SC/63/SH5

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 300 researchers and opportunistic sources. During the contract period, the Antarctic Humpback Whale Catalogue (AHWC) catalogued 924 photo-identification images representing 740 individual humpback whales from Antarctic and southern hemisphere waters. These images were submitted by 53 individuals and research organizations. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 22 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 4277, 414 and 407 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 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 breeding group C3 off Madagascar (Stevick et al. 2010), between the eastern coast of South America (Brazil) and Sector II (South Georgia) (Stevick et al. 2006), between East Australia and Area 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. 2009), and between American Samoa and the Antarctic Peninsula (Robbins et al. 2008).

The collection is internationally collaborative, with photographic contributions from 300 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 740 individuals were catalogued during the contract period, including the following:

Fundación Ecuatoriana para el Estudio de Mamíferos Marinos (FEMM): 51 individuals, Ecuador
Fagatele Bay National Marine Sanctuary: 57 individuals, American Samoa
Instituto Projecto Jubarte (IBJ): 54 individuals Brazil
Duke University: 64 individuals, Antarctic Peninsula
Cetamada: 184 individuals, Madagascar
Megaptera: 187 individuals, Madagascar
Australian Antarctic Division: 59 individuals, Ross Sea (AWE)
Opportunistic: 18 individuals, Antarctic Peninsula; 31 individuals, Breeding Group E3; 6 individuals Breeding Group D; 23 individuals, Breeding Group E1; 1 individuals, Area II; 1 individual, Chile; 5 individuals, Breeding group C3; 1 individual, Breeding Group G; and 5 individuals, Breeding Group C1.

	No. of photographs	No. of whales	No. of re-sightings	No. of new whales
Antarctic Peninsula	109	92	4	88
Chile	1	1	0	1
Area II	1	1	0	1
Area V	85	59	0	59
Breeding stock A	60	54	7	47
Breeding stock C1	5	4	0	4
Breeding stock C2	42	32	0	32
Breeding stock C3	413	344	1	343
Breeding stock E	5	47	2	45
Breeding stock E1	23	22	0	22
Breeding stock E3	31	28	2	26
Breeding stock G	73	52	6	46
Total	924	740	22	718

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 (2), and between breeding stock G and breeding stock A (1). Within-region re-sightings were identified in the Antarctic Peninsula (4), breeding stock A (6), breeding stock C3 (1), breeding stock E (2), breeding stock E3 (2) and breeding stock G (4).

Region	Fluke		R. dorsal		L. dorsal	
	Photos	# whales	Photos	# whales	Photos	# whales
Antarctic Peninsula	2037	1089	50	34	42	34
Antarctic II-VI total	562	356	145	110	169	127
Sector II	31	23	-	-	-	-
Sector III	196	117	16	13	26	15
Sector IV	168	108	82	59	72	63
Sector V	152	99	30	26	53	37
Sector VI	11	7	17	12	18	12
Chile	84	78	-	-	-	-
Breeding stock A	1583	936	2	2	5	5
Breeding stock B	3	2	-	-	-	-
Breeding stock B1	95	79	-	-	-	-
Breeding stock B2	11	7	-	-	-	-
Breeding stock C1	5	4	-	-	-	-
Breeding stock C2	105	84	-	-	-	-
Breeding stock C3	472	209	-	-	-	-
Breeding Stock D	323	248	252	237	221	213
Breeding stock E	356	213	-	-	-	-
Breeding stock E1	57	49	1	1	2	1
Breeding stock E3	55	45	-	-	-	-
Breeding stock F	3	2	-	-	-	-
Breeding stock F2	2	2	-	-	-	-
Breeding stock G	1147	767	73	31	64	26
TOTALS	6896	4278	522	414	503	407

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).

The fluke photographic collection now consists of 6896 photographs of 4278 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 407 individuals. The longest interval between re-sightings was 22 years for individual #0958, first identified in 1981 and photographed again in 2002. There were 53 individuals with sightings in three or more different years and 112 individuals identified in more than one area. Distribution of the photographs by area is shown in Table 2.

