

SC/68B/PH/02

Preliminary results of comparisons within
Southern Hemisphere Blue Whale
Catalogue (SHBWC) Project in the
Southeast Pacific and Eastern Tropical
Pacific region

Barbara Galletti Vernazzani, Elsa Cabrera, Sonia
Espanol, Ken Findlay, Paula Olson and Frederick Toro



INTERNATIONAL
WHALING COMMISSION

Preliminary results of comparisons within Southern Hemisphere Blue Whale Catalogue (SHBWC) Project in the Southeast Pacific and Eastern Tropical Pacific region

Barbara Galletti Vernazzani, Elsa Cabrera, Sonia Español, Ken Findlay, Paula Olson and Frederick Toro

Abstract

Blue whales are known to occur in the South Pacific and Eastern Tropical Pacific but little is known about their long-term movements. The Southern Hemisphere Blue Whale Catalogue is a platform to share individual photo-identification catalogues among blue whale research groups. Comparisons of 838 photo-identified blue whales from five different research groups working in southern and northern Chile and ETP provided ten whales re-sighted. Matches were found only within southern Chile, consistent with the strong site fidelity previously reported for this area. The longest re-sightings occurred over 10 years for three different whales. Matching process is still ongoing and will provide further insight on this blue whale population over these different areas.

Introduction

Three subspecies of blue whales are currently recognized in the Southern Hemisphere: the pygmy blue whale (*Balaenoptera musculus brevicauda*) in the Indian Ocean and western Pacific Ocean; the Antarctic blue whale (*B. m. intermedia*) that summers in the Antarctic Zone, and the yet unnamed Chilean blue whale (*B.m. spp.*) that has recently been accepted by the Taxonomy Committee of the Society for Marine Mammalogy¹. These subspecies are morphologically (Branch *et al.* 2007; Pastene *et al.* 2020), genetically (LeDuc *et al.* 2007; LeDuc *et al.* 2017), and acoustically (McDonald *et al.* 2006) distinct.

Blue whales are known to feed during the austral summer and autumn (late December to early May) in southern Chile off Isla de Chiloe-Corcovado Gulf (Cummings and Thompson 1971a, b; Gilmore 1971; Findlay *et al.* 1998; Hucke-Gaete *et al.* 2004; Cabrera *et al.* 2005; Abramson and Gibbons, 2010; Forsterra and Haussermann 2012; Galletti Vernazzani *et al.* 2012a). An additional feeding aggregation of blue whales off Isla Chanaral, northern Chile was first reported in 2012 (Galletti Vernazzani *et al.* 2012b).

Photo-identification data from long-term studies as well as a coordinated, multi-site effort is required so that the population abundance, trend and connectivity of blue whales can be assessed accurately (IWC 2017). Since 2008, the International Whaling Commission (IWC) Scientific Committee has supported the collaborative Southern Hemisphere Blue Whale Catalogue (SHBWC) (IWC 2009).

To date, the SHBWC represents the most important collection of regional blue whale catalogues in the Southern Hemisphere. Blue whales off Chile and Australia has become assessment priorities for the sub-committee on Other Southern Hemisphere Whale Stock population assessments (IWC 2017).

Previous photo-identification comparisons from SHBWC catalogues from areas off the Eastern South Pacific, the Eastern Tropical Pacific, the Southern Ocean (Galletti Vernazzani and Cabrera 2011; Galletti Vernazzani and Olson 2012; Olson *et al.* 2020) and waters off Australia, New Zealand and Sri Lanka (Galletti Vernazzani *et al.* 2019) have been reported.

The first matching process for Chile was conducted with about 300 individuals uploaded to the SHBWC through 2009. One match was found over a ten-year period in southern Chile (Galletti and Cabrera 2011).

Following the first matching process, with photos through 2019, important new contributions have been received under the SHBWC for the Southeast Pacific (Galletti Vernazzani *et al.* 2020) and matching

¹ <https://www.marinemammalscience.org/species-information/list-marine-mammal-species-subspecies/>

process has started. This paper presents preliminary results of comparisons between catalogues of blue whales off Chile, Peru and ETP received at the SHBWC until March 2020.

Methods

Major catalogues from different research groups have been contributed to the SHBWC that now comprises more than 1,773 individual blue whales. These whales have been geographically separated into four major regions from waters off 1) Antarctica region, 2) Australia/New Zealand/Indonesia region, 3) Southern Africa/Madagascar region and 4) Gulf of California/Eastern Tropical Pacific/South America region (Galletti Vernazzani *et al.* 2020).

