

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 260 researchers and opportunistic sources. During the contract period, the Antarctic Humpback Whale Catalogue (AHWC) catalogued 899 photo-identification images representing 721 individual humpback whales from Antarctic and southern hemisphere waters. These images were submitted by 21 individuals and research organizations. Photographic comparison of submitted photographs to the AHWC during the contract period yielded 34 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 3665, 413 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 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. 2009), and between American Samoa and the Antarctic Peninsula (Robbins et al. 2008).

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The collection is internationally collaborative, with photographic contributions from 262 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 899 photographs were catalogued during the contract period, including the following:

International Whaling Commission (IWC): 29 individuals, SOWER cruises
Fundación Ecuatoriana para el Estudio de Mamíferos Marinos (FEMM): 255 individuals, Ecuador
Fagatele Bay National Marine Sanctuary: 72 individuals, American Samoa
Instituto Projeto Jubarte (IBJ): 61 individuals Brazil
Smithsonian Tropical Research Institute: 26 individuals, Panama
British Antarctic Survey: 12 individuals, South Sandwich Islands
Duke University: 14 individuals, Antarctic Peninsula
Cetamada: 114 individuals, Madagascar
Megaptera: 101 individuals, Madagascar
Opportunistic: 17 individuals, Antarctic Peninsula; 13 individuals, Tonga; 2 individuals, E. Australia; 3 individuals, Area IV; 1 individual, Chile; 1 individual, Madagascar

	No. of photographs	No. of whales	No. of re-sightings	No. of new whales
Antarctic Peninsula	38	31	5	26
Chile	1	1	1	0
Area II	16	12	0	12
Area III	3	2	0	2
Area IV	31	30	0	30
Breeding stock A	75	61	1	60
Breeding stock C2	63	52	0	52
Breeding stock C3	184	164	1	163
Breeding stock E1	2	2	0	2
Breeding stock E3	122	85	0	85
Breeding stock F	2	2	0	2
Breeding stock G	362	281	27	254
Total	899	721	34	687

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 (19), between breeding stock G and Chile (3), between breeding stock A and breeding stock C3 (1; see SC/62/SH27) and

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between breeding stock E and the Antarctic Peninsula (2; see SC/60/SH5). Within-region re-sightings were identified in the Antarctic Peninsula (3) and breeding stock G (11).

Region	Fluke		R. dorsal		L. dorsal	
	Photos	# whales	Photos	# whales	Photos	# whales
Antarctic Peninsula	1924	995	50	34	42	34
Antarctic II-VI total	478	296	145	110	169	127
Sector II	30	22				
Sector III	196	117	16	13	26	15
Sector IV	168	108	82	59	72	63
Sector V	67	40	30	26	53	37
Sector VI	11	7	17	12	18	12
Gabon	94	78	-	-	-	-
Ghana	1	1	-	-	-	-
S. Africa	11	7	-	-	-	-
St. Helena	3	2	-	-	-	-
Brazil	1524	888	2	2	5	5
Chile	83	77	-	-	-	-
Peru/Ecuador/Colombia/ Panama/Costa Rica	1075	767	72	30	64	26
American Samoa	265	159	-	-	-	-
Tahiti	1	1	-	-	-	-
Tonga	24	18	-	-	-	-
New Zealand	2	1	-	-	-	-
French Polynesia	2	2	-	-	-	-
Madagascar	247	226	-	-	-	-
E. Australia	34	27	1	1	2	1
W. Australia	317	242	251	236	221	213
TOTALS	6083	3665	521	413	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).

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The fluke photographic collection now consists of 6,083 photographs of 3,665 individual whales. The right dorsal fin/flank collection consists of 521 photographs of 413 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 51 individuals with three or more sightings in different years and 128 individuals identified in more than one area. Distribution of the photographs by region is shown in Table 2.

