauritius just west of the village of Souillac. The SWIO region is predominantly composed of relatively poor range countries, yet imminent Blue/Ocean economy developments are prevalent throughout the region. This study highlighted the importance of establishing baselines, upon which any future potential impact from anthropogenic developments in the region can be measured.

The Committee commended the authors for this comprehensive study. In discussion, interest in the analysis of class and gender of the individual strandings were discussed and the authors confirmed that this information was not included in this higher-level review. The data presented was reliant upon the confidence of individual networks across the IndoCet region. In some regions, little or no manpower, limited the data availability and confidence level. The work presented proved useful to highlight regions needing training and the levels of investment required.

SC/68D/E/04 examined humpback whale (*Megaptera novaeangliae*) stranding data from 2002 to 2021 (1,260 strandings: 106 alive; 1,145 dead; nine without information), collated from the Brazilian Aquatic Mammals Stranding Network (REMAB), and beach monitoring projects – PMP. There was a positive exponential trend in the number of strandings over time. Most strandings occurred in August (30.2%) and September (22.1%), but there is an apparent shift in the peak of mortality, becoming earlier. Calves were the most frequent in 15 out of 20 seasons, with juveniles predominating in only five seasons. In 2021 30 strandings were recorded with 187 classified as juveniles (where age could be determined). Strandings occurred predominantly close to the main breeding area in the Abrolhos Bank, but for 2016 and 2021 there was a significant displacement to higher latitudes. From 146 necropsies conducted from 2015 to 2021, 19.2% of deaths were caused by anthropogenic interactions, such as entanglement in fishing gear and ship strikes. Regarding body condition, 26.9% were cachectic or thin, and 24.2% were in good body condition. The

increase in humpback whale strandings along the Brazilian coast over time might be a result of a combination of different factors. Population growth, which seems to be reflected in the amount of strandings, increases the likelihood of interactions with human activities, hence increasing non-natural mortality. Another factor could be the nutritional condition of the individuals, which relates to food availability in higher latitudes. Previous work suggests a relationship between the occurrence of krill in the Islands at 54°-55°S, 36°-38°W and strandings of humpback whales in Brazil (Marcondes *et al.*, 2017). This seems to mainly affect juvenile individuals that were observed with food remains in their gastrointestinal tracts (on average: 40% per year). Further analyses are underway, focusing on the effect of changes in krill biomass and climate variability on humpback whales' mortality and stranding rates.

In discussion, the Committee considered whether two significant contamination events along the Brazilian coast in 2019 were identifiable within contamination levels of lactating juveniles. While not investigated at this time, the authors confirmed that further analyses were planned.

Boys *et al.* (2021) described the available published data on cetacean euthanasia in 2,147 peer-reviewed articles, highlighting knowledge gaps and providing direction to improve stranded cetacean welfare. The current knowledge and implementation of euthanasia methods remain highly variable, with limited data on the practicalities and welfare impacts of procedures. Two examples of countries by methods employed were drawn from IWC reports. In the UK, chemical euthanasia was most common (52%), whilst in NZ only ballistics methods were used. In general time to death/insensibility (TTD) was rarely mentioned, only reported by 0.5% of peer-reviewed articles, whilst TTD from IWC reports was reported for 35% of individuals in the UK and for 98% in NZ. The findings highlight the lack of available information on cetacean euthanasia and suggest increased data collection and the application of appropriate methods to improve cetacean welfare.

Boys *et al.* (2022a) evaluated Standard Operating Procedures (SOPs) for end-of-life decision-making and technically enacting euthanasia of stranded cetaceans across Australasia. The aim was to highlight similarities and differences in management and explore directions to improve stranded cetacean welfare. For this purpose, twenty-nine parameters for the implementation of end-of-life decisions were evaluated. Euthanasia and palliative care were options for end-of-life, with palliative care recommended when euthanasia was not feasible or presented human safety risks. Three euthanasia methods were recommended. Ballistics was recommended in seven SOPs, chemicals in five and explosives in three SOPs. Variability existed in the exact procedures and equipment recommended in all three methods. Additionally, only five SOPs provided criteria for verifying death, while only two recommended time to death (TTD) be recorded; hindering evaluation of the welfare impacts of end-of-life decisions and euthanasia procedures. The findings highlight the need for detailed guidance and consistency in end-of-life decisions and euthanasia techniques, to ensure reliable welfare outcomes. Systematic, standardised data collection at euthanasia events across regions is required to facilitate assessment of welfare impacts and develop evidence-based recommendations. International collaboration is key to developing objective criteria necessary to ensure consistent guidance for end-of-life decisions.

Boys *et al.* (2022b) explores fundamental concepts and key concerns relating to the welfare and survival of stranded cetaceans. Based on the expert criteria one of the main conclusions was that stranded cetacean welfare should be characterised based on interrelated aspects of animals' biological function, behaviour, and mental state and the impacts of human interventions. The characterisation of survival likelihood should reflect aspects of stranded animals' biological functioning and behaviour as well as a 6-month post-re-floating survival marker. Post-release monitoring was the major knowledge gap for survival. Welfare knowledge gaps related to diagnosing internal injuries, interpreting behavioural and physiological parameters, and euthanasia decision making. Twelve concerns were highlighted for both welfare and survival likelihood, including difficulty breathing and organ compression, skin damage and physical traumas, separation from conspecifics, and suffering and stress due to stranding and human intervention. These findings indicate inextricable links between perceptions of welfare state and the likely survival of stranded cetaceans and demonstrate a need to integrate welfare science alongside conservation biology to achieve effective and ethical management at strandings.

Attention: C, SC Environmental Concerns, and WKM&WI

*The Committee **welcomes** this new information on cetacean welfare and **encourages** that these papers should be brought to the attention of the IWC's Whale Killing methods and Welfare Issues group.*

14.4 Climate change

14.4.1 Review report from intersessional workshop on climate change

Simmonds presented the report of the 2021 Climate Change Workshop (SC/68D/REP/01). The workshop met virtually between 30 November and 3 December 2021. Sixty-six participants took part from 21 countries. The workshop took note of the previous work by the SC on climate change and a compilation of recent publications on cetaceans and climate change made by Nunny and Frey. The workshop considered the latest contributions from the IPCC. Global warming of 1.5 or 2°C – the upper limit defined in the Paris Agreement – will be exceeded during the 21st century unless deep reductions in CO_2 and other greenhouse gas emissions occur. However, even then there are many changes due to past and future greenhouse gas emissions that will remain irreversible for centuries or even millennia, especially in the oceans. Examples include the melting of the Greenland and Antarctic Ice Sheets, global sea level rise, ocean warming, deep ocean acidification, and deoxygenation.

The workshop received and discussed a number of presentations including:

- Rebuilding baleen whale ecosystems, which noted that whaling in the Southern Ocean provides a case study in which over a million great whales were removed but for many species recovery has been slow and is currently hampered by the potential decline of krill biomass;
- Recent developments related to climate change in the Bering-Chukchi-Beaufort Sea where there is an increasing complexity of environmental, ecological and anthropogenic stressors; new information from a population viability analysis (PVA) for beluga (*Delphinapterus leucas*) that explicitly included climate change (Williams *et al.*, 2021);
- Climate change effects on the four species of marine mammals present in the Baltic Sea, where the Baltic Proper harbour porpoise is critically endangered (Carlén *et al.*, 2021);
- A review of baleen whale ecology in high-latitude marine ecosystems; belugas (*Delphinapterus leucas*) which have been recorded potentially outside of what is regarded as their normal habitat or range;
- The Climate Smart Conservation Cycle; the use of Climate Vulnerability Assessments; Important Marine Mammal Areas (IMMAs).

Additionally, Cavanagh and colleagues from the British Antarctic Survey presented on the impacts of climate change on Southern Ocean ecosystems, looking, in particular, at synergies between the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and IWC. The workshop noted that due to its truncated virtual nature, not all elements of the planned agenda had been completed. A further in-person workshop was recommended.

The Workshop recognised the gravity of the impacts of climate change and noted the importance of long-term monitoring programmes to detect climate-driven changes in cetacean populations and habitats. The Workshop made a number of recommendations, including that climate change should be considered explicitly in recovery efforts for endangered species, that the IUCN Important Marine Mammal Area (IMMA) assessment process include an evaluation of the effects of climate change on IMMA habitats, and that there be stronger collaboration between the IWC and CCAMLR. The review of multiple case studies generated recommendations for highlighted species, including that the range states for the Baltic harbour porpoise take action to improve the resiliency of the population, and that expert networks, translocation protocols, and hydrological monitoring be established to address climate-related threats to river dolphins.

The Workshop also produced several over-arching recommendations, including prioritising climate change-related research in regions known to be experiencing intense climate change impacts, shifting management focus from sustainability to building resilience in cetacean populations, and including climate change impacts in investigations on cumulative effects of multiple stressors.

Climate Change Workshop

The Committee welcomed the extensive report and thanked the workshop group for its work. In discussions it was noted the importance of the issue and that there was a mandate from the Commission for the Committee to work on climate change (Resolution 2009-1). The importance of understanding the potential effects of climate change to cetaceans was recognised and the Climate Change Steering Group was encouraged to find ways to continue to integrate climate change within the work of all relevant sub-committees such as accounting for it effects in population assessments and management plans.

Attention: SC,CC, C

*The Committee **welcomes** the report of the virtual IWC Climate Change Workshop (SC/68D/REP/01) and endorses it recommendations. The Committee **encourages** further work, recognising the importance of continuing the integration of new information on climate change impacts to cetacean populations into its work.*

*Whilst a second workshop, intended as an in-person meeting, could not be supported at this time the Committee **encourages** the Climate Change Steering Group to promote integration of climate change aspects within the work of all relevant sub-committees.*

14.4.2. review new information

SC/68D/E/10 highlights recent publications about the various effects of climate change on cetaceans. Changes of cetacean habitat due to climate change include, *inter alia*, additional freshwater input into key habitats. This can alter salinity, which can have serious health consequences for some species (Fazioli and Mintzer, 2020). Extreme temperature events are also of concern. For example, in 2013, a persistent area of warm water developed off Alaska and, by summer 2014, this water mass stretched all the way south to Mexico. These triggered extended harmful algal blooms (HABs) and several populations of marine predators were adversely affected. In 2019, a second similar substantial area of warm water developed off the Pacific coasts of North America. Similar marine temperature anomalies have been reported from elsewhere in recent years, notably to the west of New Zealand. A change in the frequency and severity of storms is also of concern, as the available literature indicates that this may lead to changes in behaviour and distribution of cetaceans. Climate change is also predicted to change the occurrence and distribution of HABs (Townhill *et al.*, 2018). Finally, climate change may lead to alteration of human behaviour or distribution of human activities, which in turn may affect cetacean populations (Alter *et al.*, 2010). Examples include the development of marine renewable energy sources and increased marine debris in the Arctic. In order to more fully understand these various potential and actual impacts of climate change and better mitigate against them, the authors propose a second workshop on climate change, where some of the issues outlined above could be further considered alongside mitigation plans.

The Committee welcomed this information and noted the proposal for a second workshop.

Agrelo *et al.* (2021a) presented new information on the effects of ocean warming on the recovery of southern right whales (*Eubalaena australis*). By analysing a five-decade (1971-2017) data series of individual southern right whales photo-identified at Península Valdés, Argentina, the authors found a marked increase in whale mortality rates following El Niño events. The modelling of population responses to changes in the frequency and intensity of El Niño events suggests that such events are likely to impede southern right whale population recovery and may even lead to population declines, with the potential for disruptions of trophic web interactions in the Southern Ocean, further weakening that ecosystem's contribution to the mitigation of climate change.

In discussion the Committee noted two important points. First, the effects of climate change may be putting recovery of baleen whale populations at risk, even in areas where anthropogenic threats were previously considered to be relatively low. Second, this study emphasised the need to take into account how El Niño events may be affecting prey availability for southern hemisphere baleen whales feeding in Antarctica, and the important linkage to CCAMLR and the management of the krill fishery.

Attention: SC, CC

*The Committee **recognises** that climate change will affect the recovery for many cetacean species and **recommends** that future studies of population dynamics and recovery for cetaceans consider the effects of climate change on survival and fecundity.*

14.5 Underwater noise

The Secretariat presented paper SC/68D/E/09 on the collaboration with the International Maritime Organization (IMO) on reducing underwater noise from shipping. The IWC Scientific Committee has been discussing the impacts of noise on cetaceans for two decades and has been sharing the findings from this research with the IMO, the international organisation responsible for guidance or regulations to address underwater noise from ships. The IWC has observer status at IMO and contributed to the development of non-mandatory technical guidelines in 2014 for reducing underwater noise. Due to a low uptake in these measures, the IMO has started a process of revising the guidelines and identifying the next steps required to reduce underwater noise from shipping. The IWC will contribute to this work by providing input on available information on known impacts of shipping noise and relating this to the distribution of cetaceans and proposed measures to reduce underwater radiated noise. The IMO Correspondence Group will provide a report in early 2023 to the SDC 9 (the IMO Ship Design and Construction sub-committee).

The Committee welcomes this information and noted the importance of continued progress towards collaboration with the IMO.

Cholewiak reported on the seismic survey activity detected along the US eastern seaboard in the western North Atlantic, utilising acoustic data from 11 passive acoustic recorders deployed during 2016-2017. Airguns were detected at some sites for up to 69% of the study period. Results showed that at some periods, signals were detectable across all offshore US waters. Localisation analyses suggest the source of some of the surveys likely originated from South America. This long-distance propagation indicates that the area in which marine mammals could be exposed to noise generated by seismic surveys includes an entire ocean basin.

The Committee thanked Cholewiak for presenting this information and expresses concern over these findings. In discussion, the Committee noted the potential value in using AIS data to better understand the temporal and spatial scale of these seismic surveys. The Committee looks forward to receiving additional information on this study at its next meeting.

Reyes presented a proposed questionnaire to compile information on ongoing and planned marine seismic surveys in national and international waters, in order to get a better overview of the timing and locations of these activities and identify sensitive areas where potential impacts from impulsive noise on cetaceans may occur. This initiative is part of the work plan of the IWC Anthropogenic Underwater Noise Working Group of the Conservation Committee, which identified seismic exploration as one of its priority issues to be addressed in the short term and follows IWC Resolution 2018-4 on anthropogenic underwater noise.

The Committee welcomed the information presented and thanked the working group for their efforts.

Attention: SC, CC, C

Recalling Resolution 2018-04, and recognising the threats posed to cetaceans by underwater noise, the Committee:

(1) ***encourages*** *further collaboration between the IWC and the IMO with regards to addressing ship noise; and*
(2) ***reiterates*** *the need for intersessional collaboration between the Scientific Committee and the Conservation Committee on underwater noise, particularly with respect to addressing seismic survey impacts.*

14.6 Marine debris

Fossi *et al.* (2020) discussed the relevance of cetaceans as ocean health indicators of marine litter impacts and the development of new methodologies for evaluating such impacts. An approach based on the detection of new plastic tracers in tissues and the identification (through 'omics techniques) of the potential ecotoxicological effects caused by plastic debris ingestion in indicator species is a promising new diagnostic methodology. Coordinated efforts on the studies of debris ingestion and entanglement in cetaceans are of key importance to better understand the impacts of both macro- and micro-debris. In this context, the authors re-emphasise the recommendations from the IWC workshop concerning standardised approaches to necropsies and recording and measuring plastics and other debris (IWC, 2021b). Recently, the idea of cetaceans as indicators of ocean health has attracted the attention of the scientific community (IWC, 2021b). Some cetaceans, in particular sperm whales (*Physeter macrocephalus*) and fin whales (*Balaenoptera physalus*) have the potential to provide important information about marine litter impact at a global scale and may help in steer further research.

In discussion, the Committee noted that even the deep sea is not immune to the impacts of marine debris, and that the Mediterranean Sea appears to be a hotspot for marine litter. The Committee agrees that there is now ample evidence of the impacts of marine debris on cetaceans, and that action on the part of international bodies is required to address this issue.

Eisfeld-Pierantonio *et al.* (2022) suggest that about 68% of cetacean species are affected by interacting with marine debris, with an increase in the number of species reported to have interacted with it over the past decades. This includes 31 species impacted by entanglement and 57 species reported to have ingested plastic, with macroplastics being the main issue for all. The contribution of the ongoing COVID-19 pandemic to marine plastic pollution appears to be substantial, with potentially serious consequences for marine life including cetaceans, though so far, no cetacean species have been recorded as affected by COVID-19 related litter. However, the pandemic offers an opportunity to investigate the direct links between industry, human behaviour and the effects of marine debris on cetaceans. This may help inform management, prevention efforts, describe knowledge gaps and guide advancements in research efforts. The review highlighted the lack of assessments of population-level effects related to marine debris and suggested that these could be rather immediate for small, threatened populations already under pressure from

other anthropogenic activities. Finally, the review suggested that marine debris is not only a pollution, economic and social issue, but also a welfare concern for the species and populations involved.

The Committee thanked the authors for presenting this information and expressed serious concern over the findings reported in this paper.

Stockin *et al.* (2021) provide a first assessment of microplastics (MPs) in stomach contents of 15 common dolphins (*Delphinus delphis*) from both single and mass stranding events along the New Zealand coast between 2019 and 2020. MPs were observed in all examined individuals, with an average of 7.8 pieces per stomach. No correlation between total number of MPs and biological parameters (total body length, age, sexual maturity, axillary girth, or blubber thickness) was observed, with similar levels of MPs observed between each of the mass stranding events.

The Committee welcomes this information and noted the increasing number of papers on the topic of microplastics and marine debris. The Committee also discussed the value of necropsies, recognising that in the waters around New Zealand, species such as beaked whales may serve as good indicators for microplastics in the deep ocean.

Attention: SC, CC, CG, C

*The Committee **reiterates** its growing concerns about the impacts of marine debris on marine wildlife.*
The Committee:
*(1) **encourages** new information on wastes arising from the COVID-19 pandemic that are entering the marine environment, and in particular that findings of these materials during necropsies be reported;*
*(2) **encourages** necropsies that examine stomach contents for marine debris materials whenever possible.*

Recalling previous recommendations (SC20136, SC20137), the Committee agrees to continue work on marine debris issue via an intersessional correspondence group (ICG), including considering how marine debris-related information might be best collected and collated in an IWC database. In discussion, the Committee also noted that the UN Environment Assembly had agreed in March to establish an Intergovernmental Negotiating Committee with the mandate to forge an international legally binding agreement to end plastic pollution, and that the IWC could contribute to this effort.

Attention: SC, CC, CG, C

Recognising the importance in addressing the marine debris issue on a global scale, the Committee:

*(1) **requests** the Commission to support the development of the international legally binding instrument on plastic pollution, including in the marine environment, at the UN Environment Assembly;*
*(2) **requests** that the Secretariat engage in the ad hoc open-ended working group to prepare for the work of the intergovernmental negotiating committee to end plastic pollution convened by the UNEP Executive Director resulting from UNEA 5.2 resolution 5/14; and*
*(3) **recommends** the Secretariat consult on ship-based marine debris with the IMO.*

14.7 Habitat alteration as anthropogenic impact on cetaceans

Baldwin *et al.* (2021) provides an overview of 20 species of cetaceans occurring off the Sultanate of Oman, with chapters 3, 4 and 5 detailing known threats to cetaceans off Oman, mitigation options for threat reduction and organisations involved in conservation management of cetaceans, respectively. Identified threats include ship strikes, underwater noise, hydrocarbon exploration and production activities, fisheries activities, whale watching, chemical pollution, coastal development, biotoxins and infectious disease, and climate change. Species and threat-specific mitigation options are provided specifically for ship strikes, underwater noise, fisheries activities and an emerging whale watching industry, including linkage to IMO, CMS and IWC. Details of conservation and management organisations relevant to Oman (IWC, IMO, CMS, IUCN, CITES, FAO, regional fisheries organisations, ASWN and Omani organisations) are also presented, with the aim of educating readers and providing them with tools to help address environmental and conservation concerns, and build synergies between various organisations.

The Committee welcomed this information and noted the relevance to and linkage with the Conservation Management Plan (CMP) for the Arabian Sea humpback whales.

14.8 SOCER

The State of the Cetacean Environment Report, or SOCER, was the result of several resolutions of the Commission, including Resolutions 1997-7 and 1998-5, which directed the Scientific Committee to provide regular updates on environmental matters that affect the cetacean environment. In 2018, a compendium of the previous five years was

produced, which is now available on the IWC website. The 2022 SOCER (SC/68D/E/12), with just over 75 entries, focuses on the polar oceans.

The remoteness of polar seas is increasingly affording less protection to cetaceans from a wide range of threats. Climate warming, as exemplified by changes in the Greenland ice sheet, a massive ice shelf collapse in East Antarctica and significant reductions in Antarctic sea ice, is expected to exacerbate such threats. For example, pollutants as diverse as mercury and microplastics that are currently stored in ice will be set free. Underwater noise here is also predicted to increase because: (1) ice-free waters are generally louder and this will be affected by earlier melt and later freeze-up; (2) shipping is predicted to increase during the extended ice-free months; and (3) sound propagation may change with temperature. In light of increased vessel traffic, several papers have recently dealt with oil spills and their potential behaviour in Arctic waters and sea ice. The ship strike risk for baleen whales may also increase as trans-Arctic shipping routes open up, as will the risk from a range of other vessel-related contaminants. The reaction of polar organisms is described as 'naïve' with regard to a wide range of threats. In the Arctic, certain whale prey species such as copepods are expected to shift northwards and shifts in the distribution of endemic Arctic cetacean species have been recorded. The Southern Ocean and Antarctica are highly sensitive to environmental changes, with the greatest anthropogenic threat being climate change, in contrast to global marine ecosystems, where exploitation is considered to represent the greatest risk. There are gaps in our knowledge of major aspects of the ecology of krill, as key whale prey; a potential decline of krill or a shift to a salp-dominated ecosystem is of key concern.

Many of the studies related to climate change in the Arctic and Antarctic will ultimately have global impacts through changing marine ecosystems, ocean chemistry, global circulation patterns and sea levels. The synergy between climate impacts and ocean noise is also highlighted, especially in polar regions. The latest IPCC report paints a grim view of how the world is responding to climate change, with a high likelihood that we will exceed a 1.5°C increase in global temperatures and will soon be at a "tipping point" for major climatic changes. Other "global" environmental highlights include the increasing number of studies on microplastics in the marine environment and biota. It was found that there was poor compliance with voluntary speed restrictions to reduce the threat of ship strikes on whales and enforced, legal speed limits may be required. Research has also increased our understanding of how cetaceans react to sonar, and impacts appear to be primarily behavioural – which is a critical issue as many regulations assume physical impacts, which occur at much higher levels of sound exposure than would cause behavioural effects.

The Committee welcomes the new compilation of SOCER and thanked the editors for their continued work in compiling it. The full SOCER report can be found as Annex L.

Attention: SC

*The Committee **agrees** that the State of the Cetacean Environment Report for the next meeting should be compiled for the Indian Ocean.*

14.9 One Health

SC/68D/E/14 provided an update on the advances on Intersessional Correspondence group (ICG) on One Health approach. The "One Health" concept recognises that animal, human and environmental health are intrinsically intertwined and interdependent. The ICG objectives were to propose specific recommendations on how the One Health approach can be operationalised within the Scientific Committee, and its sub-committees, particularly to inform preventative, mitigation, and management actions. It was noted that One Health could be addressed at least for three major stressors (zoonoses, pollution and climate change) which may overlap in space and time. The ICG proposed to advance on recommendations at two levels: to integrate One Health considerations into existing sub-committee groups of the IWC and to increase collaboration with other international organisations on One Health matters. The ICG noted that several IWC programmes and groups are already applying a One Health approach to their protocols and research, including the IWC Global Entanglement Response Network, the IWC Strandings Initiative, and the sub-committee on Environmental Concerns. The ICG also considered that international collaboration with other organisations, such as the World Animal Health Organisation (OIE), IUCN, FAO, WHO, UNEP, Wildlife Disease Association, CITES, CMS, and others, is an important step to develop a broad and synergistic One Health approach to facilitate a good conservation status of cetaceans and marine ecosystems. The ICG undertook a literature search on One Health and marine wildlife, that could be applied to the work and aims of the IWC. The review identified over 200 published research articles with about 40 studies directly addressing One Health. It remains a work in progress as new papers are identified.

In discussion, the Committee **noted** the importance of this approach, as well as the importance of linking it with

other interrelated topics such as ecosystem functioning and the ecosystem health approach, recognising the role that cetaceans play in the health of marine ecosystems.

Attention: SC, SC-E, CC

*The Committee **endorses** the recommendations presented in the One Health approach, recognising that work will continue intersessionally to refine those recommendations.*
*The Committee also **encourages** the development of a case study to apply the One Health approach to a Conservation Management Plan (CMP) or marine protected area, to develop a proof of concept and show how the approach can be operationalised.*

14.10 Biennial workplan

Table 22
Workplan for Environmental Concerns

Topic	Intersessional	Next Meeting	Intersessional	Subsequent Meeting
Pollution 2025	Continue collecting information on legacy and emerging contaminants in cetaceans, on cumulative impacts; monitor and research on trace element and heavy metal contamination in Caribbean cetaceans (SC20122, SC2164, SC2165)	Review progress	Continue collecting information on legacy and emerging contaminants in cetaceans, on cumulative impacts	Review progress
Cetacean Diseases of Concern	Continue collecting information on Emerging diseases, adapt ToR (SG-8), SC20125	Review progress	Continue collecting information on Emerging diseases	Review progress
Strandings	Reform steering committee of the SI and appoint a convener, SI and SEP will finalise the details of the workplan, work on recommendations on satellite imagery, SC20128, SC20128, SC20130, SC20131	Review progress of intersessional work	Progress towards workplan	Review progress
Climate Change	Continue collecting information on impacts of climate change, follow up on workshop, adapt ToR (ICG-9)	Review progress of intersessional work	Continue work to follow up on recommendations	Review progress
Noise	Adapt ToR (ICG-9), SC20133, SC20134, SC201235, SC2183	Review progress of intersessional work	Continue work to follow up on recommendations	Review progress
Marine Debris	Follow up on recommendations (SC19185-19224), adapt ToR (ICG-10); 20137, SC2185	Review progress	Continue work to follow up on recommendations	Review progress
SOCER	Report compilation on the Indian Ocean regions	Review SOCER report	Report compilation on the Mediterranean and Black Sea regions	Review SOCER report
Sub-committee coordination (ICG)	Porter & Convenor will work with SC sub-committee convenors to develop a strategy to better integrate the SM and E workplan across the SC as appropriate	Review progress	Continue ICG if needed	Review progress
One Health approach (ICG)	Continue to develop recommendations; work across sub-committees, and specifically with the ecosystem functioning group	Review progress of intersessional work	Continue work across sub-committees	Review progress of intersessional work
ICG on beaked whales in conjunction with SM ICG	Develop response protocol, develop recommendations for improved data sharing (SC2181)	Review progress of intersessional work	Continue ICG if needed	Review progress of intersessional work

15 ECOSYSTEM MODELLING

The Ecosystem Modelling Working Group was first convened in 2007 (IWC, 2008b) 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 EM 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.

15.1 Workshop on the Role of Cetaceans in Ecosystem Functioning: Gap Analysis

15.1.1 Review outcomes and recommendations from the Workshop on the Role of Cetaceans in Ecosystem Functioning: Gap Analysis

In response to Resolution 2016-3 (IWC, 2017a) 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 gap analysis 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, 2019b, p.46).

In 2019, the Committee reiterated the need for a workshop to begin the process of responding to Resolution 2016-3 and agreed a plan including potential hypotheses and questions for consideration, and a comparison of the ecosystem function of cetaceans between different ecosystems (IWC, 2021c). However, due to difficulties in holding the workshop as planned originally, the committee held a virtual IWC-CMS workshop on Cetacean Ecosystem Functioning in April 2021 (IWC, 2021a) for better coordination for the future in-person workshop.

Unfortunately, similar circumstances prevented a face-to-face workshop from being held before SC68D, but the Committee agrees that it would be beneficial to hold the second workshop before the next meeting (as a pre-meeting as previously discussed). For this reason, the Committee re-established a workshop steering group with the same terms of reference as previously (see Table 23 provided below). The Committee recognises that estimates of pre-exploitation and current abundance of large whale populations are needed in advance of the second workshop. Re-analyses to estimate population-wide prey consumption and nutrient excretion rates so as to inform on the ecosystem functioning mechanisms under consideration are also needed and the second workshop should be deferred if the necessary information is not available in time.

15.1.2 Any new information on ecosystem functioning

SC/68D/EM/01 presents new information on nutrient concentrations in minke whale faeces and the potential impact on dissolved nutrient pools off Svalbard, Norway. There is increasing interest in assessing the impact of whales on nutrient and carbon cycling in the ocean. By fertilising surface waters with nutrient-rich faeces, whales may stimulate primary production and carbon uptake, but robust assessments of such effects are lacking. Based on the analysis of faeces collected from minke whales (n=31) off Svalbard, Norway, this study quantified the concentration of macro- and micronutrients in whale faeces prior to their release in seawater. Concentrations of the macronutrients nitrogen (N) and phosphorous (P) in minke whale faces were 50.1 ± 10.3 and 70.9 ± 12.1 g kg-1 dry weight, respectively, while the most important micronutrients were zinc (Zn), iron (Fe), manganese (Mn) and copper (Cu). By combining measured faecal nutrient concentrations with estimated prey-consumption and prey-assimilation rates, the study calculated that the current population of approximately 15,000 individuals, in the small management area (SMA) of Svalbard, defecate annually 1258 ± 259 tonnes (t) N and 1782 ± 305 t P. The molar ratio of N:P in minke whale faeces was 1.6:1, meaning that N was proportionally limiting, when compared to average elemental ratios of 16:1 in phytoplankton. In the case of no N-limitation in surface waters at that time, the release of elemental P through defecation in surface waters has the potential to stimulate 73,000 t of carbon per year as new or regenerated primary production in the SMA of Svalbard. This amounts to 0.5% of annual new primary production and 0.4 to 4.1% of daily net primary production to this region. This study provides the first assessment of nutrient concentration in whale faeces prior to their dissolution in sea water. Further research, namely on the amount of N released via urine and the proportion of excreted nutrients remaining in the euphotic zone, is needed to better assess the full potential of whale nutrient additions to dissolved nutrient pools in surface waters at regional and global scales.

In discussion, the author advised that research is ongoing in regard to several key questions, including the dissolution rate of nutrients in faeces exposed to seawater, utilisation of excreted nutrients, and nutrient concentrations in urine. Faeces reported in SC/68D/EM/01 were collected from hunted specimens. There is the

possibility of obtaining faecal samples from stranded whales. However, it is better to have fresh samples because substances like carbon degrade over time. Additionally, if the whale stranded due to illness, it might not be representative of the whales in the area. The Committee also discussed the need to investigate spatial and temporal variability in nutrient concentrations in faeces from minke whales that would result from different minke whale diets, and also differences in faecal nutrient concentrations across different species of cetaceans. All of the faeces reported in SC/68D/EM/01 were from minke whales that had been feeding on capelin. Tamura advised of his interest in collaborating on future research by collecting faecal samples in the waters off Japan and comparing differences in nutrient concentrations between geographic areas. The Committee noted that there are no existing faecal samples from whales hunted in the past in the Southern Ocean.

The Committee was given a summary of the IWC Conservation Committee Workshop on Socio-Economic Values of the Contribution of Cetaceans to Ecosystem Functioning. The workshop was held virtually on 5th, 6th and 11th of April 2022, and was aimed at reviewing analytical valuation methods and assessing the potential of applying those methods to cetaceans. The workshop received information on the IWC-CMS workshop on cetaceans and ecosystem functioning; the relation of ecosystem functions and services to other traits from marine megafauna and to cetacean carcasses; the possible future impacts of climate change and other threats related ecosystem services; and the United Nations System of Environmental Economic Accounting. The workshop also reviewed market and non-market techniques of economic valuation for ecosystem services, and discussed the need to integrate socio-economic data into marine science policy. The workshop discussed the need to create financial and institutional structures to support the conservation of marine species using the Common Asset Trust and Nature-Based Solutions frameworks. Discussions relating the cetacean traits, identified by the IWC-CMS workshop, to an ecosystem service that could be used from a socio-economic perspective revealed that this is a challenging exercise. A preliminary review of the IWC-CMS table on cetacean traits showed that probably two of the 26 traits identified could be used for direct valuation of ecosystem services because, from a socio-economic perspective, the beneficiaries ultimately need to be humans. Options to include other important traits to enable incorporation of indirect benefits and non-market valuations were discussed. In the short-term, the workshop proposed the development of a pilot project on one species and simplifying the number of functions used. For the medium-term, the workshop proposed modelling potential socio-economic impacts derived from climate change and other threats. Finally, the workshop suggested that the IWC could consider exploring the development of financial and institutional frameworks to create conservation funds for those species that provide socio-economic benefits based on non-market valuation of cetacean ecosystem services.

During discussion, the Committee indicated that the socio-economic values of the contribution of cetaceans to ecosystem functioning need to be assessed for two different time points. The first valuation represents the potential or inherent value of the current system. This initial valuation is the focus of the Committee's present undertaking and will be assessed with a pilot project involving a single focal species. The species to be examined in the pilot project has yet to be determined; species selection will depend on available information. Members of the Committee, particularly the EM Working Group, are encouraged to assist with the pilot project. The second valuation represents the change in the status quo due to any actions taken in accordance with management decisions.

15.2 Review results of ecosystem modelling in the Antarctic Ocean and northeast Atlantic Ocean

Ecosystem modelling is an active area of research of particular interest to the Committee with regard to investigating ecological functions of whales in the ecosystem. The Committee received no papers this year on ecosystem modelling in the Antarctic Ocean or northeast Atlantic Ocean. The Committee noted that some of the discussions in the workshop on the ecosystem functioning of cetaceans overlapped with the ecosystem modelling in these regions (see 15.3); therefore, the Committee looks forward to submissions on this topic next year.

