

Annex S

Report of the *Ad hoc* Working Group on Photo-Identification

Members: Olson (Convenor), Al Harthi, Aoki, Bell, Brierley, Brownell, Castro, Charlton, Clapham, Collins, Coscarella, Dalla Rosa, de Andrade Freitas, Domit, Doniol-Valcroze, Donovan, Double, Elwen, Ferriss, Forestell, Fortuna, Gallego, Galletti, Genov, Iñíguez, Irvine, Jackson, Kim, Kuppusamy, Lang, Lauriano, Luna, Lundquist, Mallette, Marcondes, Marmontel, Matsuoka, Minton, Mizroch, Øien, Palka, Panigada, Reeves, Reyes Reyes, Ritter, Robbins, Rodriguez, Ryeng, Scott, Slooten, Slugina, Stack, Strasser, Svoboda, Taylor, Torres, Torres-Florez, Tullio, Urbán, Vikingsson, Wade, Wambiji, Weinrich, Weller, Willson, Zerbini.

1. INTRODUCTORY ITEMS

1.1 Opening remarks

Olson welcomed participants and introductions were made.

1.2 Election of Chair

The Working Group formally approved the nomination of Olson as Chair.

1.3 Appointment of Rapporteurs

Minton agreed to undertake duties as rapporteur.

1.4 Adoption of Agenda

The adopted Agenda is given in Appendix 1.

1.5 Documents available

The documents available to the Working Group were SC/67b/PH01-05; SC/67b/ASI04; SC/67b/SH08; SC/67b/SH16.

2. Humpback whale catalogues

This agenda item was opened with an update from Olson on the Antarctic Humpback Whale Catalogue (AHWC), maintained at College of the Atlantic, USA. The catalogue was established in 1987 and during the past 30 years its data have been used in dozens of studies and publications (Stevick *et al.*, 2017). With a recent loss in funding, the catalogue database is now 'frozen' and not being actively updated. The Working Group expressed strong disappointment at this news as well as the hope that the AHWC's funding situation will change and enable the catalogue to continue.

Attention: SC, G

The Scientific Committee has been informed that due to a loss of funding, the Antarctic Humpback Whale Catalogue curated by the College of the Atlantic, USA will no longer be updated. The Committee:

- (1) **draws attention** to the great value this catalogue (established in 1987) has provided to the Committee, including receiving photographs from the IWC IDCR and SOWER cruises and providing information for the Committee's *Comprehensive Assessment of Southern Hemisphere humpback whales*;
 - (2) **welcomes** news that the existing catalogue will remain a resource for scientists; and
 - (3) **encourages** potential funders to support future continuation of the catalogue.
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Mallette shared information about the Mid-Atlantic Humpback Whale Photo-ID Catalog (MAHWC), which includes images and sighting data collected over the last two decades from the mid-Atlantic and southeast coast of the United States (New York to Florida). The MAHWC will be hosted by OBIS-SEAMAP and will help standardize and streamline photo-ID efforts to facilitate efficient exchange of information between the MAHWC and broader regional catalogues (i.e. North Atlantic Humpback Whale Catalog and Gulf of Maine Catalog). The Working Group **welcomed** this information and recognised the growing trend in large, collaborative catalogues with the development of increased technological archiving capabilities.

2.1 Flukebook

SC/67b/PH03 described Flukebook, a non-profit, open source cetacean data archiving and photo matching tool developed under the Wildbook Platform. In 2016 the IWC approved funding for the development of a regional data platform for the Arabian Sea Whale Network (ASWN), to be implemented in collaboration with Wild Me, the developers of Flukebook. The ASWN is joining Flukebook, with two primary objectives: (1) to consolidate and more effectively manage humpback whale and other cetacean data collected in Oman over the past 20 years; (2) to provide an online platform that will allow comparison and regional-level analysis of cetacean data collected by different research groups throughout the Arabian Sea. Humpback whale photo-identification data have been uploaded from Oman, as well as a few incidental photos from Pakistan and India. The data platform has been designed according to the Terms of Reference specified by the ASWN, and a number of improvements and further refinements are being made to the platform in response to feedback gathered during a workshop held in Oman in January 2018 (SC/67B/CMP07). While the data uploaded from ASWN contributors will be accessible only to the data contributors themselves, the new data fields and functions that have been added to the Flukebook platform will become standard and available to all future users of the open-source platform.

