

Agenda Item 7.1

Cooperation with other Bodies

Report by the Secretariat, Parties and
Partners

Information Document 7.1b

Report of the IWC Scientific Committee
(SC/68a)

Action Requested

Take note

Submitted by

International Whaling Commission



Note:

Delegates are kindly reminded to bring their own document copies to the meeting, if needed.

Report of the IWC Scientific Committee

Nairobi, Kenya, 10-23 May 2019

**This report is presented as it was at SC/68A
There may be further editorial changes (e.g. updated references, tables,
figures) made before publication. Page 81, para 7, last line, revised.**

**International Whaling Commission
Nairobi, Kenya, 2019**

Report of the Scientific Committee

Contents

1. INTRODUCTORY ITEMS.....	4
2. ADOPTION OF AGENDA.....	6
3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS.....	6
4. COOPERATION WITH OTHER ORGANISATIONS.....	7
5. GENERAL ASSESSMENT AND MODELLING ISSUES (and see Annex D).....	13
6. RMP <i>IMPLEMENTATION</i> -RELATED MATTERS (And see Annex D).....	14
6.1 Completion of the <i>Implementation Review</i> of western North Pacific Bryde’s whales.....	14
6.2 <i>Implementation Review</i> of western North Pacific common minke whales.....	17
6.3 Workplan.....	18
7. AWMP <i>IMPLEMENTATION</i> -RELATED MATTERS (And see Annex D).....	18
7.1 <i>SLA</i> development for the common minke whales off East Greenland.....	18
7.2 Progress with testing the remaining carryover and interim relief allocation provisions for some <i>SLAs</i> and consequent updates to the Aboriginal Whaling Scheme (AWS).....	19
7.3 Preparation for 2020 <i>Implementation Review</i> for North Pacific gray whales.....	19
7.4 Workplan.....	20
8. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING (ASW).....	20
8.1 New information and progress on recommendations.....	20
8.1.1 Bering-Chukchi-Beaufort Seas bowhead whales.....	20
8.1.2 Eastern Canada/West Greenland bowhead whales.....	21
8.1.3 North Pacific Gray whales.....	21
8.1.4 Common minke whales off East Greenland.....	21
8.1.5 Common minke whales off West Greenland.....	21
8.1.6 Fin whales off West Greenland.....	21
8.1.7 Humpback whales off West Greenland.....	21
8.1.8 Humpback whales off St. Vincent and the Grenadines.....	21
8.2 Progress with previous recommendations.....	21
8.3 Workplan.....	21
9. WHALE STOCKS NOT SUBJECT TO DIRECTED TAKES.....	21
9.1 Comprehensive or In-depth Assessments.....	21
9.1.1 Comprehensive Assessment of North Pacific humpback whales.....	22
9.1.2 Comprehensive Assessment of North Pacific sei whales.....	23
9.1.3 Workplan.....	23
9.2 Potential new assessments: progress on recommendations and workplan.....	24
9.2.1 Non-Antarctic Southern Hemisphere blue whales.....	24
9.2.2 Antarctic blue whales.....	25
9.2.3 Southern Hemisphere fin whales.....	26
9.2.4 Southern right whales not the subject of CMPs.....	27
9.2.5 North Pacific blue whales.....	29
9.2.6 North Atlantic sei whales.....	29
9.2.7 North Atlantic right whales.....	29
9.2.8 North Pacific right whales.....	30
9.2.9 North Atlantic humpback whales.....	30
9.3 New information and workplan for other northern stocks.....	31
9.3.1 Gulf of Mexico Bryde's whales.....	31
9.3.2 North Pacific fin whales.....	31
9.3.3 Workplan.....	31
9.4 New information and workplan for other Southern Hemisphere stocks.....	32
9.4.1 Southern Hemisphere humpback whales.....	32
9.4.2 Other species if new information is presented.....	32
10. STOCKS THAT ARE OR HAVE BEEN SUGGESTED TO BE THE SUBJECT OF CONSERVATION MANAGEMENT PLANS (CMP).....	32
10.1 Stocks with existing CMPs: new information and progress with past recommendations.....	33
10.1.1 SE Pacific southern right whales.....	33
10.1.2 SW Atlantic southern right whales.....	33
10.1.3 North Pacific gray whales.....	33
10.1.4 Plans to address Franciscana in 2020.....	35
10.2 Progress with identified priorities.....	35

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

10.2.1 Humpback whales (and other species) in the northern Indian Ocean including the Arabian Sea.....	35
10.2.2 Mediterranean fin whales.....	36
10.2.3 Mediterranean sperm whales	36
10.2.4 Amazon River Dolphins	37
10.4 High priority CMP candidates.....	37
10.4.1. Central American humpback whales	37
10.5 Workplan.....	37
11. STOCK DEFINITION AND DNA TESTING.....	37
11.1 Advice on stock structure to other sub-groups	38
11.2 New genetic (and other) methods for species, stocks and individual identification	39
11.3 IWC DNA data quality and genetic analyses guidelines (and see Annex I, item 3).....	39
11.4 Reference databases and standards for diagnostic DNA registries.....	40
11.5 Other matters.....	40
11.5 Workplan.....	41
12. CETACEAN ABUNDANCE ESTIMATES AND STOCK STATUS.....	41
12.1 Summary of abundance estimates and update of IWC consolidated table.....	42
12.2 Methodological issues	42
12.3 Consideration of the status of stocks	43
12.4 Workplan 2020.....	44
13. BYCATCH AND ENTANGLEMENTS	44
13.1 Progress with the IWC Bycatch Mitigation Initiative.....	44
13.2 Review new methods and estimates of entanglement rates, risks and mortality (large whales)	45
13.3 Mitigation measures for preventing large whale entanglement.....	45
13.4 Review new methods and estimates of bycatch rates, risks and mortality (small cetaceans)	45
13.4.1 EU Regulations and directives.....	45
13.4.2 Common dolphins in the Bay of Biscay.....	46
13.4.3 Mitigation in tuna gillnet fisheries that operate out Karachi, Pakistan.....	47
13.4.4 Shark nets and mitigation and monitoring in South Africa	47
13.4.5 Bycatch in Ecuadorian waters.....	48
13.4.6 Consideration of ‘rapid risk assessment’ tools.....	48
13.4.7 Consideration of remote electronic monitoring and vessel tracking	48
13.4.8 Hector’s and Māui dolphins in New Zealand: consideration of spatial risk assessment of threats.....	48
13.5 Scientific aspects of mitigation measures for small cetaceans.....	49
13.6 Review of information in National Progress reports on bycatch and entanglement	49
13.7 Workplan.....	50
14. SHIP STRIKES	50
14.1 Review new methods and estimates of rates of ship strikes, risk of ship strikes and mortality (including review progress on the IWC ship strikes database).....	50
14.2 Mitigation of ship strikes in high risk areas.....	50
14.3 Cooperation with [other organisations including] IMO Secretariat and relevant IMO committees	52
14.4 Workplan.....	53
15. Environmental concerns	53
15.1 Pollution (and see Annex K, Item 2)	53
15.2 Diseases of concern (and see Annex K, item 3)	54
15.3 Strandings and mortality events (and see Annex K, Item 4)	55
15.4 Noise	56
15.5 Update on other standing topics and previous recommendations.....	56
15.5.1 Marine debris.....	56
15.5.2 Climate change	57
15.5.3 State of the Cetacean Environment Report (SOCER).....	57
15.6 Other related information	57
15.7 Work plan.....	57
16. ECOSYSTEM MODELLING.....	58
16.1 Cooperation with CCAMLR on multi-species modelling including progress with workshop(s)	58
16.2 Progress on species distribution models (SDMs) and ensemble averaging, including preparation of guidelines.....	58
16.3 Modelling of competition among whales including progress with IBEMs	58
16.4 Standing topics	58
16.4.1 Effects of long-term environmental variability on whale populations	58
16.4.2 Review the information on krill distribution and abundance from NEWREP-A	58
16.4.3 Modelling of relationship between whales and prey.....	58
16.4.4 Body condition analyses	59
16.4.5 Progress with workshop on Cetacean and Ecosystem Functioning.....	59
16.5 Progress on previous recommendations	59
16.6 Workplan.....	60
17. SMALL CETACEANS (and see Annex M).....	60
17.1 Review of small cetaceans of Africa	60
17.1.1 Tackling Data Gaps Through Rapid Assessment and Collaborative Efforts with a focus on Sousa	60
17.1.2 Angola, Democratic Republic of Congo, Equatorial Guinea, Gabon, Republic of Congo, and São Tomé and Príncipe...61	
17.1.3 Liberia.....	61

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

17.1.4 Madagascar	61
17.1.5 Kenya	61
17.2 Poorly documented takes for food, bait or cash and changing pattern of use	61
17.3 Updates from intersessional groups including small cetaceans task team	62
17.4 Review of takes of small cetaceans	62
17.5 Status of The Voluntary Fund for Small Cetacean Conservation Research	63
17.6 Progress on previous recommendations	63
17.6.1 Vaquita: Update on CIRVA Progress	63
17.6.2 Maui’s and Hector’s Dolphins	65
17.6.3 International Workshop on the Status of Harbour Porpoises in the North Atlantic	65
17.7 Work plan and budget requests	66
18 Whalewatching	66
18.1 Assess the impacts of whale watching on cetaceans (see Annex N)	66
18.2 Platforms of opportunity and citizen science	67
18.3 Whale watching locations of interest	68
18.4 Whale Watching Handbook	69
18.5 Update of the whale watching guiding principles	70
18.6 Review progress on scientific recommendations	70
18.7 Other matters	71
18.7.1 Communication with the Conservation Committee	71
18.8 Work plan	71
19. SPECIAL PERMITS	71
19.1 NEWREP-A	71
19.2 NEWREP-NP	72
19.3 JARPN II consolidated report	72
20. WHALE SANCTUARIES	73
21. WORKSHOP ON CETACEAN TAG DEVELOPMENT AND GUIDELINES FOR TAGGING BEST PRACTICES	74
22. IWC LIST OF RECOGNISED SPECIES	75
23. IWC DATABASES AND CATALOGUES	75
24. IWC MULTINATIONAL RESEARCH PROGRAMMES AND NATIONAL RESEARCH CRUISES THAT REQUIRE IWC ENDORSEMENT	76
25. SCIENTIFIC COMMITTEE BUDGET FOR THE CURRENT BIENNIUM	78
26. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR 2020	83
27. WORKING METHODS OF THE COMMITTEE	83
27.1 Updates on Rules of Procedure of the Scientific Committee and working methods	83
27.2 Biennial reporting and related matters including development of the budget in light of the timing of the Commission’s financial year and longer-term planning	83
27.3 Succession plan for key Scientific Committee experts	83
27.4 Update on data availability requests and consideration of potential updates/clarifications	83
27.5 Committee use of the IWC recommendations database of recommendations	84
27.6 Matters related to ‘Annex P’	85
27.7 Matters related to the ‘Governance Review’	85
27.8 Implications to the SC of Japan's Withdrawal from the IWC	85
27.9 Workplan	87
28. PUBLICATIONS	87
29. ELECTION OF OFFICERS	88
30. ADOPTION OF REPORT	88

The meeting (SC/68A) was held at the Safari Park Hotel, Nairobi, Kenya, from 10-23 May 2019 and was chaired by Robert Suydam, Chair of the Scientific Committee. The next meeting (SC/68B) will be held from 12-25 May 2020 in Cambridge, UK. The next meeting of the Commission will be held from 25 September-2 October 2020 in Portoroz, Slovenia. The list of participants to SC68A is given as Annex A (about 33% of the Contracting Governments were represented by delegates).

1. INTRODUCTORY ITEMS

1.1 Chair's welcome and opening remarks

Suydam welcomed the participants to the meeting. He thanked Kenya for hosting the meeting in such a beautiful location. The Chair also expressed gratitude to the members of the Secretariat for their preparations for this meeting and for their work during the intersessional period.

The Director of Administration for Fisheries, Dr. Harun Khator, provided welcoming remarks on behalf of the government of Kenya. He noted Kenya's many efforts to combat illegal fishing in its Exclusive Economic Zone, Kenya's growing role in marine research and that marine mammals are protected in Kenya. Kenya is a land of safari and large game and thus urged the participants to take part in some of the wildlife viewing opportunities in Kenya. He wished the participants fruitful deliberations and a productive meeting.

IWC Executive Secretary Rebecca Lent thanked the Kenyan Fisheries Director for his words of welcome and added her voice to the welcome for the many delegates. She noted the importance of the Governance process (IWC,2019 pp78-79) and the workshop of the Commission's Working Group on Operational Effectiveness (WGOE) to be held 17-18 July 2019 in London. The Committee will be represented by its Chair and the Executive Secretary urged participants to provide the Chair with any views they wish to be taken to this Workshop.

Following a round of introductions, the Chair noted that a few delegations would not be able to attend this year's SC meeting, and asked that the participants be cognisant of this and make appropriate arrangements given these absences. Some agenda items may need to be postponed until the 2020 meeting.

The Chair then turned to remembrances for scientists who passed away in the previous year:

(1) John Bannister was remembered with remarks from Brownell. John was truly a giant of the Committee, making significant contributions over 50 years - he is the only person to have chaired the Committee twice. He began his whale career as an inspector on British whaling expeditions, moving to Australia in 1967, first as Curator of Mammals at the Western Australian Museum, and then as Director from 1975 until 1992. His contributions to the science of the great whales were immense, in particular on long-term research on humpback, blue and Southern right whales. John's chairing skills were exceptional even, perhaps especially, for topics outside his areas of expertise. He was renowned for his combination of firmness and good humour. He was especially a champion of the Scientific Committee dinner and his renditions of Australian jokes became legendary – even telling his famous 'dunny' joke remotely at one dinner he was unable to attend. The Committee is a poorer place without his skill, humour and enthusiasm.

(2) Zerbini provided a remembrance of Pablo Bordino, an Argentinian scientist who was a champion for franciscana conservation. He received the Whitley award in 2001 and the WildInvest Continuation Award for Conservation of Nature in 2002. Pablo's work was supported by several global organisations. He was a sailor and an anthropologist who worked closely with the coastal communities as an integral part of his work, which included the use of alternative fishing gear and acoustic alarms to minimise cetacean bycatch

(3) Simmonds provided a few words about Joanna (Jo) Toole who was a victim of the tragic Ethiopian Airline flight 302 crash, in which many Kenyans and other UN staff also lost their lives. Jo was remembered as a colleague and a friend, working early in her career for World Animal Protection and Ocean Care. Jo was co-founder of the Global Ghost Gear initiative and worked more generally on marine debris and whale conservation. She attended many IWC meetings, and her last contribution was to the development of the FAO Gear Marking Guidelines. Jo's positive and dedicated attitude to addressing such important and complex conservation issues is one we should all continue, as we celebrate what she achieved in her too-short life.

(4) Suydam recognised Robert (Bob) Elsner, who passed away at almost 99 years old. While Bob never attended an SC meeting, he inspired many of the scientists involved in SC through his work on diving physiology. He lived in Alaska for many years and conducted research in the Arctic, Antarctic and many places in between. Robert relayed that once while Bob was in the Antarctic, he became lost for 24 hrs and was stranded in a blizzard. Bob stayed calm and built an emergency shelter from his snowmobile and so was able to survive. In addition to contributions to science, Bob was cheerful, supportive of others, and was the essence of a scholar and a gentleman.

(5) The Chair then remembered Lloyd Lowry, whose contributions to the Committee related to his work on the biology and of white whales and on co-management with subsistence hunters in Alaska. He and his wife Kathy Frost worked closely together and published extensively and were Charter members and founders of the Alaska Beluga Whale

Committee. Lloyd and Kathy were also commercial fishers, and Kathy won the World Women's sprint sled dog championship races 9 times with Lloyd's support. They showed unparalleled hospitality, opening their minds and hearts to everyone. During his retirement years Lloyd, worked assiduously to assist the Specialist Groups of the IUCN Species Survival Commission in their efforts to ensure that Red List assessments of the pinnipeds and cetaceans were complete and up to date.

The Chair noted that for all of us, our contributions would not be possible without a huge amount of support from those we often leave at home.

(6) Zerbini provided a remembrance of Gretchen Steiger who died just a month before the SC meeting. Gretchen was an integral part of the Cascadia Research Collective. Her initial years included work as an observer on Russian fishing boats and surveying wildlife on islands while working solo in the field. She was an avid rower and contributed to community rowing programs. Gretchen is survived by her husband, John Calambokidis, another SC collaborator.

(7) Finally, Cherry Allison provided the remembrance for Jette Donovan Jensen, wife of the IWC Secretariat's Head of Science, Greg Donovan. Jette died on 14 April and Greg would arrive in Kenya only at the start of the sub-committee week. In the 1990s, Jette worked for several years on whales at the then Greenland Fisheries Research Institute before becoming the Executive Secretary to ASCOBANS; in both capacities she attended several Committee and Commission meetings. When ASCOBANS relocated to Bonn, Jette returned to Denmark in an administrative role in a University environment working on various aspects of fisheries and the environment. The AWMP group, in particular, remember Jette with special fondness as she supported the logistics of the meetings when they met in Copenhagen, finding exciting places to eat (including the Parliament) and relax after the challenging work days, stimulating the atmosphere of co-operation. She enthused all with her smiles, enthusiasm and love of the local lore and history. Jette was interested in everyone and everything, living life to the full and encouraging all around her to do the same and never losing her love for Greenland. She trained herself to open champagne bottles with a sword, stressing that this required extensive practice – and of course that provided a great excuse to share and drink the 'bubbles' afterwards. Greg's contributions to the IWC and cetacean conservation could not have been achieved without her love and support.

Following these remembrances, the Chair asked that the delegates stand and applaud in celebration of these people who lived such rich and full lives and contributed so much to the work of the Committee and to cetacean science and conservation.

1.2 Appointment of rapporteurs

Jones, Donovan and Lent of the Secretariat were appointed rapporteurs and were assisted by various members of the Committee as appropriate. Chairs of sub-committees and Working Groups appointed rapporteurs for their meetings.

1.3 Meeting procedures and time schedule

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

Allison of the Secretariat provided background for first-time participants on the operations of the Committee, its many subgroups and specific ways of conducting business. The Chair invited new people to ask experienced members any questions about the operation of the Committee.

1.4 Establishment of sub-committees and Working Groups

The following pre-meetings were held:

(1) Bycatch Workshop under the Bycatch Mitigation Initiative on 8-9 May, which was discussed in the Working Group on Non-Deliberate Human-Induced Mortality of Cetaceans

(2) Wild Aquatic Meat with a focus on West Africa on 7-9 May, which was discussed in the sub-committee on Small Cetaceans; and

(3) Standing Working Group on Abundance Estimates, Stock Status and International Cruises on 8-9 May.

The results of these pre-meetings were either included in the relevant Annexes (see below) or as standalone reports.

Annex D	Sub-committee on <i>Implementation Reviews and Simulation Trials</i>
Annex E	Sub-committee on Aboriginal Subsistence Whaling
Annex F	Sub-committee on In-Depth Assessments
Annex G	Sub-committee on Northern Hemisphere Whale Stocks
Annex H	Sub-committee on other Southern Hemisphere Whale Stocks
Annex I	Working Group on Stock Definition and DNA Techniques
Annex J	Working Group on Non-Deliberate Human-Induced Mortality of Cetaceans
Annex K	Standing Working Group on Environmental Concerns

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

Annex L	Working Group on Ecosystem Modelling Approaches
Annex M	Sub-committee on Small Cetaceans
Annex N	Sub-committee on Whale Watching
Annex O	Sub-committee on Conservations Management Plans
Annex P	Committee Procedures for Submission, Review and Validation of Abundance Estimates
Annex Q	Standing Working Group on Abundance Estimates, Stock Status and International Cruises
Annex R	<i>Ad hoc</i> Working Group on Sanctuaries
Annex S	Scientific Committee Use of the IWC Database of Recommendations
Annex T	Intersessional Correspondence Groups
Annex U	Statement regarding Japan's Withdrawal from IWC
Annex V	Statements on the Agenda

The Chair emphasised that the Special Permit (SP) group's meeting will be shorter this year and be eliminated next year because of Japan's withdrawal as an IWC Contracting Government (and see Item 27.8). Any future documents arising out of the analyses of data from special permit catches will be discussed in relevant sub-groups. The *ad hoc* Working Groups on Databases and photo-ID related matters will not meet due to the absence of the Convenor and many of the participants but they will resume work in 2020.

The Chair announced two new sub-committees:

- (1) sub-committee on *Implementation Reviews* and *Simulation Trials*, which includes the work of the former sub-committee on the RMP and future quantitative aspects of the work of the former SWG on the AWMP (including *Implementation Reviews*); and
- (2) sub-committee on Aboriginal Subsistence Whaling will review catch data and new information on stocks subject to aboriginal hunts.

1.5 Computing arrangements

Allison outlined the computing and printing facilities available for delegate use. The Chair noted that given the transition to paperless meetings, including the Supplement for the 2018 SC report, this agenda item will not be included next year.

2. ADOPTION OF AGENDA

The adopted Agenda is given as Annex B.

Japan drew attention to its position in relation to specific topics on the agenda, notably small cetaceans, whale watching and CMPs. Although Japan did not block the adoption of the agenda, it registered its objection. Norway and Iceland also asked that their statements opposing the same topics be attached to the SC report. Those statements can be found in Annex V. Also, Japan drew attention on the issue relating to the DNA registration and submitted a statement thereon jointly prepared with Iceland and Norway. Norway, also on behalf of Iceland that is absent from the Committee this year, associated themselves with Japan on this issue. The joint statement can be found in Annex V.

The Commissioner from Japan also provided an opening statement (Annex U) addressing Japan's withdrawal from the IWC and its intention to continue to cooperate and contribute to the SC through participation in the Committee as an observer.

The Chair thanked Japan for its statement clarifying the situation of its withdrawal as well as for its involvement and contribution to the Committee over many years. This matter is considered under Item 27.8 below.

3. REVIEW OF AVAILABLE DATA, DOCUMENTS AND REPORTS

3.1 Documents submitted

The documents available are listed in Annex C. As agreed at the 2012 Annual Meeting, primary papers were only available at the meeting in electronic format. A total of 141 primary papers and 4 intersessional meeting reports were available.

3.2 National Progress Reports on research

All member nations are urged by the Commission to provide Progress Reports to the Scientific Committee. The National Progress Reports have their origin in Article VIII paragraph 3 of the Convention and Scientific Committee Rule of Procedure E.1. Summary details of the individual country data uploaded this year to the database were made available to the Committee as documents SC/68A/ProgRep/01-13.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

As agreed at the 2012 Annual Meeting (IWC, 2013), all National Progress Reports were submitted electronically through the IWC National Progress Reports data portal. The Secretariat reported that it had received 13 National Progress Reports this year (Argentina, Australia, Denmark, Italy, Japan, Mexico, Netherlands, New Zealand, Panama, Rep of Korea, Spain, UK, USA), which is a down from the 18 received in 2018.

3.3 Data collection, storage and manipulation

3.3.1 Catch data and other statistical material

Table 1 lists data received by the Secretariat since the 2018 meeting.

3.3.2 Progress of data coding projects and computing tasks

Allison reported that a new version of the IWC catch databases is due for release in summer 2019 and will include data received for the 2017 and 2018 seasons. The previous version of the database is available on request.

Programming work has concentrated on completion of the *Implementation Review* trials for North Pacific Bryde's whales (see Item 6.1) and development of the *Implementation Review* trials for North Pacific minke whales (see Item 6.2). Work is described under the relevant sub-committee items.

Table 1
List of data and programs received by the IWC Secretariat since the 2018 meeting.

Date	From	IWC reference	Details
Catch data from the 2018 and 2018/19 season:			
23-04-19	Japan: Y. Morita	E135 Cat2018	Individual data for Japan's catches in 2018 in the N. Pacific (JARPN II) & 2018/9 in the Antarctic.
03-05-19	Iceland: G. Vikingsson	E135 Cat2018	Individual records of fin and minke whales caught by Iceland 2018
04-05-19	USA: R. Suydam	E135 Cat2018	Individual records from the USA aboriginal bowhead hunt in 2018 off Alaska
07-05-19	Norway: N. Øien	E135 Cat2018	Individual records from the 2018 commercial catch of minke whales by Norway. Access restricted (specified 14-11-2000).
17-05-19	Russia: D. Litovka	E135 Cat2018	Individual data from the Russia aboriginal hunt in 2018
17-05-19	St Vincent & G: Cruickshank-Howard	J.E135 Cat2018	Individual records from the St Vincent and the Grenadines' aboriginal hunt 2018-9
08-04-19	Canada: S. Reinhart	E135 Cat2018	Details of the Canadian bowhead harvest for the 2015-8 seasons and some information on the 2019 quota
Catch data from previous seasons:			
28-02-19	Japan: M. Goto	E134	A summary of bycatches by sub-area off Japan 2001-2016 (update to numbers in Progress Reports) together with individual records. Update on no. of set nets in operation around the coast of Japan by sub-area 1979-2016 and data collected by the Japan coast guard showing times of year that the nets were in operation
29-03-19	Korea: H.W. Kim	E134	Individual records of bycatches off Korea 1996-2017
Sightings data			
21-11-18	Japan: K. Matsuoka	HD	2018 POWER sightings cruise photographs
05-12-18	Japan: K. Matsuoka	E133	2018 POWER sightings cruise data (including videos & copies of the record sheets)
06-05-19	Japan: K. Matsuoka	E131	Data from the 2018 NEWREP-NP and 2018/19 NEWREP-A dedicated sighting surveys: (weather, effort, sighting and distance & angle experiment records plus resighting records from the NEWREP-A survey).

4. COOPERATION WITH OTHER ORGANISATIONS

SC/68A/02 provides an overview of progress made by the Secretariat, in collaboration with members of the Scientific Committee and Conservation Committee, on cooperation with other organisations since IWC67. At IWC67 the Commission endorsed several recommendations for strengthening engagement with other organisations, following recommendations made by the Scientific Committee, Conservation Committee and other subgroups as well as proposals in an update paper from the Secretariat (IWC/67/19). This Committee's work over many years has shown that anthropogenic threats to cetaceans other than hunting are a growing concern for the conservation and recovery of marine mammals under the IWC's mandate. Whilst the Committee investigates impacts to cetaceans from bycatch, shipping, underwater noise and other human activities, it recognises that control and mitigation of human activities are primarily the responsibility of other organisations, reinforcing the importance of collaboration.

4.1 African States Bordering the Atlantic Ocean (ATLAFCO)¹

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

4.2 Arctic Council

4.2.1 Protection of Arctic Marine Environment Working Group (PAME)²

The PAME II-2018 was held 1-4 October 2018 in Vladivostok, Russian Federation. No IWC SC observer attended the meeting. The Committee **agrees** that if possible, an IWC observer should attend the next meeting of PAME.

4.3 Convention on Biological Diversity (CBD)³

Lent updated the Committee on the forthcoming CBD/post 2020 framework workshop. The CBD has launched the process of developing a new framework for biodiversity post-2020 as we reach the end of the period for the last biodiversity framework. By being engaged in this effort, the IWC can ensure that the ever-growing list of threats to cetaceans might be addressed through setting appropriate goals on activities such as fisheries, shipping and other habitat disturbances, etc. As a member of the Liaison Group of Biodiversity-Related Conventions (BLG), the IWC was invited to a workshop in early June to provide input on development of this framework and sent a small delegation to this workshop, led by the IWC Commission Chair, Andrej Bibic.

4.4 Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR)⁴

The 37th meeting of the CCAMLR Scientific Committee was held 22-26 October 2018 in Hobart, Australia. Although no IWC observer attended the meeting, cooperation with CCAMLR remains an important component of the IWC's work and is discussed further under Item 16.1.

4.5 Convention on the Conservation of Migratory Species (CMS)⁵

The IWC's cooperation with CMS is far-ranging. In addition to IWC representation to the meetings below, cooperation with CMS includes joint work on the Whale Watching Handbook, planning a possible CMP for Arabian Sea Humpback Whales and cooperation on Ecosystem Functioning.

4.5.1 Scientific Council

The third meeting of the Sessional Committee of the CMS Scientific Council met 29 May to 1 June 2018, Bonn, Germany. No IWC SC observer attended the meeting.

4.5.2 Conference of Parties

There has been no meeting of the Conference of Parties in the intersessional period. The next meeting will take place from 15 to 22 February 2020 in Gandhinagar, India.

4.5.3 Agreement on Small Cetaceans of the Baltic and North Seas (ASCOBANS)⁶

The report of the observer to ASCOBANS is given as SC/68A/O3F. The following key activities have occurred since the 2018 IWC SC meeting:

24TH MEETING OF THE ADVISORY COMMITTEE. The 24th Meeting of the ASCOBANS Advisory Committee took place on 25-27 September 2018 in Vilnius, Latvia. The agenda covered bycatch, resource depletion, marine debris, surveys and research, use of bycatches and strandings, species action plans, status of small cetaceans in the agreement area, relevant EU Policy matters, and cooperation with other bodies.

COMMON DOLPHIN SPECIES ACTION PLAN. The meeting approved the new Species Action Plan (SAP) for the North-East Atlantic Common Dolphin. The IWC SC is represented in the SAP steering group. The meeting report, summarised Action Points, documents and presentations are available on the ASCOBANS website.

BYCATCH. The Advisory Committee agreed to commission a cost-benefit analysis of different monitoring methods aboard fisheries with regards to cetacean bycatch, and a cost analysis for mitigation measures in fisheries with high bycatch. The ASCOBANS Secretariat will soon be advertising the relevant consultancies.

RESOURCE DEPLETION. The Advisory Committee agreed to establish a Working Group on resource depletion to review new information on this topic, its impacts on small cetaceans and in order to make recommendations for future action.

MARINE DEBRIS. The meeting recommended a joint ASCOBANS and ACCOBAMS workshop to: (1) harmonise best practice guidelines for necropsy methodologies; and (2) to ultimately facilitate the comparison of national results, and this workshop will take place in June in Italy.

JASTARNIA GROUP. The 15th Meeting of the Jastarnia Group took place 18-20 March 2019 in Turku, Finland. The meeting: (1) reviewed progress and assessment categories under the conservation plan and action points; (2) discussed

¹ www.comhafat.org

² <https://www.pame.is>

³ <https://www.cbd.int>

⁴ <https://www.ccamlr.org>

⁵ <https://www.cms.int>

⁶ <https://www.ascobans.org/>

the effects of pollution, physical habitat change, MPAs and whale watching; and (3) heard updates from across the Baltic and Belt Seas, namely from HELCOM, the Second Marine Biogeographical Process Seminar, the EU Marine Expert Working Group meeting, ICES WGBYC meeting, and from IMR/NAMMCO Workshop on the Status of Harbour Porpoises in the North Sea, among others. The meeting also discussed the EU Technical Measures Regulation, which will replace EU Regulation 812/2004 governing bycatch mitigation. Jastarnia Group members expressed their concern that despite input in the consultation process, few of the recommendations made by ASCOBANS appeared to have been considered. Adopted action points are available online, and the meeting report will be posted later in May on the ASCOBANS website.

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

*4.5.4 Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS)*⁷

MEETING OF PARTIES

There was no Meeting of the Parties (MoP) to ACCOBAMS during the intersessional period. Donovan, or another member of the Secretariat, will represent the Committee as an observer at the next ACCOBAMS MoP in Istanbul, Turkey, November 2019.

SCIENTIFIC COMMITTEE

The Scientific Committee of ACCOBAMS met in Monaco from 5-8 November 2018⁸. Donovan attended the meeting 'virtually'. The primary purpose of the meeting was to develop recommendations for consideration as the scientific basis for Resolutions at the Meeting of Parties. Several of the recommendations are of great interest to the IWC Scientific Committee and many of them referred to the excellent ongoing collaboration and/or encouraged further collaboration. These include initiatives on the following: abundance estimates and the results of the ACCOBAMS Survey Initiative; cetacean/fisheries interactions including bycatch, entanglement and depredation; ship strikes; anthropogenic noise; commercial whale watching; marine debris and strandings; use of IMMAs and CMPs. The Committee **agrees** that Donovan should continue to represent it at the ACCOBAMS Scientific Committee.

4.6 Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)⁹

No relevant meetings of CITES have taken place in the intersessional period.

4.7 Food and Agriculture Organisation of the United Nations (FAO)¹⁰

The Committee on Fisheries (COFI) met in Rome, Italy 9-13th June 2018. The Secretariat attended this meeting, in addition to the pre-meeting of the Regional Secretariats Network. This is discussed in more detail in under Item 13.1.2 and in Annex J, items 2.1 and 2.3.

4.8 Inter-American Tropical Tuna Commission (IATTC)¹¹

The 93rd meeting of the IATTC was held in San Diego, USA 27-30 August 2018. No IWC SC observer attended the IATTC meeting in the intersessional period.

4.9 International Committee on Marine Mammal Protected Areas (ICMMPA)¹²

The report of the IWC observer documenting the 2017 activities of ICMMPA is given as SC/68A/03E. The 5th International Conference on Marine Mammal Protected Areas was held in Messinia, Greece, from 6-12 April 2019.

A primary goal of the conference was to focus on the challenges ahead to examine concrete and practical steps towards achieving effective place-based protection and management for marine mammals and to identify a path forward that will lead ICMMPA into its second decade. Hosting the Conference in Greece not only allowed representatives from Europe and the Mediterranean region to participate and help to build local and regional capacity, but also to bring experts from all over the world. In total approximately 200 individuals from 40 countries participated in the different workshops and plenary sessions. The sessions highlighted the ecological uniqueness of the Mediterranean Sea and proposed the need to safeguard it with respect to key emerging impacts. It also helped in identifying steps towards advancing effective marine mammal conservation key areas. In addition, the progress of the IUCN process identifying Important Marine Mammal Areas (IMMAs) globally, was reviewed, and it's potential to provide a systematic, biocentric approach to identifying areas of possible conservation and management concern, was highlighted.

A Joint IWC-IUCN-ACCOBAMS workshop to evaluate how the data and process used to identify Important Marine Mammal Areas (IMMAs) can assist the IWC to identify areas of high risk for ship strike took place on 6-7th April, immediately prior to the Conference. The goals and objectives of the workshop were to investigate the utility and process of using IMMAs to help identify areas of high risk for ship strikes, using the Mediterranean Sea as a test case. A summary

⁷ www.accobams.org

⁸ <http://www.accobams.org/meetings/twelfth-meeting-of-the-scientific-committee/>

⁹ <https://www.cites.org>

¹⁰ www.fao.org

¹¹ <https://www.iatc.org>

¹² icmmpa.org

and key recommendations were reported to the ICMMPA5 conference. The full report of the workshop is available as paper SC/68A/HIM/07.

The Committee thanked Rojas-Bracho for his report and agrees that he should continue to represent it at ICMMPA meetings.

4.10 International Council for the Exploration of the Sea (ICES)¹³

The report of the IWC observer documenting the 2018 activities of ICES is given as SC/68A/O3A. The ICES Working Group on Marine Mammal Ecology (WGMME) met in La Rochelle, France from 19-22 February 2018. It reported on cetacean population abundance, population/stock structure, management frameworks, and anthropogenic threats to individual health and population status. Information was provided regarding the passive acoustic monitoring of harbour porpoises in the Baltic Sea as well as updates regarding visual survey monitoring and strandings of several cetacean species. With respect to the development of common indicators and targets for the Marine Strategy Framework Directive, updates from France and the Macaronesian region were provided. A revision of the delineation of assessment units for harbour porpoises in the Belt Sea was discussed. New information on anthropogenic stressors was compiled and a further stressor category ‘Tourism’ was introduced.

The Working Group on Bycatch of Protected Species (WGBYC) met at the Marine and Freshwater Research Institute in Reykjavik, Iceland 1-4 May 2018. Highlights from the meeting included: (1) review of ongoing bycatch mitigation research projects; (2) bycatch risk assessments (BRAs) for harbour porpoise and common dolphin in the Celtic Seas and Bay of Biscay and Iberian Coast Ecoregions; (3) review of the Joint ICES WGBYC/WGCATCH Workshop on sampling of bycatch and Protected, Endangered and Threatened species; (4) comparison of fishing effort from different sources (ICES Regional Database; WGBYC database; Logbooks); and (5) review and application of the fishPi method to inform relative risk of bycatch in different gears.

Annual national reports submitted to the European Commission under Regulation 812/2004, and other published documents and collated bycatch rates and estimates in EU waters were reviewed. The UK is the only member state (MS) with a dedicated PETS (Protected, Endangered and Threatened Species) observer programme; other MS use non-dedicated observers through the Data Collection Framework (DCF) (EC) No 2017/1004 and DC-MAP (Commission Decision 2016/1251/EU). WGBYC remains concerned about the likely negative bias in PETS data recorded by non-dedicated observers and therefore discussions on training for onboard observers were recommended.

WGBYC continues to incorporate monitoring, effort and bycatch data from non-EU states/countries that have fishing fleets in the North Atlantic and adjoining seas; this will facilitate more robust bycatch estimates for the many wide-ranging species that fall under WGBYCs remit. Bycatch of marine mammals and sea birds was evident in most ecoregions.

The harbour porpoise BRA highlights the risk to this species in the Celtic Sea Ecoregion from net fishing; mortality may represent 1–2.4% of the best available abundance estimate for the Celtic Sea (CS). The BRA for common dolphin in midwater trawls and nets, suggest that the total mortality in the CS and the Bay of Biscay (BoB) is between 0.53 and 1.57% of the best regional abundance estimate; the mortality is highest in the BoB. However, there are incomplete observation and fishing effort data to inform this approach. The results from the BRA are biased and they should only be considered as indicators of areas and métiers in need of further investigation.

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

4.11 International Maritime Organisation (IMO)¹⁴

The report of the observer to IMO is given as SC/68A/O3. The Secretariat and members of the Committee have continued to work with IMO particularly on underwater noise and ship strikes.

UNDERWATER NOISE. Leaper (Convenor of HIM) attended the IMO Marine Environment Protection Committee (MEPC 73) in October 2018 on behalf of IWC. Underwater noise from shipping is not currently on the MEPC agenda but was discussed under Any Other Business following a paper by Canada and New Zealand. This paper (MEPC 73-18-4) included a proposal for a ship design and technology workshop in January 2019 as a step towards a new work output for the MEPC which would put noise back on the agenda. Ferriss and Smith (IWC Secretariat) attended the workshop ‘Quieting Ships to Protect the Marine Environment’ in January 2019, hosted at the IMO and convened by Canada. The workshop aimed to identify the state of knowledge on quiet ship technology, provide an opportunity for international collaboration, and exchange research ideas. A summary of the workshop and its conclusions is provided in IMO paper MEPC74/Inf.36¹⁵.

MEPC 74 will occur during May 2019 and will be attended by Ferriss from the Secretariat. There is no proposal for a new work output on underwater noise but several papers on the issue have been submitted under Any Other Business and

¹³ <https://www.ices.dk>

¹⁴ <https://www.imo.org>

¹⁵ <https://www.transportstyrelsen.se/contentassets/cc9a6651e83046e8a5f78cf92ceb231f/74-inf36.pdf>

discussions will continue on specific actions that could be undertaken by MEPC. In addition, Ferriss will attend a meeting, convened by Canada, in the margins of MEPC74 to discuss next steps on this issue, including the development of a new work output proposal for MEPC75.

SHIP STRIKES. Proposals for ship routing measures are considered by the sub-committee on Navigation, Communications and Search and Rescue (NCSR) which meets once a year. There were no routing proposals specifically related to cetaceans at NCSR 6 in February 2019. The ship strike section of the IWC website¹⁶ contains a list of the measures that have been put in place globally through IMO or national regulations to reduce ship strike risks to whales. This will be updated with measures agreed at NCSR 5.

The south coast of Sri Lanka is one of the high-risk areas for ship strikes identified by the Committee and in the IWC Ship Strikes Strategy. The Secretariat has previously written to the Government of Sri Lanka offering the assistance of the Committee in evaluating alternative routing options to reduce ship strike risk to northern Indian Ocean blue whales. Organisations representing the majority of shipping industry using the current route off the southern tip of Sri Lanka at IMO have also written to the Government of Sri Lanka requesting establishment of an offshore route away from whales, whale watching and coastal fishing vessels. Leaper attended a workshop titled ‘National Stakeholder Consultation, Maritime Activities off the Coast of Sri Lanka: the case of the blue whale population near Dondra Hd’. It was held on 05/12/18 in Colombo and organised jointly by the Sri Lankan Marine Environment Protection Authority (MEPA) and IMO. This provided an opportunity to present the discussions and recommendations of the Committee to Sri Lankan stakeholders and officials.

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

4.12 International Union for the Conservation of Nature (IUCN)¹⁷

The report of the IWC Observer to IUCN is given as SC/68A/O3H. The IUCN Marine Mammal Protected Areas Task Force held its 4th regional workshop in Oman in March 2019 to select candidate Important Marine Mammal Areas (IMMAs) for the Western Indian Ocean and Arabian Seas. The 55 candidate IMMAs proposed by the workshop are currently undergoing independent review. More details are given under Item 20.2.1.

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

The IUCN Red List web site (redlist.org) has been redesigned and restructured. Since the last Committee meeting, new or updated Red List assessments have been published for a further 40 cetacean taxa, in addition to the 29 cetacean taxa that were assessed in the 2017-18 intersessional period. Reassessments for *Kogia* spp., *Tursiops aduncus*, *Phocoena phocoena*, *Lagenorhynchus acutus* and *Indopacetus pacificus* are nearing completion. Remaining high priorities for re-assessment include *Cephalorhynchus hectori*, *Sotalia fluviatilis*, *Physeter macrocephalus*, and the Arabian Sea subpopulation of *Megaptera novaeangliae*.

IUCN continues to convene the Western Gray Whale Advisory Panel (WGWAP), which provides advice to Sakhalin Energy Investment Company (SEIC) and other parties, especially on the mitigation of industrial and other impacts on the gray whales that feed each summer off Sakhalin Island, Russian Federation. A new Cumulative Effects task force had its first meeting in April 2019. Details of the Panel’s recent work are given in Annex O Appendix 2.

News items on activities by members of the IUCN SSC Cetacean Specialist Group are posted on the CSG web site – iucn-csg.org. In particular, there are regular updates of the vaquita situation in the Gulf of California, Mexico: the species still survives but hopes for averting its extinction are fading fast.

The Committee thanked Cooke for his report and **agrees** that he should represent the Committee at IUCN meetings intersessionally.

4.13 North Atlantic Marine Mammal Commission (NAMMCO)¹⁸ **SCIENTIFIC COMMITTEE**

The report of the IWC observer at the 25th meeting of the NAMMCO Scientific Committee (NAMMCO SC) held 13-16 November 2018 in Norway is given as SC/68A/O3.

RESEARCH COOPERATION WITHIN THE NAMMCO SC. Possible cooperation among NAMMCO scientists within its SC was discussed for genetic and life history analysis of harbour porpoises and for satellite tagging and tracking of baleen whales in the North Atlantic. The NAMMCO SC agreed that a collaborative project to develop a ‘super-tag’ (a smaller tag with better ballistic performance, smaller footprint (i.e. tag attachment) in the whale and improved retention time) for tracking

¹⁶ <https://iwc.int/ship-strikes>

¹⁷ <https://www.iucn.org>

¹⁸ <https://nammco.no>

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

large cetaceans in the North Atlantic would provide important information for understanding ecological interactions and making management decisions.

