



## Amazon River's mouth: the northernmost stranding site of humpback whales in Brazil

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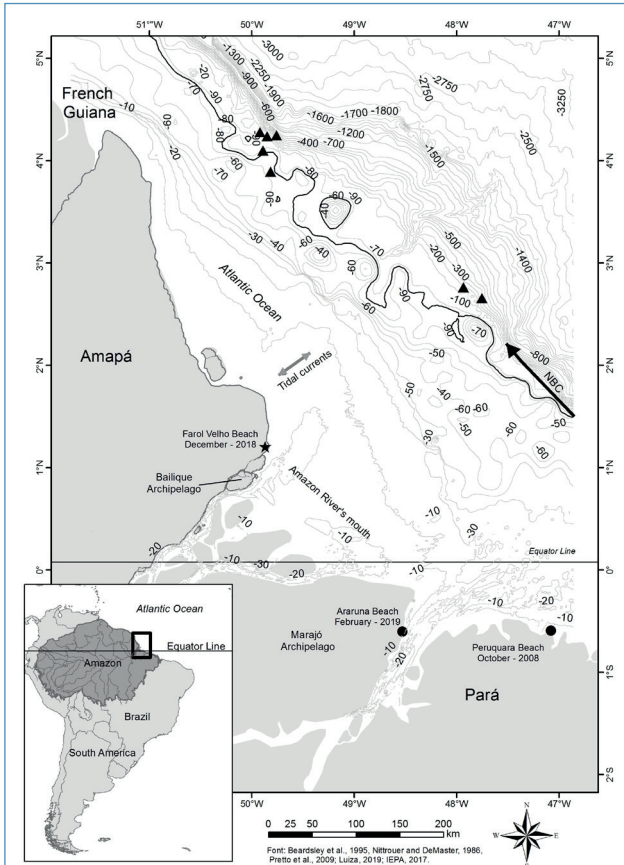
The humpback whale (*Megaptera novaeangliae*) is a cosmopolitan balaenopterid that undertakes annual long-range migrations from feeding areas in high latitudes, where it spends spring through fall, to tropical breeding areas, where mating, birthing and nursing of calves take place during winter (Clapham, 2009). Commercial whaling dramatically reduced most populations during the 20<sup>th</sup> century (Clapham and Mead, 1999). However, since the ban on commercial whaling was implemented in 1966, populations have recovered and the conservation status of the species is currently stated as “least concern” by IUCN (Cooke, 2018). Distinct populations occur in the Northern and Southern hemispheres, the latter with seven recognized ‘management areas’ or breeding populations (IWC, 1998). Between June and December each year, Southern Hemisphere humpback whales frequent the shallow breeding grounds off the Brazilian coast (IWC’s breeding stock ‘A’, Zerbini *et al.*, 2004; Fleming and Jackson, 2011).

The current known distribution of humpback whales in Brazil is based on regular sightings and occasional strandings. Distribution of humpback whales in Brazil ranges from Rio Grande do Sul (34°S) in the south, to Pará (00°42’S) in the north (Pinedo, 1985; Pretto *et al.*, 2009); with most sightings occurring at the 15-18° S mid-latitudes around the Abrolhos Bank (Andriolo *et al.*, 2010). In what may have been one of the first citizen-science studies, the Dutch Royal Navy, Aeronautical Services and shipping companies reported whale sightings throughout the world during the mid- to late 1950s, including records of humpback whales offshore the Northern Brazilian coast (Slijper and Van Utrecht, 1959). Humpback whales in the Southeastern Atlantic Ocean were targeted by

the whaling industry both in Brazilian and Antarctic waters until full protection was afforded by IWC in 1966 (Andriolo *et al.*, 2006). All humpback whale strandings on the Northern Brazilian coast were recorded in Maranhão (Magalhães *et al.*, 2008; Costa *et al.*, 2017, Ristau *et al.*, 2020), Piauí<sup>1</sup> (Costa *et al.*, 2017), and Pará (Pretto *et al.*, 2009; Luisa, 2019). Recent sightings were reported during 2014 to 2017 seismic surveys of the Amazon River’s mouth (*Foz do Amazonas*) and Barreirinhas basins (Barreto *et al.*, 2019).