By March 2020, the Gulf of California/Eastern Tropical Pacific/South America sub-catalogue of the SHBWC included photographs of 838 individuals comprising 619 left side IDs, 625 right side IDs, and 11 photo-IDs from flukes (Table 1).

The regional catalogue from Gulf of California/Eastern Tropical Pacific/South America area were contributed by the 1997/98 IWC/SOWER survey off Chile, Centro de Conservacion Cetacea off southern and northern Chile between 2004 and 2015, MERI Foundation off southern Chile between 2014 and 2017, Panthalassa off northern Chile between 2010 and 2019, SWFSC/NOAA during various years between 1992 to 2009 off the Galápagos Islands, Peruvian waters and the Costa Rica Dome, and opportunistic sightings off Peru, northern Chile and southern Chile from 2010-2018. Details on opportunistic sightings are given in Table 2.

Blue whales are individually identifiable from the unique pattern of mottling on both sides of the body near the dorsal fin (Sears *et al.* 1990), and from the highly variable dorsal fin shape (Gendron and Ugalde de la Cruz 2012). Separate photographic collections for left sides, right sides and flukes are maintained under the SHBWC. Left side, right side, and fluke photographs of individual blue whales were compared between each group to determine the number of individuals re-sighted in different study sites.

For this report only whales received before March 2020 from South America and ETP are compared (n=838 IDs).

Results

Comparisons of left sides photo-IDs are about 80% completed. Right side comparisons are scheduled to commence after left side is completed. Recently uploaded catalogues from Panthalassa (northern Chile) and opportunistic sightings have not been compared yet but have been scheduled.

To date, ten matches have been found. All the matches were obtained from CCC off northwestern Isla de Chiloe (41.94°S - 74.03°W) and from MERI off Chaiten (42.90°S - 72.80°W) in front of the east inlets of Isla de Chiloe. One duplicate individual was found on the CCC catalogue during matching process.

The longest sighting recaptures were recorded over a period of ten years on three different whales (Matching ID 1, 2 and 3). All these whales were first sighted on February 2006 off northwestern Isla de Chiloe by CCC and were last time sighted on 2016 by MERI foundation off Chaiten. One of the whales with longest sighting recapture (Matching ID 1), named *Valentina* under CCC catalogue, has been sighted ten times and recorded on six different years. One whale has been seen on five occasions on three different years, another whale on four occasions on three different years, two other whales on three different occasions over three different years and four whales seen on two occasions from two different years.

No matches have yet been found between South America blue whales and ETP blue whales, or within northern Chile and southern Chile.

Discussion and conclusions

Our results found several matches only between blue whales off southern Chile. This is consistent with the high overall annual return previously reported for Isla de Chiloe (Galletti Vernazzani *et al.* 2012, 2017).

Using photo-ID data from 2004 to 2012, blue whales feeding in the waters off Isla de Chiloe are estimated to number ~570-760 whales, with periodic fluctuations in abundance suggesting that use of this area varies between years (Galletti Vernazzani *et al.* 2017). Forsterra and Haussermann (2012) also reported that two out of five opportunistically sightings in the east inlets waters of Chiloe region were previously sighted off northwestern Isla de Chiloe. The ten matches found in this study off west coast of Isla de Chiloe and then resighted off Chaiten in the east inlets of Chiloe region provides further evidence about the connectivity of the southern Chile feeding area.

Galletti Vernazzani *et al.* (2017) also reported that blue whales were not equally connected to Isla de Chañaral (northern Chile) because of lack matches to any whales previously identified in Chiloe. Only one match between northern and southern Chile has been reported (Galletti Vernazzani *et al.* 2012) to date. In this regard, it has been suggested that Chilean blue whales regularly visit multiple feeding sites along the Chilean coast during the summer season, explaining both the regional site fidelity and the lack of population structuring between feeding sites (Galletti Vernazzani *et al.* 2017).

Although no matches have yet been found during the matching process between northern and southern Chile, comparisons are still on-going for these regions that prevent giving further conclusions.

Based on year-round sightings of unidentified blue whales, the Eastern Tropical Pacific (ETP - Costa Rica Dome, Galapagos waters) has been proposed as possible winter destination of this population (Reilly and Thayer 1990; Palacios 1997). Genetic, acoustic, satellite tag and photo-identification data have found connections between the whales found off southern Chile and the ETP (Buchan *et al.* 2014, 2015; Torrez-Flores *et al.* 2015, Huckle-Gaete *et al.* 2018). These observations strongly suggest that at least some Chilean blue whales from southern Chile feeding grounds migrate to west of the Galapagos Islands and into the Eastern Tropical Pacific (ETP) for breeding and calving.