BYCATCH. The NAMMCO By-Catch Working Group (BYCWG) met in May 2017 and had two teleconference meetings in April and October 2018. The NAMMCO SC commended the work and endorsed the recommendations given to the various NAMMCO countries about by-catches in gillnet fisheries for cod, monkfish and lump-sucker. Among the cetaceans, harbour porpoises are particularly vulnerable to bycatch.

CETACEAN STOCKS. The NAMMCO-SC reviewed abundance estimates and recent research and developments for the following species: fin whale, humpback whale, common minke whale, white whale, narwhal, sei whale, bottlenose whale, pilot whale, dolphins, harbour porpoise, sperm whale, bowhead whale and blue whale.

In 2017, the NAMMCO-SC had recommended that the *SLAs* developed in the IWC SC be used for advice for large whales in Greenland. Without incorporating the concept of 'need', the NAMMCO SC agreed that annual strikes of no more than 25 humpback whales off West Greenland are sustainable from 2019 to 2024. Due to the aboriginal subsistence needs statement for West Greenland, the NAMMCO Council had some concerns with this advice, and requested the NAMMCO SC to provide further advice on catch levels of humpback whales. In the 2018 meeting the NAMMCO SC provided a more detailed explanation and justification for its advice and the choice of models used. It reiterated its recommendation that the *SLAs* developed in the IWC provide the best scientific basis for advice on sustainable takes of large whales in Greenland and can be applied without using needs statements.

The NAMMCO SC concluded that there is not enough data to carry out an assessment or provide advice for white whales in East Greenland as has been requested. The status of white whale stocks will be reviewed by the next NAMMCO- Joint Committee on Narwhal and Beluga (JCNB) WG in 2020. The NAMMCO SC reiterated its previous recommendations that catch quotas be reduced and no hunting be permitted south of 68°N. They also agreed that the issue was urgent and of high priority and therefore recommended that an ad hoc WG be convened to review the information and assess the population.

A contracted review examining all available information and current research activities on abundance, stock structure and movements of killer whales in the North Atlantic was presented to the NAMMCO SC. It revealed an urgent need for research on abundance and population structure off Eastern Canadian Arctic, Newfoundland- Labrador and both West and East Greenland. The NAMMCO SC agreed that there is currently not enough information to perform a sound assessment of the sustainability of the killer whale harvest in Greenland and recommended that existing catch records be validated and reporting improved. The NAMMCO SC also recommended that Greenland regulate the hunt and restrict quotas in a precautionary way.

NAMMCOs whale sighting surveys in the Northeast Atlantic in 2015 (NASS2015) included an intensive survey with the purpose of estimating the abundance of pilot whales around the Faroe Isles, an aerial survey of the coastal waters in East Greenland and a ship-based survey around Jan Mayen following methods developed for the Norwegian minke whale surveys. The NAMMCO SC remarked that NASS2015 was successful and agreed that if this survey series is to be continued, the best next year will be 2023, although it could wait until 2026 to join efforts in the North West Atlantic.

A table presenting the status of analyses from the 2007 and 2015/16 NASS surveys was presented and a plan for completing the remaining analysis agreed by the NAMMCO SC. Furthermore, joint analyses being done in collaboration with St. Andrews University (on oceanographic features driving changes in cetacean abundance and distribution) and Duke University (mapping densities of cetaceans in the north Atlantic at different times of year) were presented and discussed as important ways to maximise outputs from the survey data.

Cooperation between the abundance estimate working groups of the NAMMCO SC and the IWC SC has begun. As a first step, the Chairs (or their representatives) of each WG are now standing invited participants in the meetings of the other.

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

COUNCIL

The Report of the observer at the NAMMCO Council Meeting in the Faroe Islands, 3-4 April 2019 is given as SC/68A/O3G. A performance review of NAMMCO was conducted during 2018-19 by a panel of international experts nominated by the IWC, FAO and Northwest Atlantic Fisheries Organization (NAFO). Caterina Fortuna, former Chair of the IWC SC, served as the Chair for that panel. The report presented to the Council concluded that NAMMCO was meeting its general objective to contribute through regional consultation and cooperation to the conservation, rational management and study of marine mammals in the North Atlantic. Outputs from Management Committee, Scientific Committee and Committee on Hunting Methods had been significant and substantial, thus NAMMCO had attained a level of credibility. The panel also listed points of concerns, which should be properly addressed. NAMMCO will review the conclusions and recommendations of the panel and consider relevant follow-up actions.

Abundance of marine mammal stocks in the North Atlantic was updated, and those for most of the cetacean stocks are confirmed. A new assessment in 2018 specifically confirmed the status of humpback whales as LC (least concern) on the global IUCN Red List.

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

4.14 North Pacific Marine Science Organisation (PICES)¹⁹

The Report of the observer at the 2018 meeting of PICES, Yokohama, Japan, 25 October - 4 November 2018 is given as SC/68A/O3C. The observer report of 2018 IWC/SC was presented along with some work regarding cetaceans in the North Pacific (e.g. The Proposed Research Plan for IWC/POWER cruise, the results of the *Implementation Review* for the North Pacific Bryde's whales). Related results were discussed, particularly in view of recent observations of increased mortality in grey and humpback whales in the eastern Pacific.

A productive workshop on 'Diets, consumption, and abundance of marine birds and mammals in the North Pacific' was held. In 2019 a workshop will focus on 'Implications of prey consumption by marine birds, mammals, and fish in the North Pacific'.

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

4.15 Protocol on Specially Protected Areas and Wildlife (SPA) of the Cartagena Convention for the Wider Caribbean²⁰

No IWC SC observer attended The Eighth Meeting of the Scientific and Technical Advisory Committee (STAC) to SPAW held in Panama on 5 -7 December 2018.

5. GENERAL ASSESSMENT AND MODELLING ISSUES (AND SEE ANNEX D)

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

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

$MSYR$ is the key production parameter used in simulation trials to evaluate the conservation and catch performance (or effect of removals) for specific species and regions. The Committee has been reviewing progress on an individual based energetics model (IBEM) developed to provide insights into the relationship between $MSYR_{1+}$ and $MSYR_{mat}$. A workplan was established to continue the development of a model to emulate the IBEM and compare yield from the IBEM and emulator models (IWC, 2019c, p.7) with a view to future use of the latter as the basis for a multi-stock, multi-area population dynamics model and how such a model could be conditioned given available data. No papers on this topic were presented this year.

Attention: SC

*The Committee **agrees** that work should continue to: (a) develop an emulator model; (b) assess whether it is possible to represent the trajectories from the individual based energetics model (IBEM) using an emulator model; (c) compare the yield curves from the IBEM with those from the emulator model; and (d) develop guidelines for how to use an emulator model as the basis for a multi-stock, multi-area population dynamics model and how such a model could be conditioned given available data.*

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

The Committee continues to work on developing a way to provide consistent broad information on the status of populations by region, by integrating the results of a set of *Implementation Simulation Trials*. Work undertaken on two case studies in response to last year's workplan (IWC, 2019c, p.7) was reviewed in Annex Q, Item 3.3 and a recommendation for future work is given under Item 12.

5.3 Progress on previous recommendations and on the workplan

Progress relative to evaluating the energetics model and hence the relationship between $MSYR_{1+}$ and $MSYR_{mat}$ and the use of *Implementation Simulation Trials* to evaluate status are summarised under Items 5.1 and 5.2. Last year, the Committee had suggested some possible additional work with respect to changes to specifications to the model by Kitakado (2018), to further investigate use of age data and modified *CLAs* to evaluate whether they led to improved

¹⁹ <https://www.pices.int/>

²⁰ <http://www.cep.unep.org/content/about-cep/spaw>

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

management performance. No papers were received on this topic this year. In light of discussions under Item 19, it was not added to the workplan for next year that is given as Table 2.

Table 2

Work plan for general assessment and modelling issues

Topic	Intersessional 2019/20	2020 Annual Meeting (SC/68B)	Intersessional 20/21	2021 Annual meeting (SC/69A)
Work to evaluate the energetics-based model and hence the relationship between MSYR ₁₊ and MSYR _{mat}	(a) Continue to assess whether it is possible to represent the trajectories from the IBEM using the emulator model (de la Mare) (b) Compare the yield curves from the IBEM with those from the emulator model (de la Mare) and (c) Develop guidelines for how to use an emulator model as the basis for a multi-stock, multi-area population dynamics model and how such a model could be conditioned given available data (de la Mare).	Continue to work to evaluate the energetics-based model and hence the relationship between MSYR ₁₊ and MSYR _{mat}	Conduct analyses	follow-up Continue to work to evaluate the energetics-based model and hence the relationship between MSYR ₁₊ and MSYR _{mat}
Use of ISTs for consideration of status	Modify control programs used for <i>Implementation Simulation Trials</i> to report the three measures of status (Allison & Punt)	Review the work conducted.		

6. RMP IMPLEMENTATION-RELATED MATTERS (AND SEE ANNEX D)

This agenda item includes the details of ongoing *Implementation Reviews* and preparations for new ones. For discussions related to the stock structure and abundance of these stocks, see also Items 11 and 12.

6.1 Completion of the *Implementation Review* of western North Pacific Bryde’s whales

The Committee’s work on the *Implementation Review* of Bryde’s whales in the western North Pacific was initiated at the 2016 Annual Meeting and is summarised in Table 3. The focus of the present meeting was to review the results of the trials in accordance with the RMP guidelines (IWC, 2012b). These guidelines are explained fully in Annex D (item 3.1.1.1) and relate to the definitions of defining ‘acceptable’, ‘borderline’ and ‘unacceptable’ performance and how to review the results in that light.

Table 3

Summary of the work undertaken to complete the *Implementation Review* for western North Pacific Bryde’s whales.

Meeting	Date	Reference
First Intersessional Workshop	21-24 March 2017	(IWC, 2018e)
First Annual Meeting	9-24 May 2017	(IWC, 2018e)
Second Intersessional Workshop	14-16 February 2018	(IWC, 2019e)
Second Annual Meeting	24 April – 6 May 2018	(IWC, 2019e)
Third Annual Meeting	10-22 May 2019	This report

6.1.1 Summary of stock structure hypotheses considered

Figs 1 and 2 illustrate the sub-areas, boundaries and stock structure hypotheses considered during the *Implementation Review*. Two stock structure hypotheses were taken forward, one of the four considered during the 2007 *Implementation* and one new hypothesis:

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

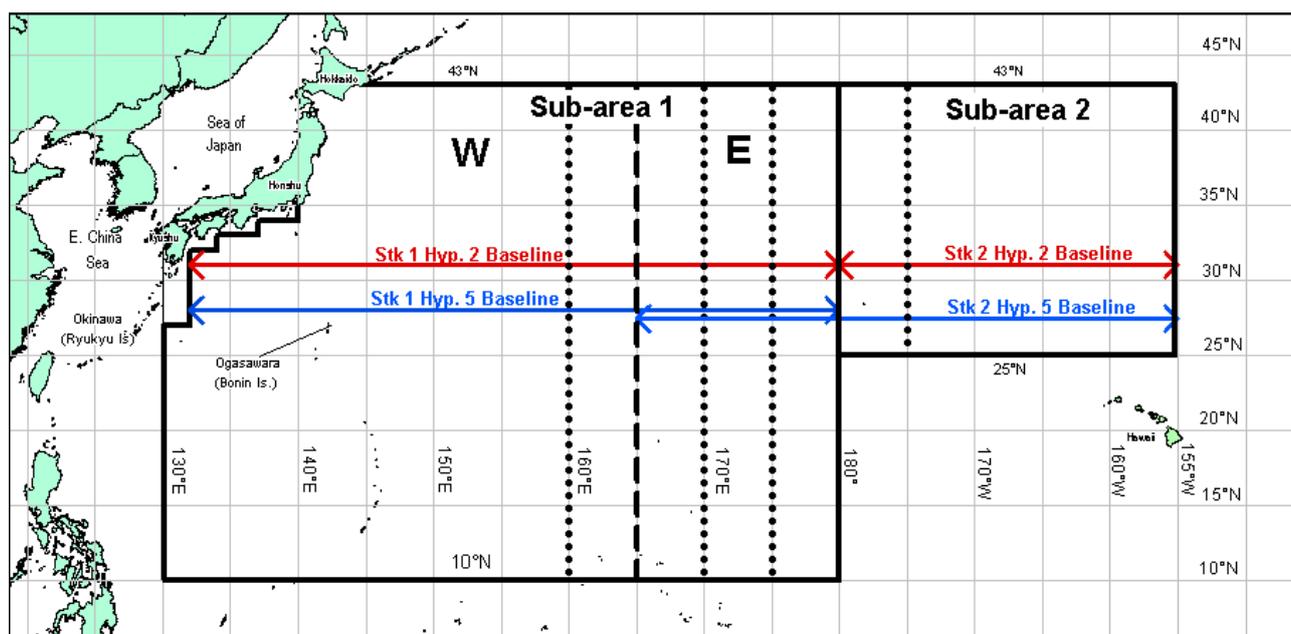


Fig. 1. Map of the western North Pacific showing the sub-areas defined for the western North Pacific Bryde's whales *Implementation Review*. The ranges of the stocks for Hypotheses 2 and 5 (baselines) are also shown. The boundary between the sub-areas 1W and 1E at 165°E, indicated by a dashed line, is a management boundary (used by the RMP). The dotted lines at 160°E, 170°E, 175°E and 175°W denote the boundaries between the "Component-areas" and are used for trials in which the true boundary between the stocks differs from the boundary on which the RMP is based. The staggered border to the south of Japan is used to ensure that no catches of the inshore form of Bryde's whales are included in these trials.

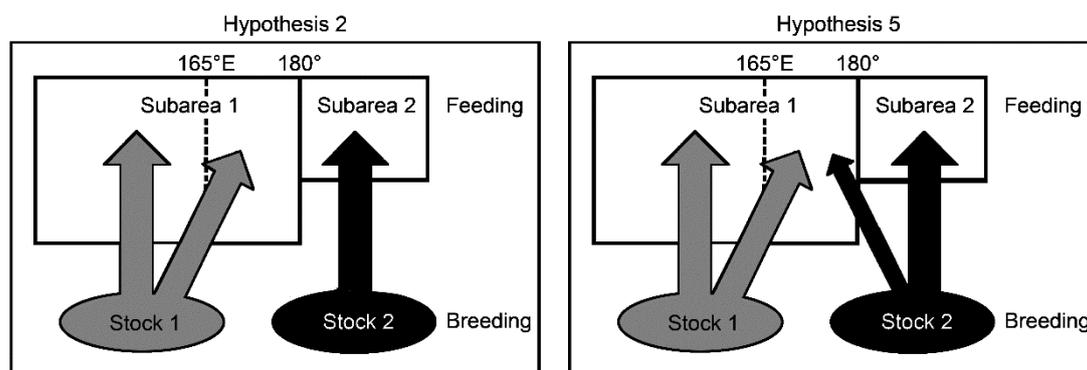


Fig. 2. The two hypotheses considered in the *Implementation Simulation Trials* (and see text)

6.1.2 Results of the trials

The *Implementation Simulation Trials* are shown in Table 4. A total of five management variants were considered. These are described below (terms in italics are defined in full in IWC (2012)).

- (1) V1 Sub-areas 1W, 1E and 2 are *Small Areas* and catch limits are set by *Small Area*.
- (2) V2 Sub-area 2 is taken to be a *Small Area* and the complete sub-area 1 is treated as a *Small Area*. For this management option, all of the future catches in sub-area 1 are taken from sub-area 1W.
- (3) V3 Sub-area 2 is taken to be a *Small Area* and sub-area 1 is taken to be a *Combination area*. Sub-areas 1W and 1E are *Small Areas*, with *catch-cascading* applied.
- (4) V4 Sub-area 1W is taken to be a *Small Area* and sub-areas 1E and 2 (combined) are taken to be a *Combination Area*. Sub-areas 1E and 2 are *Small Areas*, with *catch-cascading* applied.
- (5) V5 Sub-areas 1 and 2 (combined) are taken to be a *Combination area*. Sub-areas 1W, 1E and 2 are *Small Areas*, with *catch-cascading* applied.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

Table 4

The *Implementation Simulation Trials* for the Western North Pacific Bryde’s whales. Note that all 1% trials were considered medium plausibility. The remaining trials were high plausibility. All trials were also run under two potential future sighting survey strategy options as discussed in Annex D, Item 3.1.1.

Trial	Stock structure hypothesis	MSYR ¹	Additional variance	Catch series	Western boundary of Stock 2	Eastern boundary of Stock 1	Comment
Br1-1	2	1	Baseline	Best	180°	180°	Baseline stock structure hypothesis 2
Br1-4	2	4	Baseline	Best	180°	180°	Baseline stock structure hypothesis 2
Br2-1	5	1	Baseline	Best	165°E	180°	Baseline stock structure hypothesis 5
Br2-4	5	4	Baseline	Best	165°E	180°	Baseline stock structure hypothesis 5
Br3-1	5	1	Baseline	Low	165°E	180°	Stock hypothesis 5 with low catches
Br3-4	5	4	Baseline	Low	165°E	180°	Stock hypothesis 5 with low catches
Br4-1	5	1	Baseline	High	165°E	180°	Stock hypothesis 5 with high catches
Br4-4	5	4	Baseline	High	165°E	180°	Stock hypothesis 5 with high catches
Br5-1	5	1	Upper CI	Best	165°E	180°	Stock hypothesis 5 with higher additional variance
Br5-4	5	4	Upper CI	Best	165°E	180°	Stock hypothesis 5 with higher additional variance
Br6-1	2	1	Baseline	Best	175°E	175°E	Stock hypothesis 2 with alternative boundaries 1
Br6-4	2	4	Baseline	Best	175°E	175°E	Stock hypothesis 2 with alternative boundaries 1
Br7-1	5	1	Baseline	Best	160°E	175°E	Stock hypothesis 5 with alternative boundaries 1 ²
Br7-4	5	4	Baseline	Best	160°E	175°E	Stock hypothesis 5 with alternative boundaries 1 ²
Br8-1	5	1	Baseline	Best	170°E	175°W	Stock hypothesis 5 with alternative boundaries 2 ²
Br8-4	5	4	Baseline	Best	170°E	175°W	Stock hypothesis 5 with alternative boundaries 2 ²
Br9-1	2	1	Baseline	Best	180°	180°	Density-dependent <i>M</i>
Br9-4	2	4	Baseline	Best	180°	180°	Density-dependent <i>M</i>
Br10-1	5	1	Baseline	Best	165°E	180°	Density-dependent <i>M</i>
Br10-4	5	4	Baseline	Best	165°E	180°	Density-dependent <i>M</i>

¹MSYR=1% is related to the 1+ component; MSYR =4% is related to mature component

² Based on alternative mixing proportion data

The full set of results can be obtained from the IWC Secretariat. A fuller presentation of the key results and the evaluation process is given in Annex D. Table 5 below summarises the results for the 1% trials (see Table C) – the results for the 4% trials were all ‘acceptable’.

Table 5

Summary of the conservation and annual average catch performance (lower 5th percentile and median) of the five RMP variants for the Western North Pacific Bryde’s whales and for the two survey strategies and the 1% trials. Survey strategy 1 covers each sub-area in a single year whereas survey strategy 2 takes 3 years to cover 1W and then one year each for sub-areas 1E and 2.

	Survey strategy	Number of Trials			Total catch All years		1W catch All years		Total catch First 10yrs		1W catch First 10yrs	
		Acceptable	Borderline	Unacceptable	5%	Med	5%	Med	5%	Med	5%	Med
V1	1	9	1	0	94	130	16	45	64	76	18	30
V1	2	10	0	0	99	136	19	49	60	82	14	37
V2	1	9	1	0	92	138	71	111	120	120	109	109
V2	2	4	6	0	103	151	74	127	120	120	109	109
V3	1	9	1	0	93	138	34	62	119	119	63	71
V3	2	8	2	0	103	151	41	72	119	119	57	72
V4	1	5	5	0	103	143	16	45	90	102	18	30
V4	2	5	5	0	109	148	19	48	86	108	14	37
V5	1	9	1	0	100	155	42	69	151	152	72	82
V5	2	4	6	0	109	165	48	76	151	152	65	83

6.1.3 Recommendations for acceptable variants

Attention: C

The Committee **advises** the Commission that this **concludes** its work on the Implementation Review for western North Pacific Bryde’s whales. Variants 1, 2, 3, 4 and 5 for both survey strategies are acceptable in terms of conservation performance. Of these variants, variants 2 and 5 achieve the best performance in terms of catch. It **thanks** Donovan for leading this review and Allison, de Moor and Punt for their hard work and expertise in implementing and running the trials.

6.2 Implementation Review of western North Pacific common minke whales

6.2.1 First Intersessional Workshop

The process for the *Implementation Review* for western North Pacific common minke whales was preceded by a workshop (IWC, 2019b) solely to consider the considerable new stock structure information that had become available since the completion of the previous *Implementation Review*. The *Implementation Review* itself was initiated at last year's meeting (IWC, 2019) and the First Intersessional Workshop was held in Tokyo from 25 February to 1 March 2019 (SC/68A/Rep04), chaired by Donovan.

A major part of the work of the workshop related to consideration of stock hypotheses and the report of the workshop on that topic is summarised (and discussed) in Annex I (item 4.1.1). The Workshop also: (a) compiled a list of the available abundance estimates for use in the review (annex J to SC/68A/Rep04) and identified a number of surveys for which estimates should be developed and presented at the 2019 Annual Meeting; (b) received potential future survey plans for Korea and Japan; (c) reviewed and updated catch and bycatch data; and (d) developed a list of factors to be considered in the trials, factors to be considered in conditioning, a set of draft trials and considered the development of mixing matrices.

The Committee thanked Donovan for chairing the meeting, the Government of Japan for providing excellent facilities and all the participants for their co-operation, collaborative spirit and contributions to progress the *Implementation Review*.

6.2.2 Plausibility of hypotheses²¹

The objective of discussing plausibility is to reach consensus on whether a particular hypothesis (e.g. on stock structure, MSYR) should be considered of high, medium or low plausibility – this will lead into the final weighting of each trial. It is important to recognise that this is not the equivalent of formal ranking, in that more than one hypothesis may receive the same plausibility category.

Discussions this year focussed on the three stock structure hypotheses agreed at the Workshop:

- (1) Hypothesis A: there is a single J stock distributed in sub-areas 1W, 1E, 2C, 5, 6W, 6E, 7CS, 7CN, 10W, 10E, 11 and 12SW, and a single O stock in sub-areas 2C, 2R, 3, 4, 7CS, 7CN, 7WR, 7E, 8, 9, 9N, 10E, 11, 12SW, 12NE and 13 (referred to as Hypothesis A as it was in 2013);
- (2) Hypothesis B: as for hypothesis A, but there is a third stock (Y) that resides in sub-area 1W, 5 and 6W and overlaps with J stock in the southern part of sub-area 6W (referred to as Hypothesis B as it was in 2013); and
- (3) Hypothesis E: there are four stocks, referred to Y, J, P, and O, two of which (Y and J) occur to the west of Japan, and only three of which (J, P, and O) are found to the east of Japan and in the Okhotsk Sea (a new hypothesis referred to as Hypothesis E – the 2013 hypotheses C and D were not taken forward this time). Stock P (earlier termed 'purple', see Annex D) is a coastal stock.

These hypotheses were reviewed in the light of additional analyses presented this year and the detailed discussions can be found in Annex I (item 4.1.1) and Annex D (item 3.2.2.2.1). An approach to estimate the rate of transferred individuals (relative to stock size) from the inferred parent-offspring pairs within and across stocks was developed (Annex D, appendix 3) that will be refined and implemented intersessionally.

Attention: SC

*With respect to the plausibility of stock structure hypotheses for western North Pacific common minke whales, the Committee **agrees** to take three hypotheses forward as summarised below.*

- (1) Hypothesis A. This hypothesis is considered 'high' plausibility. There is overwhelming support for there being at least two stocks of common minke whales in the western North Pacific (J and O), including evidence from both genetic and non-genetic methods.*
- (2) Hypothesis B. This hypothesis is considered 'high' plausibility, primarily because it is in essence the same as Hypothesis A but with a separate Y stock (as had been included in the 2013 Implementation). There was no new information on Y stock provided during this Implementation Review. The available Korean genetics data should be appropriately analysed to be comparable with the Japanese genetics data.*
- (3) Hypothesis E. Support for this hypothesis is provided by the GENELAND analyses, although it was noted that some recommended genetic analyses have yet to be completed. Some members expressed concerns that the hypothesis may be inconsistent with the observed age/sex/size structure and other non-genetic data. The Committee therefore **agrees** that it is not possible to evaluate plausibility until the results of the conditioning process become available.*

²¹ These discussions of plausibility took place in an RMP context, before it was decided in Plenary (Item 27.8) to continue work on western North Pacific common minke whales as a Comprehensive Assessment. It is noted that a formal discussion of plausibility and subsequent weighting of trials is not required outside an RMP context.

*In addition to examining the conditioning results for Hypothesis E before assigning plausibility, the Committee **agrees** that further analyses of genetics data would assist in this matter including interpretation of the results of the application of GENELAND with admixture and application of coalescent methods to further investigate when the P stock diverged from common ancestors.*

With respect to MSYR, in accordance with the MSYR review (IWC, 2014a), two values are considered in the trials: 1% defined in terms of the total (1+) component of the population is assigned medium plausibility; and 4% defined in terms of the mature female component of the population is assigned high plausibility.

6.2.3 Final trials

Allison and de Moor reported on progress with coding the *Implementation Simulation Trials* since the February 2019 workshop and in light of discussions at this meeting, a number of clarifications and updates to the trial specifications were agreed (Annex D, appendix 3). The abundance estimates used for conditioning will be updated in light of the discussions undertaken in the ASI SWG (see Annex Q, Item 2.1.2). The Committee re-established a Steering Group (Allison (Chair), Butterworth, de Moor, Donovan, Hakamada, Hoelzel, Pastene, Punt, Taguchi, Tiedemann, Wilberg) to guide the work and review additional changes to the trial specifications.

Attention: SC

*In conclusion, the Committee **agrees** to the final trial specifications for the Implementation Review of North Pacific common minke whales provided in Annex D, appendix 3, recognising that (a) some aspects may require further modification intersessionally; and (b) that the work next year will occur in the context of a Comprehensive Assessment.*

6.3 Workplan

Because of Japan's withdrawal from the Commission, the Committee has agreed (see Item 27) that rather than continue work on the Western North Pacific Bryde's and common minke whales in an RMP context (see Item 27), the work would continue as a Comprehensive Assessment. A consolidated workplan for the remaining RMP and AWMP *Implementation Reviews* is discussed under Item 7.4.

7. AWMP IMPLEMENTATION-RELATED MATTERS (AND SEE ANNEX D)

Last year (IWC, 2019c), the Committee completed a considerable body of work related to the management of aboriginal subsistence whaling including agreement on *Strike Limit Algorithms (SLAs)* and on the scientific aspects of an Aboriginal Whaling Scheme (AWS). This was accepted by the Commission, who also agreed that the Committee should develop an *SLA* for the East Greenland hunt for common minke whales and complete work on testing interim relief and carryover provisions and present the results by the 2020 meeting.

7.1 *SLA* development for the common minke whales off East Greenland

Last year, the Committee agreed that it should consider development of an *SLA* for the hunt of common minke whales off East Greenland based on operating models used when developing the West Greenland common minke whale *SLA*. This year, the Committee received a paper that applied the *SLA* agreed for common minke whales off West Greenland to the East Greenland hunt (SC/68A/IST04).

Attention: C, SC

*Last year, it had been agreed that an *SLA* should be developed for the hunt of common minke whales off East Greenland (IWC, 2019c). Based upon work considered at this meeting, the Committee:*

- (1) **advises** the Commission that the WG common minke *SLA* tested for East Greenland minke whales performed satisfactorily in terms of the Commission's conservation and need objectives for the Evaluation Trials;*
- (2) **agrees** that this 'G-Common minke *SLA*' is therefore appropriate to provide management advice to the Commission on the both the West and East Greenland common minke whale hunts, subject to final consideration of the results of the Robustness Trials at next year's meeting;*
- (3) **thanks** Witting for the development work and Allison and Punt for their work refining the operating models; and*
- (4) **agrees** that Allison and Punt should develop a single simulation testing framework for the North Atlantic common minke whales and provide a synthesis paper at next year's meeting that includes results for all Evaluation and Robustness trials as well as the evaluation of carryover and interim allowance for the East and West Greenland common minke whales.*

7.2 Progress with testing the remaining carryover and interim relief allocation provisions for some SLAs and consequent updates to the Aboriginal Whaling Scheme (AWS)

The Committee thanked Punt for presenting two papers that addressed the testing of the carryover and interim relief allocation provisions for the *WG-Minke SLA*, the *WG-Bowhead SLA* and *WG-Fin SLA* for the scenarios considered for the previously tested *Bowhead SLA* and the *WG-Humpback SLA* (SC/68A/IST01 and 02). No papers were submitted for the *Gray Whale SLA* and the work needed to address this as part of the forthcoming *Gray Whale SLA* is discussed in Annex D (Item 4.4.2). Given the work and provisional adoption of a *G-Common minke SLA* considered under Item 7.1 above, this should be re-tested before next year's annual meeting.

Attention: C, SC, NI

*The Committee had been requested by the Commission to undertake simulation trials to investigate the carryover provisions and interim relief allocation strategy for all SLAs (apart from the already-tested Bowhead SLA and the WG-Humpback SLA). In the light of results presented this year, the Committee **advises** that the Commission's conservation objectives are met for common minke, bowhead and fin whale hunts of West Greenland (whilst noting that the 'G-Common minke whale SLA will be tested for the East Greenland hunt intersessionally:*

- (1) for a carryover provision in which allowance is made for the carryover of unused strikes from the previous three blocks, subject to the limitation that the number of such carryover strikes used in any year does not exceed 50% of the annual strike limit; and*
- (2) for the interim allowance approach included in the AWS.*

*The Committee **agrees** that:*

- (1) Donovan should update the provisions of the AWS accordingly for the West Greenland hunts by next year; and*
- (2) the evaluation for the Gray Whale SLA should occur as part of the Implementation Review for that species and that it should be designed to: (a) allow removals under the Makah Management Plan to be unaffected by the simulated scenarios regarding carryover and interim allowance (b) explore equivalent scenarios to those considered in SC/68A/IST1-3; and (c) adjust the carryover and interim allowance protocols such that three strikes are available annually irrespective to enable the Makah Management Plan to be implemented.*

7.3 Preparation for 2020 Implementation Review for North Pacific gray whales

Originally it had been intended to undertake the *Implementation Review* for North Pacific gray whales at the present meeting but for a variety of reasons it was agreed to postpone it until the 2020 meeting.

7.3.1 New data available or likely to become available in time given the data availability rules including abundance estimates, catch/removals data and expected analyses

As described in Annex D (item 4.4), updated estimates of Pacific Coast Feeding Group (PCFG) and Western North Pacific (WNP) abundance should be available for the *Implementation Review*. The photo-ID catalogue for ENP gray whales will be revised and updated and used to provide information on ENP-WNP ocean basin movements. No new genetic analyses are expected for the 2020 *Implementation Review* (IWC, 2019c). Estimates of removals (US, Russia) will be updated for the review, including human-caused mortality for 1924-2015.

The models developed for the Rangewide Review will be available too, and could be updated for, the 2020 *Implementation Review*.

7.3.2 Workplan including consideration of a workshop or pre-meeting and DAA deadlines

The Committee established a Steering Group under (Donovan) to assist with preparations for the *Implementation Review*. That group will consider necessary analyses, invited participants and the need for a pre-meeting.

Attention: SC

*The Committee **agrees** that in accordance with the DAA (IWC, 2004) and the AWS (IWC, 2019c), scientists from the country or countries undertaking the hunts, or others intending to submit relevant analyses, shall develop a document or documents that explains the data that will/could be used for the Implementation Review for gray whales as soon as possible after the Annual Meeting (see details in Annex D, item 4.4).*

The data themselves should be available for request in electronic format one month after the close of the Annual Meeting i.e. 24 June 2019. Requests for the data should be submitted via the DAG (chair Zerbini: sc.vice-chair@iwc.int).

With respect to new analyses, papers using novel methods should be available at least 3 months in advance of the Annual Meeting (i.e. 12 February 2020), papers using standard methods should be available at least 2 months before the Annual Meeting (i.e. 12 March 2020) and papers responding to such analyses at least 1 month before the meeting (i.e. 12 April 2020).

7.4 Workplan

Table 6 provides a workplan for AWMP-related matters.

Table 6

Work plan for AWMP Implementation Matters

Topic	Intersessional 2019/20	2020 Meeting	Intersessional 20/21	2021 meeting
<i>SLA</i> development for the common minke whales off East Greenland	Develop a single simulation testing framework for the Atlantic common minke whales and provide synthesis paper that includes results for all <i>Evaluation</i> and <i>Robustness trials</i> as well as the evaluation of carryover and interim allowance for East and West Greenland minke whales (Punt and Allison)	Review results of 68B with a trials.	n/a	n/a
Conduct the <i>Implementation Review</i> for the Eastern North Pacific gray whales	Develop papers in accordance with the guidance of the Steering Group	Conduct the <i>Implementation Review</i>	Follow-up work (if needed)	Complete review if needed
Evaluate carryover and interim allowance for the Eastern North Pacific gray whales	Conduct evaluation of carryover and interim allowance for the Eastern North Pacific gray whales (Punt)	Review results of analyses and complete		

The Committee noted that its future work plan should try to develop a consolidated workplan for both RMP and AWMP *Implementation Reviews* under the sub-committee on IST. One potential workplan is provided in Table 7 below.

Table 7

Potential long term workplan for RMP and AWMP *Implementation Reviews*

Species/area	Year <i>Implementation (IRs)</i> completed	Next <i>Implementation Review</i>
Chukotka gray whales	2004 (2010)	Start 2020
Makah gray whales	2013 (2018)	
West Greenland humpback whales	2014	Estimated start 2021
North Atlantic common minke whales	1993 (2003, 2008, 2017)	Estimated start 2022
North Atlantic fin whales	2009 (2016)	Estimated start 2023
West Greenland fin whales	2018	Estimated start 2023
West Greenland bowhead whales	2015	Estimated start 2024
Alaskan and Chukotka bowhead whales	2000 (2007, 2012, 2018)	Estimated start 2025
West Greenland common minke whales	2018	
East Greenland common minke whales	2019	Estimated start 2026

8. STOCKS SUBJECT TO ABORIGINAL SUBSISTENCE WHALING (ASW)

The Commission adopted new catch and strike limits for aboriginal subsistence whaling at its meeting in 2018 as well as scientific aspects of an Aboriginal Whaling Scheme²². The new Schedule does not require the Scientific Committee to undertake an annual review of management advice for ASW hunts. *Implementation reviews* are undertaken regularly, normally every 5 to 6 years, to ascertain the status of the stock. If new information becomes available to suggest that the status of the stock is not as expected (i.e., outside of tested parameter space - see Annex E, (IWC, 2019e), a *Special Implementation Review* can occur. Otherwise the agreed *SLA* is next required to be used in 2024.

8.1 New information and progress on recommendations

8.1.1 Bering-Chukchi-Beaufort Seas bowhead whales

The Committee was updated about plans for two abundance surveys for Bering-Chukchi-Beaufort seas bowhead whales for 2019: (1) an ice-based count in spring near Utqiagvik (formerly Barrow); and (2) an aerial line-transect survey across the US and Canada Beaufort Sea in summer. The latter incorporated comments from the review by the Committee at last year’s meeting (IWC, 2019e). The last successful estimate was from 2011 (Givens *et al.*, 2016) thus a new estimate is needed by 2021 to adhere to the Aboriginal Whaling Scheme.²¹

The Committee received a summary of harvest data from the aboriginal hunt for bowhead whales in Alaska. In 2018, 68 bowhead whales were struck resulting in 47 animals landed (23 females and 24 males). Additional details can be found in SC/68A/ASW/02. For the 2013-2018 quota, a total of 270 bowheads were landed using 346 strikes in Alaska and Chukotka. The 2013-2018 quota allowed for 336 whales landed using 402 strikes (not including possible carryover).

²² <https://archive.iwc.int/?r=7592>

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

The Committee noted that a lactating female had been taken. Suydam indicated that his information was that no calf had been observed nearby. It was likely that her calf of the year had been recently weaned.

No bowhead whales were taken off Chukotka, Russian Federation, in 2018.

8.1.2 Eastern Canada/West Greenland bowhead whales

In 2018, three bowhead whales were struck by Canadian hunters in the eastern Canadian Arctic (out of a maximum allowable take of 7, as permitted by Canada). Since 2015, eight whales were struck resulting in seven landed, all females. The Committee **expresses** its great appreciation to Canada for providing information on takes of bowheads and sending an expert to the meeting. DNA samples are routinely collected from this hunt.

No bowhead whales were struck in 2018 off West Greenland. Fifty biopsy samples were obtained from bowhead whales in Disko Bay in 2018.

8.1.3 North Pacific Gray whales

New information on gray whales in the eastern and western North Pacific is presented in Annex O (item 6.1.3).

A total of 106 gray whales was landed (58 males and 48 females, including one 'Stinky' whale used for food to the extent possible) and one was struck and lost off Chukotka in 2018. For the 2013-2018 block quota, a total of 716 gray whales was landed from a quota of 744. DNA samples are being routinely collected. A male gray whale was harvested in Alaska in the Bering Sea in 2018. The Committee was informed that the take of this whale will be reported as an infraction by the USA to the IWC.

Attention: CG, R

*The Committee **reiterates** its previous recommendation (IWC, 2019c, p.15) that genetic samples and photographic data for gray whales (including from the hunt) be collected and combined analyses undertaken to better assess stock structure hypotheses.*

8.1.4 Common minke whales off East Greenland

Two common minke whales (1 male and 1 female) were landed in East Greenland in 2018 and none were struck and lost. One common minke whale of unknown sex was bycaught in pelagic (mackerel) trawling gear in August 2018. Skin samples were obtained from 3 whales.

8.1.5 Common minke whales off West Greenland

A total of 112 common minke whales (21 males and 91 females) were landed in West Greenland in 2018. Four were struck and lost. Skin samples were collected from 103 whales.

8.1.6 Fin whales off West Greenland

Six fin whales (3 males and 3 females) were landed in West Greenland in 2018. One was struck and lost. Skin samples were obtained from 4 whales.

8.1.7 Humpback whales off West Greenland

Six humpback whales (1 male and 5 females) were landed in West Greenland in 2018. None were struck and lost. Skin samples were obtained from each animal.

Three humpback whales were reported as bycatch, one in East Greenland and two in West Greenland.

8.1.8 Humpback whales off St. Vincent and the Grenadines

No humpback whales were taken off St. Vincent and the Grenadines in 2018.

8.2 Progress with previous recommendations

Attention: CG, R

*The Committee **welcomes** the information on data collected from the hunts including biopsy samples. It **reiterates** previous recommendations (IWC, 2019c, p.16) that data that can assist with stock structure (in particular skin or tissue samples and, as possible and relevant, photographs be collected, archived and analysed in collaborative studies to be presented at Implementation Reviews (see the schedule for such reviews provided under Item 7.4).*

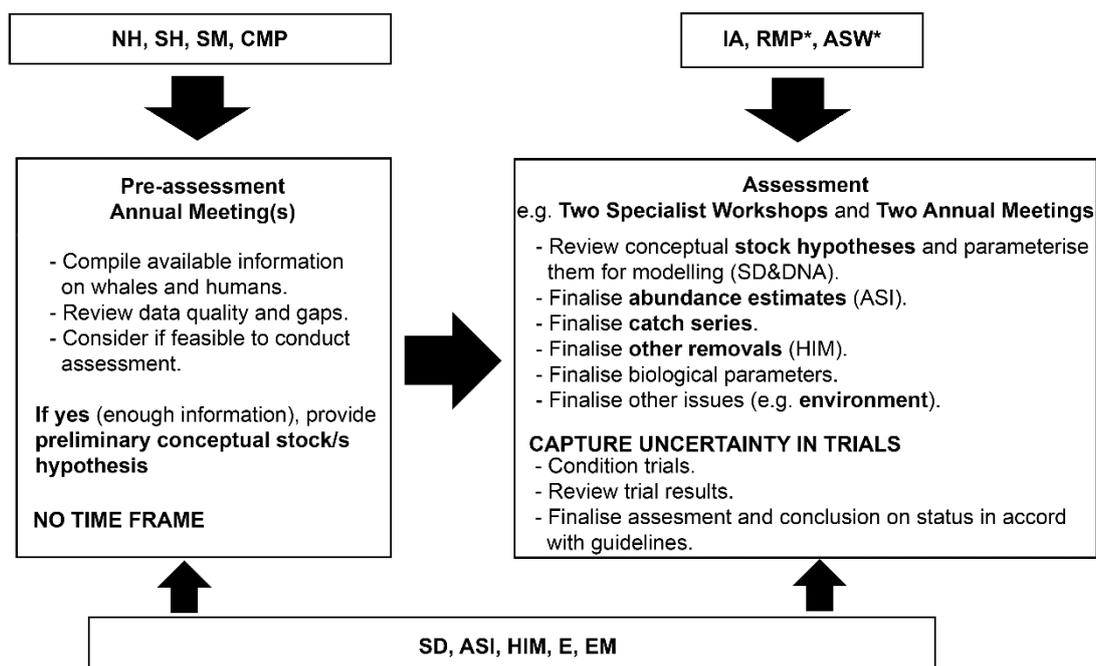
8.3 Workplan

In 2020, the Committee will review new biological information and catch information on species and stocks subject to aboriginal subsistence whaling.

9. WHALE STOCKS NOT SUBJECT TO DIRECTED TAKES

9.1 Comprehensive or In-depth Assessments

An updated process for undertaking Comprehensive (the first time an assessment is completed for a species/region) and in-depth assessments (subsequent assessments for a species/region) was agreed last year (the full process is described in (Donovan, 2018; IWC, 2019c) and is summarised in the figure below.



9.1.1 Comprehensive Assessment of North Pacific humpback whales

Work towards a Comprehensive Assessment of whales began in 2016, and included an intersessional workshop held in April 2017 (IWC, 2018b). Last year (IWC, 2019a, pp.18-19), a simplified age-aggregated assessment model and four potential stock structure hypotheses were proposed. However, there were still questions about the connections among the proposed breeding and feeding areas. Over the past year, Cheeseman pursued improvements to an automated photo-ID matching algorithm that is the technical basis for his website *happywhale.com*. At the same time, he developed a collaboration with many of the major contributors of North Pacific humpback whale photographs. Together with the new algorithm, there is now an opportunity to conduct an updated large-scale matching exercise across much of this ocean basin. The results of such an exercise are expected to further refine our understanding of population structure and interchange rates in the North Pacific, including for areas that were under-represented during the SPLASH project (Calambokidis *et al.*, 2008). It was noted that the matched photographs may also be used to estimate abundance, subject to consideration of the potential biases and differential survey effort.