15.3 Review progress on estimating pre-exploitation and current abundance of large whale populations

To proceed with the analyses of the "ecosystem functioning of cetaceans", pre-exploitation and current abundance estimates of large whale populations are needed as these play a fundamental role in understanding ecosystem functioning. At SC68C, the Committee began identifying existing information and potential resources for those estimates in the North Atlantic and Southern Ocean, the main areas of interest to the Committee for investigating ecosystem functioning of cetaceans. The Committee recognised that abundance estimates for several North Atlantic stocks have already been approved by the Committee and used for IST, AWMP or RMP. Both NAMMCO and the IWC have developed tables of accepted abundance estimates. Therefore, identifying the best abundance estimate for each stock will be a relatively straightforward undertaking for the North Atlantic. In contrast, the Committee has not recently conducted reviews or In-depth assessments for Southern Ocean whale populations. Reviewing existing and identifying the best abundance estimates for the Southern Ocean will be a larger task; notwithstanding that, this region is of primary importance to the Committee's investigations into the ecosystem functioning of cetaceans.

The fact that the Secretariat maintains a database of recent abundance estimates for Southern Ocean stocks, including those listed in the IWC Table of Accepted Abundance Estimates, may assist in this regard.

Last year the Committee established an intersessional correspondence group to provide plausible sets of pre-exploitation and current abundance of populations of relevant large whale species in the Southern Ocean and the North Atlantic from the literature, and to conduct additional analyses if needed. Unfortunately, little progress had been made during the intersessional period. However, considering the importance of this information for the Committee's work on the ecosystem functioning of cetaceans, the Committee re-established an intersessional steering group to progress these issues. The steering group's membership includes Kitakado (convenor) Givens (co-convenor), Allison, Biuw, Butterworth, Donovan, Elvarsson, Ferguson, Haug, Jackson, Katara, Kelly, Kinzey, Lindstrøm, Moosa, New, Palka, Plaganyi, Punt, Robbins, Sigurdsson, Solvang, Tulloch, Vikingsson, Watters, Witting, and Zerbini. Steering group membership includes expertise on the Committee's statistical and computational needs and priorities, the North Atlantic ecosystem (including representation from NAMMCO), and the Southern Ocean ecosystem (including representation from CCAMLR).

Note that this work is not a complete review of the population estimates (such as is being conducted by the ASI group), but rather the task is to provide a summary of existing population estimates and those based on ongoing work. Furthermore, for assessment models and the estimation of pre-exploitation abundance, the extent and accuracy of the values listed should be commensurate with the accuracy needed for evaluating the contribution of whales to ecosystem functioning in the region in question. The Terms of Reference are as follows:

(1) North Atlantic
   a) Compile a list of absolute estimates or relative indices of abundance of blue, fin, humpback, right, common minke, and gray whales in all or part of the region north of 60 degrees, including those recorded in the IWC and NAMMCO databases.
   b) Compile a list of pre-exploitation estimates of abundance for these same species for part or all of the region north of 60 degrees based on modelling studies.
   c) The extent and accuracy of the values listed should be commensurate with the accuracy needed for evaluating the changed contribution as a result of past harvesting of these whales to ecosystem functioning in this region.

(2) Southern Ocean
   a) Compile a list of absolute estimates or relative indices of abundance of Antarctic blue, fin, humpback, minke, southern right, sei, and Bryde's whales in all or part of the region south of 60 degrees, including those recorded in the IWC database.
   b) Compile a list of pre-exploitation estimates of abundance for these same species for part or all of the region south of 60 degrees based on modelling studies.
   c) The extent and accuracy of the values listed should be commensurate with the accuracy needed for evaluating the changed contribution as a result of past harvesting of these whales to ecosystem functioning in this region.

Table 23
Tasks, timeline, and responsibilities of the intersessional steering group on estimating pre-exploitation and current abundance of large whale populations

	Task	Time	Main Responsibility
(1)	Circulate draft separate tables with references for abundance in the North Atlantic Ocean by past surveys and any kind of assessments/ecosystem modelling (including on-going work, but not requiring further ecosystem modelling to estimate pre-exploitation abundances)	By the end of July 2022	North Atlantic team
(2)	Circulate draft separate tables with references for abundance in the Southern Ocean by past surveys and any kind of assessments/ecosystem modelling (including on-going work, but not requiring further ecosystem modelling to estimate pre-exploitation abundances)	By the end of July 2022	Butterworth, Kelly, Moosa, Tulloch
(3)	Comment on tables of abundance estimates	By the end of August 2022	All ISG members
(4)	Zoom meeting to finalise tables of abundance estimates	September 2022	All ISG members

(5)	Complete tables of abundance estimates and send them to the steering group for the workshop on the ecosystem functioning of cetaceans	Late September or early October 2022	Co-convenors

15.4 Progress on multi-species distribution models (MSDMs)

Duengen *et al.* (2019) presented a model of fin whale distribution on their Nordic and Barents Sea feeding grounds. Understanding cetacean distribution is essential for conservation planning and decision-making, particularly in regions subject to rapid environmental changes. Nevertheless, information on fin whale spatiotemporal distribution is commonly limited, especially from remote areas. Species distribution models (SDMs) are powerful tools, relating species occurrences to environmental variables to predict the species' potential distribution. This study aims at using presence-only SDMs (MaxEnt) to identify suitable habitats for fin whales (*Balaenoptera physalus*) on their Nordic and Barents Seas feeding grounds. The analysis used spatial-block cross-validation to tune MaxEnt parameters and evaluate model performance using spatially independent testing data. The analysis considered spatial sampling bias correction using four methods reflecting the important environmental variables: distance to the shore and sea ice edge, variability of sea surface temperature, variability of sea surface salinity, and depth. Suitable fin whale habitats were predicted along the west coast of Svalbard, between Svalbard and the eastern Norwegian Sea, coastal areas off Iceland and southern East Greenland, and along the Knipovich Ridge to Jan Mayen. The paper concluded that the results support presence-only SDMs as effective tools to predict cetacean habitat suitability, particularly in remote areas like the Arctic Ocean. SDMs constitute a cost-effective method for targeting future surveys and identifying top priority sites for conservation measures.

During discussion, the Committee addressed several analytical and ecological aspects of the fin whale distribution model. The author clarified that all covariates used in a MaxEnt model are re-scaled to lie between 0 and 1; therefore, the model results are not sensitive to the original scale of the covariates. The Committee asked for elaboration on the methods used to determine how much of the variation in the data the model was able to explain. The author explained that the analysis incorporated spatial cross-validation, wherein the data were partitioned into spatial blocks that were alternately used as training and testing datasets. AUC was used to evaluate the model and the resulting AUC values were high; however, the author cautioned that AUC was not designed to evaluate models constructed from presence-only data. The Committee observed that distance to sea ice was considered the most important predictor variable in the model, showing a peak in fin whale habitat suitability that occurred approximately 200km from the mean sea ice edge. The Committee asked what factors might be acting to influence fin whale habitat at that distance from the sea ice. The author replied that fin whales have been recorded only in sea ice-free areas throughout their range, so this association with the sea ice might be related to the ecology of the species. It is also possible that the data were spatially biased, and that a different dataset might produce different results.

El-Gabbas *et al.* (2021a) reported on a dynamic species distribution model used to predict year-round habitat suitability for baleen whales in the Southern Ocean. Species distribution models (SDMs) relate species information to environmental conditions to predict potential species distributions. The majority of SDMs are static, relating species presence information to long-term average environmental conditions. The resulting temporal mismatch between species information and environmental conditions can increase model inference uncertainty. For SDMs to capture the dynamic species-environment relationships and predict near-real-time habitat suitability, species information needs to be spatiotemporally matched with environmental conditions contemporaneous to the species' presence (dynamic SDMs). Implementing dynamic SDMs in the marine realm is highly challenging, particularly due to species and environmental data paucity and spatiotemporal biases. El-Gabbas *et al.* (2021a) implemented presence-only dynamic SDMs for four migratory baleen whale species in the Southern Ocean (SO): Antarctic minke, Antarctic blue, fin, and humpback whales. Sightings were spatiotemporally matched with their respective daily environmental predictors. Background information was sampled daily to describe the dynamic environmental conditions in the highly dynamic SO. The analysis corrected for spatial sampling bias by sampling background information respective to the seasonal research efforts. Independent model evaluation was performed on spatial and temporal cross-validation. The analysis predicted the circumantarctic year-round habitat suitability of each species. Daily predictions were also summarised into bi-weekly and monthly habitat suitability. Important predictors and species suitability responses to environmental changes were identified. The paper concluded that the results support the propitious use of dynamic SDMs to fill species information gaps and improve conservation planning strategies. Near-real-time predictions can be used for dynamic ocean management, e.g., to examine the overlap between habitat suitability and human activities. Nevertheless, the inevitable spatiotemporal biases in sighting data from the Southern Ocean call for the need to improve sampling effort in the Southern Ocean and using alternative data sources (e.g., passive acoustic monitoring) in future SDMs. The paper further discussed challenges of calibrating dynamic SDMs on baleen whale

species in the Southern Ocean, with a particular focus on spatiotemporal sampling bias issues and how background information should be sampled in presence-only dynamic SDMs. The paper also highlighted the need to integrate visual and acoustic data in future SDMs on baleen whales for better coverage of the environmental conditions suitable for the species and to avoid constraints of using either data type alone.

Discussion focused on the availability and spatiotemporal resolution of different types of dynamic variables that might influence baleen whale distribution in the Southern Ocean. The Committee noted that physical oceanographic covariates sampled daily and matched to contemporaneous whale sightings provided the dynamical forcing in the model. The spatial and temporal resolution of the environmental predictors vary across datasets, and it was suggested that variables characterised by finer sampling resolutions (in space or time) would likely perform better than coarsely sampled variables. The author clarified that the analysis considered only physical oceanographic datasets that had a daily resolution; however, the spatial resolution varied across datasets and the 10 x 10km analytical resolution was a compromise among the datasets. The Committee noted that wind direction, wind speed, and upwelling, both contemporaneous and lagged, have been found to be good predictors of bowhead whale habitat in the Arctic. The author explained that wind and upwelling data are not available across the full extent of the Southern Ocean year-round. The analysis examined whether the variance in sea ice concentration over the preceding 14-day period was associated with baleen whale habitat in the study area. The lagged sea ice variable was not found to be important; however, different temporal lags might produce different results. The sea surface height anomaly is another remotely-sensed physical oceanographic predictor that has shown promise in predicting cetacean habitat in other areas. The analysis incorporated sea surface height (SSH) and current speed data. ADT (absolute dynamic topography) was used to represent SSH, while current speed was estimated from the zonal and meridian components of the absolute geostrophic velocity. The author expressed interest in investigating the use of finite Lyapunov exponent dataset derived from sea surface height anomaly in future investigations.

Furthermore, the Committee acknowledged that the whales are likely choosing their habitat based on the availability of krill, not the physical oceanographic covariates, and asked whether it is likely that the relationship between the physical properties and the krill would remain stationary. The author explained that the Southern Ocean lacks biological data sampled synoptically throughout the region. For example, Krillbase was considered as a potential predictor variable for the model, but the data were not available for the full extent of the study area. Chlorophyll data were also considered, but ultimately were not incorporated into the model because they do not sufficiently cover the study area throughout the year. The spatial coverage of the data was only sufficient from December to March, hindering the use of these data in year-round dynamic models.

The diversity and complexity of analytical methods used for single species distribution models (SDMs) and multispecies distribution models (MSDMs) continues to increase at a rapid rate. To ensure that the Committee can evaluate these types of models and determine whether their results can be used to provide the Committee with management advice, SC68C established an Intersessional Correspondence Group to advance the Committee's work on developing guidelines and possible simulation platforms for SDMs and MSDMs. During the intersessional period, the ICG convener and co-conveners conducted small-group virtual meetings to develop a strategy for accomplishing the tasks set forth in the group's terms of reference, and the ICG conducted discussions over email. New scientific literature on SDMs and MSDMs was compiled and added to the previous library developed by the Committee. This work will be continued by an ICG during the upcoming intersessional period.

Attention: SC

*The Committee **Recommends** continued work under an Intersessional Correspondence Group, with membership of Ferguson (convenor), Kitakado (co-convenor), Palacios (co-convenor), Biuw, Burkhardt, El-Gabbas, Friedlaender, Genov, Herr, McKinlay, Miller, Kelly, New, Palka and Solvang, 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 develop guidelines for multi-species distribution models (MSDMs);
(3) to continue to conduct a literature review of SDMs and MSDMs; and
(4) to develop possible simulation platforms to evaluate SDMs and MSDMs.

15.5 Progress with development of individual-based energetic models (IBEMs)

The Committee has developed an individual-based energetic model (IBEM) to be used, *inter alia*, in RMP simulations. The IBEM may be used to incorporate information on prey types, foraging strategies, individual energetics and breeding and feeding cycles into simulations for assessing populations and testing ecological hypotheses to explain

population trends. Last year, the Committee agreed that future efforts should be directed towards making the IBEM itself easier and quicker to use, rather than in further refining the emulator for the IBEM.

The chair of the EM Working Group was informed by correspondence that the IBEM developer, de la Mare, has completed the fundamental structures to model multiple species (e.g., humpback and minke whales) in the same environment, including a model with sea ice and krill swarms, but that further time is needed to complete the work. For example, additional programming is needed to allow two species to limit competition through features such as the amount of ice coverage and through behaviours that depend on seasonality, food concentrations, etc. The Committee recognised that the IBEM's estimates of density-dependent cetacean mortality may be potentially useful in parameterising aggregated models (most recently by Moosa *et al.* 2017 and Tulloch *et al.* 2018). Furthermore, the Committee highlighted this synergy between modelling efforts as an example of how cross-fertilisation of ideas and results from different modelling approaches within the Committee may enhance understanding of various aspects of cetacean science. The Committee looks forward to receiving further progress next year.

15.6 Modelling of competition among whales and relationships between whales and prey

The Committee briefly discussed two related questions regarding krill and whales in the Southern Ocean. The first question was whether the commercial krill fishery might have had or will have effects on food availability for whales in the Southern Ocean. The second question was whether changes in the ecosystem that are not related to the krill fishery have caused krill abundance in the Southern Ocean to decline. The Committee noted that it is generally considered that the fishery for krill has yet to grow to the extent that it might impact natural predators at a regional scale, but there may be local effects from fishing in the neighbourhood of the land-based breeding colonies of some of these predators. It was further acknowledged that these are fundamental issues that CCAMLR addresses. The Committee was informed that CCAMLR has recently undertaken two risk assessments for the krill fishery in the Southern Ocean. It was noted that CCAMLR and the Committee have begun conversations to collaborate on efforts to further progress these investigations, using updated estimates of whale abundance and their krill consumption rates, and also updated estimates of krill biomass or abundance.

Modelling of competition among whales and relationships between whales and prey is a standing agenda item for the EM Working Group. The Committee received no papers this year on this subject, but it looks forward to receiving information in the future because this is an issue of great interest to the Committee.

15.7 Standing topics

15.7.1 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, 2011c).

Table 24

Number	Text	Type	Year	Commission body	Species	Themes	Actions	To be actioned by	Also relevant to	Progress	Last review	Outcome
SC21128	The Committee agrees to continue SDM-related work under a new Intersessional Correspondence Group, with the following members: Kitakado (Convenor), Ferguson (co-convenor), Palacios (co-convenor), Biuw, Burkhardt, Friedlaender, Genov, Herr, McKinlay, Miller, Kelly, New and Palka. This group will develop 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.	Workplan action	2021	Scientific Committee, Working Group on Ecosystem Modelling		Ecosystem modelling	(In progress) - continue the work under the Intersessional correspodence goup (Annex M) for the taks (1)-(3) as descrived in the ToR.	Working Group on Ecosystem Modelling	Research Community	Ongoing	Works are onging	Re-established the ICG to continue the work.
SC21129	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.	Workplan action	2021	Scientific Committee, Working Group on Ecosystem Modelling		Ecosystem modelling	(in progress) under SC21128	Working Group on Ecosystem Modelling	Research Community	Ongoing	See above	See above
SC21130	The Committee agrees that future efforts should be directed toward making the IBEM easier to use directly, rather than in further refining the emulator. A possible exception is in the conditioning of RMP trials, where the emulator may be useful for the purpose of making operating model parameters more compatible with the current information.	Recommendation	2021	Scientific Committee, Working Group on Ecosystem Modelling		Ecosystem modelling	(In progress) by a developer		Research Community	Ongoing	Works are onging	Continue discussion within EM
SC21131	The Committee agrees to re-establish the intersessional correspondence group with members Friedlaender (convenor), Biuw, Cooke, de la Mare, Donovan, Kitakado, Palacios and Palka to facilitate this work with new terms of reference: 1) to further develop individual-based energetics models (IBEMs), with emphasis on their application to Southern Hemisphere baleen whale populations and their interaction with krill; 2) find ways to incorporate existing ecological and demographic data; and 3) use the model to infer functional responses for baleen whale feeding on krill.	Workplan action	2021	Scientific Committee, Working Group on Ecosystem Modelling	Baleen Whales	Ecosystem modelling	(In progress)	Working Group on Ecosystem Modelling	Research Community, CCAMLR	Ongoing	Works are onging	Continue discussion within EM
SC21132	The Committee reiterates the importance of understanding baleen whale demographics and long-term environmental variability and re-established an intersessional corresponding group led by Cooke (convenor) with membership of Butterworth, Friedlaender, Kitakado, de la Mare, Palacios and Tulloch to conduct a literature review into the effects of climate change and environmental variability on whales and marine ecosystems.	Workplan action	2021	Scientific Committee, Working Group on Ecosystem Modelling	Baleen Whales	Ecosystem modelling, climate change	(In progress)	Working Group on Ecosystem Modelling	Research Community	Ongoing	Works are onging	Continue discussion within EM

The Committee reiterates the importance of understanding the relationships between baleen whale demographics and long-term environmental variability. The Committee acknowledged that other Committee entities (e.g. sub-committees, standing working groups, or intersessional working groups) might have similar interest in these issues, and that it is important to effectively communicate to share information and progress.

15.7.2 Review progress on evaluation of krill distribution and abundance

In the previous meetings, the Committee had been informed that Japan had conducted a dedicated krill survey independent of NEWREP-A in the Indian Sector of the Southern Ocean in 2018/19. The Japanese data are being analysed to estimate the abundance of Antarctic krill in a region of the Antarctic. The abundance estimates would be presented to the SC after the analysis is completed.

Results from the 2019 large-scale krill survey covering CCAMLR management area 48 (Scotia Sea and the Antarctic Peninsula) have recently been published (Krafft *et al.*, 2021). The coverage of this survey was identical to that carried out in 2000, in connection with the SOWER cetacean surveys, and therefore provides a valuable updated estimate of krill standing stock in this key region for krill fisheries.

15.8 Progress on previous recommendations

15.9 Biennial workplan

Table 25

Summary of the biennial work plan for the Ecosystem Modelling Working Group

Item	Intersessional	Next meeting	Intersessional	Subsequent meeting
(1) Preparation of estimates of pre-exploitation and current abundance of large whale populations	Intersessional Correspondence Group activity	Review results from the ICG and discuss associated outcomes		
(2) Update of any exercises on krill distribution and abundance	Conduct any data analysis	Review results of analyses		
(3) Ecosystem modelling in the Antarctic and northeast Atlantic Oceans	Continue further analyses	Review results of further analyses	Continue further analyses	Review results of further analyses
(4) Cetacean and ecosystem functioning: a gap analysis workshop	Continue analyses and hold 2nd workshop	Review result of analyses and outcomes of workshop	Continue further analyses/discussion	Prepare for a report to the Commission in 2024
(5) Species distribution models (SDMs) and multi-species distribution models (MSDM)	Intersessional Correspondence Group activity	Review progress of Working Group	Intersessional Correspondence Group activity	Review progress of Working Group
(6) Effect of long-term environmental variability on whale populations	Continue further analyses	Review results of further analyses	Continue further analyses	Review results of further analyses
(7) Further development of individual-based energetic models (IBEMs)	Continue further analyses	Review results of further analyses	Continue further analyses	Review results of further analyses
(8) Modelling of competition among whales and relationship between whales and prey	Continue further analyses	Review results of further analyses	Continue further analyses	Review results of further analyses

16. SMALL CETACEANS

16.1 Small Cetacean Use as Aquatic Wildmeat

The Committee has prioritised the need to better document the take of small cetaceans for consumptive and non-consumptive purposes. The products from aquatic vertebrates, including small cetaceans, are referred to as 'aquatic wildmeat' and defined as (IWC, 2016a):

> *'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*.'

The detailed documentation of the use of small cetaceans as wildmeat remains a priority and the Committee agreed to maintain the ICG set up for this purpose and to continue collaboration with the Convention on the Conservation of Migratory Species of Wild Animals (CMS) Aquatic Wildmeat Group (AWG).

16.1.1. Progress on identified issues/areas

The Committee collaborates with the CMS AWG to better document the use of small cetaceans as wildmeat and to identify areas of concern. Together, the Committee and the AWG published a review on the use of megafauna (small cetaceans and other species) for aquatic wild meat in the tropics and subtropics as part of their collaborative work programme (Ingram *et al.*, 2022). The review aimed to consolidate literature and knowledge of the exploitation of aquatic non-fish animals for food and other purposes, drawing on diverse literature and resources, including the reports from the series of regional workshops this Committee supported through the Small Cetacean Voluntary Fund, and provide both research and action recommendations. Prideux summarised the review and other intersessional work conducted by the AWG, highlighting that the use of aquatic animals as wildmeat remains widespread, and that in some places has been sustained for millennia, and is an important source of nutrition, income, and cultural identity to local communities. A critical first step is to understand the scope of this exploitation, so that appropriate international policy and conservation management agendas can become more effective. Some regulated hunts do keep records of the number of species taken each year (e.g. IWC, 2019b), but opportunistic take largely remains undocumented and can only be estimated from local community interviews or assessment of skeletal remains that may be kept by some cultures. Throughout the tropics and sub-tropics, all of the reported numbers of takes of small cetaceans, known either through the hunt log books or estimated from community interviews, appears to be unsustainable and, in some areas, economic opportunities to exploit wildlife at higher levels appears to be increasing; the Atlantic humpback dolphin (*Sousa teuszii*), the Burmeister's porpoise (*Phocoena spinipinnis*), short-finned pilot whales (*Globicephala macrorhynchus*), killer whales (*Orcinus orca*) and all riverine dolphins (e.g., *Inia* spp.*, Platanista* spp.*, Sotalia fluviatilis*). The review concludes with a series of research recommendations, several of which have particular relevance to the work of this Committee and the work of the Conservation Committee:

- Increase quantitative assessments of consumption and trade in aquatic wildmeat to better understand demand and trade pathways;
- Increase research into the ecological sustainability of current harvests, and the population parameters, processes, and science-based management strategies needed to overcome problems, especially in the face of climate change impacts on habitats;
- Where bycatch is a known problem, design and test fishing methods to minimise and ultimately eliminate bycatch mortality;
- Increase research into the use of aquatic wild meat as bait for other commercial fisheries and the possibility of using alternative baits that can be derived sustainably;

In discussion, concern was raised that the use of small cetaceans, as well as sirenians, has been known to increase in times of war or conflict, e.g., Vietnam and Cambodia, and this was noted as an emerging issue in Myanmar, where the use of small delphinids as a source of protein is now being documented.

The Committee commended the authors for this substantive review and noted that this landmark paper will assist researchers and conservation authorities to identify priority areas. The Committee concurred with the review conclusion that the establishment of networks of appropriate experts to foster collaborative efforts to develop regional action plans for reducing unsustainable aquatic wild meat uses was critical. The Committee noted its intention to develop a framework for progress on this issue has been delayed as the issue is complex and requires In-depth discussion. The Committee agrees to make progress on framework development at the next in person meeting of this Committee.

16.1.2 Review of Other Information

SC/68D/SM/13 reported the results of genetic and toxicological analyses of piracatinga (*Calophysus macropterus*), a scavenger catfish from the Amazon and Orinoco River basins, whose fishery has relied on the intentional killing of river dolphins and caimans for use as bait, mainly in the central Amazon. A previous genetic study revealed that piracatinga were being sold in Brazil as processed fillets labelled with fictitious names to deceive consumers (e.g. Carvalho *et al.*, 2020). Due to the potentially unsustainable impact on river dolphin populations, and to the threat to human health posed by the consumption of this mercury-rich species, Brazilian authorities issued in 2015 a five-year moratorium on the fishing, storage and trade of piracatinga. This study reports the analyses of fillets labelled as surubim, dourada, piramutaba, mapará and piranambu, purchased in supermarkets, apprehended in fish processing plants, or offered as meals in a public school during the moratorium (2017-2018; n=133). Nearly half (47%) of the samples were genetically identified as *C. macropterus*, with 89% of fillets from supermarkets belonging to this species. Mislabelling involving this and other species was revealed in 100% of fillets from supermarkets. Total mercury concentration was above the safe limit for predatory fish set by FAO (1.0mg. kg-1), ranging from 0.27 to 1.92mg. kg-1 in 44% of the *C. macropterus* fillets.

This study revealed that despite the moratorium, the piracatinga has continued to be fished and commercialised, and consequently the moratorium may not have been effective in reducing the impact of the illegal fishery on dolphin and caiman populations. Additionally, the weekly consumption of even small amounts of piracatinga weekly can be toxic and a health risk for humans.

SC/68D/SM/15 detailed a survey conducted by INPA (National Institute of Amazonian Research) and Sea Shepherd Global in the five segments of three rivers of the Central Amazon, where the high number of interactions between dolphins (the boto *Inia geoffrensis* and the tucuxi *Sotalia fluviatilis*) and fishing activities is considered the main threat to these species. Observations of the overlap of fisheries and dolphins was collected, in addition to information on any observed dolphin carcasses. In the first survey (October 2021), it was noted that areas that had high numbers of fishing nets were strongly correlated with a lower encounter rate of botos, indicating a potential conflict between this species and fishers. Despite the ban on piracatinga fishing and trade, there was evidence that this illegal activity was still taking place. It was noted that although entanglement in fishing gear (e.g., gillnets) was also a significant threat to both Amazon river dolphin species, it was acknowledged that this was more difficult to address in the short term, compared to illegal piracatinga fishing.

Mosquera-Guerra *et al.* (2022) provides a systematic review of literature published since 1980, together with structured surveys of researchers, to identify areas where Amazon river dolphin products are consumed or traded. Unsustainable fishing practices in large parts of the Amazon, Tocantins, and Orinoco basins have been a principal cause of the declines in Amazon River dolphins leading to IUCN listing the species as Endangered. So-called byproducts of bycaught or stranded dolphins are used in a variety of ways – the flesh and blubber as bait for the piracatinga fishery and, more recently, for human consumption. Organs are used for traditional or medicinal purposes. Fifty-seven areas were identified where botos were used as wildmeat (33 in the Amazon, two in the Tocantins, 22 in the Orinoco and two more on the Brazilian Atlantic coast), with recent reports of targeted take for consumption in the upper Orinoco River. Areas where Amazon River dolphin byproducts are trafficked were also identified. This information was integrated with a kernel density analysis of the distribution of boto populations and indicated that the use of boto as wildmeat is geographically widespread. It was stressed that decision-makers should direct policies towards mitigating the socioeconomic and cultural circumstances associated with illegal practices affecting boto populations.

The Committee noted that the current ban on piracatinga fishing in Brazil will end in June of 2022 (item 9.1.5). The Committee recognised the importance of this ban for the conservation of the boto and strongly supported the renewal of the piracatinga fishing ban.

16.2 Potential CMP Small Cetaceans

16.2.1. Asian River Dolphins (Platanista minor)

SC/68D/SM/14 reported preliminary findings on the first successful satellite telemetry tagging of any freshwater dolphin in Asia. Three Indus River dolphins *(Platanista minor*) were fitted with ARGOS satellite tags (Wildlife Computers) in the Indus River, Sindh, Pakistan. The dolphins were rescued from a canal in Dadu (1 male) and a disconnected mainstem side channel (2 females), on 11th and 15th January 2022, respectively. All were released just above the Sukkur barrage in the Indus Dolphin Reserve, a 1,250km^2 protected area between Guddu (28°25'07.74"N, 69°42'46.95"E) and Sukkur barrages (27°40'45.68"N, 68°50'45.55"E). The two adult females have been transmitting locations since 15th Jan 2022, 97 days to the time of writing, while after a few messages, the tag on the young male did not transmit any more data. The preliminary data from satellite tracking has provided some insights into ranging patterns. It has also helped to identify how various riverine features – confluences, side channels and the mainstem – are used. The two dolphins appear to have spent equal percentages of time (42% recorded locations) in the Indus mainstem. One dolphin recorded 41% and 17% and the other, 21% and 36% of locations in confluences and side channels, respectively. The longest distances travelled for each female were 44.8 km and 11km, upstream towards Sukkur barrage. These initial results appear promising for a large-scale telemetry study in Pakistan, and also for applications elsewhere in Asia and in South America. Khan anticipates using the data obtained from this initial effort to improve understanding of dolphin movement patterns in relation to water flow variations and of habitat use and preferences more generally within the Indus, a highly managed river system. It is also expected that telemetry work will help monitor post-release survival of rescued dolphins and will support conservation planning for long-distance translocations in the future.

In discussion it was suggested that in future reporting on their work, the authors add details on how the tags were programmed. Also, it was suggested that they consider using GPS tags rather than Argos-only tags as this would improve reliability of the data. The authors were encouraged to pursue efforts to locate, resight and

photograph the tagged individuals so that potential issues related to tag attachment and wound healing are evaluated. In conclusion, the Committee acknowledged the authors for sharing these preliminary results and commended their ground-breaking work with this threatened species of river dolphin. The Committee also requested that future analyses of this tagging study be shared when appropriate.

16.3 Previous Recommendations

*16.3.1. Finless Porpoise (*Neophocaena *spp.)*

The Committee last conducted a comprehensive review of finless porpoise (*Neophocaena* spp.) in 2005. The Committee has continued to review and receive updates on the status of the freshwater population in the Yangtze River, however, marine populations of finless porpoise have not been considered further although several area-specific issues were noted during the last five years. The 2005 review highlighted the need for taxonomic clarification and noted that further work was required to elucidate population structure throughout the genus' range. At that time, some areas of high density were identified but it was unknown whether these populations were isolated or were part of a wide-ranging and contiguous population. High levels of bycatch were documented from some parts of the genus's range. Also, high levels of mortality from multiple causes have been recorded in areas such as Hong Kong SAR (IWC, 2021c). The purpose of this review is to provide an update on the status of marine finless porpoise populations and, where there is new information, fill previously identified knowledge gaps and assess current threats. This is not intended to be a review of all new information, but an update to assist the Committee in identifying previous recommendations that have been addressed and to better understand the conservation status of marine finless porpoise.

16.3.1.1 Taxonomy and Status

At the time of the previous review of the status of marine populations, only one species of finless porpoise was recognised. The genus has since been divided into two species, the Indo-Pacific finless porpoise (*N. phocaenoides*) and the narrow-ridged finless porpoise (*N. asiaeorientalis*), following the recognition of two reproductively isolated populations with distinctive external morphology and differences in cranial osteology (Amano *et al.*, 1992; Jefferson *et al.*, 2002; Jefferson and Wang, 2011; Wang *et al.*, 2008). The narrow-ridged species comprises two subspecies: the East Asian finless porpoise (*N. a. sunameri*) and the freshwater Yangtze finless porpoise (*N. a. asiaeorientalis*). Outside East Asia, external morphology is less well understood, however, new research shows that pigmentation of finless porpoise in Kuwait and the United Arab Emirates (UAE), differs from those elsewhere, with distinctive white colouration of the mouth and ventral area that is present in both adult and young individuals (Fig. 1a). This colouration has also been observed in one stranding reported in Shirgaon, Palghar, Maharashtra, India (Nithyanandan and Bohadi, 2021). In the South China Sea, finless porpoises tend to be uniformly gray, though both light and dark-pigmented individuals have been recorded around Hong Kong (Fig. 9). A recent review of molecular data suggests that the genus should be further investigated as existing, but limited, molecular data point to divisions between the Indo-Pacific porpoise of the Indian and Pacific Oceans (Lin *et al.*, 2017).

The conservation status of the two recognised species of finless porpoise was assessed for the IUCN Red List in 2017. It was noted that the narrow-ridged finless porpoise was relatively better studied than the Indo-Pacific species. The narrow-ridged finless porpoise is currently classified on the Red List as 'Endangered' primarily because of significant declines in population size in some areas, due to incidental mortality in fisheries. The Indo-Pacific finless porpoise, which has a much broader range and which is still less studied than the narrow-ridged porpoise, is classified as 'Vulnerable' because declines in population size have been recorded, or are suspected, in several areas. Both species are threatened from the combined impacts of interactions with fisheries, habitat loss and degradation, prey depletion and pollution (Wang and Reeves, 2017a; 2017b).

16.3.1.2 Distribution

Both species are restricted to shallow, tropical and temperate waters, however, it was noted in 2005 that many parts of the species range that were poorly documented. Contributors to this review provided first-hand data in addition to published information, to help fill gaps in our knowledge of the species' ranges.

