Movement of a humpback whale from Abrolhos Bank, Brazil to South Georgia (Antarctic Area II)

Peter T. Stevick[1,2], Luiza Pacheco de Godoy[3], Megan McOsker[4], Márcia H. Engel[3] and Judith Allen[1]

1- College of the Atlantic, 105 Eden Street, Bar Harbor, ME 04609 USA
2- Bioscience Research Institute, University of Southern Maine, 96 Falmouth Street, 178 Science Building, Portland, Maine 04104-9300 USA
3- Projeto Baleia Jubarte/Instituto Baleia Jubarte, Rua Barão do Rio Branco, 26 Centro, Caravelas, Bahia, Brazil CEP: 45900-000
4- Oceanites Inc., P.O. Box 15259, Chevy Chase, MD 20825 USA

contact e-mail: peterstevick@aol.com

Abstract

Most models of population structure for Southern Hemisphere humpback whales (*Megaptera novaeangliae*) assume that individuals feeding in the Scotia Sea region of Antarctic Area II migrate primarily to the breeding and calving area off Brazil. However the data to support this are few and mostly indirect, and alternative migratory destinations have been suggested for individuals from both of these areas. Abrolhos Bank, Brazil, is the largest breeding and calving ground for humpback whales in the western South Atlantic Ocean, while historically the waters near South Georgia held the largest concentrations of humpback whales in Area II, and were among the largest in the Southern Ocean. Photographs of individually distinctive natural markings on humpback whale flukes collected from Area II (n = 8) and from the waters off Brazil (n = 394) were compared to identify re-sightings. An individual humpback whale first photographed on 4 August, 2000 at Abrolhos Bank, Brazil was subsequently photographed on 4 December, 2004 near Shag Rocks, off South Georgia. The migratory distance between these sightings is 3935km. This finding constitutes the first long distance re-sighting of an individual to be documented from either of these areas.

Early modern industrial whaling operations decimated humpback whale (*Megaptera novaeangliae*) populations in the South Atlantic Ocean and corresponding areas of the Southern Ocean during the early decades of the 1900s (Mackintosh, 1942; Tønnessen & Johnsen, 1982). Since humpback whales were severely depleted before biological data were routinely taken on killed whales and before the development of the Discovery tag (Brown, 1978) there are few data presently available with which to assess the movements and population structure of humpback whales in the region, though observed movement of individuals identified by natural markings is an increasingly important tool in these waters.

Two principal low-latitude breeding and calving grounds for humpback whales occur in the South Atlantic Ocean. One encompasses the coastal waters of central Brazil (Siciliano *et al.*, 1999), the other the west coast of Africa (Townsend, 1935; Walsh *et al.*, 2000). Abrolhos Bank, Brazil (17°20' to 18°10'S, 38°35' to 39°20'W), is the primary breeding and calving ground of humpback whales in the western South Atlantic Ocean. More than

2,000 individuals have been identified by natural markings in the area through 2004 (Projeto Baleia Jubarte, unpublished data). Mark-recapture abundance estimates for the period 1996 to 2000 range from 1,848 (95% CI; 725 – 2971) to 3,871 (95% CI; 2795 – 5542) depending on the combination of years and the model assumptions used (Freitas *et al.*, in review).

The distribution within the high-latitude feeding grounds is less clearly delineated. While humpback whaling was widespread over the entire region (Mackintosh, 1942), both historical (Mackintosh, 1942) and recent evidence (IWC, 1998; Kasamatsu *et al.*, 1996) indicates that distribution is patchy and that local concentrations of humpback whales occur. Most authors suggest three primary concentrations in the area, one to the west, associated with the Antarctic Peninsula and South Shetland Islands extending into the Bellingshausen Sea ("Chilean Group" Mackintosh, 1942; "Area I" see Donovan, 1991; "Group G" IWC, 1998), another in the Scotia Sea, principally near South Georgia and the South Sandwich Islands ("Atlantic Group" Mackintosh, 1942; "Area II" see Donovan, 1991; "Group A" IWC, 1998), with a third (and perhaps a fourth) south of Africa ("African Group" Mackintosh, 1942; "Area III" see Donovan, 1991; "Groups B and C" IWC 1998). The waters of Area II near South Georgia (54.5°S, 37°W) and the South Sandwich Islands were a principal centre of early humpback whaling operations and, at least historically, one of the primary concentrations of humpback whales in the Southern Ocean (Mackintosh, 1965; Tomilin, 1957).

The migratory movements of whales from these areas have not been well documented. Most current models of population structure for Southern Hemisphere humpback whales assume that individuals feeding in Antarctic Area II waters near South Georgia migrate primarily to the breeding and calving area off Brazil (e.g IWC, 1998; IWC, 2005; Siciliano *et al.*, 1999). However the data to support this are few and mostly indirect. Alternative migratory destinations have been suggested for individuals from both Brazil and South Georgia. Notably South Georgia has been linked to western Africa (Mackintosh, 1942), while movement by at least some individuals from Brazil to the Antarctic Peninsula area has been widely suggested, though with varying levels of uncertainty (Evans, 1987; Mackintosh, 1942; Slijper, 1979).