Attention: SC, R

The Committee is undertaking a Comprehensive Assessment of North Pacific humpback whales. To obtain the most robust assessment and thus conservation advice, the Committee agrees that:

(1) a large-scale matching effort of post-2005 photo-ID should be undertaken using the new matching algorithm to help clarify the connections among the feeding/breeding areas within the North Pacific;

(2) to assist in this, it reiterates (IWC, 2019a, pp.18-19) its previous strong encouragement for all catalogue holders to contribute photographs, including the forthcoming 2019 IWC-POWER photographs, and participate in this exercise, after the appropriate data sharing agreements are made;

(3) the breeding/feeding subareas should then be re-evaluated to be consistent with new results from the new matching effort;

(4) accordingly, the historical abundance and catch should be re-calculated to correspond to new subareas and then inputted into the assessment model; and

(5) to facilitate this work the intersessional steering group, convened under Clapham, should be re-established (Annex T) and depending on progress of the above, a 1-day intersessional workshop should be held to discuss the stock structure hypotheses in light of the matching results, and a 1-day pre-meeting should be held to review the new data and preliminary assessment results.

9.1.2 *Comprehensive Assessment of North Pacific sei whales*

The Committee began the Comprehensive Assessment of North Pacific sei whales in 2015 (IWC, 2016c). Last year (IWC, 2019a), the Committee agreed to proceed with two stock structure hypotheses for modelling purposes: (i) a single stock in the entire North Pacific; and (ii) five stocks with some overlap in feeding areas. At that time, the Committee had agreed that the evidence for multiple stocks was weak. However, because virtually all the genetic samples had been obtained in just one of the putative sub-areas (the Pelagic sub-area), the Committee was not able to reject the hypothesis of multiple stocks at that stage. The Committee had emphasised that this decision to proceed does not imply endorsement of either hypothesis at this stage.

Considerable progress was made intersessionally and at this meeting, as discussed in Annex F, item 3. The assessment model input data (absolute and relative abundance estimates, catch series, mark-recovery locations, estimates of mixing between sub-areas, and life history parameters) is expected to be completed intersessionally. Using a standard population model, preliminary base-case model runs were undertaken; although they did not fit well. In particular, it was difficult to reconcile (a) the high recent estimate of absolute abundance in the pelagic area from the IWC-POWER cruises (2010-12) with estimates of historical depletion in the same area, as evidenced by the relative abundance data from scouting, the mark-recapture data, and the catch per unit effort used in the Committee's previous assessments (Tillman, 1977); and (b) the low abundance and apparent lack of recovery of sei whales in the western coastal, Aleutian and eastern areas. One way to investigate this issue will be undertaken intersessionally by exploring alternative model structures that include, for example, changing *K* or relatively slow, density-dependent redistribution of whales between areas following depletion.

Attention SC, R, S

*The Committee notes the progress made with respect to the Comprehensive Assessment of North Pacific sei whales with respect to stock structure, abundance estimates, marking data, catch history, life history parameters and the assessment model. To progress this work, the Committee **agrees** to:*

(1) the work described in Annex F, item 5.2 undertaken to (a) finalise input data for the assessment and (b) support the modelling work identified in Annex F; and

(2) re-establish the intersessional steering group to oversee the assessment, convened under Cooke (Annex T).

Attention SC, R

*The Committee also welcomes the satellite tag data from eight sei whales (SC/68A/SP02) and **encourages** further sei whales be tagged by expeditions in the North Pacific whenever the opportunity arises to contribute information on the movement patterns within the Pacific.*

9.1.3 *Workplan*

Table 8 provides the workplan for Comprehensive and In-depth Assessments.

Table 8
Summary of the workplan for Comprehensive and In-depth assessments

Topic	Intersessional 2019/20	2020 Annual Meeting (SC/68B)	Intersessional 2020/21	2021 Annual meeting (SC/69A)
Comprehensive Assessment of North Pacific sei whales	Re-establish the ISG to further data preparation and development of the assessment model	Review progress of intersessional work and continue/finalise the assessment	If needed finalise/continue preparation of assessment	As needed, review progress of intersessional work and finalise assessment
Comprehensive Assessment of North Pacific humpback whales	Re-establish the ISG to further data preparation, development of the assessment model and hold a Workshop	Review progress of intersessional work and continue the assessment	Finalise/continue preparation of assessment	Review progress of intersessional work and continue/finalise the assessment
In-depth Assessment of North Pacific common minke whale	In-depth Assessment of North Pacific common minke whale		Continue an assessment that began as an IR within the context of the RMP ¹	
Comprehensive Assessment of non- Antarctic Southern Hemisphere blue whales	Continue to try to finalise pre-assessment work	Prepare for an assessment if possible, otherwise continue pre-assessment	Continue pre-assessment or begin assessment [?]	Finalise preparation/continue assessment

¹ An RMP *Implementation Review* was initiated for North Pacific common minke whales (see Item 6.2). However, since Japan is withdrawing from the IWC, this assessment will continue as an in-depth assessment.

9.2 Potential new assessments: progress on recommendations and workplan

9.2.1 Non-Antarctic Southern Hemisphere blue whales

The Committee is preparing for a Comprehensive Assessment of non-Antarctic Southern Hemisphere blue whales and hopes to finalise the assessment within the next two years. In this regard, the Committee has supported ongoing work compiling the Southern Hemisphere blue whale catalogue to identify re-sightings of use for capture-recapture analysis of abundance (SC/68A/SH09). Progress on the migration of this catalogue to IWC servers is almost complete but requires further funding in order to be finalised and maintained; pending budgetary support, this activity should be completed by 2020.

Since Southern Hemisphere blue whale calls vary amongst regions (fig 1, IWC, 2019f), to assess blue whale distribution and population structure the Committee has also supported a web-based Southern Hemisphere blue whale song library which will enable researchers to compare their blue whale acoustic recordings with validated song archetypes. The library is close to completion and should be launched next year (see Annex H, item 3).

To progress regional population assessments, blue whale catches have been assigned to each region on the basis of acoustic data. Initial results were presented last year (Item 3.1, IWC, 2019a) and updated results are presented in SC/68A/SH15 and provide catch estimates from the northern Indian Ocean (1,796), the southwest Indian Ocean (7,674), the southeast Indian Ocean (2,310) and the southwest Pacific Ocean (404). The Committee has funded further work to: (i) allocate catches to two putative acoustic stocks in the northern Indian Ocean, using new acoustic data; (ii) integrate these catches into population models; and (iii) conduct regional assessments of blue whale recovery around the Southern Hemisphere. Results will be discussed next year, and assessments are expected to be finalised by 2021.

Attention: SC, R

*To enable completion of population assessments of pygmy and Chilean blue whales, the Committee **agrees**:*

(1) that the Southern Hemisphere Blue Whale Catalogue continue, with a priority focus on matching photographs within regions to measure regional abundance of pygmy blue whales.

(2) with the finalisation of regional catch scenarios and the construction of population assessment models for pygmy and Chilean blue whales, to assess their recovery from whaling.

(3) that population modellers should subdivide catches in the Northern Indian Ocean using data on the acoustic distribution of the two putative stocks, in order to assess these stocks separately.

9.2.1.1 SOUTHEAST PACIFIC BLUE WHALES

Progress on the Southern Hemisphere blue whale catalogue is required in order to complete the southeast Pacific (Chilean) blue whale assessment, by enabling estimation of regional abundance. An assessment model was explored in 2016, (Item 5.3.1.2, IWC, 2017a), but the abundance dataset was not spatially representative of the Chilean coast and the Committee decided to delay the assessment while the catalogue is enlarged. At present, the catalogue holds approximately 400 right and left sides each but requires quality coding to complete.

A good understanding of population structure and connectivity is necessary to conduct assessments. The Committee received new information establishing that the Chilean blue whales and pygmy blue whales are different subspecies (Pastene *et al.*, In press-a). The Committee is now comparing catch length data and mitochondrial DNA patterns between the southeast and northeast Pacific in order to establish the level of population connectivity, since these populations appear to have some genetic interchange on their low-latitude wintering grounds (Leduc *et al.*, 2017). The Committee also advised that the photo-ID catalogue holders from the Gulf of California be invited to join the Southern Hemisphere blue whale catalogue, in order to assess whether there is any direct evidence of overlap between this northeast Pacific blue whale wintering ground, and the Chilean blue whale wintering area.

Attention: SC, R

*To assess blue whale population connectivity across hemispheres in the eastern Pacific, the Committee **encourages**:*

(1) comparison of morphometric and genetic data between northeast and southeast Pacific whales; and

(2) completion of photo-ID catalogue matching and quality coding in the southeast Pacific, to enable abundance estimation.

9.2.1.2 INDONESIA/AUSTRALIA BLUE WHALES

Photo-ID catalogue matching and quality coding within the Southern Hemisphere blue whale catalogue for Australia is nearly complete (SC/68A/SH04). Intersessionally, this catalogue will be reviewed and suitability for a capture-recapture estimate of regional abundance assessed.

9.2.1.3 NEW ZEALAND BLUE WHALES

Compilation of the Southern Hemisphere blue whale catalogue for New Zealand is ongoing, and more catalogue submissions are required before this dataset is suitable for abundance estimation. In 2018, the Committee received a mark-recapture based estimate of New Zealand blue whales (Barlow *et al.*, 2018a). The ASI SWG reviewed this estimate and recommended further work. The Committee looks forward to an updated estimate of abundance at the 2020 Annual Meeting.

Attention: SC, CG

*To progress the population assessment of New Zealand blue whales, the Committee **reiterates** its advice (IWC, 2019a, p.21) that it **encourages** New Zealand photo-ID catalogue holders to submit images to the Southern Hemisphere Blue Whale Catalogue, to enable the fullest possible assessment of regional abundance.*

*The Committee also **strongly encourages** further work to update the abundance estimate for New Zealand blue whales, following Committee recommendations.*

9.2.1.4 NORTHERN INDIAN OCEAN BLUE WHALES

Northern Indian Ocean blue whales are poorly understood and face a variety of anthropogenic threats including ship strikes, entanglement and pollution (IWC, 2019a, p.21). A recent survey off Oman during March/April 2019 (SC/68A/CMP08) yielded blue whale sightings, photo-IDs, biopsy, faecal samples and acoustic data. Further detail from this report can be found in Annex O (item 6.2.2), together with a series of suggestions for future work.

Attention: SC, CG, G, R, CC

***Reiterating** its advice that the distribution and population isolation of blue whales is poorly understood in the northern and western Indian Ocean (IWC, 2019a, p.21), the Committee **encourages** researchers and range states to address the following research priorities:*

(1) continued photo-identification and genetic sampling of blue whales off Oman (noting that the peak period of abundance is December/January);

(2) passive acoustic monitoring to determine seasonal presence, population abundance and trends;

(3) comparison of blue whale photographic catalogues with other blue whale catalogues in Oman, India, Sri Lanka and any others available in the Indian Ocean (and possibly the Antarctic); and

(4) collection and analysis of tissue samples, to better understand the taxonomy and stock structure of Arabian Sea blue whales;

*The Committee **recommends** IWC Member country and non-member country governments and regulatory bodies support these important research priorities and adopt appropriate management measures in core areas of habitat for blue whales in the Arabian Sea.*

9.2.1.5 WORKPLAN AND BUDGET REQUESTS FOR 2019/20

The work plan for Southern Hemisphere blue whales is given in Table 9. A budget request to quality check and code the Chilean blue whale photo-IDs within the Southern Hemisphere blue whale catalogue is discussed under Item 25.

9.2.2 Antarctic blue whales

The Committee are preparing for an assessment of Antarctic blue whales; the last (in 2008) concluded that whilst increasing, in 1997 Antarctic blue whales were only at 0.9% (95% Probability Intervals 0.7-1.0%) of pre-exploitation levels (IWC, 2009a, p.237; 2009b). The Committee received new information this year (SC/68A/ASI02, SC/68A/SP01, SH/68A/SH10) and developed a plan and timeframe for a new assessment (see Appendix 3 and item 3.1.3 in Annex H); the new assessment will also be conducted on the circumpolar population.

Attention: SC, R

*In order to conduct a new population assessment of Antarctic blue whales within the next four years, the Committee **reiterates** (IWC, 2019a, p.22) that it **strongly encourages** further work to update the abundance estimate for Antarctic blue whales, following Committee recommendations. The Committee also:*

*(1) **agrees** to review all available evidence for population structuring within Antarctic blue whales;*

- (2) *encourages matching of photo-IDs between Chile and the Scotia Sea, to assess possible inter-ocean connections; and*
- (3) *encourages an assessment of length data in blue whale catches made near Grytviken, to estimate the potential proportion of Chilean blue whales in this catch record.*

9.2.2.1 WORKPLAN AND BUDGET REQUESTS FOR 2019/20

The work plan for all Southern Hemisphere blue whales is given in Table 9. The budget request received on this topic is discussed under Item 25.

Table 9

Workplan for Southern Hemisphere Antarctic, pygmy and Chilean blue whales

Item	Intersessional 2019/20	2020 Annual meeting (SC/68B)
Antarctic blue whales		
Population structuring	Review evidence for population structuring within Antarctic blue whales	Report
Catalogue matching	Catalogue matching of photo-IDs	Report
Abundance estimation	Mark recapture modelling of abundance	Report
Progress towards population assessment	Assess catch length data to measure possible Chilean blue whale component in Scotia Arc catch	Report
	Match Scotia Arc photo-IDs with Chilean catalogue (Appendix 5, Annex H)	Report
SH non-Antarctic blue whales		
Catalogue matching	Complete matching and quality coding of photo-IDs from Australia. Complete matching of photo-IDs from Chile. Complete quality coding (Appendix 6, Annex H)	Report
Abundance	Provide updated abundance estimate for New Zealand blue whales following ASI SWG recommendations	Report
Catch allocation	Finalise catch separation model and explore alternative catch allocation models	Report

9.2.3 Southern Hemisphere fin whales

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

9.2.3.1 POPULATION STRUCTURE

This year two genetic population structure papers were reviewed (SC/68A/SH02 and 05); neither found strong evidence of fin whale population structuring in the Southern Hemisphere. The only evidence for any structure to date comes from acoustics (IWC, 2019a); the Committee had proposed to conduct an acoustic analysis of Southern Hemisphere fin whale song variation last year (IWC, 2019) but this has yet to be undertaken due to funding limitations.

Attention: SC, CG, R, S,

*Knowledge of population structure is essential to future efforts to assess Southern Hemisphere fin whales. The Committee **welcomes** the new work presented and reiterates its recommendations from last year (IWC, 2019b, p.23) regarding (i) analysis of fin whale acoustic recordings to assess song variation (ii) strategic biopsy sampling and analysis to measure fin whale genetic differentiation; and (iii) a review of all Discovery mark data published on fin whales should be conducted, to assess population connectivity patterns.*

*The Committee also **reiterates** its request that the Secretariat provide a letter of support for a study examining the evidence for *B. physalus patachonica*, which requires access to the holotype for this species from the Bernardino Rivadavia Natural Sciences Museum (MACN) in Buenos Aires.*

9.2.3.2 DISTRIBUTION AND ABUNDANCE

The Committee received new information on sightings and planned cruises to study fin whales in the northern Antarctic Peninsula, the Scotia Arc (Annex H, item 4.2) and the Antarctic region south of South Africa (Annex H, item 4.4). Past catches may be informative about abundance hotspots for fin whales and an effort-stratified analysis of these catches is expected in 2020. The new ‘Fin whale’ theme under IWC-SORP (see Item 24.2) could be used to compare current sightings with past data in order to assess whether abundance hotspots have changed over time and to develop standard survey protocols for fin whale sightings surveys, to facilitate collection of sightings data which are more comparable across different surveys.

The Committee welcomed a summary of recent work dedicated fin whale research by the Brazilian Antarctic Program (PROANTAR) using sighting surveys, photo-ID, biopsy sampling and telemetry. The programme began in 1997 but this year the project has been discontinued.

A new circumpolar fin whale abundance estimate using IWC-IDCR-SOWER data is expected in 2020.

Attention: SC, CG, R

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

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

- (1) **recommends** the review of a new circumpolar fin whale abundance estimate at next year's meeting;
- (2) **encourages** analysis of fin whale distribution and geographic aggregations using catches;
- (3) **encourages** meta-analysis of the Antarctic Peninsula and Scotia Sea sightings data, to measure contemporary fin whale distribution and density patterns;

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

9.2.3.3 WORKPLAN FOR 2019/20

The work plan for Southern Hemisphere fin whales is given in Table 10.

Table 10

Workplan for Southern Hemisphere fin whales.

Item	Intersessional 2019/20	2020 Annual meeting (SC/68B)
Population structure	Review available fin whale Discovery mark data	Report
Catch densities	Update fin whale catch model to include Soviet catch data	Report
Population abundance	Estimate abundance using IDCR-SOWER data	Report
	Develop sightings survey protocol to assist comparable future data gathering	Report

9.2.4 Southern right whales not the subject of CMPs

The Committee continues to progress regional population assessments for southern right whales (IWC, 2017d), inviting new information on population structure, abundance, trend and past exploitation levels. This year, new information was received on regional population structure, health, trends and sightings.

9.2.4.1 SOUTH AFRICA

The Committee welcomed the results of the 2018 survey of southern right whales flown along the coast of South Africa, part of a long-term monitoring programme since 1979 (SC/68A/SH01). SC/68A/SH12 investigated the relationship between numbers of cow-calf pairs and climate. SC/68A/SH14 used a life history model to assess southern right whale abundance trends with photo-ID data collected from 1979 to 2018. Details and discussion of these papers can be found in Annex H, item 5.2.3.

Attention: SC, CG, R

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

- (1) **encourages** further work to understand and assess the impact of climate drivers underlying South African southern right whale population dynamics including calf productivity;
- (2) **encourages** the development of a global, standardised, IWC-endorsed health assessment protocol to assist a synoptic assessment of southern right whale health across calving grounds; and
- (3) **recommends** further development of the South African southern right whale population dynamics model in order to provide a good representation of the underlying population dynamics

9.2.4.2 AUSTRALIA

The Committee was informed about two southern right whale projects currently funded by Australia's National Environmental Science Program. The first is a long-term aerial survey in southwest Australia, which provides information on regional trends in abundance. The second is an initiative to collate photo-ID catalogues collected across Australia

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

(southwest and southeast calving grounds), to assess regional abundance and population connectivity patterns. In addition, two papers were considered on the southwest Australian southern right whale seasonal occurrence and densities (Charlton *et al.*, 2019b) (Charlton *et al.*, 2019a). Discussion of these can be found in Annex H (item 5.2.2).

Attention: SC, CG, R

The Committee **reiterates** (IWC, 2019b, p.27) its strong support for the Australian long-term right whale monitoring programmes to understand right whale population trends and dynamics and **recommends** that this monitoring continue, as well as the collection of right whale information from their offshore feeding grounds.

The Committee also **encourages** ongoing work to establish levels of population connectivity between the two Australian calving grounds and estimate regional abundance.

9.2.4.3 NEW ZEALAND

In New Zealand, the main calving ground for southern right whales is around the sub-Antarctic Auckland Islands. Southern right whales were extirpated from New Zealand mainland waters over 150 years ago but are now occasionally sighted. New information was received on development of hormone assays to assess right whale health in New Zealand waters (SC/68A/SH03) and on a planned initiative to collect new data on southern right whale occurrence in mainland New Zealand waters through public engagement over three years (2019-2021) in a drive to collect new sightings, photo-IDs and biopsy samples and assess mainland recovery patterns. The Committee **welcomes** this information, noting the importance of these data collections for regional assessment of population recovery.

9.2.4.4 FEEDING GROUNDS

New southern right whale sightings data and skin biopsies were collected in the middle latitudes of Area IV of the southeast Indian Ocean (SC/68A/SP01).

9.2.4.5 PROGRESS TOWARDS POPULATION ASSESSMENT

This year new information was provided on the genetic population identity of southern right whales on the Chile/Peru calving ground and a feeding area in the northern Scotia Arc (SC/68A/SH06, Annex I, item 4.3.3).

The Committee expressed its support for a collaborative initiative proposed in 2018, to integrate southern right whale demographic data from all the calving grounds into a common modelling framework, to investigate correlations between southern right whale abundance trends/calving intervals and environmental variables in the Southern Ocean and therefore assess population trends in parallel (Annex H, item 5.3).

A catch history workshop to update regional pre-modern catch estimates for southern right whales and estimate pre-exploitation levels, will be held prior to the 2020 meeting.

Attention: SC, CG, R

To progress regional population assessments of southern right whales, the Committee **reiterates** (IWC, 2019b, p.28) that:

(1) southern right whale calving grounds should be co-analysed using a common life-history model, to estimate regional demographic parameters and investigate commonalities in their population dynamics.

The Committee also **strongly encourages** the matching of photo-ID catalogues between Brazil and Argentina, to progress assessment of the recovery of the southwest Atlantic southern right whale population and to more accurately estimate right whale abundance on this last calving ground in the southwest Atlantic.

9.2.4.6 WORKPLAN FOR 2019/20

The work plan for southern right whales is given in Table 11. A budget request is discussed under Item 25.

Table 11

Workplan for southern right whales

Item	Intersessional 2019/20	2020 Annual meeting (SC/68B)
Population structure	Compare photo-ID catalogues between Brazil and Argentina (Appendix 7, Annex H)	Report
Population abundance	Population modelling of South African right whale abundance and trend Population abundance estimate of SE Australian right whale	Report Intersessional review with report to SC/68B.
Body condition	Develop protocol to use for conducting health assessments of southern right whales using overhead images	Protocol report
Catch records	Right whale catch series workshop	Meeting report.

9.2.5 North Pacific blue whales

The Committee is at the pre-assessment stage for blue whales in this area. There are at least two populations of blue whales in the North Pacific, and possibly three, based mainly on song type. The recovered status of the eastern North Pacific population is well-known and was assessed by the Committee in 2016 (IWC, 2017). 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 welcomed an update from an intersessional correspondence group regarding data available from recent surveys, historical catch data and acoustics/song analysis (SC/68A/NH/07_rev1 and see discussion in Annex G, item 6.1).

Attention: SC; R

*The Committee is continuing its work to assess blue whales in the North Pacific, especially in the central and western areas. To advance this work, the Scientific Committee **agrees** that the following analyses be completed to prepare for a future Comprehensive Assessment, with reports (or updates) presented at the 2020 Annual Meeting:*

(1) abundance estimates from IWC-POWER and JARPN/JARPN-II surveys;

(2) combined genetic analysis using the US (ENP), IWC-POWER and ICR samples collected during JARNPII and NEWREP-NP;

(3) mapping of older catches (prior to 1920) in Japanese waters, especially west of 145°E;

(4) results of photographic matching across the region (including 2018 photos), amongst IWC-POWER, JARPN/JARNPII, Cascadia Research Collective and other ENP catalogues;

(5) presentation of new acoustic information and fine-scale analysis of existing data for western and central Pacific blue whale calls, with particular focus on waters adjacent to Japan, including data collected by the NMFS Pacific Islands Fisheries Science Center across the central and western Pacific (with a focus on the Northern Mariana Islands); and

(6) report on blue whale life history parameters derived from long-term photo-identification datasets held by the Mingan Island Cetacean Study Research Station and the CICIMAR-IPN.

*The Committee **agrees** that the intersessional correspondence group under Branch (Annex T) should continue its work to review data needed for an assessment of North Pacific blue whales.*

9.2.6 North Atlantic sei whales

The Committee is at the pre-assessment stage for sei whales in this area. Sei whale movements, distribution, stock structure and population size are not well-understood in the North Atlantic. This year, the Committee received new information from passive acoustics, sighting surveys, strandings data and photo-ID, with an emphasis on the western North Atlantic (Annex G, item 2.2). The Committee also reviewed new information on North Atlantic sei whale population structure based on molecular genetics (see Annex I, item 4.2).

Attention: SC

*The Committee is continuing its work to ascertain when sufficient information is available to assess sei whales in the North Atlantic. The Committee **agrees** that to advance this, the intersessional correspondence group under Cholewiak (Annex T) reviewing data needs for a Comprehensive Assessment should continue.*

9.2.7 North Atlantic right whales

In response to a request last year (IWC, 2019c) the USA provided an update regarding North Atlantic right whale population status and management initiatives (SC/68A/NH01 and SC/68ANH/06). This is discussed in detail in Annex G, item 2.3. The western North Atlantic population continues to decline, with a 2017 estimate of 411 (95% Bayesian credible interval 389-430). A total of 17 mortalities were documented in 2017 (and accounted for in the abundance estimate), followed by three in 2018 and none so far in 2019. No calves were observed in 2018, although seven have been confirmed to date (12 May) in 2019. Recent research suggests that anthropogenic mortality and morbidity are important causes of poor calving success and chronically low annual survival (e.g Pace *et al.*, 2017). A US workshop will take place in June 2019 to improve knowledge of North Atlantic right whale health and to advance right whale recovery through a better understanding of drivers and contributing factors influencing health. A US/Canada Bilateral Right Whale Working Group has also furthered collaboration in research and management.

Of the 17 mortalities in 2017, 12 were found in Canada and appeared to correspond with a (perhaps temporary) shift of North Atlantic right whales into the Gulf of St. Lawrence, thought to have been a response to prey shifts driven by ecosystem and climate changes. A series of management measures were implemented by Canada in 2018, and no further deaths have been detected in Canadian waters despite substantial survey effort. In 2019, slightly modified management measures remain in place in Canada along with enhanced monitoring.

In the USA, The National Oceanic and Atmospheric Administration (NOAA) Fisheries convened an expert Working Group in May 2018 to gather input to evaluate the effectiveness of US management efforts to reduce ship strikes and entanglements. NOAA Fisheries is currently undertaking a review of the vessel speed rule that will include assessments of biological effectiveness, compliance, economic impacts, and navigational safety impacts of the rule. In 2019, the US Atlantic Large Whale Take Reduction Team reached near unanimous consensus on a package to reduce mortality by 60% by reducing vertical buoy lines, requiring the use of lines with an equivalent of a 1700-pound (lbs) breaking strength, and expanding gear marking specifications on US trap/pot fishery buoy lines throughout US East Coast waters. NOAA Fisheries plans to develop regulations using these recommendations. The US Northeast and Southeast Recovery Plan Implementation Teams have been developing action plans. This will include the development of an assessment tool by spring 2020 that will characterise the extinction risk in light of current and future threats and assess how changes in present-day mortality and reproduction schedules might affect population trajectories.

Attention: C, CG, SC, R

*The Committee strongly **reiterates** (1) its serious concern over the status of right whales in the western North Atlantic that is the only viable population of this species and (2) that the US and Canada make every effort to reduce human induced injury and mortality in the population to zero (e.g. see IWC, 2019). It **stresses** that the two primary threats to North Atlantic right whale recovery are entanglement in fishing gear and vessel strikes. The Committee:*

*(1) **recognises** that significant efforts have been underway in both the US and Canada to understand North Atlantic right whale status and to mitigate human impacts;*

*(2) **encourages** the submission of further updates on these efforts and their outcomes in SC/68B;*

*(3) **requests** that the IWC Executive Secretary notify the US and Canada of its willingness to share expertise and to participate in on-going or planned processes to assess North Atlantic right whales and their threats.*

9.2.8 North Pacific right whales

Three individually identified North Pacific right whales were sighted during the 2018 IWC-POWER cruise (SC/68A/ASI/04). One animal was matched to the existing US catalogue and two were new individuals. Two individuals were located initially through passive acoustics and biopsy samples were collected from all three whales. Genetic analysis of the samples is currently underway at the US Southwest Fisheries Science Center and a portion will be sent to Japan for additional analyses. Detailed discussion can be found in Annex G, item 2.4.

Attention: SC

*The Committee **notes with concern** that eastern North Pacific right whales are critically endangered. Information on them is scarce and the Committee **welcomes** the contribution made by the IWC-POWER cruises to providing information on these animals. It **looks forward** to analyses of the results obtained thus far and to information from future cruises in the area.*

9.2.9 North Atlantic humpback whales

The Comprehensive Assessment of North Atlantic humpback whales was completed in 2002 (IWC, 2002; 2003). In 2018, the Committee agreed that it was timely to consider a rangewide in-depth assessment (IWC, 2019c, p.133). The Committee is thus at the pre-assessment stage. This includes consideration of new information on stock structure (especially the relationship of the southeastern Caribbean to other North Atlantic breeding areas e.g. (e.g. Stevick *et al.*, 2018), distribution, movements and abundance (e.g. from projects such as MONAH) as well as human activities including the hunt in Bequia, bycatches, entanglement and other anthropogenic factors. The studies and information sources are discussed in Annex G, item 2.5. New passive acoustic (SC/68A/NH/02) and telemetry studies that are underway have the potential to improve understanding of breeding ground stock structure. Considerable genetic and photo-identification data are also available across the North Atlantic (although the small number of genetic samples collected during aboriginal subsistence whaling at St. Vincent and the Grenadines and housed at the Sanriku Branch of the Institute of Cetacean Research were destroyed by the 2011 tsunami). Finally, the Committee received an update on an Unusual Mortality Event that has been underway since 2017 along the US East Coast. More details can be found in Annex G, item 2.5.

Attention: SC

*Considerable new information has accumulated since the Comprehensive Assessment of North Atlantic humpback whales completed in 2002. Further work should be undertaken to compile, collect, analyse and review those data for a future in-depth assessment and the Committee **agrees**:*

(1) the need to further evaluate humpback whale stock structure in the North Atlantic, most notably the relationship of the southeastern Caribbean and other North Atlantic breeding and feeding areas (e.g. Stevick et al., 2018) including use of genetic, photo-identification, acoustic and telemetry data and in particular:

(a) comparative analysis of existing song data from the eastern and western Caribbean;

(b) the collection and analysis of additional data, (photo-identification, genetic, acoustic and telemetry) from less well-understood areas of the North Atlantic, with particular attention to the southeastern Caribbean, low-latitude areas of the eastern North Atlantic, northern Africa and migratory corridors;

*(c) **recommends** that photo-identification data and genetic samples be obtained from animals caught during aboriginal subsistence whaling and shared with relevant data archives in the North Atlantic (see also Item 8.2).*

(2) the value in undertaking further analysis of the MONAH data (although these will not directly answer questions about breeding stock structure outside of the western Caribbean); and

(3) to form an intersessional correspondence group under Mattila (Annex T) to identify existing data and analyses for review at the 2020 Annual Meeting.

Attention: CG, G

*In addition, the Committee **expresses** concern about a multi-year unusual mortality event off the US East Coast and **encourages** that any new information on causes and impacts be provided to the Committee at the 2020 Annual Meeting.*

9.3 New information and workplan for other northern stocks

9.3.1 Gulf of Mexico Bryde's whales

The Committee has previously expressed serious concern and made a number of recommendations about a small, isolated population of Bryde's whale found in the northern Gulf of Mexico and currently known to occur only in US waters (IWC, 2019, p. 26). In response to last year's recommendation, US scientists reported that the population was listed as Endangered under the US Endangered Species Act in 2019. This new legal status will provide more management protection against human activities, such as seismic surveys, fishing and shipping. A Deep Horizon Oil Spill Programmatic Damage Assessment and Restoration Plan is expected to be released in draft form for public comment this spring and is expected to lead to restoration projects benefiting this species. NOAA Fisheries' Southeast Fisheries Science Center has a variety of ongoing research projects, including six passive acoustic studies aimed at improving understanding of Gulf of Mexico Bryde's whale distribution, range, habitat use and critical habitat (SC/68A/NH/03_rev1 and Annex G).

Attention: SC, CG, S

*The Committee **reiterates the serious continuing concern** it expressed last year (IWC, 2019c, p.26) about the small and isolated population of Bryde's whales in the Gulf of Mexico, numbering approximately 30 animals and thus far only known to occur in US waters. The Committee:*

*(1) **welcomes** the information received by the USA this year that the that the Gulf of Mexico Bryde's whales has been listed as Endangered under the US Endangered Species Act, and **recognises** that this will provide a basis for maximal legal protection; and*

*(2) **encourages** the USA to provide any new information on population abundance, status and critical habitats at SC/68B, as well as the details of legal protections afforded from seismic surveys and other anthropogenic threats.*

*(3) **welcomes** an update from Rosel on the sub-species status of Gulf of Mexico Bryde's whales.*

*(4) **encourages** that future data collection from observed individuals include auxiliary information such as ventral body colouration, which is known to vary with geographic location.*

9.3.2 North Pacific fin whales

North Pacific fin whales were documented during the 2018 IWC-POWER cruise, and those data will be the basis of a planned abundance estimate. Details of photo-identification, biopsy sampling and acoustic detections can be found in SC/68A/ASI/04 and Annex G.

9.3.3 Workplan

The Committee prioritised three Northern Hemisphere stocks for intersessional work to accumulate data for future assessments: North Pacific blue whales, North Atlantic sei whales and North Atlantic humpback whales (Annex G). The Committee also prioritised the review of new information on North Atlantic right whales and Gulf of Mexico Bryde's whales in light of concerns about their population status and recent implementation of protective management efforts.

9.4 New information and workplan for other Southern Hemisphere stocks

9.4.1 Southern Hemisphere humpback whales

9.4.1.1 BREEDING STOCK D

The assessment of breeding stocks D (West Australia), E1 (East Australia) and Oceania was completed in 2014 (IWC, 2015), but there were difficulties in obtaining a reliable estimate of absolute abundance for breeding stock D (IWC, 2017a; 2018a).

Attention: SC, 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 carried out, with a view to implementing a new survey of this population in the future (and see Item 25).*

9.4.2.2 NEW ABUNDANCE ESTIMATES

A new humpback whale abundance and trend estimate (Monnahan *et al.*, 2019b) has been provided from a feeding ground area in the Magellan Straits (associated with humpback breeding stock G in the southeast Pacific). Noting that population recovery estimates for breeding stock G are rather uncertain because no population trend data were included in the original assessment (IWC, 2016a), the Committee proposed to review this estimate intersessionally.

9.4.2.2 WORK PLAN AND BUDGET REQUESTS FOR 2019/20

The work plan for humpback whales is given in Table 12. The budget request received is discussed under Item 25.

9.4.2 Other species if new information is presented

9.4.2.1 SOUTHERN HEMISPHERE SEI WHALES

Little is known about their Southern Hemisphere population structuring but this year new information on population structuring between the South and North Pacific and North Atlantic was received (SC/68A/SH08), along with an informal update on genetic work being conducted in the South Atlantic (Annex I, item 4.3.4). Maternally inherited mitochondrial DNA analysis suggests Northern and Southern Hemisphere sei whales are highly differentiated across the equator, perhaps to the level of subspecies. The Committee welcomed progress on this topic and invited further updates to better understand range-wide population structuring.

Table 12

Workplan for Southern Hemisphere humpback whales

Item	Intersessional 2019/20	2020 Annual meeting (SC/68B)
Population abundance of south-eastern Pacific feeding ground (Breeding Stock G)	Assess Magellan Strait abundance and trend for future BSG assessment	Report
Assess feasibility of future surveys for west Australia wintering ground (Breeding Stock D)	Reanalyse pilot study to assess feasibility of future West Australia surveys	Report

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

Conservation Management Plans (CMPs) are an important conservation initiative of the IWC. They provide a framework for countries within the range of vulnerable cetacean populations to work together, and in collaboration with other relevant stakeholders, to protect and rebuild those populations. This item covers stocks (with a focus on progress with scientific work and information) that are either: (1) the subject of existing CMPs; or (2) are high priority candidates for a CMP. It also considers stocks that have previously been considered as potential CMPs, recognising that the Commission has stressed the need for range states to support any IWC CMPs.

Rojas Bracho reviewed changes to the CMP process (SC/68A/CMP/03). The Committee **welcomes** the guidance for a draft standard form of wording for it to use when making recommendations on new priority species/populations for consideration as CMP candidates:

'The Scientific Committee considers that [species/population] would benefit from the development of a CMP and **recommends** that the SWG-CMP treat the species/population as a 'priority species/population' for the purpose of the CMP development process. In making this recommendation, the Scientific Committee acknowledges that a nomination would not be required for the species/population, and the Scientific Committee encourages the SWG-CMP to commence outreach to relevant range states and stakeholders to encourage and support the development of a CMP.'

10.1 Stocks with existing CMPs: new information and progress with past recommendations

10.1.1 SE Pacific southern right whales

The Committee received information on advances made on implementing priority actions for the CMP for Southeast Pacific Southern Right Whales from April 2018 to March 2019 (SC/68A/CMP/05). Significant progress has been made for the priority action “Increase sighting efforts on possible reproductive areas” (RES05), as a result of the implementation of a Passive Acoustic Monitoring (PAM) project (SC/68A/CMP/06).

A second coordination meeting for this CMP was held in August 2018 in Peru and a new implementation strategy for 2019-20 was endorsed by the Commission in Brazil in 2018. A landmark achievement was the signing of a Memorandum of Understanding between the governments of Chile and Peru ‘to coordinate cooperation in the conservation of the southern right whale population of the southeast Pacific’ during the II Binational Cabinet Meeting of Chile-Peru held in Chile (November 2018).

Additional details are discussed in Annex O, item 6.1.1.

Attention: SC, CC, CG

The Committee **reiterates** the importance of the CMP for the conservation of the critically endangered southeastern Pacific right whale population (IWC, 2019c, p.28). The Committee **welcomes** the progress made and:

- (1) **encourages** the continued coordination between Peru and Chile under the Memorandum of Understanding; and,
- (2) **commends** the scientific work and international cooperation being undertaken for the PAM (passive acoustic monitoring) project and **looks forward** to receiving the results of these studies that should assist in designing future sighting surveys and providing baseline information on the location of breeding grounds.

10.1.2 SW Atlantic southern right whales

The Committee received new information about southwest Atlantic southern right whales (for details see Annex O, item 6.1.2) and welcomed an update on progress with CMP actions (SC/68A/CMP18). In 2018 near Peninsula Valdés, aerial surveys recorded the highest count of whales ever (1,605 whales) but the authors concluded that the numbers of adults may now be stabilising although the number of calves continues to increase. Whale watching near Peninsula Valdés, Argentina has taken place since the early 1970s, but prior to the study reported in SC/68A/CMPprev1, only short-term behavioural reactions to boats had previously been evaluated. The authors concluded that the whales that breed at Peninsula Valdés may be habituated to whale watching boats and this is discussed further under Item 18.1.3.

Attention: SC, CC, CG

The Committee **reiterates** the importance of the CMP for the Southwest Atlantic right whales (IWC, 2019c, p.29). The Committee **welcomes** the progress made in its implementation and:

- (1) **commends** the impressive array of work being undertaken;
- (2) **reiterates** the importance of continuing the long-term monitoring programme;
- (3) **encourages** the continuation of the telemetry studies and **recommends** that the IWC Commissioner for Argentina facilitates the internal permit process for the right whale tagging programme;
- (4) **encourages** studies of stress hormones in baleen and the presentation of results to the Committee when they become available;
- (5) **recommends** collaboration among range states to generate new information and **encourages** additional effort from Brazil given the additional funding received;
- (6) **encourages** comparisons of photo-ID catalogues between Argentina, Brazil and Uruguay.

10.1.3 North Pacific gray whales

10.1.3.1 RANGEWIDE ASSESSMENT

The Committee has a long-standing cooperation with the IUCN Western Gray Whale Advisory Panel (WGWAP) and there is a joint IUCN/IWC CMP for western gray whales. Details of the work of the WGWAP are provided in Annex O, Appendix 2. Key factors include: discussion of a seismic survey held in 2018; the future of WGWAP; the slow progress with developing a single gray whale photo-identification catalogue/database for Sakhalin and Kamchatka; and the scaling back of the Sakhalin Energy-Exxon Neftegas Limited Joint Program (regular monitoring of whale behaviour, acoustic

monitoring and benthic sampling have been cut). Steep declines in amphipod biomass were detected in the Piltun nearshore feeding area in 2013-16, but these sampling surveys have ended. Therefore, the Committee emphasises the critical importance of collecting benthic data and reiterated previous recommendations from the Committee that the benthic sampling be reinstated. The Committee **thanks** WGWAP for this update.

Planning for a CMP stakeholder workshop to update the existing joint IUCN/IWC CMP is underway by the workshop Steering Group and the workshop may be held in Tokyo, Japan in late 2019 or early 2020.

The Committee also received information (SC/67A/CMP11_rev1) about the multinational (Mexico, Russian Federation, USA) effort of the *Collaborative Pacific Wide Study on Population Structure and Movement Patterns of North Pacific Gray Whales*. A total of 379 whales identified on the summer feeding grounds off Russia were compared to 10,685 individuals identified in the wintering lagoons of Baja California, Mexico. A total of 54 gray whales were linked between Russia and Mexico.

Details and discussion on the above papers is provided in Annex O (item 6.1.3.1).

Attention: C, CC, IGO, S, I, R

The Committee reiterates the importance of (1) the joint IUCN/IWC CMP for western gray whales and associated studies off Sakhalin Island and other parts of the western North Pacific and (2) the long-standing co-operation with the IUCN Western Gray Whale Advisory Panel (IWC, 2019c, p.30). The Committee:

(1) welcomes the plans to update the CMP via a stakeholder workshop during the intersessional period and encourages the Steering Group and Secretariats of IWC and IUCN to facilitate this;

(2) notes with concern the reported benthic biomass declines in the gray whale feeding area in Piltun, and potentially related changes in whale numbers and distribution, and reiterates previous recommendations that the benthic sampling programme be reinstated by the oil and gas companies (or other capable parties) working in the area;

(3) strongly reiterates its previous recommendation for a consolidated photo-identification catalogue of photographs for the western North Pacific under the auspices of the IWC (IWC, 2019c, p.30) and urges the relevant data holders to finalise this process with the IWC Head of Science; and

(4) encourages the continuation of the multinational effort of the Collaborative Pacific Wide Study on Population Structure and Movement Patterns of North Pacific Gray Whales.

10.1.3.2 REGIONAL STUDIES

The Committee was pleased to receive recent information from long-term studies including photo-identification, distribution and body condition for the breeding grounds in Mexico (SC/68A/CMP11_rev1; CMP12_rev1; CMP13; CMP14), census information from the USA (SC/68A/CMP17), photo-ID studies (including an abundance estimate) from feeding grounds in Russia (SC/68A/CMP16; CMP21) and sightings and strandings from Japan (SC/68A/CMP02; CMP04). Details of these papers and discussion of them can be found in Annex O item 6.1.3.2.

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

The Committee reiterates the importance of long-term monitoring of gray whales (IWC, 2019c, p.30), strongly recommends that Range States and others support this work and welcomes the new information provided by Mexico, Russia, USA and Japan. In particular, the Committee:

(1) commends the work in the breeding lagoons of Mexico, urges its continuation and expresses concern about the high number of strandings, poor body condition and low calf counts observed off Mexico in 2019 and encourages Range States to take proactive measures to prepare for a future broader population-level mortality event;

(2) highlights that the analysis in SC/68A/CMP21 suggests that a western breeding population that migrates through Asian waters still exists but is likely to be very small (<80) and thus a highly endangered remnant group of 'true' western north Pacific gray whales – this should be considered further next year in light of the forthcoming Implementation Review and use of the rangewide modelling framework;

(3) stresses the value of the ocean basin photo-identification catalogue comparisons and encourages contribution of photographs from all parts of the range especially Chukotka, Russia;

(4) commends work on the feeding ground off Russia by the Russian Gray Whale Project and urges its continuation;

(5) welcomes the continued provision of information from Japan and encourages researchers to continue to collect as much information on sightings as possible, including, if feasible, attempting to obtain biopsy samples and photographs.

