Photo-identification of Antarctic blue whales during the SORP Antarctic Blue Whale Voyage 2013

Paula A. Olson[1], Paul Ensor[2], Natalie Schmitt[2], Carlos Olavarria[2], Michael C. Double[2]

[1] Southwest Fisheries Science Center NMFS/NOAA, 8901 La Jolla Shores Drive, La Jolla, CA 92037 USA

[2] Australian Marine Mammal Centre, Australian Antarctic Division, 203 Channel Highway, Kingston, Tasmania 7001 Australia

Paula.Olson@noaa.gov

ABSTRACT

Fifty Antarctic blue whales were photo-identified during a 47-day research voyage in the Southern Ocean, 135°E-170°W. Eight whales were re-sighted during the voyage; the re-sighting rate was 16%, similar to the re-sighting rates from three recent IWC SOWER cruises. Time intervals between re-sights in 2013 ranged from 1 to 27 days. Straight-line distances between re-sights ranged from 15km to 1,172km with minimum daily movements ranging from 15km/day to 93km/day. One whale was initially photographed 1,172km from where it was satellite tagged (and re-photographed) 27 days later. Photographs of three whales from the voyage matched to the circumpolar Antarctic Blue Whale Catalogue with time intervals of 3, 5, and 6 years. These three whales exhibited long-range movements of thousands of kilometres between sighting locations including one whale that moved a minimum of 6,550km and 145° of longitude. The 2013 voyage was the first voyage of the Antarctic Blue Whale Project under the Southern Ocean Research Partnership (SORP). The photo-identification data collected during the voyage will contribute towards a new abundance estimate of Antarctic blue whales using mark-recapture methods.

KEYWORDS: ANTARCTIC, BLUE WHALE, PHOTO-ID, MOVEMENTS, MARK-RECAPTURE

INTRODUCTION

In 2013 the Australian Antarctic Division sponsored the first Antarctic Blue Whale Voyage as part of the Antarctic Blue Whale Project under the auspices of the Southern Ocean Research Partnership (SORP) (Double *et al.*, 2013b). The 2013 voyage was conducted in the expectation that it would be the first in a series of SORP voyages focused on Antarctic blue whales (*Balaenoptera musculus intermedia*) with goals including the production of a contemporary circumpolar estimate of abundance. Obtaining a current estimate of abundance is considered key for the assessment of the status of the Antarctic blue whale population and in monitoring its recovery.

A primary research objective of the voyage was to collect identification photos of Antarctic blue whales at a number sufficient for estimating abundance using mark-recapture methods (Double *et al.*, 2013a). Key methodology for the voyage was the use of passive acoustics to track and target vocalising Antarctic blue whales in order to maximize the number of individual blue whales photographed (a novel method, see Miller *et al*. 2013a). The photo-ID data will also provide information on blue whale population structure and movement. Photo-identification of Antarctic blue whales was undertaken previously during IWC IDCR/SOWER cruises and these photographs formed the basis of the Antarctic Blue Whale Catalogue (Olson, 2010; 2012). Prior to the 2013 voyage, the catalogue contained 227 identified individuals, representing 10% of the most recent population estimate of 2,280 (Branch, 2007). New identification photographs collected during the Antarctic Blue Whale Voyage will expand upon that work.

METHODS

The voyage was conducted from 30 January to March 17 2013 (47 days) aboard the 65m *FV Amaltal Explorer*. Twenty-nine days were spent in the study area south of 60°S, from 135°E to 170°W. Passive acoustics were used to locate and direct the ship to vocalising Antarctic blue whales (Miller *et al*., 2013a). When acoustically targeted blue whales were detected visually they were approached for photo-ID. One member of the research team would guide the ship (specific directions called to the bridge personnel) for the best approach to the whale(s). Both sides of each whale were photographed whenever possible. In good weather biopsy was

conducted at the same time as photography: typically two photographers and two biopsiers worked from the bow of the *Amatal Explorer*. In optimal weather conditions a RHIB was launched from the *Amaltal Explorer* to pursue blue whales for photo-id as well as biopsy and satellite tagging. When the RHIB was deployed one photographer worked on each vessel. In the roughest weather photography only was attempted from the *Amaltal Explorer*. DSLR cameras with image-stabilized zoom lenses were used.