The Working Group was impressed by the features described for this platform and the sophistication of its fluke matching algorithms for humpback whales. Questions arose regarding the merging of large datasets. The author explained that ASWN's data set is relatively small but Flukebook houses large data sets on the scale of the SPLASH study (Calambokidis *et al.*, 2008). The Working Group looks forward to updates on this work.

2.2 Happywhale

SC/67b/PH05 provided an update on the development and status of Happywhale, a web-based marine mammal photo-ID crowd-sourcing platform which has been online since August 2015. Happywhale has now received over 88,000 contributed images. To date the platform has concentrated on humpback whales although it gathers images from other cetacean species as well. Currently the computer-assisted matching system is available for humpbacks only. In addition to humpback whales, in recent months Happywhale provided

images to research scientists of a Northern right whale, Southern right whales, Antarctic blue whales, and Antarctic killer whales. Active system development has continued in the past year, focusing on both improving the user experience to make participation more rewarding, and on features to support science usage. As a result, there has been a doubling of usage rates in the last year with an increase of 110% of the total dataset as of the same time in 2017. As the system has become more widely known and better understood, image and metadata quality has increased, and more users are contributing images with embedded GPS, significantly improving the scientific value of encounter data.

The Working Group was interested in how the humpback whale fluke matching algorithms work. The platform uses the same matching algorithms developed by the WildBook platform and also used by Flukebook (briefly described in SC/67b/PH03). There was also interest in what happens with photos contributed to the platform. It was clarified that photographs uploaded to/contributed to Happywhale are subsequently forwarded on to the appropriate catalogue holders for the species and region where the sighting was made for inclusion in their respective catalogues.

Clapham described a proposed study that would utilize Happywhale to conduct large-scale comparisons of humpback whale photographs from regions across the South Pacific from Oceania to South America. The overarching question to be addressed is whether humpback whales move across the entire South Pacific, or whether whales in the eastern portion of this ocean constitute a largely discrete population. The Working Group **endorsed** this proposal (with no budget implications). Furthermore, it was **agreed** that the effort should be as inclusive as possible, including all South Pacific catalogues that wish to participate and have suitable data to submit (IWC, 2017).

3. BLUE WHALE CATALOGUES

3.1 Photo-identification of Antarctic blue whales

SC/67b/PH02 described the results of the comparison of newly available collections of identification photographs of individual Antarctic blue whales to the images of 441 individuals in the Antarctic Blue Whale Catalogue. The sources of photographs include the IWC IDCR/SOWER cruises in 1989/1990, 1993/1994, and 1997/1998, and opportunistic photographs collected by collegial scientists, naturalists, and tourists 2015-2018. Seventeen new individual blue whales were identified: 4 from the SOWER cruise in 1998 and 14 from the opportunistic photos. There were no matches between any of the newly identified whales or to the Antarctic Catalogue. The 17 new identifications bring the total number of photo-identified Antarctic blue whales up to 458 whales, represented by 342 left sides and 332 right sides. The minimum (332) and maximum (458) number of unique individuals represents 15% and 20%, respectively, of the most recent accepted estimate of abundance of Antarctic blue whales, 2,280 in 1997/1998 (Branch, 2007). All 17 of the new identifications came from IWC Management Areas underrepresented in the catalogue, Areas I and II. The photographs from 1998 are a valuable contribution to the Catalogue; a future recapture of any of the identified whales from this year would improve the estimate of survival in an abundance model. To date the longest recapture interval is 12 years, 1995-2007 (Olson *et al.*, 2016). The collection of Antarctic blue whale identification photographs provide data for capture-recapture estimates of abundance (SC/67B/SH08) as well as

information on the movement of individual blue whales within the Antarctic region.

The Working Group **commended** the work of the catalogue and **agreed** that it continue. There was interest in how outreach is conducted in order to promote new contributions to the database. This has occurred mainly through Happywhale, as well as direct outreach by the IWC-SORP program to the Association of Antarctic Tour Operators (IAATO).