10.1.4 Plans to address *Franciscana* in 2020

An in-depth review of the *Franciscana* was identified as a priority during SC/67A but could not be performed at this meeting. New data will be reviewed at next year's meeting and an in-depth assessment is expected to occur in 2021, given the extent of new data available (e.g. stock structure, abundance estimates). As the last in-depth review was undertaken in 2004, the 2020/21 review is timely and will be useful to inform conservation and management decisions.

Attention: CG, R

The Committee **reiterated** the importance of the CMP for the conservation of *franciscana* in the waters of Argentina, Uruguay and Brazil and **encourages** presentation of new information at the 2020 Annual Meeting. The Committee therefore:

- (1) **stresses** the value of the actions included in the CMP towards future assessments of the status of *franciscana*, which is imperative for determining the effectiveness of conservation efforts;
- (2) **reiterates** the recommendation that research be undertaken to conduct a synoptic survey and estimate the abundance of *franciscana* dolphin across its range, especially off Uruguay that can be reviewed by ASI; and
- (3) **encourages** collection and analyses of genetics samples especially off Uruguay and Argentina to inform questions on stock structure and encourages a collaborative paper by scientists in the region on stock structure that can be reviewed by SDDNA in 2021.

10.2 Progress with identified priorities

10.2.1 Humpback whales (and other species) in the northern Indian Ocean including the Arabian Sea

Humpback whales in the northern Indian Ocean are believed to number (<100 animals, Minton *et al.*, 2011) and are subject to a number of threats, including ship strikes, entanglement in fishing gear, and coastal development. These whales have been identified as a candidate for a future CMP (e.g. see IWC (2019c, p31). The Committee welcomed information on: the activities of the Arabian Sea Whale Network (ASWN) that co-ordinates humpback whale research and conservation efforts across the Arabian Sea (SC/68A/CMP09); an online data platform for matching photo-ID catalogues across the Arabian Sea (SC/68A/SH07); and the identification of candidate IUCN Important Marine Mammal Areas specifically designed to include important humpback whale habitat off the coasts of Oman, Pakistan and India at a recent IUCN workshop (IUCN, 2019). These candidate areas are now undergoing review.

A study (SC/68A/CMP07) using WWF-trained observers has been documenting sightings, entanglements and bycatch of cetaceans from tuna boats along Pakistan's coast. Recent sightings included 13 confirmed humpback whales, mostly in waters over the continental shelf and slope. It was suggested that these sightings positions be used to guide future dedicated cetacean research, particularly for humpback whales off Pakistan.

A study off the west coast of India documented recent sightings of Bryde's whales and humpback whales (SC/68A/CMP10) and identified five 'hotspot areas'. India has listed the Arabian Sea humpback whale a Priority Species for Conservation and is developing a National Arabian Sea Humpback Whale Research and Recovery program. The Committee highlights the importance of collecting genetic samples from India but notes that collection and genetic analysis of tissue samples was historically difficult in this region for several reasons including the advanced state of decomposition of specimens, challenges with sample collection, personnel training and limited access to exportation permits.

Multiple opportunistic surveys were recently conducted in southern Oman (SC/68A/CMP08). In addition to humpback whales, that study documented 18 other cetacean species in the area, with Bryde's whales, the most frequently observed, and humpback whales, common dolphins and blue whales also regularly documented. Nine humpback whale sightings were documented, including four individuals that were previously identified animals, supporting the idea that the Oman humpback population is small in size. Photo-ID data collected off Oman are also being used to develop a new regional abundance estimate for humpbacks, which will be reviewed at the next meeting.

The Committee was informed that at the direction of the Commission, the Secretariat has been in communication with Oman and India regarding the possibility of a CMP for Arabian Sea Humpback Whales (ASHW). The response from the Indian government has been positive; they have made ASHW a priority species for conservation and are planning a workshop in 2019 focussed on Arabian Sea humpback whales. They would like to invite Oman to this workshop, along with the IWC and CMS.

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

The Committee **reiterates** that Arabian Sea humpback whales are a priority candidate for a CMP (IWC, 2019c, p.31) and **welcomes** efforts to encourage range states to develop one. It **commends** the efforts of scientists within the region and especially the Arabian Sea Whale Network to develop a strong scientific basis to guide the development of a CMP and **recommends** continuation of those studies. The Committee:

(1) **recommends** that the work of the crew-based observer programme in Pakistan (SC/68A/CMP07) continue, and where possible, be replicated throughout the region, especially in areas where systematic cetacean surveys are not feasible;

(2) **encourages** collaboration between the Pakistan observer programme and the IWC Bycatch Mitigation Initiative (BMI), so that lessons learned can be shared with other countries tackling bycatch in similar circumstances (and see Item 13.1);

(3) **encourages** continued collection of sightings and entanglement data by such programmes and **urges** that consideration be given to including measures of effort in the data collection protocols;

(4) **recommends** use of passive acoustic monitoring to document (seasonal) whale presence with lower security risks and logistical challenges than boat-based surveys off the Sindh and Balochistan coasts (Pakistan);

(5) **highlights** the importance of collecting genetic samples from India to establish the population identity of humpback whales in the eastern Arabian sea, whilst recognising the challenges this poses;

In addition, the Committee **welcomes** the efforts to initiate range state collaboration within the region and especially the efforts of India including the proposed workshop. It **suggests** that the IWC Secretariat offer scientific support for the workshop. It also notes that the BMI and Large Whale Entanglement Response teams can provide advice on safe handling and mitigation techniques and perhaps the collection of genetic samples associated with bycatch.

10.2.2 Mediterranean fin whales

The Committee received updated information on a potential ACCOBAMS/IWC CMP for Mediterranean fin whales, noting that a workshop is planned by ACCOBAMS for September 2019, where scientists involved in fin whale research in the Mediterranean will be invited to collaborate in the preparation of a draft CMP document for consideration by the ACCOBAMS Meeting of Parties in November 2019 and by the IWC Scientific Committee in 2020.

Attention: CG, CC, IGO

The Committee **notes** that ACCOBAMS has adopted the IWC guidelines for its CMPs. It **welcomes** news of progress in developing a CMP for Mediterranean fin whales and **recommends** that the SWG-CMP treat the Mediterranean fin whale sub-population as a 'priority species/population' for the purpose of the CMP development process.

In making this recommendation, the Committee **acknowledges** that a nomination would not be required for this sub-population and **encourages** the SWG-CMP to commence outreach to relevant range states and stakeholders to encourage and support the development of a CMP.

The Committee **encourages** the relevant IWC and ACCOBAMS Range States to work towards developing a draft CMP for fin whales for presentation at SC68B.

10.2.3 Mediterranean sperm whales

The Committee notes that ACCOBAMS is considering the development of a CMP for Mediterranean sperm whales which are threatened by various anthropogenic threats including ship strikes and bycatch and have been recently listed as Endangered under the IUCN Red List.

Attention: CG, CC, IGO

The Committee **welcomes** the news that ACCOBAMS is considering the possibility of a CMP for sperm whales in the near future **and** agrees that consideration should be given to this being a joint ACCOBAMS/IWC CMP.

The Scientific Committee considers that Mediterranean sperm whales would benefit from the development of a CMP and **recommends** that the SWG-CMP treat the population as a 'priority population' for the purpose of the CMP development process. In making this recommendation, the Scientific Committee acknowledges that a nomination would not be required for the population for an IWC CMP and it encourages the SWG-CMP to commence outreach to relevant range states and stakeholders to encourage and support the development of a CMP.

10.2.4 Amazon River Dolphins

The Committee noted that a workshop on Amazon dolphins will be hosted in Bogota in June 2019 by the Government of Colombia to begin the process of developing a CMP for the boto (*Inia* spp.) and the tucuxi (*Sotalia fluviatilis*). The presentation of a report of the workshop is expected at next year’s meeting. The Committee **welcomed** this update and looks forward to reviewing the workshop report and new information on Amazon river dolphins in 2020.

10.4 High priority CMP candidates

10.4.1. Central American humpback whales

The Committee received new information on the endangered Central American humpback whale population, which has a minimum estimate of 411 individuals (Wade *et al.*, 2016). This small population is particularly vulnerable to anthropogenic threats including: bycatch in the Dungeness crab fishery in California, entanglements in fishing gear off the west coast of Baja California and off mainland Mexico (Brownell and Mallette, 2018), ship strikes off Panama (Guzman *et al.*, 2013) and anthropogenic noise (acute and chronic), micro and nano-plastics, physical and climate change throughout the population’s range.

The Committee established an intersessional correspondence group under Urban to identify and evaluate data on distribution, abundance, stock structure and catches as scientific input for the development of a CMP.

Attention: SC, CC, CG

*The Scientific Committee considers that the Central American humpback whale population would benefit from the development of a CMP and **recommends** that the SWG-CMP treat the species/population as a ‘priority population’ for the purpose of the CMP development process. In making this recommendation, the Scientific Committee acknowledges that a nomination would not be required for the population for an IWC CMP and it encourages the SWG-CMP to commence outreach to relevant range states and stakeholders to encourage and support the development of a CMP.*

*The Committee **recommends** continuation of and increased collaborative research among groups focused on identified priorities for research and conservation with range states.*

10.5 Workplan

The workplan for stocks subject to a Conservation Management Plan or those identified as priorities for a CMP is given as Table 13.

Table 13
Workplan for stocks subject to or under consideration for a CMP

Item	Intersessional 2019/2020	2020 Annual Meeting (SC/68B)	2021 Annual Meeting (SC 69A)
Southeast Pacific right whale	Workshop on WW & research permits	Review progress on scientific aspects of CMP	Review progress on scientific aspects of CMP
South Atlantic right whales	Entanglement Workshop (June 2019)	Review progress on scientific aspects of CMP	Review progress on scientific aspects of CMP
Gray whales	Stakeholder Workshop (late 2019 or early 2020)	Review progress on scientific aspects of CMP	Review progress on scientific aspects of CMP
Franciscana	Preparation for review	Review new information	In-depth review
Arabian Sea humpback whales	Abundance estimates (email)	Review progress on identified priorities for research and conservation	Review progress on identified priorities for research and conservation
Mediterranean fin whales	CMP workshop (September 2019)	Review progress on scientific aspects of CMP	Review progress on scientific aspects of CMP
Mediterranean sperm whales		Review progress on scientific aspects	Review progress on scientific aspects of CMP
South American river dolphin	Bogota Workshop (June 2019)	Review progress on scientific aspects of CMP	Review progress on scientific aspects of CMP
Central American Humpback whale	CMP strategic planning (email)	Review progress on Research Priorities	If available discuss draft CMP

11. STOCK DEFINITION AND DNA TESTING

During the present meeting, the Stock Definition and DNA Testing Working Group (hereafter, the SD-DNA WG) provided advice on stock structure to other sub-committees, assessed genetic methods used for species, stock and individual identification, including matters associated with the maintenance of DNA registers; and continued to develop and update guidelines for preparation and analysis of genetic data within the IWC context. The Report of the Working Group is given as Annex I.

11.1 Advice on stock structure to other sub-groups

The SD-DNA WG has the task of discussing high-priority stock related papers from other sub-committees and Working Groups, and then providing them with stock structure related feedback and recommendations. These discussions often refer to the IWC's genetic analysis guidelines and genetic data quality documents (Waples *et al.*, 2018).

11.1.1. Western North Pacific common minke whales

The SD-DNA WG reviewed the stock structure components of the First Intersessional Workshop on the Implementation Review of North Pacific minke whales (SC68A/Rep04) as well as the results of new analyses that were completed after the Workshop (SC/68A/SDDNA/01 and SC/68A/SDDNA/02). The details of the extensive technical discussions can be found in Annex I, item 4.1.1 and the integration of the advice into the *Implementation Trial* structure, including details of a method to inform demographic exchange amongst stocks in Hypothesis E can be found in Annex D, item 3.2 and appendix 3 (trials will be conducted under the assumption that the numbers dispersing from the P to the J stock and the P to the O stock were the same at unexploited equilibrium; and initial evaluation will assume that the same number of calves disperses from the P to the J and O stock). Additional suggested analyses are given under Item 6.2.2.

Attention: SC

The Committee **expresses** great appreciation for the immense amount of work and high level of collaboration put toward providing the results needed to inform the Committee's decisions on the stock structure of western North Pacific common minke whales. After reviewing the available information, the SD-DNA WG concluded that no single stock structure hypothesis was consistent with all results of the various analyses performed. The Committee **endorses** further consideration of the three stock structure hypotheses identified during the Intersessional Workshop (SC/68A/Rep04 and see discussion under Item 6.2.2):

(1) Hypothesis A: there is a single J-stock found in sub-areas 1W, 1E, 2C, 5, 6W, 6E, 7CS, 7CN, 10W, 10E, 11 and 12SW; and a single O-stock in sub-areas 2C, 2R, 3, 4, &CS, 7CN, 7WR, 7E, 8, 9, 9N, 10E, 11, 12SW, 12NE and 13;

(2) Hypothesis B: as Hypothesis (A), but there is a third stock (Y-stock) that resides in sub-areas 1W, 5, and 6W, and overlaps with J-stock in the southern part of sub-area 6W; and

(3) Hypothesis E: there are four stocks, referred to Y, J, P (earlier termed 'purple'), and O, two of which (Y and J) occur in the Sea of Japan, and three of which (J, P, and O) are found to the east of Japan and in the Okhotsk Sea. Stock P is a coastal stock. This new hypothesis E is based on genetic assignment of individuals to clusters taking spatial occurrence into account (as implemented in the software GENELAND; SC/68A/Rep04) and can only be maintained if some demographic exchange between the P stock and both J- and O-stocks is allowed (see item 4.1.1 in Annex I).

The Committee clarified that while Hypothesis E is being considered plausible with respect to moving forward with the simulation trials, its inclusion should not be taken as confirmation of its existence but rather as a way to further evaluate patterns in the data that are difficult to explain under Hypothesis B.

In the discussions of western North Pacific common minke whale stock structure, several issues regarding new analytical techniques, and their interpretation, arose that are more broadly applicable to the Committee's work on stock structure.

Attention: SC

The Committee **encourages** additional exploration of spatially explicit genetic analyses, in particular methods for genetic assignment of individuals to clusters. The Committee **agrees** that such analyses provided valuable information in assessing the stock structure of western North Pacific minke whales and are likely to have broad utility in elucidating stock structure in other cetaceans.

11.1.2. North Pacific sei and Bryde's whales

The 'final' review of JARPN II was conducted in 2016 at a workshop in Tokyo (IWC, 2017c) but at that point, only the samples collected through 2014 had been genetically analysed. SC/68A/SP05 presented the final conclusions of JARPN II by including updated genetic analyses of the stock structure of sei and Bryde's whales in the North Pacific based on the inclusion of all samples collected through 2016.

Attention: SC

In reviewing the final report of the JARPN II surveys SC/68A/SP05, the Committee **expresses appreciation** to Japan for providing the results of analysis of this comprehensive dataset and **agrees** that the most recent results assessing the stock structure of North Pacific sei and Bryde's whales are consistent with those from previous analyses.

11.1.3. North Atlantic sei whales

New information on the stock structure of sei whales in the North Atlantic was considered (Huijser *et al.*, 2018a; Huijser *et al.*, 2018b). Currently, three management stocks of sei whales are defined in the North Atlantic, primarily on the basis of historical catch and sighting data (Donovan, 1991) but the authors detected no evidence of population structure within the North Atlantic. However, the samples analysed were derived from areas considered to be feeding grounds or migratory corridors. Analysing additional samples from a broader portion of the range would be useful in continuing to assess structure within this ocean basin.

11.1.4. Southern Hemisphere whale stocks

The Committee reviewed the results of genetic analyses of Southern Hemisphere whale stocks, including Southern Hemisphere blue (Pastene *et al.*, In Press-b), fin (SC/68A/SH/02 and SC/68A/SH/05), southern right (SH/68A/SH/06) and sei whales (SC/68A/SH/08). Detailed discussions of these analyses are presented in Annex I, item 4.3. These results highlighted the value of existing collections of tissue samples to address stock structure questions.

Attention: SC, R

*In reviewing the results of stock structure analyses of Southern Hemisphere whale stocks, the Committee **reiterates** its concern regarding the depletion of tissue samples in existing collections, including those collected during the IWC SOWER surveys (IWC, 2019d, p.33). The Committee **agrees** that:*

- (1) sample depletion should be avoided, such that sample requests will be fulfilled only with those samples for which a substantial amount of tissue remains;*
- (2) whole-genome sequencing is the best approach to maximise the value and avoid depletion of tissue samples, and requests for projects using this approach should be prioritised; and*
- (3) the intersessional Working Group formed two years ago should continue its work to provide recommendations on genomic approaches to maximize the utility of these samples for future studies (Annex T).*

*With respect to sei whales, the Committee **recognises** the importance of the work in SC/68A/SH/08 to understand stock structure of this species and it **encourages** collaboration between researchers in both the Northern and Southern Hemispheres to integrate genetic datasets to allow for a more comprehensive analysis.*

11.2 New genetic (and other) methods for species, stocks and individual identification

The Committee reviewed (Archer *et al.*, 2017) and discussed the use of ‘diagnosability’ as a criterion to identify taxonomic units. Diagnosability is a measure of the ability to correctly determine the taxon of a specimen of unknown origin based on a set of distinguishing characteristics. It differs from other measures used to distinguish taxa in that it focusses on the distinctiveness of individuals rather than on the degree of differentiation between groups. This method can be used with a wide range of data types, including genetics and morphology, and has been used in evaluating the subspecies status of Antarctic versus eastern South Pacific blue whales (Pastene *et al.*, In Press-c). For details see Annex I, item 2.1.

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.*

11.3 IWC DNA data quality and genetic analyses guidelines (and see Annex I, item 3)

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.

11.3.1. Updates to DNA quality guidelines

The DNA data quality guidelines address DNA validation and systematic quality control in genetic studies and are currently available as a ‘living document’ on the IWC website²³. In recent years, it has become common for the Committee

²³ <http://iwc.int/scientific-committee-handbook#ten>

to review papers using data derived from Next Generation Sequencing approaches, including SNPs, to address stock structure questions. This year, quality control measures and associated threshold values for this type of data were identified for inclusion into the guidelines.

11.3.2. Consideration of need to update analysis guidelines

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

Attention: SC, S

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

- (1) **encourages** that the guidelines be followed in papers reporting the results of DNA analyses to the Committee;
- (2) **emphasises** the need to update these guidelines to incorporate the discussion of data quality measures used for Next Generation Sequencing data and the suggestions for such an update;
- (3) noted that while Genbank is a valuable resource for the work of the Committee, it is essentially an uncurated database and may contain inconsistencies or out-dated information in the metadata – the Committee **agrees** to include a section in the DNA quality guidelines detailing the need for caution when incorporating Genbank sequences into studies;
- (4) **agrees** to continue the intersessional email group (Annex T) 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; and
- (5) **recommends** that the Secretariat makes the guidelines available via the main Scientific Committee webpage to ensure that they can be easily found by researchers.

11.4 Reference databases and standards for diagnostic DNA registries

The Committee previously endorsed a new standard format for the updates of national DNA registers to assist with the review of such updates (IWC, 2012a, p. 53), and the new format has worked well in recent years. This year the update of the DNA registers by Japan, Norway and Iceland were based again on this new format. Details are given in Appendices 2-4 of Annex I for each country, respectively. The Japanese and Icelandic registries cover the period up to and including 2018, while the Norwegian registry covers the period up to 2017. Almost all samples in the three registries have been analysed for mitochondrial DNA (mtDNA) and a standard set of microsatellites. A subset of the samples in the Norwegian registry have also been genotyped for SNPs.

Attention: CG

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

11.5 Other matters

11.5.1 Simulation tools for spatial structuring

TOSSM was developed with the intent of testing the performance of genetic analytical methods in a management context using simulated genetic datasets (Martien *et al.*, 2009), and more recently the TOSSM dataset generation model has been used to create simulated datasets to allow the plausibility of different stock structure hypotheses to be tested (e.g. Archer *et al.*, 2010; Lang and Martien, 2012). The Working Group noted that while TOSSM has been particularly valuable in informing the interpretation of results of stock structure related analyses, it has not been broadly used within the IWC Scientific Committee for this purpose.

In recent years, a wide range of software packages have become available for producing simulated datasets that can be used for statistical inference and/or validating statistical methods (Hoban, 2014; IWC, 2017e, p.48), and in 2016 the Committee agreed to expand this item (formerly specific to TOSSM) to include a broader range of tools (IWC, 2016b, item 11.3, p.44).

Attention: SC

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

11.5.2 Terminology

Defining and standardising the terminology used to discuss ‘stock issues’ remains a long-standing objective of the Working Group, in order to help the Committee report on these issues according to a common reference of terms (IWC, 2014b).

Attention: SC

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

11.5.3 Epigenetic ageing and close-kin mark-recapture

In previous meetings, the Committee reviewed the utility of novel methods that use genetics to estimate age, (epigenetic ageing, IWC, 2019c; Polanowski *et al.*, 2014, p.34) and to estimate abundance, life history parameters, gene flow and stock structure (close-kin mark-recapture, Bravington *et al.*, 2016, p.40; IWC, 2018d). No papers on epigenetic ageing or close-kin mark-recapture were presented to the Committee this year.

Attention: SC

The Committee **agrees** that the utility of epigenetic age estimation to the Committee should be further evaluated by the sub-committees concerned with regard to the degree of precision needed for the specific application of interest. The Committee **encourages** future submission of papers using epigenetic ageing and/or close-kin mark-recapture in light of the potential of both approaches to inform many aspects of the Committee’s work.

11.5 Workplan

The details of the workplan for stock definition and DNA testing are given in Table 14.

Table 14
Work plan for stock definition and DNA testing

Topic	Intersessional 2019/20	2020 Meeting	Intersessional 2020/21	2021 meeting
DNA quality guidelines	Intersessional email group to review recent revisions to the DNA quality guidelines that pertain to data produced using NGS approaches.	Report and finalise updated guidelines		
Recommendations to avoid sample depletion	Intersessional email group to provide recommendations on genomic approaches to maximize the utility of tissue samples that are in danger of becoming depleted in the future	Report and provide advice		
Terminology	Intersessional email group to continue discussions of the use of stock structure-related terms within the Committee	Report	Continue as needed	Report as needed

12. CETACEAN ABUNDANCE ESTIMATES AND STOCK STATUS

In recent years (IWC, 2014c) the Committee has recognised the need for consistency in the way it reviews and categorises abundance estimates, which in the past were reviewed only within the sub-group to which they were submitted. Since 2017, all abundance estimates have been reviewed by a Standing Working Group (SWG) on Abundance Estimates, Stock Status and International Cruises (ASI) and the advice passed on to the relevant sub-group early in the meeting if it was needed urgently or at a future meeting if the reviews can be completed intersessionally. The ASI is also tasked with the (a) the development of a table of an agreed set of abundance estimates for use by the Committee; and (b) a biennial document compiling abundance estimates for the Commission and the public to provide a broad overview by species and

ocean basin, and by specific areas if appropriate. In addition, the ASI will provide a biennial overview of the status of whale stocks, largely based upon completed *In-depth Assessments* and or *RMP/AWMP Implementations* or *Implementation Reviews*.

12.1 Summary of abundance estimates and update of IWC consolidated table

Detailed information on abundance estimates received by the Committee is presented in item 2 and appendix 2 of Annex Q. This year, the Committee **endorses** the following estimates:

- (1) aerial line-transect estimates of Eastern Chukchi Sea white whales for the period 2012-2017 (Annex Q, item 2.1.5);
- (2) ship-based estimates of abundance for North Pacific common minke whales for 2008, 2011, 2013, 2014, 2016, 2017 and 2018 (Annex Q, item 2.1.2);
- (3) a genetic mark-recapture time series of abundance estimates of Māui Dolphin for the period 2001 to 2016 (Annex Q, item 2.1.6).

It also **re-affirms** acceptance of the estimates of abundance for North Atlantic fin whales previously agreed (Annex Q, item 2.1.1).

Attention: SC, S, C-A

*With respect to the IWC Consolidated Table of Accepted Abundance Estimates, the Committee **agrees** that:*

- (1) the endorsed estimates presented in Annex Q, Appendix 2 should be incorporated into that table and uploaded to the IWC website; and*
- (2) the table should continue to be updated intersessionally.*

12.2 Methodological issues

A pre-meeting of ASI was held 8-9 May 2019, to propose a process for reviewing and validating abundance estimates, including those that require population models (e.g. capture-recapture models), and to consider how best to summarise the status of stocks. The pre-meeting report is given in Annex Q (appendix 3).

12.2.1 Process to validate non-standard software and methods

Based on the discussions at the pre-meeting and the ASI SWG, the Committee developed a comprehensive document (Annex P) that outlines the process for the submission, review, endorsement, and possibly validation of abundance estimates submitted to the SC. Some key elements of this process are summarised below.

- (1) Submission of abundance estimation manuscripts at least 1 month prior to the annual SC meeting. The email address abundance@iwc.int should be used.
- (2) Establishment of the Abundance Steering Group (ASG), whose members are the Chair and Vice-Chair of the SC, the Head of Science and Head of Statistics from the Secretariat, and the Convenors of the following subcommittees and Working Groups: ASI, ASW, EM, IST, IA, NH, SM and SH, to prioritise and conduct an initial review of submitted abundance estimates intersessionally. After such a review, and potentially other actions (below), the ASG may recommend that the estimate is ready for consideration by the ASI SWG. In this case, the ASG may choose to suggest acceptance (and category) or rejection, highlighting issues for the ASI SWG to consider. The ASG may also choose to make no specific recommendation to the ASI SWG, but rather provide a list of comments or concerns.
- (3) A set of criteria for prioritising ASG review.
- (4) Establishment of a standing 1-day pre-meeting of the ASG prior to each annual SC meeting to enable the ASG to finalise its initial review of submitted abundance estimates.
- (5) Submission of the data, computer code and associated input files used to calculate the abundance estimate. Before an estimate can be fully endorsed by the Committee as Category 1 ('acceptable for use in in-depth assessments or for providing management advice') or 2 ('underestimate—suitable for AWMP usage or other conservative management but not reflective of total abundance'), the data, code and input files must be lodged with the Secretariat and tested to ensure that the results are reproducible. The ASG may also require these data, code and input files for estimates in other categories in some circumstances, and in cases when external reviews, simulation testing or code validation are needed.
- (6) Additional ASG actions: external technical review by specialist(s), simulation testing, and code validation. The ASG may elect to conduct any of these prior to deciding that the estimate is ready for consideration by the ASI SWG. Such actions would likely mean that endorsement of the abundance estimate would be delayed until the next year's SC meeting, and this would certainly be so if funds were needed to carry out the action(s).

- (7) A list of issues to consider when evaluating abundance estimates.
- (8) Continued research and software for simulating datasets to test abundance estimation methods.

Attention: SC

*The Committee **agrees** to the adoption of the procedures for the submission, review and validation of new abundance estimates provided in Annex P. In particular, it **agrees** to the establishment (and associated funding) of a standing 1-day pre-meeting of the ASG prior to each annual Committee meeting to enable it to finalise its initial review of submitted abundance estimates.*

12.2.2 Abundance estimates from methods that require population models

The Committee discussed some issues related to the use of abundance estimates from methods that require population models (e.g. capture-recapture analyses) Details are given in Annex Q (item 3.2 and appendix 3). SC/68A/ASI/11 offered advice on formulating appropriate models and estimating parameters. For example, a population model is always required for interpreting mark-recapture data, although for some standard methods it may be a minimal model, such as a closed population model. For such models, the popular practice of treating capture probabilities in different years as equal whenever this yields a lower Akaike Information Criterion (AIC) was discouraged, because it amounts to treating sample size as an index of relative abundance without regard to sampling effort.

Attention: SC

*The Committee **agrees** to the approaches summarised in Annex Q regarding the consideration of abundance estimates from methods that require population models and how to archive such estimates in the IWC Consolidated Table of Abundance Estimates.*

12.2.3 Amendments to the RMP Guidelines

At last year's meeting, the ASI SWG agreed that the RMP Guidelines needed to be extended to incorporate spatial model approaches to estimate abundance by 2020. A Steering Group was established to (1) develop a set of specific instructions for the amendment of the RMP guidelines to consider model-based abundance estimates and (2) select a candidate to conduct this work. Dr. David Miller from CREEM (Centre for Research into Ecological & Environmental Modelling, University of St. Andrews) was selected to modify the Guidelines with advice from a Steering Group.

Attention: SC

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

12.3 Consideration of the status of stocks

The Committee has been asked to provide broad information on the status of whale stocks for the Commission and general public. Analyses to facilitate this work were discussed in Annex Q, item 3.3. This information will be further summarised for conveyance to the Commission.

Attention: SC, S, NI

*When providing advice about stocks that have been subject to Implementations, Implementation Reviews, or In-depth Assessments, the Committee **agrees**:*

(1) that the information provided to the Commission should include (a) current 1+ abundance, (b) 1+ depletion (if available) and (c) a qualitative statement on recovery over the past several decades, based on trajectory plots – for the first two both averages over trials and 90% intervals should be considered;

(2) that results should be summarised across two values of the MSY rate (normally 1% in terms of harvesting of the total (1+) component of the population and 4% in terms of harvesting of the mature component) and across simulations and trials by taking medians and percentiles over all simulations and averages across trials;

- (3) that the guidelines (Annex Q) for how to choose stocks and areas to which the above calculations should apply while noting that flexibility may be necessary, and that the decision will often depend on what was of interest during Implementations, Implementation Reviews and In-depth Assessments;
- (4) that the Committee should highlight any additional matters that may be of special interest to the Commission, such as bringing attention to peculiarities in the population trajectory, or information relevant to a small biological stock or population isolated spatially or genetically;
- (5) to the additional technical specifications detailed in Annex Q, item 3.3; and
- (6) that Allison and Punt modify the computer code and data processing for Implementations, Implementation Reviews and In-depth Assessments to enable the agreed information to be obtained.

For stocks for which an agreed abundance estimate is available, but no assessments have been undertaken, the preceding approach should still be used to the extent possible recognising that some case-specific adjustments will be required.

12.4 Workplan 2020

The Committee agrees to the workplan provided in Table 15.

Table 15

Summary of the work plan related to abundance estimates, status of stocks and international cruises for the period 2019/20

Item	Topic	Intersessional 2019-20	2020 Annual Meeting
1	Review of Abundance Estimates.	ASG to coordinate the review of the following abundance estimates identified at SC68A: New Zealand blue whale ((Barlow <i>et al.</i> , 2018b), SH agenda item 3.1.2) Magellan strait humpback whales (Monnahan <i>et al.</i> , 2019a), SH agenda item 6.2) SE Australian right whales (Stamation <i>et al.</i> , In Prep), SH agenda item 5.2.2) Review method used to estimate Maui dolphin abundance (Cooke <i>et al.</i> , 2019), ASI agenda item 2.1)	Review intersessional progress and estimates available at SC68s
2	Upload the estimates accepted at the annual meeting to the IWC website and continue to update the IWC Abundance Table.	Update the table with estimates accepted at SC68A (Allison)	
3	Amend the RMP Guidelines to consider abundance estimates computed with model-based methods.	Develop a set of specific instructions for the amendment of the RMP Guidelines to consider model-based abundance estimates. (Steering Group and Miller)	Review an updated document of the RMP Guidelines
4	Develop simulation software to evaluate methods for abundance estimates.	Continue development of software (Palka and Smith)	Review Progress
5	Provide Commission with advice on status of stocks.	Compute results for internal review (Punt and Allison)	Provide advice to Commission
6	Host a pre-meeting for the Abundance Steering Group (ASG).	ASG to review necessary information in preparation of pre-meeting.	Host pre-meeting
7	Address issues (including $g(0)$) related to estimates of abundance of western North Pacific abundance estimates for use in simulation trials and provision of regional estimates	ICG to coordinate intersessional work	Review progress
8	Consider diagnostic methods (e.g., model fit) for mark-recapture models to estimate abundance.	ASG to identify an expert group.	Review progress

13. BYCATCH AND ENTANGLEMENTS

13.1 Progress with the IWC Bycatch Mitigation Initiative

13.1.1 Priorities and report from workshop

Following a strategic assessment in 2018, the Bycatch Mitigation Initiative (BMI) plans to focus on bycatch in small scale/artisanal gillnets. The BMI has a ten-year strategic plan and a two-year costed work plan and is advised by a multi-

disciplinary Expert Panel²⁴. The BMI has been working to identify potential pilot projects where novel, multidisciplinary approaches can be applied for monitoring, mitigation and fisheries engagement. The BMI is also developing Terms of Reference for a review of cetacean sensory ecology (e.g. factors that affect a cetacean's ability to detect fishing gear) which might inform future experimental work on mitigation measures.

A regional workshop on 'Bycatch Mitigation Opportunities in the Western Indian Ocean and the Arabian Sea', was held in Nairobi on 8-9 May, organised by the BMI. Participants from 19 countries included regional representatives from fishing communities, cetacean and bycatch scientists, social scientists, fisheries managers and the BMI Expert Panel. The workshop recognised bycatch as one of the most significant threats to cetaceans in the Indian Ocean region, where large numbers of small to medium scale gillnet fisheries overlap with cetacean distribution. The Committee thanked Tarzia, Minton and the IWC Secretariat for their efforts in organising the workshop which had made significant progress towards more clearly identifying knowledge gaps and opportunities for reducing bycatch through regional and cross-stakeholder collaboration.

13.1.2 Progress on collaboration on bycatch-related issues with other organisations including FAO and IOTC

Engagement with FAO and RFMOs (Regional Fisheries Management Organisations) is discussed in Annex J, items 2.1 and 2.3. In 2018, an FAO Expert Workshop on Means and Methods for Reducing Marine Mammal Mortality in Fishing and Aquaculture Operations (SC/68A/INFO/11) recommended that the FAO develop Technical Guidelines on means and methods for prevention and reduction of marine mammal bycatch, a mechanism for facilitating and monitoring the implementation of any guidelines, and a programme for capacity building. Following IWC participation in the FAO's Committee on Fisheries (COFI) meeting in 2018, COFI requested that the FAO work with the IWC and others in the development of Technical Guidelines on marine mammal bycatch mitigation. The IWC Secretariat expects to be invited to a follow up workshop in September 2019. The IWC Secretariat has engaged with a number of RFMOs through the Regional Secretariat's Network and continues to engage with other international bodies on bycatch.

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

The Committee reviewed a paper on previously undocumented entanglements of common minke whales in the inshore waters of Scotland based upon interviews with fishermen that indicated a much higher rate of entanglement for this species than previously documented (SC/68A/HIM02). It was suggested that follow up work could potentially take a similar approach to (Song *et al.*, 2010) in examining common minke whale entanglement by gear type.

13.2.1 Review report of the Fourth Workshop on Large Whale Entanglement Issues

Mattila, the IWC's technical advisor for reducing unintended human impacts, reported on relevant activities under the entanglement initiative, including the Fourth Workshop on Large Whale Entanglement Issues (IWC, 2018c). Details are summarised in Annex J, item 2.2.1. Mattila noted that several IWC entanglement response trainings have been conducted in regions with existing or proposed CMPs, including the most recent training for Peru and Chile, and a planned training in 2019 for Argentina, Uruguay and Brazil. The Committee thanked Mattila and the Global Whale Entanglement Response Network (GWERN) members for their ongoing dedication and hard work.

13.2.2 Review proposal for global entanglement database

The Fourth Workshop on Large Whale Entanglement Issues (IWC, 2018c) reiterated the importance of collecting accurate data but did not reach consensus that investment in a global entanglement database would provide the desired return. The Committee **agrees** that Mattila should request that members of the GWERN collect data using the consensus data form (Annex D, IWC/64/WKM&AWI REP1) over the coming year. This could establish if the data collected would warrant the cost of building the database as designed.

13.3 Mitigation measures for preventing large whale entanglement

FAO has now published guidance (FAO, 2019) on the marking of fishing gear in order identify the fishery and potentially the individual owner, in the event that it is abandoned, lost or discarded (ALDFG). Any gear marking that allows ALDFG to be traced will also likely allow entangling gear removed from whales to be identified. While this guidance is voluntary, it tasks individual States to develop gear marking schemes for identified fisheries and also recommends coordination between States on gear marking schemes. The Committee **welcomes** this important work by the FAO and **agrees** that gear marking is an important step in tackling large whale entanglements.

13.4 Review new methods and estimates of bycatch rates, risks and mortality (small cetaceans)

13.4.1 EU Regulations and directives

The Committee discussed the new (2019) European Commission Technical Measures Regulation, aspects of which may either strengthen or weaken European bycatch monitoring and mitigation measures compared to previous legislation. Details are given in Annex J, item 2.4. It was noted that advice and recommendations from the Committee could assist in the implementation of the legislation by EU Member States. The Committee also welcomes Norway's plan to host an expert workshop to examine cetacean bycatch rates and the effectiveness of pingers.

²⁴ www.iwc.int/bycatch

Attention: CG

*The Committee notes the limitations of cetacean bycatch estimates and mitigation programmes across the EU and **recommends** that improved monitoring programmes should be established.*

13.4.2 Common dolphins in the Bay of Biscay

The Committee discussed two new papers regarding large numbers of common dolphin strandings showing evidence of bycatch from the Bay of Biscay (SC/68A/HIM11, Peltier *et al.*, Submitted-b). These studies related to strandings in France, but it was also noted that there were substantial numbers of common dolphin strandings reported in National Progress reports from UK and Spain along coasts close to the Bay of Biscay. Details are in Annex J, item 2.4. The Committee recalled its serious concerns over the large number of stranded common dolphins reported in previous years and that common dolphins may have a bycatch which threatens the conservation status of the population (IWC, 2019g). In addition, the Committee noted that a robust evaluation of the effectiveness of bycatch mitigation measures requires a combination of monitoring measures, including well-designed and effectively implemented observer/electronic monitoring programmes and stranding programmes. The general issue of remote electronic monitoring is also discussed under Item 13.4.7.

The Committee noted that:

- (a) new information reveals a complex situation with potentially multiple different fisheries involving both mobile and static gear contributing to the high levels of bycatch;
- (b) the level of strandings associated with bycatch has been steadily increasing (2019 is the highest on record, with a total of 1170 cetaceans stranded between 01/12/2018 and 16/04/2019 along the French Atlantic coasts, which likely represents only a small fraction of the total bycatch) - this highlights the urgency of the situation and adds to the previous concerns;
- (c) the substantial and consistent peak from strandings from January-March suggests that the most intense observer effort is required during this period and in fact short concentrated periods (1-3 weeks) have been have contributed to more than half of the annual counts in 23 of the last 30 winter seasons;
- (d) this suggests a short period of intense spatial and temporal overlap between dolphin distribution and the fisheries and hence that a ‘moving on procedure’ in line with the new EU Technical Measures Regulation might be an effective mitigation option;
- (e) obtaining representative observer coverage had been problematic in the past because vessels could choose whether or not to accept observers.

Attention: CG

*The Committee is **concerned** that the bycatch of common dolphins in the Bay of Biscay may threaten the conservation status of the population. The Committee **recommends** that:*

- (1) high intensity observer effort is required to identify the fisheries involved, produce reliable estimates of total bycatch and determine the relative contribution from each fishery (the complexity of the situation and highly over-dispersed bycatch rates indicate that this may need to be 100% coverage with either observers or electronic monitoring);*
- (2) full monitoring coverage (either through observers or electronic monitoring) is required to facilitate compliance with and monitoring of ‘moving on’ procedures as a mitigation measure;*
- (3) further consideration of the area covered by the monitoring and mitigation provisions is needed and this should take into account the distribution of estimated bycatch locations identified in SC/68A/HIM11;*
- (4) further work is needed to specify a ‘moving on procedure’ including determination of the trigger for ‘moving on’ (e.g. level of bycatch) and the extent of the movement required - implementing full monitoring coverage that allows any ‘moving on’ procedure to be evaluated may remove the need for time area closures which would otherwise have to be considered;*
- (5) mandatory participation in the monitoring programme and agreeing to the mitigation measures should be made a condition for fishing in the area during the period January to March through the relevant European Union fisheries management processes.*

In addition, the Committee:

(1) **advises** that the ICES WGMME (2018) found that ‘Good Environmental Status’ had not been achieved in the Bay of Biscay due to unsustainable bycatch of common dolphin and that bycatch pressure must be addressed adequately in French waters during the next EU Marine Strategy Framework Directive (MSFD) cycle; and

(2) **recommends** that the concurrent implementation of both monitoring and mitigation is required to ensure that bycatch is properly assessed and reduced in an appropriate timescale to meet MSFD obligations.

13.4.3 Mitigation in tuna gillnet fisheries that operate out Karachi, Pakistan

The results of a multi-year study conducted by WWF Pakistan using fishing crew-based observers to collect data on cetacean bycatch in tuna gillnet fisheries was discussed (Annex K, item 2.4). Extrapolations from the monitored vessels to the full fleet indicated that cetacean bycatch probably involved thousands of individuals. Since 2015, most of the fleet switched from setting their drift gillnets at the surface to a depth of 2m in order to catch larger individual fish. This shift in gear deployment was also associated with a statistically significant reduction in cetacean bycatch (SC/68A/HIM/12). The WWF Pakistan team is collaborating with members of the IWC Expert Panel on Bycatch to further analyse the data and quantify the level of bycatch reduction.

13.4.4 Shark nets and mitigation and monitoring in South Africa

The Committee received two papers regarding bycatch in shark nets in South Africa. Net marks and other injuries on stranded dolphins are considered to be a clear indication of entanglement. However, only a small percentage (23%) of bycaught animals actually presented such signs. Thus, other methods in addition to net mark presence are required to reliably identify entanglement cases in strandings (SC/68A/HIM/10).

Endangered Indian Ocean humpback dolphins (*Sousa plumbea*) are bycaught in shark nets in KwaZulu-Natal, South Africa (SC/68A/HIM/16). These nets are responsible for a significant portion of the permanent loss of humpback dolphins at Richards Bay and may be affecting the wider population (SC/68A/INFO/52). Changing some gear from gillnets to baited hooks has reduced bycatch but further replacements of gillnets with baited hooks is unlikely and a new deployment of shark nets is also being considered.

Further recommendations regarding humpback dolphin bycatch off South Africa were also made following discussions under 17.1 (See Annex M item 2.1) including re-emphasising the concerns it has previously raised on the poor status of *Sousa* populations.

Attention: CG

With respect to bycatch of cetaceans in shark nets of South Africa, the Committee recommends that:

(1) *prior to new shark nets being deployed, data should be gathered on the use of the area by cetaceans and the likely impacts of the nets; and*

(2) *more effort should be focused on the process of finding and testing a wider range of alternatives to shark nets in South Africa in order to increase mitigation efforts to reduce the bycatch of Indian Ocean humpback dolphins.*

Seakamela described a new effort by Department of Environmental Affairs and Department of Agriculture, Forestry, and Fisheries in South Africa which seeks to build a marine mammal observation programme alongside the current seabird observer programme. There are currently bycatch mitigation plans in place for turtles and seabirds but there has been limited attention to marine mammal bycatch apart from some set line fisheries for rock lobster and octopus which have mitigation measures in place to reduce risks to large whales.

The Committee appreciated the opportunity to advise on the development of this observation programme and noted that many of the fisheries in question may face challenges analogous to other fisheries that already have cetacean bycatch monitoring programmes. It suggested that South Africa may wish to consult directly with other fisheries experts to learn from their experiences. An in-person meeting in South Africa could also help progress the development of a monitoring programme.