Photographs of blue whales were judged generally to meet minimum criteria of quality based on distance to the subject (whale), focus, angle and lighting. Photographs meeting these criteria were considered suitable for identifying individual blue whales and were analysed for this report. Note that a more rigorous quality coding of photographs based on a 4-tiered system is currently underway and may slightly alter results presented in the future.

Identification photographs from the voyage were compared within season and to the Antarctic Blue Whale Catalogue, which contains photographs from the circumpolar Antarctic 1991-2012. Methods used followed those outlined in Sears *et al*. (1990).

RESULTS

Antarctic blue whales

Thirty-three groups of an estimated 82 Antarctic blue whales were approached for photo-ID; 75 of these whales were photographed. Post-voyage analysis of the photos identified 50 individual whales (39 left sides, 44 right sides). The other 25 identification photos (out of 75) were either of whales recognized as re-sights or the photos were poor quality due to weather - whales obscured by snow or sea state preventing a sufficiently close approach by the ship.

Re-sights within 2013 season

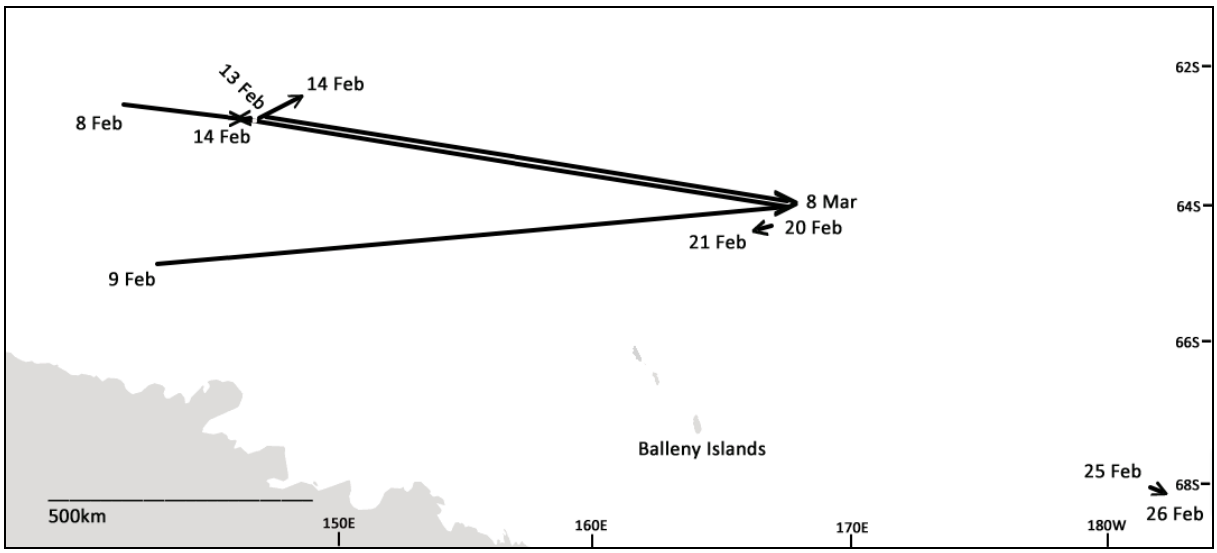
Eight Antarctic blue whales were re-sighted within the voyage with a time interval ≥1 day (24hrs). The re-sighting rate for the voyage was 16% (8/50). Time intervals between re-sights ranged from 1 to 27 days (Table 1). Straight-line distances between re-sights ranged from 15km to 1,172km (Fig. 1) with minimum daily movements ranging from 15km/day to 93km/day.

One whale was initially photographed 1,172km from where it was satellite tagged (and re-photographed) 27 days later.

Table 1. Sighting histories for eight Antarctic blue whales photographed during 2013. Distances were calculated using rhumb lines on a Mercator projection.

