

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

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Abstract

College of the Atlantic (COA) 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 354 researchers and opportunistic sources. During the contract period, the Antarctic Humpback Whale Catalogue (AHWC) catalogued 938 photo-identification images representing 774 individual humpback whales from Antarctic and southern hemisphere waters. These images were submitted by 36 individuals and research organizations. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 17 previously known individuals. The database contains records of 133 individuals identified in more than one area and 361 individuals with sightings in more than one year. Because of the long-term nature of the project, 40 individuals have re-sightings separated by spans of 10 years or more, with a maximum span of 27 years. These submissions bring the total number of catalogued whales identified by fluke, right dorsal fin/flank and left dorsal fin/flank photographs to 5343, 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 more than two decades, and continues 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 American Samoa and the Antarctic Peninsula (Robbins et al. 2008), between the western coast of Central America (Costa Rica and Panama) and the Antarctic Peninsula (Rasmussen et al. 2007, Guzmán et al. 2009), between the eastern coast of South America (Brazil) and Sector II (South Georgia) (Stevick et al. 2006), and between East Australia and Sector V (Rock et al. 2006). Movement between breeding stocks has also been documented, with two animals from Brazil (breeding stock A) identified in Madagascar (breeding stock C3) and off Ecuador (breeding stock E) respectively (Stevick et al. 2010, in press). The collection is internationally collaborative, with photographic contributions from 354 researchers and opportunistic sources. This interim report summarizes progress to date on the various tasks assigned within the contract between COA and the IWC.

Task 1: Compile three collections of photographs of Antarctic Humpback Whales

A total of 938 photographs were catalogued during the contract period, including the following:

- Center for Dolphin Studies (CDS): 135 individuals, South Africa
- Centro de Conservacion Cetacea (CCC): 3 individuals, Chile
- Fagatele Bay National Marine Sanctuary (FBNMS): 9 individuals, American Samoa
- Fundación Ecuatoriana para el Estudio de Mamíferos Marinos (FEMM): 9 individuals, Ecuador
- Instituto Projeto Jubarte (IBJ): 283 individuals, Brazil
- International Whaling Commission (IWC): 2 individuals
- Megaptera: 104 individuals, Madagascar
- Smithsonian Tropical Research Institute (STRI): 64 individuals, Panama
- University of Otago: 56 individuals, East Australia
- Wheelock College: 19 individuals, West Australia
- Opportunistic: 37 individuals, Antarctic Peninsula; 1 individual, Peru; 1 individual, Ecuador; 13 individuals Panama; 4 individuals, Brazil; 20 individuals, Tonga; 12 individuals, E. Australia

	No. of photographs	No. of whales	No. of re-sightings	No. of new whales
Antarctic Peninsula	45	39	1	38
Chile	3	3		3
Breeding stock A	343	287	12	275
Breeding stock C1	135	135		135
Breeding stock C2	31	25		25
Breeding stock C3	112	79		79
Breeding stock D	20	19		19
Breeding stock E	14	9		9
Breeding stock E1	11	10	1	9
Breeding stock E3	113	78		78

Breeding stock G	108	88	3	85
Total	938	774	17	757

Table 1. Photographs catalogued during contract period.

Matches made during the contract period to previously sighted individuals include re-sightings between breeding stock G and the Antarctic Peninsula (1). Within-region re-sightings were identified in breeding stock A (12), breeding stock E1(1), and breeding stock G (3). The latter includes an individual first identified in Ecuador that was re-sighted in Panama.

Region	Fluke		R. dorsal		L. dorsal	
	Photos	# whales	Photos	# whales	Photos	# whales
Antarctic Peninsula	2113	1146	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	2068	1332	2	2	5	5
Breeding stock B	3	2	-	-	-	-
Breeding stock B1	95	79	-	-	-	-
Breeding stock B2	11	7	-	-	-	-
Breeding stock C1	140	139	-	-	-	-
Breeding stock C2	171	139	-	-	-	-
Breeding stock C3	588	474	-	-	-	-
Breeding Stock D	344	268	252	237	221	213
Breeding stock E	454	281	-	-	2	2
Breeding stock E1	94	76	1	1	2	2
Breeding stock E3	218	166	-	-	-	-
Breeding stock F	4	3	-	-	-	-
Breeding stock F2	2	2	-	-	-	-
Breeding stock G	1259	905	73	31	64	26

TOTALS	8225	5343	522	414	503	409
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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).

