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Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue

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ABSTRACT

College of the Atlantic has maintained a collection of humpback whale (*Megaptera novaeangliae*) identification photographs from the Antarctic since 1987. In 1998 the International Whaling Commission (IWC) approved funding to support the expansion of this catalogue to members of the IWC, with an aim to substantially improve the accessibility and organization of the database. The collection has been internationally collaborative from its beginning, with photographic contributions from 360 researchers and opportunistic sources. During the contract period, the Antarctic Humpback Whale Catalogue (AHWC) catalogued 763 photo-identification images representing 614 individual humpback whales from Antarctic and Southern Hemisphere waters, a growth of more than 10%. These newly-catalogued images were submitted by 11 individuals and research organizations. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 43 previously known individuals. These submissions bring the total number of catalogued whales identified by fluke, right dorsal fin/flank and left dorsal fin/flank photographs to 5923, 414 and 409 respectively. This report details these findings, as well as other recent advances in the AHWC.

INTRODUCTION

The Antarctic Humpback Whale Catalogue (AHWC) is an international collaborative project investigating movement patterns of humpback whales (*Megaptera novaeangliae*) in the Southern Ocean and corresponding lower latitude waters. College of the Atlantic (COA) has maintained a collection of humpback whale identification photographs from the Antarctic since 1987, with initial contributions coming primarily from collaborating scientists and opportunistic sources from South America and the Antarctic Peninsula. In 1998, the International Whaling Commission (IWC) approved funding to support the expansion of this catalogue, with an aim to improve the accessibility and scope of the project.

The collection has grown substantially in size and geographic scope. It now contains records of individual whales collected throughout the Southern Ocean Sanctuary, in all of the Antarctic management areas, the feeding grounds in southern Chile and also in most of the known or suspected low-latitude breeding areas, allowing comparisons to be made between all of the major regions used by Southern Hemisphere humpback whales without preconceptions about expected movement patterns. The collection spans three decades, continuing to yield important results from early contributions. Early matches confirmed migration of humpbacks between the Antarctic Peninsula and the western coast of South America (Ecuador and Colombia) (Stone et al. 1990, Stevick et al. 2004). More recent matches have documented migration of humpbacks between the eastern coast of South America (Brazil) and Sector II (South Georgia) (Stevick et al. 2006), between East Australia and Sector V (Rock et al. 2006), between the western coast of Central America (Costa Rica and Panama) and the Antarctic Peninsula (Rasmussen et al. 2007, Guzmán et al. 2014), and between American Samoa and the Antarctic Peninsula (Robbins et al. 2011). Inter-oceanic and inter-breeding-group movement has also been documented between the eastern coast of South America (Brazil) and Madagascar (Stevick et al. 2010) and between western coast of South America (Ecuador) and the eastern coast of South America (Brazil; Stevick et al. 2014). The collection is a collaborative venture, with photographic contributions from 354 researchers and opportunistic sources from across the globe. This interim report summarizes progress to date on the work outlined within the contract between COA and the IWC.

PROCESSING AND ANALYSIS OF PHOTOGRAPHS

A total of 761 photographs was catalogued during the contract period, including the following:

Allied Whale (COA): 81 individuals, Antarctic Peninsula
Cascadia Research: 7 individuals, Costa Rica
Fagatele Bay National Marine Sanctuary: 1 individual, American Samoa
Heidi Krajewski: 40 individuals, Antarctic Peninsula
Cetamada: 59 individuals, Madagascar
Center for Dolphin Studies (CDS): 113 individuals, South Africa
Panacetacea: 307 individuals, Panama
Opportunistic: 14 individuals, Antarctic Peninsula

	Number of photographs	Number of whales	Number of re-sightings	Number of new whales
Antarctic Peninsula	156	131	7	124
Breeding stock C1	119	113	0	113
Breeding stock C3	59	59	2	57
Breeding stock E	1	1	0	1
Breeding stock G	428	311	35	276
Total	763	614	43	571

Table 1. Photographs catalogued during the contract period.

Nearly half of the individuals added during the contract period were from a collection of animals identified off Panama (Stock G) spanning ten years. This increased by more than a third the number of individuals in the database for this breeding stock. Photographs originating from eco-tourism once again dominated in the Antarctic Peninsula, increasing the number of individuals known from that area by about 10%. Progress on two collections from stock C increased the sample from that area by nearly a quarter, roughly doubling the sample size from the African mainland (C1).