Whale ID	Date first sighting	Date re-sighting	Time interval between re-sights (days)	Distance between re-sights (km)	Average km/day
#1301	8 Feb	14 Feb	6	270	45
#1305	9 Feb	8 Mar	27	1,172	43
#1306	13 Feb	14 Feb	1	15	15
#1310	13 Feb	14 Feb	1	93	93
#1355	13 Feb	8 Mar	23	1,030	45
#1317	14 Feb	8 Mar	22	1,045	48
#1331	20 Feb	21 Feb	1	42	42
#1340	25 Feb	26 Feb	1	27	27

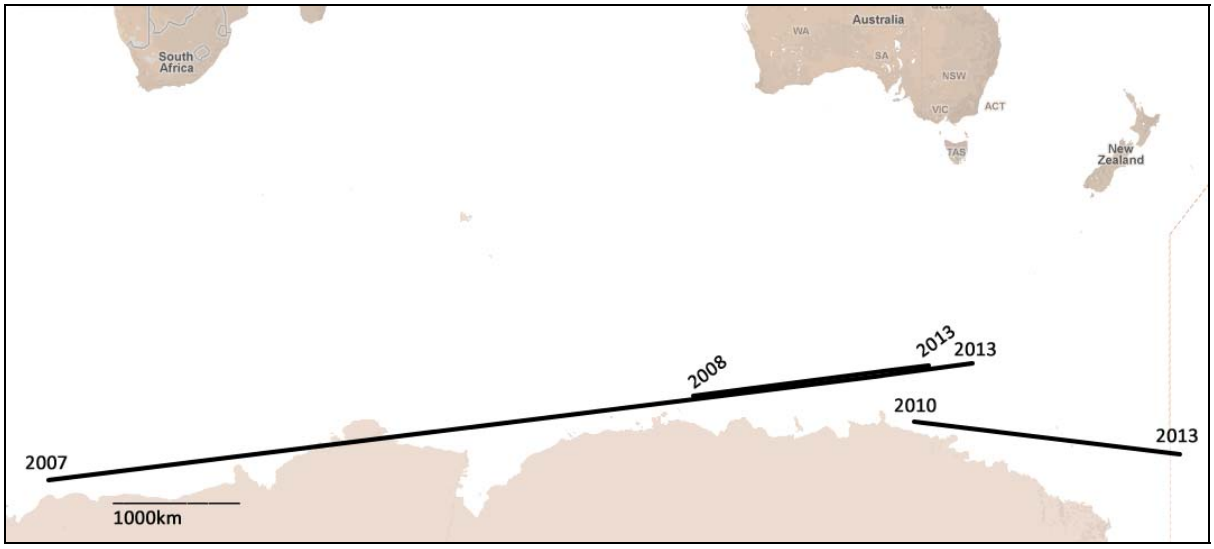
Figure 1. Movements of eight Antarctic blue whales photographed during the Antarctic Blue Whale Voyage 2013. Lines represent a straight-line distance between sighting locations, not actual whale movements.



Re-sights between years

Photographs of three Antarctic blue whales from 2013 matched with previously identified whales in the Antarctic Blue Whale Catalogue. The three matches revealed long-range movements of thousands of kilometres between sighting locations (Fig. 2). One whale moved a minimum of 6,550km and 145° of longitude between sighting locations. Time intervals were 3, 5, and 6 years.

Figure 2. Movements of three Antarctic blue whales re-sighted between years. Lines represent a straight-line distance between sighting locations, not actual whale movements.



New Zealand blue whales

Fourteen blue whales were photographed in New Zealand waters during transits to and from the Antarctic study area. More information about New Zealand blue whales encountered during this voyage is given in Miller *et al*. (2013b; acoustics) and Olson *et al*. (2013; photo-ID).

