

# Antarctic blue whale photo-identification catalogue summary

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## ABSTRACT

Identification photographs of Antarctic blue whales collected during 20 years of IWC IDCR/SOWER cruises (1987-88 to 2009-10) were analyzed and compiled into a catalogue of photo-identified individuals (Olson 2010). In 2011 and 2012 the photographs of 8 new whales and 1 re-sighted whale (2007-2010) were added to the catalogue by the contribution of photographs from collegial scientists working in the Antarctic. Currently the catalogue contains a total of 227 identified whales. Seven whales were re-sighted in multiple years. Distances between inter-year sighting locations ranged from 19km to over 5000km. Mark-recapture analysis of Area III yielded estimates of abundance ranging from 818 to 1097 whales.

KEYWORDS: ANTARCTIC, PHOTO-ID, MOVEMENT, MARK-RECAPTURE

## INTRODUCTION

In 2006 the Scientific Committee agreed to initiate an in-depth assessment of Southern Hemisphere blue whales, *Balaenoptera musculus* (IWC, 2006). In support of this assessment, from 2007 to 2010 Antarctic blue whale identification photographs collected during 20 years of IWC IDCR/SOWER cruises were analyzed and compiled into a catalogue of 219 photo-identified individuals (Olson, 2010). This paper summarizes updates to the catalogue since 2010 and a mark-recapture analysis of Area III begun during the past year.

## MATERIALS AND METHODS

Blue whale photographs were examined for unique natural markings and identified as individuals following methods outlined in Sears *et al.* (1990). Thorough details of materials and methods used in the creation of the Antarctic Blue Whale Photo-ID Catalogue are given in Olson (2010). The catalogue is archived at the Southwest Fisheries Science Center.

### New photos from 2010 and 2011

Three collegial scientists working in Area II and Area V during the 2009/2010 and 2011/2012 summer seasons collected blue whale photographs opportunistically and contributed them to the catalogue. Individual whales were identified from the photos and inter-matched through the catalogue.

Photographs from French scientists working in the Kerguelan, Crozet, St. Francis, and Amsterdam Islands during the years 1999-2010 were contributed to the catalogue in November 2011. These photographs will be compared to the catalogue in 2012.

### Photo quality coding

Identification photos (the best left side and best right side for each individual whale) were coded for quality using a 4-tier system: 1=excellent, 2=good, 3=fair, 4=poor. Photo quality was based on 3 features:

- 1) Angle - excellent is directly perpendicular to dorsal fin with portion of flank in front of and behind the fin visible; no dorsal fin visible is a code 4 no matter how excellent the exposure or focus qualities;
- 2) Exposure - excellent is good bright light, not overexposed, too dark, or backlit;
- 3) Focus - excellent is clear, sharp focus.

### Mark-recapture analysis of Area III

An exploratory mark-recapture analysis to estimate the abundance of blue whales in Area III was undertaken using the model POPAN MARK called by the software RMark. Photos from Area III with quality codes 1-3 were used (Table 3).

Two analyses were conducted, one for the years 1992/1993–2006/2007 (all years with available data) and one for the 3 successive years when the bulk of the data were collected, 2004/2005–2006/2007. The second analysis was conducted to see how much the estimates varied without the 9 samples from 1992/1993 and 1994/1995. In each analysis, left and right side collections were treated as separate data sets supplied to POPAN.

The POPAN model assumes marked and unmarked whales have equal catchabilities so that newly identified whales are a random sample of all whales in the population. In both the 15-year and 3-year analyses, 10 models were based on different pre-specified adult survival rates, ranging from 0.91 to 1 (the latter value assumes no deaths during the sampling period) and compared based on AIC.

#### *1992/1993–2006/2007*

A total of 143 left side photos and 138 right side photos collected during the 15 year period were supplied to POPAN.

#### *2004/2005–2006/2007*

136 left side photos and 136 right side photos collected during the last 3 years of the time period were used in this analysis.

## RESULTS AND DISCUSSION

The contributed photos from 2010 and 2011 yielded 9 individual whales: 8 new whales and 1 re-sighted whale. With the addition of the 2010 and 2011 photos there are a total of 227 individual whales in the catalogue, represented by 189 left side photos and 175 right side photos. The re-sighted whale, #0738, was first sighted in 2007 in Area III during SOWER, then re-sighted by the contributor in 2010 over 2,000km to the west near Elephant Island.

The distribution of identified whales by Area is given in Table 1. 66% of the identified whales were seen in Area III. This is due in part to the high density of blue whales found there during 3 recent SOWER cruises (2004/2005–2006/2007) and the use of digital cameras on SOWER since 2003.

Table 1. Number of individual blue whales identified by Area. (Whale #0617 seen in Area III and Area V, whale #0738 seen in Area III and Area II.)