During the contract period a re-sighting was discovered between breeding group A off Brazil and breeding group G off Ecuador (SC/63/SH4). Also, two papers were published using AHWC results, one documenting movement from group A to C3 (Stevick et al., 2010), and another documenting movement of two individuals between breeding group E and the Antarctic Peninsula (Robbins et al., 2010). These findings of dramatic long-distance longitudinal movement highlight the value of large, collaborative catalogues like the AHWC. They also demonstrate the remarkable distances over which animals can be re-sighted, and thus the importance of comparing identified individuals between areas without preconceptions about probable destinations. Two of these findings relied on opportunistic data collection, further reinforcing the importance of non-dedicated effort.

Catalogues from Madagascar (Megaptera, Cetamada), Antarctic Peninsula (Duke University), American Samoa (FBNMS/PCCS), Ecuador (FEMM) and Brazil (IBJ) have been submitted to the AHWC. Analysis of the Megaptera, Cetamada, Duke, IBJ and FEMM catalogues 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 AHWC. For the period 1981 through 2011, 788 individuals have been identified from ecotourism and other opportunistic sources. In the Antarctic Peninsula region, 60% of the catalogued individuals were 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 identified during the contract period (SC/62/SH27). 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 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. 2009). 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.

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

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 FoxPro relational databases. 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):

*Robbins, J., L. Dalla Rosa, J.M. Allen, D.K. Matilla, E.R. Secchi, A.S. Friedlaender, P.T. Stevick, D.P. Nowacek, 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.

*Stevick, P.T., M.C. Neves, F. Johansen, M.H. Engel, J. Allen, M.C. Marrcondes, 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.

*Guzmán, H.M, B. Pérez-Ortega, J.J. Capella, P.T. Stevick, 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.

Recent SC Documents

*Acevedo, J., J. Allen, C. Castro, F. Felix, K. Rasmussen, L. Florez-Gonzalez, A Aguayo-Lobo, E. Secchi, M. Llano, F. Garita, P. Forestell, B. Haase, J. Capella, L. Dalla Rosa, D. Ferrina, J. Plana, I.C. Tobon, G. Kaufman, P. Flak, M. Scheidat and L.A. Pastene. 2008 Migratory destination of humpback whales from the eastern South Pacific population as revealed by photo-identification analysis. Document SC/60/SH20.

*Allen, J.M., C. A. Carlson, J. Viechnicki and P.T. Stevick. 2009. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Document SC/61/SH11.

*Allen, J.M., C. A. Carlson, J. Viechnicki and P.T. Stevick. 2008. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Document SC/60/SH19.

*Allen, J.M., C. A. Carlson, B. Holm and P.T. Stevick. 2007. Interim Report: IWC Research Contract 16, Antarctic Humpback Whale Catalogue. Document SC/59/SH17.

Dalla Rosa, L., F. Felix, P.T. Stevick, E.R. Secchi, J.M. Allen and K. Chater. 2008. Interchange of humpback whales between the South Orkney Islands (Weddell Sea) and the northwestern coasts of South American and the Antarctic Peninsula, confirmed by photo-identification. Document SC/60/SH42.

Robbins, J.; L. Dalla Rosa; J.M. Allen; D.K. Mattila; and E.R. Secchi. 2008. Humpback whale photo identification reveals exchange between American Samoa and the Antarctic Peninsula, and a new mammalian distance record. Document SC/60/SH5.

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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Guzmán, H.M, B. Pérez-Ortega, J.J. Capella, P.T. Stevick, 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, 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, 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, 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, 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., M.C. Neves, F. Johansen, M.H. Engel, J. Allen, M.C. Marrcondes, 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.

Stevick P.T., L. Pacheco de Godoy, M. McOsker, M.H. Engel, J. Allen. 2006. A note on the movement of a humpback whale from Abrolhos Bank, Brazil to South Georgia. J Cetacean Res Manage 8:297-300.

Stone, G.S., L. Florez-Gonzalez, S. Katona. 1990. Whale migration record. Nature, Lond 346:705

SC/63/SH5

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

Investigators:
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Budget 2011-2012: 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	3,200
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 grown by 50%, adding over 1400 new individuals in the last two years. These additions included substantial additions from areas that were previously under-represented in the collection, resulting in unprecedented resightings between widely-separated breeding stocks (Ecuador and Brazil, and Brazil and Madagascar), and two additional re-sightings documenting the movement from Samoa and the Antarctic Peninsula.

The project has a hemispheric scope and the database spans more than two 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 continued at **£15,000 GBP**. 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.