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Progress report on Southern Hemisphere  
Blue Whale Catalogue: Period May  
2018-April 2019

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INTERNATIONAL  
WHALING COMMISSION

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## ABSTRACT

The Southern Hemisphere Blue Whale Catalogue has a total of 1,585 individual blue whale photo-identifications (photo-IDs) that include regions off Antarctica, Chile, Peru, Ecuador-Galapagos, Eastern Tropical Pacific (ETP), Australia, Timor Leste, New Zealand, southern Africa, Madagascar and Sri Lanka. From May 2018 to April 2019, SHBWC work focused on finalizing photo comparisons between catalogues from Australia, New Zealand and Sri Lanka. A considerable amount of new photo-identifications (+300 IDs) from South America, Australia, New Zealand and Sri Lanka have been received and/or are in the process of being uploaded. After photo-quality coding, Australia-New Zealand-Sri Lanka photographs may be used for assessment purposes. South American catalogues are in preparation to begin a new matching process.

## INTRODUCTION

Three subspecies of blue whales are currently recognized in the Southern Hemisphere: the pygmy blue whale (*Balaenoptera musculus brevicauda*) in the temperate and sub-Antarctic zone; the Antarctic blue whale (*B. m. intermedia*) which summers in the Antarctic Zone (Rice, 1998); and recently a yet unnamed subspecies that has been accepted by the Taxonomy Committee of the Society for Marine Mammalogy (SMM, 2017). The unnamed subspecies, occurring off Chile, is intermediate in size between pygmy blue whales and Antarctic blue whales (Branch *et al.*, 2007).

The Southern Hemisphere Blue Whale Catalogue (SHBWC) is an international collaborative effort to facilitate cross-regional comparisons of individual blue whale photo-identification catalogues.

In 2006 the Scientific Committee of the International Whaling Commission (IWC, 2007) agreed to initiate an in-depth assessment of Southern Hemisphere blue whales and in 2008, the Committee endorsed a proposal to establish a central web-based catalogue of blue whale identification photographs (IWC, 2009).

Individual blue whales are identifiable from unique patterns of mottling on both sides of the body near the dorsal fin (Sears *et al.*, 1990) and in some cases, permanent scars can be used to identify or confirm individuals. The SHBWC uses specially designed online software that allows for simultaneous upload and comparisons between catalogues from different regions (IWC, 2009).

To date almost 1,500 individual blue whales have been contributed to the SHBWC from research groups working in regions off Antarctica, Chile, Peru, Ecuador-Galapagos, in the Eastern Tropical Pacific, off 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 provide data to model abundance estimates. The results will greatly contribute to the IWC Southern Hemisphere blue whale assessments.

This report summarizes the progress made between May 2018 to April 2019 on the work of the SHBWC.

## **USERS & UPLOADING OF CATALOGUES**

Catalogues currently maintained in the SHBWC include those from waters off Antarctica, Chile, Peru, Ecuador-Galapagos, in the Eastern Tropical Pacific (ETP), off southeastern Australia, Western Australia, Timor Leste, New Zealand, Southern Africa, Madagascar and Sri Lanka. A total of 1,585 blue whales are currently comprised in the SHBWC; totaling 1,148 right side photo-IDs, 1,171 left side and 70 flukes (Table 1).

Overall, 20 blue whale research groups from all regions are contributing to the SHBWC. During this time period, three new groups joined the SHBWC: from Australia (Killer Whale Australia), Sri Lanka (Biosphere Foundation) and Chile (Phantalassa). Another group from Sri Lanka (National Aquatic Resources Research and Development Agency) expressed its interest in joining the SHBWC (but the Terms of Reference and Data Sharing Agreement have not been received yet).

Collections from MERI Foundation (Chile) and National Institute of Water and Atmospheric research Ltd (NIWA-New Zealand) have been received and uploaded. Centro de Conservacion Cetacea (CCC-Chile) already communicated that they finalized their internal catalogue consolidation up to 2016 and is currently working on data management to upload +220 new IDs into the system. Eutropia (Chile) already sent their catalogue of about 27 individuals from Isla de Chañaral, northern Chile, but the photos and data still need to be uploaded into the system. Panthalassa (Chile) also has contributed their data (approximately 15 individuals) from Isla de Chañaral, which will be uploaded into the system.

In addition, photo-IDs and data from Sri Lanka, obtained between 1983-1984 and 2010-2015, have been provided by Biosphere Reserve on an external hard drive. However, data and photos need to be reviewed and processed before being uploaded to the SHBWC.