Comparisons between Chile and ETP, Galapagos Islands and Peru are still ongoing, but the lack of matching suggest that if found, only some Chilean blue whales may be migrating to these areas.

Acknowledgements

We specially thank Tymen Engelaar for his assistance in the photo-identification process. We would like to thank Vreni Haussermann and Fundacion Huinay, Fabian Ritter, Juan Pablo Castro, Aldo Pacheco, Fiorella Sanchez Salazar, Marcelo Flores, Ana María Cegarra, Sheila Wright, Isabella Clegg and Julia O'Hern for their contribution with opportunistic photo-IDs. We also thank the International Whaling Commission and its Scientific Committee for supporting the Southern Hemisphere Blue Whale Catalogue. In memory of Dr. Carole Carlson who greatly contributed to the knowledge of the Chilean blue whale population.

References

- Abramson, J. and Gibbons, J. 2010. New records of blue whales *Balaenoptera musculus* (Linnaeus, 1758) in winter season in the inlet waters of Chiloe continental – Chile. *Anales Instituto Patagonia, Serie Cs Nat.* (Chile) 38(2): 107–09.
- Branch, T.A., Abubaker, E.M.N., Mkango, S. and Butterworth, D.S. 2007. Separating southern blue whale subspecies based on length frequencies of sexually mature females. *Mar. Mammal Sci.* 23(4): 803-33.
- Buchan, S.J., Stafford, K. M. and Huckle-Gaete, R. 2015. Seasonal occurrence of southeast Pacific blue whale songs in southern Chile and the eastern tropical Pacific. *Marine Mammal Science*, 31(2): 440-458.
- Buchan, S.J., Huckle-Gaete, R., Rendell, L. and Stafford, K.M. 2014. A new song recorded from blue whales in the Corcovado Gulf, Southern Chile, and an acoustic link to the Eastern Tropical Pacific. *Endangered Species Research* 23: 241-252.
- Cabrera, E., Carlson, C.A. and Galletti Vernazzani, B. 2005. Presence of blue whale (*Balaenoptera musculus*) in the northwestern coast of Chiloe Island, southern Chile. *LAJAM* 4(1): 73–74.
- Cummings, W.C. and Thompson, P.D. 1971a. Bioacoustics of marine mammals: R/V Hero Cruise 70±3. *Antarctic Journal*; X:158±60.
- Cummings, W.C. and Thompson, P.D. 1971b. Underwater sounds from the blue whale, *Balaenoptera musculus*. *J. Acoust Soc Am.*; 50:1193.
- Findlay, K., Pitman, R., Tsurui, T., Sakai, K., Ensor, P., Iwakami, H., Ljungblad, D., Shimada, H., Thiele, D., Van Waerebeek, K., Huckle-Gaete, R. and Sanino, G.P. 1998. 1997/1998 IWC-Southern Ocean Whale and Ecosystem Research (IWC-SOWER) blue whale cruise, Chile. Paper SC/50/Rep2. International Whaling Commission, Cambridge, United Kingdom. 40pp
- Forsterra, G. and Haussermann, V. 2012. Report on blue whales sightings (*Balaenoptera musculus*, Linnaeus, 1758) in a narrow fjord during autumn-winter in southern Chile (Mammalia, Cetacea, Balaenopteridae). *Spixiana*; 35(2):237±45.
- Galletti Vernazzani, B. and Cabrera, E. 2011. Long term mark-recapture of blue whales in Chilean Waters. Paper SC/63/SH8 presented to the IWC Scientific Committee.
- Galletti Vernazzani, B. and Olson, P. 2012. Progress of between region comparison under Southern Hemisphere Blue Whale Catalogue (SHBWC). Paper SC/64/SH20 presented to the IWC Scientific Committee.
- Galletti Vernazzani B., Carlson C., Cabrera E., Brownell Jr. R.L. 2012a. Chilean blue whales off Isla Grande de Chiloe, 2004-2010: distribution, site-fidelity and behaviour. *J. Cetacean Res. Manage.* 12(3):353–360.
- Galletti Vernazzani, B., Brownell Jr, R.L., Cabrera, E., Carlson, C.A. and Sironi, M. 2012b. Update on 2012 blue whale field season in Chile. Paper SC/64/SH18 presented to the IWC Scientific Committee, May 2012 8pp [Available from IWC].
- Galletti Vernazzani B., Jackson J.A., Cabrera E., Carlson C.A., Brownell Jr. R.L. 2017. Estimates of Abundance and Trend of Chilean blue whales off Isla de Chiloé, Chile. *PLoS ONE* 12(1): e0168646.
- Galletti Vernazzani, B., Attard, C.R.M., Barlow, D.R., Burton, C., de Vos, A., Double, M., Gill, P., Jenner, C., Jenner, M-N., Moller, L.M., Olson, P., Salgado-Kent, C. and Torres, L.G. 2019. Southern Hemisphere Blue Whale Catalogue: preliminary results of IWC comparisons between Australia, New Zealand and Sri Lanka regions. Paper SC/68a/SH/04 presented to the IWC Scientific Committee, May 2019 (unpublished). 9pp. [Available from the IWC]
- Galletti Vernazzani. 2020. Progress on Southern Hemisphere Blue Whale Catalogue: Period May 2019-April 2020. Paper SC/68b/SHxx presented to the IWC Scientific Committee.
- Gendron, D. and A. Ugalde de la Cruz. 2012. A new classification method to simplify blue whale photo-identification technique. *J. Cetacean Res. Manage.* 12(1):79–84

