



Migrations of Blue whales (*Balaenoptera musculus*) in the Eastern South Pacific connect multiple South American jurisdictions with the High Seas

A case study illustrating ecological connectivity in areas beyond national jurisdiction



Case study: Migrations of Blue whales (*Balaenoptera musculus*) in the Eastern South Pacific connect multiple South American jurisdictions with the High Seas

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Introduction

Baleen whales are traditionally understood to migrate long distances between their summer feeding and winter breeding grounds; many exceptions to this pattern have however been recorded throughout the years, such as individuals that forgo migration to take advantage of abundant resources on the feeding grounds (Barendse et al. 2010) or even records of individuals performing longitudinal inter-oceanic exchanges (Stevick et al. 2014). A deeper understanding of migratory species and their transboundary connections is thus important to underpin regional and national management (Hucke-Gaete et al. 2018).

The blue whale (*Balaenoptera musculus*) is a cosmopolitan migratory species which takes part in long term cyclical movements, although these are much less understood than other baleen whale species' movements (CPPS Report 2014). Moreover, blue whales are the world's largest animal – in some cases measuring more than 30 meters in length and weighing over 150 tons (Jefferson et al. 2008). The high energetic requirements of these huge animals require them to forage frequently, in contrast with other baleen whales which fast for extended periods of time (Goldbogen et al. 2011). Subsequently, to meet this high energetic demand while migrating or even while nursing and breeding, their movements are thought to be influenced by oceanographic processes such as upwelling that produce abundant prey sources (Branch et al. 2007; Hucke-Gaete et al. 2018).

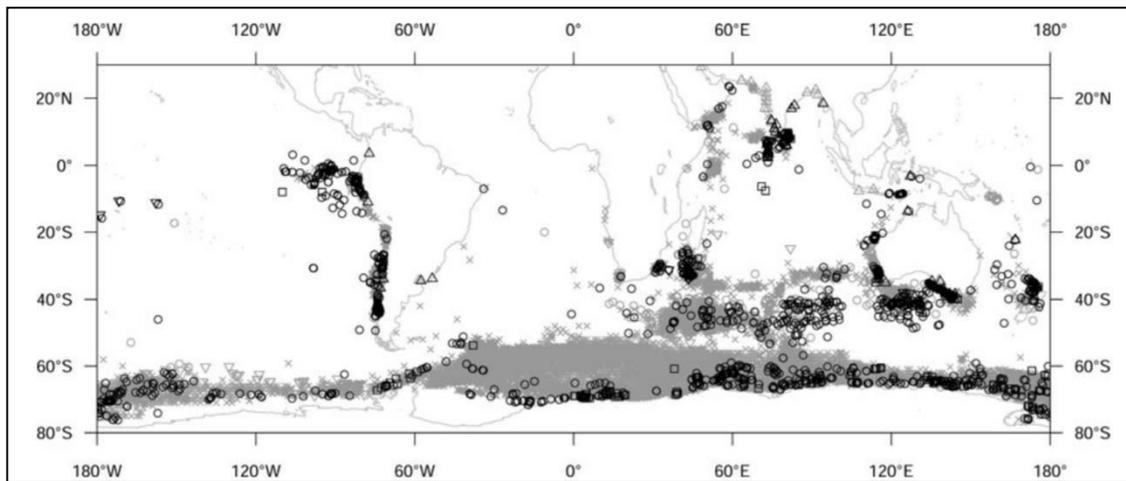


Figure 1 reprinted from Branch et al. 2007: Map of distribution of blue whales in the Southern hemisphere in all months based on catches (x), sightings (o), strandings (Δ), acoustic records (□) and Discovery mark positions (▽). Grey is used for positions ≤ 1973 and black for > 1973.