The fluke photographic collection now consists of 8225 photographs of 5343 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. The longest interval between re-sightings was 27 years for individual #1212, first identified in 1985 and photographed again in 2011. Individual #0117, first identified off Ecuador in 1988, was identified during the contract period from a photograph taken off Panama 19 years later. This constitutes the third longest re-sighting span in the database. There were 58 individuals with sightings in three or more different years and 133 individuals identified in more than one area. Distribution of the photographs by area is shown in Table 2.

Catalogues from Madagascar (Megaptera, Cetamada), South Africa (Center for Dolphin Studies), American Samoa (FBNMS/PCCS), Ecuador (FEMM) and Brazil (IBJ) have been submitted to the AHCW. Analysis of photographs from Megaptera, Cetamada, CDS, IBJ and FEMM is in progress.

Progress continues in efforts to stimulate submission of 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. Opportunistic data represent a significant portion of the AHCW. For the period 1981 through 2013, 1,111 individuals have been identified from ecotourism and other opportunistic sources. In the Antarctic Peninsula region, 53% 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 contribution from a cruise ship contributed to our understanding of the eastern limits of the feeding aggregation off the Antarctic Peninsula (Dalla Rosa et al. 2012). A photograph collected from a whale watch vessel contributed to the first re-sighting between breeding stock A and breeding stock C (Stevick et al 2010). The submission of photos from a cruise ship off South Georgia in 2004 of an animal previously seen off Brazil resulted in the first long-distance re-sighting of an individual documenting migration between 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. 2009). The AHCW 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.

Task 2. Scan and archive all images and link to databases in Task 3.

The use of image management software has substantially increased the efficiency of photo comparison (Allen et al. 2011). All of the catalogued photographs have been digitized. Images that were not submitted in digital form were scanned at 300 dpi and stored in TIFF

format. The image management software iMatch© is used for image analysis. The best images of each individual are stored in the iMatch© database, and assigned categories including pattern type and geographic area. During the past two years the iMatch database has been enhanced by the addition of special categories such as injuries, scar shape and pattern sub-types, allowing the user to further refine searches and increasing the efficiency of analysis. Photographs of an individual are compared to the catalogue by two technicians before being considered new to the catalogue. 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. Comparison using iMatch© has reduced the time required for image analysis by as much as 75%.

Task 3. Create relational databases for associated field data.

Data are stored in a relational database. The fluke and dorsal/flank collections are combined in a single data file but distinguished by use of a data field indicating fluke or dorsal type, to facilitate analysis of the collections independently or collectively. Digital images and data are backed up daily and kept in a separate location.

Task 4. Report to contributors on completion of photo comparison.

A standardized data report is issued to all contributors on completion of cataloguing of submissions. The report includes the catalogue number assigned, the data recorded in the file, and the contributor and region for any previous sighting history.

Task 5. Provide on-line access to the photographic collection.

The AHWC is available on-line at <http://www.coa.edu/antarctic>. Only those photographs which we have received permission to publish electronically are included in the on-line collection. The database is searchable by fluke pigmentation pattern, geographic area, or catalogue number. Dorsal fin/flank collections are also available on line, although a search criterion allowing the user to specify dorsal fin/flank has not yet been added. Images displayed are identified by catalogue number and the contact organization for the contributor. No additional data are available on-line, and the images displayed are low resolution (100dpi - suitable for display but not for print).

We have developed a new web site using flickr (<http://www.flickr.com/ahwc>). This system offers advantages over the existing system including a superior user interface, higher resolution images, and improved data security and database/search options. We are in the process of migrating to this new system; all new photos will be posted only to the Flickr site.

In accordance with guidelines from the 2002 Scientific Committee Meeting and IWC policy, access to images collected on the IWC-funded research cruises is available to everyone. In addition to IWC images, 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.

Contributors are contacted to determine whether they wish to make their photos available to the general public or restrict access only to other contributors, and photos are tagged as public

or private accordingly. All contributors are invited to create a Flickr account and become a contact of the AHWC, which gives them access to both public and private photos. Contributors are also advised of the security protocol of the project, whereby users are not permitted to share their account with others, or reuse photographs or other information without permission. In the coming year, completing migration of the website will be one of the main project goals.

Recent publications/presentations arising from the AHWC

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

*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, 95-99.

*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* 31:17331-17324.

*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: 117-121.