The fluke photographic collection has approximately doubled in size in the past five years, and now consists of 9007 photographs of 5923 individual whales. The right dorsal fin/flank collection consists of 522 photographs of 414 individuals. The left dorsal fin/flank collection consists of 503 photographs of 409 individuals. Distribution of the photographs by area is shown in Table 2.

Matches made during the contract period to previously sighted individuals include re-sightings between breeding stock G and the Antarctic Peninsula (18) and between breeding stock G and the Chilean feeding area (3). Within-region re-sightings were identified in breeding stock C3 (2), breeding stock G (18) and the Antarctic Peninsula (7).

A number of individuals identified during the contract period were re-sighted to some of the earliest records in the database, adding substantially to the number of individuals with long sighting histories. These included six of the nine individuals in the collection with sighting spans exceeding 20 years. The two individuals with 28 year sighting histories, the longest in the database, were identified during the contact period. Individuals #0006 and #0039, first identified in 1985 and 1986, and last photographed in 2012 and 2013 respectively. Sixty-eight individuals had re-sightings spanning ten years or more. There were 334 individuals identified in more than one year, 73 of these with sightings in three or more different years. There were 137 individuals identified in more than one region.

Three analyses arising from the AHWC were published during the contract period. Evidence for movement of an adult female humpback between Ecuador and Brazil, first presented as SC/63/SH4, was recently published in the Journal of Cetacean Research and Management (Stevick et al. 2014). Comparison of whales identified in Area V to photo databases including the AHWC was published in Marine Biology (Constantine et al. 2014). The results of studies conducted in Panama, including re-sightings to feeding grounds from the AHWC, were published in Early View in Marine Mammal Science (Guzmán et al. 2014).

During this contract period, photographs from eco-tourism once again made a substantial contribution to the database. Opportunistic data represent a significant portion of the AHWC. For the period 1981 through 2014, 1,058 individuals have been identified from ecotourism and other opportunistic sources. In the Antarctic Peninsula region, 58% of the catalogued individuals have been contributed by opportunistic sources, primarily from ecotourism. The availability of these data has broadened our understanding of the exchange between areas and in some cases provided information that was previously not available. A photograph collected from a whale watch vessel contributed to the first re-sighting between breeding group A and breeding group C (Stevick et al. 2010). The submission of photos from a cruise ship off South Georgia of an animal previously seen off Brazil resulted in the first long-distance re-sighting of an individual from these areas (Stevick et al. 2006). Photos taken from a cruise ship resulted in one of several matches between the Peninsula and Costa Rica (Rasmussen et al. 2007) and sightings of five individuals from the Peninsula to Panama, one in two separate years (Guzmán et al. 2014). Data from a cruise ship guide were also instrumental in documenting the movement of an individual

Region	Fluke		R. dorsal		L. dorsal	
	Photos	# whales	Photos	# whales	Photos	# whales
Antarctic Peninsula	2269	1270	50	34	42	34
Antarctic II-VI total	565	360	145	110	169	127
Sector II	32	24	-	-	-	-
Sector III	196	117	16	13	26	15
Sector IV	169	109	82	59	72	63
Sector V	152	99	30	26	53	37
Sector VI	11	7	17	12	18	12
Chile	93	83	-	-	-	-
Breeding stock A	2069	1332	2	2	5	5
Breeding stock B	3	2	-	-	-	-
Breeding stock B1	95	79	-	-	-	-
Breeding stock B2	11	7	-	-	-	-
Breeding stock C1	259	252	-	-	-	-
Breeding stock C2	171	139	-	-	-	-
Breeding stock C3	647	531	-	-	-	-
Breeding Stock D	344	268	252	237	221	213
Breeding stock E	471	291	-	-	2	2
Breeding stock E1	94	76	1	1	2	2
Breeding stock E3	219	167	-	-	-	-
Breeding stock F	4	3	-	-	-	-
Breeding stock F2	2	2	-	-	-	-
Breeding stock G	1687	1197	73	31	64	26
TOTALS	9007	5923	522	414	503	409