Arabian/Persian Gulf, Arabian Sea, Bay of Bengal and Andaman Sea

The Indo-Pacific finless porpoise has been recorded in several areas within the Arabian/Persian Gulf, Arabian Sea, Bay of Bengal and Andaman Sea. Information was presented for the United Arab Emirates (UAE), Saudi Arabia, Kuwait, India and Thailand. In the UAE, finless porpoise regularly occur in coastal waters of Dubai and Abu Dhabi. In the northern Emirates, only one sighting has been recorded in Ras Al Khaimah (2013) and a single stranding in Umm al Quwain (2015). To date, no sightings or strandings have been recorded in other northern Emirates either on the Musandam Peninsula or in the Gulf of Oman. Between December 2012 and April 2019, a

citizen-science programme recorded 25 finless porpoise sightings in Emirati waters, with the highest occurrence near the cities of Dubai and Abu Dhabi (Natoli *et al.*, 2021). Between May 2019 and April 2022, an additional ten (10) sightings were recorded both close to the mainland and in waters adjacent to offshore islands. Between 2014 and 2021, 5,444km of line transect survey effort was completed in Dubai waters. A total of nine (9) sightings were recorded, three (3) in 2020 and six (6) in 2021, resulting in an encounter rate of 0.001 finless porpoise per km. Finless porpoise were consistently recorded in the same area each year, between the Palm Jumeirah and the World Island. Additionally, in 2021, two (2) sightings were recorded opportunistically ~15km offshore. In both years, calves were observed and the maximum recorded group size was seven (7) (Natoli, pers. comm.). Since 2010, eight (8) strandings have been recorded, of which three (3) occurred in 2021. Only one (1) stranding was fully necropsied and of the strandings that could be inspected, no signs of entanglement in fishing gear were evident (Natoli ibid).

In Saudi Arabia, two line transect surveys were conducted in coastal waters from the Qatar to Kuwait maritime borders, including Bahrain, between 2018 and 2019. No finless porpoise sightings were recorded. Opportunistic records between February 2016 and August 2020 documented only two (2) sightings and one (1) stranding on the northern Saudi Arabian coast between Al-Kalji and Ras Al Khai, suggesting that this region of the Arabian/Persian Gulf is sparsely populated by porpoise (Rabaoui *et al.*, 2021).

A recent review of incidental mortality between January 2010 and May 2020 recorded 27 incidents, confirming finless porpoise occurrence in Kuwait's coastal waters (Nithyanandan and Bohadi, 2021). The strandings included individuals judged to be adults, sub-adults, calves and neonates, leading to speculation that a resident population may occur in the area. Sightings have been recorded near Failaka Island in the north, and Al Khiran in the south (Amr, 2021; Bishop *et al.*, 2013).

In Iran, a compilation of marine mammal records from universities, natural history museums, Department of Environment (DoE) offices, Iranian Fisheries Research Organisation (IFRO) centres and various non-governmental wildlife organisations (NGOs) confirmed 25 records of finless porpoise; 23 were from the Persian Gulf and two from the Gulf of Oman (Braulik *et al.*, 2010). Records appear to be concentrated around Bushehr, near the head of the Arabian/Persian Gulf, and Qeshm Island, near the Strait of Hormuz. It is unclear whether distribution is continuous between these two areas.

In Pakistan, recent reviews of published, unpublished and anecdotal accounts of cetacean sightings, strandings and research initiatives summarised species diversity and distribution as well as threats to local cetaceans. Finless porpoise were recorded year round along the entire coastline, though they occurred more frequently inshore and during the northeast monsoon period (July to September) (Gore *et al.*, 2017; Gore *et al.*, 2012; Ibrahim *et al.*, 2021).

In India, a comprehensive review of marine mammal strandings recorded between 1748 and 2017 showed that finless porpoise strand consistently on both the west (Arabian Sea) and the east (Bay of Bengal) coasts, with slightly more strandings recorded on the west coast since at least the early 20th century (Dudhat *et al.*, 2022). This review combined records of finless porpoise with records of "dolphins" and therefore must be considered a very coarse indication of stranding patterns.

In Bangladesh, vessel-based line-transect surveys conducted in February 2004 recorded finless porpoise between the Sundarbans Mangrove Forest and the Matamuhuri and Bagkhali Rivers (Smith *et al.*, 2008).

In Myanmar, the presence of finless porpoise was confirmed in the Gulf of Mottama based on opportunistic boat surveys in 2018 (Htay *et al.*, 2019).

In Thailand, the Thailand Strandings Network recorded finless porpoise along both the west (Andaman Sea) and the east (Gulf of Thailand) coasts between 2002 and 2012. The finless porpoise was the second most frequently stranded species on both coasts (Adulyanukosol *et al.*, 2012). The Satun-Langkawi Archipelago, which straddles the Thailand-Malaysia border, has been designated as an Important Marine Mammal Area (IMMA) as finless porpoise occur there in significant numbers[26].

Finless porpoise occur predominantly on the west coast of peninsular Malaysia, in the Straits of Malacca, particularly Penang Island (Rodríguez-Vargas and Yobe, 2018) and Matang, the State of Perak where they are present year-round (Kuit *et al.*, 2021). Opportunistic records and reports from the media and the Department of Fisheries, the Government of Malaysia, indicate that the species occurs throughout all coastal waters of

[26] https://www.marinemammalhabitat.org/portfolio-item/satun-langkawi-archipelago/

Peninsular Malaysia (Ponnampalam 2012).

Indo-Malay Archipelago and South China Sea

The Indo-Pacific finless porpoise has been recorded in several areas within the Indo-Malay archipelago and South China Sea and its distribution begins to overlap with that of the narrow-ridged finless porpoise in the vicinity of Hong Kong (22.3° N). Information was presented for China, including Hong Kong and Macau, and for Malaysia, Indonesia and Brunei. An update on information presented to this Committee in 2021 for Taiwan is also included in this update. A comprehensive strandings network operates in the Philippines but no finless porpoise have been recorded in Philippine waters.

In East Malaysia, finless porpoise are observed year-round in the states of Sarawak and Sabah. In Sarawak, sightings appear to be concentrated in Kuching Bay, along the Similajau-Kuala Nyala coastline and around Miri (Minton *et al.*, 2013; Minton *et al.*, 2011b). Since 2006, 29 strandings and incidental takes have been recorded, based on reports from the fishing community and social media (Sarawak Dolphin Project, unpublished data). In Sabah, only two finless porpoise strandings have been recorded, both on Sabah's west (South China Sea) coast (Chen *et al.*, 2017).

In Brunei, only a handful of opportunistic sightings and eight (8) strandings were recorded between 1990 and 2022. All records came from the southwestern districts of Belait and Tutong. No records exist for northeastern districts of Brunei-Muara and Temburong, including Brunei Bay.

In Indonesia, at least 20 strandings have been recorded by Whale Stranding Indonesia[27]. The majority of strandings originated in East Kalimantan, with records also from Bangka-Belitung, Riau, Jakarta, Central Kalimantan and West Kalimantan. On 1st August 2021, a single finless porpoise stranded after being incidentally caught in a gillnet off Sumenep, Madura Island, East Java Province. Genetic analyses confirmed that it was an Indo-Pacific finless porpoise. This stranding has prompted interest in surveying the waters adjacent to Madura Island, to better understand distribution in Indonesian waters and assess threats to the species.

In Vietnam, a summary of marine mammal strandings compiled from social media between 2004 and 2018 recorded 16 finless porpoises, ranging from Quang Ninh province in the north to Tien Giang province in the south (Vu and Ponnampalam, 2018)[28].

In Cambodia, the results of boat-based surveys conducted in 2001 suggest that the waters of Kompong Som Bay were, at least at that time, important habitat for finless porpoise (Beasley and Davidson, 2007).

Finless porpoise are the most commonly stranded cetaceans in Hong Kong, and both species are represented in the stranding record[29]. Hong Kong is the southernmost confirmed location for the narrow-ridged finless porpoise. It is presumed, given that only two narrow-ridged finless porpoise have been identified in the Hong Kong strandings record over the last 25 years, that most sightings and acoustic detections in Hong Kong and adjacent waters are of Indo-Pacific finless porpoise. Finless porpoise are recorded throughout Hong Kong waters, except the northwest, where freshwater influence of the Pearl River is at its strongest. Numbers peak inshore during the northeast monsoon (December to May) although passive acoustic monitoring data from both fixed and towed array transect surveys indicate that they occur in Hong Kong waters year-round (IWC, 2021c; Wong, 2021). Macau SAR is located on the western banks of the Pearl River Estuary and the city of Zhuhai lies just to the north. There are no recorded sightings of finless porpoise from within the western reached of the pearl River Estuary, which is influenced all year round by freshwater flow, however, a handful of strandings have been recovered from these waters (Lin *et al.*, 2019)

In southern China, Indo-Pacific finless porpoise have been recorded in Guangxi, Hainan, Guangdong and Fujian. Strandings and bycatch records sourced from government documents between 2000 and 2006 (Wang *et al.*, 2015) and social media reports between 2008 and 2019 (Liu *et al.*, 2021; 2022) suggest that distribution along the South China Sea coast is likely contiguous, with the exception of the east coast of Hainan.

The East China Sea and the Sea of Japan

In China, narrow-ridged finless porpoise occur in coastal areas of the Bohai Sea, Yellow Sea and the northern Taiwan Strait (Liu *et al.*, 2021). Interview surveys of fishermen along the south coast of the Bohai Sea suggest

[27] http://www.whalestrandingindonesia.com/

[28] https://rpubs.com/Long_Vu_CCES/395186

[29] https://www.opcf.org.hk/en/conservation-research/hong-kong-marine-life-stranding-online-database

that the western coast of Laizhou Bay and the area south of the Yellow River Estuary are hotspots for this species (Cheng *et al.*, 2021). Sightings appear to peak in April and September and decrease between November and February. Records sourced from government documents between 2000 and 2006 also suggest that the south coast of the Bohai Sea is a hotspot of finless porpoise strandings and bycatch, with a peak between March and May (Wang *et al.*, 2015). Boat-based line transect surveys in the Bohai Sea and Yellow Sea indicate sighting hotspots in Laizhou Bay, Changdao Island and Laoshan Bay, with peaks in encounter rates between March and November (Cheng *et al.*, 2022).

In Taiwan, both species of finless porpoise occur. Between 2016-2020, 62 of the 161 porpoise that stranded were identified to species; 66% were Indo-Pacific finless porpoise and 34% were narrow-ridged finless porpoise. The majority of strandings occurred along the north and west coasts of Taiwan, which have significantly shallower waters than the east coast. Strandings peaked during the onset of the south monsoon (May). Since 2016, there has been a marked increase in the number of finless porpoise strandings that could not be attributed to changes in reporting procedures of the national strandings programme or increased public awareness (IWC, 2021c).

In the Republic of Korea, narrow-ridged finless porpoise are sighted year-round on the west (Zhang *et al.*, 2004) and south coasts (Choi *et al.*, 2010). Distribution appears to be fairly continuous from Busan to Mokpo and north to the border with Democratic People's Republic of Korea. Stranding and bycatch records indicate finless porpoise may also be found along the north coast of Jeju Island, though to date, no sightings have been reported south of the islands of Jeollanam-do.

Finless porpoise are well studied in Japanese waters. On the Pacific coast, they range from the west coast of Kyushu, through the Inland Sea, Ise Bay, and Tokyo Bay, to Sendai Bay, occupying areas with depths of <50m and non-rocky substrates. At least five distinct populations have been identified, including one in the Inland Sea of Japan (Shirakihara *et al.*, 2007).

This review goes some way towards fulfilling the previous recommendation of this Committee to improve understanding of where both species occur and are likely absent, particularly the western extent of the range of the Indo-Pacific finless porpoise. A distribution map is included, based on data contributed to this review, which include confirmed sightings, as well as strandings and bycatch records. In addition to the Philippines, there are seven areas where surveys have been conducted and/or strandings programmes operate and no finless porpoise have been recorded, as follows: the Gulf of Oman (both Iran and Oman coasts), the outer reaches of the Gulf of Thailand (the south coasts of Cambodia and Vietnam), the north end of Borneo (from west coast Sabah, Malaysia to North Kalimantan, Indonesia), south east Borneo (South Kalimantan, Indonesia) and eastern Hainan Island, China (Fig. 9).

16.3.1.3 POPULATION STRUCTURE

Evidence for genetic structure (population differentiation and distinctiveness) has been examined for both Indo-Pacific and narrow-ridged finless porpoise inhabiting the Bohai Sea, Yellow Sea, East China Sea, Taiwan Strait and northern region of the South China Sea in Guangdong Province (Jia *et al.*, 2014; Lin *et al.*, 2014; Lin *et al.*, 2017). Different genetic markers have been used in these studies, including mitochondrial DNA control region, microsatellites, and genomic single nucleotide polymorphisms (SNPs). Genetic differentiation was generally observed between the putative populations examined. For instance, significant genetic differentiation between the three recognised species/sub-species (originally diagnosed using morphological characters and geography) would be expected. By increasing the sampling effort, genetic structure was eventually detected across the species/subspecies range, including differentiation between populations in the Bohai/northern Yellow Sea and southern Yellow Sea, Taiwan Strait and Pearl River Delta region, and the Yangtze River. The most recent theories posit the divergence between the narrow-ridged and Indo-Pacific finless porpoise as being a result of lower sea levels during the last glacial maximum, which interrupted gene flow through Taiwan Strait. Following this logic, glacial isolation might also be expected in the eastern Malay Peninsula, Sri Lanka and Malacca Strait as these areas were isolated during the periods of lowest sea level, but any such predictions remain to be tested with increased sampling and research effort in those regions.

A recent review proposed that the genetic divergence between the two forms of finless porpoise is substantially lower than the range of species-level divergences observed for most cetacean congeners, however, our current understanding may be based on inadequate sampling (Hao, In Prep). For instance, most of our current knowledge about the genetic structure of the genus is restricted to east Asian coastal and Japanese waters, and is particularly limited for the Indo-Pacific finless porpoise from Southeast Asian waters and the Indian Ocean, with only one individual from the Persian Gulf and two from the west coast of Indian. A preliminary study suggests that the divergence (ϕst based on control region sequences) between Indo-Pacific finless porpoise in the Indian Ocean

and Pacific region was >0.75, much greater than the inter-species divergence documented in Taiwan Strait and the average species-level divergence for cetaceans.

16.3.1.4 ABUNDANCE

Since the last SC review, several abundance estimates for additional areas have been published, however, the degrees of connectivity between populations or hotspots remain poorly understood. Available estimates are provided here, however, not all of these have been evaluated by the ASI Working Group as the Committee does not, at this time, intend to use the estimates as a basis for management recommendations. In some countries, surveys have covered a substantial portion of a population's range, e.g., the Sea of Japan, whereas in other locations abundance estimates refer to only a portion of what is believed to be a larger population, e.g., Hong Kong (Table 26).

Table 26

Estimated Abundance of Finless Porpoise (made available since the previous review)

Geographical Population	Estimated Abundance*	CV	Year	Notes	Source
Narrow-Ridged Finless Porpoise					
Korea (offshore)	58,650 (95% CI=34,961-98,389)	26.38	2001	West Coast Offshore Korea (WCOK)	Zhang et al. (2004)
Korea (inshore)	1,571 (95% CI=881-2800)	29.15	2003	West Coast Inshore Korea (WCIK)	Zhang et al. (2004)
Inland Sea of Japan	7572	17.3%	2000		Shirakihara et al (2007)
Indo-Pacific Finless Porpoise					
Hong Kong (summer monsoon)	101.7	0.77	2019	Reviewed ASI (2022)	Jefferson and Moore (2020)
Hong Kong (winter monsoon)	112.6	0.26	2019	Reviewed ASI (2022)	Jefferson and Moore (2020)
Kuching Bay, Malaysia	135 (95% CI=74-246)	0.31	2007-10		Minton et al (2013)
Matang, Perak, Malaysia	600 (95% CI=354-1016)	27%	2013-16		Kuit et al (2021)
Bangladesh (inshore)	1,382	54.8%	2004	nearshore waters	Smith et al (2018)

* Reviewed by the ASI Working Group

16.3.1.5 ECOLOGY

Stomach content analysis has been used in Korea and Japan to identify prey species of narrow-ridged finless porpoise; in Korean waters, 13 species of crustaceans, eight fish species and three cephalopod species were identified (Park *et al.*, 2005) and in Japanese waters, more than 31 fish species, seven cephalopod species and three crustacean species were identified (Shirakihara *et al.*, 2007). In the Bohai, Yellow and East China Seas, 21 prey species were identified (16 fish, two cephalopods, two crustacean and one bivalve mollusc species') using morphological and DNA-based approaches. All studies indicate that the narrow-ridged finless porpoise is a generalist with regards to prey choice (Chen *et al*., 2016; Lu *et al*., 2017). The prey species of Indo-Pacific finless porpoise is less well studied; in Hong Kong, stomach content analysis identified 25 fish species, three of cephalopod genera and one crustacean species (Barros and Clarke, 2002) and in India, prey items principally consisted of fish species from two genera (*Clupeidae* and *Loliginidae*) (Krishnan *et al*., 2008).

Significant knowledge gaps remain in what is known of prey species for specific populations and, concomitantly, by-catch risk, in many areas. In recent years, however, the use of passive acoustic monitoring (PAM) techniques has provided new insights to the distribution and behaviour of some populations of finless porpoise, particularly in relation to soniferous fish prey species. In Laizhou Bay, China, a static PAM station was deployed to investigate the potential relationship between porpoise and their prey. Porpoise were acoustically detected year-round, however, detection rates differed between spring (April-May) and autumn (September-October) in concert with fish choruses. During spring, fish choruses occurred throughout the afternoon, and porpoise vocalised more frequently during this season. In autumn, when fish choruses were absent, porpoise detection rates decreased and diurnal patterns were not detected. In the Yellow River Estuary, both towed and static PAM was used to gain information on the spatial distribution of porpoise and soniferous fishes. In spring, a higher density of acoustic detections was recorded in the northern part of the estuary and central Laizhou Bay compared to the southern part of the estuary and western Laizhou Bay. Only two types of fish calls were identified

in the northern Yellow River estuary and central Laizhou Bay, with a particularly high density of fish choruses recorded in central Laizhou Bay (Cheng *et al.*, 2022).

In Hong Kong waters, both towed and static PAM was used to obtain information on the diurnal occurrence of porpoise. Porpoise vocalisation density was higher at night and distribution was more widespread throughout the habitat, compared to daytime periods. General Additive Modelling indicated that porpoise night-time occurrence was related to lunar phase, tidal height, temperature, water depth and seabed slope, although it was noted that more effort was required to sample the area effectively (SMRU Hong Kong 2018[30]). During both visual and acoustic surveys, no observations were made of mixed schools of finless porpoise and Hong Kong's other resident cetacean, the Indo-Pacific humpback dolphin. In Sanniang Bay, Guangxi Province, China, where finless porpoise and Indo-Pacific humpback dolphins both reside, one incident has been recorded of a single finless porpoise calf with a large group of dolphins of multiple age classes (Pan Wenshi, pers. comm.)

In the United Arab Emirates (UAE), ecological niche modelling analysis showed that the finless porpoise has a broader area of suitable habitat in the Gulf than the other two most often sighted species: the Indo-Pacific bottlenose dolphin and the Indian Ocean humpback dolphin. The strong correlation to different environmental variables compared to the other two species suggests that this relates to different prey preference (Natoli *et al.*, 2021). There are no records of finless porpoise mixing with other cetacean species, despite the small size of the total habitat area.

At this time, interactions between finless porpoise and predators, e.g., sharks and killer whales, remain poorly understood, with little evidence of predation apparent in the large strandings database compiled in recent years, noting these data are dominated by the well developed strandings networks in the East and South China Sea area.

16.3.1.7 THREATS

Both species of finless porpoise are threatened by take, both directed and incidental, pollution (chemical contaminants as well as noise), habitat loss and degradation, ship strike and altered prey availability. Vast gaps remain, however, in understanding the extent of these threats on specific populations or areas. Some isolated studies provide indications that throughout their range, both species of finless porpoise are impacted by multiple threats and are in decline. For example, in the Bohai Sea, more than half of the fishermen interviewed during a survey of local ecological knowledge, reported an overall decline in population and attributed this to increasing pollution, declining prey resources and ongoing fishery bycatch, although it was noted that direct take for consumption rarely occurred (Cheng *et al.*, 2021). In the Yellow River Estuary specifically, and likely elsewhere, underwater noise that masks fish choruses could interrupt finless porpoise feeding success, in addition to the negative impacts of intensive fishing of these prey species on both resource availability and the rate of entanglement in fishing gear (Cheng et al 2022a, 2022b). In Taiwan, an analysis of strandings between 2019-20, indicated that of the known causes of death, bycatch accounted the highest proportion or mortality, followed by ship strike and disease (IWC, 2021c). In Kuwait, where cause of death was determined, ship strike accounted for the highest proportion, followed by bycatch of recovered finless porpoise strandings (Nithyanadan and Bohadi, 2021) and in Iran, the high number of bycaught individuals recorded suggests that incidental mortality in fishing gear is unsustainable (Braulik *et al.*, 2010). There is little information on the level of directed take, however, it seems unlikely that this is a significant threat, compared to bycatch. Noting that many Asian cultures do use cetaceans as wildmeat, it is likely that both direct and opportunistic direct take occurs (Porter and Lai, 2016).

Threats to narrow-ridged finless porpoise are being actively mitigated in one area. In the Yellow Sea, Korea, large numbers of finless porpoise are bycaught in several different fishing operations, e.g., stow nets, gill nets, trawl and set nets. The Korean National Institute of Fishery Science (NIFS) has established a five-year plan (2022-2027) to develop bycatch mitigation methods for several fishing gears. Stow net modification trails are already underway and gear modified with escape hatches and varying mesh sizes appears to have reduced bycatch (see this report, Section 12.5; SC68D/HIM12).

In Hong Kong, the application of virtopsy techniques has greatly improved the ability of veterinarians to assign cause of death to stranded Indo-Pacific finless porpoise. Between 2017 and 2020, 92 finless porpoise were subjected to virtopsy procedures, of which 34.8% causes of death were attributed to human-interactions (vessel strikes and fisheries bycatch). It is hoped that this standard assessment procedure for finless porpoise strandings in Hong Kong will provide management authorities with clearer direction on where to focus management efforts for this species, particularly as the local mortality rate has increased significantly in the last five years (Kot *et al.*,

[30] http://env.threerunwaysystem.com/en/meef/disclaimer-meef2018010.html

2021).

16.3.1.10 Advances in Study Methods

Both new technology and the application of more accessible and/or affordable technology has facilitated progress in several areas of study. Imaging technologies, e.g., post-mortem computed tomography (PMCT), post-mortem magnetic resonance imaging (PMMRI), post-mortem ultrasonography (PMUSG), and three-dimensional surface scanning (3DSS), to perform 'virtopsies' are powerful tools that have provided significant new insights to parasite load, disease and trauma. Such technologies augment conventional necropsy practices by enabling image-guided examination and sample collection by veterinarians and pathologists, e.g., Chan et al 2017. In Hong Kong, the use of virtopsy procedures in the local marine life stranding programme has substantially improved the diagnosis of pathological findings and the ability of researchers to determine cause of death of finless porpoise and other species (Kot *et al.*, 2021). Imagery of stranded cetaceans from other areas has also been provided to the Hong Kong virtopsy team, e.g., Granados-Zapatalse *et al.,* (2022), demonstrating that the techniques and protocols developed in Hong Kong can be used regionally to improve understanding of finless porpoise mortality elsewhere.

Previously, this Committee recommended that passive acoustic monitoring techniques be used to determine their usefulness to improve understanding of the distribution and behaviour of finless porpoise, particularly given the difficulty of sighting this small and cryptic animals at sea. The parameters of finless porpoise vocalisations have been well documented, (e.g., Li et al 2007; Song *et al.,* 2017; Kumera *et al.,* 2021), however, acoustic detection thresholds (the minimum number of echolocation clicks in a click train required to confirm presence) are less well studied. In Hong Kong, several different acoustic and visual survey methods have been used to better define these thresholds and then apply them to estimate the percentage of porpoise missed by observers during visual line-transect surveys, as well as to better determine porpoise density in low light or poor visibility conditions. For Indo-Pacific finless porpoise in Hong Kong, the minimum detection threshold for towed acoustic surveys is ≥ 5 Narrow Band High Frequency (NBHF) clicks in any click train, which is similar to that reported for harbour porpoise (*Phocoena phocoena*) (≥ 6 NBHF: Gillespie et al. 2005) and other species that produce NBHF, such as Heaviside's dolphin (*Cephalorhynchus heavisidii*) (≥ 5 NBHF: Martin *et al.*, 2020) (Porter and Brannan, In Press).

Unmanned Aerial Systems (UAS) have been used to study both species of finless porpoise. The use of UAS for studying finless porpoise is of particular interest, as their small size, lack of a dorsal fin and cryptic behaviour make them challenging to study using traditional visual methods. In Japan, UAS imagery was used to assess individual and group response to vessel traffic and provided new insights into narrow-ridged finless porpoise social behaviour (Morimura and Mori, 2019). In Hong Kong, surveys for Indo-Pacific finless porpoise were conducted using a variety of UAS models and cameras. It was demonstrated that porpoise can be detected at distances up to 90m, using even the most basic camera, and there was no evidence to suggest that UAS presence at altitudes between 30-90m elicited behaviours indicative of disturbance (Brannan, unpublished data). In Hong Kong, and elsewhere, where porpoise habitats are difficult to survey by vessel, the use of UAS has immense potential as a tool to better understand behaviour and to estimate population density parameters.

16.3.1.11 Progress on Previous Recommendations

In 2021, the Committee highlighted several knowledge gaps with regards to understanding the status, including population structure, of *Neophocaena* spp. throughout their range. This updated review, prepared by the finless porpoise intersessional group, although not exhaustive, does highlight progress on several previous recommendations;

- research efforts have increased on the Indo-Pacific porpoise in the western regions of its distribution,
- progress has been made on determining the frequency and cause of mortality
- passive acoustic monitoring techniques have been assessed and are being used to provide improved density estimates and behavioural patterns

The Committee commended the finless porpoise intersessional correspondence group on its growing collaboration and data sharing and although progress made on previous recommendations was noted, the Committee again expressed its concern over the status of the genus *Neophocaena* throughout its range. The Committee requested the group to continue to work in the intersessional period, to coordinate data collection and analyses wherever possible and to progress towards an assessment of the genus throughout its range.

Fig. 8. Pigmentation patterns of Indo-Pacific Finless Porpoise (*Neophocaena phocaenoides*) in (1) Kuwait, the Arabian/Persian Gulf (© M. Pope, reproduced from Nithyanandan and Bohadi, 2021) and (2) Hong Kong waters (© L. Porter, SEAMAR).

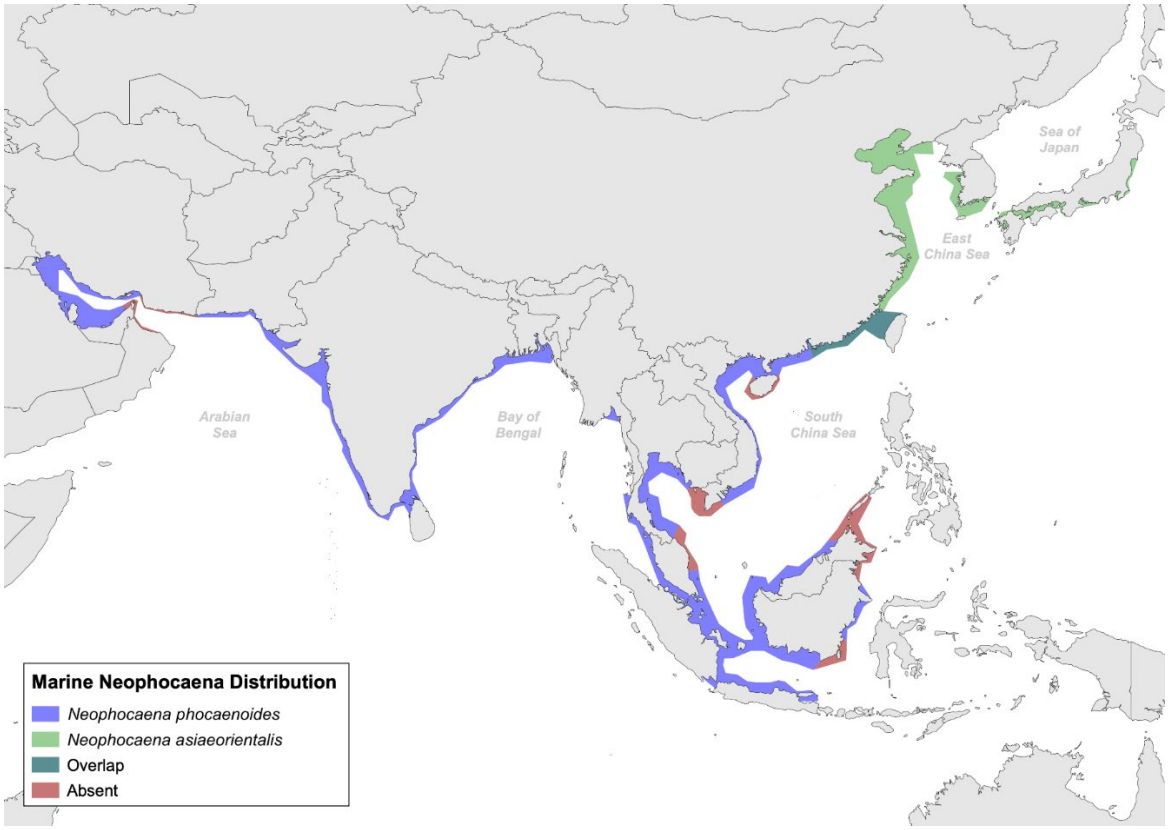


Fig. 9. Distribution of the marine populations of Finless Porpoise, based on sightings and strandings data contributed to the IWC 2022 review

16.3.2. Atlantic humpback dolphins (Sousa teuszii)

Minton presented the annual report of the Consortium for the Conservation of the Atlantic Humpback Dolphin (CCAHD, 2021). The report highlighted the increasing participation of range-countries, the higher number of range-state nationals taking leadership roles, the launch of a trilingual website[31] with multiple downloadable resources[32], successful fund-raising for, and implementation of, government engagement and research projects, and the establishment of a foundation under Dutch law. Research projects involving interview surveys and boat-based surveys conducted by CCAHD partner organisations are currently underway in Congo, Gabon, Cameroon, Liberia, The Gambia, Senegal, and Guinea. Continued fundraising efforts will enable partners to implement the

[31] https://www.sousateuszii.org/

[32] https://www.sousateuszii.org/resources/

priority actions identified in the CCAHD Priorities Report (CCAHD, 2020). These priorities address multiple recommendations made by the IWC SC in previous years.

Keith-Diagne presented preliminary results of Atlantic humpback dolphin (*Sousa teuszii*) research conducted in the Saloum Delta, Senegal (SC/68D/SM/12). The Delta hosts one of the largest and potentially least depleted populations in the species' known range. The CCAHD prioritised this area for research and the African Aquatic Conservation Fund (AACF) has initiated a long-term research and conservation programme. Beginning in July 2021, two dedicated surveys were conducted to map distribution, habitat use and threats, and to obtain imagery suitable for photo-ID. Encounter rates were comparable to those documented in 2015 (Weir, 2016), but the distribution of encounters was concentrated in the north (as opposed to the south) of the Delta. More than 14,000 images were collected and are being processed for a photo-ID catalogue that will provide the basis for generating mark-recapture abundance and population trend estimates, as well as information on individual ranges and reproductive parameters, body condition, and health over time. One Sound Trap (ST) and one F-POD were deployed and recovered at two locations beginning in July 2021 and have yielded about 30 days of continuous recording on the ST and 60 days of automated detection on the F-POD. Initial review indicates that both units documented click trains congruent with dolphin vocalisations. Three more units were deployed in March/April 2022. Carcass recovery and sampling began in 2018. To date, three *S. teuszii* carcasses have been examined and genetic samples collected. Environmental DNA collection will begin in June 2022. Two awareness raising meetings were held for Senegal government stakeholders/partners, and training was provided for five African researchers from Senegal, The Gambia, Mauritania, Nigeria, and Cameroon.

In discussion, it was noted that there is a petition to list *S. teuszii* as an endangered species under the United States Endangered Species Act (ESA), with the goal of leveraging the United States Government to provide support for conservation of the species. The CCAHD is providing technical support and resources for the ESA review process, as well as for the CMS Concerted Action (CA) for the species. It was recognised that both the petition and the CMS CA were potentially significant in drawing attention to the plight of the species.

The apparent change in distribution between the 2015 study by Weir (2016) and this study was noted, and it was confirmed that the differences in distribution of encounters were not due to discrepancies in effort but likely representative of a shift in habitat use from the southern area of the Delta to the northern area, however, the drivers underlying such a shift are currently unknown.

The Committee noted that a comparison of the 2015 and current photo-ID dataset could be used to estimate population size and examine shifts in individual habitat use. The Committee encouraged all data holders to conduct a comparison of the 2015 and current photo-ID datasets, and offered its assistance to facilitate this process, if required.

In discussion, it was noted that direct threats to *S. teuszii* in the Saloum Delta are not yet fully assessed but the greatest one is likely bycatch. It was noted that direct hunting of *S. teuszii* has not been observed or reported, as yet. As bycatch events are difficult to observe and document, future research will include mapping of fisheries effort and interview surveys, to obtain data for bycatch risk assessments.

The Committee commended CCAHD on the excellent progress in developing a research and conservation workplan, obtaining funding and implementing a suite of projects on a species for which this Committee has expressed considerable concern. The Committee reiterated its strong support of the CCAHD workplan and requested that an update be provided at next year's Committee meeting.

16.3.3. Vaquita (Phocoena sinus)

Rojas-Bracho summarised the 2021 vessel-based survey (17 October to 3 November) (SC/68D/SM/06) and the Expert Elicitation (EE) analysis of the survey results. This survey was conducted in the same way as those conducted in 2019 and 2020 (Rojas-Bracho *et al.*, 2021; Rojas-Bracho *et al.*, 2020), primarily to address three objectives:

(1) Determine how many unique individuals (adults and potential calves) were sighted;
(2) Determine how many individual calves (only) were sighted; and
(3) Determine whether any poor health indicators were observed when vaquitas were sighted.

Rojas-Bracho noted that a manuscript covering both survey periods (2019 and 2021) had been submitted to a scientific journal, examining the question of whether vaquitas are doing better than had been expected given the data on abundance and trend collected since 2018.