On 11 December 2018, a whale carcass was found stranded on Farol Velho beach (01°10’31.3”N, 49°53’25.8”W), Vitória Island. This island is located at the northern side of the Amazon River’s mouth, on the coast of Amapá state, approximately 130 km north of the Equator line (Figure 1). The carcass was first sighted by locals, who shared photographs on social media. Based on visual observation of characteristic features (shape of the knobby head, long pectoral flipper, small dorsal fin located low and set back, and the serrated trailing edge of the caudal flukes), the species was identified as a humpback whale (Figure 2). It is not known if the animal stranded live or dead, however the carcass was found in prone position, suggesting it may have live-stranded. On 17 December the carcass was examined by field assistants, but due to the advanced state of decomposition (code 3 *sensu* Geraci and Lounsbury, 2005), it was not possible to identify the sex or determine the cause of death. Judging from

<sup>1</sup>Severo, M., Barragana, M., Costa, A.F., Marinho, A.C. and Tannús, R.M. (2004) Encalhe de uma baleia Jubarte (*Megaptera novaeangliae*) na Praia da Pedra do Sal em Parnaíba-PI. In Livro de Resumos, 3<sup>o</sup> Encontro Nacional sobre Pesquisa e Conservação dos Mamíferos Aquáticos. 1-7 April 2004, Itaparica-BA.



**Figure 1.** Humpback whale records around the Amazon River's mouth, highlighting the stranding site in the Amapá state (star). Spheres represent other stranding sites around the Equator line; triangles represent sightings.



**Figure 2.** Humpback whale (*Megaptera novaeangliae*) carcass found on the northern side of the Amazon River mouth, on the Amapá coast, Brazil. Photo credit: Alcindo Farias.

the carcass condition, the animal appeared to have died in early December. A task force involving research institutions working in Amapá, the State government and locals was mobilized from 4 to 9 January 2019 to rescue osteological and genetic material for further studies (Figure 3). Based on the relationship between skull and body length for humpback whales proposed by Tomilin (1957, *apud* Winn and Reichley, 1985; Nagasawa and Mitani, 2004), we estimated the animal's total length at 7.5–8 m (smaller than originally reported by the locals at 12 m). Therefore this was considered an immature whale (Stevick, 1999).

The stranding site was located approximately 5 km south of the old mouth of the Araguari River<sup>2</sup> and 6 km northwest of the Bailique Archipelago. This is an intertidal zone in an

accretionary area<sup>3,4</sup>, 300 km from the -90 m isobath on the continental shelf<sup>2</sup>, in a region where recent humpback whale sightings have also been reported (Barreto *et al.*, 2019). It is characterized by intense environmental processes, presence of the dispersal systems of the Amazon River (Nittrouer *et al.*, 1996), in Equatorial region subject to the influence of the Intertropical Convergence Zone – ITCZ (Schneider *et al.*, 2014), and semidiurnal macrotides with tidal bore (Santos *et al.*, 2005). Strong tidal currents with speeds greater than 2m/s cross the Amazon continental shelf perpendicular to the coastline (Beardsley *et al.*, 1995). The Brazilian northward current (NBC) borders the outer platform in a northwesterly direction with speeds that could be greater than 1 m/s (Nittrouer and DeMaster, 1986). We suggest that the

<sup>2</sup>Santos, V.F., Takiyama, L.R., Jardim, K.A., Proisy, C., Lobato, E., Santana, L.O., Figueiredo, A.G., Polidori, L., Silveira, O.F.M., Miranda, A.G., Amaro, V.E. and Matos, F.A. (2016) The Araguari Amazonian macrotidal estuary is closing: processes and consequences. Pages 482-483 in Vila-Concejo, A., Bruce, E., Kennedy, D.M. and McCarroll, R.J. (eds) Proceedings, 14<sup>th</sup> International Coastal Symposium. *Journal of Coastal Research*, Special Issue No. 75.

<sup>3</sup>Mendes, A.C. (1994) *Estudo sedimentológico e estratigráfico dos sedimentos holocênicos da região da costa do Amapá - setor entre a Ilha de Maracá e Cabo Orange*. Dissertação de Mestrado. Centro de Geociências, Universidade Federal do Pará, Belém. 274 pp.

<sup>4</sup>Silveira, O.F.M., Santos, V.F., Martins, M.H.A. and Monteiro, C.J. (2002) Dinâmica morfológica na Foz do Rio Amazonas através de análise multitemporal de imagens de satélite. In Resumos VI Workshop ECOLAB - Ecossistemas Costeiros Amazônicos, MPEG, Belém.