Area	No. of whales identified
I	2
II	18
III	152
IV	15
V	36
VI	6

### Photo quality coding

The identification photos of 208 individual whales met criteria for quality codes 1 – 3, with 160 left side photos and 177 right side photos.

The numbers of left side and right side photos from Area III with quality codes 1-3 are given in Table 2. The data based on these photos were used in the mark-recapture analysis.

Table 2. Numbers of individual left and right side blue whale photos from Area III, by year, with quality codes 1-3.

Year	No. of left side photos	No. of right side photos
1992/1993	4	2
1994/1995	3	0
2004/2005	15	12
2005/2006	40	39
2006/2007	81	85
Total	143	138

### *Uploading into the Southern Hemisphere Blue Whale Catalogue*

The Antarctic Blue Whale Photo-ID Catalogue has been uploaded into the collaborative Southern Hemisphere Blue Whale Catalogue (see Galletti and Olson, 2012). Photos with quality codes 1-3 were uploaded.

### Inter-year re-sights and movements

Seven whales re-sighted between years (Table 3.) The time intervals ranged between 1 and 12 years. Four whales were re-sighted within 19–753km of their original location and 3 whales were re-sighted long distances, over 2,000km from their original sighting. Whale #0623 was sighted in Area III in 3 successive years. Whale #0617 exhibits the longest distance between sighting locations with 5,677km between locations.

Two of the re-sights, for whales #0617 and #0738, were corroborated by genetic recapture found by Sremba *et al.* (2012). (The other re-sights did not have corresponding genetic samples.)

The movement of blue whales within the Antarctic is still not well-understood on either a large or fine scale. The inter-year re-sights found here suggest that at least some whales return to the same Area in multiple years, while others forage widely. These disparate movements are similar to those reported from the Discovery marking program (Branch *et al.*, 2007). The continued collection and analysis of photographs from the Antarctic, along with other research methods, will yield more information on these patterns.

Table 3. Sighting histories of blue whales re-sighted between years. Distances were calculated using rhumb lines on a Mercator projection.

Whale ID	Date	Area	Latitude	Longitude	Distance between re-sights in different years (km)
#0104	2001 Jan 12	V	68°06'S	170°42'W	
#0104	2004 Feb 05	V	73°10'S	175°37'E	753
#0617	2002 Jan 06	V	64°24'S	136°29'E	
#0617 <sup>1</sup>	2006 Jan 26	III	69°40'S	005°33'E	5,677
#0622	2006 Jan 29	III	67°49'S	012°06'E	
#0622	2007 Jan 07	III	67°40'S	001°29'E	447
#0623	2005 Feb 04	III	68°32'S	019°16'E	
#0623	2006 Jan 29	III	67°31'S	012°31'E	302 (from 2005 Feb 4)
#0623	2006 Feb 13	III	68°40'S	014°27'E	
#0623 <sup>1</sup>	2007 Feb 07	III	69°36'S	005°50'E	355 (from 2006 Feb 13)
#0738	2007 Jan 30	III	68°23'S	010°51'E	
#0738	2010 Feb 19	II	60°47'S	048°10'W	2,818
#0761	2005 Jan 21	III	69°26'S	005°46'E	
#0761	2007 Feb 06	III	69°22'S	006°14'E	19
#0772	1995 Jan 29	III	65°44'S	058°20'E	
#0772	2007 Feb 08	III	69°49'S	004°47'E	2,222

<sup>1</sup>Genetic recapture reported in Sremba *et al.* (2012), Table 3.

### Mark-recapture analysis of Area III

#### 1992/1993–2006/2007

The best (lowest AIC) left side N estimate for 1992/1993–2006/2007 was for the model assuming no deaths in the sampling period, estimating 1097 whales with a 95% CI from 75 to 2120 whales in Area III. The best right side N estimate assumed a survival rate of 0.97 and estimated 970 whales with a 95% CI from 75 to 1866 whales in Area III.

#### 2004/2005–2006/2007

All ten models based on survival rates (0.91 to 1) were equally supported by the AIC, so no "best" models were chosen for the years 2004/2005–2006/2007. The estimates differed more based on whether the left or right side photos were used than on the pre-specified survival rate. The 95% confidence intervals calculated separately from 10 models based on the left side photos ranged between 1047 and 1097 whales, while the right side confidence intervals ranged between 818 and 903 whales.

In summary, the preliminary estimates of abundance for Area III in the 3-year time period 2004/2005–2006/2007 range from 818 to 1097 whales. The range from the 3-year time period included the mean estimates from the 15-year time period and was more narrow than the range from the 15-year time period. The work is ongoing with further results to be made available as the analysis progresses.

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