Following discussion regarding the value of photographs contributed from citizen scientists, the Working Group **agreed** that the development of a simple guide to help tourists and operators take photos that are suitable for photo-identification. This guide could be produced in an A4 PDF format that could be laminated for use on vessels, and a short Powerpoint presentation could be prepared for naturalists to use for pre-tour or on-board presentations.

The Working Group also put forth that any photos obtained through these channels in the Antarctic be uploaded to Happywhale, which could function as a central conduit to ensure photos are disseminated to the relevant species catalogue holders. It was suggested that the relationship between Happywhale and the producers of the guide be formalized with an MoU to clarify roles, responsibilities and data ownership.

Attention: SC

- (1) *The Working Group **agrees** that the Antarctic Blue Whale Catalogue continue its work collecting adding photo-identification data to the catalogue in order to assist with developing estimates of population abundance for Antarctic blue whales.*
 - (2) *The Working Group **agrees** that the development of a simple guide (physical and electronic versions) to help tourists and naturalists take photos that are suitable for photo-identification should be undertaken. This will support the photo-ID catalogues from the Antarctic region for use in population assessments by the IWC, particularly for blue whales, right whales, fin whales, and humpback whales.*
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3.2 Southern Hemisphere Blue Whale Catalogue

SC/67b/PH04 summarised the progress made on the Southern Hemisphere Blue Whale Catalogue (SHBWC). To date, the SHBWC has a total of 1,519 individual blue whale photo-identifications represented by 1,101 right side identifications, 1,116 left side identifications and 60 tail flukes. The SHBWC has become the largest repository of Southern Hemisphere blue whale photo-identifications. Seventeen blue whale research groups are contributing photo identification data from areas off Antarctica, Chile, Peru, Ecuador-Galapagos, Eastern Tropical Pacific (ETP), Australia, Timor Leste, New Zealand, southern Africa, Madagascar and Sri Lanka. During this period no new data were received either from new seasons or new groups. In line with recommendations made last year during SC/67A, SHBWC's work in 2017 focused on comparisons of the catalogues from Australia, New Zealand and Sri Lanka. Results based on the left side comparisons found no matches between Australia, New Zealand and Sri Lanka, reinforcing the hypothesis of separate populations. Exchange was found between three areas in Australia, suggestive of single a population. Re-sights found in New Zealand support the hypothesis of some site fidelity to this area. Further details are reported in SC/67b/SH16. Comparison of right sides

is underway and expected to be completed soon. Once these priority comparisons are completed, the Australian photographs will undergo uniform quality coding, to prepare a database for a capture-recapture analysis.

In 2017 improvements made to the database software included the implementation of a tool to import from Excel the date and location data associated with the photos.

In order to support the assessment work of the Scientific Committee, in 2018 priorities for the SHBWC are to integrate the IWC photo-ID catalogue guidelines on photo-quality, update the user manual, and to compare of the catalogues from the ETP and South America (which will include new photographs expected from Chile).

The Working Group **commended** these efforts and recognised the enormous volume of work it reflects. It was **agreed** that the catalogue continue. The importance of performing regular back-ups of the database on the IWC server was pointed out. Clarifications to the wording in the User Manual were suggested and will be carried out in the upcoming months. The author explained that quality scoring of photographs will be supported by a document standardising scoring criteria with examples for each category to ensure consistency of scoring between individuals and over time. New data are expected in the next year from Chile, Madagascar, and the eastern tropical Pacific.