DISCUSSION

Antarctic blue whales

The use of passive acoustics to track and target Antarctic blue whales was highly beneficial in obtaining photo-ID images (Miller *et al*., 2013a). The total of 50 photo-identified individuals is substantial since blue whales are infrequently encountered in the Southern Ocean (Branch *et al.*, 2007), even in areas of relative higher density such as IWC Area V where the voyage was conducted. Prior to this voyage a total of 32 blue whales had been photo-identified from Area V during four IWC IDCR/SOWER cruises (Olson, 2010). (Although a direct comparison cannot be made since the IWC cruises were visual line-transect surveys targeting minke whales with ½ of the search effort in passing mode). The number of photo-identified blue whales from Area V has now more than doubled as a result of the 2013 voyage. Furthermore Area V has notably poor weather (Kelly *et al*., 2012; e.g. Ensor *et al.*, 2002, 2003, 2004) making it especially challenging to approach blue whales for photo-identification in addition to detecting them. Not only did the acoustic team locate and direct the ship to aggregations of blue whales, irrespective of the prevailing weather conditions, but on several occasions aided the visual/photo team in re-locating whales that had been lost in poor conditions of fog or snow. The only IWC cruise to obtain more photo-ID's of blue whales in a single season (80 in 2006/2007) was conducted in Area III which has a higher sighting rate of blue whales and experiences better weather than Area V (Kelly *et al*., 2012; e.g. Ensor *et al*., 2005, 2006, 2007).

The collection of identification photographs from the 2013 voyage lays the groundwork for a contemporary estimate of abundance for Antarctic blue whales. From a simulation mark-recapture analysis run by Kelly *et al*. (2012), the best model required a minimum number of 50 photo-ID samples per voyage; the 2013 voyage achieved that minimum.

The within-season re-sighting rate of 16% for this voyage (8/50) is similar to the within-season re-sighting rates of Antarctic blue whales from three recent IWC SOWER cruises: 11%, 2005-2006; 18%, 2006-2007; 22%, 2008-2009 (Olson, 2010). The distances and time intervals between re-sights in 2013 were also comparable to the SOWER cruises, excepting three whales in 2013 with longer time intervals (22-27 days) and corresponding longer distances between sighting locations. The potential average re-sighting rate of 17% should be considered in the planning strategy of future voyages as it affects the level of effort required to obtain the desired number of photo-identified whales.

The movement of blue whales within the Southern Ocean is not well understood on any scale (fine or large). Previous matches of individual Antarctic blue whales between summer seasons show a wide variation in the distances between re-sightings (Branch *et al*., 2007; Olson, 2012) and this same pattern is evident for the inter-year photographic matches resulting from the 2013 voyage. The continued collection and analysis of photographs from the Antarctic, along with other research methods, will yield more information on these patterns and contribute to the understanding of blue whale population structure in the Southern Hemisphere. The wide-ranging, ocean basin scale of movements exhibited by individual Antarctic blue whales reinforces the need for international cooperation in the management and conservation of this endangered population.

Future work

The Antarctic blue whale photo-ID data from this voyage will be utilized for mark-recapture analysis to estimate abundance per Kelly *et al*. (2012). Identification photographs will be uploaded into the internationally collaborative Southern Hemisphere Blue Whale Catalogue (IWC, 2008) for comparisons with other regional photo-ID catalogues, exploring potential exchange of individuals between geographic areas and yielding information on population structure.

ACKNOWLEDGEMENTS

Many people contributed to the success of this voyage, including the scientists and support staff at the Australian Marine Mammal Centre and the Australian Antarctic Division as well as the superb crew of the *FV Amaltal*

Explorer. We thank our fellow voyage scientists, especially Brian Miller, Jay Barlow and Virginia Andrews-Goff. Kym Collins, Cath Deacon, Kylie Owen and Melinda Rekdahl donated personal photographs. Thanks also to Victoria Wadley, Natalie Kelly and Elanor Bell. The International Whaling Commission's Southern Ocean Research Partnership and the Antarctic Blue Whale Project provided essential guidance and planning efforts. The US National Oceanic and Atmospheric Administration (NOAA) funded the participation of Olson and Barlow during the voyage. We thank Claire Garrigue for the contributing the photograph of the Antarctic blue whale in 2010 - that was re-sighted in 2013 - to the Antarctic Blue Whale Catalogue.

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