While each group is encouraged to upload their catalogues and update them periodically, there are some cases where the contributors prefer the SHBWC to take responsibility of uploading their information. For example, the contributor of older data from Sri Lanka (of images of northern Indian Ocean region blue whales) recently requested that SHBWC upload their information that would not otherwise be available.

Currently, the Antarctic sub-catalogue uploaded to the SHBWC includes photographs of 320 individuals contributed by IWC IDCR/SOWER surveys from 1987-1988 to 2008-2009 that covers all six IWC Management Areas, the Australian Antarctic Division (AAD) from 2013 and 2015, and the Mammal Research Institute Whale Unit, University of Pretoria from 2014.

The Gulf of California/ETP/South America sub-catalogue includes photographs of a total of 561 individuals contributed by the 1997/98 IWC/SOWER survey off Chile, Centro de Conservacion Cetacea off Chile between 2004 and 2009, SWFSC/NOAA during various years between 1992 to 2009 off the Galápagos Islands, Peruvian waters and the Costa Rica Dome, and MERI Foundation off southern Chile between 2014 and 2017.

The Indonesia/Australian/New Zealand sub-catalogue includes photographs of 705 individuals photographed between 1990's to 2018 that were contributed by Blue Whale Study Inc. (BWS), AAD and Flinders University from the Bonney Upwelling, Western Whale Research (WWR) from Geographe Bay and Timor Leste, Center for Whale Research Western Australia (CWR) from Perth Canyon, Asha de Vos from Sri Lanka, and Oregon State University, NIWA and AAD from New Zealand.

## **MATCHING PROGRESS**

Due to increased numbers of photo-IDs it was agreed to give priority to within-region matching (e.g. within Australia) over between-region matching. Priorities for the sub-committee on other Southern Hemisphere Whale Stock population assessments currently are blue whales off Chile and Australia (IWC, 2017).

Priority was given in this period (May 2018 to April 2019) to finalize comparisons of catalogues received prior to 2018 in the Indonesia/Australian/New Zealand region that include photo-IDs from Australia, New Zealand and Sri Lanka. Left side comparisons have been finished and right side comparisons are almost finished, with exception of few comparisons between a couple of groups. 698 photo-identified blue whales from seven different research groups working in the Perth Canyon (southwestern Australia), Geopraphe Bay (southwestern Australia), Bonney Upwelling (southern Australia), around New Zealand, and Sri Lanka provided eighteen whales resighted between different areas. Matches were found between Australian catalogues and between New Zealand catalogues, but no matches were found between those two regions or with Sri Lanka. The results reinforce the hypothesis of separate populations. Details of these findings are reported in Galletti Vernazzani *et al.* (2019).

New entries from Chile are underway (+300 IDs) with updated seasons from previous groups and contributions from new ones. Therefore, matching between catalogues of the ETP and South America will become the next priority for 2019-2020.

## **PROGRESS TOWARD POPULATION ASSESSMENTS**

The combined Australia-New Zealand -Indonesia photo data have been completely compared on the left side and is almost finished for right side (Galletti Vernazzani *et al.* 2019). Final results regarding movements and sighting histories will soon become available. Currently photographs from this area are being coded to uniform photo-quality, enabling the preparation of the database for a capture-recapture analysis. Most groups that joined the SHBWC at the beginning of its development have still not uploaded their associated data on date and location. These data are important in order to achieve capture-recapture abundance estimates models.

Photographs from several Chilean institutions have been received or are currently being uploaded, considerably contributing to the increase in blue whale photo-ID data for this region. During 2019, the commencement of a new matching effort within South America and ETP is recommended. Photo-quality coding should follow before abundance estimates are explored. Currently, data on locations and dates are missing for a small collection from the ETP.

## **SOFTWARE IMPROVEMENTS**

Improvements to the software have been continually identified and additional information needs to be integrated in order to fulfill the new IWC photo-ID catalogue guideline requirements (Olson *et al.* 2016).

Several improvements have already been implemented and others have been postponed in order to give priority to those needed for assessment purpose. Details on advances and future improvements can be found in last year's SHBWC progress report (Galletti Vernazzani *et al.* 2018).

Priority for this period (May 2018 to April 2019) was to integrate the IWC photo-ID catalogue guidelines on photo-quality in order to be consistent, and to implement the same criteria for rating the quality of the photographs. This task is at its final stage and proved to be challenging as different coding entries from multiple users were too complex to be implemented. The solution was to have one dedicated user to conduct the photo-quality coding (analyst) and a second user (supervisor) to review and validate them. The final accepted coding for photo-quality will be used as an input to filter the encounter histories of the individuals. This will decrease bias from different observers coding photo-quality and impacting the final results.