Attention: SC

*The Southern Hemisphere Blue Whale Catalogue provides data useful for estimating abundances and examining connectivity between feeding and breeding grounds. The Working Group **agrees** that the catalogue continue.*

4. FIN WHALE AND OTHER WHALE PHOTO-ID CATALOGUES

4.1 Photo-identification of Antarctic fin whales

SC/67b/PH01 reported on the compilation of a new photo-identification catalogue of Antarctic fin whales. A total of 1,121 fin whale photographs from SOWER cruises 2004-2008 and 22 photographs collected opportunistically near the South Orkney Islands during a CCAMLR research voyage investigating Antarctic demersal fish were examined for individual identifications. In order to assess the suitability of Antarctic fin whales for photo-ID, individuals were scored categorically in two measures of distinctiveness: (1) the number of match points per side, and (2) the 'brightness' of the chevron and blaze pigmentation on the right side. The photographs yielded 30 unique identifications, represented by 15 left sides and 19 right sides. Twenty-eight identified whales were photographed in IWC Management Areas III, IV, and V. Two whales were photographed at the South Orkney Islands in Area II. There were no matches between any of the identified individuals from different dates. The study confirmed that Antarctic fin whales are marked well enough to serve as subjects for photo-ID projects. 97% of scored whales exhibited 3 or more match points per side and 75% of the whales scored for brightness had moderately visible or highly visible chevron and blaze patterns. It was noted that the majority of the fin whale photographs from SOWER 2006/2007 are currently missing from the IWC archives. When the photos are recovered they should add another 20-24 identifications. The catalogue serves as a foundation for future photo-ID studies, especially those proposed for the western Antarctic Peninsula.

The Working Group **welcomed** this effort and **encouraged** the continuation of this work as it can potentially contribute to the work toward generating an abundance estimate for fin whales in the Southern Hemisphere. It was **agreed** that the missing photographs from 2006/2007 be located, including an in depth search at the IWC Secretariat and contacting researchers from the cruises. It was noted that the photographs from this season are from the second year of two back-to-back years of fin whale research in Area III, potentially providing the opportunity for site fidelity matches. A steering group was convened to search for and/or reconstruct the collection of missing photographs from 2006/2007 and from other SOWER years.

A suggestion was made (as above) to develop clear instructions that could be shared with Antarctic tour operators so that on-board naturalists and tourists with suitably advanced camera equipment and skill would be aware of the types of photos that are needed to contribute to photo-identification efforts.

Attention: S, SC, SH

- (1) *The Working Group **encourages** continuation of the Antarctic Fin Whale Catalogue which can potentially provide data toward estimating abundance or identifying movement patterns.*
 - (2) *The Working Group **agrees** that an exhaustive search be conducted to locate SOWER photos that are missing from the IWC archives, including those of fin whales.*
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4.2 Photo-identification studies of gray whales, NE Sakhalin Island, Russia

SC/67b/ASI04 presented the results of photo-identification studies conducted annually on the Sakhalin feeding aggregation of North Pacific gray whales between 2002 and 2017. The research takes place off the northeast coast of Sakhalin Island as part of an industry-sponsored ENL-SEIC joint monitoring program. With the addition of nine calves in 2017, the Joint Program's Sakhalin gray whale catalog now contains 283 identified individual gray whales. The population can be divided into a group of 175 whales that come to Sakhalin Island for feeding on a regular basis, a group of 27 whales recorded at intervals greater than 3 years and a group of 71 individuals that have been recorded only once.

The 2017 data were collected by three teams in order to cover all of the Piltun and Offshore feeding areas. One vessel-based team conducted photographic surveys in the Piltun and Offshore feeding areas while two onshore teams, split between the southern and northern parts of the Piltun feeding area, moved along the coast in vehicles taking imagery of the whales they encountered directly from shore. DJI Phantom 4Pro drones with video cameras were added to the onshore teams' equipment. In most cases, the drone was used at an average distance of 800m from the shore, although they were able to go as far as 2.5km from the shore. The standard flight height was 8 meters. With the availability of vertical perspective photographs from the drones, a new catalog was created with video imagery of 35 individuals.

Questions arose regarding the cross-platform matching of images. The author indicated that there were no difficulties resolving the photos obtained from the three different platforms, and that it was also easy to compare with aerial photos with those obtained only from boats in previous years. The Working Group was impressed with these results.

Concern was expressed that the low-flying drones (standard height of 8m) could be causing stress to the whales, particularly mothers with calves. USA regulations require a minimum sustained height of 100ft. Although the author did not report any visible behavioural response to the drones, other researchers cautioned that stress responses (e.g., increased levels of stress hormones) may not be immediately detectable.