Attention: CG, SC, CC, S

The Committee draws attention to the request of South Africa for advice on development of a national programme to monitor and mitigate marine mammal bycatch in national fisheries. It recommends that this request be referred to the Bycatch Expert Panel and also notes that individual Committee members are willing to provide advice.

13.4.5 Bycatch in Ecuadorian waters

The Committee received two papers on bycatch in Ecuadorian waters (Annex J, item 2.4). The primary cause of bycatch mortality for both small and large cetaceans is the artisanal drift gillnet fishery, with significant bycatch of humpback whales in particular.

Attention: BMI

The Committee **recognises** the potential for the Ecuadorian artisanal drift gillnet fishery to be a BMI pilot project to explore bycatch mitigation options and **encourages** consideration of this by the BMI. The Committee also **encourages** the IWC's large whale entanglement initiative to provide entanglement response training in Ecuador.

13.4.6 Consideration of 'rapid risk assessment' tools

The Committee discussed two approaches to rapid risk assessment of bycatch ((Braulik *et al.*, 2018; Hines *et al.*, 2018); Annex J, item 2.4.1) and noted that there could be some scope for implementing a combination of both methods in a BMI pilot project.

The Committee received information on a University of Washington, Ocean Modeling Forum Working Group that is developing tools that are relevant to compliance with the MMPA Import Provisions rule (SC/68A/HIM1).

13.4.7 Consideration of remote electronic monitoring and vessel tracking

Two papers on Remote Electronic Monitoring (REM) were discussed (Annex J, item 2.4.2). A REM project to assess the bycatch of harbour porpoise in the Dutch commercial bottom-set gillnet fishery had allowed estimates of bycatch and generated a number of recommendations for future use of REM (Scheidat *et al.*, 2018).

A small REM system originally developed for use in monitoring fishing operations in the Eastern Pacific was applied on over 500 small scale fishing vessels and used to monitor marine turtle bycatch off the coast of Peru. The development team is keen for further collaborations with researchers in different parts of the world who would be willing to test the system's functionality in different fisheries and settings, and especially its effectiveness in detecting cetacean bycatch (SC/68A/HIM/06).

13.4.8 Hector's and Māui dolphins in New Zealand: consideration of spatial risk assessment of threats.

The Committee discussed three papers related to risk assessment of threats to Hector's and Māui dolphins in New Zealand. SC/68A/HIM/05 provided an update on Hector's and Māui dolphins and fisheries. Cooke *et al.* (2019) fitted an individual-based model to genetic capture-recapture data from Māui dolphins from biopsies collected during 2001-16 and from some carcasses, in order to make future projections under various scenarios. Roberts *et al.* (2019) presented a spatially explicit risk assessment of fisheries and non-fishery threats affecting Māui and Hector's dolphins. This risk assessment method estimates encounters between dolphins and threats based on the level of spatial overlap between their mapped distributions.

There was considerable discussion of the relative impact of different threats in addition to technical details of the analyses (Annex J item 2.4.3). (Roberts *et al.*, 2019) estimated that at current levels, commercial fisheries risk alone would not be sufficient to produce the observed decline in the Māui dolphin population, suggesting that other threats are also impacting the population. The estimates of Cooke *et al.* (2019) imply that if commercial fisheries-related mortality was the only threat responsible for the population decline, then a further reduction of at least 50% in fisheries mortality would be needed to eliminate the risk of Māui's extinction.

Overall, while a number of issues were resolved in the course of discussion, the Committee **agrees** that the time required to review the novel and complex model of Roberts *et al.* (2019) and its assumptions, inputs and outputs, was greater than could be realistically allocated during SC/68A, especially given that the spatial modelling could not be discussed in any detail due to time constraints. In particular, the Committee did not have adequate time to rigorously evaluate the specific choices made in designing and implementing the model, including determination of the sensitivity of the conclusions to the choices made.

In light of the many recommendations concerning Māui dolphins that the Committee has made in the past, the Committee welcomed these presentations and the potential for new information to inform this issue. The Committee expressed support for the New Zealand government's use of a spatial risk assessment for Māui and Hector's dolphins and agreed with the principle of estimating encounters between dolphins and lethal threats as a function of their overlap in space. The Committee therefore **recommends** that the work be reviewed intersessionally, to assess if the model is sufficiently robust to inform management.

Attention: CG, SC, S

The Committee **reiterates** last year's recommendations (IWC, 2019c, p17), given its continued grave concerns regarding Māui dolphins. The Committee **thinks** the Government of New Zealand for bringing forward the spatial risk assessment model for Māui and Hector's dolphins presented in Roberts et al. (2019). However, in order provide a rigorous evaluation of the approach and its outputs, the Committee **recommends** that an intersessional Working Group (Annex T) be convened to provide a thorough, independent review of the spatial risk assessment model. The Terms of Reference would include the preparation of solicited review papers on the information and analysis presented in Roberts et al. (2019) on:

- (a) Māui and Hector's dolphins' life history parameters;
- (b) Māui and Hector's dolphins' spatial distribution;
- (c) estimates of bycatch rates and vulnerability;
- (d) toxoplasmosis; and
- (e) the risk model outputs;

A Steering Group of individuals from the Committee would be convened to coordinate the review process and identify individuals for the Review Panel. The Review Panel will consist of five independent experts with backgrounds appropriate to topics a-e above, and who are able to carry out a comprehensive review in their area of expertise. No individual on the Steering Group will also serve on the Review Panel to avoid any perceived conflict of interest. Further, in order to ensure the independence of the review and its process, in both perception and reality, no member of the Review Panel or the Steering Group will be associated with Roberts et al. (2019), Cooke et al. (2019) or SC/68A/HIM/05. The results of the Review Panel's independent reviews would be discussed in a two-day pre-meeting to the 2020 Annual Meeting. All conclusions will be presented to the Committee in SC/68B for further discussion, and any decisions with regards to existing or future recommendations will be made at that time.

The Committee **encourages** the Government of New Zealand to work with the Committee to consider how to support the independent reviewers and the pre-meeting needed to achieve a rigorous review and evaluation of the spatial risk assessment model presented in Roberts et al. (2019)

The recommendations above are additional to, and do not supplant, the recommendations made by the Committee last year (IWC, 2019c, p17), including closures of any fisheries within the range of Māui dolphins that are known to pose a risk of bycatch to dolphins (i.e. set net and trawl fisheries).

The Committee also acknowledged toxoplasmosis as a recently recognised threat to Māui and Hector's dolphins (Roe et al., 2013) and the need for additional research beyond that covered in the Terms of Reference of the intersessional group to better understand the implications of this infection.

Attention: CG, SC, S

The Committee **recommends** that further research be carried out to better understand the source and potential risk of toxoplasmosis, as well as approaches to its mitigation, as it relates to Maui and Hector's dolphins, particularly as toxoplasmosis would compound the threat posed by bycatch.

Given the link between the review on toxoplasmosis in Māui and Hector's dolphins and the planned Environmental Concerns focus session on toxoplasmosis at the 2020 Annual Meeting, the Committee **agrees** that there is a need for coordination in the selection of the expert reviewer for toxoplasmosis and that individual's participation across both fora.

13.5 Scientific aspects of mitigation measures for small cetaceans

SC/68A/HIM/04 presented information from preliminary trials of cetacean escape devices in anchored stow nets in South Korea. The narrow-ridged finless porpoise (*Neophocaena asiaeorientalis*) is regularly caught in stow nets, particular along the west coast of the Korean peninsula. The Committee noted the extremely useful nature of this type of work, given that there is a widespread lack of trialling of novel mitigation solutions. It welcomed further tests of these escape devices to reduce finless porpoise bycatch.

13.6 Review of information in National Progress reports on bycatch and entanglement

Reports on bycatch and entanglement in National Progress reports were not reviewed but are summarised in Annex J (appendix 4).

13.7 Workplan

Table 16
Work plan related to bycatch and entanglement

Topic	Intersessional 2019/20	2020 Annual meeting
Bycatch Mitigation Initiative		Review aspects relevant to Committee and respond to requests for advice
Rates and risks		Review new estimates of entanglement rates, risks and mortality
Mitigation		Review new information on mitigation
Global disentanglement database	Mattila to trial a data form for disentanglement activities conducted by members of the IWC network at GWERN meeting	Review Progress
Collaboration with FAO	Continue collaboration	Continue to review
FAO bycatch mitigation table	Create decision tree structure from mitigation table	Review decision tree
Observer schemes in South Africa	Work with BMI Expert Panel to provide advice on design of observer schemes	Review advice and consider further if needed
Risk assessment of threats to Hector's and Māui dolphins	Intersessional review papers as input to pre-meeting	Review risk assessment in Roberts et al. 2019

14. SHIP STRIKES

14.1 Review new methods and estimates of rates of ship strikes, risk of ship strikes and mortality (including review progress on the IWC ship strikes database)

The Committee considered a comprehensive review (Peltier *et al.*, Submitted-a) of confirmed collision records of large whales in France based on strandings. Details are given in Annex J (item 3.1).

The Committee expressed concern about the increasing number of stranded whales linked to ship strikes in several areas off the coast of France. It was noted that the number of stranded individuals will only be a small fraction of the ship strike mortalities, and that modelling the drift of carcasses may help determine the location of the ship strike. The Committee noted that few measures have been implemented to reduce ship strikes in the affected areas.

The intersessional work of the IWC ship strike data coordinators is summarised in SC/68A/HIM14. The Committee recognised the importance of the finalisation of a bulk uploader tool, as there are outstanding datasets that are too large to be entered manually into the ship strikes database without a considerable investment in time. The coordinators are currently waiting for records from US and Australian data to be integrated into the database. If this can be achieved, then it should be possible to have a fully reviewed database by next year's meeting that can be made available for use.

Attention: SC, S, CG

*The Committee commended Panigada and Ritter for their intersessional work and **recommends** the continuation of the work of the IWC ship strike data coordinators and the Data Review Group to review historical records.*

*The Committee **recommends** the Secretariat prioritise development of the bulk upload tools for the ship strikes database and contact known holders of large data sets (especially the national datasets in Australia and the USA) to request that the data be shared with the IWC database.*

14.2 Mitigation of ship strikes in high risk areas

The Committee received SC/68A/HIM09 which described the distribution of humpback whales and shipping traffic patterns in coastal waters of Peru and proposed measures to address ship strikes. The Committee recognised the potential for ship strikes to impact cetaceans in Peru's coastal waters, but further detail is needed for the Committee to evaluate the routing options proposed in the paper. The Committee **encourages** the authors to submit additional information to next year's meeting and highlighted the intersessional correspondence group on vessel routing (Annex T) which may be able to assist in providing advice on any routing measures that are proposed in the intersessional period.

The Committee was informed about recent measures adopted by the International Association of Antarctica Tour Operators (IAATO) to reduce ship strike risks from Antarctic expedition tourism vessels. Members of IAATO have adopted mandatory measures to mitigate ship strike risks in areas off the Antarctic Peninsula (Annex J, item 3.2). The Committee **supports** the newly adopted mitigation measures and expressed interest in receiving more information from the evaluations by the IAATO Secretariat. This is discussed further under Item 20.2.2.

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

The Canary Islands are identified as an area of high risk for ship strikes in the IWC Strategic Plan to Mitigate the Impacts of Ship Strikes on Cetacean Populations²⁵. The high number of reported strikes is due to the overlap between cetacean habitats and intense marine traffic in the archipelago, especially fast inter-island ferries.

Analysis of strandings data indicated a recent increase in ship strikes in the Canary Islands, coincidental in time with the introduction of new high-speed ferry routes, raising the concern of the impact of ship strikes on the conservation of sperm whales (SC/68A/HIM08). Diagnostic methods have also improved allowing for ship strikes to be identified even from putrefied carcasses ((Arregui *et al.*, Submitted; Díaz-Delgado *et al.*, 2018).

The unusually high number of ship strikes observed in the first months of 2019 has led to initiatives by the Spanish and Canary Islands Governments and the shipping industry to move towards the implementation of mitigation measures. The Committee commends the broad support for further mitigation measures by the relevant stakeholders and notes that the situation continues to be a serious concern.

Attention: CG, CC, S

*The Committee **draws attention** to the high level of ship strikes in the Canary Islands. It therefore **re-iterates** previous Committee recommendations on the need to immediately implement mitigation measures that will reduce the risk of vessel-whale collisions in the Canary Islands archipelago. Therefore the Committee:*

- (1) **welcomes** the initiative of convening a Ship Strike Prevention Working Group to unify efforts by different stakeholders under the guidance of the Canary Island and Spanish Governments, as well as a proposal to hold a multi-stakeholder workshop;*
- (2) **recommends** that mitigation measures should include operational, technological and educational aspects in order to reduce mortalities and injuries to cetaceans as a result of ship strikes, improve reporting of such incidents and increase public and industry awareness; and*
- (3) **recommends** that the Secretariat notify Spain of the Committee's recent review of new information on ship strikes in the region, its concern over the situation, and its willingness to help with information and advice.*

14.2.2 Consideration of methods to identify 'high risk' areas including report of IMMA workshop

SC/68A/HIM/07/rev1 reports on a joint IWC-IUCN-ACCOBAMS workshop held in Greece in April 2019 to evaluate how the data and process used to identify Important Marine Mammal Areas (IMMAs) can assist the IWC to identify areas of high risk for ship strike, using the Mediterranean Sea as a test case. The IWC defines high risk areas as 'the convergence of either areas of high volume of shipping and whales, or high numbers of whales and shipping'

The Committee discussed the recommendations made by the workshop which included recommendations related to ship strike issues in areas of the Mediterranean such as the Pelagos Sanctuary and the Hellenic Trench which are identified high risk areas in the IWC Strategic Plan²⁶.

Following the workshop, a GIS project to examine the overlap between ship traffic and IMMAs has been initiated by WWF in direct response to the recommendation at the workshop to undertake an initial analysis of global IMMAs to identify potential high-risk areas. The Committee welcomed this initiative and looked forward to reviewing the results.

Attention: SC, CC, NI, IGO

*The Committee **thanks** the participants of the workshop and Panigada for presenting the report of the joint IWC-IUCN-ACCOBAMS workshop to identify high risk areas for cetaceans (SC/68A/HIM/07/rev1). It **agrees** that Panigada become the liaison between the IWC Scientific Committee and Conservation Committee, ACCOBAMS Scientific Committee, the CMS and the IUCN MMPA Task Force on issues related to IMMAs.*

²⁵ <https://iwc.int/ship-strikes>

²⁶ <https://iwc.int/ship-strikes>

Attention: SC, CC, CG

The Committee **draws attention** to the recommendations of the Joint IWC-IUCN-ACCOBAMS workshop on the evaluation of data and processes used to identify Important Marine Mammal Areas (SC/68A/HIM/07/rev1).

The Committee **advises** that Important Marine Mammal Areas (IMMAs) represent a systematic and biocentric approach to identifying important habitats, and that as such they can be helpful in identifying potential high-risk areas for ship strikes. In particular, if an IMMA contains a species or population that is vulnerable to ship strikes, and it is transited by significant shipping, the area can be 'flagged' for further investigation and potential mitigation. It also **advises** that IMMAs can potentially be used to identify high risk areas for other threats, including combined threats, e.g. bycatch and noise.

The Committee therefore **recommends** that:

- (a) the best overall current mitigation measures are to plan voyages to avoid high risk areas or, if they cannot be avoided, restrict speed to 10 knots, which has been shown to be an effective speed to reduce fatal collisions with most large whales;
- (b) the steps identified in SC/68A/HIM07 are undertaken by the IWC Ship Strikes Working Group and the IWC Scientific Committee as part of a process to identify High Risk Areas for Ship Strikes based on IMMAs
- (c) the IWC Ship Strikes Working Group develop case studies to demonstrate the benefits, anticipated and actual costs of measures introduced to reduce ship strikes and that the IWC Secretariat consider whether an intern could be recruited to support the development of these case studies.
- (d) the IWC Scientific Committee and the IUCN MMPA Task Force review the potential uses of the IWC databases (e.g. historical catch, sightings, strandings etc) in helping to identify Areas of Interest (AOI) for future surveys, and for the verification of the longevity of IMMAs.

Attention: IGO

The Committee **reiterates** its recommendation from last year (IWC, 2019c) for continued work to develop and evaluate mitigation measures, such as speed restrictions, that might be associated with the designation of a Particularly Sensitive Sea Area (PSSA) in the Pelagos Sanctuary area. In light of the recommendation from the IMMAs/ship strikes workshop, the Committee **encourages** the ACCOBAMS Secretariat and ACCOBAMS Parties to further develop the process for the designation of a PSSA at a scale that includes the North West Mediterranean Sea, Slope and Canyon IMMA, plus potentially the Spanish corridor with ship strike mitigation tools such as speed reduction and routing measures as part of Associated Protective Measures.

Frantzis *et al.* (2019) describe the distribution of shipping traffic and sperm whales in the Hellenic Trench and identify options to significantly reduce ship strike risk through a small offshore shift in shipping routes. The overall collision risk for sperm whales in the study area would be reduced by around 70%, while a maximum of 11 nautical miles would be added to major routes and only around 5 nautical miles for the majority of ships. It was noted that much of this work had already been reviewed by the Committee leading to a recommendation in 2016 to move forward with Greece, ACCOBAMS and other stakeholders with a routing proposal to IMO.

Attention: G, I

Recognising that ship strikes are a significant threat to the eastern sub-population of sperm whales in the Mediterranean and taking account of the discussions at the workshop in addition to the previous recommendations of the Committee, the Committee **encourages** the Greek Ministry of Maritime Affairs and Insular Policy to work with other Greek Ministries (e.g. Ministry of Environment and Energy) and relevant stakeholders including the shipping industry, the European Commission and other countries, NGOs, IGOs and scientists to put in place risk reduction measures in the Hellenic Trench and submit a formal proposal by 2020 to the IMO for approval.

14.3 Cooperation with [other organisations including] IMO Secretariat and relevant IMO committees

Ongoing cooperation with IMO including work related to noise and ship strikes is described in SC/68A/03.

Attention: S

The Committee **recommends** that the IWC Secretariat continue to cooperate with the IMO Secretariat on the development of new routeing measures and ship strike issues related to cetaceans in conjunction with the Scientific and Conservation Committees as appropriate.

The south coast of Sri Lanka is one of the high-risk areas for ship strikes identified by the Committee and in the IWC Strategic Plan to Mitigate the Impacts of Ship Strikes on Cetacean Populations. Following the recommendation from the Committee in 2016 that the available data would support a proposal to IMO to move the shipping lanes (IWC, 2017f), there has been ongoing contact between the Secretariat and IMO Secretariat regarding routing of ship traffic off southern Sri Lanka. A workshop titled ‘National Stakeholder Consultation, Maritime Activities off the Coast of Sri Lanka: the case of the blue whale population near Dondra Hd’ organised jointly by the Sri Lankan Marine Environment Protection Authority (MEPA) and IMO provided an opportunity to present the discussions and recommendations of the Committee to Sri Lankan stakeholders and officials.

Attention: S, SC, IGO, CG

*Noting previous concerns and recommendations regarding the situation for northern Indian Ocean blue whales and ship strikes off Sri Lanka, the Committee **recommends** that the Secretariat should maintain the ongoing dialogue regarding re-routing shipping off southern Sri Lanka with the IMO Secretariat and Sri Lankan officials. It also **agrees** that Sri Lankan scientists working on blue whales be considered as invited participants for SC68B.*

14.4 Workplan

Table 17
Work plan for ship strikes

Topic	Intersessional 2019/20	2020 Annual Meeting
Mitigation		Review new information on mitigation
Advice on routing measures related to ship strike risk	Provide advice as required (ICG, Annex T)	Review advice
Follow up on previous contacts offering IWC assistance regarding high risk areas	Secretariat to maintain contact with Sri Lankan and Greek authorities	Review progress on identified high risk areas in IWC Ship Strike Strategic Plan
Continued cooperation with IMO	Secretariat to maintain dialogue with IMO Secretariat. Attend relevant IMO meetings.	Review cooperation
Rates and risks		Review estimates of rates of ship strikes, risk of ship strikes and mortality
Ship strike database	Continue ongoing data entry into Ship Strike Database and validation of records	Review progress against specific deliverables and timeline
Provision of AIS data	Secretariat to continue to develop MOU with Marine Traffic for provision of data	Consider best way to handle requests for data through the MOU

15. ENVIRONMENTAL CONCERNS

The Commission and the Scientific Committee have increasingly taken an interest in the environmental threats to cetaceans. In 1993, the Commission adopted a resolution on research on the environment and whale stocks and on the preservation of the marine environment, IWC Resolution 1994-12 (IWC, 1994) and it has subsequently passed additional Resolutions on environmental matters (IWC, 1996; 1997a; 1998; 1999; 2010). The report of the sub-committee on environmental concerns can be found as Annex K.

15.1 Pollution (and see Annex K, Item 2)

15.1.1 Polychlorinated biphenyls, DDTs and mercury in cetaceans

The Committee considered new information on the occurrence and impact of PCBs, DDTs and mercury in cetaceans. It acknowledged the value of these studies and recognised the continued concern about the possible impact of these legacy contaminants on cetacean health.

15.1.2 Mitigation measures for Persistent Organic Pollutants

A summary of potential mitigation measures to reduce the exposure of cetaceans to persistent organic pollutants (POPs) concluded that (1) reductions in their use, (2) their management in closed systems (where no substances are exchanged with their surrounding environment) and (3) the application of appropriate destruction technologies could substantially reduce exposure. The Committee then discussed the importance of engaging with key initiatives and organisations to

control and reduce the input of POPs into the environment, particularly the Stockholm Convention²⁷ which specifically deals with eliminating POP usage.

15.1.3 Update on intersessional progress on the Pollution 2020 initiative

An update on progress within the Pollution 2020 initiative was received. This work is now complete, and its findings will be reported at next year's meeting and to the 2020 meeting of the Commission.

15.1.4 Afterlife of Pollution 2020 products

The Committee discussed how it might continue to update and support the Pollution 2020 initiative products, particularly the Contaminant Mapping Tool (SC/68A/E01) that will become accessible through the IWC website (www.iwc.int). These products will be maintained into the future by the IT support staff at the University of St Andrews and the database behind the map will be updated by the SOCER team (and see Item 15.5.3) who will, in future, summarise and upload any relevant contaminant data from the publications they review.

15.1.5 Other pollution issues

The use of heavy fuel oil (HFO) in the Arctic is an issue of concern and several new studies have recently been published on the impacts of HFO on cetaceans. The Committee was informed that the International Maritime Organisation is developing a ban on HFO for use and carriage as fuel by ships in Arctic waters, on an appropriate timescale.

15.1.6 Conclusions and future work

Attention: C, SC, S, CC

The Committee reiterates the threats that chemical pollutants pose to cetaceans. The Committee:

(1) advises the Commission that the Pollution 2020 initiative is complete and that a consolidated final report will be developed by Hall and others for next year's meeting and for the Commission;

(2) agrees that a new, multidisciplinary pollution/cumulative effects initiative, named Pollution 2025 should be developed – a Steering Group under Holm has been established to develop options for such an initiative to be submitted to next year's meeting;

(3) reiterates the importance of engaging with key initiatives and organisations on mitigation and in this regard

offers to assist the Secretariat in engaging with initiatives such as the Stockholm Convention, the Convention on Biological Diversity and the United Nations Environment Assembly to facilitate knowledge exchange about reducing exposure of cetaceans to pollutants and

requests that the Conservation Committee considers how to take forward interactions with relevant fora to reduce cetacean exposure to pollutants.

15.2 Diseases of concern (and see Annex K, item 3)

15.2.1 Infectious diseases and host-pathogen interactions

The Committee will hold a focus session on disease at next year's meeting. This year, it received new information on the occurrence and nature of infections in stranded cetaceans from the Canary Islands and Costa Rica (SC/68A/E11 and E13). It also considered a review (Di Guardo *et al.*, 2018) that highlighted gaps in the knowledge of cetacean host-pathogen interactions. The Committee also acknowledged toxoplasmosis as a recently recognised threat to Māui and Hector's dolphins (Roe *et al.*, 2013) and see Item 13.4.8). The discussions around these papers led to the conclusions and recommendations below.

Attention: SC

The Committee will hold a focus session on disease at next year's meeting. In addition to the issues identified for this session last year (IWC, 2019), the Committee agrees:

(1) that the focus session on Brucella and Morbillivirus in cetaceans be expanded to include toxoplasmosis and herpes viruses; and

*(2) that papers should be submitted that address knowledge gaps on cetacean host-pathogen interactions identified by Di Guardo *et al.* (2018) i.e. characterisation of the cell receptors allowing infection; interaction and effects of chemical pollutants on the expression levels of the aforementioned cell receptors; pathogenetic evolution of the concerned infections in T helper 1-dominant vs. T helper 2-dominant cetacean individuals; and effects of pregnancy-associated immune status on the infectious potential of specific pathogens.*

²⁷ <http://chm.pops.int/>

15.3 Strandings and mortality events (and see Annex K, Item 4)

15.3.1 Update on the IWC Strandings Initiative

15.3.1.1 PROGRESS REPORT

The Committee received a progress report on the IWC Strandings Initiative (SC/68A/E05) that summarised the main intersessional activities of the Strandings Coordinator (Stockin) and the Strandings Expert Panel (SEP). Some of those activities included further plans for a Global Strandings Network and discussions with relevant international agreements such as CITES, ACCOBAMS and ASCOBANS. The Committee welcomed the update and **thanks** Stockin for her efforts.

15.3.1.2 TRAINING PRIORITISATION MATRIX

The Committee reviewed the training prioritisation matrix (SC/68A/E04) that was devised in conjunction with the SEP to guide decisions for prioritising stranding response training following requests for training by contracting governments and outlines procedures during emergency response requests. The Committee noted that this would be an iterative process and that the matrix, which is designed to be flexible, could be modified as necessary in the future. It also discussed the availability of training materials that could be used by the Strandings Coordinator and how these might be summarised, perhaps in the form of case studies, for fund raising and outreach purposes. In addition, the Committee encourages the Strandings Coordinator and SEP to develop a package of training materials for use in IWC events and for outreach purposes.

Attention: SC, C, CG, S

*The Committee **reiterates** its support for the IWC Stranding Initiative and the work of the co-ordinator, noting that it is entering a new and important critical phase. The Committee:*

- (1) **agrees** that the guidelines in the Prioritisation Matrix (SC/68A/E04) for providing stranding response training by the strandings coordinator should be adopted and modified in future as necessary;*
- (2) **encourages** the Strandings Coordinator and SEP to develop a package of training materials for use in IWC events and for outreach purposes;*
- (3) **recommends** that funding be sought for the continued support of the Strandings Coordinator beyond October 2020;*
- (4) **encourages** Contracting Governments to consider providing support for this initiative; and*
- (5) **encourages** the Secretariat to pursue wider fundraising efforts for Strandings Initiative activities.*

15.3.1.3 LARGE WHALE EUTHANASIA

The Committee received a paper describing a new method of euthanasia for large whales that was developed by veterinarians in the Netherlands (SC/68A/E02). It **agrees** that this information should be provided to the Commission Working Group on Whale Killing Methods and Welfare Issues.

15.3.2 New information on unusual mortality and mass stranding events

The Committee discussed several reports of unusual mortality and mass stranding events (SC/68AE08, E12 and E10). The IWC strandings coordinator and SEP supported a mass-strandings event of short-beaked common dolphins in Argentina, Peninsula Valdés. Other mass mortality events and strandings were reported from other areas of Argentina and Chile. The further investigation of strandings and acoustic events (e.g., seismic surveys, oil and gas activities, and military exercises) in the southwest Atlantic Ocean was noted. There was discussion about how such events could be brought to the attention of the Committee in future.

Attention CG, S, G, R, CC

*The Committee **recognises** the importance of receiving information on and understanding the causes of mass strandings and unusual mortality events and encourages submission of such reports to the Committee. In particular it:*

- (1) **agrees** that National co-ordinators should indicate mass stranding or unusual mortality events in the National Progress Reports;*
- (2) **recommends** that the Strandings Coordinator looks to identify unusual mortality events and to request those involved to submit papers for consideration by the Committee;*
- (3) **reiterates** to the Commission and Contracting Governments the vulnerability of beaked whales to acoustic impacts; and*
- (4) **recommends** that wherever possible strandings and especially mass strandings events of beaked whales and baleen whales be thoroughly investigated - the Committee can assist in this through the Strandings Initiative and it **encourages** governments to request help if required.*

15.4 Noise

15.4.1 Mid Frequency Active Sonar

A study by Bernaldo de Quirós *et al.* (2019) which illustrated the effectiveness of a ban on the use of Mid Frequency Active Sonar around the Canary Islands during military exercises was discussed. The Committee concluded that this type of noise-generating ‘activity exclusion’ was a valuable mitigation approach. It was also noted that the effects of noise should be considered with other stressors, such as the effects of persistent organic pollutants, as their effects may be synergistic or additive.

15.4.2 Update on co-operation with the International Maritime Organization (IMO)

The Secretariat attended an IMO workshop on ‘Quieting Ships’. That workshop reviewed the ship-based noise limits and discussed the various technical issues involved in approaches to noise reduction. According to IMO and reiterated by the Committee, ship noise should be regarded as a pollutant and should therefore be the subject of legislation. The recommendations from that workshop were noted by the Committee. The IMO workshop agreed that a goal of reducing underwater shipping noise by 3 dB/decade in order to reverse the trend of the past 60 to 80 years was feasible.

15.4.3 New information on noise impacts

A review study (Weilgart, 2018) investigating the effect of noise on cetacean prey heard that a wide variety of impacts have been reported in fish and invertebrates and that mitigation recommendations were broadly similar to those that the Committee has made regarding cetaceans over the last few years.

15.4.4 Noise pre-meeting at SC68B

Topics for the pre-meeting on noise to be held before the 2020 Annual Meeting were discussed and it was agreed that the intersessional steering group (Annex T) will continue to refine them and to organise the meeting.

15.4.5 Conclusions and recommendations

Attention: C, CG, CC, SC

*The Committee **reiterates** the threats posed to cetaceans by noise (IMO, 2019) and also that ocean noise can have adverse effects on other trophic levels including fish and invertebrates, which may be prey for cetaceans. The Committee:*

- (1) **encourages** ‘activity exclusion’ as an effective mitigation approach;*
- (2) **endorses** the IMO workshop goal of reducing underwater shipping noise by 3 dB/decade in order to reverse the trend of the past 60 to 80 years as feasible;*
- (3) **agrees** that the Steering Group (Annex Y) established last year should continue to develop the agenda for next year’s pre-meeting including international approaches to noise targets and thresholds (ambient and impulsive) and monitoring and communicating such targets; the contribution of small vessels to coastal soundscapes; and collaboration with other IWC bodies and with IMO.*

15.5 Update on other standing topics and previous recommendations

15.5.1 Marine debris

The occurrence of marine debris, particularly plastic and microplastic debris, in cetaceans and its potential impact on their health, is of continuing concern. Studies on this topic were reviewed including data and models estimating the abundance of floating debris including an estimate from data collected on the IWC-POWER cruises (SC/68A/E11). The outcomes of a workshop on marine litter in marine mammals organised by the European Cetacean Society (Panti *et al.*, 2019) were reviewed and issues, such as the standardisation of protocols on the analysis of litter in marine organisms, were discussed.

The Committee also received information on the FAO ‘Voluntary Guidelines on the Marking of Fishing Gear’ that are intended to help states meet their responsibilities under the relevant international law and the specific requirements for gear marking contained in FAO’s Code of Conduct for Responsible Fisheries (and see Item 13).

Attention: CG, G, CC

The Committee **reiterates** the threat to cetaceans of marine debris (e.g. Panti et al., 2019). The Committee:

- (1) **welcomes** the provision of new information on marine debris and its impacts on aquatic ecosystems and cetaceans including papers that will allow estimation of baselines and trends, such as that provided from IWC-POWER cruises this year;
- (2) **welcomes** the FAO guidelines on gear marking and encourages FAO to promote their uptake and monitor their application;
- (3) **agrees** that limiting the input of marine debris, primarily through reduced production and waste, is key in addressing this issue; and
- (4) **looks forward** to the report from the IWC marine debris workshop to be held in December 2019.

15.5.2 Climate change

The Committee reviewed new information on the effects of climate change on cetaceans and concluded that the approach to managing the effects needed to be swifter and more precautionary. For example, some marine protected areas (MPAs) designated to protect cetaceans took one or two decades to be implemented. Potential shift of animals during this time should be taken into consideration for the adaptation of the planned MPAs. Concern for ice-dependent species and those where habitats are limited, is growing. Climate change continues to be an overarching issue that may interact with almost all the stressors of concern to the Committee and it **looks forward** to receiving more information in future.

15.5.3 State of the Cetacean Environment Report (SOCER)

The State of the Cetacean Environment (SOCER) requested by the Commission, is designed to provide an “environmental framework/ecosystem health ground-truthing”, to facilitate the work of the Scientific Committee and inform the decisions of the Commission. Unfortunately, due to budgetary constraints, a report was not produced this year. However, in 2018 a Compendium was produced, consolidating the most recent 5-year cycle into a single, global document which can be downloaded from the IWC SOCER website, <https://iwc.int/socer-report>.

Attention: SC

The Committee **agrees** that SOCER 2020 should be compiled as planned for the North and South Atlantic and that any relevant contaminant data identified would be appended to the Contaminant Mapping Tool database.

15.6 Other related information

Other related information included the results of a study assessing hormones in baleen and serum which may be used to determine age at sexual maturity.

15.7 Work plan

The work plan for the sub-committee on Environmental Concerns is given in Table 18.

Table 18
Work plan for issues related to environmental concerns

Topic	Intersessional 2019/20	2020 Annual Meeting
Marine debris	Hold workshop (Simmonds, Annex T)	Workshop report
Strandings Initiative	Respond to emergency requests, carry out training, synergise protocols with other IGOs (Strandings Coordinator: Stockin)	Report on activities and progress
Pollution 2020	Complete tasks and produce report (Hall)	Review and produce report for Commission
Pollution 2025	Draft ToRs for Pollution 2025 taking into account work to date; likely key pollution issues including but not limited to POPs and marine debris; pollution interactions with other factors ; and draft workplan (Holm, Annex T)	Agree Terms of Reference and recommended workplan
Diseases of Concern	Identify and invite IPs for infectious disease focus session (Stimmelmayer, Annex T and Chair, Vice-Chair and Head of Science)	Hold focus session and develop recommendations
SOCER	Atlantic Ocean focus (SOCER team)	Review report and determine next focus
Noise	Plan pre-meeting, compile relevant documents, Identify and invite IPs, conduct pre-meeting (Leaper, Cholewiak, Annex T)	Review pre-meeting recommendations

16. ECOSYSTEM MODELLING

The report of the Working Group on Ecosystem Modelling (EM) is given in Annex L. The Working Group was first convened in 2007 (IWC, 2008) and was tasked with informing the Committee on relevant aspects of the nature and extent of the ecological relationships between whales and the ecosystems in which they live.

Each year, the EM 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.

16.1 Cooperation with CCAMLR on multi-species modelling including progress with workshop(s)

Ecosystem modelling in the Antarctic Ocean is an active area of research of interest to the Committee especially with regard to ecological functions of whales. No new information was received this year. Data about krill abundance from JARPAII and NEWREP-A are still being analysed (and see Annex L, item 3) but will be available in the future.

The Committee noted that a joint IWC-CCAMLR workshop is now expected to take place sometime in the period 2020 to 2022 (Annex L, item 6). By then progress will have been made by both EM and CCAMLR in identifying information gaps and necessary research. It is envisaged to invite a member of CCAMLR to the future Committee's meetings to function as a bridge between CCAMLR and the Committee.

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

The Committee has recognised that species distribution models (SDMs) can help predict spatial species density by quantifying the relationship between the observed species distribution and its influencing factors. In general, although both statistical models and machine learning methods can be applied as SDMs, there is still an open question regarding the estimation performance of those SDMs.

To assess the estimation performance among the SDMs and compare difference in performance between the two survey designs (i.e. tooth-shaped as used for krill vs. zig-zag as used for cetaceans), new analyses on species distribution models were presented this year with an example of the Antarctic krill survey (SC/68A/EM03). Detailed discussions can be found in Annex L, item 4. Random forests (RF) and boosted regression trees (BRT) were revealed to be the most reliable machine learning methods in this study. In addition, the zig-zag-shaped and tooth-shaped designs were found to have comparable performances, and either can be applied in krill field surveys.

Attention: SC

*The Committee **reaffirms** the importance of species distribution models (SDMs) to its work and **agrees** to re-establish the intersessional correspondence group (Annex T) that is working to develop guidelines for best practices for the application of Species Distribution Models (SDMs).*

16.3 Modelling of competition among whales including progress with IBEMs

The Committee did not receive any new information this year but looks forward to future submissions.

16.4 Standing topics

16.4.1 Effects of long-term environmental variability on whale populations

The issue of variability in baleen whale demographics was examined at a workshop held in 2010 (IWC, 2011b). This remains an active area of research that is of particular interest with regards to how long-term environmental variability might affect stock assessments. No new papers were received this year, but the Committee **looks forward** to contributions on this topic in the future.

16.4.2 Review the information on krill distribution and abundance from NEWREP-A

The Committee received new information (SC/68A/EM01) on a krill and oceanographic survey conducted in Antarctic Areas III-E and IV during the 2018/19 austral summer season as a part of the New Scientific Whale Research Program in the Antarctic Ocean (NEWREP-A). The discussion can be found in Annex L, item 3. The relationship of the current biomass of krill estimates in Area V and consumption rates of whales are of great interest and krill biomass is an important parameter informing ecosystem models. The Committee **looks forward** to receiving the abundance estimates from the krill surveys in the future.

16.4.3 Modelling of relationship between whales and prey

The Committee received several papers relevant to this subject that were updates of work originally presented at the JARPN II review workshops of 2009 and 2016 (IWC, 2010; 2017). Primary areas of focus were:

- (1) estimation of prey consumption of sei, Bryde's, and common minke whales (SC/68A/SP05, Appendices 1 and 2);

- (2) Ecopath static ecosystem modelling exercise in the western North Pacific in 2013 including cetacean species (Watari *et al.*, 2019).
- (3) population dynamic modelling for sandlance off Sanriku with consideration of predation impact by the common minke whales (SC/68A/EM05).

Detailed discussion can be found in Annex L, item 2.1 where a number of technical suggestions for improved analyses were provided for the authors. In conclusion, the Committee **thanks** the authors for presenting the updated analyses that addressed issues raised in the two workshops and **encourages** continued work on these topics.

16.4.4 Body condition analyses

SC/68A/EM02 presented results of body condition analyses of common minke whales in the northeast Atlantic. The analyses revealed a significant negative trend from 1993 until 2015. From 2015 to 2018, the trend reversed with increasing body condition values. Those results may be due to a connection between cod abundance and feeding conditions for top predators, such as common minke whales. In discussion, it was noted that data collected during JARPA between 1989 and 2004 had revealed a similar decrease in the body condition of Antarctic minke whales, but without indication of changes in prey abundance (krill). Additional details can be found in Annex L, item 2.4. The Committee **welcomes** the results of this study and **encourages** the authors to conduct suggested analyses and to continue ecosystem-based modelling of the data, integrating whales, seals, cod and their prey.

Last year, the Committee decided that the discussion on the body condition of Antarctic minke whales be discontinued but researchers were encouraged to publish their results (IWC, 2019a, pp.45-6). The Committee was pleased to discover that Cunen *et al.* (2019) had recently been accepted for publication in a statistical journal.

16.4.5 Progress with workshop on Cetacean and Ecosystem Functioning

In response to Resolution 2016-3 (IWC, 2017b) that tasked the Committee with investigating the contribution of cetaceans to ecosystem functioning, the Committee recognised that this was a complex long-term task and agreed to start the process by holding a workshop to (a) define short- and medium-term objectives to be addressed and (b) to identify what further research is required in order to begin initial modelling of the contribution of cetaceans to ecosystem functioning (IWC, 2019a, p.46). Considerable progress was made intersessionally with respect to the workshop organisation in terms of logistics, funding and a possible contract for a background review to be prepared by an external contractor(s). As requested, the Secretariat had contacted CMS and is waiting a formal reply as to whether it wishes to co-sponsor the workshop.

During this meeting, the focus was on: reviewing the terms of reference and agenda for the workshop; considering the focus for each agenda item (see Annex L, appendix 2 for potential hypotheses and questions for consideration); developing terms of reference for one or two background reviews to ensure that the broad range of views concerning the absolute and relative roles of cetaceans in the ecosystem are discussed; and developing a list of experts from outside the cetacean research community to assist the steering committee in developing a final invited participants list. Details can be found in Annex L, item 5.

Attention: SC, C

The Committee reiterates (IWC, 2019a, p.46) the need to hold a Workshop to begin the process of responding the Commission's Resolution asking for advice on the role of cetaceans in ecosystem functioning. Considerable progress has been made and the workshop will be held in the intersessional period and the report will be submitted to the 2020 meeting of the Committee. The Committee:

- (1) agrees to the revised Terms of Reference and draft agenda for the workshop provided in Annex L, appendix 2 and the guidance provided in Annex L, appendix 3 including the need to explore conducting analyses for regions outside the Southern Ocean to compare ecosystem function of cetaceans amongst different ecosystems;*
- (2) welcomes the advances made with respect to funding and other logistics; and*
- (3) reinstates the workshop Steering Group under Ritter (Annex T).*

16.5 Progress on previous recommendations

Previously, the Committee recommended that collaboration be enhanced between the Committee and CCAMLR. To this end, the Committee **agrees** to invite Watters, a member of CCAMLR to future Committee meetings.

16.6 Workplan

Table 19

Summary of work plan for ecosystem modelling

Item	Intersessional 2019/20	2020 Annual Meeting (SC/68B)
(1) Ecosystem modelling in the Antarctic Ocean	Continue further analyses	Review results of further analyses
(2) Application of species distribution models (SDM)	Intersessional Working Group activity	Review progress of Working Group
(3) Effect of long-term environmental variability on whale populations	Continue further analyses and literature review	Review results of further analyses and progress of Working group on literature review
(4) Further development of individual-based energetic models	Continue further analyses	Review results of further analyses
(5) Modelling of competition among whales and relationship between whales and prey	Continue further analyses	Review results of further analyses
(6) Update of any exercises on krill distribution and abundance	Conduct krill surveys and analyse data	Review results of survey and analyses
(7) Cetacean and ecosystem functioning: a gap analysis workshop	Continue analyses and hold workshop	Review result of analyses and outcomes of workshop

17. SMALL CETACEANS (AND SEE ANNEX M)

17.1 Review of small cetaceans of Africa

The Committee has reviewed various populations and species of small cetaceans found in northwestern Africa and the Eastern Tropical Atlantic several times since 2002 (IWC, 2011a). A workshop that focused on the poorly documented take of small cetaceans in West Africa was held immediately prior to SC68A (see Item 17.2) that enabled the Committee to review and update some previous recommendations as discussed below.

17.1.1 Tackling Data Gaps Through Rapid Assessment and Collaborative Efforts with a focus on *Sousa*

The Committee received a presentation (Braulik *et al.*, 2017) on a rapid assessment technique that incorporated combined visual and acoustic vessel surveys, community interviews and online data on shipping and fisheries in Tanzania to identify risks to small cetaceans. The objective was in a short period of time to gather information on the occurrence and distribution of small cetacean species throughout Tanzanian waters and to document threats. This inexpensive study identified a hotspot for small cetaceans and highlighted the issue of blast (dynamite) fishing which occurs throughout Tanzanian waters. Managers were alerted by the authors to the extent of a significant threat to marine resources.