- Gilmore, R.M. 1971. Observations on marine mammals and birds off the coast of southern and central Chile, early winter 1970. *Antarctic Journal*; X:10±1.
- Hucke-Gaete, R., Osman, L.P., Moreno, C.A., Findlay, K.P. and Ljungblad, D.K. 2004. Discovery of a blue whale feeding and nursing ground in southern Chile. *Proc. R. Soc. Lond. Ser. B.* 271: S170–S173.
- Hucke-Gaete, R. Luis Bedrinana-Romano, L., Viddi, F.A., Ruiz, J.E., Torres-Florez, J.P. and Zerbini, A.N. 2018. From Chilean Patagonia to Galapagos, Ecuador: novel insights on blue whale migratory pathways along the Eastern South Pacific. *PeerJ* 6:e4695; DOI 10.7717/peerj.4695
- International Whaling Commission. 2009. Report of the Scientific Committee. 1-13 June 2008, Santiago, Chile. *J. Cetacean Res. Manage.* 11 (Suppl.). 74pp. [Available from the IWC]
- International Whaling Commission. 2017. Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks. *J. Cetacean Res. Manage. (Supp.)* 18:230-263.
- LeDuc, R.G., Dizon, A.E., Goto, M., Pastene, L.A., Kato, H., Nishiwaki, S., LeDuc, C. and Brownell Jr., R.L. 2007. Patterns of genetic variation in Southern Hemisphere blue whales and the use of assignment test to detect mixing on the feeding grounds. *J. Cetacean Res. Manage.* 9:73-80.
- 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. *Molecular Ecology* 26:740-751.
- McDonald, M.A., Mesnick, S.L. and Hildebrand, J.A. 2006. Biogeographic characterisation of blue whale song worldwide: using song to identify populations. *J. Cetacean Res. Manage* 8:55-65.
- Olson, P.A., Double, M.C., Matsuoka, K., Pastene, L., and Findlay, K. 2020. The Antarctic Blue Whale Catalogue: new data from 2015-2019. Paper SC/68b/PH presented to the IWC Scientific Committee, May 2020. [Available from IWC]
- Pastene, L.A., Acevedo, J., and Branch, T.A. 2020. Morphometric analysis of Chilean blue whales and implications for their taxonomy. *Marine Mammal Science* 36:116-135.
- Palacios, D. 1997. Blue whale (*Balaenoptera musculus*) occurrence off the Galapagos Islands, 1978–1995. *J. Cetacean Res. Manage* 1:41–51.
- Reilly, S. B., and V. G. Thayer. 1990. Blue whale (*Balaenoptera musculus*) distribution in the eastern tropical Pacific. *Marine Mammal Science* 6:265–277.
- Sears R., Williamson J.M., Wenzel F.W., Bérubé M., Gendron D., Jones, P. 1990. Photographic identification of the blue whale (*Balaenoptera musculus*) in the Gulf of St. Lawrence, Canada. *Rep. int. Whal. Commn (special issue)* 12:335-42.
- Juan Pablo Torres-Florez, J.P., Olson, P.A., Bedrinana-Romano, L., Rosenbaum, H.C., Ruiz, J., LeDuc, R., and Hucke-Gaete, R. 2015. First documented migratory destination for eastern South Pacific blue Whales. *Marine Mammal Science* 31(4): 1580–1586

Table 1 – Summary of photographic collection of blue whale photo-identifications under the Gulf of California/ETP/South America sub-catalogue of the SHBWC as of March 2020