Surveys in 2021 were conducted from two vessels (R/V Narval from the Museo de la Ballena y Ciencias del Mar and M/V Sharpie from Sea Shepherd Conservation Society), using previously developed techniques to combine acoustic and visual monitoring (Rojas-Bracho et al. 2019). In 2021, there were only five days of weather suitable (Beaufort >3) to survey within the Zero Tolerance Area (ZTA: as defined by the Mexican Government in 2020). Survey effort of the ZTA was also hindered by the large numbers of pangas and illegally deployed gillnets. Nonetheless, vaquita were sighted eight times over 5 days and all appeared in good health, although no images of sufficient quality were obtained for photo-ID therefore, it was not possible to conduct a mark-recapture analysis estimate incorporating previous data. Thus, an Expert Elicitation (EE) was used to estimate the number of unique calves and the total number of unique vaquitas (including calves) encountered during the surveys (SC/68D/SM/07). The EE process was the same as that used in 2019 (Rojas-Bracho *et al.*, 2021) and included the 2019 recommendation that an 'evidence dossier' should be compiled for each sighting during the survey itself to maximise the level of detail.

The EE for the 2021 survey concluded that the median distribution for the number of calves observed was 1.5, with approximately equal probability of 1 or 2. For the unique number of vaquitas sighted (including calves), the most likely values were 7 and 8. The final distribution indicated a 78% belief that the true number of unique vaquitas sighted was between 6 and 10. Overall, the EE results suggested that the number of calves (and correspondingly the total number of unique vaquitas) seen in the ZTA had decreased between 2019 and 2021. Because the surveys covered only the ZTA, where acoustic data indicate the highest chances of encountering vaquitas, the EE estimates should be interpreted as minimum values. A large portion of the historical range of the species, where vaquitas could still be present in low densities, has not been surveyed, either acoustically or visually, since 2018.

Jaramillo Legoretta presented background information on the use of passive acoustic techniques to study vaquita relative abundance and distribution since 1997 (SC/68D/SM/10). In the period 1997–2007, recording equipment was deployed from a vessel and the acoustic data were used to infer population trend. Comparison of acoustic results with 1997 and 2008 abundance estimates, generated using a visual distance sampling approach, demonstrated that acoustic data are reliable for inferring relative abundance (Taylor *et al.*, 2016).

Beginning in 2011, a monitoring program that used autonomous acoustic detectors (C-PODs) was implemented in a grid of 46 sites inside the Vaquita Refuge. Through 2018, the programme detected an average annual population decline of 45%. A 2015 abundance estimate of 59 individuals (95% CRI 22-145), was followed by a 2018 acoustic data-based estimate of only about nine individuals remaining (95% CRI 6-19) (SC/68D/SM/10). In 2017 and 2018, acoustic activity was detected mainly towards the southwestern portion of the Refuge. In 2019, after an increase in illegal fishing activities, over 60 moorings and C-PODs were lost, and acoustic detections by those remaining decreased markedly. Similar to previous years, acoustic activity was primarily detected in the southwestern portion of the Refuge, mainly inside the ZTA. Loss of equipment during the 2021 sampling period reduced sampling to only 31 sites out of the usual 46. As in 2019, sampling was also attempted in the ZTA between October and November. Again, over 50 moorings and C-PODs were lost. In 2021 acoustic activity was again detected mainly in the ZTA, higher in the western and central portions, and occasionally towards the eastern area.

Acoustic sampling in 2022 will be attempted only inside the ZTA and during neap tides, when fishing effort decreases significantly; in 2019 and 2021 this strategy was effective in minimising equipment loss. During a pilot study in April 2022, vaquita acoustic activity was detected at two of three sites monitored inside the ZTA, showing that vaquitas were still using at least this portion of their habitat.

Taylor presented evidence from several reports available online that refute recent claims that illegal fishing has been reduced within the ZTA, the last stronghold of vaquitas (SC/68D/SM/09). Earlier recommendations by the Vaquita Recovery Team (CIRVA—Comité Internacional para la Recuperación de la Vaquita) had stressed that vaquitas could be saved from extinction only if gillnets were banned throughout their range and fishermen adopted viable vaquita-safe fishing methods. The October/November 2021 vaquita survey within the ZTA took place during shrimp season. The launching of fishing vessels during daylight hours with gillnets clearly visible onboard was observed both within the harbour next to the Navy station and from a site further towards the San Felipe town centre. Illegal gillnetting was observed on all survey days; on 1, 2 and 3 November, for example, minimum counts within the ZTA were 72, 66 and 117 vessels, respectively. On 3 November vessel locations were plotted to document the hindrance of survey efforts (See IUCN – SSC Cetacean Specialist Group iucn-csg.org). The total length of gillnets deployed in the ZTA on 3 November 2021 was estimated to be between 117km (1 km net/panga) and 234 km (2 km net/panga). Using the lower estimate of km gillnet per panga, there was enough gillnet deployed to traverse five complete lengths of the ZTA (5x24km). Observations from land during the winter

months when totoaba and curvina fishing occurs also showed high levels of illegal fishing activities in both the 2020/2021 and the 2021/2022 seasons with a maximum count of 58 pangas recorded on 10 January 2022. This was at a time when an accord between the Mexican Navy and the Sea Shepherd Conservation Society was in place and illegal fishing was allegedly reduced within the ZTA. If vaquitas are to be saved from extinction, at a minimum, the ban on gillnet fishing in the ZTA must be enforced, and current evidence demonstrates this is not happening.

The Committee commended Rojas-Bracho, Jaramillo Legorreta, Taylor and their teams of science and conservation collaborators, including volunteer observers monitoring the presence of vessels and gillnets in and adjacent to the ZTA, co-operating fishermen and those involved in net-removal operations, for their continued efforts to save the vaquita.

In discussion, it was noted that the 'trigger plan' currently being applied by the Government of Mexico allows up to 65 fishing vessels at a time to fish with gillnets inside the ZTA (24 September 2020, Article 17 Enforcement Plan). The ZTA remains a no entry zone, however, gillnet fishing activities are carried out without respecting the regulations established by the relevant authorities. During the 2021 vaquita surveys, on 1, 2 and 3 November minimum counts within the ZTA clearly exceeded the "trigger" number, however, no observed enforcement of the no-entry regulation was subsequently conducted. This clearly indicates there have been numerous occasions when the "trigger plan" is not being enforced and gillnetting is allowed unchecked. The Enforcement Plan, including trigger factors, is mandated to be reviewed every six months and it seems that a review is essential given the current observed failings. It was further noted that Article 2 (Sept. 24, 2020[33]) prohibits the use of gillnets for fishing in, or transport within, delimited areas and especially within the ZTA, transport of gillnets in the marine zone or in terrestrial areas less than 10 km from the coast and, construction, or sale of gillnets in the marine zone, or in the towns nearby, and that there was unambiguous evidence that no enforcement takes place. It was opined that the Enforcement Plan review must improve the strategy for prompting enforcement activities, e.g., the triggering factors could include detection of violations outside the ZTA itself, such as violations that occur during transportation of nets by road, where it would be much easier to quantify violations and take actions, as compared to the difficulty of counting pangas directly inside the ZTA, where their presence increases the risk to remaining vaquitas.

The impacts of widespread, unregulated gillnet use on other large vertebrate species in the Upper Gulf of California was also discussed as a matter of grave concern over the bycatch of other cetaceans, including large whales, in addition to pinnipeds, turtles, elasmobranchs and other marine wildlife, with no monitoring or management of this mortality. It was highlighted that a resident population of bottlenose dolphins found only in the Upper Gulf of California have been killed as bycatch in parallel with vaquitas since gillnets were first introduced in the region, and the current abundance and status of this dolphin population is unknown (IWC 2017).

The Committee expresses extreme frustration that despite decades of warnings and recommendations to the Commission and the Government of Mexico, and the adoption of IWC Resolutions and promises of action, the situation is increasingly dire even though the singular threat – bycatch in fishing gear – is well known. The vaquita will certainly become extinct in the near future, with the IWC apparently powerless in preventing the extinction of the species, unless the well-understood requisite actions to eliminate the risk of entanglement in illegal gillnets are effectively implemented. These illegal nets continue to be deployed throughout the vaquitas' range, and the range of other megafauna, even in the so-called ZTA.

Attention: C, CC, CG Mexico

The Committee recalls its previous concerns and recommendations regarding the declining status of the vaquita-and reiterates the urgent recommendations of the past six Committee meetings, detailed in Appendix Q.

*The Committee **draws attention to** evidence that clearly indicates the vaquita population is still decreasing and that the threat of gillnet entanglement, including in and near the Zero Tolerance Area (ZTA), is increasing. Contrary claims of vaquita recovery in some media are false and have been refuted by this Committee given the multiple lines of evidence presented. Gillnetting within the ZTA has increased since 2018 due to the*

[33] 1 Diario Oficial de la Federación. Acuerdo por el que se regulan artes, sistemas, métodos, técnicas y horarios para la realización de actividades de pesca con embarcaciones menores y mayores en Zonas Marinas Mexicanas en el Norte del Golfo de California y se establecen sitios de desembarque, así como el uso de sistemas de monitoreo para tales embarcaciones (Sept. 24, 2020), available at http://www.dof.gob.mx/nota_detalle.php?codigo=5601153&fecha=24/09/2020; see also Ex. A: Legal Fishing Guide for The Upper Gulf of California.

continuation of illegal fishing for totoaba, and the openly conducted and increased illegal fishing for shrimp and finfish.

*The Committee **strongly recommends** that to provide the best possible assessment of the declining vaquita population, the acoustic monitoring and visual survey work planned between May 2022 and June 2023 be fully funded and that the Mexican authorities take steps to assure that the field teams can carry out this work safely and efficiently and **requests** that an update be provided of this monitoring at the next SC meeting.*

*The Committee **emphasises** that between 6 and 10 (0.78 probability) vaquita remain and the species is close to extinction solely due to entanglement in gillnets and **stresses** that any inferred demographic gain from the small number of vaquita births documented since 2019 has probably been offset by unrecorded bycatch given that*

(i) nets that kill vaquitas are still in the water,
(ii) very little monitoring of beaches (for stranded carcasses) has taken place since the start of the pandemic; and
(iii) calves and young individuals are the age classes most vulnerable to bycatch.

*The Committee **urges** the Government of Mexico to fully permit and fund the implementation of alternative fishing gears for shrimp and legal finfish to help communities eliminate the need to fish illegally by providing viable, legal livelihoods that do not endanger vaquitas and other megafauna species.*

Attention: SC, S,

*The Committee **notes** that the Agreement to ban gillnets including Article 17 on Inspection and Surveillance Functions is not achieving its main purpose, which is to remove fishing vessels and gillnets from inside the Zero Tolerance Area (ZTA) of the Upper Gulf of California therefore, the Committee **strongly recommends** that a review and revision of the Enforcement Plan be urgently undertaken and this review should include additional and strengthened actions that aim to effectively cease the manufacture, sale, transport and use of gillnets, all of which are currently prohibited by law.*

An emerging issue was highlighted with regards to the recent approval, by the Standing Committee of the Convention on International Trades of Endangered Species of Wild Flora and Fauna (CITES), to permit the international, commercial trade in captive bred totoaba meat by Earth Ocean Farms (EOF); an aquaculture operation based in La Paz, Mexico. Concerns were raised that given the difficulty in identifying captive bred versus wild caught totoaba, this legal trade will obscure the continued expansion of illegal gillnetting for wild totoaba. It was noted that both the Mexican Government and EOF have committed to prohibit the trade of swim bladders from captive bred totoaba and that all swim bladders from EOF operations (currently stored and future) will be destroyed, until approval from the CITES Standing Committee, however, concerns remained that the commercial breeding operation will mask illegal fishing and thus exacerbate the decline of the vaquita.

Attention C, CG, S, IGO; CITES

*The Committee **expressed concern** over the certification of mariculture facilities (currently Earth Ocean Farms) to export totoaba products due to the impossibility of discriminating between illegal and legal products thus providing an expanded avenue for the continued trade in illegal catches that, in turn, will incentivise the illegal setting of gillnets in the vaquita's habitat.*

*The Committee further **noted** that CITES has agreed that IWC are the primary body that advises on whale issues, however the decision by the CITES Standing Committee to approve trade that directly impacts the survival of the vaquita was done so without consultation with IWC. The Committee, therefore**, requests** that the Secretariat sends a letter to CITES expressing the considerable concerns of the Committee and to also **respectfully request** that members of this Committee be included in any visit(s) planned by CITES to Mexico to assess the totoaba trade-vaquita paradigm.*

16.3.4. Strait of Gibraltar killer whales

SC/68D/SM/03 provided an update on over 250 interaction events involving killer whales (*Orcinus orca*) and vessels along the Atlantic coast of the Iberian Peninsula and adjacent waters. Interactions consistently involved 14 individual whales, most of them juveniles, that occur in four groups. Analysis shows that most of the vessels 'targeted' in these interactions were medium-sized (<15m), spade-rudder sailing vessels (average speed 6kn),

that could have been either sailing or motoring. Interactions occurred year-round but peaked between June and September, the summer and early autumn months. Although interactions were recorded throughout daytime and night-time hours, there was a peak at midday. Interactions lasted an average of 35 min. The behaviour of the killer whales when interacting with boats was not considered aggressive, although no clear motive for this novel behaviour was apparent. It appeared to be curious and playful, something that could have arisen spontaneously or could have been catalysed by a specific event and then carried forward into further interactions. As interactions intensified in certain areas, several mitigation measures, to protect both whales and boat users, were introduced. These included a temporary ban on sailing vessels entering specific areas and in Portuguese waters, and an advisory notice to whale-watching boats to stay away from these killer whales. A study is underway seeking to understand the motivation for this behaviour. The research will be conducted from a medium-sized sailing vessel that will manoeuvre in a variety of ways, e.g. stop, accelerate, reverse, change direction, etc., to see what actions provoke particular types of whale behaviour and to document what seems to trigger interactions. Two types of noise deterrents will also be tested, i.e., metal tubes and pilot whale vocalisations.

In discussion, it was suggested that special attention be given to addressing existing assumptions concerning whale behaviour, in particular, the current media misrepresentation of the behaviour as 'aggressive'.

The Committee thanked the authors for presenting such a thorough overview, encouraged the continued monitoring of the whales and supported the proposed study aimed at better understanding the potential triggers of this behaviour. In conclusion, the Committee agrees to continue the Intersessional Correspondence Group (ICG) and invited an update at next year's meeting.

16.3.5. Management of the Solitary Sociable Dolphin in Northwest Spain

Simmonds presented a report from the ad hoc Working Group on the Spanish Solitary Dolphin, concerning a male juvenile common bottlenose dolphin (*Tursiops truncatus*) known as 'Confi'. The dolphin has been living on the coast of Galicia, northwest Spain, since December 2019 in a region that is popular with swimmers, divers and fishermen. His increasingly tactile interactions with people triggered a request from the Spanish Government to the IWC for advice. An ad hoc working group was established and met twice intersessionally. At the first meeting, information on solitary sociable dolphins was reviewed, with particular focus on the behaviour progression (Eisfeld *et al.*, 2010; Nunny and Simmonds, 2019) and unpublished information on similar situations with a bottlenose dolphin in Ireland and a pantropical spotted dolphin (*Stenella attenuata*) in Hong Kong. Solitary social dolphins typically display increasingly tactile behaviour if their interaction with people is prolonged. These behaviours have the potential to injure people, sometimes seriously, and the dolphins themselves are at a higher risk of being injured or killed by human activities. 'Confi' appears to fit the typical sequence model of a solitary sociable dolphin; including biting, preventing swimmers from leaving the water, knocking the mask and regulator from a diver, biting the airlines of shellfish divers. The local NGO Coordinadora para o Estudo dos Mamíferos Mariños (CEMMA), has been monitoring the dolphin regularly, mapping his range and behaviour. To ensure the welfare and safety of both, the ad hoc group recommended that a discrete management plan be developed that clearly defines what constitutes disturbance and harassment. Other recommendations included: providing information in the form of boards and brochures; establishing "Guardians of Information" and "Godmothers" or "Godfathers" (i.e., points of contact to relay information to CEMMA and the authorities); the establishment of a permanent evaluation committee; and the establishment of a veterinary assistance team. In discussion, it was noted that a solitary sociable dolphin in the Netherlands had died as a result of anthropogenic trauma (Ijsseldijk et al. 2020). This highlighted the Committee's concern that both dolphins and humans were at risk if such events and interactions were not properly managed. The Committee agrees to maintain the ad hoc working group and provide support to the Spanish authorities, and others, who may require guidance.

16.3.6. Lahilles dolphin (Tursiops truncatus gephyreus)

SC/68D/SM/08 presented the annual progress report on the work of the Lahilles dolphin (*Tursiops truncatus gephyreus*) Task Team, which was established in March 2021. In 2020, the Committee recommended that:

- an assessment of population status in Argentina be conducted;
- authorities should be encouraged to take immediate action to reduce the level of bycatch (particularly in southern Brazil);
- monitoring should be continued to permit the assessment of life-history parameters, trends in abundance and the prevalence and etiology of chronic skin diseases; and
- a health assessment programme should be implemented.

In 2021, no significant progress was made on the assessment of population status in Argentina. Although no significant actions were taken to reduce the level of bycatch, there were no reported deaths at Patos Lagoon Estuary and Laguna in southern Brazil for the first time in 20 years. In discussion, it was noted that this apparent reduction in mortality could have been a result of a change in fisheries dynamics and/or cryptic mortality. In southern Brazil and Uruguay, photo-ID surveys resumed at seven sites. Preliminary results indicate that there are fewer than 300 individuals across these seven sites, with an apparent survival rate of 0.89 (CV and reference). In Argentina, photo-ID surveys have not been conducted since 2012. There has been no progress on documenting the prevalence and etiology of chronic skin diseases or the implementation of a health assessment programme, due to difficulties with securing funding.

In 2021, this Committee also encouraged the Task Team to;

- coordinate the regional efforts between Argentina, Uruguay and Brazil to estimate and monitor population parameters;
- seek ways to work cooperatively with fishing communities and fisheries authorities to reduce bycatch; and
- explore potential synergies with the franciscana CMP.

Two virtual meetings were held with the Southern Brazil-Uruguay (SBU) and Argentina research teams, during which information was exchanged regarding the usual activities each group conducts, the main goals for the next year, and the priority actions for the next five years. Five different projects were funded (four in SBU and one in Argentina) to conduct photo-ID studies, train surveillance agents, conduct interviews with fishermen and promote conservation of Lahille's bottlenose dolphins and cooperative fishing through community-based tourism. In September 2021, a workshop was held in Laguna, Brazil, where 40 participants were trained in mark-recapture analytical techniques. Surveys for the next two field seasons were planned and a virtual space of sharing dorsal fin catalogues was created, which now contains 280 individuals from seven different locations. In addition, more than 30 agents from three different governmental agencies (IBAMA, ICMBio and PATRAM) participated in a training programme designed to build the skills and capacity required to combat illegal fisheries at a regional scale, with a focus on the Patos Lagoon Estuary. A citizen surveillance app was also developed, specifically to record illegal fishing activities in coastal areas, and both sightings and strandings of Lahille's bottlenose dolphins.

The Committee thanked Fruet for the update and commended the task team on the progress made despite the challenges of the global pandemic. The Committee requested that the task team provide a report at next year's meeting.

16.3.7. Review of previous recommendations

At SC68B a review and consolidation of previous recommendations was initiated, and an Intersessional Correspondence Group (ICG) was established to further assess the recommendations on small cetaceans included in the new IWC Database of Recommendations (IWCDoR). The goal of this exercise is to eventually assess which recommendations led to significant progress in that particular issue, and characterise any factors or components that contributed to successful (= effective) recommendations to guide future efforts. Progress has been made in compiling information on individual IWCDoR records into a database, identifying related and equivalent recommendations and tracking responses to the recommendations and progress in completing any specified actions. Trujillo and Jimenez presented the killer whale and the franciscana as examples of how this process works. It was suggested that an approach for identifying and tracking related or equivalent recommendations, the timeliness with which the recommendations were implemented and changes in public policy, if any, due to implementation of the recommendations. The proposed framework will also identify recommendations that have not been addressed and will allow the Committee to assess a more appropriate approach to effecting action or developing a new strategy to fulfil the recommendations of this Committee

The examples presented indicated that having engaged and responsive national governments and state or provincial agencies, positively influenced the recommendation outcome. Future recommendation review will also assess the effectiveness of recommendations made where no one individual or group was identified to drive the proposed process or when multiple agencies are requested to take action, but no individual or group takes

responsibility for converting the recommendation(s) into policy. Recommendations requiring inter-organisational coordination or collaboration, such as with CMS or IUCN, were encouraged, as findings thus far suggested that this is more likely to result in positive action and progression towards a more favourable conservation status for the species or population in question. It was noted that one important outcome of making formal recommendations is that funding bodies view this as expert support of a related research proposal and thus research groups are more likely to obtain funding, especially in the initial stages of a project.

The Committee recognised the progress made on database compilation and welcomed the inclusion of more members to the ICG. It was highlighted that future analyses should be mindful of how the change in recommendation format and the ICG should develop a process and provide comparisons in the framework design. It was noted that some recommendations can take many years to be disseminated, understood, agreed and implemented before any progress is observed and this will complicate analysis. It was suggested that for these instances, a detailed history of how a recommendation has been translated into action should be incorporated into the analysis. It was reiterated that when populating the database with older recommendations, that are not in the current required format, any revision or refocus of the original recommendation must be avoided.

Once all recommendations have been inserted into the database, the ICG will be divided into species and/or regional groups, and will evaluate the effectiveness of relevant recommendations. It was suggested that as an initial target, ten species should be assessed. It was also suggested that the analyses include: the identification of bottlenecks in the implementation of recommendations, determination of what topics progress effectively and what topics should be priorities moving forward. Although challenging, it was acknowledged that where appropriate, recommendations made by other sections of the committee that affect small cetaceans should be integrated into the database.

The Committee commended Trujillo and Jimenez on the progress made on the review and agrees to maintain the Intersessional Correspondence Group on the Review of Recommendations and to expand its membership. The Committee also agrees to progress in the analyses of the recommendations made for ten species.

16.3.8. Other

16.3.8.1 INTEGRATED CONSERVATION PLANNING FOR CETACEANS (ICPC)

In 2021, the Committee received information on the goals and objectives of the Integrated Conservation Planning for Cetaceans (ICPC) team. SC/68D/SM/11 briefly reviewed ICPC with a focus on progress made since May 2021. ICPC is a sub-group within the IUCN Species Survival Commission's Cetacean Specialist Group. The ICPC team was formed in response to the desperate situation for an increasing number of endangered riverine and coastal dolphin and porpoise species and populations and the need for research and management to build our understanding of species biology and the threats these species and populations face. Six ongoing projects aiming to fill critical knowledge gaps were reviewed.

Atlantic humpback dolphins (Sousa teuszii) – Conservation Action Plan Project. In 2020 scientists involved with the ICPC, as well as the IWC and CMS, collaborated to form the Consortium for the Conservation of the Atlantic Humpback Dolphin. Boat-based field surveys in the Saloum Delta, Senegal and in the Tristao Islands, Guinea, will be completed in 2021. Standardised interview surveys of fishing communities will be conducted in seven range countries, commencing in 2022, with a goal of better understanding species distribution.

*Indus (*Platanista minor*) and Ganges River dolphins (*Platanista gangetica*) – Capacity Building Project.* The frequent entrapment of Indus and Ganges dolphins in irrigation canals in Pakistan and India has resulted in the translocation of dolphins from the canals back to the river mainstem on a regular basis. New alliances have been formed that will build urgently needed capacity through training local first responders and collecting data in order to improve long-term conservation efforts.

*Franciscana dolphins (*Pontoporia blainvillei*) – Health Assessment Project.* Up to six franciscanas will be caught, tagged and released off the coast of Argentina to document movement patterns relative to coastal fisheries. During the process of handling for tagging, health assessments will be conducted by experienced veterinarians.

*Franciscana dolphins (*Pontoporia blainvillei*) – Neonate & Juvenile-Adult Rehabilitation Protocols.* Live-stranded franciscana dolphins, especially neonates that typically die within hours of stranding, require rapid response. A neonate care protocol has been developed and juvenile and adult franciscana handling procedures have been improved. The development of mobile animal care units is underway.

Lahille's bottlenose dolphins (Tursiops truncatus gephyreus) – Epigenetic Aging Analysis Project. Improved knowledge of age structure, population demography and health status will provide a broader basis for protection

of this subspecies that totals only around 600 individuals. To fill one data gap, a pilot study is underway to develop a skin-based, epigenetic technique to estimate age.

Capture myopathy – Critical Data Gaps Project. A virtual workshop was held in 2021 with the primary goal of developing a better understanding of capture myopathy, which is an essential veterinary consideration for hands-on conservation work with small cetaceans. The workshop report is in the final stages of review and will be shared with the scientific community upon completion.

*Yangtze Finless Porpoise (*Neophocaena asiaeorientalis asiaeorientalis*) – Steps towards a One Plan Approach.* In 2019, a workshop considered the Chinese government's Action Plan for Saving the Yangtze Finless Porpoise, which states the goals of increasing the size of the *ex situ* metapopulation and increasing the number of *ex situ* reserves. A further virtual workshop is planned for late 2022, to conduct a PVA that analyses the risks of extinction and loss of genetic diversity by including both the *in situ* and *ex situ* populations as components of a range-wide metapopulation.

Discussion focused on the objectives of the ongoing projects, progress with the Yangtze finless porpoise abundance surveys, prospective new ICPC components and the potential for coordination with IWC on additional projects. Taylor noted that the goal of developing a neonate (and eventually juvenile/adult) rehabilitation protocol for franciscanas was to learn as much as possible from stranded animals in order to learn more about individual variability in stress response and other aspects of health assessment, given the high number of neonate strandings. Cipriano noted that in cases such as the franciscana, although ICPC held a workshop and is developing health assessment protocols, including coordination with a long-term tagging programme[34], the main conservation planning effort for this species is related to development of the CMP, and ICPC wishes to help with that. Wang Ding explained that the planned range-wide abundance survey for Yangtze finless porpoises had been delayed because of recent covid outbreaks in China, which delayed both observer training and the survey start. Taylor noted that ICPC intended to limit the number of projects it supports in order to focus on making progress on the most critical issues. Identifying potential projects and prioritizing conservation needs, in parallel with discussion of how subpopulations are assessed within the IUCN assessment programme, will be the subject of a 2-day workshop to be held prior to the Society for Marine Mammalogy Conference, 30-31 July 2022, in Florida, USA. SC members are welcome to participate either in person or virtually. Further discussion included the potential of *ex situ* measures to distract from or divert resources from the *in situ* programmes. Taylor clarified that in all ICPC projects, research will be oriented to addressing critical knowledge gaps, supporting *in situ* conservation and helping conservation scientists become better prepared to handle conservation emergencies.

16.4 South Pacific Island Small Cetaceans

16.4.1 Review of SPREP work on small cetaceans

K. Baird presented an overview of the South Pacific Islands region and the role of the Secretariat of the Pacific Regional Environment Programme (SPREP). The region, as defined by the Noumea Convention and the Convention of Migratory Species (CMS) Memorandum of Understanding (MoU) for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (CMS, 2007), consists of the marine areas under the jurisdiction of each State or Territory between the Tropic of Cancer and 60° South latitude, and between 130° East longitude and 120° West longitude. The region stretches over some 10,000km from east to west and 5,000 km from north to south, with a combined economic exclusion zone (EEZ) of approximately 30 million km². It contains 22 Pacific Island Countries and Territories, as well as a portion of the Australia continent, both the North and South Islands of New Zealand, and a portion of the Hawaiian Islands. Regionally, the role of SPREP is to provide environmental advice to Pacific Island member countries and territories. Baird drew attention to two items: SPREP Regional Marine Species Action Plans (RMSAPs) and the Pacific Ocean Cetacean MoU. RMSAPs provide guidance on the conservation priorities of five species groups within the Pacific region: cetaceans, sharks and rays, marine turtles, dugongs and seabirds. The first RMSAP was published in 2003, and currently, updated iterations are planned for 2022 and 2026. The Pacific Ocean Cetacean MoU was established under the auspices of CMS and encompasses 15 member countries and territories in the Pacific region. The fourth meeting of signatories was held in 2021, during which several gaps were identified, both finance and technical, that need to be addressed before the MOU conservation goals can be met.

16.4.2 Review of regional long term research programmes

Constantine reported the results from continued genetic monitoring of New Zealand's endemic Hector's dolphin subspecies, the Māui dolphin (*Cephalorhynchus hectori maui*), during 2020 and 2021, following the same

[34] The Sarasota Dolphin Research Program, https://sarasotadolphin.org/

methods as previously reported for surveys conducted in 2001–2007, 2010–2011 and 2015–2016 (Constantine *et al.*, 2021). The primary objectives were to estimate the abundance and effective population size of Māui dolphins in 2020–2021 and to document the movements of individuals of this subspecies and migrant South Island Hector's dolphins (*C. h. hectori*) using DNA profiles derived from biopsies. DNA profiles from biopsies collected during the 2020–2021 surveys were also matched with all other biopsies collected since 2001, including tissue samples from necropsies of beachcast individuals.

Small-boat surveys dedicated to the collection of biopsies from Māui dolphins were conducted along the northwest coast of Te Ika-a-Māui / the North Island of Aotearoa New Zealand, from just south of the entrance to the Kaipara Harbour in the north to the Mokau River, Taranaki, in the south during the austral summers of 2020 (11 - 27 February) and 2021 (13 February - 15 March). A total of 84 biopsies were collected during these surveys from individual dolphins aged 1 year and older (50 in 2020 and 34 in 2021). DNA profiling was undertaken for all samples, including genotyping of up to 25 microsatellite loci (average of 24.94 loci/sample), genetic sex identification and mitochondrial DNA (mtDNA) control region sequencing.

Based on DNA profile matching, 32 individuals were identified from the 50 samples collected in 2020 and 24 individuals from the 34 samples collected in 2021, with 13 individuals recorded in both surveys. These totals provide a minimum census of 43 individual dolphins (22 females and 21 males) alive at some point during the 2-year study period. Of this total, one male and one female that were sampled in 2020 were identified as South Island Hector's dolphin migrants based on their distinct mtDNA haplotypes and genotype-based population assignment procedures. The female South Island Hector's dolphin was first identified in 2010, while the male had not been sampled previously. With the addition of this male, four live South Island Hector's dolphins (two females and two males) have now been sampled in association with Māui dolphins since 2001. Despite the intermingling of the two subspecies, there is no evidence to date of interbreeding between the South Island Hector's and Māui dolphins (i.e., all subspecies identifications have been consistent with diagnostic differences in mtDNA and assignable differentiation of microsatellite genotypes).

Five DNA samples have been collected from beachcast Māui dolphins since the previous survey in 2015–2016: four in 2018, including one female and her near-term foetus, and one in 2021. Two of the four individuals reported in 2018 had previously been sampled alive: an adult male that was first sampled in 2001 and the pregnant female, which was first sampled in 2004. The remaining two samples collected in 2018 were from young individuals – a neonate and the near-term foetus. The sample collected in 2021 was from a female of adult length but did not match any previously sampled dolphins.

Based on the sampling locations, individual movements within the sampling period were typically over short distances (i.e., less than 10 km). The maximum distances travelled were 32 km over 15 days by a male in 2020 and 31 km over 29 days by a female in 2021, both of which travelled between south of the Manukau Harbour and near Port Waikato. Although the dolphins did not travel as far as in previous surveys, the evidence that some individuals move throughout the typically observed range of Māui dolphins is consistent with the expectation of random intermingling for capture–recapture models.

The census abundance (N_c) of Māui dolphins in 2020–2021 was estimated to be 54 individuals aged 1 year or older (1+) (95% confidence interval (CI) = 48–66) within the survey area, using a two-sample, closed-population model. This estimate applies to the number of individuals alive during either sampling year and is comparable to the previous estimates based on the genotype surveys in the same area in 2015–2016 and 2010–2011. An effective population size (N_e) of 35 (95% CI = 21–67) was estimated from the genotypes of the 41 Māui dolphins sampled in 2020–2021 using the one-sample linkage disequilibrium method. This is unchanged from the previous estimate for 2015–2016 but lower than estimates for 2010–2011 and 2001–2007. The smaller size of N_e relative to the capture–recapture N_c estimate is consistent with the expectation that N_e represents only the individuals of the parental population that contributed successfully to the next generation.

Retrospective matching of DNA profiles for all samples collected from 2001 to 2021 resulted in a total count of 137 individual Māui dolphins, 118 of which were sampled alive only, 16 of which were sampled beachcast (dead) only, and three of which were sampled alive and then dead two, 14 and 17 years later. During the reconciliation of this 'DNA register', one individual that was sampled in 2015 and previously reported to be unmatched was found to be a match to an individual sampled in 2002 and 2006. This error in identity did not affect the previously reported closed-population estimates but does reduce the total DNA register by one. One male was sampled in both 2001 and 2020, confirming a minimum survival of 20 years, given the minimum age of 1 year old at the time of sampling. The complete 21-year record of captures and recaptures is available for further abundance estimates using open-population models.

These results highlight the importance of individual identification and genetic monitoring using biopsies and DNA profiling. The register of DNA profiles now spans 21 years and is providing new information on the life history parameters, local movements and numbers (both N_c and N_e) of Māui dolphins, as well as the long-distance dispersal of South Island Hector's dolphins into their range. Future work should include using reduced representation genomic sequencing to generate thousands of nuclear loci, which will enhance the power of genetic monitoring and allow patterns of relatedness amongst individuals to be determined.