Researchers working with gray whales in Mexico are also starting to use drones for photo-identification and assessment of health/body condition, as are researchers working with Arabian Sea humpback whales off the coast of Oman. Custom-designed drones with high resolution cameras and LIDAR to allow photo-identification and health assessment from a higher position are currently very expensive, and researchers expressed an interest in promoting ways to adapt off-the-shelf drones for whale research purposes. The Working Group **agreed** that the increasing prevalence of drone use in whale research projects around the globe merits further discussion in SC/68A.

SC/67b/CMP/7 (see Annex O Item 2.1.3) provides details on a concurrent photo-ID study of this population of gray whales. At this year's meeting (Annex O) it was reported that the two catalogues will be unified under the auspices of the IWC.

5. GUIDELINES FOR IWC CATALOGUES AND PHOTO-ID DATABASES

5.1 Development of Appendices

At last year's meeting SC/67A, the Working Group finalised the IWC Guidelines for Photo-Identification Catalogues (IWC, 2018). The Guidelines outline common standards (e.g. with respect to photograph subject and quality, data submission, maintenance and reporting) such that they provide data at a level sufficient to allow the IWC to meet its population assessment and conservation goals. The Guidelines are intended for use by projects of large whales. Because they are not guidelines on field or laboratory techniques, a selection of Appendices would be an appropriate and useful resource attached to the Guidelines.

The Working Group discussed and reviewed items for inclusion as Appendices in five categories: (1) cataloguing software; (2) image matching software; (3) seminal papers defining individual identification, by species; (4) photo quality guides; and (5) photo/data collection apps. The Working Group **agreed** to continue working on the appendices intersessionally.

6. INTERSESSIONAL WORKING GROUPS

One intersessional correspondence group and two steering groups convened during SC/67A were relevant to the aims

of the *ad hoc* Working Group. ICG-17 was convened to facilitate filling data gaps in Chile and Australia regional holdings of the SHBWC and to assess data readiness for use in abundance estimates. Progress was made and an assessment of data readiness was provided in SC/67B/PH04. Relatedly, SG-12 was formed to ensure continued work on photo-identification catalogues needed towards population assessments. A particular focus was to assess temporal and spatial progress of catalogues and the preparation of Australian catalogues for quality coding. Progress was made and details were provided in SC/67B/PH04. SG-13 was created to begin compiling technical appendices for the IWC Photo-identification Guidelines for Catalogues. A compilation of appendices was begun and continued forward during SC/67B.

See Table 1 for a list of intersessional e-mail correspondence groups for the intersessional period 2018-2019, which will report back to SC/68A next year.

7. CONCLUSIONS AND RECOMMENDATIONS

The Southern Hemisphere and Antarctic photo-identification catalogues for blue whales are potential sources of data for estimating abundances and examining connectivity between feeding and breeding grounds. The Working Group **encourages** the continuation of these catalogues.

The continuation of a new Antarctic fin whale photo-identification catalogue was **encouraged**. It was **agreed** that the missing fin whale photographs from SOWER 2006/2007 be located if possible in order that they can be added to the catalogue. A steering group was convened to search for and/or reconstruct the collection of missing photographs from 2006/2007 and from other SOWER years.

It was **agreed** that the development of a simple guide (laminated hard copy and Powerpoint format), in order to help tourists and naturalists take photos that are suitable for photo-identification should be undertaken. This would support the photo-ID catalogues from the Antarctic region for use in population assessments by the IWC, particularly for blue whales, fin whales, right whales, and humpback whales.

The Working Group **agreed** that a future agenda item (for SC/68A) on the use of drones for photo-identification would be useful to inform continued discussions of IWC standards for photo-identification databases.

8. WORK PLAN AND BUDGET REQUESTS FOR 2019-2020

8.1 Work plan

The Southern Hemisphere Blue Whale Catalogue and the Antarctic Blue Whale Catalogue will continue matching and adding to their respective databases (see also Annex H

Table 1
Intersessional E-mail Groups for PH 2018-2019 (for full listing see Annex Y).