According to the SHBWC blue whale photo quality coding guide, photographs are evaluated based on angle (of the whale to the photographer), exposure (lighting), and focus. Based on a combination of these attributes (each to be weighted equally during evaluation), the overall quality of the photographs are categorized into one of four categories: 1=Excellent; 2=Good; 3=Fair; 4=Poor (Olson *et al.* 2018). Similar to the previous rationale, in order to avoid bias from different subjective views on each component and then

applying an arbitrary (mathematically) weighting, the photo-quality analyst will be asked to provide the overall quality of the photos that accounts for all three components (angle, focus and exposure). This will simplify the process since there will be only one entry to evaluate the quality of the photo that will be used for photo-ID capture-recapture.

Finally, the IWC purchased a server compatible with the SHBWC structure in order to support the existing catalogue and the software has been installed on the server. The migration of the entire SHBWC database to the IWC server in Cambridge, England has not yet been implemented due to IWC financial limitations and the ongoing funding for database hosting being removed from the SC budget.

As pointed out last year, because a large number of new improvements to the SHBWC software have been implemented, it will be necessary to update the 2016 user manual, which is proposed to be undertaken in 2019 after the photo-quality coding tools are fully implemented.

## **CURRENT AND NEXT STEPS**

Matching process is almost finished for Australia-New Zealand-Sri Lanka with data received prior to 2018. Photo-quality coding of these datasets are underway and funds have already been secured to perform this task. This will allow the work to estimate abundance of blue whale populations by capture-recapture to be commenced in this area, which has been a primary goal of IWC. However, there are some groups that have joined the SHBWC before the capability of uploading date and location data and it will be necessary for them to upload their data on dates and locations in order to advance with abundance estimates.

Research groups from Chile have also advanced in the contribution of their datasets to the catalogue, which will considerably increase the number of photo-IDs from this region (+300 IDs). The matching process within this region is planned to commence in 2019 and hopefully be completed in 2020. Almost all associated data will be available but there are still a few groups that will need to upload this information to the catalogue in order to progress with abundance estimates. Photo quality codes will also be required; however there is no budget currently for this item.

Additionally, it seems there may be some typographical errors in the database, particularly regarding sighting dates, that need to be reviewed, particularly with regard to sighting dates. Therefore sending a summary of whale sightings details to each contributor group and asking them to review and/or complete the form is proposed.

Finally, there is a need to decide how to manage the data provided by one contributor from blue whales off Sri Lanka that still require processing before uploading to the catalogue is possible. These data are potentially highly valuable and should be considered for use in an assessment of northern Indian Ocean blue whales.

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**Table 1 – Summary of blue whale photographic collections and catalogues in the SHBWC**

Region	Group	Fluke	Left Side	Right Side	Area
Gulf of California-ETP-SouthAmerica	CCC	0	288	299	Chile
	SWFSC	0	60	53	Peru, Ecuador, ETP
	IWC Chile	0	14	9	Chile
	MERI	9	48	45	Chile
	CBA-UACH	0	0	0	Chile
	EUTROPIA	0	0	0	Chile
	PANTHALASSA	0	0	0	Chile
	<b>Sub-total</b>	<b>9</b>	<b>410</b>	<b>406</b>	
Indonesia-Australian-NewZealand	BWS	5	85	84	Australia
	WWR	0	30	23	Australia
	Asha de Vos	0	89	79	Sri Lanka
	CWR	50	204	212	Australia
	CMST	0	0	0	Australia
	MARVEL	0	15	12	Australia
	OSU	5	40	36	New Zealand
	AAD-Australia	0	35	36	Australia
	AAD-NewZealand	0	12	11	Australia
	NIWA	1	7	2	New Zealand
	BF	0	0	0	Sri Lanka
	KWA	0	0	0	Australia
<b>Sub-total</b>	<b>61</b>	<b>517</b>	<b>495</b>		
Southern Ocean	IWC SOWER	0	158	157	Antarctica
	MRI-SO	0	19	13	Antarctica
	AAD-Antarctica	0	67	77	Antarctica
	KWA-SO	0	0	0	Antarctica
	<b>Sub-total</b>	<b>0</b>	<b>244</b>	<b>247</b>	Antarctica
West and Central Indian Ocean	MRI-SA	0	0	0	South Africa, Madagascar
	Gardline	0	0	0	South Africa, Madagascar
	<b>Sub-total</b>	<b>0</b>	<b>0</b>	<b>0</b>	
	<b>TOTAL</b>	<b>70</b>	<b>1171</b>	<b>1148</b>	