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Progress report on Southern Hemisphere  
Blue Whale Catalogue: Period June  
2016-May 2017

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INTERNATIONAL  
WHALING COMMISSION

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## ABSTRACT

The Southern Hemisphere Blue Whale Catalogue has a total of 1,520 individual blue whale photo-identifications (photo-IDs) that include areas off Antarctica, Chile, Peru, Ecuador-Galapagos, Eastern Tropical Pacific, Australia, Timor Leste, New Zealand, Southern Africa, Madagascar and Sri Lanka. In 2016-2017, the catalogue increased about 13% with the addition of new photo-IDs. To date matches have been found only within region but not between regions. With increasing photo-ID numbers, a re-evaluation of matching priorities is proposed in order to fulfill IWC assessment requirements. Therefore, future work will focus on within region comparisons in the upcoming years to be used for assessment purposes while between region comparisons to check for migration and connectivity will be considered as second priority.

## INTRODUCTION

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

The Southern Hemisphere Blue Whale Catalogue (SHBWC) is an international collaborative effort to facilitate cross-regional comparison 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 is specially designed online software that allows for simultaneous upload and comparisons of catalogues from different areas (IWC, 2009).

To date more than 1,500 individual blue whales have been contributed to the SHBWC from research groups working in areas 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 to model abundance estimates. The results will greatly contribute to the IWC Southern Hemisphere blue whale assessments.

The present report summarizes the progress made between June 2016 to May 2017 on the work of the SHBWC.

## USERS & UPLOADING OF CATALOGUES

Several groups already fully uploaded their catalogue and consequently, their user category was upgraded to have full viewing access of the other catalogues.

Catalogues currently maintained at the SHBWC include waters off Antarctica, Chile, Peru, Ecuador-Galapagos, in the Eastern Tropical Pacific, off southeastern Australia, western Australia, Timor Leste, New Zealand, Southern Africa, Madagascar and Sri Lanka. A total of 1,520 blue whales are currently comprised in the catalogue, accounting for 1,116 right side photo-IDs, 1,131 left side and 60 flukes (Table 1). This represents an increase of about 13% of the total catalogued whales thanks to the new photo-ID whales received in 2016-2017.

The Antarctic sub-catalogue uploaded to the SHBWC includes photographs of 208 individual blue whales meeting quality criteria collected during IWC IDCR/SOWER surveys from 1987-1988 to 2008-2009 and covers all six IWC Management Areas (Olson, 2012). It also includes 89 whales from the Australian Antarctic Division (AAD) from 2013-2015 and recently 16 blue whales ID from the Mammal Research Institute Whale Unit, University of Pretoria have been incorporated.

The eastern South Pacific Ocean sub-catalogue includes photographs of a total of 418 individuals including 21 whales photographed during the 1997/98 IWC/SOWER survey off Chile (Findlay *et al.*, 1998; Galletti Vernazzani and Cabrera, 2011) and 397 whale ID's from the catalogue of Centro de Conservacion Cetacea photographed off southern Chile between 2004 and 2009 (Galletti Vernazzani *et al.*, 2010).

The ETP sub-catalogue includes photographs of 84 individuals contributed by the SWFSC/NOAA collected during various years from 1992 to 2009. Of these, 11 whales were photographed near the Galapagos Islands, 23 in the oceanographic cold equatorial tongue that extends westward from the Galapagos, 18 in Peruvian waters, and 32 at the Costa Rica Dome (Gerrodette and Olson, unpublished data; see Fig. 7 Branch *et al.* 2007b).

The Indonesia/Australian/New Zealand sub-catalogue includes photographs of 699 individuals contributed by Blue Whale Study Inc. (BWS) and AAD from Bonney Upwelling, Western Whale Research (WWR) from Geographe Bay & Timor Leste, Center for Whale Research Western Australia (CWR) from Perth Canyon, Flinders University, Asha de Vos from Sri Lanka and Oregon State University and AAD from New Zealand.

New groups with photo-IDs from West and Central Indian Ocean region (Madagascar, Kenya, Sri Lanka) as well as new groups from Chile joined the SHBWC. Therefore photo-IDs from these areas are expected to significantly increase in the upcoming years. Overall, 17 blue whale research groups from all regions are contributing to the SHBWC.