In discussion, all agreed that these numbers are small and concerning, regardless of small differences related to variations in the statistical analysis used to estimate the 2020-2021 abundance. There was also agreement that it was difficult or impossible to estimate trends in abundance given the confidence limits on all recent abundance estimates for Māui dolphins, and that protection of the tiny population is important regardless of the exact numbers and should be continued. Some members stated that the measures determined to be necessary to adequately protect Maui dolphins were in place, while others thought that additional measures were needed. Since 2012, the Committee has repeatedly highlighted the critically endangered status of the Māui dolphin and the ongoing threats to its habitat and has made multiple recommendations to improve the status of this subspecies. Some members again highlighted previous urgent requests to the New Zealand Government to commit to specific population increase targets and timelines for Māui dolphin conservation. The New Zealand Government reiterated their views expressed in 2021 that measures implemented in 2020 meet this target and recommendations should be updated to reflect the most recent information (for context, see IWC 2021 - section 12.8.1, p96]. The Committee noted that a delayed intersessional meeting aimed to address several recommendations for the Māui dolphin population will be conducted before the next SC meeting (see Section 12.7, this report) and it was requested that all other previous recommendations made by this Committee be reviewed by the Recommendation Review ICG (see Section 16.3.7, this report) to provide an update at the next Scientific Committee meeting.

Attention: SC-SM, SC-HIM, CC, C, CG-New Zealand

*The Committee **draws attention to** the critically endangered status of the Māui dolphin (Cephalorhynchus hectori maui) and the 2021 population estimate of only 54 individuals and **re-emphasises** the inherent and irresolvable uncertainty surrounding information on most small populations, which point to the need for precautionary management.*

*The Committee **agrees** to include the Māui dolphin as one of the ten species to be assessed by the Recommendation Review ICG working on the review of previous recommendations in the 2022-23 period.*

Garrigue provided a review of small cetaceans of New Caledonia, which encompass 1.3 million km^2 of water, including 24,000km^2 of lagoon. Fourteen delphinids have been identified: killer whale (*Orcinus orca*), short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), melon-headed whale (*Peponocephala electra*), pygmy killer whale (*Feresa attenuata*) , Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), common dolphin (*Delphinus delphis*), spinner dolphin (*Stenella longirostris*), pantropical spotted dolphin (*S. attenuata*), striped dolphin (*S. coeruleoalba*), Fraser's dolphin (*Lagenodelphis hosei*), common bottlenose dolphin (*Tursiops truncatus*) and Indo-Pacific bottlenose dolphin (*T. aduncus*). Both bottlenose dolphin species are observed within the shallow lagoon waters while all others occur offshore, in relatively deep waters. The common bottlenose dolphins that occur in New Caledonia are a large oceanic form, with evidence of limited gene flow between China-Taiwan, New Zealand and Palmyra-Kiribati-Hawaii. The Indo-Pacific bottlenose dolphins that occur in New Caledonia are a small coastal form and appear to be differentiated from other Pacific Islands populations. At least six isolated lagoon communities are threatened and require conservation action. They number in the low hundreds, with very low mtDNA diversity and strong mtDNA structure (Bonneville *et al.*, 2021; Oremus *et al.*, 2015a).

Poole provided a written update on small cetacean research in French Polynesia, which encompass 5 million km^2 and comprise 118 islands in five archipelagoes (the Marquesas, Society, Tuamotu, Gambier and Austral Islands). Fourteen species of small cetaceans have been identified: the killer whale, the short-finned pilot whale, false killer whale, melon-headed whale, pygmy killer whale, Risso's dolphin, rough-toothed dolphin, spinner dolphin, pantropical spotted dolphin, Fraser's dolphin, common bottlenose dolphin, Cuvier's beaked whale (*Ziphius cavirostris*), Blainville's beaked whale (*Mesoplodon densirostris*) and the dwarf sperm whale (*Kogia simu*s). Most of these species are widespread within French Polynesia, however, pygmy killer whales and pan-tropical spotted dolphins are known only from the Society Islands and Marquesas, respectively. Research has

been conducted in all five archipelagoes, with most effort directed towards spinner dolphins and rough-toothed dolphins in the Society Islands (e.g. Oremus *et al.*, 2007; 2012). The small resident population of spinner dolphins at Moorea (148; 95% CI 121 - 181), despite being a largely closed community, has an incredibly high level of genetic diversity due to gene flow between it and other islands. The behaviour and distribution of this population is being impacted by increased boat traffic and sedimentation, due to poor developmental and agricultural practices. At Tahiti and Moorea, rough-toothed dolphins are deliberately injured (and possibly killed) by fishermen, as they remove bait from the hooks of the long-line fishery.

SC/68D/SM/04 presented work on the photo-ID-based age estimation of false killer whales utilizing information on sex, relative size, markings and morphology. A protocol for deriving age estimates of false killer whales in Hawaiian waters using information curated from a long-term photo-ID catalogue was developed. The protocol integrates several qualitative lines of evidence (e.g., morphometric features, parentage, markings) into a quantitative framework for deriving age point estimates. Further, confidence ratings based on the strength and weaknesses of supporting evidence were developed to directly account for uncertainty in age estimates and scale the plausible range of ages (minimum and maximum) specific to each individual. While originally intended to inform a concurrent study on epigenetic aging of this population, our protocol provides a compelling alternative for estimating the age of individuals with common metrics from photo-ID catalogues and for which advanced genetic aging methods of biological samples (e.g., biopsies) are not feasible.

The Committee thanked Baird for the presentation and noted that this innovative approach for estimating the age of individuals was a valuable, and relatively low-cost alternative to epigenetic aging methods if photo-identification catalogues are already available.

16.4.3 Threats to small cetaceans of the South Pacific Islands

Miller presented an overview of threats to small cetaceans of SPREP member countries and territories. Regionally, 22 small cetacean species have been documented in the region, however, it is likely that the species reported represent only a minimum of the actual species diversity. Threats discussed included: incidental catch and fishing gear interactions, direct harvesting, pollution, vessel traffic, pathogens and introduced species, resource depletion and climate change. Estimates of cetacean bycatch in the region are limited by the small amount of fishing vessel monitoring, e.g., observer coverage is less than 1% for South Pacific long-line vessels (1987-2000), 5% for purse seiners (1994-2000) and only 2% for Solomon Island line-and-pole fishing trips (1988). This level of observation is inadequate to determine true bycatch numbers, however, from the limited information available, false killer whales, short-finned pilot whales, Risso's dolphins, rough-toothed dolphins and bottlenose dolphins are all believed to be heavily impacted throughout the region. With respect to impacts from tourism, species of regional concern include spinner dolphins, bottlenose dolphins and short-finned pilot whales.

Addressing knowledge gaps in this region will require:

- increased quality and quantity of data collected,
- improved understanding of cetacean diversity, distribution, population structure and threats,
- more in-country partnerships and support for cetacean conservation and
- mainstreaming of relevant national and regional environmental initiatives.

Possible means to encourage greater observer coverage on fishing vessels and thereby more robust estimation of bycatch rates and better documentation of species affected were discussed, in particular, the high rates of interaction between false killer whales and long-line fisheries. In response to a question about the potential use of electronic monitoring (EM) systems, Miller explained that the current focus is on fish bycatch and regulation compliance, rather than cetaceans; observers are not provided with much equipment and may have to take photos of specimens with personal cell phones, and they are typically located in positions far from bycaught animals; and there has been some consideration of expanding the genetic "barcoding" programme for tuna to include cetaceans but this is a long way off. K. Baird added that EM is being trialled by some Pacific Island countries, such as Fiji. It was also pointed out that it was difficult for organisations like the Western & Central Pacific Fisheries Commission (WCPFC) to make decisions by consensus on such issues, and countries are usually reluctant to develop monitoring systems for additional fisheries if they are likely to reveal a larger scope for a problem that already has compliance issues.

Childerhouse presented an overview of potential threats to small cetaceans in the South Pacific Island region from deep sea mining activities. To date, 31 exploration permits have been issued by the International Seabed Authority (ISA), with no commercial exploitation permits yet issued. There are currently no recognised

international best practice guidelines for minimising or mitigating environmental impacts, though these are to be developed by the ISA, prior to June 2023. In most potential mining locations, the biological environment is very poorly understood and the potential impacts on small cetaceans will likely vary considerably, depending on the cetaceans' usage of the area (e.g. breeding, feeding, migrating); importance of the area to the species or population (e.g. whether they can undertake the same activities elsewhere); sensitivity (e.g. whether the species can tolerate increased sedimentation or noise, or they can switch prey); conservation status (e.g. endangered versus non-threatened); and the exact nature and extent of the mining operation (e.g. whether sedimentation is highly localised or operational noise is only slightly above ambient).

Attention: SC, R

*The Committee **welcomes** the information provided on the small cetaceans of the South Pacific Islands and the threats that they face.*

*The Committee **agrees** that future communication and collaboration with the Secretariat of the Pacific Regional Environment Programme (SPREP), and other regional bodies, was needed to better understand and mitigate threats to the small cetaceans of the region, particularly with regards to small cetacean bycatch which for some species, e.g., false killer whales, is extremely high.*

*The Committee **agrees** to establish an Intersessional Correspondence Group to consider the status of small cetaceans in the South Pacific region and to establish future research and action priorities.*

Beasley and Amepou reported on the continued and likely unsustainable bycatch of Australian humpback (*Sousa sahulensis*) and snubfin (*Orcaella heinsohni*) dolphins in gillnet fisheries in the Kikori Delta, Papua New Guinea (SC/68D/SM/16). Very little is known of the number of individuals or their habitat use, however, both species appear to exist as small, localised populations of only a few hundred, i.e., approximately 100 humpback dolphins and 200 snubfin dolphins. By-catch in the gillnet fisheries was documented during dolphin abundance surveys conducted in 2013 and 2015, by-catch levels had increased significantly to at least 3-4 dolphins/month; over a period of three months (November 2021 – January 2022) a total of 13 snubfin dolphin carcasses were recovered, 11 of which were confirmed to have been by-caught in large-mesh gillnets. In discussion, new information from March 2022 recorded a further 56 snubfin and one humpback dolphin deaths, additional to the data presented in SC/68D/SM/16. This increase in bycatch is an unintended consequence of a newly developed fishery targeting fish swim-bladders for export to China. Fishermen earn at least PGK1000 (USD$300) for one good-quality swim-bladder, which equates to more than a month's salary, thus resulting in a fishery that is very difficult to manage. The fishermen of the Kikori Delta do not want to catch dolphins and have requested the assistance of international bodies, including this Committee, to reduce bycatch. This situation parallels the dire situation facing Mexico's endemic vaquita (*P. sinus*), which has been pushed to near extinction by an illegal fishery for swim-bladders of the totoaba fish *(Totoaba macdonaldi*). In discussion, that urgency of developing strategies to reduce by-catch was highlighted and it was further noted that in order to better manage this and other threats, the stock structure and connectivity of the Kikori Delta dolphins must be better understood.

Attention: S, G: Papua New Guinea, SC: HIM, SM, CC: BMI, Marine Mammal Bycatch Expert Panel

*The Committee **draws attention to** the unsustainable levels of bycatch from the two small populations of Australian humpback (*Sousa sahulensis*) and Australian snubfin dolphins (*Orcaella heinsohni*) in the Kikori Delta, Papua New Guinea, and **agrees** that there is an urgent need for collaborative action (i.e. research, community/government consultation and by-catch mitigation) to reduce dolphin mortality as a matter of priority and:*

*(1) **agrees** to offer technical support to the Piku Biodiversity Network (PBN, University of Canberra) for continuation and extension of their monitoring studies and for developing strategies to reduce inshore dolphin by-catch in the Kikori Delta, in coordination with the Bycatch Mitigation Initiative and the Marine Mammal Bycatch Expert Panel;*

*(2) **requests** that the Secretariat contact the Government of Papua New Guinea to advise them of concerns surrounding the high and increasing bycatch of dolphins in the Kikori Delta, which is driven by high prices for swim bladders exported to China.*

Oremus presented an overview of traditional drive hunting of small cetaceans in the Solomon Islands, which has been practiced for centuries by a few villages on the island of Malaita. Following the controversy over the

Solomon Islands live dolphin trade in 2003, a workshop was convened by the IUCN Species Survival Commission in 2008 to assess the status of the target species, Indo-Pacific bottlenose dolphins (Reeves and Brownell, 2009). The workshop provided an opportunity to initiate contact with the Solomon Islands government in 2009, and through this collaboration and with support from the IWC Small Cetacean Voluntary Conservation Fund, the South Pacific Whale Research Consortium was able to assess the sustainability of the live dolphin trade and collect information on other species and traditional activities, particularly dolphin drive hunting (IWC, 2013b).

Following the international attention resulting from the workshop, in 2010, the Earth Island Institute (EII) signed an MOU with some of the villages involved in the drive hunt, which offered financial support to communities to develop alternative activities to drive hunting. In January 2013, however, the village of Fanalei on Malaita, resumed the traditional hunt and over eleven hunts, 1,698 individuals were captured, comprising three different species: pantropical spotted dolphins, spinner dolphins and common bottlenose dolphins. An analysis of available hunting logbooks indicated that a minimum of 15,444 dolphins were landed on Malaita between 1976 and 2013 although this is likely a vast underestimate as only 21 years of hunting logbooks were available from a 35-year period and the spatial coverage of available records was also highly variable (Oremus *et al.*, 2015b).

The EII initiative both failed to stop the hunt and created opposition in the Fanalei community. Fanalei's elders did not understand the attention they attracted with regards to traditional practices, which they want to preserve even though the community has concerns over the drive hunts sustainability. This echoes the concerns stated with regards to the gillnet fishery in Kikori; where income is limited and communities' daily sustenance is derived directly from fishing or hunting, with few other options available to sustain local livelihoods, research and conservation action must be conducted with sensitivity and in full collaboration with local people.

Attention: S, G: Government of the Solomon Islands SC: Statistics Department

*The Committee **draws attention to** the likely unsustainable drive hunt for small cetaceans practiced by some villages on Malaita, Solomon Islands, and noted elders from at least one village were also concerned that their traditional practice was not sustainable.*

*The Committee **agrees** that a variety of studies are needed to better understand the impact of drive hunts on dolphin populations and the socio-economic context of the hunting, including, collection of additional hunt records, studies of genetic population structure, genetic diversity and abundance and new social and anthropological assessments,*

***encourages** the re-establishment of collaboration with hunting communities, as per previous research supported by the IWC, as a first step towards assessing both dolphin conservation and human cultural implications of the drive hunt and,*

***recommends** that drive hunt records from 2013 onwards be collected in order to better understand the potential impacts to the local cetacean populations, and to update previous work funded by this Committee on total take estimates and capture trends.*

*The Committee **requests** that the Secretariat write to the appropriate agency of the Government of the Solomon Islands to offer assistance in reviewing the annual records of the drive-hunt and offering the Committee's expertise in assessing the status of small cetaceans in Solomon Island coastal waters.*

16.5 Review direct takes and live captures of small cetaceans

The Committee received the summary of takes of small cetaceans. These data were extracted from National Progress Reports, online reports of the Japan Fisheries Agency and other information provided to the Committee. NAMMCO's reporting of small cetacean takes was particularly noted as contributing significantly to the Committee's understanding of the status of small cetacean species in the North Atlantic area. It was noted that the summary table of takes now spans more than 23 years, for some species and areas. The dataset can be requested from the Secretariat (statistics@iwc.int). The Committee notes its great appreciation for all who compiled and reviewed data on directed takes. Allison, the IWC Head of Statistics, retired in the intersessional period and this Committee expressed sincere thanks to Allison for leading the collation of the small cetacean take data, for over two decades, and especially for the last three years, during which Allison expended considerable effort working with all parties to verify the figures in the dataset. Allison has facilitated the research, collation, and management of an extensive data resource with which this Committee can now progress its work.

At SC68C, it was noted that the virtual nature of recent meetings makes detailed discussion of some topics

challenging, however, progress on the analyses of the table of takes should be initiated as a matter of priority. A working group was established to develop a framework for analyses intersessionally. Katara has recently been appointed Lead for Statistics and, on a first review of the compiled data, has proposed that a gap analysis be initiated to identify i) opportunities for trend and comparative analyses to be conducted immediately, particularly the killer whale take information, including the and ii) where additional data, such as effort, abundance estimates, population structure, environmental conditions and trade statistics, would facilitate a more In-depth review of the impact of takes on certain small cetacean populations. The existing tables of direct takes include data on multiple species and various countries rely heavily on National Progress Report submission, however, the usefulness of other datasets, available in open, online databases, published literature and other sources, should be assessed with a view to including them in future analyses. The work will be supervised by Katara, in collaboration with Porter, with the possibility of the assistance of an IWC intern or postgraduate student who can dedicate the time required to initiate the analyses. Progress on this work and a more detailed work plan will be presented at the 2023 meeting of the SC.

Attention SC

*The Committee **reiterates** its previous recommendation to make progress on the analyses of the data in the direct take tables, compiled by the Committee.*

*The Committee **agrees** to progress on this matter via an intersessional working group (co-convenors: Porter and Katara) and report to the Committee in 2023.*

16.5.1 Direct Takes

On review of the direct takes tables, it was noted in discussion that the takes of killer whales (*Orcinus orca*) in Greenland (both West and East) are of concern and that there is a need for a full assessment of this population, or populations, impacted by these hunts. It was further noted that recent evidence suggests that harbour porpoise (*Phocoena phocoena*) in West Greenland may be genetically distinct and constitute a distinct ecotype (Olsen *et al.*, 2022) therefore, the current level of takes reported from that area, compounded by the significant level of estimated bycatch, is also concerning.

The Committee discussed in depth the reported takes of narwhals (*Monodon monoceros*) in southeast Greenland and noted the recent publication that concludes that excessive hunting has affected life history and population dynamics of this population (Garde *et al.*, 2022). Naalakkersuisut, the executive body for the government of Greenland, recently issued hunting quotas for 2022 totalling 50 narwhals in three 'management areas' in southeast Greenland (Ittoqqortoormiit, Kangerlussuaq and Tasiilaq). This decision adds greatly to the risk that narwhals will be extirpated and no longer present in southeast Greenland due to overhunting. Issuance of the 50-narwhal quota for 2022 implicitly reversed Naalakkersuisut's previous plan to reduce the total quota to 20 by 2023 (NAMMCO, 2021).

Over three meetings since 2019, the Scientific Council of the North Atlantic Marine Mammal Commission (NAMMCO, 2019; 2021; 2022) has considered stock structure, genetic diversity, abundance, range, sex- and age-distribution and pregnancy rates for narwhals in southeast Greenland and examined impacts on them from hunting and commercial trade, climate change and other anthropogenic stressors. The Committee noted that were no sightings of narwhals in recent surveys of the area. The Council has repeatedly reiterated its concern for the "high risk of extirpation of the stocks if harvest at any level continues" (NAMMCO, 2021) and "strongly reiterated" advice to reduce the hunt to zero in all three management areas. It has "underlined that all available knowledge and data, including hunter knowledge, had now been exhausted to update the assessment" and "did not expect new surveys planned for 2022 to change its advice" (NAMMCO, 2022). The Committee also noted that for the human communities that rely on hunts for sustenance and livelihood, sustainable management has to be a priority.

The advice from NAMMCO to set zero quotas is unprecedented in its gravity and urgency, but Naalakkersuisut has not yet adequately responded to the situation; the quota was exceeded at least once in each management area in 2020 and 2021 (Annex R) and the government recently set quotas for 50 narwhals for the three management areas for 2022 (NAMMCO, 2022).

Attention S, SC, CC, G-Greenland

*The Committee **expresses serious concern over** the imminent risk of extirpation of the narwhal (*Monodon monoceros*) population present in southeast Greenland due to overhunting. The Committee **recommends***

that Naalakkersuisut, the executive body for the government of Greenland, immediately reduce the quota for the southeast Greenland hunt of narwhals to zero.

*The Committee **recommends** that the Secretariat write a letter to Naalakkersuisut to express its **serious concern** over these continued hunts and to immediately reduce the hunting quota for southeast Greenland narwhals to zero.*

In discussion, the Committee also noted the high number of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) reported as direct takes in recent years. The Atlantic white-sided dolphin is hunted in Norway, Newfoundland, Greenland, Canada, and the Faroe Islands (Cipriano, 2018). The Faroe Island dolphin hunts, which include Atlantic white-sided dolphins, takes place year-round, peaking in August and September (Bloch and Mikkelsen, 2018). Between 1872 and 2018, Faroese catch records record 12,067 Atlantic white-sided dolphins as direct takes (Bloch & Mikkelsen, 2018). Although catch frequency decreased after 2006, the Committee noted with concern that 1,423 individuals were killed in a single drive hunt, in September 2021. This is believed to be the largest ever take of the species.

At its 26th meeting, the ASCOBANS Advisory Committee expressed concern over this hunt and requested the ASCOBANS Secretariat to write a letter to the Faroe Islands to question the sustainability of the hunt (ASCOBANS, 2021). ASCOBANS also established an Intersessional Working Group on *Lagenorhynchus* species to: (1) review the available information on population structures and trends, distributions, abundances, mortalities, reproductive outputs, health, diet, behaviour, and data gaps; and (2) review issues that pose a conservation threat (ASCOBANS, 2021). The ASCOBANS Secretariat stated that IWC participation in this working group was welcome and Simmonds was appointed to coordinate with the ASCOBANS Secretariat and members of this Committee to assist in this work.

The EU and its Member States that are Parties to the International Convention for the Regulation of Whaling, with the exception of Denmark, also formally expressed concerns, via IWC Circular Communication IWC.CCG.1488[35], over the sustainability of the hunt and highlighted the need for scientific investigation, taking into account additional threats faced by the species.

Attention S, SC, CC, G-Faroe Islands

*The Committee **draws attention to** the serious concerns expressed via IWC Circular Communication (IWC.CCG.1488)[34] and by the ASCOBANS Advisory Council with regards to the high number of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) reported as direct takes in recent years, particularly by the Faroe Islands in 2021, which have occurred without a full assessment of the status of the Atlantic white-sided dolphin at species and population level.*

*The Committee **reiterates its longstanding recommendation** that no small cetacean removals (live capture or directed harvest) should be authorised until a full assessment of status has been made (e.g., IWC 2021b)*

*The Committee **recommends** that the Secretariat write a letter to the Faroe Island Government **stating concern** with regards to the sustainability of the Atlantic white-sided dolphins hunts and to convey this Committee's advice that no small cetacean removals should be authorised until a full assessment of the status of this dolphin population has been undertaken.*

16.5.2 Live Captures

SC/68D/SM/05 reported on the readaptation of a beluga to the natural environment. A male beluga named Gary was caught in 2012 and kept in an artificial environment for six years before being released into Sakhalin Bay in 2018, with a satellite tag attached. The beluga moved at variable speed along the west coast of Sakhalin, reached the southern coast in one month, and passed the La Perouse Strait, before entering the northern waters of Hokkaido, Japan. The whale then left Japanese waters, travelled through the Sea of Japan and entered the waters of South Korea, after which he returned to Russian waters, whereupon the satellite tag stopped transmitting. Overall, 91 days of tracking data were obtained. An analysis of the track showed that the beluga mostly travelled in sight of the coastline at shallow depths, which is not a typical migration pattern for the Sakhalin-Amur beluga population. Based on movement speed and delays near river mouths, it is believed that the beluga successfully regained foraging skills.

[35] **https://archive.iwc.int/?r=19399**

The Committee noted that there are few data available on the behaviour of cetaceans following their release from captivity and welcomes the insights provided by this detailed 91-day record of the post-release behaviour of this beluga. In discussion, Guscherov stated that the estimated age of this beluga at capture was two years, based on colouration (dark grey) and body length (2.3m). There was no opportunity to extract and section a tooth while in captivity to confirm age. The beluga's ability to identify, pursue and capture suitable prey for at least three months post-release, given his age at capture, was noted as remarkable, which Gushcherov explained was likely due to the conditions of his captivity; the beluga was kept in an open bay, inside three large-mesh net cages, through which small fish passed freely. Gushcherov reported that the beluga was repeatedly observed "sucking" fish through the mesh of the nets of the pontoon enclosure. It was opined that the beluga's tendency to remain in shallow water post release was likely an artefact of his upbringing in a shallow-water environment, leading to a disinclination to moving into deeper water."

16.6 Status of the voluntary fund for small cetacean conservation research

The Voluntary Fund for Small Cetacean Conservation Research currently totals £86,839, of which £41,215 is unallocated (SC/68D/O/04rev1). Since April 2021, contributions have been received from the Government of Netherlands, Animal Welfare Institute, Campaign Whale, Cetacean Society International, Dolphin Connection, Humane Society International, LegaSeas, Natural Resources Defence Council, OceanCare, ProWildlife and Whaleman Foundation. The Secretariat has updated the Small Cetacean Voluntary Fund webpage with a full list of donors, completed and ongoing projects and new publications.

The Committee expressed its sincere gratitude for these contributions and noted that the Fund is intended to support critical conservation research projects of direct relevance to the work of the small cetacean sub-committee.

16.6.1 Recommendations for 2021-22 Projects

At SC68C, the Small Cetacean Voluntary Fund Review Panel recommended five projects for funding. These projects were approved at the 2021 Virtual Meeting of the Commission. Three projects have commenced and two will start within the next few months. The progress of each project will be reported to this committee yearly and final reports for all projects will be submitted between 2022-26 (Table 27).

Table 27
Proposals Approved for Funding from the Voluntary Research Fund for Small Cetaceans.

Principal Investigator	Title	Anticipated Final Report (SC Year)t
Gopal Khanal	Understanding the effects of trans-boundary barrage operations on the Nepal-India border for Ganges River dolphin habitat and population dynamics (*Platanista gangetica)*	**SC 2023**
Laura J May-Collado	Rapid assessment of the occurrence and conservation status of Guiana dolphins at the northern periphery of their range in Central America (*Sotalia guianensis)*	**SC 2023**
Yurasi Briceño	More knowledge, less mortality: education for the conservation of Guiana dolphins (*Sotalia guianensis*), Lake Maracaibo, Venezuela	**SC 2023**
Joanna Alfaro Shigueto	Assessing the conservation status of Burmeister's porpoises in Peru – trialling tools for estimating abundance and bycatch of this cryptic and poorly known species (*Phocoena spinipinnis)*	**SC 2024**
Mariano Alberto Coscarella	Population assessment and dynamics of Lahille's bottlenose dolphins in Argentina (*Tursiops truncatus gephyreus)*	**SC 2026**

A proposal was presented to the Committee that requested funds to support an information gathering expedition to remote hunting communities in the Solomon Islands. Data gathering will include inspection of the village hunt logbooks and interviews with hunters. The data gathered will update the long-term dataset (1976-2013) archived by the IWC of the small cetacean takes in this region. This proposal was approved by both the Small Cetacean Voluntary Fund Review Panel and the Committee.

16.7 Workplan

The workplan was discussed both in session and via the 'Comments document'. Several ICG/AG were noted as long term and ongoing; franciscana Review, Poorly Documented Take of Small Cetaceans, Recommendation Review, Guiana Dolphin Review, Small Cetacean Task Team Steering Committee, Lahille's Dolphin Task Team, South American River Dolphins CMP co-ordination, analyses direct takes of small cetaceans and Tursiops Taxonomy Review. In addition, several groups were re-established during the meeting as they remain useful;

the Strait of Gibraltar Killer Whale Advisory Group and the Management of the Solitary Dolphin of Northwest Spain Advisory Group. A new group was formed to plan work on the small cetacean of the South Pacific Islands (The South Pacific Island SM Group)

Several ICG were noted as completed or moved to other parts of the Committee:

- Sub-Committee Co-ordination, to improve communication across SC so that sub-committees can better coordinate discussion, when appropriate.
- ICPC/SM Communication platforms, to provide an easy mechanism for communication across various conservation initiatives, particularly the IUCN ICPC and SM,

The final workplan is presented in Table 28.

Table 28
Final workplan

Topic	Intersessional 2022/24	Annual Meetings (2023-24)
Franciscana Review (ICG)	Porter and Trujillo. Co-ordinate outcomes of CMP across sub-committees	Report progress
Poorly Documented take of Small Cetaceans (ICG)	Porter (convenor), Ingram, Hodgins, Avila. Continue development of framework for SM work on Aquatic Wildmeat	Report progress
Recommendation Review (ICG)	Trujillo (convenor), Porter, Jimenez, Couto di Tullio. Make progress on new review framework and establish regional and species assessment teams	Report progress
Sotalia guianensis (ICG)	Domit (convenor). Continue review of the Guiana dolphin	Report progress
Small Cetacean Task Team Steering Committee (AG)	Simmonds (convenor), Donovan, Genov, Parsons, Porter, Reeves, Rojas-Bracho, Staniland, Thomas, Trujillo. Provide ongoing advice and support to established Task Teams and consider any new proposals	Report progress
Lahille's Dolphin Task Team (ICG)	Vermeulen (convenor), Fruet (convenor), Berninsone, Von Fersen, Laporta, Daura-Jorge, Coscarella, Smith (pending). Develop research priorities for the next 5 years and identify funding opportunities.	Report progress
Direct Takes (ICG)	Porter, Katara and Fisher. Make progress on the analyses of direct take data of small cetaceans compiled by the SC since 1977	Report progress
Tursiops Taxonomy (ICG)	Rosel and Cipriano. Develop Tursiops taxonomy database and monitor new publications related to this issue	Report progress
Strait of Gibraltar, Killer whale (ICG)	Esteban (convenor) García-Bellido, Rose, Sequeira, Simmonds, Porter. The ICG will continue to compile information on the novel behaviour of the Strait of Gibraltar killer whale subpopulation and when required, will seek input from other marine mammal behaviour experts and suggest appropriate management actions	Report progress
Management of the Solitary Sociable Dolphin in Northwest Spain (AG)	Simmonds (convenor), Aymerich, Eisfeld-Pierantonio, Fernandez, García-Bellido Capdevila, Garcia-Párraga, López-Piñeiro Pérez, Nunny, O'Callaghan, Porter, Staniland, Torres The AG will continue to assess information pertaining to the dolphin and its' interactions, providing advice to the Government of Spain, if requested and through established communication plan, address any significant developments as quickly and efficiently as possible	Report progress
The South Pacific Island SM Group	Porter (convenor), Amepou, Beasley, Baird, K., Baird, R., Baker, Childerhouse, Constantine, Donoghue, Garigue, Orams, Poole	Report Progress
Finless Porpoise (marine) (ISG)	Porter and Brannan (conveners), Bohadi, Bopardikar, Bradley, Chansu, Cheng, de la Paz, Ham, Hao, Jog, Kot, Li S-L, Li T-Y, Masrini binti Muhamad, Mi, Mustika, Naruki, Natoli, Nithyanandan, Peter, Ponnampalam, Roshan, Soojin, Stokes, Sutari, Tomoyoshi, Wang Ding, Yang	

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 issues of concern; and (v) emerging technologies

Discussion of this item has been postponed to the next meeting.

17.1.2 Review responses to Modelling and Assessment of Whale Watching Impacts (MAWI) questionnaire
Discussion of this item has been postponed to the next meeting.

17.2 Update on IWC's General Principles for Whale Watching after intersessional discussion with the Conservation Committee and Secretariat
SC/68D/WW/01 summarised the work of the Conservation Committee's (CC) Standing Working Group (SWG) on Whale Watching since SC68C. In two rounds of review by email, in 2020 and 2021, the SWG fulfilled its plans, as outlined at SC68C, to edit and endorse the revised General Principles for Whale Watching. The SWG asked the Committee for any final comments, particularly on whether to cross-reference the Convention on Migratory Species (CMS) (Resolution 11.29)[36] and/or Species-specific Guidelines for Boat-based Wildlife Watching[37], before consideration by the CC and Commission at IWC68. In response, the Committee concluded that a link to the CMS resolution made sense, but there was no need to link to the species-specific guidelines (which omit cetaceans), as the CMS will be referencing the IWC Whale Watching Handbook and its cetacean-specific guidelines. The Committee approved and endorsed these revised General Principles with no further edits.

Attention: SC, CC, C, S

*The Committee **agrees** that posting the revised General Principles for Whale Watching to the IWC website is a matter of urgency. The Committee **endorses** the revised General Principles communicated by the Conservation Committee's Standing Working Group on Whale Watching at SC68D and **recommends** that the Conservation Committee present this version to the Commission at IWC68 for approval and endorsement, after which the General Principles should be posted to the IWC website by the Secretariat with due dispatch (including a link in the Whale Watching Handbook).*

It was also noted that the CMS expects to provide an update on the development of its guidelines for in-water interactions with aquatic mammals (CMS, 2017; Notarbartolo di Sciara and Frisch-Nwakanma, 2018) by the next meeting.

17.3 Progress with regional reviews of whale watching
17.3.1 Sri Lanka
No papers were submitted under this Item. Discussion has been postponed to the next meeting.

17.3.2 Latin America
SC/68D/WW/02 described the first web-based citizen science initiative in Argentina, E-WHALE, aimed at cetacean monitoring. Data on species, group sizes, distribution and seasonality in San Matías Gulf, collected via E-WHALE, were presented. A total of 500 sightings of eight cetacean species were recorded over a period of nine months. There was a strong relationship between researchers and the whale watching operators prior to the launch of E-WHALE, which was a key factor in building the sightings reporting network. This novel citizen science platform may provide valuable data regarding cetacean threats, which would contribute to appropriate conservation strategies.

The Committee welcomed this paper and urged the authors to confer with other Committee members with appropriate expertise regarding the best methods for utilising and analysing data on animal presence/absence collected using these types of citizen science platforms.

SC/68D/WW/04 described a prospective new whale watching site inhabited mainly by sei whales near Rada Tilly and Comodoro Rivadavia in Chubut province, Argentina. Data on seasonality and relative abundance showed whales were present in high densities from March to July. As many as 70 sei whales were reported in the area simultaneously, feeding on swarming prey, including squat lobster. Aerial surveys to determine an abundance estimate are underway.