Two successful collaborative studies were presented, one based in Gabon (Minton *et al.*, 2017), where government agencies, NGOs and scientists used vessels provided by an oil and gas company to document the occurrence of small cetaceans and provided a platform for government departments to conduct compliance and enforcement patrols on fisheries. The survey also facilitated capacity building across multiple sectors. The other collaborative project (SC/68A/SM03) was the development of a consortium of 18 partners from 15 institutions working on the genus *Sousa* (humpback dolphins) in South Africa. This project developed a regional photo-identification catalogue that provided greater insight to the status of *Sousa*. In an area where funding is scarce, expertise is sparse and coastlines are vast, this collaboration demonstrated the value of pooling data and resources.

Discussion of these papers can be found in Annex M, item 2.1.

Attention: CG, R, CC

*The Committee reiterates its previous concerns over the status of the genus *Sousa* and its recommendations to improve the situation (e.g. IWC, 2017g). The Committee stresses the need to identifying high priority areas and populations of *Sousa* in Africa to obtain better information on status and mitigation and to assist in this:*

*(1) encourages a wider collaboration among researchers who work on the genus *Sousa*, which include international collaboration for funding and capacity building, the development of regional and sub-regional research projects and co-ordination of data collection;*

*(2) recommends the establishment of an Africa focused ‘*Sousa* Task Team’ to (a) facilitate and co-ordinate work in response to IWC recommendations, (b) start working towards developing a comprehensive framework of conservation actions and (c) to report back to the SM convenors by September 2019; and*

*(3) recommends that South Africa develops a mitigation strategy to (a) reduce bycatch of *Sousa* in shark nets; (b) establish multiple-use management areas and (c) design and implement strategies to reduce the impacts of noise.*

17.1.2 Angola, Democratic Republic of Congo, Equatorial Guinea, Gabon, Republic of Congo, and São Tomé and Príncipe

Information on strandings from 2002-19 from six central west African countries was presented. Data were obtained from a variety of sources and bycatch was determined to be the primary cause of mortality. The continued directed take of small cetaceans, particularly the Atlantic humpback dolphin, was also highlighted; the Committee has previously expressed considerable concern over the status of this species. Details are given in Annex M, item 2.2.1.

Attention: R, CG

*The Committee **welcomes** the new data from six Central African countries and **encourages** further work to improve information from these data poor areas. The high mortality of Atlantic humpback dolphins in the Conkouati-Douli National Park, Republic of Congo, is of **particular concern**, given the likely small population size and restricted range of the population. The Committee **recommends** that the Government initiates high priority research and management actions.*

17.1.3 Liberia

Marine mammal observer programmes conducted onboard seismic survey vessels in 2009 ((SC/68A/SM04) improved knowledge on small cetaceans in Liberia. Details are provided in Annex M, item 2.2.2. As noted in previous meetings, it would be beneficial if resource exploration companies could release biological data (i.e. marine mammal observer data) collected during seismic surveys in a timely manner, as is the case for South Africa where there is a formal understanding that this should be done.

17.1.4 Madagascar

SC/68A/SM07 provided an update on previous work, some funded by the IWC Small Cetacean Research Fund (SC/61/SM15; SC/65B/SM21), detailing the continued and large-scale deliberate take of small cetaceans in southwest Madagascar. Conservation efforts involving community engagement were reported. In one community (Anakao), a self-sustaining conservation programme was established, resulting in the near cessation of hunting. In another (Befandefa) a similar program was launched but then abandoned midway and large-scale drive hunts were resumed. These outcomes underscore the potential success of effective community engagement, the critical importance of sustained conservation efforts and emphasizes the need to comprehensively evaluate the consequences of stopping projects before they are complete.

Attention: CG, R, CC

*The Committee **draws attention to** the large-scale (ca 3000 animals in 18 years) hunting of small cetaceans in southwest Madagascar although they are formally protected; the sustainability of these hunts is doubtful. Effective community engagement was shown to be successful in markedly reducing hunting in one community (Anakao) and the Committee **encourages** similar efforts to be resumed in the community of Befandefa, along with efforts to monitor catches and abundance of the affected populations.*

17.1.5 Kenya

The Committee welcomed information on the Kenya Marine Mammal Network (KMMN), a multi-stakeholder collaboration, which was initiated in 2011 (SC/68A/CMP20). To date it has resulted in a systematic database of 1,406 sightings of 24 species of marine mammals. This has allowed the identification of inshore cetacean hotspots in which focused studies are now being implemented. The Committee **highlights** the value of multi-sector partnerships and coordinated research activities and commends Kenya on the rapid progress being made on research on small cetaceans in national waters.

17.2 Poorly documented takes for food, bait or cash and changing pattern of use

Since 2016, two workshops have been held (International Whaling Commission, 2019c; IWC, 2019k) on the poorly documented take of small cetaceans in South America, supported by the Government of the Netherlands.

17.2.1 Workshop of Poorly documented take of Small Cetaceans: West Africa

This year, a third workshop dedicated to the better documentation of small cetaceans for use as aquatic wildmeat, was conducted immediately prior to this meeting. Researchers and managers from eight West African countries provided information focused on the species or habitat most at risk and considerable new information was presented. There were common issues across all countries which were addressed through a set of overarching recommendations as well as country specific recommendations. As the workshop was held so close to the present Committee meeting, there was not time for the full Workshop report to have been finalised and reviewed. The overarching and specific recommendations of the workshop were presented at the meeting of the sub-committee on small cetaceans and can be found in Annex M. The Committee **agrees** that it will be appropriate to develop its final recommendations at next year's meeting when the full report is available for consideration.

Attention: SC

The Committee **thanked** the organisers and participants of the successful third workshop on poorly documented takes for food, bait or cash and changing pattern of use that covered West Africa. It **agrees**:

- (1) that it will review the final report of the workshop and discuss endorsement of the recommendations at the 2020 annual meeting; and
- (2) that a synthesis of the results of the three workshops should be developed for discussion at the 2020 Annual Meeting.

17.3 Updates from intersessional groups including small cetaceans task team

17.3.1 Small Cetacean Task Team: South Asian River Dolphin

The South Asian River Dolphin Task Team will have its first in person meeting in Kuala Lumpur, Malaysia in July 2019. The anticipated outcomes of this meeting are outlined in Annex M and the report will be presented at the Committee meeting in 2020.

17.3.2 Franciscana

The CMP for Franciscana will be presented at the Committee meeting in 2020 (and see item 10.1.4). The Committee will also receive new information on the Franciscana at 2020 at joint meetings of the SM/CMP.

17.3.3 Sotalia guianensis Workshop

Some members of the *Sotalia* intersessional correspondence group met in late 2018. It agreed to develop an online data gathering form, to be disseminated to all institutes working on this species, with the aim of improving understanding of available ecological and demographic data as well as identifying potential threats to different populations.

The Committee noted that that ongoing and large-scale coastal development is widespread within the regions that *Sotalia guianensis* inhabit. The Committee **agrees** to explore the establishment of a Task Team to more quickly address the multiple pressures that this species faces.

17.3.4 Aquatic Wildmeat Database

The Committee heard an update from the Aquatic Wild Meat Database Intersessional Correspondence Group (SC68A/SM02).

The 'Aquatic Wild Meat Database' is an independently developed online data entry platform. Intersessional discussion has focused on the research questions relevant to IWC that could be answered by the database and how data can be verified, as input is unrestricted and voluntary.

Attention: SC

The Committee **thinks** the Aquatic Wild Meat Database Intersessional Correspondence Group convened by Cosentino (Annex T) and **agrees** that it should continue its work and the final report should be discussed at the 2020 Annual Meeting.

17.4 Review of takes of small cetaceans

17.4.1. New information on directed catches

The Committee received a summary of takes of small cetaceans in 2017–18 extracted from the online National Progress Reports and prepared by the IWC Secretariat, in addition to information obtained online. No direct takes of small cetaceans were reported in the 2018 National Progress Reports. The Committee noted that it would be helpful if the Secretariat encouraged all member countries and IGOs (e.g. NAMMCO) to submit information on direct takes as a routine procedure.

The content of the Japan Progress Report on Small Cetaceans, a public document available from the website of the Fishery Agency of the Government of Japan, was also summarised (Annex M, appendix 2). Catch statistics cover the calendar year whereas catch quotas are set seasonally and so may not be directly comparable. The Committee will work intersessionally to provide a perspective on the last decade of catches reported to the Committee.

A review of directed hunts in St. Vincent and the Grenadines, between 1949-2017 (Fielding, 2018) was presented and provided catch data for ongoing hunts (see Annex M, item 6.1 for details).

Attention: CG

*Given the lack of regulation of the hunt and the poorly known status of short-finned pilot and killer whale in the waters of St. Vincent and the Grenadines, available information (Fielding, 2018) raises concern that current takes are unsustainable and underscores an urgent need for research into the status of these species in national and adjacent waters. The Committee **reiterates its concern** and over-arching recommendation that no small cetacean removals (live capture or directed harvest) should be authorised until a full assessment of status has been made.*

*In addition, given the paucity of information on tropical killer whales, it **reiterates** that additional research is required, particularly as takes of these species are regularly occurring.*

In 2018, the Committee expressed concern over the then proposed live captures of killer and white whales, from Russian waters, for the international aquarium trade (IWC, 2019g). These captures occurred, and the whales remain in temporary holding facilities in Russia.

Attention: CG

*In light of the live capture of at least 11 killer whales between July to September 2018 in the Shantar region of the Okhotsk Sea, and information received at this meeting that Russian authorities may consider future live takes of killer whales from this region, the Committee **strongly reiterates** its long-standing recommendation (e.g. IWC, 2019c, pp53-4) that no small cetacean takes (live captures or hunts) should be authorised until a full assessment of the sustainability of these takes has been conducted.*

*The Committee also expressed **grave concern** regarding the removal of 90 juvenile white whales, some with potentially poor survival prospects, from the Sakhalin Bay-Amur River feeding aggregation in summer 2018; this level of removal is unsustainable. The Committee **recommends** that no more removals are authorised from the Sakhalin Bay-Amur River feeding aggregation.*

*Furthermore, given the stated intention of the Russian Federation to reintroduce into the wild both the killer and white whales that were captured during the summer of 2018, the Committee **recommends** that reintroductions should only be carried out with appropriate caution and with the advice of international experts on rehabilitation, so as to maximise the likelihood of individual animal survival.*

*The Committee **requests** that the Executive Secretary contact Government of the Russian Federation drawing attention to the concerns of the Committee on these matters and **requesting** that the Government provide an update to the 2020 Annual Meeting.*

17.5 Status of The Voluntary Fund for Small Cetacean Conservation Research

In 2018, donations for the Voluntary Fund for Small Cetacean Conservation Research totalling GBP 30,869 were received from the Government of Italy, the Government of Netherlands, the Government of the United Kingdom, Campaign Whale, Centro de Conservacion de Cetacea, Cetacean Society International, Dolphin Connection, Environmental Investigation Agency, Humane Society International, IFAW, OceanCare, ProWildlife and the Whaleman Foundation. At the end of the financial year 2018, this brought the total of the fund to GBP 72,123.

The Committee **expresses** sincere gratitude for all contributions and notes that these funds support critical objectives of the Committee.

17.6 Progress on previous recommendations

17.6.1 Vaquita: Update on CIRVA Progress

The Committee received an update from the Comité Internacional para la Recuperación de la Vaquita (SC/68A/SM01). The causal factors driving the precipitous decline of the vaquita continue and have intensified. No more than 22 vaquitas remained alive during the summer of 2018, and each year around half of the remaining vaquitas are killed in illegal fishing nets. The key measure to save the vaquita from extinction is the removal of active and derelict totoaba nets. Details are provided in Annex M, item 5.1.

Attention: CG

*The Committee **expresses grave concern** at the violence directed towards scientists, legal fishermen, NGOs and law enforcement agencies from those who are involved in the illegal totoaba fishery, which is responsible for the continued bycatch of the vaquita.*

The Committee also **commends** the considerable contributions made by Rojas-Bracho and his Mexican colleagues on the vaquita issue and their regular expert updates to this Committee and other key fora across many years. Independent advice is of fundamental importance to the work of the Committee. Given the escalating violence in the Gulf of California, Mexico, the Committee **requests** that the Government of Mexico and all in appropriate positions of power ensure that independent scientists are able to provide data, advice and their expertise free from the threat of violence and other intimidation or retribution.

Attention: SC, CC, CG-R

The Committee yet again expresses its disappointment and frustration that, despite almost three decades of repeated warnings, the vaquita's rapid decline to extinction continues because of ineffective management measures. As such, it re-emphasises the concerns it has raised on the status of the vaquita over many years, reiterates the urgent recommendations of the past three Committee meetings, and endorses and adopts the recommendations in the CIRVA-11 report (SC/68A/SM01).

The precipitous decline of the vaquita reported previously has continued in 2018. As monitoring is critical for evaluating the effectiveness of conservation actions, the Committee **strongly recommends** that:

(1) the CIRVA-11 acoustic monitoring programme be continued as in previous years to provide an annual empirical estimate of population trend, and that opportunistic use of smaller CPOD acoustic arrays be continued to assess vaquita presence and to support possible periodic photo-identification and visual monitoring efforts outside the regular summer sampling period;

(2) photo-identification efforts proposed in CIRVA-11 be conducted as soon as possible, to obtain information on the minimum number of animals alive, [and to refine understanding of life history parameters including survival rates];

In addition, the Committee **recommends** that the CIRVA-11 proposal to use photographic capture-recapture techniques to obtain an estimate of minimum abundance be explored (which is preferable to relying on simple single day counts of different individuals) and that (a) local marine mammal scientists and naturalists with training and experience in photo-identification techniques, organize rapid-response teams to take advantage of weather conditions suitable for such monitoring work and (b) more local personnel be trained and equipped to maximize the number of opportunities to obtain photographs and potentially biopsies.

The Committee also **strongly endorses** the recommendations made in CIRVA-11 and:

(1) **advises / recommends** that the Government of Mexico fully mobilise its enforcement assets to eliminate illegal fishing in the area where the last few vaquitas survive, a small area henceforth referred to as the 'Zero Tolerance Area' (where the goal will be to remove any illegal net within hours of its deployment). In this Zero Tolerance Area, particularly during the totoaba season;

(2) **urges** the Government of Mexico to:

- fully fund and expand net-removal efforts to maintain the area as a net-free zone;
- provide 24-hour surveillance and monitoring;
- take all necessary measures to protect net-removal teams from harm or intimidation; and
- arrest and prosecute illegal fishermen, for example, by placing an FGR agent on net removal ships and Navy vessels to facilitate arrests.

With regards to the advice of the Expert Committee on Fishing Technology (ECOFT) reported in previous CIRVA reports, the Committee **reiterates** previous recommendations (IWC, 2019a, p.52) to

- develop a transparent, multi-year workplan;
- require INAPESCA to consult and inform ECOFT before conducting new field tests or proposing the approval of new gear;
- implement the use of Electronic Monitoring Systems (EMSs) with video in all gear-testing and fishing operations in the Upper Gulf of California (UGC);
- issue fishing permits (from CONAPESCA) for small trawls by commercial vessels equipped with EMSs; and
- prohibit the use of monofilament or multimonofilament nylon line in the construction of alternative

gear, including purse seines and suriperas.

While recognising that the commitments embodied in the “Plan for the Comprehensive Care of the Upper Gulf of California and the Comprehensive Program for the Protection and Recovery of the Vaquita” were made by the previous administration, the Committee;

*(1) **urges** the present Government of Mexico to implement, fully and expeditiously, the commitments made in the Plan;*

*(2) **strongly approves** the continued role of CIRVA with regards to their assistance in:*

- reviewing monthly reports of enforcement efforts;*
- participating in an enforcement contact group; and*
- providing advice on implementation of the plan for alternative gear.*

With regards to strengthening direct linkages between the fishermen using alternative gears and the seafood buyers as a way of incentivising the conversion of the fleet to gillnet-free operations, the Committee;

***reiterates** its previous recommendation that Mexico work with gear-testing partners to conduct rigorous cost-benefit analyses on the new gears and to test markets for the vaquita-safe products and that Mexico work with producers and buyers to develop and implement a comprehensive chain of custody and traceability system for vaquita-safe products from the Upper Gulf of California, noting that it is critical that this system be in place before legal shrimp fishing resumes in September 2019 and that information is accessible to producers, buyers, and consumers.*

Finally, the Committee:

***reiterates** its previous recommendations that the Mexican enforcement agencies: (a) efforts to remove gillnets from vaquita habitat be continued and enhanced and the numbers and locations of new nets recovered be published monthly; (b) also publish monthly the number of inspections, interdictions, arrests, sentences, and other enforcement actions, together with information on observed levels of illegal activities obtained from intelligence operations, for example from drones; (c) ensure that successful prosecution and subsequent penalties be sufficient to deter illegal fishing; and (d) development of gillnet free fisheries be enhanced and linkages to incentivise the conversion of the fleet to gillnet-free operations be strengthened.*

17.6.2 Maui’s and Hector’s Dolphins

The Committee discussed spatial risk assessment of threats to Hector’s and Māui dolphins in New Zealand in joint sessions with the Standing Working Group on Abundance Estimates, Stock Status and International Cruises, the sub-committee on Small Cetaceans and the sub-committee on non-deliberate human-induced mortality of Cetaceans. These are reported under Annex J and a recommendation is given under Item 13.4.8.

17.6.3 International Workshop on the Status of Harbour Porpoises in the North Atlantic

The North Atlantic harbour porpoise was last discussed thoroughly in the Small Cetacean sub-committee in 1994 (IWC, 1995) and then briefly in 1996 (IWC, 1997b). The joint Institute of Marine Research/NAMMCO workshop (IMR/NAMMCO, 2018) held late 2018, consolidated significant work on harbour porpoise in the North Atlantic and provided a framework for future research needs.

The Committee also notes that recommendations made during previous committee meetings for the North Atlantic harbour porpoise have now been superseded by the workshop recommendations.

Attention: SC; R; ICES; CG (range state governments in the North Atlantic)

*The Committee **welcomes** and **draws attention** to the report of the International Workshop on the Status of Harbour Porpoises in the North Atlantic (IMR/NAMMCO, 2018). The Committee **endorses** its recommendations. In particular, it highlights one of the recommendations regarding the challenges that exist for accessing reliable bycatch data and estimates, and the importance of this information for generating scientifically sound assessments. The Committee **recommends** that it is imperative to:*

- (1) construct more reliable time series of bycatch data for the different fisheries in the different areas,*
- (2) modify the fishing effort database in such a way that the data is consistent and reliable,*
- (3) include by-catch data from small vessels in reporting, and*
- (4) conduct more reporting of by-catch by different types of gear.*

The Committee has previously expressed serious concerns regarding the status of the harbour porpoise subpopulation of the Baltic Proper (IWC, 2018d). The Workshop **confirmed** that the East Greenland and ‘Baltic Proper’ subpopulations are distinct. The Baltic Proper population is estimated at under 500 individuals and high levels of bycatch continue. Recent evidence suggests that bycatch remains the primary threat to this population (as well as the species as a whole).

The Committee was informed that the ASCOBANS Advisory Committee (ASCOBANS, 2018) had supported listing the Critically Endangered Baltic harbour porpoise sub-population population in Appendix I of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and, accordingly, a proposal was prepared. It was noted that the German authorities announced that they will not propose listing the Baltic Sea harbour porpoise since they believed that harbour porpoise populations are increasing, the Baltic harbour porpoise is not a species and thus not threatened by extinction and that an inclusion of the Baltic harbour porpoise population in Appendix I of CMS could make a closure of set net fisheries necessary.

In discussion, it was noted that (a) there are no data supporting an increase in either the North Sea or the Baltic Sea populations, (b) this Committee and Commission has always considered conservation and management at the level of populations as well as species; and (c) assignment of conservation status should be independent of the feasibility of mitigation.

Attention: CG, I

*The Committee **reiterates** its previous serious concern about the status of the population (IWC, 2018d) and **agrees that** listing the harbour porpoise population of the Baltic Proper in Appendix I of CMS can greatly assist in conservation efforts. The Committee therefore:*

*(1) **encourages** a member state of CMS consider submitting a listing proposal for the upcoming COP of CMS in early 2020, noting that such proposals must be submitted by 19 September 2019.*

*(2) **recommends** that the IWC Executive Secretary convey the Committee’s views on this issue to the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Ministry for Food and Agriculture (BMEL) encouraging a reconsideration of their decision not to submit a proposal.*

17. 7 Work plan and budget requests

17.7.1 Priority topics for 2019 to 2024

The sub-committee on small cetaceans discussed ongoing priorities and agreed to continue the development of these intersessionally. It was noted that in 2020, several pieces of work will come to a conclusion: the Franciscana CMP; the *Sotalia guianensis* workshop series; the Aquatic Wildmeat workshop series; and the work of the first phase of the Asian River Dolphin Task Team. It is anticipated that a 2-4-6-year work plan will be generated following the report of these initiatives.

17.7.2 Work plan for 2019-20

Table 20
Work plan for matters related to small cetaceans

Topic	Intersessional 2019/20	2020 Annual meeting
<i>Franciscana</i> CMP	ICG (Annex T) to synthesis actions from this report and develop a work plan	Report and develop recommendations and a work plan
Wildmeat	Email group (Annex T) to summarise workshop series and develop future work plan. Email group (Annex T) to finalise work relating to databases	Report and develop recommendations and a work plan
Small Cetacean Task Team	Follow up recommendations from the 2018/19 river dolphin workshop.	Report progress and update work plan
<i>Sotalia</i>	SG (Annex T) to plan and conduct workshop #2	Receive workshop report and develop recommendations and a work plan

18 WHALEWATCHING

18.1 Assess the impacts of whale watching on cetaceans (see Annex N)

18.1.1 Review progress of Modelling and Assessment of Whale Watching Impacts (MAWI)

The Modelling and Assessment of Whale Watching Impacts (MAWI) has been on the Committee’s agenda for several years. Last year (IWC, 2019a, p.54), the Committee recommended that a third MAWI workshop be held intersessionally,

ideally just before or after the 2nd World Marine Mammal Science Conference in December 2019, in Barcelona. The planning for this workshop is ongoing by a Steering Group convened by New (Annex T).

18.1.2 Swim-with-whale operations

The Committee has considered the issue of swim-with-whale operations for some time and has encouraged submissions on this topic. It was pleased to receive a paper concerning initial research into the effects of swim-with-whale operations on humpback whales in Hervey Bay, Australia (SC/68A/WW02). Preliminary results from this study indicated that there was the potential that behavioural changes would occur in response to swim-with-whale activities. Details can be found in Annex N, item 2.2.

18.1.3 Review specific papers addressing impacts

The Committee received a paper that analysed the impacts from long-term whale watching on southern right whales that has been occurring in Puerto Pirámides, Argentina since 1973 (SC/68A/CMP15). The authors consider this to be a social-biological system in which both components are integral to the system's sustainability. The possibility that these whales are habituating to whale watching is a concern. Details can be found in Annex N, item 2.3. The Committee also thanked Parsons for the annual digest of papers published on whale watching (SC/68A/WW03).

Attention: R, CG

*The Committee **welcomes** the research on swim-with-whale operations in Australia (SC/68A/WW02) and the analysis of long-term whale watching on southern right whales in Puerto Pirámides, Argentina provided (SC/68A/CMP15). The Committee also **encourages** the continuation of this research and, in the case of Argentina, the integration of social sciences within the studies and the collection of control data on whales in areas not subject to whale watching.*

18.1.4 Emerging concerns

Interactions between solitary-social dolphins and humans have led to instances of accidental and intentional harm to cetaceans, and these individuals are at greater risk of vessel strikes. Details can be found in Annex N, item 2.4. Human interaction with solitary-social dolphins was identified as a form of whale watching, and so is an issue of concern for the Committee.

Attention: SC

*The Committee has long recognised that human-induced behavioural changes of cetaceans related to whale watching is of concern and it **agrees** to retain the intersessional correspondence group under Simmonds on this topic (Annex T).*

18.2 Platforms of opportunity and citizen science

18.2.1 Review new information

Mobile apps have been developed to collect data from individuals taking part in whale watching tours. Other forms of data collected from platforms of opportunity, such as photos for the individual identification of whales, are also known to contribute to scientific research. However, there are a number of difficulties, particularly with regards to statistical analysis, when using these data to inform research because of problems such as the lack of information on the effort behind the data collection, and the often biased nature of the sampling.

Attention: SC, R

*Given the many caveats that must be taken into account when using platforms of opportunity and citizen science data for analyses of cetacean sightings, even when such platforms follow systematic line transects and have qualified data collectors on board to ground-truth citizen science data, the Committee **agrees** that:*

(1) the sub-committee on whale watching should work with other relevant sub-groups (e.g. ASI, EM and IA) to (a) identify the types of analyses that would be acceptable when using data from platforms of opportunity and especially citizen science data from the growing number of available mobile phone apps and (b) develop a list of desirable functions for cetacean sightings apps in order to be of benefit to cetacean science - once developed the list could be included as part of the Whale Watching Handbook; and

(2) designers of cetacean sighting apps should try to incorporate the ability to measure observer effort in the app design (some may already do so), as it is important for analysis.

18.3 Whale watching locations of interest

18.3.1 Communication with the Indian Ocean Rim Association (IORA)

The IORA Sustainable Whale and Dolphin Watching Tourism Network was convened by Australia during the intersessional period. In the longer term, the Network intends to lead initiatives such as training and other capacity building efforts and help to facilitate partnerships to improve whale and dolphin watching practices in the region. The Committee noted that communication between this organisation and the IWC has been beneficial to all parties and welcomes its continuation.

Attention: IGO, CC, SC

*Given the developing whale watching industry in the Indian Ocean region and the previous engagement between the IWC and the Indian Ocean Rim Association, the Committee **recommends** that the dialogue between the IWC (both the Conservation Committee and this Committee) and IORA continue, and **agrees** to retain the intersessional correspondence group (Annex Y) to assist in this dialogue.*

18.3.2 River dolphins in the Amazon and Asia

The South American River Dolphin Initiative (SARDI) has been addressing tourism focused on Amazon River dolphins (*Inia geoffrensis*), a species listed as Endangered by IUCN. Within the framework of responsible dolphin watching and with government support, SARDI has held multiple training and capacity building workshops, and at least three responsible wildlife viewing guides have been published. Due to the economic importance of whale watching, tourism was a primary motivation for designating more than 2 million hectares of the Amazon River as Ramsar²⁸ sites. The Committee looks forward to receiving updates in the future and has added a review of whale watching in Latin America as a priority to the work plan for 2020 Annual Meeting (Table 21).

18.3.3 Africa

Whale watching is being developed in Benin as an alternative to the utilisation of cetaceans for wild meat. This has led to a growing interest in cetaceans within the country and Beninese researchers have recommended increased scientific research on Benin's marine resources and increased international collaboration, including with the IWC.

Attention: G, CG, SC, R

*Some countries, such as Benin, have begun or are considering a transition from exploiting cetaceans as wild meat to using them for whale watching tourism (Nature Tropicale NGO, 2018). The Committee **draws attention** to this transition and:*

- (1) **encourages** research to examine the effectiveness of responsible whale watching tourism in reducing the exploitation of cetaceans as wild meat in those countries and regions where it is occurring; and*
- (2) **agrees** that such areas, where whale watching is in its infancy, should be considered as potential sites for the MAWI initiative (see Annex N and Item 18.1).*

A summary of known whale watching operations on the east and west coasts of Africa was presented to the Committee (see Annex N, table 2). Many countries have official and opportunistic whale watching, and humpback whales are the main target on both coasts. Whale watching guidelines could not be identified for all countries.

Attention: CG, G, CC

*Many countries in certain regions have fledgling whale watching industries. The Committee periodically conducts basic regional reviews of the whale watching operations. These reviews at times identify countries where whale watching is just starting or may already be at high levels, but without regulations or guidelines. If such areas are identified during a review, the Committee **recommends**:*

- (1) that Governments work to put regulations or guidelines in place as soon as possible, before their whale watching industries develop further;*
- (2) that the Conservation Committee examines recent regional reviews to determine which countries do not appear to have regulations or guidelines - if further investigation determines this is correct, the Conservation Committee should encourage these countries to develop guidelines for, or regulate, their industries.*

²⁸ <https://www.ramsar.org/>

18.3.4 Additional locations

18.3.4.1 BOCAS DEL TORO, PANAMA

The mortality of bottlenose dolphin calves in Bocas del Toro, Panama, some due to boat strikes, was estimated to be higher than the levels reported in comparable areas. Research is ongoing to determine if a recent, concentrated effort to train boat operators has been successful in reducing calf mortality, minimising behavioural disruption and increasing compliance with regulations.

Attention: SC, R, CG

*The Committee has expressed **concern** over the bottlenose dolphin watching operations in Bocas del Toro, Panama for several years (IWC, 2019a, pp.57-58). The Committee **encourages** the continuation of the current research in Bocas del Toro investigating the effectiveness of recent efforts to improve the situation and looks forward to the presentation of this work at future meetings.*

18.3.4.2 SRI LANKA

Prakesh *et al.* (2019) identified Sri Lanka (particularly Marissa) as a whale watching location of concern, using social science methods with anecdotal evidence of vessels crowding and chasing whales and failing to maintain safe distances from whales (see Annex N, item 4.4.2).

Attention: SC

*The Committee noted reports (Prakesh *et al.*, 2019) that whale watching in Sri Lanka (particularly in Marissa) was not being effectively managed. The Committee **agrees** that Sri Lanka and Latin America should remain 'areas of interest' and funding should be secured, if possible, to bring researchers working on whale watching and capacity building in those regions to the 2020 Annual Meeting.*

18.4 Whale Watching Handbook

18.4.1 Review and provide comments on the IWC's Whale Watching Handbook

The IWC Whale Watching Handbook was launched in October 2018²⁹. Work to maintain and update it is ongoing, and it has been promoted and positively received widely. The Committee thanked Minton and Ferriss for their hard work on this IWC product. Based on the feedback provided, a need for the inclusion of a greater number of case studies on whale watching areas of concern was identified (see Annex N, item 5).

Attention: S, SC, CG

*The Committee **recommends** that the promotion of the IWC's Whale Watching Handbook continue and that Contracting Governments and Scientific Committee members promote its use and continue to provide relevant and up-to-date information. The Committee **agrees**:*

(1) that an appropriate balance between positive and negative case studies is needed for future updates to the Handbook and to have further discussion intersessionally with the Secretariat and the Conservation Committee on how to strike this balance; and

(b) to retain the Whale Watching Handbook intersessional correspondence group (Annex Y) to pursue these discussions.

The Committee sought clarification regarding the process by which the Handbook would be updated, how different case studies would be reviewed prior to being made available online and the role the Committee can play in continuing to contribute to the Handbook in a positive and effective way. SC/68A/WW04 included a request from the Secretariat for suggestions for updates to the current content on the Handbook including with respect to new case studies and country profiles, literature updates and content to support industry stakeholders.

²⁹ <https://iwc.int/whale-watching-handbook>

Attention: S, SC, CC

The Committee noted (a) that the Whale Watching Handbook will be updated annually in accordance with guidelines on the IWC website for updating content and (b) that the Conservation Committee and the Secretariat will be establishing protocols for managing content of the Handbook, which will be presented to the Committee at the 2020 Annual Meeting. The Handbook is a Commission tool to promote responsible whale watching and requires Commissioner approval for country profiles and case studies, coordinating with their own relevant agencies and experts. Therefore, the Committee **agrees:**

(1) to provide the Secretariat with suggestions for updates to the Handbook in response to SC/68A/WW04 at the 2020 Annual Meeting;

(2) that Minton will contact Committee members intersessionally and request individual (and immediate) input to specific needs for the 2019 update; and

(3) to retain the Whale Watching Handbook as an item on the Agenda to allow the Committee to continue to contribute to the process of updating the Handbook on an ongoing basis.

With regard to feedback from Commissioners on aspects of the Handbook into which Committee members had significant input, the Committee **recommends:**

(1) that the protocols on managing Handbook content, to be established by the Conservation Committee and the Secretariat, include provisions to contact Committee members who worked on particular case studies and country profiles to discuss Commissioner feedback on those case studies and profiles; and

(2) that these Committee members should also approach the Secretariat for clarification at any time should revisions be noted on which they have comments or concerns.

18.5 Update of the whale watching guiding principles

18.5.1 Review draft guiding principles

The Commission's General Principles for Whale Watching were revised in order to incorporate issues that have arisen within the whale watching industry since the Guidelines were originally drafted in 1996. Details can be found in Annex N, item 6.1. The major changes relate to inclusion of issues such as swim-with operations and the emergence of new technologies. Once the revised principles are approved by the Commission, they will be uploaded to the IWC website.

Attention: C, CC, S, SC

The Committee **draws the attention** of the Commission, the Conservation Committee and the Secretariat to the need to update the IWC General Principles for Whale Watching, as they have not been updated since 1996. The Committee **recommends** the approval and adoption of the revised general principles, as given in Annex N, Appendix 2, at the earliest opportunity.

18.6 Review progress on scientific recommendations

18.6.1 Global influence of recommendations

As a part of Ecuador's programme to promote and implement responsible marine tourism practices, the government has sponsored training events, workshops, seminars and conferences, as well as published the First Whale Watching Guide of Ecuador. The Committee **welcomes** this information and offers its congratulations to the Government of Ecuador and its Ministry of Tourism for its pro-active response to its developing whale watching industry.

A two-day workshop on responsible whale and dolphin watching was held in Oman in August 2018 through collaboration among Oman's Ministry of Environment and Climate Affairs (MECA), the Environment Society of Oman (ESO), Five Oceans Environmental Services (5OES) and the Pacific Whale Foundation (PWF). The Committee welcomed this information and thanked MECA, the ESO, 5OES and PWF for their cooperation and collaboration in organising this workshop. This workshop was in direct response to a previous recommendation from the Committee (IWC, 2019a, p.56).

18.6.2 Tracking progress on previous recommendations

Progress on previous recommendations was reviewed (Annex N, item 7.2) in preparation for a more thorough review at the 2020 Annual Meeting, and to ensure that the relevant individuals and groups responsible for following through with the recommendations had been properly identified.

18.7 Other matters

18.7.1 Communication with the Conservation Committee

The Committee continued discussions with the Secretariat and the Conservation Committee on the best way to improve communication. Several potential mechanisms were identified, including sharing of reports and the use of the recently developed recommendations database. A similar internal discussion on improving communication with the Committee is planned for the July 2019 meeting of the Conservation Committee Planning Group.

Attention: S, CC, SC

*Given the need to improve communication and collaboration about whale watching between the Committee and the Conservation Committee, the Committee **agrees** that:*

(1) the whale watching sub-committee should serve as an early adopter of the recommendations database, to assess and determine its maximum utility with regard to facilitating communication between and among various IWC committees;

(2) the ongoing effort by the Secretariat to archive committee reports and documents on the website is consistent with its suggestion to circulate or otherwise make Conservation Committee reports and documents relevant to Committee work plans available as soon as they are ready for distribution; and

(3) a standing agenda item will be added to review such reports and documents from (in particular) the standing Working Group on whale watching as they are produced.

18.8 Work plan

The work plan for matters related to whale watching is given as Table 21.

Table 21

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 SC/68B (see Annex N)

Topic	Intersessional 2019/20	2020 Annual Meeting
Assess impacts of whale watching on cetaceans – PRIORITY	Prepare papers	Papers to be presented
(a) Short-term impacts		
(b) Mid- and long-term impacts		
(c) Swim-with operations		
(d) Emerging issues of concern e.g. drones and new technology		
Third MAWI workshop	Hold Workshop (convenor New) at World Marine Mammal Science Conference in December 2019	Review Report and develop recommendations and work plan
General Principles for Whale Watching		Receive update
Review whale watching in Sri Lanka	Intersessional correspondence group (Annex T)	Papers to be presented
Review whale watching in Latin America	Work to prepare review	Papers to be presented
Intersessional correspondence groups (see Annex T)	Email correspondence and work	Receive reports
Review progress on previous recommendations	-	Papers to be presented
Review documents, communication and intersessional collaboration with Conservation Committee Standing Working Group on Whale Watching (SWG)	Email correspondence, esp. regarding July 2019 planning meeting	Receive update
IWC Whale Watching Handbook	Email correspondence with the Secretariat and Minton	Receive updates
Increased collaboration with other sub-committees regarding platforms of opportunity and citizen science data	Email correspondence and work	Receive updates

19. SPECIAL PERMITS

The Chair called for brief overviews of the papers on NEWREP-A, NEWREP-NP and JARPN II in Plenary with a request that the discussion focus on scientific aspects of these reports.

19.1 NEWREP-A

19.1.1 New information

SC/68A/SP01 provided the results of the biological sampling of Antarctic minke whales during the NEWREP-A survey conducted in Area III, south of 60°S during the 2018/19 austral summer season. Three sighting sampling vessels (SSVs) and one research base vessel were engaged in the survey which sampled 333 Antarctic minke whales (186 female and 147 male). The sampling added to the information on stock structure of Antarctic minke whales, particularly the western boundary of the I-stock. Additional samples and data were collected on southern right, humpback, fin and Antarctic minke whales.

19.2 NEWREP-NP

19.2.1 *New information*

SC/68A/SP02 reported the results of the offshore (sub-areas 7, 8 and 9) survey of the NEWREP-NP in May-August 2018. Three research vessels sampled 43 common minke whales and 134 sei whales. Japanese sardine and mackerel were the major prey species for these whales. Three blue whales were photo-identified, and biopsy samples were collected from one blue, seven sei and one common minke whale using the ‘Larsen’ system. Nine satellite transmitters were successfully attached to eight sei whales and one common minke whale.

SC/68A/SP03 presented the results of the second survey of the coastal component of NEWREP-NP carried out of three ports (Ayukawa, Hachinohe and Kushiro) where biological examination was conducted. A total of 80 common minke whales were sampled (49 males and 31 females) and additional sightings data were collected. The dominant prey species were sand lance, Japanese sardines, and krill.

SC/68A/SP04 outlined the results of the second survey of the NEWREP-NP coastal component (southwestern part of the sub-area 11). The August 2018 survey by five small-type whaling catcher boats encountered a total of 91 schools (93 individuals) of common minke whales, of which 47 animals were sampled. There were 16 males and 31 females, of which 21 were pregnant; this bias towards females as similar to the previous year’s survey. There were also sightings of 163 fin whales and one humpback whale. Stock assignment for 47 animals was conducted from microsatellite data, resulting in 28 assignments to the J stock and 15 to the O stock (four unassigned). The proportion of J stock animals increased throughout August (58% to 73.7%). Foetal body lengths indicated a conception date peak in March, similar to a previous study in the southern Okhotsk Sea. Dominant prey species were krill (59.6%) and Japanese sardine (38.3%), again similar to past surveys in the Okhotsk sea.

19.3 JARPEN II consolidated report

19.3.1 *Presentation by proponents*

SC/68A/SP05 reported the final conclusions of the Japanese Whale Research Program under the IWC Special Permit program in the western North Pacific-Phase II (JARPEN II), conducted between 2000 and 2016. The three main research objectives focused on feeding ecology and ecosystem modelling, environmental pollutants, and stock structure. The final review of JARPEN II was carried out by an Expert Review Panel (IWC, 2017c) and their report was discussed at the 2016 Committee (IWC, 2017). The scientific outputs of JARPEN II were highlighted in this review and researchers were encouraged to follow the Panel’s recommendations and to submit further work to peer-reviewed scientific journals. JARPEN II scientists conducted refined analyses based on these recommendations, with results similar to those presented in the 2016 final review. Details of the analyses were presented and discussed by relevant sub-committees (EM, E and SDDNA) at the present meeting.

19.3.2 *Discussion and conclusions*

In discussion, Walløe congratulated his Japanese colleagues on the successful field work in the Antarctic Ocean last summer. He singled out the high value of obtaining biological samples from minke whales in a more western area in the Indian Ocean than had been possible previously. He also expressed his view that the number of genetic samples obtained by lethal sampling was probably much higher than would have been possible to obtain by biopsy sampling with the same effort.

Kitakado noted that in light of the reasons for moving from JARPA II to NEWREP-A, considerable effort had been put into the question of the appropriate sample size for NEWREP-A by both himself and the Scientific Committee. The proponents had stated that an annual sample size of 333 Antarctic minke whales over a 12-year period was estimated to be sufficient and necessary to meet the stated objectives of the programme. However, in light of Japan’s withdrawal from the IWC and announcement that it would no longer take whales under special permit after the 2018/19 Antarctic season, it was clear that the objectives of NEWREP-A could not be attainable. He therefore questioned the justification for the decision to take 333 whales in the 2018/19 season under special permit after Japan’s declaration of withdrawal. The same logic applies to the NEWREP-NP programme, where special permit whaling is taking place now. The issue is not whether some scientific information can be obtained from those catches (of course it can) but that the catches were taken even though it is known that those data are insufficient to meet the stated objectives of the programmes.

Japan responded that the decision to withdraw from the IWC had been taken late in December after the 2018/19 NEWREP-A survey had already started in the Antarctic Area III. While certain objectives of NEWREP-A could indeed no longer be met, that did not apply to others. For example, a further year of age data would allow for improvement of future population assessments. Furthermore, the 2018/19 NEWREP-A survey provided an excellent opportunity to collect genetic samples of Antarctic minke whales in an area not surveyed previously (Area IIIW). As explained in SC/68A/SP01, the genetic analyses of those samples will allow for further elucidation of the distribution of the I and P stocks in the Indo-Region of the Antarctic (Pastene *et al.*, 2016), which was another objective of NEWREP-A. Regarding NEWREP-NP, Japan disagreed with Kitakado’s logic. Future commercial catches could serve the same role as catches under scientific permit in numerous respects, so that many of the objectives of NEWREP-NP would still be attained, although perhaps over a slightly longer period than originally planned in some instances. Japan’s decision to withdraw from the IWC had

been a policy decision, trading off amongst many considerations, but its decisions overall would still result in the provision of data which would lead in time to improvements in scientific understanding of whales.

20. WHALE SANCTUARIES

20.1 Review progress on Southern Ocean Sanctuary management plan

In the absence of key delegations or documents, no new information was presented this year regarding the issue of progress on the Southern Ocean Sanctuary. This item will remain on the agenda to be considered at SC/68B.

20.2. Receive new information on sanctuaries

20.2.1 Indian Ocean Sanctuary

Minton presented information on the IUCN Important Marine Mammal Areas (IMMA) work³⁰. The aim of the IMMA classification is to identify and delineate discrete habitats, important for the conservation of one or more marine mammal species (see Annex R; item 3.1 for details). The Western Indian Ocean and Arabian Seas were the focus of a March 2019 IMMA workshop, held in Salalah, Sultanate of Oman. A total of 55 candidate IMMAs (cIMMAs) were identified, which is the largest number proposed from a single workshop to date. These cIMMAs are now undergoing peer review by an independent review panel and may be adopted by the Marine Mammal Protected Areas Task Force Committee later this year.