New ToR for the SHBWC was agreed by the IWC in 2016. These clarify the rights of all catalogue submitters and also require data on the date and location of each photo-identified whale to be provided on upload. This is so that assessments of regional population abundance are possible with the data provided by contributors. It is expected that the groups that are already members with previous ToR and data sharing agreement would sign the new updated agreement. All data are protected and will be used only for IWC assessment purpose. To date, new groups joining the SHBWC have signed the new ToR. Of the old groups only few have signed the new ToR so far.

## MATCHING PROGRESS

Regional comparisons of catalogues uploaded before December 2015 within Australia/New Zealand/Indonesia are completed. Five whales were re-sighted within all three areas of Australia (Perth Canyon, Geographe Bay and Bonney Upwelling) but no matches were found with New Zealand blue whales (Galletti Vernazzani *et al.* 2016). Regional comparisons within Southern Ocean have been made with catalogues through 2017. Fourteen whales from the Southern Ocean were re-sighted in multiple years;

five of the whales were re-sighted within 19 to 753 km of their original location and one whale had a 12-year sighting interval (Olson *et al.*, 2016a). Regional comparisons within ETP and South America have been done with catalogues uploaded until 2009. One match has been found over a ten-year period in southern Chile (Galletti and Cabrera, 2011).

Between regions comparisons of Antarctica, ETP and Chile uploaded until 2009 have also been finalized. No matches were found for left and right sides (Galletti Vernazzani and Olson 2013, Olson *pers. comm.*).

With increasing numbers of groups joining the SHBWC and consequently an increasing amount of photo-IDs, the number of hours needed for the matching process has also significantly increased. Currently, the salary for matching process considered under 2016-2018 SHBWC period for matchers is unrealistic (10GBP/hour) making it difficult to hire experienced matchers to conduct the work. In order to ensure the work is being done, the regional coordinators have proposed what is considered the necessary amount of salary (19,5GBP/hour or 25US\$/hour) to hire experienced matchers. But it will reduce the amount of comparisons made which will ultimately delay the completion of the work. Table 2 shows the funding amount requested (of the IWC) and a more realistic funding amount needed. In summary, to ensure all the work is done, additional funding sources will be needed or the work will take more time to be complete. If this option is not implemented, it will be difficult to hire persons to conduct this work.

Fewer photo-ID's than expected were received from Australia-NewZealand-Indonesia, therefore a reduction of the amount of time and budget for 2017-2018 matching has been adapted (Tables 2 and 3). In addition, the matching process with new photo-ID from Southern Ocean that was scheduled for 2018 has already been fully completed with SORP funding, consequently reducing the amount of budget needed for this region. Results from the matching process have revealed no matches and are reported by Olson *et al.* (2017).

In this sense a re-schedule of the work on SHBWC is proposed by regional coordinators to be more realistic (Table 3). Considering that IWC blue whale assessment is a priority, within region comparisons are considered the highest priority while between region comparisons to assess migration and connectivity are considered second priority. While this option allows completing within region comparisons of new contributions made before 2017 by the end of 2018, between region comparisons will only have 45% of completion for Australia-NewZealand-Indonesia vs Antarctica and 40% of completion for Australia-NewZealand-Indonesia vs ETP-SouthAmerica. These do not include comparisons within or between the new uploaded photo-IDs since 2017; those are expected to take place from 2019 onwards.

It has to be considered that the increase in new groups joining the SHBWC and new photo-ID's are expected to stabilize over the years since most catalogues will be soon fully contributed and so only new field seasons should be expected. Therefore, in the future, it is likely that more between region comparisons could take place.

Finally, considering that the matching process should be conducted by an experienced people, it has been proposed to develop a test for blue whale matching to ensure matchers capabilities and that left and right side comparisons are conducted by different matchers in order to reduce the likelihood of missing matches.

## **SOFTWARE IMPROVEMENTS**

The IWC purchased a server compatible with SHBWC structure in order to support the existing catalogue. Currently, the software has been installed and is being tested. Migration of the entire SHBWC software and database to the IWC server in Cambridge, England will follow after the server is fully tested.