Table 2. Fluke and dorsal photographic collections, by region. Individual whales that have been identified in multiple regions are listed in each region, so the total number of individuals listed may not be the same as the column totals. The region designated as the Antarctic Peninsula includes individuals identified along the coast of the AP and South Shetland Islands as far to the east as the South Orkney Islands (45°W). Area II includes individuals identified east of the South Orkneys to 0° (see SC/60/SH42, Dalla Rosa et al. 2012).

between the Peninsula and South Orkney, helping to define the limits of that feeding aggregation (Dalla Rosa et al. 2012). Progress continues in efforts to stimulate submission of such opportunistic data from eco-tourism cruise ships in the Southern Ocean and from research organizations and expeditions working throughout this region and the Southern Hemisphere. The AHWC provides a unique clearing house for these opportunistic data, facilitating public education and participation, and providing a valuable source of data to researchers for scientific analysis.

MANAGEMENT OF PHOTOGRAPHS AND DATA

Photographs of an individual are compared to the catalogue twice before being considered new to the catalogue. Analysis of photographs uses the image management software iMatch©. The best images of each individual are stored in the iMatch© database, and assigned categories including pigment configuration, with categories representing both the proportion of light and dark pigment and also the pattern of that pigment, geographic area, injuries and scar type. This allows the user to conduct detailed and directed searches, substantially increasing the efficiency of analysis. Comparison using iMatch© has reduced the time required for image analysis by as much as 75%. This increased efficiency is critical as the collection continues to grow in size. Detailed pattern and mark information along with other relevant data can be stored in the database as well, making it a very effective tool for catalogue management.

Data are stored in a relational database. Digital images and data are backed up daily and kept in a separate location. Data are reported to contributors in a standard format.

The AHWC is available on-line at http://www.flickr.com/ahwc.Only those photographs which we have received permission to publish electronically are included in the on-line collection. The site is searchable by pigmentation pattern, geographic area, or catalogue number. No additional data are available on-line, and the images displayed are low resolution. In accordance with IWC policy, access to images collected on the IWC-funded research cruises is available to everyone. In addition, all photographs taken by COA researchers and all opportunistic photos have been included in the on-line database as public access. Terms of use, which include not publishing or reproducing information without written consent, are posted on the site.

RECENT PUBLICATIONS/DOCUMENTS ARISING FROM THE AHWC

(* indicates that opportunistically collected data were included in the analysis):

Stevick, P.T., J.M. Allen, M.H. Engel, F. Félix, B. Haas and M.C. Neves. 2014. Inter-oceanic movement of an adult female humpback whale between Pacific and Atlantic breeding grounds off South America. J. Cetacean Res. Manage. 13: 159-62.

*Constantine, R., D. Steel, J. Allen, M. Anderson, O. Andrews, C.S. Baker, P. Baverstock, P. Beeman, D. Burns, J-B Charrassin, S. Childerhouse, M.C. Double, P. Ensor, T. Franklin, W. Franklin, N. Gales, C. Garrigue, E. Gates, N. Gibbs, P. Harrison, N. Hauser, A. Hutsel, C. Jenner, M. Jenner, G. Kaufman, A. Macie, D.K. Mattila, C. Olavarría, A. Oosterman, D. Paton, M. Poole, J. Robbins, N. Schmitt, P. Stevick, A. Tagarino, K. Thompson and J. Ward. 2014. Remote humpback whale feeding ground confirmed: implications for population recovery. Marine Biology 161: 1087-93.

*Guzman, H.M., R. Condit, B. Pérez-Ortega, J.J. Capella and P.T. Stevick. 2014. Population size and migratory connectivity of humpback whales wintering in Las Perlas Archipelago, Panama. Mar. Mamm. Sci. Doi 10.1111/mms.12136.

*Dalla Rosa, L., F. Félix, P. T. Stevick, E. R. Secchi, J. M. Allen, K. Chater, A. R. Martin and M. Basso. 2012. Feeding grounds of the eastern South Pacific humpback whale population include the South Orkney Islands. Polar Research 31:17331-24.

*Allen, J., C. Carlson and P. Stevick. 2011. A description and summary of the Antarctic Humpback Whale Catalogue. J. Cetacean Res. Manage. (Special Issue) 3, 95-9.