Minton also reported that the IWC Bycatch Mitigation Initiative will probably result in training and capacity building in the Indian Ocean region (see Annex J). It was noted that there is an IndoCet (Indian Ocean Network for Cetacean Research) meeting taking place in July 2019 and an Indian Ocean Cetacean Symposium planned in the Maldives that will take place in July 2020.

Attention: SC, IGO, CG

The Committee welcomes the new information on work being undertaken within the Indian Ocean Sanctuary area by the IUCN Important Marine Mammal Areas network as well as the forthcoming meeting of IndoCet (Indian Ocean Network for Cetacean Research) in July 2019 and an Indian Ocean Cetacean Symposium in July 2020. It encourages submission of the outcomes of this work at future meetings.

20.2.2 Southern Ocean Sanctuary

As also noted under Item 14.2, members of the International Association of Antarctic Tour Operators (IAATO) voted at its recent annual meeting in Cape Town, South Africa, to adopt mandatory measures to mitigate ship strike risk from ship operations in the waters of the Antarctic Peninsula. Details are provided in Annex R, item 3.2, and Annex J.

Attention: SC, CG, I

The Committee welcomes the decision of the International Association of Antarctic Tour Operators (IAATO) to adopt mandatory measures to mitigate ship strike risk from ship operations in the waters of the Antarctic Peninsula. It encourages the provision of such information and updates at next year's meeting.

20.3 Other

No information was presented under this agenda item.

20.4 Work plan

Table 22
Work plan for issues related to sanctuaries (no intersessional work is planned for 2019/20)

Topic	2020 Annual Meeting
Consider new information on the Southern Ocean Sanctuary Management Plan	Cross-reference relevant information from other sub-committees and Working Groups
Consider new information on other sanctuaries	Receive papers
Provide responses to requests from the Commission on scientific aspects of sanctuaries	Respond to requests should they arise

³⁰ <https://www.marinemammalhabitat.org/>

21. WORKSHOP ON CETACEAN TAG DEVELOPMENT AND GUIDELINES FOR TAGGING BEST PRACTICES.

Electronic data recorders (tags) have become powerful tools to understand cetacean ecology and to enhance cetacean conservation. Many Committee sub-groups receive information on tagging studies, which are then used in the deliberations of the Committee. Zerbini presented the report of a two-part workshop co-chaired by Donovan and Weise and aimed at reviewing the progress in tag design and attachment over the last several years, reviewing studies that have examined the effects of tagging and developing best practices for cetacean tagging (SC/68A/Rep03). The workshop was jointly organised and funded by the IWC, the US Office of Naval Research (ONR) and by NOAA in 2017/18.

The Workshop was attended by a total of 42 participants from 9 countries and included tag developers, tag users, veterinarians, engineers, representatives of governmental and inter-governmental organizations and tag manufacturers. Overall, the workshop participants agreed that the over-arching goal within the tagging community is to extend tag duration, while minimising impacts to the animal. Detailed discussions covered the following topics:

- (1) data sharing (tag registry, deployment databases, coordination between taggers, sightings of opportunity and stranding networks);
- (2) anatomy and physiology (need to better understand anatomy and tissue response to tagging, assessment of pain);
- (3) tag sterilisation (sterilisation, antimicrobials/antiseptics);
- (4) tag deployment (improving accuracy and precision in tag deployment, proper training of tagging teams, selection of the best candidate for tagging);
- (5) tag attachment (limitations, future developments); and
- (6) tag follow-up studies (need to conduct follow-up studies to assess tag robustness and sub-lethal effects, improvements in technology to relocated tagged animals).

In discussion of these various topics, the workshop produced a series of recommendations (section 5 and Annex H of the SC/68A/Rep03), which were prioritised according to the process outlined in section 6 of SC/68A/Rep03.

The Committee received a document describing best practice guidelines for cetacean tagging (Andrews *et al.*, Submitted). This version incorporates revisions provided by participants at the Workshop on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices after their review of an early draft (SC/68A/Rep03). With the increasing need for data provided by tagging and the increasing availability of tags, research with animal-borne instrument is becoming more common. Therefore, a single source of best practice recommendations for cetacean tagging was needed. The 'Guidelines Document' provides best practice recommendations for cetacean tag design, deployment and follow-up assessment of tagged individuals. It was compiled by 21 biologists and veterinarians from nine different countries. Each contributor has experience with cetacean tagging, and each has expertise in one or more of these disciplines relating to cetaceans: general biology, capture and release, veterinary medicine, tagging, and tag technology. The Guidelines are intended to serve as a global resource to assist tag users, veterinarians, ethics committees and regulatory agency staff in the implementation of high standards of practice, and to promote the training of specialists in this area. Standardized terminology for describing tag design and illustrations of tag types and attachment sites are provided, along with protocols for tag testing and deployment (both remote and through capture-release), including training of operators. The recommendations emphasise the importance of ensuring that tagging is ethically and scientifically justified for a particular project and that tagging only be used to address bona fide research or conservation questions that are best addressed with tagging, as supported by an exploration of alternative methods. Recommendations are provided for minimizing effects on individual animals (e.g., through careful selection of the individual, tag design and implant sterilisation) and improving knowledge of tagging effects on cetaceans through increased post-tagging monitoring.

The Committee recognised the need to regularly update the guidelines given ongoing technological advances, as noted in the guidelines document itself. The section on ethical and legal considerations offers a process to determine whether tagging is the best method and whether conservation questions are addressed in the research, especially when species of concern are being tagged are also issues previously raised by the Committee. The importance of training and field experience in tagging, in addition to providing the guidelines, was also emphasised. Apprenticeships as used by the IWC Entanglement Response Programme may serve as a good model, and workshops held by this programme could represent an opportunity for training in both disentanglement techniques and in tagging techniques. Outreach efforts on the guidelines will be critical, including sharing the guidelines with other IGOs (e.g. ACCOBAMS, ASCOBAN, NAMMCO), the use of social media, and a workshop at the World Marine Mammal Conference in Barcelona in December 2019.

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

*The Committee **recognises** that electronic data recorders (tags) have become powerful tools in understanding cetacean ecology and enhancing cetacean conservation efforts. It **endorses** the report and recommendations of the Workshop*

on Cetacean Tag Development, Tag Follow-up and Tagging Best Practices (SC/68A/Rep03) and **thanks** the co-sponsors (the US Office of Naval Research, the IWC and the US National Oceanic and Atmospheric Administration).

The Committee also **endorses** best practice guidelines for tagging provided in Andrews *et al.* (in press) that will be published this year in the Journal of Cetacean Research and Management.

The Committee **draws attention** of these guidelines to IWC Contracting Governments and:

(1) **recommends** that the Secretariat give them prominence on the IWC website and disseminates them to other relevant IGOs such as ACCOBAMS, ASCOBANS and NAMMCO as well as professional societies such as the European Cetacean Society, the Society for Marine Mammalogy and the Latin American Society for Specialists in Aquatic Mammals;

(2) **agrees** to use them when reviewing relevant research proposals within the Committee;

(3) **encourages** their use by agencies when evaluating applications for national cetacean tagging permits; and

(4) **agrees** to include an agenda item next year on when tagging is an appropriate tool to use in cetacean studies, building for example on the work undertaken when designing the tagging study on western gray whales.

22. IWC LIST OF RECOGNISED SPECIES

The Committee reviewed the current IWC list of recognised species and noted that needs to be updated for consistency with the list of marine mammal species and subspecies of the Society for Marine Mammalogy, which is adopted by the Committee. The Committee **agrees** that Brownell and Malette should prepare a document with proposed updates to the IWC list of recognised species for the 2020 Annual Meeting.

23. IWC DATABASES AND CATALOGUES

For primarily logistical reasons, it was agreed that the working group on Global Databases and Repositories and the *ad hoc* Working Group on Photo-identification would not meet at this meeting; both will meet next year.

However, a report on intersessional progress was submitted by Double and Miller. A key factor noted was that the overall prioritisation of development work by the Secretariat IT team has to consider not only the Committee's priorities but also the needs and priorities of the Commission, the Secretariat and other Commission sub-groups. SC database priorities list for the 2019-20 period will remain as established at the 2018-19 period with the key items being updates and maintenance as well as the Individual Catch and Catch Summary databases. This will be reviewed at the 2020 meeting in Cambridge, UK.

23.1 Progress with existing or proposed new catalogues (PH)

23.1.1 New developments in automated matching of photo-IDs

The Committee received new information about a number of photo-ID matching initiatives which are underway using automated matching algorithms, including for humpback whales (SC/68A/SH07 and Annex H, item 6.3,) and southern right whales (Item 5.3, Annex H) as well as a plan to develop a photo-ID matching algorithm for blue whales (Item 3.2, Annex H). Two main developers operate in this field (FlukeBook³¹ and Happywhale³²) that have similar underlying architecture and are both free to use, but have interface differences. For example, Happywhale is fully open access, whereas FlukeBook users can maintain catalogue privacy and require permission for access to match between catalogues. Happywhale provides auto-feedback on matches to submitters and has become a popular site for submission of citizen-collected photo-ID data in some regions, particularly for humpback whales in the northeast Pacific (Cheeseman and Southerland, 2018).

Until recently, photo-ID matching algorithms have been used to assist human matching but were not considered a full replacement. New algorithms such as the 'deep-learning' based 'Kaggle' photo-ID algorithm have promise to provide photo-ID matching accuracy similar to that of humans (i.e. over 97%), potentially making them very useful for rapid and accurate future development of capture-recapture datasets for lower cost than at present. These algorithms are currently most advanced for humpback whales (Annex H, item 6.3,) but are under development for other species of interest to the Committee for population assessment.

³¹ <https://www.flukebook.org/>

³² <https://happywhale.com/home>

Attention: SC, R, I

*Photo-identification data are of great value to many aspects of the work of the Committee (including population structure, movements, abundance, life history parameters). As catalogue sizes grow, reliable automated matching is of increasing value. Therefore, the Committee **requests** further updates on automated matching efforts for at least humpback, right and blue whales that incorporate data on matching accuracy (missed matches and erroneous matches) to help evaluate their comparability with human matching efforts.*

24. IWC MULTINATIONAL RESEARCH PROGRAMMES AND NATIONAL RESEARCH CRUISES THAT REQUIRE IWC ENDORSEMENT

Multinational research programmes (e.g., IWC-POWER and IWC-SORP) and national research cruises provide valuable information to the work of the Committee. These cruises occur in many regions around the world, most notably in the Antarctic and in the North Pacific.

24.1 IWC-POWER

The IWC-POWER (North Pacific Ocean Whale and Ecosystem Research) programme is an international collaborative effort coordinated by the IWC and Japan and designed by the IWC's Scientific Committee. The focus of the programme is the North Pacific Ocean, and particularly little-studied areas, some of which had not been surveyed for 40 years before the instigation of the programme. Details of discussions on the IWC-POWER cruises this year are given in Annex Q, item 4.1.

The Committee welcomed the results of the 9th annual IWC-POWER cruise conducted between 3 July and 25 September 2018 in the central Bering Sea (SC/68A/ASI/04). Researchers from Japan, USA and IWC participated on the surveys. A total of 338 sightings of 10 cetacean species was made including information on the critically endangered eastern population of North Pacific right whales. The Committee also welcomed a study that assessed the distribution and density of marine debris in the North Pacific resulting from data collected during the 2010-16 IWC-POWER cruises (SC/68A/E11)

The report of the IWC-POWER Technical Advisory Group (TAG) was considered that included advice to refine abundance estimates of several species using data collected during the programme and an initial approach to developing the medium-term plan (SC/68A/Rep01).

The Committee received a report of the 2019 IWC-POWER cruise planning meeting; funds to conduct the cruise have already been approved. The cruise was expected to occur in the western Bering Sea, but because of difficulties in obtaining a permit to survey in Russian waters, the backup plan is to survey in the Gulf of Alaska. The Committee noted the greater value of surveying the Russian part of the IWC-POWER cruise plan as soon as possible to ensure that spatially proximal areas are surveyed in proximal years (thereby facilitating abundance estimation for larger areas).

Attention: SC, C-A, CG-R

*The Committee **reiterates** to the Commission the great value of the data contributed by the Committee-designed IWC-POWER cruises which cover many regions of the North Pacific Ocean not surveyed in recent years and addresses an important information gap for several cetaceans species, providing fundamental information on abundance necessary for developing conservation and management advice. The Committee:*

***thanks** the Governments of Japan (who generously supplies the vessel and crew) and the USA (who generously provides acoustic equipment and acoustic experts), for their continued support of this IWC programme;*

***thanks** the researchers involved in the cruises, the ship's crew and the cruise leader;*

***agrees** that the 2018 cruise was duly conducted following the requirements and guidelines of the Committee (IWC, 2012) and **looks forward** to receiving abundance estimates based on these data;*

***endorses** the report and work plan set out by the Technical Advisory Group (TAG) for continuation of work related to the IWC-POWER cruises;*

***endorses** the plans for the 2019 and 2020 POWER cruises;*

***reiterates** a previous **strong recommendation** (IWC, 2019) that the IWC Secretariat writes a letter to the Russian Federation urging this country to facilitate the proposed research by providing permits for the IWC-POWER cruise to survey their national waters in the Bering Sea and adjacent waters;*

***looks forward** to receiving a report from the 2019 survey at the 2020 Annual Meeting; and*

***urges** that a mechanism be found for these cruises to continue.*

24.2 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 improving the coordinated and cooperative delivery of science to the IWC. The Partnership currently has 13 member countries: Argentina, Australia, Belgium, Brazil, Chile, France, Germany, Italy, New Zealand, Norway, South Africa, the United States of America, and Luxembourg. New members are warmly welcomed.

There have been six ongoing IWC-SORP themes:

- (1) ‘The Antarctic Blue Whale Project’;
- (2) ‘Distribution, relative abundance, migration patterns and foraging ecology of three ecotypes of killer whales in the Southern Ocean’;
- (3) ‘Foraging ecology and predator-prey interactions between baleen whales and krill’;
- (4) ‘Distribution and extent of mixing of Southern Hemisphere humpback whale populations around Antarctica?’ focused initially on east Australia and Oceania; and
- (5) ‘Acoustic trends in abundance, distribution, and seasonal presence of Antarctic blue whales and fin whales in the Southern Ocean’.
- (6) ‘The right sentinel for climate change: linking foraging ground variability to population recovery in the southern right whale’.

A 7th theme was added this year: ‘Recovery status and ecology of Southern Hemisphere fin whales’, which will be included in future calls for proposals.

Bell presented the IWC-SORP Annual Report 2018/19 on the continued progress of research undertaken researchers involved in the six themes since last year (SC/68A/SH10). This progress includes the production of 18 peer-reviewed publications during 2018/19, bringing the total number of peer-reviewed publications produced since the start of the initiative to 144. In addition, 133 IWC-SORP related papers have been submitted to the Scientific Committee to date, 8 of them this year.

Fieldwork was undertaken to a variety of places during the past year, including the Southern Ocean (60°S – 67°S; 138°E – 152°E), the western Antarctic Peninsula, Marion Island and the Great Barrier Reef, Australia. Thousands of images for photo-identification have been collected, including those identifying 25 Antarctic blue whale individuals; a variety of satellite tag-types were deployed on Antarctic minke whales, humpback whales and killer whales and biopsy samples were collected from these same species; and hundreds of hours of acoustic recordings have been made and analysed. The support of national marine facilities and tour companies in providing research platforms to facilitate these activities, as well as external data contributors, were acknowledged by the Committee.

A brief report on the IWC-SORP Research Fund following two open, competitive grants rounds was also given (SC/68A/SH11). In 2016/17, £144,058 GBP were allocated to 10 projects and in 2018/19, £489,154 GBP were allocated to a further 15 projects. £135,497 GBP remain unallocated and unspent in the fund (see also SC/68A/05). A new Call for Proposals will be opened in late 2019. The Committee acknowledged and thanked all contributors to the IWC-SORP Research Fund for their voluntary contributions. The Committee also noted that since SC67B, substantial vessel time has been secured by IWC-SORP researchers for the 2019/20 austral field season.

Attention: SC, G

Acknowledging the great value of the IWC-SORP (Southern Ocean Research Partnership) programme to its work, the Committee:

(1) encourages the continuation of SORP;

(2) commends the researchers involved who are key to the overall success of 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-identification data, to IWC-SORP and the wider Committee.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

23.2.1 Workplan

The work plan for IWC-SORP is given in Table 23.

Table 23.

Workplan for the Southern Ocean Research Partnership

Item	Intersessional 2019/20	2020 Annual meeting (SC/68B)
Analyses	Continued analysis of data/samples from previous IWC-SORP voyages/fieldwork	Receive analyses
Voyages	Baleen whale and krill research voyages along Western Antarctic Peninsula	Receive reports
Fieldwork	Continued fieldwork around Marion Island and the GBR	Receive reports
Ships of opportunity	Continued use of ships of opportunity to conduct cetacean research	Receive reports
Acoustics	Retrieval and redeployment of passive acoustic recorders	Receive reports

24.3 National cruises that require IWC oversight

The Committee welcomed plans for national research cruises to be conducted in the intersessional period of 2019-2020. The cruises will be conducted in the Okhotsk Sea by Russia and Japan, in the North Pacific and the Antarctic by Japan, and off western North Africa by the Republic of Guinea. The Committee received cruise reports from surveys conducted in the Antarctic, the western North Pacific, the North Sea and the Sea of Okhotsk. Details on the cruise plans and cruise reports are presented in Annex Q, item 4.2.

Attention: SC, C-A

*The Committee **recognises** the value of information provided by national cruises. It therefore*

*(1) **endorses** the proposed sighting survey plans provided in SC/68A/ASI/01, 05, 08 and 13;*

*(2) **encourages** collaboration among member countries and other nations for development of surveys that have common objectives and for which survey area overlaps; and*

*(3) **encourages** submission of abundance estimates from these surveys in accordance with the Procedures for Submission, Review and Validation of Abundance Estimates (Annex P).*

24.4 Work Plan

The Committee **agrees** to the workplan provided in Table 24.

Table 24

Work Plan for multinational research programs and national research cruises that require IWC oversight

Topic	Intersessional 2019-20	SC68B
Review and provide advice on plans for future surveys.		Receive, review and provide feedback to research plans to conduct abundance estimates
IWC-POWER Cruise in the Bering Sea.	Conduct 2019 survey and planning meeting for the 2020 cruise (IWC, Japan, USA)	Review cruise report, report from the planning meeting and new abundance estimates from IWC-POWER cruises.

25. SCIENTIFIC COMMITTEE BUDGET FOR THE CURRENT BIENNIUM

25.1 Status of funded research, workshop proposals, data processing and computing needs

SC/68A/05/Rev1 provides information regarding the position on the Scientific Committee's research budget at the end of the 2018 financial year. This year, more detailed information on income and expenditure had been provided.

Projects undertaken in 2018 were generally on budget or under budget, however a total of approximately £8,000 from the contingency fund was utilised to cover overspends across a total of seven projects. The remaining balance on the Committee contingency fund at the end of 2018 was £24,000, which equates to 10.7% of the 2019 budget and therefore is in line with the expected balance as outlined in the Rules of Procedure (IWC, 2019i).

In 2018, the Research Fund gratefully received a voluntary contribution from the Government of Italy of EUR 15,000. This was used support participation of Invited Participants at this meeting.

It was noted that a total of £30,869 had been received in voluntary contributions to the Small Cetaceans Research and Conservation Fund. A total of approximately £72,000 remained on the 31 December 2018. A total of £42,000 was spent in 2018 from this fund.

At the 2019 SC meeting, the Committee approved funding for 15 projects from the Southern Ocean Research Partnership (SORP) Fund, totalling £494,000. A further £15,000 was dispersed intersessionally by the SORP Steering Committee in line with the process outlined in the Rules of Procedure. This left £135,000 available at the year end.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

In 2019, the Government of France generously made an additional contribution to the SORP Fund of EUR 20,000.

25.1.1 Funded proposals for the current biennium 2019-20

Table 25

Summary of budget requests for 2020 based upon the budget agreed last year. For explanation and details of each project see text and IWC (2019c), pp67-74. Items in bold are new items this year funded using the money allocated last year fo

Project Title	Main Sub-Group	RP no.	From SC Funds	2020 Core	From Existing Balances	Reallocated from Other Projects	Allocated from Third Parties	2020 Budget	Total
General									
Invited Participants - SC/68a and SC/68b	ALL	67B		65,000					65,000
Supporting Commission Recommendations - Not Yet Allocated	ALL	67B				5,703			5,703
Meetings / Workshops									
Marine debris	E	67B RP06		15,540			8,613		24,153
Noise pre-meeting	E	67B RP05		8,400					8,400
North Pacific minke whale workshop	IA (was RMP)	67B RP21		15,000					15,000
South Asian river dolphins task team workshop	SM	67B RP25		6,271					6,271
Guiana dolphin pre-assessment	SM	67B RP26		6,993					6,993
Modelling whale watching impacts (MAWI)	WW	67B RP27		14,000		3,000			17,000
Catch series: Southern right whales	SH	67B RP29		11,060					11,060
Comparative biology, health, status & future of NA right whales	NH	67B RP37		10,000					10,000
Pre-Meeting of the Abundance Steering Group	ASI	68A RP05		2,000					2,000
Modelling/Computing									
Essential computing support	RMP	67B RP23		11,500					11,500
Exploration of survey methods and designs to return a new abundance estimate of west Australian (BSD) humpbacks	SH	68A RP01		4,000					4,000
Simulating line transect data to investigate robustness of novel analysis methods	ASI	68A RP06		3,000					3,000
Research									
IWC-POWER cruise	IA	67B RP01		12,500	20,000				32,500
IWC strandings initiative – emergency response and investigations	E	67B RP07		4,500					4,500
ES Pacific Southern right whales acoustic monitoring	CMP	67B RP12		11,760					11,760
Updated catch series and assessments of four pygmy blue whale populations	SH	67B RP28		12,865					12,865
Using photo-ID to Investigate the Identity of Blue Whales (S. Atlantic islands)	SH	68A RP02		390					390
Databases									
Ship strikes database coordinator	HIM	67B RP18		5,000					5,000
Southern Hemisphere blue whale photo catalogue	SH	67B RP32		3,000					3,000
Antarctic Blue Whale Catalogue: comparison of new photographs from 2014-20	SH	67B RP33		560					560
SH Blue Whale Catalogue: Coding Project	SH	68A RP03		26		2,411			2,437
Photo-ID comparison of southern right whales in Brazil and Argentina	SH	68A RP04				2,000			2,000
Reports									
State of the Cetacean Environment Report	E	67B RP04		3,000					3,000
TOTALS				226,365	20,000	13,114	8,613		268,092

Projects Requiring Voluntary Contributions									
Proposed process to facilitate a review by the Committee of 'Spatial Risk Assessment' of threats to Hector's and Maui dolphins	HIM/ SM	68A RP08							
Voluntary funds must be obtained for this project to progress. Voluntary contributions will be welcomed to support this work									51,500

25.2 Proposed budget for 2020

25.2.1 Invited participants

Invited participants (IPs) are a vital component of the working of the IWC's Scientific Committee. IPs contribute in many ways including as sub-committees and Working Groups Convenors, co-Convenors and rapporteurs, subject area experts and Convenors of intersessional groups. All sub-committees and Working Groups benefit from this budget item. This year under this budget item, 41 scientists from Belgium, Benin, Canada, Colombia, Costa Rica, France, Germany, Japan, Madagascar, Mexico, Netherlands, Norway, Oman, Peru, Rep of Guinea, South Africa, Spain, St. Lucia, UK and USA attended the meeting.

25.2.2 Workshops

SC67B RP06 MARINE DEBRIS WORKSHOP

There remains an urgent need to better understand and address the threats posed by marine debris to cetaceans. The most effective way to do this, building on earlier work by the IWC and taking into account the greatly expanded interest in this topic by many other international bodies, is to hold a workshop. It is proposed that the workshop is held in Barcelona in December 2019 just before the World Conference on Marine Mammalogy (the joint meeting of the SMM and ECS).

SC67B RP05 NOISE PRE-MEETING

Anthropogenic Noise will be a focus topic during the Committee meeting in 2020. A pre-meeting workshop is proposed for SC68B, to address emerging issues related to the management of underwater noise and its impacts on marine species.

SC67B RP37 BALAENID WORKSHOP: BIOLOGY, HEALTH, STATUS

The North Atlantic right whale's population rate of increase is much lower than that of all other well-studied balaenid populations. This workshop will compare reproductive biology, health and status of North Atlantic right whales with those of other balaenid populations with the goal of determining their potential for growth and assessing the role of anthropogenic mortality as a driver of current population decline. Possible causes of the lower reproductive rate that need reassessment include: sub-lethal effects of entanglements; environmental contaminants or marine biotoxins; inadequate prey base; stress from noise; genetic factors; and infectious diseases. This review will also help understanding population changes for other balaenid populations.

SC67B RP21 WESTERN NORTH PACIFIC COMMON MINKE WHALES

The first workshop was undertaken as part of the Committee's *Implementation Review* process. However, as discussed under Item 27.8, given Japan's withdrawal from the IWC, this will now become an in-depth assessment. The workshop will conduct the necessary conditioning of the model previously developed for the *Implementation Review* but of course will not use the *CLA* to forecast into the future.

SC67B RP29 CATCH SERIES: SOUTHERN RIGHT WHALES

The availability of new sources suggests that a new review of available catch data for measuring regional takes of southern right whales is timely. The expected outcome of this workshop is updated regional estimates of southern right whale catches, which can be used to conduct regional assessments of southern right whale past exploitation and develop population trajectories to measure past abundance and current recovery levels.

SC67B RP25 INTERSESSIONAL MEETING OF THE TASK TEAM ON SOUTH ASIAN RIVER DOLPHINS

The South Asian river dolphin, *Platanista gangetica*, is listed Endangered by the IUCN Red List. Across its range, in the countries of India, Pakistan, Nepal, and Bangladesh, the species remains highly threatened by a range of anthropogenic activities at multiple scales. These range from localised threats caused by hunting, fisheries bycatch, or local disturbances as well as from large-scale alterations of the rivers by dams, barrages, waterways and river-linking schemes. In particular, large-scale and rapidly accelerating water development in the Indo-Ganges-Brahmaputra floodplains make the outlook for the South Asian river dolphin conservation grim. In recognition of this situation, the Committee has established a Task Team for the species (IWC, 2019) and the team of experts will meet in person and discuss how to go forward.

SC67B RP26 GUIANA DOLPHIN PRE-ASSESSMENT (*SOTALIA GUIANENSIS*)

An intersessional workshop will assess the geographic extent of Guiana dolphin threats and conservation measures needed in both national and international contexts. The outcomes of the workshop shall include: (1) an examination of the status of Guiana dolphins, if possible an assessment following the Committee's guidelines (IWC, 2019); (2) recommendations to potentially improve management actions and the monitoring efforts associated with the current conservation plans of actions; and (3) a consolidated report to be presented to the Committee at next year's meeting for review.

SC67B RP27 MODELLING WHALE WATCHING IMPACTS (MAWI)

There has been little research on the potential mid- and long-term impacts of whale watching on cetacean populations. This is due to the complexity of the required modelling approaches, lack of clarity regarding the data needed to inform them and the need to identify locations suitable for data collection. Without addressing these issues, understanding the potential mid- and long-term impacts of whale watching is not possible. The workshop will bring together modellers and field researchers to achieve the following outcomes: (1) identify existing modelling approaches that could be used to understand the potential mid- and long-term impacts of whale watching, and determine whether new approaches are required; (2) determine which data currently being collected are suitable for answering questions regarding the mid- and long-term impacts of whale watching, and what new data are required; and (3) determine the feasibility of data collection, and identify locations where this has already been done or could be achieved.

SC68A RP05 PRE-MEETING OF THE ABUNDANCE STEERING GROUP

A pre-meeting of the Abundance Steering Group will occur prior to the 2020 Annual Meeting evaluate abundance estimates received intersessionally following the process established in Annex Omega.

25.2.3 Modelling/computing

SC68A RP01 EXPLORATION OF SURVEY METHODS AND DESIGNS TO RETURN A NEW ABUNDANCE ESTIMATE OF WEST AUSTRALIAN (BSD) HUMPBACK WHALES

The Comprehensive Assessment of Southern Hemisphere humpback whales was concluded in 2015 (IWC, 2016). However, assessment of one stock (BSD, west Australia) could not be completed due to uncertainty over the present

absolute abundance of this stock. There is no strong case to further re-analyse past survey data for BSD because of the absence of success despite the efforts of two experienced modellers. Efforts will thus focus on designing and implementing a new survey of the population. Funds will be used to: review the existing survey data/methodology for west Australian humpback whales; explore existing ‘feasibility studies; and formulate a new survey design plan for future surveys for west Australian humpback whales.

SC68A RP06 SIMULATING LINE TRANSECT DATA TO INVESTIGATE ROBUSTNESS OF NOVEL ANALYSIS METHODS

The IWC has already invested time and money in developing simulated line transect data to evaluate the robustness of the Norwegian minke whale and Antarctic minke whale survey data. This project will update the old code for the simulator to make it more user-friendly so that it can be made available to all Committee members and to produce some standard data sets in accordance to the specifications agreed last year (IWC, 2019).

SC67B RP23 ESSENTIAL COMPUTING SUPPORT TO THE SECRETARIAT

Regular *Implementation Reviews* are required under the RMP and AWMP. Computing support is also required for Comprehensive and in-depth assessments. The Committee has developed a complex trials structure for *Implementation Reviews* and a similar approach is now being used for other assessments. A key task in this process is to develop and validate the code for the simulation trials that are the core component of this process. Experience has shown that the Secretariat staff alone cannot handle the workload of the complete process themselves, so computing support is needed.

25.2.4 Monitoring

SC67B RP01 IWC-POWER CRUISE

The Committee has strongly advocated the development of an international medium- to long-term research programme involving sighting surveys to provide information for assessment, conservation and management of cetaceans in the North Pacific, including areas that have not been surveyed for decades. This is one of the most important international collaborations undertaken by the IWC and the cost to the IWC is minimal given the generous contribution of a vessel by Japan and acoustic equipment by the USA. Committee objectives have been developed for the overall plan and requested funding will allow for the continuing work of the initial phase and progress on developing the medium-term phase. The IWC contribution is for: (1) IWC researchers and equipment; (2) to allow the Committee’s Technical Advisory Group to meet to review the multi-year results thus far and develop the plans for the next phase of POWER based on the results obtained from Phase I; and (3) to enable analyses to be completed prior to the 2020 Annual Meeting.

SC67B RP12 PASSIVE ACOUSTIC MONITORING OF THE EASTERN SOUTH PACIFIC SOUTHERN RIGHT WHALE

The Eastern South Pacific southern right whale population is Critically Endangered and in 2012 the IWC adopted a CMP for this population. Over the years, few opportunistic sightings have been recorded and no breeding area has yet been identified. Until a breeding ground is found many CMP priority actions cannot be implemented. Thus, in 2016 the IWC Committee decided to support a passive acoustic monitoring (PAM) project to facilitate the identification of potential breeding areas along the coast of Chile and Peru (OWC, 2017). This project seeks to obtain temporal coverage over a complete annual cycle and spatial coverage depending on the number of sites. The PAM project is likely the most cost-effective way to investigate the seasonal and temporal distribution of southern right whales along the coast of Chile and Peru. The information will be crucial to identify aggregation areas and facilitate the implementation of CMP for this population.

SC67B RP28 UPDATED CATCH SERIES AND ASSESSMENTS OF FOUR PYGMY BLUE WHALE POPULATIONS

An in-depth assessment of populations of Southern Hemisphere blue whales is underway. Assessments have previously been conducted for two of the six populations (Antarctic blue whales, and Chilean blue whales), but not for the four pygmy blue whale populations. This project will provide crucial catch separation data and associated uncertainty needed to conduct stock assessments and provide the first assessments for each of the four populations. Such data are critical inputs for the assessments planned by the Committee.

SC68A RP02 USING PHOTO-ID TO INVESTIGATE THE IDENTITY OF BLUE WHALES NEAR ISLANDS IN THE SOUTH ATLANTIC

Blue whale catch records from islands in the South Atlantic are dominated by Antarctic blue whales and generally it has been assumed that all blue whales from there are of this form (Branch *et al.* 2007). The Antarctic Blue Whale Catalogue contains 11 individually identified blue whales that have been photographed there. Three of these whales are consistent in appearance with non-Antarctic blue whales, with a proportionally shorter tailstock and ‘bad skin’ (prevalent lesions and scarring). They appear similar to Chilean blue whales. All three whales were photographed on 28 February 2015. Comparing the identification photographs of these three whales to the photo-ID’s of Chilean whales (approximately 400 whales, held by the Southern Hemisphere Blue Whale Catalogue) may yield a match between the two regions. If a photographic match is found it would confirm the presence of Chilean blue whales in the research area.

SC67B RP07 IWC STRANDINGS INITIATIVE – EMERGENCY RESPONSE AND INVESTIGATIONS

Over the next two years, the Emergency Response and Investigations fund will support response, collection of data to determine the cause(s) or contributing factors for the event and/or to fill critical data gaps identified by the SC or Commission. The initiative is evaluated annually, and policies and procedures adapted according to feedback from responses and through Steering Group/Expert Panel advice.

25.2.5 Databases and catalogues

RP18 SHIP STRIKE DATABASE COORDINATOR

The ongoing development of the IWC ship strike database requires data gathering, communication with potential data providers and data/database management. This project will provide support for expanding and maintaining the database.

SC67B RP33 ANTARCTIC BLUE WHALE CATALOGUE: COMPARISON OF NEW PHOTOGRAPHS FROM 2014-2020

In year one (2019), this project is comparing the identification photographs of an estimated 45 individual Antarctic blue whales collected during ICR cruises 2014-17, to the Antarctic Blue Whale Catalogue. These identifications would increase the size of the catalogue (458 individuals) by almost 10%. In year two (2020) additional photos representing approximately 12 IDs are expected from collaborating scientists and citizen scientists that will be compared to the catalogue. The expected outcome is an expanded dataset that may improve estimates of population abundance and reveal new information on movement patterns.

SC67B RP32 SOUTHERN HEMISPHERE BLUE WHALE PHOTO CATALOGUE

The Southern Hemisphere Blue Whale Catalogue (SHBWC) is an international collaborative effort to facilitate cross-regional comparison of blue whale photo-identifications catalogues. To date more than 1,500 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, Madagascar and Sri Lanka. Therefore, the SHBWC has become the largest repository of Southern Hemisphere blue whale photo-identifications. Results of comparisons among different regions will improve the understanding of basic questions relating to blue whale populations in the Southern Hemisphere such as defining population boundaries, migratory routes, visual health assessments, and to model abundance estimates. The results will contribute primarily to the IWC Southern Hemisphere blue whale assessments.

SC68A RP03 SOUTHERN HEMISPHERE BLUE WHALE CATALOGUE: CODING PROJECT FOR CHILEAN BLUE WHALE IDENTIFICATION PHOTOS.

This proposal provides for a crucial step in the preparation of photo-ID data prior to its use in a capture-recapture estimate of abundance. The entire set of photographs from eastern South Pacific must be quality-coded by the same person (or team of persons trained together) to minimise subjective bias in the coding of the photos. The responsible person must follow the reference guide on coding photo-ID developed and fill the online form available at the Southern Hemisphere Blue Whale Catalogue. The expected outcome will provide a clean data set of photos for inter-matching that will in turn provide the data available for encounter histories to be used in an estimate of abundance.

SC68A RP04 PHOTO IDENTIFICATION COMPARISON OF SOUTHERN RIGHT WHALES IN BRAZIL AND ARGENTINA TO CONTRIBUTE TO IWC PROJECT: MULTI-OCEAN ANALYSIS OF SOUTHERN RIGHT WHALE DEMOGRAPHIC PARAMETERS AND ENVIRONMENTAL CORRELATES.

This project aims to complete a comparison of southern right whale photo-ID catalogues from Brazil and Argentina to provided data for the comparison of population demographics of southern right whales in Southern Hemisphere wintering grounds.

25.5.6 Reports

RP04 PRODUCTION OF ANNUAL STATE OF THE CETACEAN ENVIRONMENT REPORT (SOCER) FOR THE SCIENTIFIC COMMITTEE AND COMMISSION (2020)

SOCER is a long-standing effort to provide information to Commissioners and Committee members on key current global developments that are affecting the cetacean environment. Focus will be on the Atlantic Ocean. It will also present key current global developments that are affecting the cetacean environment. It will also contain a glossary of technical terms used and species names. A 5-year compendium spanning all regions is also being produced.

25.5.7 General items

SUPPORTING COMMISSION RECOMMENDATIONS

This line accommodated additional work requested by the Commission at IWC67 and work generated by meetings, workshops and projects funded and concluded last. This line was also used to accommodate new project proposals generated during the 2019 Scientific Committee meeting.

25.5.7 Other items

SC68A RP08 FACILITATION OF A DETAILED REVIEW BY THE COMMITTEE OF SPATIAL RISK ASSESSMENT OF THREATS TO HECTOR'S AND MĀUI DOLPHINS BY ROBERTS ET AL. (2019).

The intent of the project is to facilitate the review by the Committee at SC/67B through five solicited detailed reviews on different technical aspects a spatial risk assessment of threats to Hector's and Māui dolphins (Roberts *et al.* 2019) followed by a two-day pre-meeting to consider these reviews. It is anticipated that this process will enable the Committee to provide a detailed evaluation to confirm whether the model of Roberts *et al.* (2019) is sufficiently robust to inform management. The following topics (1-5) were agreed for solicited review papers: (1) life history parameters; (2) spatial distribution of Hector's and dolphins; (3) estimates of bycatch rates and vulnerability of Hector's and Māui dolphins; (4) toxoplasmosis; and (5) risk model outputs. The work is extremely important but the Committee does not have the funds available to conduct the proposed review in the required timeframe. Therefore, this project can only be undertaken if voluntary contributions are secured to fund it.

26. COMMITTEE PRIORITIES AND INITIAL AGENDA FOR 2020

Committee priorities can be found in the workplans incorporated by topic in this report. These will form the basis for the initial agenda for 2020.

27. WORKING METHODS OF THE COMMITTEE

27.1 Updates on Rules of Procedure of the Scientific Committee and working methods

The Chair noted that he will be working on several aspects of the Working Methods of the Committee in the coming year, in collaboration with the Vice-Chair, Head of Science and convenors. The focus will be on four items.

- (1) *Clarification of the Data Availability Agreement process*: this is particularly important given the withdrawal of Japan and its continued participation in the work of the Committee as a non-member government observer;
- (2) *Procedures for Commissioners (and others) submitting major work items or reports to the Committee for its review and advice*: discussions during this meeting (e.g. see Item 17.6.2) has made it clear that there is a need to provide guidance for Commissioners who wish to submit large pieces of work for review. This will include consideration of a provision to submit these requests with sufficient advance notice, and to note that some projects may require financial support.
- (3) *Clarification of the Rules of Procedure and Handbook on the conditions for participation by non-member government observers*: given the new situation with Japan (see Item 27.8), it will be important to ensure clarity in the participation of scientists representing non-member governments to ensure they are unambiguous and consistent across Commission guidance documents with respect to various categories of observers.
- (4) *Updating the Scientific Committee Handbook*: the Handbook will need to be updated in the light of new procedures for the review of abundance estimates (Annex Omega) and other updates and revisions agreed at this meeting (e.g. see Item 7).

27.2 Biennial reporting and related matters including development of the budget in light of the timing of the Commission's financial year and longer-term planning

The Chair reiterated its view first expressed in 2014 (IWC, 2015) of the challenging situation faced by the Committee with respect to budget timing. This problem was identified formally by the Scientific Committee in 2014 when the Committee drew the Commission's attention to the mismatch between the Scientific Committee's working years (May-June year 1 to May-June year 2), the Commission's biennial period (September year 1 - September year 3) and the Commission's financial year (1 January - 31 December). This is particularly difficult for the many iterative tasks, as the work (that may be analytical work and/or workshops) needed in year 2 is heavily dependent on the results of year 1. The problem relates to the practical difficulties arising if the funded work has to be carried out in the period following 1 January (i.e. squashed into only four months up to April) rather than either the twelve months after the Committee meeting or the even the seven months after the Commission meeting (when the Commission meets). The Committee **agrees** that a small Working Group (Suydam, Zerbini, Donovan, Penfold, Jones and Lent) should work on some options for addressing this lag in funding that can be taken to the Bureau and Commission for consideration.

27.3 Succession plan for key Scientific Committee experts

The Chair noted that this agenda item has been discussed at SC for a number of years. Steps are being taken to ensure that the expertise needed for conducting the SC's work is available for future years. Punt's work at the SC has been followed by Mike Wilberg (University of Maryland Center for Environmental Science) as part of ensuring ongoing expertise. The Chair noted that whilst Donovan has been the sole reviewer of Chairs' summaries in past SC meetings, a new approach was trialled this year by having a team comprising six members of the Secretariat and the Committee provide a pre-review of the summaries. The Chair hoped that this lightened the load for Donovan and also helped ensure that these skills be passed on to a broader group of SC participants.

27.4 Update on data availability requests and consideration of potential updates/clarifications

Zerbini provided a summary of requests received under the Data Availability Agreement shown in Table 25; all requests were made to Japanese institutes. The need to clarify the process for requirement of data under procedures A and B is noted under Item 27.1.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

Table 25
Summary of Requests under the Data Availability Agreement

Date	By	Objective/subject	Outcome
2/10/18	Baker, S	The intent of the request is to examine plausible stock hypotheses for North Pacific common minke whale. Analyses will rely primarily on tests of Hardy-Weinberg expectations, exact tests of differentiation, randomized Chi-squared tests (contingency tables), Analyses of Molecular Variance (AMOVA), as well as mixed-stock analyses, clustering methods and kinship (parent offspring pairs), to investigate dispersal and differences in haplotype frequencies, genotypes and sex for various geographic and temporal strata.	SC/F19/WNPM/1
9/10/18	Hoelzel, R	The objective is to help address the recommended 'analysis 2' from the report of the workshop on Western North Pacific common minke whale stock structure (International Whaling Commission, 2019b; IWC, 2019e) in support of the next inter-sessional meeting on WNP common minke whale stock structure. This specific aspect of the work will apply spatially explicit population structure analyses that provide greater power than the program STRUCTURE together with geographic context. The data will be analysed as a total dataset (not based on any assignment in STRUCTURE), but also include temporal subdivision to assess possible seasonal changes in patterns of connectivity. The latter aspect may be critical to understanding the true pattern of structure, but it will also be the most time-consuming, requiring extensive replication of the analyses. The results of these analyses will provide an assessment of structure in the context of biogeography using methods that have considerably more power than the program STRUCTURE and using an approach that will consider temporal patterns of movement.	SC/F19/WNPM/2, SC/F19/WNPM/8
8/2/19	McKinley, J	Request of access to biological information of North Pacific common minke whale from Special Permit programmes and incidental bycatch, including assignment probabilities to stocks J, O or Unknown from Bayesian clustering routines based on genetic information, lat/long for bycatch and distance from shore for coastal and offshore catches from approximately n = 4,554 individuals taken by Japan as bycatch from 2001-2007 or in scientific whaling from 1994-2015, including 53 fetuses (IWC, 2019e).	Proposal was rejected because it did not meet the deadline for proposal submission under DAA procedure A, which was required as the analysis proposed could lead to management advice to the Committee. In addition, the non-genetic biological data requested had not been originally made available under the DAA*.