In discussion, it was noted that this was a rare opportunity to establish an information baseline before whale watching operations commence. Impacts should thus be easier to recognise once an industry is established and, moreover, sei whales are only infrequently the target of whale watching. The researchers are working with provincial and local authorities to undertake an experimental impact study (with deliberate approaches, making observations from a land station), with the goal of developing preliminary whale watching guidelines, and a species guide has already been produced for the public. Additional data from this site, including photo-ID data,

[36] **https://www.cms.int/en/document/sustainable-boat-based-marine-wildlife-watching-2**
[37] **https://www.cms.int/en/document/species-specific-guidelines-boat-based-wildlife-watching**

will be presented at future meetings.

17.3.3 Timor-Leste

No papers were submitted under this Item.

17.3.4 Indian Ocean Sanctuary

No papers were submitted under this Item. It was noted that any papers submitted under this item in the future would also be of value to the Working Group on Sanctuaries, which is planning a review of the Indian Ocean Sanctuary and could cross-reference any relevant whale watching papers. The advisory group on communication with the Indian Ocean Rim Association (IORA) will continue (see Annex M) and updates will be reported back to the Committee at future meetings.

Attention: S

Secretariat to identify a point of contact with the new chair of IORA, South Africa, and communicate this to the Advisory Group on communication with the Indian Ocean Rim Association (IORA) at the earliest opportunity.

17.4 Collaborative work within the IWC

This item catalysed a comprehensive discussion of communications, particularly public outreach, regarding the whale watching products, resources and recommendations of the Committee and the CC. While collaboration and communication *within* the IWC amongst sub-committees and between the Committee and the CC continues to be addressed, the Committee is also concerned about the promotion of its work on whale watching to a wider audience, including researchers, the whale watching industry, managers and the public.

Attention: SC, CC, S

*The Committee **agrees** that its whale watching-related work needs wider promotion, beyond the IWC. It is of note that many researchers, managers, whale watching participants (tourists) and whale watching operators remain unaware of the whale watching outputs of the Committee. Therefore, it **recommends** the preparation of a comprehensive communications plan, with a budget, in an effort to ensure dissemination of the whale watching outputs of the Committee and the Conservation Committee to as wide an audience as possible, using social media, podcasts, webinars and other available platforms. The Committee **agrees** to form a steering group (see Annex M), which will prepare this plan and present it at the next meeting, coordinating with the Secretariat, which is already developing a promotional plan for the Whale Watching Handbook (see Item 17.4.1).*

Committee members who know of whale watching topics of broad interest or interesting whale watching case studies should contact the steering group (see Annex M) intersessionally for inclusion in the communications plan.

17.4.1 Update on the IWC's Whale Watching Handbook

SC/68D/WW/01 also offered an update on the Whale Watching Handbook. The Handbook's searchable database of scientific literature was updated in December 2021 and now features the details and abstracts of 501 reports and peer-reviewed articles on whale watching. The Secretariat is continually engaged in keeping this table up to date. As of April 2022, thanks to generous support from the CMS, all existing content has been translated from English into French and Spanish. Secretariat staff have been trained to update and edit Handbook content. The Secretariat will now continue working with countries and experts on updates or requests and will begin scoping for new content. Any minor updates of the Handbook will be undertaken in accordance with the editorial protocol endorsed at SC68B. Promotional activities in 2021 were placed in the context of the 75th anniversary of the IWC and included dissemination of the Handbook's factsheets via schools and the IWC website and flagging the Handbook in a range of presentations and articles (e.g. Wilson, 2022). The Secretariat is developing a new promotional plan for the Handbook and there will be renewed efforts in 2022 to increase support for the French and Spanish language versions of the Handbook. The SWG welcomes input from the Committee.

The Committee once again praised the Handbook, an excellent resource with global value, and a product that reflects very well on the overall workstream of the IWC. It thanked Minton again for her exemplary work on this IWC product. The Committee also offered thanks to Greg Donovan, who originally conceived the idea for the Handbook at the inaugural meeting of the CC's SWG on Whale Watching.

17.4.2 Communication with the Conservation Committee's Standing Working Group on Whale Watching

In discussion of SC/68D/WW/01, it was noted that communication with the CC's SWG would improve with the nomination of a Committee member (in addition to the WW co-Convenors and the chair or vice-Chair of the Committee) to the SWG. Parsons agreed to join this group. The revival of an intersessional correspondence group on communication with the SWG was delayed but will now proceed.

Attention: SC, S

*The Committee **reiterates** its agreement to reconstitute a standing intersessional correspondence group on communication between the Conservation Committee's Standing Working Group on Whale Watching and the Committee's sub-committee on Whale Watching. Iñiguez, a member of both groups, will serve as Convenor. Membership and Terms of Reference for this group can be found in Annex M.*

The SWG has requested the Committee submit names of industry representatives for possible membership in the SWG, where there are now two vacancies. The Committee noted that the intersessional correspondence group will include this request in its Terms of Reference (see Annex M).

It was also noted that item 1.5 of the SWG's work plan (included as Annex B of WW/01) calls for a review-to-date of implementation of the IWC Strategic Plan for Whale Watching to help identify priorities. This comprehensive review of outputs was to come within two years of commencing work on the Strategic Plan's actions, to allow activities to be refocused if required. The completion of this review would also allow the Committee to offer its input into the work plan and its implementation, an ongoing request from the SWG. This review, which has been delayed due to the COVID-19 pandemic, should also improve communications with the SWG.

Attention: SC, CC

*The Committee **recommends** that the comprehensive review of the outputs of the IWC Strategic Plan for Whale Watching, be undertaken intersessionally by the SWG, which will now include the WW co-convenors (Suydam and Urbán), the Chair or vice-Chair of the Committee (Zerbini or Porter) and another member of the Committee (Parsons).*

Finally, it was re-emphasised that Objective 3 of the Strategic Plan (research and data collection) is particularly relevant to the Committee and the SWG once again requested the Committee's active participation in implementing this objective and its related items. The intersessional correspondence group should also discuss ways to progress this and report back at the next meeting.

17.4.3 Collaboration with other SC sub-committees on platforms of opportunity and citizen science

It was noted that the Society for Marine Mammalogy's 24th Biennial Conference on the Biology of Marine Mammals will host a workshop on 31 July 2022 focused on citizen science studying tourism vessels, acoustic impacts on marine mammals, examination of best practices and possibilities for the future. In addition, it was noted that there is an obvious connection between whale watching and photo-ID efforts, and future collaboration between the sub-committee on whale watching WW and the *ad hoc* working group on photo-ID should be pursued.

17.5 Progress on previous recommendations

Discussion of this Item has been postponed to the next meeting.

17.6 Biennial work plan

A two-year work plan is given in Table 29. It was noted that the discussion of the Committee's work plan with regard to whale watching is routinely intertwined with the work plan of the Conservation Committee's SWG and the revived intersessional correspondence group on communication with the SWG should help focus the work plan in this regard.

A discussion of the Committee's standing agenda item to conduct regional reviews of whale watching concluded that, given the virtual nature of the recent meetings (previous meetings reviewed whale watching in the region of the meeting's venue), a new methodology for identifying regions or target species for which a review is needed. Notwithstanding this need, the Committee concluded that keeping a review of Latin America as a standing item on the agenda is appropriate, given the region's rapidly expanding whale watching industry. Indeed, a major updated review of this region's whale watching is overdue. It was also suggested that, when considering

a methodology for identifying priority target species for review, species of conservation concern that are the focus of intensive whale watching industries, often odontocetes, should be given particular attention.

It was also noted that the Committee should be more proactive and systematic about collaborating with other sub-committees that use data from whale watching platforms of opportunity and citizen science (see Item 17.4.3).

Attention: SC

*The Committee **agrees** to establish an intersessional correspondence to discuss the future of the sub-committee on whale watching, including, inter alia, who to invite as invited participants, how and where to solicit primary papers and how and when to collaborate with other sub-committees using data from whale watching platforms of opportunity and citizen science (see Item 17.4.3). This intersessional correspondence group will also identify a methodology for identifying regions and/or target species to view with regard to whale watching (see Item 17.3). The group will provide a summary of its discussions to the Committee at the next meeting.*

During further discussion of the biennial work plan, previous consideration of solitary sociable cetaceans was referenced. It was noted that this is a topic upon which IWC contracting governments have requested advice from the Committee. The topic, which had been removed from the agenda, was added back to the work plan (see Table 29) under 'emerging issues of concern' and will be addressed by the intersessional working group on human-induced changes in cetacean behaviour.

Table 29

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 the next meeting.

Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting
Assess the impacts of whale watching on cetaceans – PRIORITY (i) Short-term impacts (ii) Mid- and long-term impacts (iii) Swim-with operations (iv) Emerging issues of concern, e.g. solitary sociable and out of habitat cetaceans (v) Emerging technology, e.g. drones and other emerging technology in the context of whale watching	Prepare papers	Papers to be presented	Prepare papers	Papers to be presented
MAWI (questionnaire, updates)	Email correspondence and work	Paper to be presented	Email correspondence and work, if needed	Paper to be presented, if needed
Review whale watching in priority regions/areas or on priority populations identified intersessionally	Intersessional correspondence and work, including soliciting papers	Papers to be presented	Intersessional correspondence and work, including soliciting papers	Papers to be presented
Intersessional correspondence groups	Email correspondence and work	Receive reports	Email correspondence and work	Receive reports
Collaborative work with other sub-committees, particularly regarding platforms of opportunity and citizen science data	Email correspondence and work	Papers to be presented, receive updates	Email correspondence and work	Papers to be presented, receive updates
Collaborative work with Conservation Committee (SWG on Whale Watching), including communications output	Intersessional correspondence and work, including developing communications plan and budget	Present update on SWG WW; present communications plan and budget	Intersessional correspondence and work	Present updates on SWG WW work and communications plan outputs

18. WHALE SANCTUARIES (SAN)

18.1 Updates from relevant sub-committees on new information relevant to the Southern Ocean Sanctuary management plan

18.1.1 Preparation for the decadal review of the Southern Ocean Sanctuary (SOS)

The SOS was established in 1994 and Paragraph 7(b) of the Schedule, which established the SOS, specifies that the Sanctuary "…shall be reviewed ten years after its initial adoption and at succeeding ten-year intervals...". In 2003, the Commission directed the Committee to undertake the first in a series of decadal reviews of the SOS (1994-2004) (IWC, 2004, pp.47-50). A second review of the SOS was performed in 2014-2016 following terms of reference provided by the Commission (IWC, 2016e; 2017g). Thus, 2024 will mark the third decade of the Southern Ocean Sanctuary and preparations need to be made for the scheduled review.

The stages of the review process are as follows (IWC, 2016d):

(a) A Steering Group is formed (chaired by the SAN Working Group Convenor).

The terms of Reference of this Steering Group are to:

(i) Solicit contributions and collate the necessary information to assist with the review of the scientific aspects of the sanctuary in question;

(ii) Identify potential external scientists with recognised expertise in research fields relevant to the review of the Sanctuary to attend the Scientific Committee meeting and assist with the review; and

(iii) Coordinate the review of the scientific aspects of the SOS.

(b) The Steering Group will receive suggestions from SC members for potential external reviewers with recognised expertise in research fields relevant to the review of the Sanctuary, to assist with the review of the Sanctuary in question.

(c) Names of suggested reviewers are provided to the Chair of the Steering Group.

(d) The Steering Group liaises with potential invited experts.

(e) A final list of external reviewers to attend the Scientific Committee is developed.

(f) Invite the external reviewers to attend the Scientific Committee meeting

(g) Documents for the Sanctuary review are submitted.

(h) A review of the Sanctuary is conducted.

(i) A Joint meeting of the Scientific Committee and the Conservation Committee is scheduled to discuss the review held.

At SC/68C (see Item 18.4) the following workplan was agreed:

Table 30

Southern Ocean Sanctuary Review workplan

	2022	2023	2024
Establish Southern Ocean Sanctuary (SOS) review Steering Group	X		
Update the Sanctuary review Terms of Reference	X		
Develop a list of SOS reviewers	(intersessionally)		
Finalise SOS reviewers		X	
Receive documents relevant to SOS review	X	X	X
Conduct SOS review			X

In addition, it was agreed at SC68C (see Item 18.3) that an update of the document SC/66B/SAN/01 (De La Mare *et al.*, 2016), a compendium of information about research relevant to the SOS, would be of great help to the Sanctuary review process. A drafting group (with Bell as convenor) was established.

18.1.2 Form a Southern Ocean Sanctuary Review Steering Group

This Steering Group will:

(a) Develop a *pro forma* for information to be submitted to the SOS review;

(b) Solicit nominations for SOS reviewers and develop a list of potential candidates; and

(c) Plan the SOS review meeting.

The Steering Group will comprise Bell, Lauriano, Leaper, Parsons (Chair), Slooten and Zerbini.

In addition, the drafting group led by Bell will update SC/66B/SAN/01 (De La Mare *et al.*, 2016). The Steering Group will incorporate this document in the SOS review.

18.1.3 Discuss Terms of Reference

Taking into consideration previous instructions from the Commission to the Committee for Review of Sanctuaries (IWC, 2002b) and Resolution 2002-1 providing guidance to the Committee on the Sanctuary review process (IWC, 2003a), the following terms of reference for the review of Sanctuaries were developed (IWC, 2016e):

(a) Provide advice on the status and trends of whale stocks in the Sanctuary in so far as these are known. Assess the present and potential threats to whale populations and their habitats in the area of the Sanctuary and how the Sanctuaries address this;

(b) Consider whether the Sanctuary is consistent with other measures to protect whales from anthropogenic and other environmental factors;

(c) Assess the effects of the Sanctuary in terms of:

(i) the protection of whales in breeding areas, feeding grounds, and/or migratory routes; and

(ii) international agreements concerning biodiversity and conservation of nature;

(d) Evaluate whether the Sanctuary allows for the conduct of scientific research useful for meeting IWC objectives or coordinated integrated research and monitoring programmes across the range of issues of global relevance; and

(e) Provide advice on whether the sanctuary is consistent with the precautionary approach.

At SC68C, the Committee agreed (Item 18.3) that the Terms of Reference for the review of the SOS should be discussed, taking into account the broadening scientific range covered by the Committee; for example, the role of ecosystem functioning as discussed in the Standing Working Group on Ecosystem Modelling.

The Committee encourages papers and information on ecosystem modelling relevant to the SOS to be submitted to the Steering Group for inclusion in the review. Due to the major impacts of climate change in the Southern Ocean, the Committee agrees that climate change should be explicitly noted as an anthropogenic factor in item (b).

18.1.4 Discuss the Southern Ocean Sanctuary Review process

In discussion, it was noted that in previous years the Steering Group had collated a list of ten possible reviewers, from which three were chosen to assist the SC with the Review. For consistency, one of the reviewers in the most recent Review (completed in 2016) had participated in the previous Review (2004). The Committee agrees that a similar model should be followed. However, it was agreed that, during the intersessional collation and preparation of the sanctuary review report, other individuals from the short list of reviewers could be asked to provide expert opinion and participate in intersessional discussions if required.

The Committee approves the Southern Ocean Sanctuary Review process as outlined above.

18.1.5 Receive the State of the Cetacean Environment Report

SC/68D/E/12 (2022 State of the Cetacean Environment Report) was received in the Environmental Concerns Sub-Committee. This year's focus was the polar regions; therefore, there were several studies of significance related to the Southern Ocean Sanctuary. Climate warming, as exemplified by a massive ice shelf collapse in East Antarctica and significant reductions in Antarctic sea ice, is expected to exacerbate threats to cetaceans. For example, pollutants as diverse as mercury and microplastics that are currently stored in ice will be set free. Underwater noise is also predicted to increase in the Southern Ocean because ice-free waters are generally louder and this will be affected by earlier melt and later freeze-up, shipping is predicted to increase during the extended ice-free months and sound propagation may change with temperature. The Southern Ocean and Antarctica are highly sensitive to environmental changes, with the greatest anthropogenic threat being climate change. There are gaps in our knowledge of major aspects of the ecology of krill, as key whale prey; a potential decline of krill or a shift to a salp-dominated ecosystem is of key concern.

It was noted that the focus region of next year's SOCER will be the Indian Ocean, making it a valuable source of information for an Indian Ocean Sanctuary Review (if instructed by the Commission, see item 18.2.1 below).

18.1.6 Receive documents on the Southern Ocean Sanctuary

SC/68C/HIM/04 highlighted instances of whale bycatch in the Southern Ocean trawl fishery for krill (see Item 12.2.2). It was noted that data and documents regarding levels of bycatch and ship strikes in the SOS should be included in the SOS review. The Committee encourages the submission of such data and documents at future Committee meetings.

The 1st Southern Ocean regional workshop (Hoffman *et al.*, 2022), which took place on 16 February 2020 in San Diego (CA, USA), was conducted to provide the Southern Ocean community inputs to the Science Action Plan of the UN Decade of Ocean Science for Sustainable Development (UN Decade). The workshop identified several priorities under each of the goals of the UN Decade, which are synergistic and complimentary to the work of the Committee (see Table 31).

Table 31
Priorities for the Southern Ocean in relation to UN Decade goals

Goal: A healthy and resilient ocean
Improve understanding of key drivers of change and their impacts on Southern Ocean species and food webs.
Improve understanding of sea ice, including its role in ecological processes of the Southern Ocean.
Improve understanding of Southern Ocean biogeochemical cycling. The Southern Ocean plays a key role in biogeochemical cycling, particularly in regulating air-sea exchange of carbon dioxide in the global carbon cycle.
Improve societal understanding of Southern Ocean issues and appreciation of the Southern Ocean for its global value in Earth systems and unique environment.
Goal: a predicted ocean
Enhance and expand observational capability to support predictions.
Improve and enhance Southern Ocean modelling capability.
Goal: a sustainable and productive ocean
Increase the suite, types and reliability of measurements, including those focused on ecosystem change, needed to inform management and policy.
Ensure a sustainably harvested and productive Southern Ocean by working towards a stronger interface between science and policy.
Ensure science-based and effective MPAs and uphold sustainable fisheries management

The report also highlighted several cross-cutting priorities, including remote sensing in the Southern Ocean; communicating with the public to raise awareness about Southern Ocean issues; using the UN Decade to promote Southern Ocean science and awareness; and also to:

> "implement a coordinated, international, circumpolar observational program to elucidate processes that 1) allow life histories of key species in the Southern Ocean ecosystem to be quantified, 2) allow a total carbon budget to be developed, 3) provide coverage of the annual cycle, and 4) quantify the role of sea ice in regulating ecosystem productivity".

It was noted that the UN Decade may provide a platform for engaging national programs in such an effort.

Attention: SC, S

*The Committee **agrees** that there are many areas of common interest and synergy between the UN Ocean Decade priorities for the Southern Ocean and the work of the Committee and **recommends** that the Secretariat contact the Intergovernmental Oceanographic Commission (IOC) of UNESCO (coordinators for the UN Decade of Ocean Science for Sustainable Development) to discuss ongoing and future communication and possible collaboration between the IWC and the UN Decade.*

18.1.7 Plan joint work with the ASI Sub-Committee to review Southern Ocean Sanctuary whale stocks and abundance

Discussion on this item has been postponed to the next SC meeting.

18.1.8 Plan joint work with the WW Sub-Committee to review whale watching in the Southern Ocean Sanctuary

Discussion on this item has been postponed to the next SC meeting.

18.1.9 Other Southern Ocean Sanctuary Review matters

As part of its work assessing the ecosystem function of cetaceans, the EM Sub-Committee is engaged in summarising estimates of the current and pre-exploitation abundances of the large baleen whale species in the Southern Ocean. The results will provide insight into the extent to which these populations have recovered from their near-extirpation as a result of whaling in the 20th Century. The Committee encourages the submission of documents and relevant information on ecosystem modelling research that could contribute to updating De La Mare *et al.* (2016) and contribute to the SOS review.

18.2 New information for other sanctuaries

18.2.1 Discuss review of the Indian Ocean Sanctuary (IOS)

No documents were received under this item.

The Commission adopted the IOS in 1979; its designation was reviewed and renewed in 2002. Therefore, 2022 will mark the end of the second decade since the review of the IOS. The Committee reiterates its request for guidance from the Commission on whether they wish the Committee to commence planning for a review of the IOS after the SOS review has been completed.

18.2.2 Whale watching in the Indian Ocean Sanctuary (joint with WW)

No documents were received under this item; however, it was noted that papers on whale watching in the IOS may be forthcoming at the next meeting and SAN looks forward to conducting a joint session with WW next year on this topic.

18.3 Progress on previous recommendations

Discussion on this item has been postponed to the next meeting.

18.4 Biennial workplan

The work plan is as follows:

Table 32

Proposed Work Plan

	2023	2024
Finalise SOS reviewers	X	
Receive documents relevant to SOS review	X	X
Conduct SOS review		X
Receive documents relevant to the IOS	X	X
Receive guidance from Commission on IOS review	X	

Funding for the Southern Ocean Sanctuary Review (to be conducted during a two-day pre-meeting in 2024) was discussed and a budget request was prepared, reviewed and endorsed by the Committee.

Proposed Agenda for the Ad Hoc Working Group on Whale Sanctuaries at the next meeting

1. Introductory items
   - 1.1. Opening remarks
   - 1.2. Election of Chair
   - 1.3. Appointment of rapporteurs
   - 1.4 Adoption of Agenda
   - 1.5 Documents available
2. Preparation for the decadal review of the Southern Ocean Sanctuary (SOS)
   - 2.1. Finalise SOS reviewers
   - 2.2. Discuss the SOS Review process
   - 2.3. Receive documents on the SOS
   - 2.4. Plan joint work with ASI to review SOS whale stocks and abundance

2.5. Plan joint work with the WW Sub-committee to review whale watching in the SOS

2.6. Other SOS review matters

3. Discuss review of the Indian Ocean Sanctuary (IOS)

3.1. Receive the State of the Cetacean Environment Report

3.2. Receive documents on the IOS

3.3. Whale watching in the IOS (joint with WW)

3.4. Receive guidance from Commission on IOS review Work plan and budget considerations

4. Adoption of report

19. EXTINCTION INITIATIVE

Simmonds presented the work of the Extinction Initiative which grew out of a concern for the increasing number of endangered populations and species of cetaceans. and the bleak prognosis for many of those taxa. The Initiative is a communications tool, which will allow the IWC to speak out in a timely manner to address when a species or a distinct population is declared extinct or when there is a grave concern about the survival of such. The issue of extinction now has web pages but the next step is to seek Commission endorsement of the Initiative, specifically the proposal to issue public statements of concern, based on a template presented at SC68C. There has been a minor change to the template (Annex G) with the inclusion of "and Fragmentation" in relation to the area of "Habitat degradation".

Attention: C, CC, SC

*The Committee **reiterates** its support for the work of the Extinction Initiative intersessional group, and for their proposal to seek Commission endorsement for the publication of SC statements of concern.*

In discussion it was noted that, given Commission endorsement, the SM committee intend to swiftly draft a related statement for the Vaquita (16.3.3). The negative effects on ecosystem function from species-loss was raised as an additional issue that could be incorporated. In response it was stated that whilst a number of issues had been considered for inclusion it was felt that a simple clear message would be more effective. There were suggestions as to the best name for the Initiative, such as including the addition of "Preventing", that could be considered if they don't confuse the progress already made in promoting this important work.

20. IWC LIST OF RECOGNISED SPECIES

Since the last SC meeting, one new species of beaked whale has been described from the Southern Hemisphere. This new species is *Mesoplodon eueu* (Carroll *et al.*, 2021) Ramari's beaked whale. Before 2021, all previous references to this species in the Southern Hemisphere referred to it as True's Beaked Whale, *M. mirus*. It was considered the only beaked whale with an antitropical distribution – one population in the North Atlantic and the other in the Southern Hemisphere. Now the Southern Hemisphere form is recognised as a separate species (Carroll *et al.*, 2021).

Blue Whales Subspecies

While the IWC Scientific Committee does not maintain a list of cetacean subspecies, some whale species have long been reviewed and assessed at the subspecies level. The best example of subspecies usage in the SC is the blue whale. The SC has a long history of distinguishing two species of blue whales in the Southern Hemisphere, Antarctic blue whales, *Balaenoptera musculus intermedia* and the Pygmy blue whale B. *musculus brevicauda*. In the SC, we commonly use the following subspecies of blue whales in our work:

- *B. m. musculus* (Linnaeus, 1758). Northern blue whale
- *B. m. intermedia* (Burmeister, 1871). Antarctic blue whale
- *B. m. indica* (Blyth, 1859). Northern Indian Ocean blue whale
- *B. m. brevicauda* (Ichihara, 1966). Pygmy blue whale

Recently, two new subspecies of blue whale have been proposed: The Chilean blue whale (*Balaenoptera musculus chilensis*) (Khalaf, 2020) and the Arabian Sea blue whale (*Balaenoptera musculus arabica* (Khalaf, 2021). However, these subspecies names should not be used as a result of the recent review by the Taxonomy Committee under the Society for Marine Mammalogy. In this review they noted the following:

"There have been a variety of studies (Branch *et al.*, 2007; Buchan *et al.*, 2018; LeDuc *et al.*, 2017; LeDuc *et*

al., 2007; McDonald *et al.*, 2006; Torres-Florez *et al.*, 2014a) that have provided evidence suggesting blue whales in the eastern South Pacific differ from blue whales elsewhere and may represent a separate subspecies but none have provided a formal subspecies description supplying the information required under the International Code of Zoological Nomenclature for proposing new species or subspecies. Khalaf (2020) summarises information available on the population in the eastern South Pacific, designates an identifiable specimen and type location, and provides a subspecies name. However, the subspecies description is incomplete and, importantly, is diagnosed by bibliographic references alone. This is minimally sufficient to make the name available (see Code, Art. 13.1.2), but no attempt seems to have been made to collect morphological or genetic evidence, despite the ready availability of a skull and nearly complete skeleton. This is poor practice and contrary to Recommendation 13A. We therefore regard the name *B. musculus chilensis* a *nomen dubium* and do not recognise it until these faults are remedied. Khalaf (2021) also describes a new blue whale subspecies *B. musculus arabica* from the Arabian Sea. This work fails to acknowledge that more than one type of blue whale exists in northern Indian Ocean making it impossible to link the new blue whale song described by Cerchio *et al.* (2020) from this region to the blue whale skeleton from Kuwait. The subspecies is diagnosed only by bibliographic references to characterisations of its song and acoustics alone does not constitute sufficient evidence for taxonomic separation. We therefore regard the name *B. musculus arabica* a *nomen dubium* and do not recognise it."

21. IWC DATABASES AND CATALOGUES (PH AND GDR)

Due to scheduling conflicts, the *ad hoc* Working Group on Photo-Identification did not meet this year.

21.1 Guidelines for IWC catalogues and photo-ID databases (PH)

There were no updates to the Guidelines.

21.2 Progress with existing or proposed new catalogues (PH)

Two agenda items under 21.2 had information presented to the committee.

21.2.1 Right whale photo catalogues

21.2.2 Happywhale database

21.2.3 Flukebook

21.2.4 Southern Hemisphere Blue Whale Catalogue (SHBWC)

Currently this collaborative catalogue houses 2,209 individual blue whale photographs from 25 research groups. Progress with the Southern Hemisphere Blue Whale Catalogue is summarised in SC/68D/SH/04. In the last year inter-regional matching was focused on populations in the southeast Pacific and off Australia and New Zealand as these data will be used for upcoming assessment purposes; see Item 8.2.1. The results of matching analyses in the southeast Pacific (SC/68D/SH/10) suggest separate feeding grounds in northern and southern Chile, and migratory linkages between southern Chile and the southern Eastern Tropical Pacific.

21.2.5 Antarctic Blue Whale Catalogue (ABWC)

21.2.6 Fin whale photo catalogues

21.2.7 Humpback whale photo catalogues

21.2.8 Other photo-ID catalogues

The western Pacific gray whale photo-ID catalogue (1994-2021) maintained by the Russia Gray Whale Project (RGWP) will be provided to the IWC Secretariat following SC68D (SC/68D/CMP/16). The implications of making this catalogue available to the gray whale research community via the IWC are discussed in Item 9.1.3. Previously the Committee has recommended that all holders of western gray whale catalogues make their data available to the IWC (IWC, 2021) for cross-comparisons toward a better understanding of fidelity and movement patterns. The majority of whales in the RGWP catalogue now have left-side, right-side, and ventral fluke identification photographs, allowing for useful images to be collected from almost any body region. SC/68D/CMP/15 outlines the RGWP's most recent photo-ID effort. The movements of 48 photo-identified gray whales between feeding areas in the western Pacific off Russia and breeding areas in the eastern Pacific off México are documented in SC/68D/CMP/09. This represents 12.6% of gray whales identified off Sakhalin Island and Kamchatka. More information about North Pacific gray whales is given under Item 9.1.3.

An innovative approach using identification photos of false killer whales from a long-term catalogue to estimate age is presented in SC/68D/SM/04; see Item 16.4.2. The method is suitable for use on other datasets and Committee members expressed interest in applying it to their own catalogues and data.

Table33
Work plan for 2023 and 2024 for PH.

Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting
IWC Guidelines for Photo-ID (21.1)	Review Guidelines for possible updates	Update Guidelines as necessary	Review Guidelines for possible updates	Update Guidelines as necessary
Developments with AI and computer-assisted matching (21.2)	Review progress	Report(s)	Review progress	Report(s)
Southern Hemisphere Blue Whale Catalogue (SHBWC) (21.2.4)	Complete within-region comparisons of southeast Pacific and Australian photos	Report	Continue inter-regional photo comparisons	Report
Madagascar blue whale photo-ID (21.2.4)	Complete within-region comparisons	Report	-	-
Antarctic Blue Whale Catalogue (21.2.5)	Continue acquisition of new photos; compare photos; upload to SHBWC	Report	Continue acquisition of new photos; compare photos; upload to SHBWC	Report

21.3 Progress with existing IWC databases (GDR, Secretariat)

The GDR Working Group aims to assess the utility and support required for IWC databases relevant to the work of the Scientific Committee. Specifically, the Group:

(1) Collates summary information on all IWC databases relevant to the SC;
(2) Summarises data use by the SC for each database;
(3) Provides recommendations to improve integration, content and workflows;
(4) Reviews technical progress on existing databases or databases under development;
(5) Considers needs and specifications for potential new databases, including developing simple technical guidelines on new proposals; and
(6) Produces a budget and workplan for the implementation and development of existing and new databases.

21.3.1 Summary of IWC databases and current priorities

SC/68D/GDR/01 presented a review of the current status of IWC databases and data holdings. Work on existing databases included the Southern Hemisphere Blue Whale Catalogue being hosted by the IWC and administered by a local developer. The new Data Manager has continued progress on the Ship Strikes database and begun scoping the development of a Strandings database. The Database of Recommendations went live on the IWC website last year. Work has been on done to add historic recommendations and generate products for each of the sub-committees. The Statistics team have begun work on transforming the POWER/SOWER, Catch, and Abundance Databases into relational databases that are online and searchable to increase accessibility and use of the data.

In summarising the current suite of IWC databases the Secretariat emphasised the need for predictable, ongoing funding. This is more critical now because many of IWC's databases are hosted 'in the cloud' with recurring annual fees. When supporting new and existing databases these ongoing fees must be considered. Currently some costs are met through the SC Research Fund. The Secretariat proposes to communicate with the Commission to adjust the budget to have a permanent line support for data preservation. In the interim, the Secretariat will continue the status quo to request funds through the SC Research Fund.

Fortuna noted having recently received data from the Ship Strikes database that it contained data gaps and errors. It was suggested to have scientists review subset data for their area to identify missing data and resolve any issues. The Data Manager will review the quality control/quality assurance process and work with the Ship Strikes Data Review Group to address concerns with data gaps and errors.

The Committee thanked the Secretariat for the paper and the summary table has been updated and is presented below (Table 34). The Committee agrees the priorities for the further development and support of IWC databases by the Secretariat, as presented in Table 34, were appropriate. It also supported the submission of a funding proposal from the Secretariat to fund cloud services needed to host some of the SC's databases.

21.3.2 IWC National Progress Reports

There has been a great deal of effort to improve the ease of data submission in recent years. Secretariat staff directly assisted countries in their submissions this year, have made additional outreach to African nations and provided training, resulting in the submission of 13 National Progress Reports, a decrease from the 14 received in 2021.

The Committee acknowledged the low reporting rate of National Progress Reports and recommends that an intersessional group should develop a paper for IWC68 that describes the current state of reporting and present options to address the lack of submissions. The function of National Progress Reports is to satisfy part of a condition of the Convention and direction is needed from the Commission on the continuing need for, and role of, National Progress Reports.

Double provided an overview on the development of an R script that facilitates the automated visualisation of annual National Progress Report data. It was noted this aided in Australia's own internal reporting and could incentivise the states and territories to provide data. The applicability of these scripts to National Progress Report data from other countries will be assessed. When complete, these scripts will be able to automatically generate multi-year tables and plots of national data and summaries of all the data within the National Progress Report database.

In discussion there was a suggestion that data holders could be approached by the Secretariat to help reformat their data to fit into the database. There should also be a focus on who is using the data collected and making it useful to them. In this regard it was suggested that these reports should be targeted to regional groups in addition to countries. Having all the data available together in a dashboard so the user can filter and explore the data of interest would help its accessibility.

21.3.3 Review database procedures, evaluate possible integration and consolidation of existing databases, and define rules for accessing data

Future progress on IWC databases and data holdings includes a review the status of existing IWC databases and to liaise closely with those sub-committee members who are developing ideas for databases. These actions are critical in order to consider new database specifications in light of ongoing work in the Secretariat and the potential for interoperability with existing databases. The Committee acknowledged the Secretariat's progress on databases and data holdings and agreed the options for integration and inter-operability should be explored further by GDR's intersessional group.

21.4 Potential future IWC databases (GDR)

21.4.1 IWC database proposal pro forma

The Committee was reminded of the IWC database proposal proforma developed by GDR previously. The proforma is presented in Annex N.

21.4.2 New proposals for IWC databases

The GDR Working Group did not receive any proposals for the development and support of new IWC databases during SC68D. The Head of Science, Conservation and Management noted the Pollution 2025 workshop has recommended the E sub-committee seek SC research funds to support a pollution mapping tool. The GDR Working Group noted its willingness to work with groups to populate the *pro forma*.