*Robbins, J., L. Dalla Rosa, J.M. Allen, D.K. Matilla, E.R. Secchi, A.S. Friedlaender, P.T. Stevick, D.P. Nowacek and D. Steel. 2011. Return movement of a humpback whale between the Antarctic Peninsula and American Samoa: a seasonal migration record. Endang. Species Res. 13: 117-21.

*Stevick, P.T., M.C. Neves, F. Johansen, M.H. Engel, J. Allen, M.C. Marcondes and C. Carlson. 2010. A quarter of a world away: female humpback whale moves 10,000 km between breeding areas. Biol. Lett. 7: 299-302. Doi:10.1098/rsbl.2010.07.0717.

RECENT SC DOCUMENTS

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*Allen, J.M., C. A. Carlson, T. Fernald and P.T. Stevick. 2012. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Document SC/64/SH1.

*Castro, C., A. Aguayo-Lobo, J. Allen, L. Dalla Rosa, P. Forestell, G. Kaufman, M. Scheidat, D. Secchi, J. Acevedo and C. Marcos. 2012. Humpback whale identification off Ecuador and their migratory connections to Antarctica (Area I and II). Document SC/64/SH23.

Castro, C., J. Acevedo, A. Aguayo-Lobo, J. Allen, J. Capella, L. Dalla Rosa, L. Florez-González, G. Kaufman, P. Forestell, M. Scheidat, E.R. Secchi, P. Stevick and M. C. de O. Santos. Long-term resightings of humpback whales off Ecuador. Document SC/64/SH24

*Allen, J.M., C. A. Carlson, J. Viechnicki and P.T. Stevick. 2011. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Document SC/63/SH5.

*Constantine, R., J. Allen, P. Meeman, D. Burns, J. Charrassin, S. Childerhouse, M. Double, P. Ensor, T. Franklin, W. Frankln, N. Gales, C. Garrigue, E. Gates, N. Gibbs, A. Hutsel, C. Jenner, M. Jenner, G. Kaufman, A. Macie, D. Mattila, A. Oosterman, D. Paton, J. Robbins, N. Schmitt, P. Stevick, A. Tagarino and K. Thompson. 2011. Comprehensive photo-identification matching of Antarctic Area V humpback whales. SC/63/SH16.

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Dalla Rosa, L., F. Félix, P. T. Stevick, E. R. Secchi, J. M. Allen, K. Chater, A. R. Martin and M. Basso. 2012. Feeding grounds of the eastern South Pacific humpback whale population include the South Orkney Islands. Polar Research 31:17331-24.

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Proposed budget: IWC Research Contract 16, Antarctic Humpback Whale Catalogue

INVESTIGATORS:

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BUDGET 2014-2015:

This proposal seeks **£15,000** to continue the cataloging of submitted photographs and further develop and enhance the system for photo management and access. Budgetary amounts are in GBP.

AHWC BUDGET REQUEST

Salary:	
Project and database management	3,200
Photo comparison	10,000
Fringe @ 16.5%	1,650
Supplies	150
Total Budget	£15,000

REQUESTED FROM IWC:

£15,000

BUDGET NARRATIVE:

We have made tremendous progress in the catalogue with funding support from the IWC. Increasing awareness of the project among research organizations, tour operators and other potential contributors has widened the scope of the collection; research efforts in areas that had not previously been sampled have extended the geographic coverage. The AHWC has doubled in size in the past five years and grown by more than 10% in the past year, substantially increasing the time required to analyse photographs. However, because of increased efficiency, productivity has changed little over the past five years.

The project has a hemispheric scope and the database spans three decades. Conducting comparison without pre-conceptions about probable movement patterns has resulted in several unexpected and unprecedented findings. As a result the AHWC is in an excellent position to make a substantial contribution to research and management initiatives. There continues to be strong interest in the catalogue, and photographs catalogued during the contract period included substantial additions from some of the areas with the longest history and most extensive coverage in the database as well as some that were previously under-represented in the collection. The AHWC continues to be a unique clearing house for data collected opportunistically and from eco-tourism sources.

Recognizing the scope of work to be accomplished in the coming year and the importance of timely analysis to the contributing researchers and the scientific community we are requesting that funding be granted at **£15,000 GBP**. We will seek funding from other sources to provide the remaining funds required. Additional resources are provided by College of the Atlantic, including equipment and student assistants provided by College of the Atlantic, and time donated by Project Investigators Judith Allen and Carole Carlson.