* Note: There were different interpretations about the requirements for data requests under procedures A and B that will need to be clarified.

27.5 Committee use of the IWC recommendations database of recommendations

SC/68A/01 addressed the IWC Database of Recommendations (DR) and its use by the Scientific Committee. At IWC67 the Commission: endorsed the aims and principles of the DR; instructed the Secretariat to populate it and facilitate its use; and requested the Scientific and Conservation Committees to incorporate this into their working practices and reporting back to IWC68³³. Following presentation of SC/68A/01, a small Working Group was convened by Smith to further discuss use of the database by the Committee (Annex S). The Working Group welcomed the database, noting its value as a tool to assist the Committee in several ways including improving how recommendations are drafted and communicated, tracking progress on implementation of recommendations, identifying follow up actions and setting priorities for workplans. A key and essential next step is to develop an efficient way to enter and update recommendations and manage the database while keeping demands on Committee officers and the Secretariat realistic. The Working Group made a series of suggestions for next steps including the possible use of the Franciscana and entanglement of large whales as case studies.

The Committee **endorsed** the report of the Working Group and its recommendations. It further discussed the need for clarity and consistency in the guidance on developing recommendations language to ensure consistency between the 'Blue Box' and the Database of recommendations. It also noted that the flow of information from the Committee to the Commission and its other sub-groups, should also be made possible in the reverse direction. It was suggested that at each Committee meeting, a Plenary paper/presentation be provided on the outcomes of the most recent Commission meeting to facilitate improved coordination between the Committee and the Commission.

³³ - <https://archive.iwc.int/?r=7592>

ATTN: S; SC; NI

The Committee welcomes the IWC database of recommendations.

(1) The Scientific Committee recommends that the Secretariat produces the following outputs from the database:

- (a) an output of all Committee recommendations (by sub-group) to help convenors plan intersessional work and prepare for the following Committee meeting, as soon as possible after each Committee meeting;*
- (b) an output of all Committee recommendations (by sub-group) and a summary report to Plenary on the extent and type of recommendations made at the last Committee meeting, including updates on progress, at least in before the Committee meeting; and*
- (c) any additional outputs requested by Convenors that have been submitted to the Secretariat at least two months before the Committee meeting.*

(2) The Committee encourages Convenors, guided by the work plan, to use the database and its outputs in preparation for future meetings in order to assist with

- (d) reviewing progress of previous recommendations;*
- (e) identifying and drafting of new recommendations (building on or replacing recommendations made previously); and*
- (f) conducting more in-depth work, as needed, on particular topics or species (including in the planning of workshops).*

(3) The Committee recommends that the Secretariat, working with relevant members of the Committee identify and undertake one or more case studies to show the utility of the database in collating, communicating and reviewing implementation of recommendations.

(4) The Committee encourages Convenors to provide the Secretariat with any previous compilations of recommendations they have undertaken that may assist with entering previous recommendations.

(5) The Committee agrees that the Chair and Vice Chair of the SC and the Secretariat should consider how the database can facilitate the communication of Committee work and recommendations to the Commission and incorporate this in the Committee's report to the Commission for the 2020 meeting.

(6) the Committee agrees that for future meetings a Plenary paper/presentation be provided by the Chair and the Secretariat on the outcomes of the most recent Commission meeting to facilitate improved coordination between the Committee and the Commission.

(7) The Committee recommends that the Secretariat further consider and plan for how past recommendations can be entered into the database and establish a numbering system for recommendations in the database.

(8) The Committee encourages Committee members, on an ongoing basis, to (a) provide feedback on the database including, in due course, further consideration of the database fields capturing progress and implementation; and (b) to join the Commission's intersessional group on database development.

27.6 Matters related to 'Annex P'

Following Japan's departure from the IWC, no more Special Permit whaling is expected. Should another country in the future wish to undertake special permit catches, the existing 'Annex P' will be invoked (IWC, 2019h). Should new analyses/ reports from data already in hand from special permit whaling be presented in future they will be dealt with by the most relevant sub-committees.

27.7 Matters related to the 'Governance Review'

A document prepared last year (IWC, 2019j) under the leadership of DeMaster provided the Committee's initial response to the Governance Review report. At a meeting of the Heads of Delegation this year, it was decided that this document should continue to serve as the Committee's input to the Working Group on Operational Effectiveness (WGOE) meeting in July 2019, at which the Committee Chair will represent the Committee. The Chair will provide the Committee with an update of that July 2019 meeting at next year's meeting and the Committee can re-evaluate its position and recommendations to the Commission at that time.

27.8 Implications to the SC of Japan's Withdrawal from the IWC

Japan announced on 26 December 2018 its intention to withdraw from the IWC effective 30 June 2019. Further details were provided on the first day of plenary when Japan noticed its willingness to engage with the Scientific Committee in the future (SC/68A/04). Under this item, the Committee identifies the issues at the Committee that are the most likely to be affected by Japan's departure and provides options for how to move forward. The paper also examines areas of existing scientific co-operation with Japan and encourages that this co-operation be maintained.

Japan has been a major contributor to the work of the SC since they joined in the early 1950s. Japan has indicated that it wishes to continue to participate in future SC meetings as an observer and this is welcomed. Preliminary discussions have shown that Japan intends to continue to send scientists to the Committee to present papers and participate in discussions. The work of the Committee will benefit from Japan's future involvement because of the likely contributions of Japan to our knowledge about cetaceans and the IWC's interest in the conservation and management of whales worldwide, irrespective of whether the whales occur in waters of member or non-member countries.

Special permits (SP)

Discussions on active special permits will cease next year given that Japan will not be an IWC member government and thus not be issuing special permits. There is no indication that any other IWC Member Country will conduct special permit research in the near future, but Annex P is in place should that situation arise in the future (see Item 27.6). For 2019, the special permit discussions were based upon the papers provided by Japan (and see Item 19).

Japan is intending to continue the analyses of data collected through its former Special Permit programmes and has offered to submit results to the Committee in the future where individual papers will be dealt with by the most relevant sub-groups.

Revised Management Procedure, Implementation Reviews and Simulation Trials and In-depth Assessments

Under the RMP, initial *Implementations* (and then subsequent *Implementation Reviews*) are undertaken in response to a request from a member nation, which has to be approved by the Commission.

The IR for Bryde's whales in the North Pacific has been completed this year (see Item 6.1.3) and even if Japan had not decided to leave the IWC, the next IR would not be expected for six years.

The IR for western North Pacific common minke whales had been progressing under the agreed standard RMP timetable and thus has not (and was not expected to) been completed this year. Given the circumstances of Japan's withdrawal from the IWC, the Committee considered the next steps with respect to assessing common minke whales in the western North Pacific. No other country apart from Japan is intending to conduct commercial whaling in this area therefore continuing the IR is not the appropriate process or mechanism for assessing stocks in this region. However, given the levels of bycatch of common minke whales in the western North Pacific particularly adjacent to Korea and Japan, and Japan's resumption of commercial whaling targeting this species in their EEZ, it is important for the Committee to examine the conservation implications of all anthropogenic removals throughout the region and provide advice. Considerable work on stock structure and abundance has already been undertaken as part of the IR thus far as well as developing the appropriate modelling framework – this information and framework is also needed for an in-depth assessment following the approach agreed for assessments last year (IWC, 2019). The Committee therefore **considers** it appropriate to conduct an in-depth assessment of western North Pacific common minke whales building on the work initiated in the IR. The intersessional workshop originally planned for next year as an RMP workshop should still be undertaken but under the auspices of an in-depth assessment in order to maintain the excellent progress made on finalising and conditioning the operating models.

The Committee will also continue with its ongoing in-depth assessment of sei whales, which it notes will also be targeted by Japan's commercial operations within their EEZ.

IWC-POWER cruise

The IWC-POWER cruises have been an important programme providing systematic abundance and distribution data on cetaceans in the central and eastern North Pacific from areas that had not been surveyed for many years, as well as biopsy samples, acoustic data, photo-identification data and data on marine debris. The cruises are designed by the Committee and are dependent upon the generous donation of around 60 to 85 days ship time by the Government of Japan. Recently the USA has provided acoustic monitoring equipment and personnel at a cost of up to \$75,000 USD (£ 58,700) per year. The Committee adds approximately £36,000 annually towards this cruise to cover planning meeting costs and travel expenses of the international scientists. Japan's contribution to the IWC-POWER was ¥138,320,000 (£970,000) in 2019 including the cost for the operation of the research vessel for 85 days and salaries for 17 crew for the same period.

Japan indicated that it is prepared to continue providing a vessel and crews for these cruises and the necessary budget for IWC-POWER has been secured by the Fisheries Agency of Japan for the fiscal year 2019 and the request has already been made for the fiscal year 2020. Japan recognised that continuation of the IWC-POWER cruise is subject to the decision by Committee and endorsement by the Commission. The Committee noted that last year the Commission approved funding for the IWC-POWER cruise in both 2019 and 2020.

The IWC receives a great deal of information from little studied areas for its relatively minor investment in the IWC-POWER programme. The Committee **considers** that it is valuable for its scientific, conservation, management and assessment work that these cruises continue, particularly in light of the information being provided on the status of species once heavily exploited by whaling including blue, fin, sei, humpback, gray, and right whales.

Catch statistics

Many years ago, the IWC Secretariat took over the role of the Bureau of International Whaling Statistics (BIWS) and now houses those data. The Committee **welcomes** the news that Japan will voluntarily continue the submission of the

standard statistics on catches to the IWC Secretariat. It will also continue to provide information on its DNA register on a voluntary basis.

In addition, if Committee members are interested in accessing data or samples taken by Japan, Japan indicated that requests could be made following the data access protocols of relevant Japanese research institutes (ICR and NRIFSF), which are already posted within the DAA pages of the IWC website.

Japan's non-lethal research programmes

Japan is planning to continue its non-lethal research programmes on cetaceans and their habitat in the Antarctic and North Pacific. Japan intends to present results from those research programmes to the Committee in the future and is also prepared to consider requests to access to data and samples in accordance with the data access protocols of relevant Japanese research institutes (ICR and NRIFSF).

Future Observer Status

Japan indicated that it intends to participate in future Committee meetings as an observer (SC/68a/04). The Committee's Handbook indicates that the scientific representatives of non-member governments can participate fully in the Committee's scientific work and that they are expected to use discretion with respect to recommendations pertaining to Scientific Committee's procedures and policies. They are subject to the same rules of debate as Invited Participants (IWC/67/FA/20; Committee Handbook, pg. 5). Thus, Japanese scientists, some who have previously attended as National Delegates, can participate in future meetings either as observers, IPs, or 'self-funded' IPs. IPs can participate in meetings at the discretion of the Chair of the SC in consultation with the relevant Convenors. Observers can participate in meetings at the discretion of the Chair of the SC in consultation with the Chair and Vice-chair of the Commission if the Chair believes attendance is inappropriate. All observers and IPs will be treated the same. As noted under Item 27.1, the Committee will review these issues at its next meeting.

Attention: C

The Committee **notes** Japan's withdrawal from the IWC effective from 30 June 2019. It also **notes** that the IWC and the Committee will benefit by Japan's continued participation, especially as they have offered to provide data on catches, the non-lethal research programme, and possible access to data and samples. It has also offered to continue collaboration through the IWC-POWER programme. The Committee **draws attention** to the fact that having the types of information Japan is proposing to make available will improve Committee assessments of large whales in the Antarctic and North Pacific. The Committee **recommends** continued collaboration with Japan in the manner discussed under Item 27.8. It **recognises** that these matters will be considered by the Bureau at its next meeting in October 2019. The Committee will also review its views and options for communicating and collaborating with Japan while developing the 2021-2022 workplan next year and will seek guidance on these matters at the next Commission meeting (IWC/68) in 2020.

27.9 Workplan

This agenda item for SC68B will retain most of the same topics as this year, except that discussions on Special Permits will not be included. Other items will be added as necessary. For example, Givens suggested, and the Chair agreed, that a report from the Abundance Steering Group (ASG) on the operation of Annex P should be added to the agenda in SC68B.

28. PUBLICATIONS

The JCRM Editorial Board met on 20 May 2019, convened by Zerbin. The Board updated the Committee on the present status and work in progress of the *Journal of Cetacean Research and Management* (JCRM) as well as initiating a discussion of present working practices.

The major conclusions of the Board are given below.

(1) Despite the sad loss of the primary editor Bannister, the publication of the SOWER/IDCR cruises Special Issue is in hand and measures are continuing to ensure its publication prior to next year's meeting – individual papers will be uploaded and made available by the end of December 2019 but the final hardbound copies will not be printed until the next Committee meeting.

(2) Regular issues of JCRM have caught up after previous staff shortage issues and improvements are in hand to increase the accessibility of the online submission and management system. The work undertaken to assist scientists from developing countries was acknowledged and should continue.

(3) Plans are developing to raise the profile of JCRM through a more efficient web download presence and the possible use of an online referencing tool (e.g. DOI numbers) – both these initiatives will also assist ongoing attempts to make all the IWC document archive available online and improve the traceability of all the IWC's publications and archived materials– note that these initiatives will have monetary implications.

- (4) The IWC JCRM Supplement volumes (the Report of the Scientific Committee, published annually) are a valuable asset to the Committee and the wider scientific community and should continue to be professionally edited and produced.
- (5) Meetings of the Editorial Board should take place during each Committee meeting are for assessing progress and for future planning of journal-related activities.

Attention: C

The Committee **reiterates** the importance of the *Journal* to the Committee's recognition as the global body of expertise on cetaceans and to the standing of the IWC. It **endorses** the work of the Editorial Board and **agrees** that it should work with the Secretariat during the year to develop ways to increase the visibility and performance of the *Journal*. It **recognises** that this may require some additional funding and the Board will also explore options to achieve this. All Committee members are **encouraged** to assist in these efforts.

29. ELECTION OF OFFICERS

The Committee was delighted to hear that Suydam and Zerbini will continue in office after an excellent first year.

30. ADOPTION OF REPORT

The Committee adopted this report at 16:30 on 22 May 2019, apart from the final items discussed during the last session. As is customary, these items were agreed by the Chair, Vice-Chair, rapporteurs and Head of Science. The Chair thanked the participants for their scientific contributions and as well as their constructive dialogue. The Chair especially thanked the Vice-chair, convenors, Head of Science for their excellent assistance and service. The Chair and Committee also thanked the Secretariat with a standing ovation for their dedicated and tireless efforts to assist the Committee and make the meeting a success. Finally, the Chair thanked the Government of Kenya, Kenyan Commissioner Professor Micheni Ntiba, Kenyan Alternate Commissioner Susan Imende and the Safari Park Hotel staff for the excellent facilities and great service, which contributed greatly to the successes of the meeting.

- Andrews, R.D., Baird, R.W., Calambokidis, J., Goertz, C.E.C., Gulland, F.M.D., Heide-Jørgensen, M.P., Hooker, S.K., Johnson, M., Mate, B., Mitani, Y., Nowacek, D.P., Owen, K., Quakenbush, L.T., Raverty, S., Robbins, J., Schorr, G.S., Shpak, O.V., Townsend Jr, F.I., Uhart, M., Wells, R.S. and Zerbini, A.N. Submitted. Best practice guidelines for cetacean tagging. *J. Cetacean Res. Manage.*
- Archer, F.I., Martien, K.K. and Taylor, B.L. 2017. Diagnosability of mtDNA with Random Forests: Using sequence data to delimit subspecies. *Mar. Mam. Sci.* 33(special issue): 101-31.
- Archer, F.I., Martien, K.K., Taylor, B.L., LeDuc, R.G., Ripley, B.J., Givens, G.H. and George, J.C. 2010. A simulation-based approach to evaluating population structure in non-equilibrium populations. *Journal of Cetacean Research and Management* 11: 101-13.
- Arregui, M., Bernaldo de Quirós, Y., Saaavedra, P., Sierra, E., Suárez-Santana, C.M., Arbelo, M., Diaz-Delgado, J., Puig-Lozano, R., Andrada, M. and Fernández, A. Submitted. Fat embolism and sperm whale ship strikes. *Front. Mar. Sci.*
- ASCOBANS. 2018. Report of the 24th Meeting of the ASCOBANS Advisory Committee. Vilnius, Lithuania, 25-27 September 2018
- Barlow, D.R., Torres, L.G., Hodge, K.B., Steel, D., Baker, C.S., Chandler, T.E., Bott, N., Constantine, R., Double, M.C., Gill, P., Glasgow, D., Hamner, R.M., Lilley, C., Ogle, M., Olson, P.A., Peters, C., Stockin, K.A., Tessaglia-Hymes, C.T. and Klinck, H. 2018a. Documentation of a New Zealand blue whale population based on multiple lines of evidence.
- Barlow, D.R., Torres, L.G., Hodge, K.B., Steel, D., Baker, C.S., Chandler, T.E., Bott, N., Constantine, R., Double, M.C., Gill, P., Glasgow, D., Hamner, R.M., Lilley, C., Ogle, M., Olson, P.A., Peters, C., Stockin, K.A., Tessaglia-Hymes, C.T. and Klinck, H. 2018b. Documentation of a New Zealand blue whale population based on multiple lines of evidence. Paper SC/67b/SH05 presented to the IWC Scientific Committee, April-May 2018, Bled, Slovenia (unpublished). 32pp. [Paper available from the Office of this Journal].
- Bernaldo de Quirós, Y., Fernandez, A., Baird, R.W., Brownell Jr, R.L., Aguilar de Soto, N., Allen, D., Arbelo, M., Arregui, M., Costidis, A., Fahlman, A., Frantzis, A., Gulland, F.M.D., Iñiguez, M., Johnson, M., Komnenou, A., Koopman, H., Pabst, D.A., Roe, W.D., Sierra, E., Tejedor, M. and Schorr, G. 2019. Advances in research on the impacts of anti-submarine sonar on beaked whales. *Proc. R. Soc. B* 286: 20182533.
- Braulik, G., Wittich, A., Macaulay, J., Kasuga, M., Gordon, J., Davenport, T.R.B. and Gillespie, D. 2017. Acoustic monitoring to document the spatial distribution and hotspots of blast fishing in Tanzania. *Mar. Pollut. Bull.* 125: 360-66.
- Braulik, G.T., Kasuga, M., Wittich, A., Kiszka, J.J., MacCaulay, J., Gillespie, D., Gordon, J., Said, S.S. and Hammond, P.S. 2018. Cetacean rapid assessment: An approach to fill knowledge gaps and target conservation across large data deficient areas. *Aquatic Conserv.: Mar. Freshw. Ecosyst.* 28(1): 216-30.
- Bravington, M.V., Skaug, H.J. and Anderson, E.C. 2016. Close-Kin Mark-Recapture. *Stat. Sci.* 259-74.
- Brownell, J., R.L. and Mallette, S.D. 2018. Global baleen whale bycatch: the most threatened population. Paper SC/67b/HIM09 presented to the IWC Scientific Committee, April-May 2018, Bled, Slovenia (unpublished). 12pp. [Paper available from the Office of this Journal].
- Calambokidis, J., Falcone, E.A., Quinn, T.J., Burdin, A.M., Clapham, P.J., Ford, J.K.B., Gabriele, C.M., LeDuc, R., Mattila, D., Rojas-Bracho, L., Straley, J.M., Taylor, B.L., Urban R, J., Weller, D., Witteveen, B.H., Yamaguchi, M., Bendlin, A., Camacho, D., Flynn, K., Havron, A., Huggins, J. and Maloney, N. 2008. SPLASH: Structure of populations, levels of abundance and status of humpback whales in the North Pacific. Final report for Contract AB133F-03-RP-00078, US Department of Commerce Western Administrative Center, Seattle, Washington. [Available at <http://www.cascadiaresearch.org/SPLASH/SPLASH-contract-report-May08.pdf>].
- Charlton, C., Ward, R., McCauley, R.D., Brownell Jnr, R.L., Guggenheimer, S., Salgado Kent, C.P. and Bannister, J.L. 2019a. Southern right whales (*Eubalaena australis*) return to a former wintering calving ground: Fowlers Bay, South Australia. *0824-0469*.
- Charlton, C., Ward, R., McCauley, R.D., Brownell Jnr, R.L., Salgado Kent, C. and Burnell, S. 2019b. Southern right whale (*Eubalaena australis*) seasonal abundance and distribution at Head of Bight, South Australia. *Aquatic Conservation-Marine and Freshwater Ecosystems*: 1-13.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

- Cheeseman, T. and Southerland, K. 2018. Happywhale Progress Report 2017-2018. Paper SC/67b/PH05 presented to the IWC Scientific Committee, April-May 2018, Bled, Slovenia (unpublished). 4pp. [Paper available from the Office of this Journal].
- Cooke, J., Constantine, R., Hamner, R.M., Steel, D. and Baker, C.S. 2019. Population dynamic modeling of the Māui dolphin based on genotype capture-recapture with projections involving bycatch and disease risk. New Zealand Aquatic Environment and Biodiversity Report No. 216. 38 pp. [Available at: www.mpi.govt.nz/news-and-resources/publications].
- Cunen, C., Walloe, L. and Hjort, N.L. 2019. Focused model selection for linear mixed models, with an application to whale ecology. *Ann. Appl. Stat.* : 40pp.
- Di Guardo, G., Centellegho, C. and Mazzariol, S. 2018. Cetacean Host-Pathogen Interaction(s): Critical Knowledge Gaps. *Front. Immunol.* 9: 2815. [Available at: <https://doi.org/10.3389/fimmu.2018.02815>].
- Díaz-Delgado, J., Fernández, A., Sierra, E., Sacchini, S., Andrada, M., Vela, A.I., Quesada-Canales, O., Paz, Y., Zucca, D., Groch, K. and Arbelo, M. 2018. Pathologic findings and causes of death of stranded cetaceans in the Canary Islands (2006-2012). *PLOS ONE* 13(10): e0204444. [Available at: <https://doi.org/10.1371/journal.pone.044>].
- Donovan, G. 2018. Powerpoint guide to Comprehensive Assessments. Paper SC/67b/WW06 presented to the IWC Scientific Committee, April-May 2018, Bled, Slovenia (unpublished). 12pp. [Paper available from the Office of this Journal].
- Donovan, G.P. 1991. A review of IWC stock boundaries. *Reports of the International Whaling Commission (special issue)* 13: 39-68.
- FAO. 2019. Voluntary Guidelines on the Marking of Fishing Gear. Licence: CC BY-NC-SA 3.0 IGO. FAO, Rome. 88pp. [Available at: <http://www.fao.org/3/ca3546t/ca3546t.pdf>].
- Fielding, R. 2018. *The Wake of the Whale: Hunter Societies in the Caribbean and North Atlantic*. Harvard University Press, Boston.
- Frantzis, A., Leaper, R., Alexiadou, P., Prospathopoulos, A. and Lekkas, D. 2019. Shipping routes through core habitat of endangered sperm whales along the Hellenic Trench, Greece: Can we reduce collision risks? *PLOS ONE* 14(2): e0212016. [Available at: <https://doi.org/10.1371/journal.pone.016>].
- Givens, G.H., Edmondson, S.L., George, J.C., Suydam, R., Charif, R.A., Rahaman, A., Hawthorne, D., Tudor, B., DeLong, R.A. and Clark, C.W. 2016. Horvitz–Thompson whale abundance estimation adjusting for uncertain recapture, temporal availability variation, and intermittent effort. *Environmetrics* 27(3): 134-46. May 2016.
- Guzman, H.M., Gomez, C.G. and Guivara, C.A. 2013. Potential vessel collisions with Southern Hemisphere humpback whales wintering off Pacific Panama. *Marine Mammal Science* 29(4): 629-42.
- Hines, E., Verutes, G. and Ponnampalam, L. 2018. Marine megafauna bycatch in swimming crab nets in northwestern Sri Lanka: a final report for Monterey Bay Aquarium Seafood Watch. Monterey, CA, USA. 57pp. Unpublished.
- Hoban, S. 2014. An overview of the utility of population simulation software in molecular ecology. *Molecular Ecology* 23(10): 2383-401.
- Huijser, L., Bérubé, M., Cabrera, A., Prieto, R., Silva, M.A., Robbins, J., Kanda, N., Pastene, L.A., Goto, M., Yoshida, H., Vikingsson, G.A. and Palsbøll, P.J. 2018a. Population structure of North Atlantic and North Pacific sei whales (*Balaenoptera borealis*) inferred from mitochondrial control region DNA sequences and microsatellite genotypes. *Conserv. Genet.* 19: 1007-24. [Available at: <https://doi.org/10.1007/s10592-018-1076-5>].
- Huijser, L.A., Bérubé, M., Cabrera, A.A., Prieto, R., Silva, M.A., Robbins, J., Kanda, N., Pastene, L.A., Goto, M. and Yoshida, H. 2018b. Population structure of North Atlantic and North Pacific sei whales (*Balaenoptera borealis*) inferred from mitochondrial control region DNA sequences and microsatellite genotypes. *Conservation genetics* 19(4): 1007-24.
- IMO. 2019. International Technical Workshop on Quiet Ship Design. International Maritime Organization (IMO) Headquarters, London, UK, 30 January to 1 February 2019. Hosted by the Government of Canada.
- IMR/NAMMCO. 2018. Report of the Joint IMR/NAMMCO International Workshop on the Status of Harbour Porpoises in the North Atlantic. December 3rd - 7th 2018, Tromsø, Norway.
- International Whaling Commission. 2019a. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 20: 1-78.
- International Whaling Commission. 2019b. Report of the Workshop on Western North Pacific Common Minke Whale Stock Structure in Preparation for the Start of the *Implementation Review* in April 2018, 12-13 February 2018, Tokyo, Japan. *J. Cetacean Res. Manage. (Suppl.)*: 11pp.
- International Whaling Commission. 2019c. Workshop on the Poorly Documented Takes of Small Cetaceans in South America: including in-depth review of the hunting of the Amazon River dolphin (*Inia geoffrensis*) for the piracatinga (*Calophrys macropterus*) fishery, 19th - 21st March 2018, City of Santos, Brazil. *J. Cetacean Res. Manage. (Suppl.)* 20: 68pp.
- IUCN. 2019. 5th Important Marine Mammal Area Workshop, 8-12 April 2019 Costa Navarino, Greece.
- International Whaling Commission. 1994. Chairman's Report of the Forty-Fifth Annual Meeting, Appendix 12. Resolution on research on the environment and whale stocks. *Reports of the International Whaling Commission* 44:35.
- International Whaling Commission. 1995. Report of the Scientific Committee, Annex G. Report of the sub-committee on small cetaceans. *Reports of the International Whaling Commission* 45:165-86.
- International Whaling Commission. 1996. Chairman's Report of the Forty-Seventh Annual Meeting, Appendix 11. IWC Resolution 1995-10. Resolution on the environment and whale stocks. *Reports of the International Whaling Commission* 46:47-48.
- International Whaling Commission. 1997a. Chairman's Report of the Forty-Eighth Annual Meeting, Appendix 8. IWC Resolution 1996-8. Resolution on environmental change and cetaceans. *Reports of the International Whaling Commission* 47:52.
- International Whaling Commission. 1997b. Report of the Scientific Committee, Annex H. Report of the sub-committee on small cetaceans. *Reports of the International Whaling Commission* 47:169-91.
- International Whaling Commission. 1998. Chairman's Report of the Forty-Ninth Annual Meeting, Appendix 7. IWC Resolution 1997-7. Resolution on environmental change and cetaceans. *Reports of the International Whaling Commission* 48:48-49.
- International Whaling Commission. 1999. Chairman's Report of the Fiftieth Annual Meeting, Appendix 6. IWC Resolution 1998-5. Resolution on environmental changes and cetaceans. *Annu. Rep. Int. Whal. Comm.* 1998:43-44.
- International Whaling Commission. 2002. Report of the Scientific Committee, Annex H. Report of the Sub-Committee on the Comprehensive Assessment of North Atlantic Humpback Whales. *Journal of Cetacean Research and Management (Supplement)* 4:230-60.
- International Whaling Commission. 2003. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 5:1-92.
- International Whaling Commission. 2004. Report of the Scientific Committee, Annex T. Report of the data availability working group. *Journal of Cetacean Research and Management (Supplement)* 6:406-08.
- International Whaling Commission. 2008. Report of the Scientific Committee, Annex K1. Report of the working group on ecosystem modelling. *Journal of Cetacean Research and Management (Supplement)* 10:293-301.
- IWC. 2009a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 11(1): 220-47.
- International Whaling Commission. 2009b. Report of the Scientific Committee, Annex H. Report of the sub-committee on other Southern Hemisphere whale stocks. *Journal of Cetacean Research and Management (Supplement)* 11:220-47.
- International Whaling Commission. 2010. Chairman's Report of the Sixty-First Annual Meeting, Annex F. IWC Resolution 2009-1. Consensus Resolution on Climate and Other Environmental Changes and Cetaceans. *Annu. Rep. Int. Whal. Comm.* 2009:95.
- International Whaling Commission. 2011a. Report of the Scientific Committee, Annex L. Report of the Sub-Committee on Small Cetaceans. *J. Cetacean Res. Manage. (Suppl.)* 12:272-95.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

- International Whaling Commission. 2011b. Report of the Third Intersessional Workshop on the Review of MSYR for Baleen Whales, Seattle, 20-24 April 2010. *J. Cetacean Res. Manage. (Suppl.)* 12:399-411.
- IWC. 2012a. Report of the Scientific Committee of the International Whaling Commission. 517 pp.pp.
- International Whaling Commission. 2012b. Requirements and Guidelines for *Implementations* under the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 13:495-506.
- International Whaling Commission. 2013. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 14:1-86.
- International Whaling Commission. 2014a. Report of the Fourth Intersessional Workshop on the Review of Maximum Sustainable Yield Rates (MSYR) in Baleen Whales, 26-28 March 2013, La Jolla, California, USA. *J. Cetacean Res. Manage. (Suppl.)* 15:507-18.
- International Whaling Commission. 2014b. Report of the Scientific Committee. Annex I. Report of the Working Group on Stock Definition. Appendix 5. Key stock definition terms for the IWC Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 15:287-88.
- International Whaling Commission. 2014c. Report of the Scientific Committee. Annex Q. Report of the *ad hoc* group to develop a list of 'accepted' abundance estimates. *J. Cetacean Res. Manage. (Suppl.)* 15:416-17.
- IWC. 2015. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 16: 196-221.
- IWC. 2016a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 17: 250-82.
- IWC. 2016b. Report of the Scientific Committee of the International Whaling Commission. *Journal of Cetacean Research & Management* 17 (Suppl.).
- International Whaling Commission. 2016c. Report of the Scientific Committee. Annex G. Report of the Sub-Committee on In-Depth Assessments. *J. Cetacean Res. Manage. (Suppl.)* 17:224-49.
- IWC. 2017a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 18: 230-63.
- International Whaling Commission. 2017b. Chair's Report of the 66th Meeting. Annex E. Resolutions Adopted at the 66th Meeting. Resolution 2016-3. Resolution on Cetaceans and their Contribution to Ecosystem Functioning. *Rep. 65 Mtg Int. Whaling Commn* 2016:50.
- International Whaling Commission. 2017c. Report of the Expert Panel of the Final Review on the Western North Pacific Japanese Special Permit Programme (JARPN II), 22-26 February 2016, Tokyo, Japan. *J. Cetacean Res. Manage. (Suppl.)* 18:527-92.
- IWC. 2017d. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 18: 1-109.
- IWC. 2017e. Report of the Scientific Committee of the International Whaling Commission. *Journal of Cetacean Research & Management* 18 (Suppl.).
- International Whaling Commission. 2017f. Report of the Scientific Committee. Annex J. Report of the Working Group on Non-deliberate Human-induced Mortality of Cetaceans. *J. Cetacean Res. Manage. (Suppl.)* 18:277-94.
- International Whaling Commission. 2017g. Report of the Scientific Committee. Annex M. Report of the Sub-Committee on Small Cetaceans. *J. Cetacean Res. Manage. (Suppl.)* 18:340-86.
- IWC. 2018a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 19: 193-221.
- International Whaling Commission. 2018b. Chair's Summary Report of the First IWC Workshop on the Comprehensive Assessment of North Pacific Humpback Whales, 19-21 April 2017, Seattle, USA. *J. Cetacean Res. Manage. (Suppl.)* 19:595-601.
- International Whaling Commission. 2018c. Report of the Fourth Workshop On Large Whale Entanglement Issues, Provincetown, MA, USA, 5-7 June 2018.
- International Whaling Commission. 2018d. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)* 19:1-101.
- International Whaling Commission. 2018e. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 19:115-53.
- IWC. 2019a. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *Journal of Cetacean Research and Management (Supplement)* 20.
- IWC. 2019b. Report of the Scientific Committee. *Journal of Cetacean Research and Management (Supplement)* 20: 1-76.
- International Whaling Commission. 2019c. Report of the Scientific Committee. *J. Cetacean Res. Manage. (Suppl.)*.
- IWC. 2019d. Report of the Scientific Committee of the International Whaling Commission. *Journal of Cetacean Research & Management* 20 (Suppl.): 675 pp.
- International Whaling Commission. 2019e. Report of the Scientific Committee. Annex D. Report of the Sub-Committee on the Revised Management Procedure. *J. Cetacean Res. Manage. (Suppl.)* 20:93-119.
- International Whaling Commission. 2019f. Report of the Scientific Committee. Annex H. Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage. (Suppl.)* 20:211-38.
- International Whaling Commission. 2019g. Report of the Scientific Committee. Annex M. Report of the Sub-Committee on Small Cetaceans. *J. Cetacean Res. Manage. (Suppl.)* 20:320-45.
- International Whaling Commission. 2019h. Report of the Scientific Committee. Annex P. Amended Draft to 'Annex P. *J. Cetacean Res. Manage. (Suppl.)* 20:380-93.
- International Whaling Commission. 2019i. Report of the Scientific Committee. Annex W. Draft Amendments to Scientific Committee Rules of Procedure. *J. Cetacean Res. Manage. (Suppl.)* 20:454-58.
- International Whaling Commission. 2019j. Report of the Scientific Committee. Annex X. Preliminary Feedback Provided by the Scientific Committee on the 'IWC Review – Final Report' *J. Cetacean Res. Manage. (Suppl.)* 20:459-73.
- International Whaling Commission. 2019k. Report of the Workshop on the Poorly Documented Takes of Small Cetaceans in South America: Including In-Depth Review of the Hunting of the Amazon River Dolphin (*Inia geoffrensis*) for the Piracatinga (*Calophrys macropterus*) Fishery, 19-21 March 2018, Santos, Brazil. *J. Cetacean Res. Manage. (Suppl.)* 20:603-43.
- Kitakado, T. 2018. Evaluation of management procedures with CLA modified by recruitment information: specifications of trials to evaluate CLA variants for Antarctic minke whales which utilize ageing information. Paper SC/67b/RMP03 presented to the IWC Scientific Committee, April-May 2018, Bled, Slovenia (unpublished). 14pp. [Paper available from the Office of this Journal].
- Lang, A.R. and Martien, K.K. 2012. Update on the use of a simulation-based approach to evaluate plausible levels of recruitment into the Pacific Coast Feeding Group of gray whales. *Paper SC/64/AWMP4 presented to the International Whaling Commission Scientific Committee*.
- Leduc, R.G., Archer, F.I., Lang, A.R., Martien, K.K., Hancock-Hanser, B., Torres-Florez, J.P., Hucke-Gaete, R., Rosenbaum, H.C., van Waerebeek, K., Brownell, R.L. and Taylor, B.L. 2017. Genetic variation in blue whales in the eastern pacific: implication for taxonomy and use of common wintering grounds. *Mol. Ecol.* 26: 740-51. [Available at: doi:10.1111/mec.13940].
- Martien, K.K., Gregovich, D., Bravington, M.V., Punt, A.E., Strand, A.E., Tallmon, D.A. and Taylor, B.L. 2009. *tossm*: an R package for assessing performance of genetic analytical methods in a management context. *Molecular Ecology Resources* 9(6): 1456-59.
- Minton, G., Collins, T., Findlay, K., Ersts, P., Rosenbaum, H., Berggren, P. and Baldwin, R. 2011. Seasonal distribution, abundance, habitat use and population identity of humpback whales in Oman. *Journal of Cetacean Research and Management (Special Issue)* 3: 185-98.
- Minton, G., Kema Kema, J.R., Todd, A., Korte, L., Maganga, P.B., Migoungui Mouelet, J.R., Nguema, A.M., Moussavou, E. and Nguélé, G.K. 2017. Multi-stakeholder collaboration yields valuable data for cetacean conservation in Gamba, Gabon. *Afr. J. Mar. Sci.* 39(4): 423-33.

REPORT OF THE 2019 MEETING OF THE IWC SCIENTIFIC COMMITTEE

- Monnahan, C., Acevedo, J., Hendrix, N., Gende, S., Aguayo-Lobo, A. and Martinez, F. 2019a. Population trends for humpback whales (*Megaptera novaeangliae*) foraging in the Francisco Coloane Coastal-Marine Protected Area, Magellan Strait, Chile. *Mar. Mam. Sci.* Early View: 1-20. [Available at: <https://doi.org/10.1111/mms.12582>].
- Monnahan, C., Acevedo, J., Hendrix, N., Gende, S., Aguayo-Lobo, A. and Martinez, F. 2019b. Population trends for humpback whales (*Megaptera novaeangliae*) foraging in the Francisco Coloane Coastal-Marine Protected Area, Magellan Strait, Chile. *0824-0469* 2019.
- Nature Tropicale NGO. 2018. Whale watching 2018: Plaidoyer pour la sauvegarde des cétacés au Bénin. Technical Report, Nature Tropicale and IUCN. 22pp. [In French].
- Pace, R.M., Corkeron, P.J. and Kraus, S.D. 2017. State-space mark-recapture estimates reveal a recent decline in abundance of North Atlantic right whales. *Ecology and Evolution* 7: 8730-41.
- Panti, C., Baini, M., Lusher, A., Hernandez-Milan, G., Bravo Rebolledo, E.L., Unger, B., Syberg, K., Simmonds, M.P. and Fossi, M.C. 2019. Marine litter: One of the major threats for marine mammals. Outcomes from the European Cetacean Society workshop. *Environ. Pollut.* 247: 72-79.
- Pastene, L., Acevedo, J. and Branch, T. In press-a. Morphometric analysis of Chilean blue whales and implications for their taxonomy. *0824-0469*.
- Pastene, L.A., Acevedo, J. and Branch, T. In Press-b. Morphometric analysis of Chilean blue whales and implications for their taxonomy. *Mar. Mam. Sci.*
- Pastene, L.A., Acevedo, J. and Branch, T. In Press-c. Morphometric analysis of Chilean blue whales and implications for their taxonomy. *Marine Mammal Science*.
- Pastene, L.A., Goto, M. and Taguchi, M. 2016. Additional genetic analyses on stock structure in North Pacific Bryde's and sei whales. Paper SC/66b/SD01 presented to the IWC Scientific Committee, June 2016, Bled, Slovenia (unpublished). 12pp. [Paper available from the Office of this Journal].
- Peltier, H., Beaufils, A., Cesarini, C., Dabin, W., Dars, C., Demaret, F., Dhermain, F., Doremus, G., Labach, H., van Canneyt, O. and Spitz, J. Submitted-a. Long-term monitoring of marine mammal strandings reveals the importance of ship strike of large cetaceans along European coasts of France (1972-2017) and future challenges for the Marine Strategy Framework Directive. *Front. Mar. Sci.*
- Peltier, H., Dabin, W., Dars, C., Demaret, F., Doremus, G., van Canneyt, O., Laran, S., Mendez-Fernandez, P., Spitz, J., Authier, M., Daniel, P. and Ridoux, V. Submitted-b. Can modelling the drift of bycaught dolphin stranded carcasses help identify involved fisheries? An exploratory study. *Biol. Cons.*
- Polanowski, A.M., Robbins, J., Chandler, D. and Jarman, S.N. 2014. Epigenetic estimation of age in humpback whales. *Mol Ecol Resour* 14(5): 976-87.
- Roberts, J.O., Webber, D.N., Goetz, K.T., Edwards, C.T.T., Roe, W.D. and Doonan, I.J. 2019. Spatial risk assessment of threats to Hector's and Maui dolphins (*Cephalorhynchus hectori*). Fisheries New Zealand, Wellington, New Zealand. 169pp.
- Roe, W.D., Howe, L., Baker, E.J., Burrows, L. and Hunter, S.A. 2013. An atypical genotype of *Toxoplasma gondii* as a cause of mortality in Hector's dolphins (*Cephalorhynchus hectori*). *Vet. Parasitol.* 192(1-3): 67-74.
- Scheidat, M., Couperus, B. and Siemensma, M. 2018. Electronic monitoring of incidental bycatch of harbour porpoise (*Phocoena phocoena*) in the Dutch bottom set gillnet fishery (September 2013 to March 2017). Report C102/18. Wageningen Marine Research, Netherlands. 78pp. [Available at: <https://doi.org/10.18174/466450>].
- Song, K., Kim, Z., Zhang, C.I. and Kim, Y.H. 2010. Fishing gears involved in entanglements of minke whales (*Balaenoptera acutorostrata*) in the East Sea of Korea. *Marine Mammal Science* 26: 282-95.
- Stamation, K., Watson, M., Moloney, P., Charlton, C. and Bannister, J. In Prep. Population Estimate and Rate of Increase of Southern Right Whales, *Eubalaena australis* in South-eastern Australia. 22pp.
- Stevick, P.T., Bouvert, L., Gandilhon, N., Rinaldi, C., Rinaldi, R., Broms, F., Carlson, C., Kennedy, A., Ward, N. and Wenzel, F. 2018. Migratory destinations and timing of humpback whales in the southeastern Caribbean differ from those off the Dominican Republic. *Journal of Cetacean Research and Management* 18: 127-33.
- Tillman, M.F. 1977. Estimates of population size for the North Pacific sei whale. *Reports of the International Whaling Commission (special issue)* 1: 98-106.
- Wade, P.R., Quinn, T.J., II, Barlow, J., Baker, C.S., Burdin, A.M., Calambokidis, J., Clapham, P.J., Falcone, E.A., Ford, J.K.B., Gabriele, C.M., Mattila, D.K., Rojas-Bracho, L., Straley, J.M., Taylor, B.L., Urbán R., J., Weller, D., Witteveen, B.H. and Yamaguchi, M. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. Paper SC/66b/IA21 presented to the IWC Scientific Committee, June 2016, Bled, Slovenia (unpublished). 42pp. [Paper available from the Office of this Journal].
- Waples, R.S., Hoelzel, A.R., Gaggiotti, O., Tiedemann, R., Palsbøll, P.J., Cipriano, F., Jackson, J., Bickham, J.W. and Lang, A.R. 2018. Guidelines for genetic data analysis. *Journal of Cetacean Research and Management* 18: 33-80.
- Watari, S., Murase, H., Yonezaki, S., Okazaki, M., Kiyofuji, H., Tamura, T., Hakamada, T., Kanaji, Y. and Kitakado, T. 2019. Ecosystem modeling in the western North Pacific using Ecopath, with a focus on small pelagic fishes. *Mar. Ecol. Prog. Ser.* Early View. [Available at: <https://doi.org/10.3354/meps12508>].
- Weilgart, L. 2018. The impact of ocean noise pollution on fish and invertebrates. Report for OceanCare, Switzerland. 24pp. [Available at: https://www.oceancare.org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018.pdf].