**Figure 3.** Osteological material recovered from a humpback whale stranded on the coast of Amapá, Brazil. Photo credit: Maksuel Martins.

stranding event may have occurred during spring tides, which reached a maximum amplitude of 4.5 m between 5 and 8 December near the Barra Norte station of the Amazon River (CHM, 2019). The environmental conditions in the Amazon River's mouth at the time of the event may have facilitated the transport of the animal towards the coast, assuming it may have been an inexperienced juvenile or possibly a sick animal.

The humpback whale population wintering in Brazilian waters has been undergoing recovery after several decades of commercial whaling, at an approximate 7% growth rate since the 1990s (Fleming and Jackson, 2011) and 12% from 2002 to 2011 (Wedekin *et al.*, 2017). Population size estimates have improved from around 2000 whales in 1980-1990 (Freitas *et al.*, 2004) to near 25000 nowadays (Zerbini *et al.*, 2019). According to several authors (*e.g.* Lodi, 1994; Zerbini *et al.*, 2004; Andriolo *et al.*, 2006; 2010; Magalhães *et al.*, 2008; Pretto *et al.*, 2009; Fleming and Jackson, 2011), this may suggest a westerly movement and consequent reoccupation of historical areas of distribution in the Southwest Atlantic Ocean, where humpbacks were present before the 20<sup>th</sup> century whaling. It is possible that the stranded specimen was a member of the Southern Hemisphere breeding stock A overstaying on the Brazilian breeding grounds, searching for new areas and expanding the breeding range<sup>5</sup> (Ristau *et al.*, 2020). This hypothesis shall be tested with results from genetic analysis of the sample collected.

The overlap between humpback whales populations coming from both Southern and Northern hemispheres is not common, but it has been reported in Panama (Rasmussen *et al.*, 2007). A sighting of a humpback whale in Suriname in April (de Boer and Willems, 2015) coincides with the known presence of humpback whales in the southeastern Caribbean from November through April, supporting the idea that humpback whales travel between primary breeding grounds

and extreme southern limits of the population's distribution along northern South America<sup>6</sup> during the main winter season (January-May). Finally, our record may simply document the presence of a species expected to occur in an area with very limited research effort where sightings are missed.

Humpback whales have been recorded in Guiana<sup>7</sup>, Suriname (de Boer, 2015; de Boer and Willems, 2015), and French Guiana<sup>8</sup> (de Boer, 2015; Martinez *et al.*, 2019) and therefore their presence along the Amapá coasts is not surprising. Despite the relative dominance of odontocetes on the Suriname's cetacean community, de Boer and Willems (2015) suggested that large balaenopterids seasonally occur in the area. This supports Reeves *et al.*'s (2001) suggestion that South Atlantic humpback whales visit the southern or eastern Caribbean during the boreal summer at least on occasional basis.

This is the second case of a stranded humpback whale in the Amazon coast, and the northernmost stranding record in Brazil. In October 2008, a whale carcass was found by fishermen on Peruquara beach (00°42'26.0"S and 46°57'53.4"W), Quatipuru, Pará State (Pretto *et al.*, 2009). A third case was reported in February 2019 in Araruna beach, near Soure city, eastern Marajó archipelago (Luisa, 2019). The current record of a humpback whale carcass in Amapá points at the urgent need to implement systematic surveys and monitoring efforts throughout the year, in order to reveal the full extent of the aquatic mammal fauna of the state while allowing the description of their distribution, seasonality, and conservation status.

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<sup>5</sup>Del Vecchio, C., Danilewicz, D., Wedekin, L., Baumgarten, J., Souza-Lima, R. and Marcondes, M. (2015) Photogrammetry reveals spatio-temporal differences in humpback whale body size distribution in the wintering ground off Brazil. In CD-ROM of Abstracts, 21<sup>st</sup> Biennial Conference on the Biology of Marine Mammals, 13-18 December 2015, San Francisco, CA, USA.

<sup>6</sup>Reeves, R.R. (2005) *Distribution and status of marine mammals of the wider Caribbean region: an update of UNEP documents*. UNEP Report UNEP (DEC)/CAR WG.27/INF.3. 18-21 July 2005, Bridgetown, Barbados. 8 pp.

<sup>7</sup>Kalamandeen, M. and Chesney, P. (2013) *Marine Mammals of Guyana*. Marine Mammal Conservation Corridor for Northern South America - Session 3. 18-20 March, Paramaribo, Suriname.

<sup>8</sup>Delvaux, H. (2013) *Marine mammals in French Guiana: current state of knowledge and conservation stakes*. Marine Mammal Conservation Corridor for Northern South America - Session 3. 18-20 March, Paramaribo, Suriname.

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