During the contract period a re-sighting was discovered between breeding group A and breeding group C, a displacement ~4000km longer than any previously observed between breeding areas (SC/62/SH27). Two additional re-sightings were documented between breeding group E and the Antarctic Peninsula, as previously reported in SC/60/SH5. These findings highlight the value of large, collaborative catalogues like the AHC. 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. The movement between groups A and C further illustrates the importance of opportunistic data collection from whale watch vessels, as this whale was not represented in a number of other collections of photographs that were examined from breeding stock C.

Catalogues from Madagascar (Megaptera, Cetamada), Antarctic Peninsula (Duke University), American Samoa, Ecuador (FEMM) and Brazil (IBJ) have been submitted to the AHC. Analysis of the Megaptera, Cetamada, Duke, IBJ and FEMM catalogues is in progress. Talks are ongoing regarding collaboration on the Southern Ocean collection of the Pacific Whale Foundation (~6,000 individuals).

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 AHC. For the period 1981 through 2010, 684 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 AHC 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 year the iMatch database has been enhanced by the additional of special categories such as injuries and scar shape, 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 are developing a new on-line catalog using Flickr, a widely used image sharing website. This system offers many advantages over the existing system, including a superior user interface, high resolution images, improved data security and extensive database/search options. Development and testing of the site is in progress; approximately 20% of the AHWC photos have been uploaded to date, including all IWC photos. These can be viewed at www.flickr.com/ahwc.

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 are included in the public access database. The current system and the new Flickr system both have privacy controls, allowing open access to public photos and limiting access to photos that contributors choose to restrict to contributors only. All users must agree to terms of use, which include not publishing or reproducing information without written consent.

Contributors are contacted to determine whether or not they wish to keep their photos in the secure database accessible only to fellow contributors, or include them in the public access database. All contributors are assigned a login and password which gives them access to the secure database and are advised of the security protocol of the project, whereby users are not permitted to share their password with others, or reuse photographs or other information without permission. In the coming year, updating the website will be one of the main project goals.

Recent publications/presentations arising from the AHCW

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

- *Rasmussen, K., D.M. Palacios, J. Calambokidis, M.T. Saborio, 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. *Biol. Lett.* doi:10.1098/rsbl.2007.0067.
- *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 submitted to the Scientific Committee of the International Whaling Commission
 - *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 submitted to the Scientific Committee of the International Whaling Commission
 - *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 submitted to the Scientific Committee of the International Whaling Commission
 - *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 submitted to the Scientific Committee of the International Whaling Commission
- 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 America and the Antarctic Peninsula, confirmed by photo-identification. Document SC/60/SH42 submitted to the Scientific Committee of the International Whaling Commission

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 submitted to the Scientific Committee of the International Whaling Commission

Literature Cited

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, Palacios DM, Calambokidis J, Saborío MT, Dalla Rosa L, Secchi ER, Steiger GH, Allen JM, Stone GS (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

Rock J, Pastene LA, Kaufman GD, Forestell P, Matsuoka K, Allen J (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 PT, Aguayo A, Allen J, Avila IC, Capella J, Castro C, Chater K, Dalla Rosa L, Engel MH, Félix F, Flórez-González L, Freitas A, Haase B, Llano M, Lodi L, Munoz E, Olavarria C, Secchi E, Scheidat M, Siciliano S (2004) Migrations of individually identified humpback whales between the Antarctic Peninsula and South America. *J Cetacean Res Manage* 6:109-113

Stevick PT, Pacheco de Godoy L, McOske M, Engel MH, Allen J (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 GS, Florez-Gonzalez L, Katona S (1990) Whale migration record. *Nature, Lond* 346:705

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

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Budget 2010-2011: 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
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Requested from IWC: £15,000

Budget narrative: We have made tremendous progress in the catalogue with funding support from the IWC. With increased funding during this contract period we more than tripled the number of individuals catalogued over the previous year. The AHWC has grown by 25%, adding 974 new individuals in the last two years. Increasing awareness of the project among research organizations, tour operators and other potential contributors has widened the scope of the collection. Contributions from areas that had not previously been sampled or were previously under-represented have extended the geographic coverage and resulted in an unprecedented re-sighting between two widely-separated breeding stocks, 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**. 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.