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

These includes among others to make mandatory data on date and location, an option that has already been implemented. Considering that many contributors uploaded their catalogues without this information, a

software tool to import data on date and location from Excel files into the SHBWC is being developed to facilitate the uploading of this information. In addition, the possibility to include more sightings per whale ID has also already been implemented.

Future improvements being developed that were also suggested by the IWC include the inclusion of TAG data (name and number), age class and biopsy label. In addition, the development of matching reports, list of members and definition of regions among others have been proposed.

Protocols for back-up should consider daily back-ups of the data that can be kept for a month and deleted afterwards. In addition, it will be needed to keep a monthly back-up. Therefore, if some data is lost, a previous version is always accessible.

## **OTHER MATTERS**

The SHBWC English manual was updated in 2016 and has been distributed to contributors. With new software improvements made during the inter-sessional period and expected in the near future, an updated user manual should be prepared.

Regional coordinators of the SHBWC gave some presentations at the “Workshop on Southern Hemisphere blue, fin and humpback whale catalogues from the Central and Eastern South Pacific and the Antarctic Peninsula” held on 2 December 2016 in Chile, following the biennial meeting of the Society of Aquatic Mammal Experts of Latin America (IWC, 2017). As a result of the workshop, three research groups from this region decided to join the SHBWC.

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**Table 1 – Summary of photographic collection of blue whale catalogues under the SHBWC**

<b>Region</b>	<b>Group</b>	<b>Fluke</b>	<b>Left Side</b>	<b>Right Side</b>	<b>Area</b>
Gulf of California-ETP-SouthAmerica	CCC	0	288	299	Chile
	SWFSC	0	60	53	Peru, Ecuador, ETP
	IWC Chile	0	14	9	Chile
	MERI	0	0	0	Chile
	CBA-UACH	0	0	0	Chile
	EUTROPIA	0	0	0	Chile
	<b>Sub-total</b>	<b>0</b>	<b>362</b>	<b>361</b>	
Indonesia-Australian-NewZealand	BWS	5	84	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	41	36	New Zealand
	AAD-Australia	0	47	47	Australia
	AAD-NewZealand	0	15	15	Australia
	<b>Sub-total</b>	<b>60</b>	<b>525</b>	<b>508</b>	
Southern Ocean	IWC SOWER	0	158	157	Antarctica
	MRI-SO	0	19	13	Antarctica
	AAD-Antarctica	0	67	77	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>60</b>	<b>1131</b>	<b>1116</b>	

**Table 2 – Matching hours needed, salary granted by IWC, salary needed.**

	2017			2018		
	Total hours	Total GBP requested to IWC	Total GBP realistic estimate	Total hours	Total GBP requested to IWC	Total GBP realistic estimate
New Australia-NZ-Indonesia (ANI)	380	3.795	<b>7.400</b>	214	2.139	<b>4.171</b>
New ETP-SEP	-	-	-	120	1.200	<b>2.340</b>
New Antarctica	-	-	-	44	436	<b>850</b>
ANI vs Antarctica	337	3.366	<b>6.563</b>	337	3.366	<b>6.563</b>
ANI vs ETP-SEP	636	6.360	<b>12.402</b>	636	6.360	<b>12.402</b>
	<b>1.353</b>	<b>13.521</b>	<b>26.365</b>	<b>1.351</b>	<b>13.501</b>	<b>26.326</b>

**Table 3 – Working option with reduced amount of time.**

Option 1	2017		2018		% of total completion 2017-2018
	Hours	Total GBP Realistic estimate	Hours	Total GBP Realistic estimate	
New ANI <sup>1</sup>	270	5.265	183	4.171	100
New ETP-SEP	-	-	120	2.340	100
New Antarctica	44 <sup>2</sup>	0	0	0	100
ANI vs Antarctica	173	3.366	130	2.531	45
ANI vs ETP-SEP	251	4.890	260	5.063	40
	<b>737</b>	<b>13.521</b>	<b>692</b>	<b>13.501</b>	

<sup>1</sup> Reduced amount of hours and budget for 2017 and 2018 with fewer contributions received

<sup>2</sup> Matching already conducted with SORP funding