21.5 Biennial workplan

To progress the work of the GDR Working Group an on-line intersessional workshop will be convened in 2022. The workshop will develop options to present to IWC68 to address the lack of National Progress Report submissions. The workshop will also scope all current database and data holdings within the IWC scoping areas of potential integration and consolidation including data submission. The Terms of reference for this would include identifying need, intended users, overlap with external data holdings, the benefit to the work of the IWC now and over the next 10 years. The following are the Terms of Reference:

In order to improve data management within the IWC an ISG led by Double and Staniland will be formed to plan and convene an online workshop to address the following:

- *Review data collection procedures across the IWC identifying need, use and overlap with external data holdings. In particular seek ways that processes can be simplified, and streamlined, to increase submission rates and minimise duplication of effort. [with a focus on National Progress Reporting]*
- *Scope areas of potential integration and consolidation of current IWC databases and report on their status*

- *Define rules/expectations surrounding data accessibility for databases with different levels of IWC support*
- *Review any new database requests from SC68D*

Table 34

Database/Application	Status	Work Required	SC Priority *as set by Scientific Committee* *(If none set, defaults to Medium. Maintenance is always set to Highest)*
Bibliographic reference database (EndNote)	Live	Import commission papers and circulars?	Medium
Blue Whale Song Library	Stalled	Develop database (£4000 available) – Assigned to tribalsystems.uk (not done). Recommendation added to the CRMbhttps://crm.iwc.int/data/blue-whale-songs by IWC	High
Catch Summary Database	Live	Recommendation to be added to crm.iwc.int - Example crm.iwc.int/individualcatchdatabase	High
Cetacean Diseases of Concern Intranet	Stalled	Finalise website	Medium
Compendium of Whale Watching Regulations	Retired	None	N/A
Conservation Reporting Database	Under Development	Finalise specifications, Develop database and Review at CC 2022. Recommendation: Add to IWC CRM https://crm.iwc.int/data/conservation-database	High
Database of Recommendations	Live	Improved - https://recommendations.iwc.int	Medium (Default)
Discovery Marking Data	Live		Medium (Default)
Entanglement Response	Postponed	Develop database	N/A
Individual Catch Database	Live	Document idiosyncrasies exist within data. Creation of a database of records for which there are no individual data and which conforms to all available summary data on the area, sex and month of these catches, to enable easy creation of catch series. Requires full documentation. Recommendation to be added to crm.iwc.int - Example crm.iwc.int/individualcatchdatabase and GitHub for versioning and documentation	High
InforMEA project database	Live	Ongoing development of Drupal application and database	Medium (Default)
IWC biopsy sampling database	Under Development	Updates only (in progress)	Medium
IWC photographic cruise database and archive	Live	Updates only (in progress)	Medium
Journal	Live	JCRM Issues 20-23 and Special Issues now available online. Backdating previous Issues required	Medium
Meeting Documents	Live	Moved to SharePoint	Medium (Default)
Meeting Registration	Live	For SC68D Microsoft tools were used for registration and automatic addition of users to our office 365 SC groups	Medium (Default)
National Progress Reports	Live	Bulk import from CSV to be tested. Integration of standard FAO areas	Medium
New integrated sightings, photo-ID, database	Stalled	Updates only (funding available)	Medium

Research Requests	Replaced	Replaced by simple form https://forms.office.com/r/wEmk6Py8U5	Medium (Default)
SH Blue Whale Catalogue	Live	Migrated to IWC server	Medium (Default)
Ship Strikes	Live	Bulk import tool (CSV) - Not done Allow data to be submitted via API directly from country databases	Medium
Small Cetaceans Catches (Bycatch & Direct)	Live		Medium (Default)
WNP gray whale catalogue	Under Consideration	Migration to new system	tbc
WW Handbook	Live	Update to CraftCMS v3 and migrate database to PostgreSQL	High

22 IWC MULTINATIONAL RESEARCH PROGRAMMES AND NATIONAL RESEARCH CRUISES THAT REQUIRE IWC ENDORSEMENT (ASI)

Multinational research programs (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 for 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. The Committee notes that its report does not represent an official position of the IWC on the legal nature and designation of the waters to be surveyed.

This year, because of the virtual format of the meeting, the Committee did not have time to discuss all of the cruises reports and plan in zoom sessions. Instead, comment sheets were used to provide reviews.

22.1 IWC-POWER and cooperation with Japan

The Committee received the report of the IWC-POWER Steering Group (SC/68D/REP/03) summarising the progress made during the December 2021 online planning meeting by the Steering Group, including plans for 2023 and post-2023 cruises, and a recommendation for a future survey workshop in the autumn of 2022.

The Steering Group highlighted the achievements of the IWC-POWER programme since 2010, recognising that the surveys cover pelagic waters of the central and eastern North Pacific that have rarely if ever been covered by systematic line-transect surveys and had not been surveyed by any means in decades prior to the implementation of the programme. IWC-POWER has important scientific, conservation and management value, and the results have contributed greatly to the work of the Committee.

The short- and medium-term objectives were reviewed and updated by the Technical Advisory Group (TAG). The initial plan was to survey Russian waters of the Bering Sea and east of the Kuril archipelago off Kamchatka, the 'least studied' areas of the central and eastern North Pacific, which would have completed the 'short-term' objectives (IWC, 2012b). However, an official reply from the Russian government was received on May 6, 2022 stating that permission to operate in Russian waters was denied. Therefore, after consultations with IWC, NOAA and Japan, the contingency plan of surveying USA waters south of the Aleutian Island Archipelago will be implemented instead. The Steering Group applied for a permit to operate in USA waters. The survey design was optimised to reduce time lost in transit, and 6 days were set aside for experiments (distance angle, photo-ID, biopsies). Sonobuoys will be used to detect and close-in on high priority species when feasible. Collection of additional data on marine debris, sea surface temperature and possibly satellite tagging will be attempted as well. Analyses of these data will form the basis of the medium-term plan and may also result in one or two more cruises aimed at filling specific knowledge gaps before implementing the medium-term programme.

The medium-term objectives were reviewed and updated by the TAG. At least two more cruises are required to complete the initial programme. The planning for the next phase will begin as soon as possible and will be completed by 2024. The un-surveyed areas (e.g., Western Bering Sea area, East off Kamchatka) or new areas (e.g., off California, Chukchi and Beaufort Seas), are likely to be the choice for the 2023 survey plan but will depend on the international situation. In addition to the present work, future cruises 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 etc.)' (IWC, 2020a).

In discussion, the Committee noted the importance of considering how the data will be used for sei whales, particularly as it pertains to additional variance components for the integration of new results with previous estimates. The Committee commended the work undertaken by the Steering Group, the TAG, and Japan to ensure

the completion of the 2022 cruise despite the current situation and issues with obtaining a permit to operate in Russian waters, and endorses its report. The Committee also supports the proposal of the Steering Group and TAG to hold a workshop in September 2022 to develop detailed plans for the post-2022 cruises as well as the 2024 Planning Meeting.

The Committee welcomed the results of the 12th annual IWC-POWER cruise (SC/68D/ASI/03), conducted between 2 August and 30 September 2021 in the eastern North Pacific (north of 40°00'N between 135°00'W and 155°00'W, comprised entirely of the High-Sea). The cruise was carried out by the R/V *Yushin-Maru No. 2*. Survey trackline coverage was 77.2 % (1,563nm of a planned distance of 2,022nm), with a total of 834 nm in Passing with Abeam Closing mode (NSP) and 729nm in Independent Observer passing mode (IO). Sightings were made of blue (6 schools/7 individuals), fin (79/115), sei (25/40), Bryde's (20/22), sperm (19/22) and killer (1/4) whales and photo-ID data were collected for 69 individuals from 5 species. North Pacific right whale was not sighted during the cruise. A total of 19 biopsy samples were collected from 3 blue, 9 fin, 4 sei, 2 Bryde's and 1 killer whales. The estimated angle and distance training exercise and experiment were completed. The cruise also documented the distribution and characteristics of floating marine debris. No acoustic survey was conducted. A feasibility experiment of dive behaviour tagging was conducted at the discretion of Japan with tags deployed on 2 fin and 3 sei whales. Results from this cruise will contribute to the work of the IWC-SC on the management and conservation of populations of large whales. The data will be analysed during the coming years and the results presented at upcoming Committee meetings.

In discussion, the Committee stressed the importance of the IWC-POWER cruises and reiterated the small cost to the Scientific Committee compared to the contribution of a vessel and crew. The Committee thanks the Government of Japan, which generously supplies the vessel, crew, and the USA (equipment and researchers), for their continued support of this IWC programme, as well as members of the Technical Advisory Group and the international scientists who have participated in these cruises. In addition to abundance estimates obtained from the programme, the biopsy sampling component is of great value in understanding the stock structure of large whales in the North Pacific and further collection of samples, especially from blue and fin whales, is encouraged in future surveys. The Committee also stressed the importance of covering these offshore areas for which very little information is available and thanked Japan for sharing the data collected during the cruises. Finally, the Committee expressed its sincere thanks to Murase for his excellent leadership in acting as Cruise Leader for the 2021 IWC-POWER.

Attention: SC, C, CG-R

*The Committee **reiterates** to the Commission the great value of the data contributed by the IWC-POWER cruises which have covered 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 Steering Group (SC/68D/REP/03) and **recommends** that the programme continues.*

The Committee also:

*(1) **agrees** that the 2021 cruise was duly conducted following the requirements and guidelines of the Committee (IWC, 2012c) and **looks forward** to receiving abundance estimates based on the data obtained;*

*(2) **endorses** the proposed plans for the 2022 cruise and **looks forward** to receiving a report from this survey at the next meeting of the Committee; and*

*(3) **endorses** the report and work plan for the continuation of work related to the IWC-POWER cruises, including the updated medium-term objectives.*

22.2 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 seven 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';
(6) 'The right sentinel for climate change: linking foraging ground variability to population recovery in the southern right whale'; and
(7) 'Recovery status and ecology of Southern Hemisphere fin whales'.

The Committee welcomed the IWC-SORP Annual Report 2021/22 on the continued progress of research undertaken under the auspices of these themes since last year (SC/68D/SH/07). This progress includes the production of 40 peer-reviewed publications during 2021/22, bringing the total number of peer-reviewed publications produced since the start of the initiative to ca. 248. In addition, 190 IWC-SORP related papers have been submitted to the Scientific Committee to date, 22 of them this year. The initiative has directly contributed to at least 11 PhD, 6 Masters and 5 honours theses.

The COVID-19 pandemic has continued to cause major disruption to most of the IWC-SORP projects through the closure of laboratories, cancellation of voyages and disruption of fieldwork. Nevertheless, limited fieldwork was undertaken in the western Antarctic Peninsula and sub-Antarctic Marion Island. Southern right whale aerial surveys were conducted in South Africa and Australia. Images for photo-ID have been collected; satellite tags deployed on southern right and fin whales; biopsy samples collected from southern right and humpback whales; and hundreds of hours of cetacean acoustic recordings have been made and analysed. The support of national programmes in providing research platforms to facilitate these activities, as well as external data contributors, were gratefully acknowledged by the Committee.

A report on the progress of projects funded by the IWC-SORP Research Fund following three open, competitive grants rounds (2016-present) was also provided (SC/68D/SH/08). **£24,844 GBP** remain unassigned and unspent in the IWC Research Fund Financial Report (SC/68D/O/04). The Committee acknowledged and thanked all contributors to the IWC-SORP Research Fund for their voluntary contributions. The Committee also noted that, since SC68C, vessel time has been secured by IWC-SORP researchers for the 2022/23 austral field season.

The Committee recognises that the scientific research facilitated by the IWC-SORP will contribute to achieving the scientific objectives of the Southern Ocean Sanctuary.

The IWC-SORP ethos is one of open collaboration, communication and data sharing. It welcomes new partners.

Attention: SC, G

Acknowledging the great value of the IWC's Southern Ocean Research Partnership (IWC-SORP) 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 and acoustic data, to IWC-SORP and the wider Committee.

22.2.1 Workplan

Table 35
Workplan for the Southern Ocean Research Partnership

Item	Intersessional	Next meeting	Intersessional	Subsequent meeting
Analyses	Continued analysis of data/samples from previous IWC-SORP voyages/fieldwork	Report	Continued analysis of data/samples from previous IWC-SORP voyages/fieldwork	Report Report
Voyages	Baleen whale and krill research voyages on ships of opportunity along Western Antarctic Peninsula	Report	Baleen whale and krill research voyages on ships of opportunity along Western Antarctic Peninsula	
	ARA Almirante Irizar, 2022/23, to Antarctic Peninsula, islands at 61°00'-63°37'S, 53°83'-62°83'W and 60°30'-60°48'S, 44°25'S-46°43'W and Weddell Sea	Report	*ARA Almirante Irizar*, 2023/24, to Antarctic Peninsula, islands at 61°00'-63°37'S, 53°83'-62°83'W and 60°30'-60°48'S, 44°25'S-46°43'W and Weddell Sea	Report
	RV Maria S. Merian cruise MSM115-FINWAP, Feb-Mar 2023, to Elephant Island, Islands at 61°00'-63°37'S, 53°83'-62°83'W and 60°30'-60°48'S, 44°25'S-46°43'W	Report		
Fieldwork	Continued fieldwork around Marion Island 2022/23	Report	Continued fieldwork around Marion Island 2023/24	Report
	Field work around Auckland Islands Maungahuka, July 2022	Report		
Acoustics	Retrieval and redeployment of passive acoustic recorders	Report	Retrieval and redeployment of passive acoustic recorders	Report
Funded research	Progress on IWC-SORP Research Fund funded research projects endorsed by IWC	Report	Progress on IWC-SORP Research Fund funded research projects endorsed by IWC	Report

22.3 IWC-ATLAFCO collaboration for capacity building and cetacean surveys

At SC68C, the Committee formed an intersessional group to consider topics which were of potential interest to the work of COMHAFAT/ATLAFCO. The idea was to provide experts to collaborate with West African scientists to design, organise and run future capacity building workshops with COMHAFAT. The first stage of this process was to gather ideas of where the IWC could offer expertise and training. These ideas were then presented to COMHAFAT to seek input from the member governments on what topics they felt would be helpful and which, if any, of these topics would be a priority. COMHAFAT confirmed that all of the suggested topics were of interest to their members. The next stage of the process will be to identify suitable experts to address these topics, schedule workshops and seek funding to accomplish specific objectives. The Committee encouraged an intersessional correspondence group (Table 4, item 3) to continue this work.

22.4 National cruises that require IWC or request oversight

SC/68D/ASI/09 outlines the objectives and methods for the Korean Sighting Survey in spring and autumn 2022-2023. The first objective of this survey is to collect information on the distribution and abundance estimation of common minke whales for stock assessment. The second objective is to collect general information on the distribution of other cetaceans in the area. A total of 5,495 nautical miles long transect lines will be searched using closing mode with binoculars and naked eyes. Other research activities such as photo-ID will be conducted during the survey.

The Committee endorsed this planned survey and appointed Eun-Ho Kim to provide oversight.

Attention: SC, C, Korea

*National research programs provide valuable information to advance the work of the Committee. The Committee **endorses** the Korean Sighting Survey plan for 2022-2023 and **encourages** the submission of abundance estimates and other data from this study in the future in accordance with the Procedures for Submission, Review and Validation of Abundance Estimates (IWC, 2020f) and subsequent amendments thereof.*

22.5 Review and provide advice on plans for future surveys

The Committee welcomed plans to conduct the following research cruises in the intersessional period.

SC/68D/ASI/12 describes the research plan for the cetacean sighting survey in the southwestern Sea of Okhotsk (sub-areas 12 SW and 11) in 2022. The eighth Russian-Japanese sighting survey is planned for 4 August to 4 September (32 days). The survey will be conducted along systematic transects in passing mode, using standard distance sampling techniques. Photo-identification of cetaceans such as killer whales, North Pacific right whales, gray whales and humpback whales will be attempted.

SC/68D/ASI/02 outlines Japan's plan for a systematic vessel-based sighting survey in the North Pacific in 2022. The main objective of this survey is to estimate the abundance of large whale species in the North Pacific Ocean for management and conservation purposes. The survey will be conducted using the research vessels Yushin-Maru (YS1) and Kaiyo-Maru No. 7 (KY7) in August-September 2022 and will cover the area comprised between 35°-44°N, 140°E-153.5°E. Distance and angle estimations, photo-ID, biopsy, and satellite tagging experiments will be also conducted.

SC68D/ASI/04 outlines the objectives and survey procedures of the 2022/2023 line transect whale sighting survey under the Japanese Abundance and Stock structure Surveys in the Antarctic (JASS-A program). The main research objectives of JASS-A are i) the study of the abundance and abundance trends of large whale species, and ii) the study of the distribution, movement and stock structure of large whale species. JASS-A also has several secondary research objectives related to oceanography, marine debris and whale biology. The objective of this paper is to outline the objectives, survey procedures and schedule of the 2022/2023 JASS-A survey in Area VIE (145°W-130°W) of the South-Pacific region of the Antarctic.

The Committee endorsed these cruise plans.

Attention: SC, C, Russia, Japan

*National research programs of member and non-member IWC nations provide valuable information to advance the work of the Committee. In reviewing plans for national research cruises in 2022, the Committee **endorses** the planned Japanese surveys in the North Pacific and Antarctic, and the planned Russian-Japanese sighting survey in the Sea of Okhotsk. The Committee **encourages** submission of abundance estimates from these studies in the future in accordance with the Procedures for Submission, Review and Validation of Abundance Estimates (IWC, 2020f) and subsequent amendments thereof.*

22.6 Other cruise plans and reports

The Committee welcomed cruise reports from surveys conducted in 2021 and early 2022 by Japan in the Antarctic (Matsuoka *et al.*, 2021) and the North Pacific (Murase *et al.*, 2021; Øien, 2021), by Russia in the Okhotsk Sea (Gushcherov *et al.*, 2021) and by Norway in the Northeast Atlantic ((small management area EW-Norwegian Sea, Hakamada *et al.*, 2021). The plans for all of these surveys had been presented and endorsed at SC68C.

SC/68D/ASI/05 provides the results of a sighting survey conducted in the North Pacific in the spring (April-June), autumn (October-November) and winter (January-March) seasons of 2021/22. The research area was between 141°*E*-150°*E,* 35°*N*-46°*N* with a total effort of 4,956.3 nautical miles. In addition to the collection of systematic sighting data, biopsy, photo-ID, and satellite tracking experiments on baleen whales were conducted.

SC/68D/ASI/06 describes the results of a sighting survey conducted in the North Pacific (between 150°*E*-155°*W*, 30°*N-53°N*) from 4 August to 30 September 2021. The total searching distance in the research area was 3,713.8 nautical miles. As with the survey described by SC/68D/ASI/05, this survey also conducted biopsy, photo-ID and satellite tracking experiments, in addition to collecting systematic sighting data.

SC/68D/ASI/10 describes the results of the sighting survey of the Japanese Abundance and Stock structure

Survey in the Antarctic (JASS-A) conducted using line transects and distance sampling methods from 11 January to 12 February 2022 in the eastern part of Area VI East (130°W-120°W). The survey included coastal ice-free areas, south of 72°S and the total effort was 1,333.5 nautical miles. In addition to collecting systematic sighting and oceanographic data, biopsy, photo-ID, and satellite tracking experiments were conducted.

SC/68D/ASI/11 describes the results of a Russian-Japanese sighting survey conducted in the northern part of the Sea of Okhotsk from August 8 to September 10, 2021. The northern and the southern boundaries were 57°00N and 60°00N, respectively and the western and the eastern boundaries are 139°00E and 157°00E, respectively. The vessel was able to survey 100% of the pre-determined track line (1299,26 nautical miles in closing mode and 963,41 nautical miles in passing mode or transit). The document provides some overall results for 2015 - 2021 on the occurrence and behaviour of whales.

SC/68D/ASI/07 reports on the progress of a current six-year program to survey the Northeast Atlantic over the period 2020-2025 to get a new estimate of minke whale abundance by the end of this period. In the summer of 2021, the area around the island Jan Mayen, comprising the *Small Management Area* CM, was surveyed with one vessel using double platform methodology. A total of 2,641 nautical miles of primary search effort was conducted within the surveyed blocks. The most common species sighted were minke whales, Northern bottlenose whales, fin whales, humpback whales and sperm whales. In addition, sightings were made of killer whales, blue whales, white-beaked dolphins, sei whales, pilot whales and harbour porpoises. Compared to the 2016 survey of this area, fewer minke whales were recorded in the southern part of the survey area. In addition, a survey of harbour porpoises was conducted within the Hardangerfjord in southern Norway.

The Committee expresses appreciation to the countries who have sponsored these surveys providing important contributions to cetacean research.

22.7 Biennial workplan

The Committee agrees to the workplan provided in Table 36. Item 1 in this table (IWC-POWER cruises) has financial implications for the Committee. A research proposal to conduct this work was reviewed, and the Committee strongly endorses this proposal. An intersessional Steering Group has continued to assist with the planning of the IWC-POWER cruises (Annex M). Last year, a steering group was formed to explore an Indian Ocean pan-regional initiative to conduct cetacean surveys. Although little progress was made intersessionally, the Committee encouraged this work to continue its work.

Table 36

Work Plan for multinational research programs and national research cruises that require IWC oversight

Item	Topic	Intersessional	Next meeting	Intersessional	Subsequent meeting	Agenda Item
1	IWC-POWER Cruise in the North Pacific Ocean.	Conduct 2022 survey and planning meeting for the future cruises, including updating medium-term objectives, begin development of medium-term plans	Review cruise report, report from the planning meeting and new abundance estimates from IWC-POWER cruises.	Conduct 2023 survey, finalise medium-term plans	Review cruise report, and new abundance estimates from IWC-POWER cruises.	22.1
2	Review and provide advice on plans for future surveys.		Receive, review and provide feedback to research plans to conduct abundance estimates		Receive, review and provide feedback to research plans to conduct abundance estimates	22.5
3	IWC-ATLAFCO collaboration for capacity building and develop cetacean surveys.	Identify experts, schedule workshops, seek funding in support of capacity building	Review progress	Identify experts, schedule workshops, seek funding in support of capacity building		22.3
4	Indian Ocean pan-regional initiative to	Develop a plan for a collaborative pan-regional survey	Review progress	Extend and begin implementing the plan for a collaborative pan-	Review progress	

conduct cetacean surveys.	initiative across the Indian Ocean to conduct cetacean surveys.	regional survey initiative across the Indian Ocean to conduct cetacean surveys.

23. SCIENTIFIC COMMITTEE BUDGET FOR THE CURRENT AND NEXT BIENNIUM

In light of the financial deficit of £497,000 facing the Commission in the next biennium, the Committee discussed the implications for its work (see Annex D). If the Commission does not balance its biennial budget, it will become insolvent in 2025. Three possible options to balance the 2023-24 budget will be considered by the Commission at IWC68. All options are intended to establish a new status quo, that is, the Commission will not return to previous patterns of expenditure. Proposed options 1 and 3 will have a substantial impact on the work of the Committee.

Option 1 represents a cut of 48% in the SC meeting budget and a reduction of 21% in the research budget. Option 1 does not include funds for the Secretariat to support a virtual meeting of the SC, which means that if the SC choses to host a virtual meeting, funds to support this would need to be allocated from its research budget, or from external sources. A provision of funds for an ASW workshop has been included since 2024 is a renewal year for quotas.

Option 3 represents a smaller cut of 3% in the SC meeting budget and a reduction of 11% in the research budget. ASW workshops will be funded in renewal years of the ASW quotas.

The Committee stresses that annual in-person meeting SC meetings are the only option under which it can fully achieve Commission objectives. and notes that when the Commission moved to a biennial meetings schedule, it "endorsed the universal support for continuing with Annual Meetings of the Scientific Committee" (IWC, 2011a) and added Rule of Procedure B(3) at its subsequent meeting, which states "The Scientific Committee shall meet annually" (IWC, 2012a). The Committee also draws attention to the 2018 independent IWC governance report (IWC Review Team, 2018), which states that the Scientific Committee is "the jewel in the crown" of the IWC, the amount of work done "phenomenal" and its quality "outstanding".

A move to biennial meetings would reduce the Committee's ability to consider important conservation and management problems and therefore it may not be able to provide the same level of advice to the Commission. The Committee would need to reduce and prioritise its agenda, which will require guidance from the Commission.

Permanent changes to the Committee's meeting schedule and work structure will be needed in order to continue providing comprehensive information on the threats to, and the status of, cetacean stocks to the Commission. It is important to consider options to move the Committee's work forward in an efficient manner under a reduced budget scenario and to this end the Committee formed a Steering Group to address these issues intersessionally (see Annex M for membership and terms of reference).

23.1 Status of funded research, workshop proposals, data processing and computing needs

SC/68D/O/04Rev provides information regarding the position on the Committee's Research Fund at the end of the 2021 financial year. Projects undertaken in 2021 were on or under budget, with no requests from the contingency fund. The remaining balance of the contingency fund at the end of 2021 was £44,848, substantially higher than the target of 10% of the Committee's budget allocation as outlined in the Rules of Procedure (IWC, 2019i).

For 2021, the approved SC Research Fund budget was £226,400 and no voluntary contributions were received into this fund. Expenditure of £125,884 occurred during the year, giving a closing balance for 2021 of £476,883. Of this, £316,321 has subsequently been spent or is committed to existing projects. It should be noted that due to the COVID-19 pandemic, a significant number of projects had to be postponed and these projects were reviewed by the Committee.

23.1.1 Proposals for 2023-24

The Committee proposed a research programme for 2023-24, as shown in Table 37. A rigorous process of scoring and ranking was applied to ensure fair evaluation of each proposal. The total amount requested from the Commission for each year is below that requested for 2022. In-kind support for these projects totals over £2.4m.

The Committee did not approve funding for several projects as discussed shown in Table 38. Reasons for non-funding under Item 23.1.1.6.

Table 37

Scientific Committee approved projects for the biennium, 2023-24

RP Number	Sub Committee	Project Title	Brought Forward from Previous Years £	Reallocated From Other Projects £	2023 Budget Request £	2023 Total £	2024 Budget Request £	2024 total £
		General						
n/a	ALL	Invited Participants 2023-24	100,000		50,000	100,000	50,000	100,000
n/a	ALL	Responding to Commission directives from IWC68	15,000			15,000		
n/a	ALL	Contingency Fund	44,848	(24,848)		20,000		
26	ALL	Seed Funding - Communications Small Group	15,000			15,000	7,500	7,500
		Meetings / Workshops						
n/a	ALL	Meetings to address delayed agenda items[38]	108,684	24,848		133,532		
2	ALL	Annual meeting of the Abundance Steering Group	6,000		5,340	11,340	11,340	11,340
7	SH, CMP	SRW catch series, stock structure, and catch allocation review workshop		14,516	1,284	15,800	11,720	11,720
25	SAN	Southern Ocean Sanctuary review					1,985	1,985
		Modelling / Computing						
5	SH	Assessment of Antarctic blue whales			22,362	22,362	-	
11	IA	Assessments: computing to support Secretariat	3,500		17,000	20,500	25,500	25,500
12	IA	NP sei and humpback whale modelling	2,500		-	2,500	2,500	2,500
		Research						
1	ALL	POWER Cruises 2023-24	16,562		16,208	32,770	29,870	29,870
4	SH, CMP	Assessing movement rates of SW Atlantic SRW between Argentina and Brazil			5,808	5,808		
6	SH	Mark recapture analysis of Southern Hemisphere BW photo-ID datasets to estimate regional abundance					18,000	18,000
9	SH	Passive acoustic monitoring of cetaceans from the former Durban whaling ground, western Indian Ocean			1,590	1,590	1,590	1,590
16	CMP, SH	Passive Acoustic monitoring of the Eastern SP SRW			20,200	20,200	11,000	11,000

[38] The Budgetary sub-committee has accounted for these monies in reducing the overall deficit with a recommendation for *these funds be allocated to the Scientific Committee (research fund or meetings fund) to support any adjustments to operations in light of budget cuts.*"

18	CMP	Assessment of spatiotemporal distribution of humpback and blue whale song along the Arabian Sea coast of Oman			9,650	9,650	9,250	9,250
19	CMP	Continuation of field deployments in 2023-24 for passive acoustic monitoring for humpback, blue and other baleen whales off Oman			17,903	17,903		
22	E	Contaminant mapping in cetaceans: Review of spatial and temporal trends in POPs and heavy metals			10,000	10,000		
24	NH	Assessing endangered baleen whales in the Eastern North Atlantic through passive acoustic monitoring off Senegal			12,420	12,420	10,000	10,000
15	SM	Assessment of the traditional drive-hunt in the Solomon Islands: Collaborating with Indigenous communities and updating the IWC direct take database			2,500	2,500	2,500	2,500
		Databases						
13	HIM, SM	Ship strikes database coordinator			10,000	10,000	10,000	10,000
8	SH, PH	Southern Hemisphere blue whale catalogue 2023-24			3,306	3,306	15,041	15,041
14	GDR, SH, PH	Secretariat database support			6,000	6,000	6,000	6,000
23	NH	Review of the Spanish statistics in the IWC catch database			12,555	12,555		
		Reports						
3	WW	Communicating the science of sustainable, responsible whale watching[1]			1,500	1,500	~~21,050~~	0
20	E	State of Cetacean Environment Report (SOCER) for 2023-24			4,000	4,000	4,000	4,000
		TOTALS	**312,094**	**14,516**	**229,626**	**506,236**	**227,796**	**277,796**

[1]The Committee recommended funding the communications plan only and will consider further funding once this has been reviewed

23.1.1.1 GENERAL

Invited participants

Invited participants (IPs) are a vital component of the working of the IWC's Scientific Committee. IPs contribute in many ways including as sub-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.

Responding to Commission directives from IWC/68

These funds will assist the SC in responding to any urgent issues under its mandate that may arise at the October Commission meeting.

Contingency Fund

This fund allows for unforeseen overspends, for example, higher than anticipated travel costs or project overruns. No funding has been required since the last Committee meeting.

SC/68D/RP/26 Scientific Committee Communications Initiative
The Committee has a small group exploring how it can improve communication, primarily with the Commission, but also with the general public. These funds will be used to develop a range of communication tools tailored to IWC Commissioners to improve the Committee's ability to communicate its workplan.

23.1.1.2 MEETINGS/WORKSHOPS

Meetings to address delayed agenda items
The work of the Scientific Committee is vital to the Commission in providing advice to inform decisions for the management and conservation of cetacean populations. However, over the last three years the work of the Committee has been compromised by the COVID-19 pandemic and this has affected the depth of advice it can provide. During this time, the Committee has met virtually in order to progress the work requested of it as much as possible, and these meetings have provided some benefits, for example, a greater global breadth of expertise and participation. However, the actual meeting time has been reduced by 40% which, coupled with other limitations, has severely reduced progress on nearly all of the Committee's agenda items. Full, in-person meetings offer a number of advantages that enormously benefit the speed of progress and quality of the Committee's work. These advantages include: (1) allowing small *ad hoc* groups to quickly work through any issues that arise; (2) participation of Committee members from countries in unfavourable time zones when meetings are held virtually; and (3) greater synergy of groups and experts.

While emphasising that annual meetings are essential to address Commission objectives fully and to maintain the IWC's status as the premier worldwide organisation for science-based conservation and management of whales, the Committee acknowledges the possibility of transformational changes to the way it operates (e.g. moving into a biennial meeting structure) as a result of the ongoing work of the Working Group on Operational Effectiveness and the options developed to balance the Commission's budget in the long term. Conscious of these issues, the Committee has set aside monies saved from recent underspends that were a result of holding virtual meetings. Due to the uncertainty over the Committee's operation in the next biennium and the need to compensate for three years of limited progress, funds have been allocated to allow the Committee to meet in-person in 2023, irrespective of the budget option chosen at IWC68. Given the large number of stalled and delayed agenda items, it is anticipated that two full in-person meetings, or a series of additional targeted workshops, will be required to address the 2023-24 biennium workplan. This is especially true regarding the Committee's need to provide advice to the Commission about aboriginal quotas in 2024 as outlined in the Schedule. In addition, should the decision be made to move toward biennial meetings, hosting in-person meetings in the next biennium to address delayed agenda items would ensure the advice produced by the SC is as relevant and up-to-date as possible before a transition to biennial meetings from 2024 onwards is initiated.

SC/68D/RP/02 Annual Meeting of the Abundance Steering Group (ASG)
In 2019, the Committee recommended that a permanent pre-meeting for the ASG be established as a normal component of the Annual Meeting of the Scientific Committee (JCRM 21(Suppl), 2020, Annex Q). Meetings of 2-4 days have been held annually since then. A pre-meeting is proposed prior to the 2023 and 2024 SC meetings (or approximately the same time of year) for the ASG and relevant experts to meet to advance the two primary objectives of the ASI sub-committee: (1) the intersessional review of abundance estimates required by the Committee's various subgroups; and (2) development of the Committee's Status of Stocks website.

SC/68D/RP/07 Southern right whale catch series, stock structure and catch allocation review workshops
Two workshops will be held to: (1) review the historic circumpolar catch series of southern right whales; (2) review stock structure hypotheses; and (3) identify and propose catch allocation scenarios based on both the catch review and stock structure reviews. The first workshop is proposed as a 4-day intersessional workshop of catch history specialists. Both the availability of new data and the time since the last review suggest a review process of regional catch (and struck and lost) data of southern right whales is timely. The expected outcome is an updated regional estimates of circumpolar southern right whale catches in an agreed catch series necessary for assessments of southern right whale exploitation for past abundance and current recovery levels measures. The second workshop is proposed as a 3-day pre-meeting workshop to review contemporary and historical (19th century) population structure hypotheses and propose probable catch allocation scenarios for the regional populations identified by IWC (2001). The workshops will result in reports containing: (1) an agreed catch series and; (2) catch allocation scenarios for use in upcoming assessments.