Comparison of photographs of individually distinctive natural markings can provide direct evidence of whale movement. For this study, individual humpback whales were identified from photographs of the natural markings and permanent scars on the ventral surface of the flukes (Katona *et al.*, 1979). A collection of identification photographs from throughout the Southern Hemisphere is maintained at College of the Atlantic (Bar Harbor, Maine USA). This Antarctic Humpback Whale Catalogue (AHWC) is an international collaborative effort involving numerous individual or institutional contributors (Allen *et al.*, 2001; Allen *et al.*, 2005, SC/57/SH7; Stevick *et al.*, 2004b). The AHWC currently contains records of 1902 individual Southern Hemisphere humpback whales identified by fluke photographs (Allen *et al.*, 2005, SC/57/SH7). The majority of photographs were collected by research groups or by naturalists and tourists aboard cruise ships or whale watching vessels.

Recently, comparison was initiated between the AHWC and a collection of nearly 2,000 individual humpback whales photographed off Brazil between 2000-2004. Slightly >100 of these have been completed, bringing the AHWC sample from Brazil to 394 individuals. Photographs of these whales have been compared with each of the other individuals in the AHWC to identify re-sightings. The AHWC contains records of eight individuals identified in the waters of Area II near South Georgia Island, the South Orkney Islands or the offshore waters of the Scotia Sea, 602 identified near the Antarctic Peninsula and South Shetland Islands and 102 in other feeding areas in the Southern Ocean (Allen *et al.*, 2005, SC/57/SH7). While the traditional boundary between Area I and Area II and more recently between Groups A and G has been placed at 60°W, this is not consistent with observed humpback whale movement patterns (see Stevick, 2005, SC/57/SH2) and for this analysis individuals identified near the Antarctic Peninsula as far east as Elephant Island at ~55°W were included in the Antarctic Peninsula sample. Analysis continues on the remaining photographs from Brazil.

An individual humpback whale was photographed on 4 August, 2000 at 18°11.275'S, 038°37.034'W on the Abrolhos Bank, Brazil. The whale was a member of a pair that was observed from 11:40 to 12:30. Dive times ranged between 10 and 13 minutes, longer than is typical for the region. There was a record of singing in this group, though further details are not available at this time. The same individual was subsequently photographed on 4 December, 2004 at 53°33.04'S, 041°37.73'W, off Shag Rocks, off South Georgia. Approximately ten humpback whales and 15 southern right whales were present in the area. Large numbers of Antarctic fur seals, prions and other seabirds were also reported to be present, and heavy traces of prey were reported on the echo-sounder at a depth of 30m. The migratory distance between these locations is 3935km.

This observation constitutes the first long distance re-sighting of an individual to be documented from either area. The small number of individuals identified by natural markings on the feeding grounds between 0° and the Antarctic Peninsula, and the single observed re-sighting preclude any statistical analyses. The proportion of this "Area II" sample re-sighted off Brazil (0.111) is reasonably similar, however, to the proportion of individual identified near the Antarctic Peninsula that has been identified off western South America (0.081).

Only a single Discovery tag recovery has been reported from the South Georgia vicinity, and that was recovered after an interval of only 5 days and a distance of ~220 km (IWC, 1998). A tag fired into an animal in the feeding grounds at 116°W has recently been reported as having been recovered by the former USSR off Brazil at 45°W (IWC, 1998). However that tag was recovered from the cooker so the actual capture location of the whale is not known with certainty and in the absence of additional information the reported location must be considered suspect (IWC, 1998).

The movement of an individual between Brazil and South Georgia is not surprising. The migration of most animals from the South Georgia/South Sandwich/Scotia Sea area to Brazil, and the majority of animals from the Antarctic Peninsula to the west coast of South America is consistent with current thinking regarding humpback whale population

structure in the region (IWC, 1998; IWC, 2000; IWC, 2005; Siciliano *et al.*, 1999; Stevick *et al.*, 2004a). This finding supports the results of other studies that have used natural markings and genetic markers to identify links between the Antarctic Peninsula and South America and no evidence of movement from these areas to Brazil despite increasingly large sample sizes (Caballero *et al.*, 2001; Dalla Rosa *et al.*, 2004; Garrigue *et al.*, 2002; Olavarría *et al.*, 2000; Stevick *et al.*, 2004a; Stone *et al.*, 1990). Additionally, modern sighting and stranding patterns off Brazil do not support a coastal migration, but are more consistent with an offshore migration to a feeding area to the south or southeast (Siciliano *et al.*, 1999). Recent evidence from satellite-linked transmitters has also demonstrated the movement of few individuals from Brazil to the South Georgia/South Sandwich region (Zerbini *et al.*, 2004).

While the observation presented here supports a growing consensus that humpback whales from Brazil migrate to the Scotia Sea, low humpback whale densities are generally reported in the vicinity of South Georgia today. The coastal waters of South Georgia were the first in the Southern Ocean to be extensively exploited, with humpback whales being a principal target of the early fishery; >18,000 humpback whales were reported to have been taken by whaling stations at South Georgia between 1909 and 1915 (IWC, 2005; Mackintosh, 1942). The primacy of South Georgia stations in the historic humpback whale kill, and the exceptionally high krill densities in this region suggests that it was a primary concentration area for feeding humpback whales a century ago. In contrast, recent reports indicate little evidence of recovery from this depletion; few humpbacks are sighted in these waters today, while greater densities are reported near the Antarctic Peninsula and east of about 20°E (IWC, 1998; Kasamatsu *et al.*, 1996; Moore *et al.*, 1999). Thus there is little evidence to suggest that the number of humpback whales in the immediate South Georgia area today is comparable to the numbers sighted off Brazil and the question deserves more scrutiny.

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