*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.* Doi:10.1098/rsbl.2010.07.0717.

In press:

Stevick, P.T., J.M. Allen, M.H. Engel, F. Félix, B. Haas and M.C. Neves. Inter-oceanic movement of an adult female humpback whale between Pacific and Atlantic breeding grounds off South America. *Journal of Cetacean Research and Management.*

In review:

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. Remote humpback whale feeding ground confirmed: implications for population recovery.

*Guzman, H.M., R. Condit, B. Pérez-Ortega, J.J. Capella and P.T. Stevick. Population size and migratory connectivity of humpback whales wintering in Las Perlas Archipelago, Panama.

Recent SC Documents

*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.

*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.

*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. César O. Santo. Long-term resightings of humpback whales off Ecuador. Document SC/64/SH24

Constantine, R., J. Allen, P. Meeman, D. Burns, J. Charrassin, S. Childerhouse, M. Double, P. Ensor, T. Franklin, W. Franklin, 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.

Kaufman, G., D. Coughran, J. Allen, D. Burns, C. Burton, C. Castro, S. Childerhouse, R. Constantine, T. Franklin, W. Franklin, P. Forestell, R. Gales, C. Garrigue, N. Gibbs, C. Jenner, D. Paton, M. Noad, J. Robbins, E. Slooten, F. Smith and P. Stevick. 2011. Photographic evidence of interchange between East Australia (BS E-1) and West Australia (BS D) humpback whale breeding populations. SC/63/SH11.

Stevick, P.T., J. Allen, M. Engel, F. Felix, B. Haase and M. Neves. 2011. First record of inter-oceanic movement of a humpback whale between Atlantic and Pacific breeding grounds off South America. SC/63/SH4.

*Stevick, P.T., M.C. Neves, F. Johansen, M.H. Engels, J. Allen, M. Marcondes and C. Carlson. 2010. Movement of a humpback whale between breeding stocks A and C3 and a new distance record. Document SC/62/SH27.

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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, 95-99.

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Guzmán, H.M, B. Pérez-Ortega, J.J. Capella, P.T. Stevick and J.M. Mair. 2009. Population size and migratory connectivity of humpback whales breeding in Las Perlas Archipelago, Panama. Presentation to the 18th Biennial Conference of the Society for Marine Mammalogy.

Rasmussen K., D.M. Palacios, J. Calambokidis, M.T. Saborío, L/ Dalla Rosa, E.R. Secchi, G.H. Steiger, J.M. Allen and G.S. Stone. 2007. Southern Hemisphere humpback whales wintering off Central America: insights from water temperature into the longest mammalian migration. *Biology Letters*:doi:10.1098/rsbl.2007.0067

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. Return movement of a humpback whale between the Antarctic Peninsula and American Samoa: a seasonal migration record. 2011. *Endang. Species Res.* 13: 117-121.

Rock, J., L.A. Pastene, G.D. Kaufman, P. Forestell, K. Matsuoka and J. Allen. 2006. A note on East Australia Group V Stock humpback whale movement between feeding and breeding areas based on photo-identification. *J Cetacean Res Manage* 8:301–305.

Stevick, P.T., A. Aguayo, J. Allen, I.C. Avila, J. Capella, C. Castro, K. Chater, L. Dalla Rosa, M.H. Engel, F. Félix, L. Flórez-González, A. Freitas, B. Haase, M. Llano, L. Lodi, E. Munoz, C. Olavarría, E. Secchi, M.Scheidat and S. Siciliano. 2004. Migrations of individually identified humpback whales between the Antarctic Peninsula and South America. *J Cetacean Res Manage* 6:109-113.

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

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

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

Investigators:

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Budget 2013-2014: This proposal seeks **£15,000** to continue the cataloging of submitted photographs and further develop and enhance the system for on-line access. Budgetary amounts are in GBP.

AHWC BUDGET REQUEST

Salary:

Project and database management	3,350
Photo comparison	10,000
Fringe @ 16.5%	1,650
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 grown by 25% in the last two years, adding 1066 new individuals. There continues to be strong interest in the catalogue, and photographs catalogued during the contract period included substantial additions from areas that were previously under-represented in the collection,

The project has a hemispheric scope and the database spans more than two-and-a-half decades. As a result the AHWC is in an excellent position to make a substantial contribution to the Southern Ocean Research Partnership and other research and management initiatives.

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, and reflecting recent changes in the international currency markets, 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.