SC Agenda Item/Sub-Committee	Type	Group (short name)	Terms of Reference	Members
Item 5.1 PH	ICG	Appendices for photo-ID guidelines	Continue compilation of technical appendices for photo-ID guidelines	Olson (Convenor), Dalla Rosa, Donovan, Double, Galletti, Genov, Mallette, Marcondes, Matsuoka, Minton, Panigada, Reyes Reyes, Stack, Taylor, Torres-Florez, Weinrich
Item 4 PH	SG	Search for missing SOWER photos	Search for and/or reconstruct archive of missing SOWER photos	Matsuoka and Taylor (co-Convenors), Donovan, Olson

Table 2
Work plan for 2019 and 2020 for PH.

Topic	Intersessional 2018/19	2019 Annual Meeting (SC/68a)	Intersessional 2019/20	2020 Annual meeting
Appendices for IWC Guidelines for Photo-identification	Continue compilation	Appendices ready for review	Continue compilation	Appendices ready for review
Upload all available New Zealand blue whale identification photographs to SHBWC (also pertains to Annex H Item 7.1.1)	Cross-reference between separate area catalogue holdings before uploading to SHBWC avoid duplication; intersessional group convened under SH.	Included in SHBWC report	-	-
Development of how-to photo-ID materials for naturalists and citizen scientists (also pertains to Annex H Item 7.1.1.2)	Prepare hard copy and PPT photo-ID guides	Guide completed and available (pending funding)		
Search for missing SOWER photographs, especially fin whale photos from 2006/2007	Search Secretariat archives and contact SOWER researchers for personal copies of photos	Report		

items 7.1.1.2 and 7.1.1.1). Outstanding photographs from New Zealand will be uploaded, after being cross-referenced between collections to avoid duplication of entries. An intersessional email group was established under Annex H item 7.1.1 to address this. An exhaustive search will be conducted for missing photographs from SOWER cruises. A steering group was formed to undertake this work. A simple how-to photo-ID guide will be developed for tourists and naturalists, pending funding (see also Annex H item 7.1.1.2). This has budget implications for the Sub-committee for Other Southern Hemisphere Whale Stocks because the guide has implications for multiple species assessments. The *ad hoc* Working Group **agreed** to continue compiling appendices for the IWC Guidelines for Photo-identification Guidelines. An intersessional correspondence group will continue to work on this item (see Table 1 above).

8.2 Budget requests for 2019-2020

There are no budget implications for this work plan.

9. ADOPTION OF THE REPORT

This report was adopted at 14:43 on 2 May 2018.

REFERENCES

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- Olson, P.A., Double, M.C., Matsuoka, K. and Pastene, L.A. 2016. Photo-identification of Antarctic blue whales 1991 to 2016. Paper SC/66b/SH11 presented to the IWC Scientific Committee, June 2016, Bled, Slovenia (unpublished). 7pp. [Paper available from the Office of the IWC].
- Stevick, P.T., Carlson, C., Crowe, L., Kellett, M., Fernald, T. and Allen, J.M. 2017. Interim report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Paper SC/67a/PH03 presented to the IWC Scientific Committee, May 2017, Bled, Slovenia (unpublished). 8pp. [Paper available from the Office of the IWC].

Appendix 1

AGENDA

1. Introductory items
 - 1.1 Opening remarks
 - 1.2 Election of Chair
 - 1.3 Appointment of Rapporteurs
 - 1.4 Adoption of Agenda
 - 1.5 Documents available
2. Humpback whale catalogues
 - 2.1 Flukebook
3. Blue whale catalogues
 - 3.1 Photo-identification of Antarctic blue whales
 - 3.2 Southern Hemisphere Blue Whale Catalogue
4. Fin whale and other whale photo-ID catalogues
 - 4.1 Photo-identification of Antarctic fin whales
 - 4.2 Photo-identification studies of gray whales, NE Sakhalin Island, Russia
5. Guidelines for IWC catalogues and photo-ID databases
 - 5.1 Draft appendices
6. Intersessional Working Groups
7. Conclusions and recommendations
8. Work plan and budget requests for 2019-20
 - 8.1 Work plan
 - 8.2 Budget requests for 2019-20
9. Adoption of the Report