SC/68D/RP/25 Southern Ocean Sanctuary Review

The Southern Ocean Sanctuary (SOS) was established in 1994 and Paragraph 7(b) of the Schedule, which established the SOS, specifies that the SOS "…shall be reviewed ten years after its initial adoption and at succeeding ten-year intervals...". In 2003, the Commission directed the Committee to undertake the first in a series of decadal reviews of the SOS (1994-2004) (IWC, 2004, pp. 47-50). The third decadal review will be conducted in 2024, as agreed at SC68C. The review process requires collation of documents relevant to the review process, solicitation of potential reviewers and invitation of reviewers to the SC meeting to discuss and present the review (IWC, 2016).

SC/68D/RP/21 Climate change workshop: Part II
In late 2021 the Committee held a significantly down-sized virtual workshop on this topic. It met for just three 3hr sessions and its report is available [Link]. The originally approved proposal for a climate change workshop was for an in-person meeting lasting several days, but this could not proceed due to COVID-19 restrictions. The meeting report notes that there is more work that can be conducted on this topic, particularly in the context of 'indirect effects' of climate change on cetaceans (Fauquier *et al.*, 2021). The workshop also recommended a follow-up in-person workshop. This proposal was not recommended for funding, see Item 23.1.1.6.

23.1.1.3 MODELLING/COMPUTING

SC/68D/RP/05 Assessment of Antarctic blue whales
A full stock assessment of Antarctic blue whales will be conducted, and will include the following components: (1) revising and updating a time series of historical catches; (2) updated priors for rates of increase in Antarctic blue whales based biological parameters; (3) compilation of abundance and trend estimates for Antarctic blue whales; (4) fitting assessment model to available data in a Bayesian framework; and (5) preparing a report on the results for the Committee in 2024.

SC/68D/RP/11 Essential computing support to the Secretariat
The Committee is currently engaged in an In-depth assessment for Western North Pacific common minke whales and in addition, the Committee will commence an *Implementation Review* for North Atlantic fin whales in 2024. In both cases, the Committee has developed a complex assessment model structure. A key task in this process is to develop and validate the code for the models, 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 alone cannot handle this complete process themselves, so computing support is needed, especially given the recent retirement of an experienced Secretariat staff member in this area.

SC/68D/RP/12 Assessment modelling for In-depth assessments of North Pacific sei and humpback whales, 2022-24

The Committee is currently conducting In-depth assessments for North Pacific sei and humpback whales. Part of an In-depth assessment is evaluating the status of a population using a population dynamics model that is specific to the biological and behaviour parameters of that particular population and fitting it to monitoring data. The population models are spatially structured and are fitted to estimates of absolute and relative abundance, genetics data and mark-recapture data. The population models will be updated following the 2022 SC meeting and the results included in synthesis papers, which will result in an assessment of the status of the population. The project involves developing and utilising population dynamics models as required to progress the work.

23.1.1.4 RESEARCH

SC/68D/RP/01 IWC-POWER cruise in 2023 and 2024 including associated workshop/meetings and processing
The Committee strongly advocated the development of an international medium- to long-term research programme involving sighting surveys to provide information for assessment, conservation and management of cetaceans in the North Pacific, especially areas that have not been surveyed for decades. The programme has been running since 2010 and has contributed greatly to the work of the Committee and its assessment work. The amount of money is extremely small when seen in the context of Japan providing the vessel and associated costs which it wishes to continue to do although it has now left the IWC. The IWC contribution is for: (1) IWC researchers and equipment; and (2) to enable analyses and the photographic database to be updated. At least two more cruises are required to complete the initial programme and it is essential planning begins for the next phase as soon as possible with a view to completing this by 2024.

SC/68D/RP/04 Assessing movement rates of Southwest Atlantic southern right whales between Argentina and Brazil
In 2020, the Committee highlighted the need to have a multistate capture-recapture and population dynamic analysis of Brazil-Argentina right whale photo-ID data to assess movement rates between calving grounds in the

Southwest Atlantic. Multi-states mark-recapture models with a Bayesian approach will be applied to the data available, expecting the following outcomes: (1) movement rates between breeding grounds over the years (2) region-specific survival and recapture probability; and (3) influence of micropredation by kelp gulls, calf mortality and density-dependence processes at Península Valdés on movement probabilities.

SC/68D/RP/06 Mark recapture analysis of Southern Hemisphere blue whale photo-ID datasets to estimate regional abundance

The Southern Hemisphere blue whale catalogue (SHBWC) has generated large photo-ID datasets for blue whales in Chile (1,004 identifications) and Australia (243 identifications), contributed to by multiple local catalogue holders (SC/68D/SH/04). Blue whale photo-IDs comprise a mixture of right-side and left-side photographs. Whales have been matched between catalogues and quality coded within the SHBWC, generating multi-year encounter histories for whales for right and left sides. To maximise use of the information contained in the two datasets, these data will be analysed in a mark recapture framework that has been developed to handle multiple marks (Zhang *et al.*, 2019) and accommodate capture heterogeneity. Given the spatiotemporal spread of these datasets, these data will be analysed in an open population framework. These analyses will generate estimates of blue whale abundance for Chile (Northern and Southern Chile) and Australia, using customised models to accommodate multiple connected areas within each dataset.

SC/68D/RP/09 *Passive acoustic monitoring of cetaceans from the former Durban whaling ground, South Africa*
Seasonal occurrence of whales off the former Durban whaling ground, South Africa, are currently based on historic whale catches from over six decades ago. An acoustic recorder was deployed earlier this year with the goal of using acoustic signatures to separate historic catches of Antarctic and pygmy blue whales from that region and update the knowledge of species occurrence. More acoustic research is planned to determine long-term seasonal acoustic occurrence and behaviour of other whales such as sperm and killer whales that are thought to occur in that region. Effects of noise and environmental conditions on whales will be evaluated. Results of this project will be important for updating management strategies of different whale species and in informing the current use of this ecoregion by different whale species.

SC/68D/RP/16 Passive Acoustic Monitoring of the Eastern South Pacific Southern Right Whale, outputs 2023-24

Eastern South Pacific right whales are critically endangered and the IWC has a Conservation Management Plan for this population. The Committee supports a Passive Acoustic Monitoring (PAM) project that seeks to assist in the identification of a breeding area. Six sites have been selected along the coast of Chile and Peru and two sites have already been covered off central and southern Chile. Northern Chile has been monitored since March 2022, but additional funds are needed to complete a full maintenance cycle of equipment. The next site to monitor in 2023-24 is southern Peru and funds have already been secured. An opportunity to monitor Golfo de Penas has been presented and requires matching funds. Work for 2023-24 includes data collection at southern Peru and Golfo de Penas and analysis of acoustic datasets.

SC/68D/RP/18 Spatiotemporal distribution of humpback and blue whale songs along the Arabian Sea coast of Oman
The use of passive acoustic monitoring techniques is considered essential for resolving population identity, connectivity and seasonal presence for blue and humpback whales in the Northern Indian Ocean (NIO). Illegal Soviet whaling in the 1960s depleted both stocks, potentially severely. Passive acoustic data collection along the Arabian Sea coast of Oman from May 2022 to April 2023 was funded by the IWC and this project focuses on analyses of those new datasets, with the following objectives: (1) continue a dedicated research programme for Arabian Sea humpback whales and NIO blue whales in the waters of Oman, in accordance with previous Committee recommendations; (2) describe spatiotemporal distribution of ASHW and blue whale acoustic occurrence along the Arabian Sea coast of Oman through an assessment of singing activity; (3) develop an archive of acoustic data to assess occurrence of other cetaceans (including Bryde's and sperm whales) in the study area.

SC/68D/RP/19 Continuation of field deployments in 2023-24 for Passive Acoustic Monitoring of humpback, blue and other baleen whales off Oman
This project builds on historical archives (2011-14) and IWC SC funded PAM in deep water off the coast of Oman in 2021-22 by allowing for deployment and recovery of four units off the Arabian Sea coast of Oman from April 2023 to April 2024. This will be conducted in partnership with that described above and in SC/68D/RP18.

SC/68D/RP/22 Contaminant Mapping in Cetaceans: Review of spatial and temporal trends in POPs and heavy metals

The global review of PCBs, DDT and mercury in cetaceans will be updated. This will result in the documentation and mapping of decadal trends to provide an update of the current status of mercury and key persistent organic pollutants in cetacean populations at a global scale. This project builds on previous work that produced a Contaminant Mapping Tool, which displays published data on the concentrations of key persistent organic pollutants and mercury in cetacean tissues from the 1970s to the 2010s. The purpose of this tool is to allow researchers to quickly view, and explore visually, trends in the concentrations of commonly monitored contaminants in different species over time.

SC/68D/RP/24 Assessing endangered baleen whales in the eastern North Atlantic through Passive Acoustic Monitoring off Senegal, West Africa
Passive acoustic monitoring (PAM) is an important tool for improving our understanding of stock structure and distribution for endangered baleen whales. Critical data gaps exist for multiple species of large whales in the North Atlantic Ocean. In the eastern North Atlantic, the coasts of Mauritania and Senegal are believed to be important winter habitats for stocks of humpback, sei and Bryde's whales. This project will contribute PAM data for assessing protected species distribution and stock structure, as well as potential impacts of anthropogenic noise. In particular, these data will be used to: (1) assess baleen whale presence and timing of occurrence off the coast of Senegal; (2) assess stock identity for humpback whales off Senegal, comparing with the endangered Cape Verde/Northwest Africa distinct population segment; (3) assess occurrence and potential stock identity of sei whales off Senegal, by comparing vocalisations with those recorded in the Gulf of Maine; (4) assess the potential presence and vocal characteristics of Bryde's whales; (5) assess prevalence and potential impacts of local seismic survey exploration; and (6) build the capacity of Senegalese scientists to conduct PAM surveys.

SC/68D/RP/15 Assessment of the traditional drive-hunt in the Solomon Islands: collaborating with Indigenous Communities and Updating the IWC direct take database
An assessment of the Solomon Islands dolphin drive-hunt was funded by the Small Cetacean Voluntary Fund in 2012-15 (Oremus *et al.*, 2015b). The hunt's traditional methods appear to have remained consistent throughout the available written history. Meticulous hunt logs are maintained and have been published in academic records from 1976 to 2013. The hunt has been ongoing since 2013, and recently the Committee was made aware that the communities who conduct the hunts were willing to share their 2013-22 records with researchers. This project will support local travel of Solomon Islands government Fisheries Officers to the remote villages that conduct the hunts to copy the hard records kept by the hunting communities and to conduct interviews with hunters to update both this Committees record of direct takes and to document any changes in practise and update our understanding of the hunter's perspective of the cetacean population's occurrence and distribution.

SC/68D/RP/17 Development of a GIS (meta) database on information on human activities that might have an adverse impact on southern right whales
One of the two research objectives of the SWA Right Whale CMP is the development of a database in a geographic information system context, to compile a sensitivity atlas. In this project a GIS database will use information on right whales obtained from different sources (sightings, satellite tags, monitoring activities, etc.) overlapped with human activities (fishing, shipping, seismic exploration, oil and gas exploration etc.). This will allow placement of multiple threats to the population on a geographic information system. This proposal was not recommended for funding, see Item 23.1.1.6.

SC/68D/RP/10 Rock 'n Whales: can we detect blue and fin whale acoustic presence from a land-based seismic station in the equatorial Atlantic Ocean?
Existing data from a seismic land station located over 1,100km from the Brazilian coastline at the Saint Peter and Paul's Rock will be processed to quantify the acoustic presence of blue and fin whales in the equatorial mid-Atlantic Ocean, where there has been little research effort. There is data available from 2011-17, and the aim is to process this for whale bioacoustic signal detection and classification from 2011-13 to provide information about occurrence and seasonality of blue and fin whale acoustic activity in the equatorial mid-Atlantic Ocean and compare results from this land-based seismic station with those of other research groups. This proposal was not recommended for funding, see Item 23.1.1.6.

23.1.1.5 DATABASES

SC/68D/RP/13 Progressing the development and use of the IWC ship strikes database
The purpose of this work is to further develop the ship strikes database and to ensure the increased reporting of ship strike incidents into the database including through: (1) systematic outreach to data providers; (2) review and provision of data; (3) promoting access to information in the database; (4) increasing use of the database; (5) outreach to other organisations This funding will continue work that has been undertaken on the database

since 2021, which could be undertaken in two different ways depending on the endorsement by the Commission. It is proposed that this work would continue to be undertaken by the ship strikes data manager and funding would cover an appropriate portion of the costs of this position. If the coordinator cannot be retained for 2023 then this work would be delivered by another means, to be determined by the Chair of the Committee and Chair of the ship strikes Working Group in liaison with the Secretariat and Convenor of HIM. A key task for the data manager is to progress submission of data from national databases into the global IWC effort. This will be reliant on external factors but making progress on including these large existing data sets into the IWC database is likely to take a substantial proportion of the coordinators time.

SC/68D/RP/08 Southern Hemisphere Blue Whale Catalogue 2023-24
The Southern Hemisphere Blue Whale Catalogue (SHBWC) is an international collaborative effort to facilitate cross-regional comparison of blue whale photo-IDs catalogues. To date more than 2,000 individual blue whales have been contributed to the SHBWC from researchers working on areas off Antarctica, Chile, Peru, Ecuador-Galapagos, Eastern Tropical Pacific, Australia, Timor Leste, New Zealand, Indonesia, Sri Lanka and Madagascar. The Committee is currently working on the Comprehensive Assessment of non-Antarctic Southern Hemisphere blue whales, with emphasis on Australia, southeast Pacific blue whales and New Zealand. The SHBWC is assisting in matching catalogues in order to deliver regional photo-ID based mark recapture assessments of blue whale abundance.

SC/68D/RP/14 Ongoing SC database hosting and server management by IWC Secretariat
The IWC Secretariat hosts and manages several databases for the SC. These have annual service costs associated with them including web/database servers, storage, backups, software licences and other associated infrastructure costs. This funding will allow continuation of the hosting and management services required for SC databases. This funding does not contribute towards any salary.

SC/68D/RP/23 Review of the Spanish statistics in the IWC catch database
Modern whaling in Spain started in 1921 and, with some interruptions, ended in 1985. During this period, approximately 21,000 whales were caught. The IWC catch databases are incomplete for some years and contain discrepancies with the internal documentation held by the University of Barcelona and the Museo Massó, especially regarding the individual catch records. The expected outcome of the project is improving the accuracy of catch records in the IWC catch database for this particular region**.**

23.1.1.6 REPORTS

SC/68D/RP/03 Communicating the science of sustainable, responsible whale watching
The IWC SC and CC produce evidence-based advice on the best practices for sustainable, responsible whale watching. One major product of the SC/CC has been the Whale Watching Handbook, a first-class resource for whale watchers, operators and managers, based on the best available science and practices. The SC/CC is also working on General Principles for sustainable, responsible whale watching. The Committee also produces recommendations every year, for the IWC, its Parties, and beyond. However, many of the target audiences for the work are still unaware of their existence. This project aims to promote and market the whale watching work of the SC and CC to key audiences through a communications plan involving, *inter alia*, social media, video, podcasting. and other forms of outreach. The Committee recommended funding the communications plan only and will consider further funding once this has been reviewed.

SC/68D/RP/20 Compilation of the State of the Cetacean Environment Report (SOCER) for 2023-2024 including the 2nd 5-year global compendium
The SOCER is produced in response to several Commission resolutions requesting regular updates on the state of the world's oceans as relevant to cetaceans. The SOCER is an appendix to the SC report and available online on the IWC website.

23.1.1.7 UNFUNDED PROPOSALS

The Committee received a large number of applications to its research fund this year and proposals underwent a rigorous review process to assess a range of factors including scientific methodology, alignment of SC and Commission priorities and capacity building, in addition to value for money and timeliness. With an unknown but anticipated more limited budget than in previous years, proposals were ranked both within sub-committees and across the Committee as a whole, with highest priority given to those that were directly linked to progressing those areas of work that are critical to fulfilling the most immediate priorities such as population assessments. This ranking was done through evaluation by all Convenors, the SC Chair and the Head of Science, Conservation and Management. The following projects were not considered to directly advance the Committee's research

needs or were not considered to be of high enough priority for funding from the SC research fund in 2023-24 (see Table 38).

Table 38
Projects not approved for funding during SC68D

RP Number	Sub-committee	Project Title	2023 Budget Request £	2023 Total £	2024 Budget Request £
21	E	Climate Change Workshop Part II	42,680	**42,680**	
17	CMP	Development of GIS (meta) database on information on human activities that might have an adverse impact on SRW (JP2)	3,240	**3,240**	10,020
10	SH	Rock 'n Whales: can we detect blue and fin whale acoustic presence from a land-based seismic station in the equatorial Atlantic Ocean?	13,740	**13,740**	6,240
TOTAL			**59,660**	**59,660**	**16,260**

23.1.2 Funded proposals in previous years still ongoing

The following projects received funding and were approved by the Commission in prior years and are continuing to progress (see Table 39). The value of these projects was reviewed by the Committee and their continuation recommended. The majority of these projects were delayed or postponed due to COVID-19.

Table 39
Projects approved by the Commission in prior years that are continuing to progress

Project title	Sub-Comm	Funds to be spent in 2022 £	Funds remaining for 2023 £	Funds remaining for 2024 £
Invited Participants 2022			50,000	50,000
Amount to support Commission Recommendations			15,000	
Responding to Commission Developments			108,684	
Contingency Fund			44,848	
R67025 Pre-Meeting of the Abundance Steering Group	ASI		6,000	
R67003 Simulating Line Transect Data	ASI		750	
R67026 SWA Right Whale CMP Workshop	CMP	7,600		
R67027 CAHW CMP Workshop	CMP	11,460		
R67028 Franciscana Workshop	CMP	16,600		
R67043 Western Gray Whale CMP	CMP		10,500	
R68C002 Chile-Peru SRW CMP Workshop	CMP	8,750		
R67004 Quantitative assessment of threats to Arabian Sea humpback whales	CMP	3,641		
R67006 Population Dynamics SR Whales Peninsula Valdes	CMP	1,400		
R67009 Abundance Estimates Franciscana Buenos Aires	CMP	1,775		
R67036 ASHW Songs India	CMP		2,762	
R67037 ASHW Body Conditions & Fisheries Mapping	CMP		6,412	
R67040 Franciscana Aerial Survey	CMP		23,820	
R68C009 Chile-Peru SRW Acoustics	CMP		19,400	
R68C011 ASHW Conservation	CMP		14,845	

R66032 Strandings Emergency Response	E		9,915	
R67007 Ecosystem Functioning Workshop 2020	EM		20,550	
R66023 IA NP Humpbacks	IA		10,000	
R67013 Implementation Review NP Minke Whales	IA		15,000	
R67010 In-depth Assessment of NP Sei Whales	IA		2,500	
R67031 Computing Support to WNP Minke	IA	6,000		
R68C005 HW Tag Data Analysis	IA		9,860	
RO004 Essential Computing Support (refer to R67031 too)	IST	4,000	3,500	
R67023 Amendment of RMP Guidelines	IST		1,250	
R68C001 NA Humpback Workshop	NH		16,960	
R68C007 MEGARA 2022	NH	6,000		
RO002 POWER Cruise	SEC	39,220	16,562	
RO007 Secretariat Database Support	SEC	6,000		
R66006 JCRM SOWER	SEC			16,740
Seed Funding - Communications Small Group	SEC		15,000	
R67033 Acoustics Blue Whale Oman	SH		2,000	
R67035 Mid-Latitude Antarctic Blue Whale Acoustics	SH		1,500	
R68C003 SH Blue Whale Catalogue	SH		11,500	
R68C004 Madagascar Blue Whale Photographs	SH		400	
R68C006 SRW Australia Aerial Survey	SH	6,492		
R68C008 Antarctic BW Stock and Movement	SH		16,076	
R68C010 Blue Whale Acoustics Oman	SH		2,003	
R67041a SH Blue Whale Catalogue	SH	812		
R67041b SH Blue Whale Catalogue - Chile	SH		7,800	
R66017 Data Archiving NI Ocean Humpbacks	SH		1,875	
R66036 Development of Permanent Blue W Reference Library	SH		4,000	
R67030 Chile & Peru Whale Watching Workshop	WW		4,210	
TOTAL		**105,000**	**487,232**	**69,740**

23.1.3 Report on fund reallocations and contingencies for the Research Fund, Voluntary fund for Small Cetaceans and IWC-SORP Voluntary Fund

Table 40 shows the funds that were reallocated within the research funds at this meeting. A proportion of the Contingency Fund was reallocated as the Committee noted that it was substantially above the permitted level of 10% of research budget.

Table 40
Projects where funds were identified for reallocation during SC68D

Project Title	Reallocated £	Notes
Exploration of Survey Methods - West Australian BSD Humpbacks	(4,000)	Project paid for by Australian Government. Reallocated to 'SRW catch series, stock structure, and catch allocation review workshop'
SRW Australia Aerial Survey	(10,516)	Not all funding required due to additional funding from Australian Government. Reallocated to 'SRW catch series, stock structure, and catch allocation review workshop'
TOTAL	**(14,516)**	

Small Cetaceans Research Fund
The Voluntary Fund for Small Cetacean Conservation Research currently stands at £86,839, of which £41,215 is unallocated. Since April 2021, the Small Cetaceans Fund gratefully received voluntary contributions totalling £16,741 from the Government of the Netherlands, Animal Welfare Institute, Campaign Whale, Cetacean Society International, Dolphin Connection, Humane Society International, LegSeas, Natural Resource Defence Council, OceanCare, ProWildlife and Whaleman Foundation.

At its Virtual Special Meeting in 2021 (Link), the Commission approved the funding of five new projects, which are all progressing as expected. Annual, interim reports will be reviewed by the Committee at its meetings, with final reports expected 2022-26.

Southern Ocean Research Partnership Fund
The Committee was updated on the progress of projects funded through the Southern Ocean Research Partnership (SORP; SC/68D/SH/08). Despite the challenges of COVID-19 and consequent unavoidable delays, significant progress had still been made in delivering these projects. No new allocations of funding were made for 2022 or 2023. £24,844 remains unallocated in the SORP Fund.

Contributions to the IWC Small Cetaceans Fund, SORP Fund and other voluntary funds are welcomed.

24. COMMITTEE PRIORITIES FOR THE BIENNIUM 2023-24 AND INITIAL AGENDA FOR 2023

Each sub-group developed their priorities and work plan for 2023-24 (see relevant sections of this report). Those work plans will be used by the Chair and Vice-Chair to develop a draft agenda for the next Scientific Committee meeting to present to the Commission at IWC68 for their review and endorsement.

25. WORKING METHODS OF THE COMMITTEE

25.1 Updates on Rules of Procedure and Handbook of the Scientific Committee At IWC67

The Commission requested the Committee regularly revise and update their Rules of Procedure (RoP) and Handbook. In light of the potential changes to the SC meetings' structure outlined in the Budgetary Sub-Committee options the SC handbook revision has been paused. Once Commission has made a decision and the implications for the Committee's working methods are fully understood the SC Chairs and the Secretariat will review, revise, and update the handbook for consideration by the Committee. Once endorsed by the Committee, the revised documents will be presented to Commission consideration and endorsement. The Chair notes that some Committee members may be contacted for advice and input on these revisions. Committee members are encouraged to raise questions or offer comments regarding the Handbook but should first contact the Chair and Vice-Chair prior to fully developing proposed revisions.

25.2 Reporting to the Commission and related matters

The Committee's report for SC68D will be made available to the Commission and the public as soon as possible following the completion of the meeting. The Commission has directed the Committee to complete the final Scientific Committee Report draft report within 21 days of the meeting closing. The Heads of Delegation will review, revise as necessary, and endorse the 2022 Committee report by correspondence. The final draft of the Committee's report will be available in time for the 60 day submission deadline for IWC68. Given the two year postponement of IWC68 the Committee's work from four years: 2019, 2020, 2021 and 2022 will need to be presented. The ex-Chair Suydam, current Chair, and vice-Chair will work with the Secretariat and Conveners to provide an appropriate summary under these challenging circumstances.

Double presented a proposal for communicating the work of the Scientific Committee at IWC69 and beyond. The objective of this initiative is to develop new communications tools and material tailored to a non-technical audience, primarily IWC commissioners. The proposal was developed by a small steering group comprising incoming and outgoing SC leadership and members of the Scientific Committee and Secretariat. Double stressed the importance of transparency, balance and inclusivity, and proposed a process for selecting content through the existing network of SC convenors, noting that final decisions rest with the Chair and Vice Chair of the Scientific Committee.

The principal opportunity for engaging with the Commission is the biennial meeting, and the communications tools proposed are: a new, image-rich and succinct summary document to be circulated one month prior to Commission meetings; an audio-visual presentation delivered at plenary; a series of summary factsheets and a 'science hub' staffed in-person and remotely, answering questions and displaying information about the work of

the Committee.

The challenges of COVID-19 and the unprecedented four-year intersessional period have dictated that the Communications Initiative begins at IWC69 and the SC will take the opportunity at IWC68 to outline the proposal and seek feedback from the Commission on whether this approach will best meet their requirements.

It was proposed that the unspent seed funding should be carried over to the 23-24 biennium. As some of this fund may be used in support of the SC presentation at IWC68, an additional budgetary request of £7.5k was proposed to ensure enough funds remained to deliver the proposed outputs of the Communication Initiative at IWC69.

The initiative was welcomed and its importance recognised. Double was thanked for his presentation and work invested to date. In discussion, it was noted that the proposed topic selection criteria might be too broad in some places and too restrictive in others, and could risk disadvantaging SC groups whose critical work is long-term and ongoing. More leeway on the number of topics put forward was suggested for groups with larger agendas. Consultation between convenors and their sub-committees was suggested as a transparent method of selecting topics.

More information was sought on the role and composition of the steering group and the extent to which they might filter information between the Committee and the Commission. Perception of bias amongst steering group members was raised as a concern and widening the membership to include convenors was also suggested. Double stressed that the role of the steering group is to develop and support the initiative and to provide guidance on effective communication material but, importantly, the role of this group is not to filter or select content. This point will be made clearer in future iterations of the Initiative documentation and in Terms of Reference for the Steering Group. Membership of the steering group may change, rotate or expand when the initiative reaches its implementation phase.

The previous 2 year summary reports of the Scientific Committee and revised method for producing recommendations were also highlighted as useful examples.

Further consideration was requested on what actions the Scientific Committee is asking Commission to take in response to the information provided. It was suggested that the group should consult some Commissioners for their views on reverting to the previous approach to plenary, where Scientific Committee presentations were provided for each agenda item, rather than at the beginning of the session. Circulation of factsheets on a monthly basis was proposed, to avoid information-overload prior to Commission and allow time for further enquiry and dialogue.

It was agreed that all feedback would be carefully assessed and additional comments sought from the SC members who also attend Commission. The aim being to refine and submit the proposal to the Finance & Administration Committee of the Commission at IWC68 and gaining a clear mandate to proceed and launch the Communications Initiative at IWC69.

25.3 Capacity building and succession plan for Scientific Committee

The Committee continues to pursue and enhance a succession plan. For example, the work of Punt continues to be followed by Wilberg as part of ensuring ongoing modelling expertise within the Committee. On 31 March 2022, after more than 37 years with the IWC Secretariat, Cherry Allison retired from the Secretariat. The Committee expresses deep appreciation for the many decades of guidance, analyses and advice provided by Allison to the work of the Committee. The Committee is also grateful that Allison will continue to work with the Committee as an independent scientist and IP. An intersessional Small Group comprised of Secretariat and Committee representatives was formed after SC68C to continue planning for succession of the programming and implementation of population models, within both the Committee and the Secretariat (Annex M). A recruitment panel composed of representatives from the Secretariat as well as one representative from the Intersessional Small Group conducted a recruitment process to find a new Lead for Modelling and Statistics. Isidora Katara was hired in March 2022 and is now working full time for the Secretariat. Isidora is a marine biologist with twenty years of experience in multi-disciplinary research topics related to the sustainable use of aquatic resources and ecosystems. She has an interest in biostatistics, modelling and bioinformatics. Her work has focused on developing the evidence base for policy, management and conservation and includes conducting research for governmental institutes, participating in RFMOs and collaborating with international organisations. The Committee welcomes Isidora and looks forward to working with her in the future.

25.4 Update on Data Availability requests and consideration of potential updates/clarifications

The Data Availability Group (DAG) oversees the data request procedures outlined in the IWC Data Availability Agreement (DAA). The rules for data availability, summary lists of the available data, protocols for data access, agreement forms and contact points can be found on the IWC website. The databases maintained by the IWC can become available to researchers depending on agreed access rules, relevant procedures, and levels of IWC support. The process of reviewing the governance and management of databases is ongoing and focuses on data accessibility of databases with different levels of IWC support.

25.5 Committee involvement in the IWC Database of Recommendations

The Secretariat has, after extensive work, made the DoR available online[39]. A summary of historical records for Commission, SC and CC meetings is presented in SC/68D/GDR/01. Bulk upload via an Excel spreadsheet template has also been designed to assist data entry. Improvements to, and population of, the database will continue to progress intersessionally and Resolutions and Recommendations from workshops will now be prioritised for back entry. The Secretariat provided an extract of recommendations from 2020 and 2021 for each Sub-Committee so that Convenors would be able to review these during the meeting to track progress and plan next steps. Convenors were also asked to update progress on their recommendations to feed back into and update the database.

25.6 Governance Review

The IWC's Working Group on Operational Effectiveness (WG-OE) has been leading the Commission through a process to review the recommendations from the Independent Panel report that launched the Governance Review in 2018. The WG-OE is a sub-committee of the Finance and Administration Committee and is open to all contracting governments and observers. A series of workshops, in-person and virtual, have been held over the past three years; several drafting groups have produced documents that propose changes to the structure of the Commission and either new or revised Rules of Procedure and Terms of Reference. The four primary papers are as follows:

(1) potential reforms to Commission structure and meeting operations;

(2) potential 'low-hanging fruit' items, including those relating to the Rules of Procedure;

(3) IWC Strategic Principles and Terms of Reference for Working Group on Strategic Plan; and

(4) budget reform strategy.

The original mandate of the WG-OE has expanded to include the preparation of a 5th paper regarding the current Rules of Procedure (RoP) for payment of annual contributions. The WG-OE was tasked at the Virtual Special Meeting of the Commission in September 2021 to consider possible modification to the penalties for late payment of contributions (e.g., suspension of voting rights).

After having planned to meet in person in the margins of the SC meeting, the WG-OE is now planning a virtual WG-OE meeting in July 2022 (specific date TBD). In addition, an in-person meeting will be held during the pre-meeting days in the lead up to IWC68 in October. The proposed WG-OE papers will be submitted to the IWC Secretariat on 8 August 2022 for translation and preparation for posting within the 60-day deadline of 18 August 2022.

25.7 Joint Conservation Committee-Scientific Committee Working Group

The Joint Working Group (WG) of the Conservation and Scientific Committees first met in 2015. The overall aim of the group is collaboration: collating and prioritising the conservation recommendations of the two groups and developing effective strategies to communicate and implement them. Since its first meeting, the WG has attempted to meet each year, either in-person or virtually, and usually shortly after the meeting of the Scientific Committee. The WG did not meet in 2019 or 2020. Regular meetings ensure the latest research and advice of the Scientific Committee can be considered by the WG. Meeting reports of the WG are available on the IWC website.

A key output of the WG is the Database of Recommendations (DoR). The DoR was developed in order to aid collaboration between the two committees, but its potential wider benefits were quickly identified. It now holds recommendations of the Commission and all its sub-groups including legally binding Schedule Amendments, Resolutions and recommendations agreed at sub-group meetings and workshops (Database of Recommendations.)

[39] **https://recommendations.iwc.int/**

Terms of reference for the WG were revised in 2021 and a small intersessional group was formed to design a process for helping Commission prioritise conservation issues. An update of this work will be presented to the WG's forthcoming meeting.

This year's joint CC/SC meeting is anticipated for July 2022.

26. PUBLICATIONS

The Journal of Cetacean Research and Management (JCRM) is the IWC's peer-reviewed scientific journal. The IWC Secretariat's Head of Science, Conservation and Management is its Editor and the Editorial Board is comprised of members of the Committee. Recognising that the vast majority of readers now access JCRM digitally, and to search for specific papers, topics or authors. The new page layouts maximise clarity and make pages easier to read on-screen. Volume 22 was published at the end of 2021 with 11 scientific papers and was the first volume to be published in our new style. Recently, the team introduced new initiatives to streamline the submission and review process and this has been proving a successful move. The Journal is now accessible from the IWC website and is free to access and download. JCRM's visibility is much improved with the introduction of Digital Object Identifiers (DOIs). A digital repository known as LOCKSS is also now used to 'future-proof' articles, ensuring every paper published is conserved independently of either JCRM or the IWC. Work continues on raising the profile of JCRM, mainly via the IWC website and social media. Management of the JCRM is done in-house by the Secretariat and the Editorial Board volunteer their time, thus there are negligible costs to the IWC. Volume 23 of the JCRM is well underway and five papers are now available on the website. The Editorial Board are sad to announce that Jen Jackson will be stepping down as a section Editor. The Board would like to thank her for fantastic help and wish her all the best. The Board hopes to invite a new candidate to join the team. As always, tremendous thanks is given to the Editorial team for their tireless work and to all the expert reviewers who have helped to ensure the Journal maintained its rigorous scientific standards. An appeal is made, as always, for SC members to consider reviewing manuscripts to support the work of the Journal. The IDCR/SOWER Cruises and RMP commemorative special issues of JCRM are being reviewed by the Editorial Board and options are being considered on ways this work can be progressed.

The Report of the Scientific Committee meeting (and intersessional workshops) is published annually as a Supplement to JCRM and the report of the 2021 Committee meeting (SC68C) held virtually will be available here.

27. ADOPTION OF REPORT

The report was adopted by correspondence on 27 June 2021.

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