Group	Years	Whales IDs	Fluke	Left	Right	Area
SWFSC	1992-2009	83	0	60	53	Peru, Ecuador, ETP
CCC	2004-2015	621	0	469	484	Northern and southern Chile
IWC Chile	1997-1998	21	0	14	9	Chile
MERI	2014-2017	60	9	48	45	Southern Chile
Phantalassa	2010-2019	37	2	16	28	Northern Chile
Opportunistic Southeast Pacific	2010-2018	16	0	12	6	All
Sub-total		838	11	619	625	

Table 2 – Summary of opportunistic blue whale photo-identifications off Southeast Pacific as of March 2020

WhaleID	Contributor	Date of sighting	Location	Lat	Long
Huinay10_001	Vreni Haussermann – Huinay Foundation	24-04-2010	Fiordo Comau, southern Chile	-42,314012	-72,485994
Huinay10_002	Vreni Haussermann – Huinay Foundation	24-04-2010	Fiordo Comau, southern Chile	-42,314012	-72,485994
Huinay10_003	Vreni Haussermann – Huinay Foundation	26-05-2010	Fiordo Comau, southern Chile	-42,314012	-72,485994
Huinay10_004	Vreni Haussermann – Huinay Foundation	26-05-2010	Fiordo Comau, southern Chile	-42,314012	-72,485994
Huinay10_005	Vreni Haussermann – Huinay Foundation	26-05-2010	Fiordo Comau, southern Chile	-42,314012	-72,485994
Chiloe11	Fabian Ritter	02-03-2011	Cruce Corcovado-Moraleda, southern Chile	-43,534640	-73,347384
Chiloe13	Juan Pablo Castro	01-02-2013	Isla Lilihuapi, southern Chile	-42,1444	-72,585000
Peru15	Aldo Pacheco / Fiorella Sanchez-Salazar	28-08-2015	Los Organos, northern Peru	-4,129233333	-81,1685
Peru15b	Aldo pacheco / Fiorella Sanchez-Salazar	28-08-2015	Los Organos, northern Peru	-4,129233333	-81,1685
Peru15c	Aldo pacheco / Fiorella Sanchez-Salazar	28-08-2015	Los Organos, northern Peru	-4,129233333	-81,1685
Corcovado16	Marcelo Flores	31-03-2016	Golfo Corcovado, southern Chile	-43.878	-73.23
Mejillones16	Ana Maria Garcia Cegarra	20-11-2016	Peninsula de Mejillones, northern Chile	-23,20861111	-70,6072222
Chiloe17	Sheila Wright	08-02-2017	Puñihuil, southern Chile	-41,92472222	-74,0391666
Chiloe17b	Sheila Wright	08-02-2017	Puñihuil, southern Chile	-41,92472222	-74,0391666
Peru18	Aldo Pacheco	12-08-2018	Los Organos, northern Peru	-4,09368	-81,0996
GolfoPenas18	Isabella Clegg	23-11-2018	Golfo Penas, southern Chile	-46,724682	-75,510022

Table 3 - Preliminary results from comparisons among SHBWC groups from South America and ETP as of March 2020

Whales IDs	Date and Location 1	Date and Location 2	Date and Location 3	Date and Location 4	Date and Location 5	Date and Location 6	Date and Location 7	Date and Location 8	Date and Location 9	Date and Location 10
L029, L321 and Bm019	17-02-2006 NW I. Chiloe	20-04-2007 NW I. Chiloe	21-04-2007 NW I. Chiloe	20-01-2008 NW I. Chiloe	02-03-2008 NW I. Chiloe	13-03-2008 NW I. Chiloe	20-02-2010 NW I. Chiloe	24-03-2010 NW I. Chiloe	04-03-2015 Chaiten	22-02-2016 Chaiten
L038 and Bm041	22-02-2006 NW I. Chiloe	12-02-2010 NW I. Chiloe	21-02-2016 Chaiten							
L051 and Bm032	24-02-2006 NW I. Chiloe	02-02-2008 NW I. Chiloe	10-02-2008 NW I. Chiloe	02-03-2008 NW I. Chiloe	18-02-2016 Chaiten					
L053 and Bm023	01-03-2006 NW I. Chiloe	22-02-2007 NW I. Chiloe	05-03-2015 Chaiten							
L284 and Bm065	19-04-2009 NW I. Chiloe	02-03-2016 Chaiten								
L337 and Bm043	06-04-2010 NW I. Chiloe	22-02-2016 Chaiten								
L358 and Bm076	25-04-2010 NW I. Chiloe	03-03-2017 Chaiten								
L458 and Bm037	15-03-2013 NW I. Chiloe	01-04-2013 NW I. Chiloe	23-02-2015 NW I. Chiloe	19-02-2016 Chaiten						
L487 and Bm072	04-03-2015 NW I. Chiloe	25-02-2017 Chaiten								