Understanding population distribution

One of the lesser studied blue whale populations in the world is the Eastern South Pacific (ESP) population, which is possibly (though still debated) a unique subspecies, with a distinct distribution, and migratory, genetic and acoustic patterns from the closely related Antarctic

subspecies (*B.m. intermedia*) (Branch et al. 2007; Torres-Florez et al. 2014, 2015). However, the ESP population is currently managed as part of the Antarctic subspecies. Blue whales in the Southern hemisphere greatly suffered the effects of whaling in the 19th and 20th centuries, which reduced their populations to 3% of their original numbers (Laws 1977; Branch et al. 2007), and resulted in the later listing of the Antarctic subspecies as “Critically endangered” on the IUCN Redlist (Cooke 2018).

Blue whales from this population have been recorded feeding and nursing off the coast of Chilean Northern Patagonia during the austral summer (Torres-Florez et al. 2014; 2015). This area is considered to be one of the most important feeding and nursing ground for blue whales in the Southern Hemisphere (Hucke-Gaete et al. 2004), encompassing a complex system of glacial ice-melt and river run-off that influences phytoplankton blooms in the summer (Longhurst 1998).

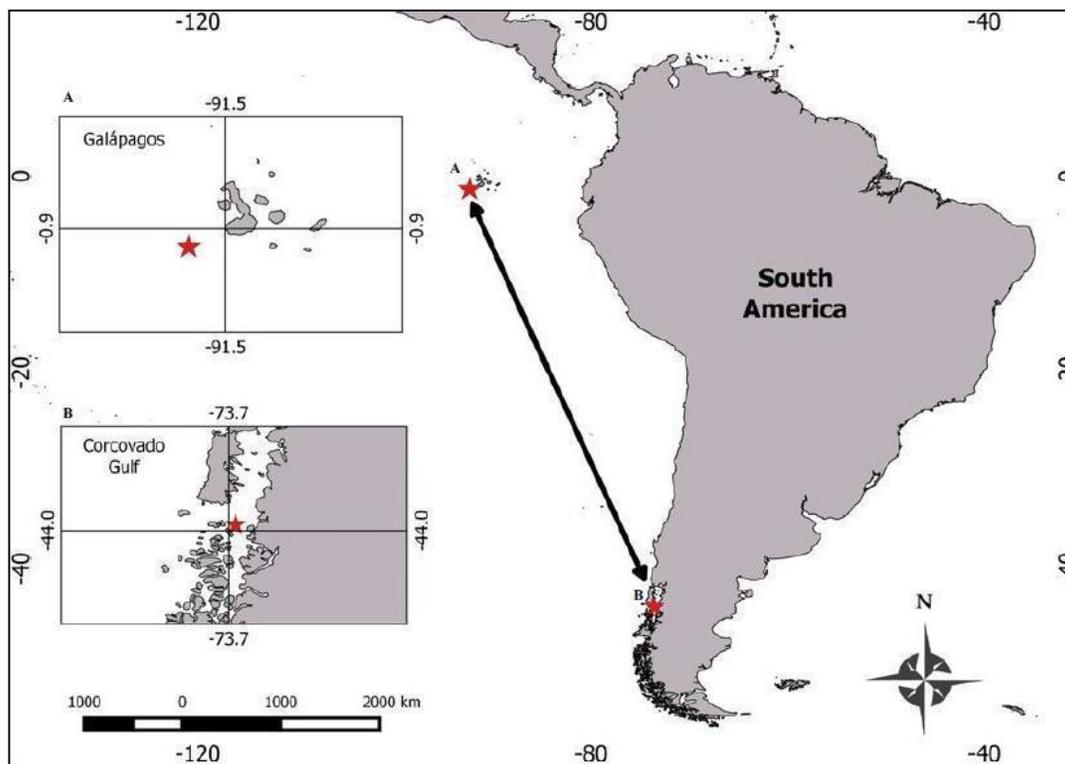


Figure 2: reprinted from Torres-Florez 2015: Survey areas. (A) Galapagos archipelago locality of the sampled and photographed whale during the 1998. (B) Corcovado Gulf locality of the sampled and photographed whale during the 2006. Arrow indicated the minimum travel path.

Complex migratory patterns

Similar to many marine migratory species, the migration patterns of the ESP population appear more complex than a single back and forth movement, and their migratory patterns are different from patterns observed in other blue whale populations (Hucke Gaete et al. 2018).

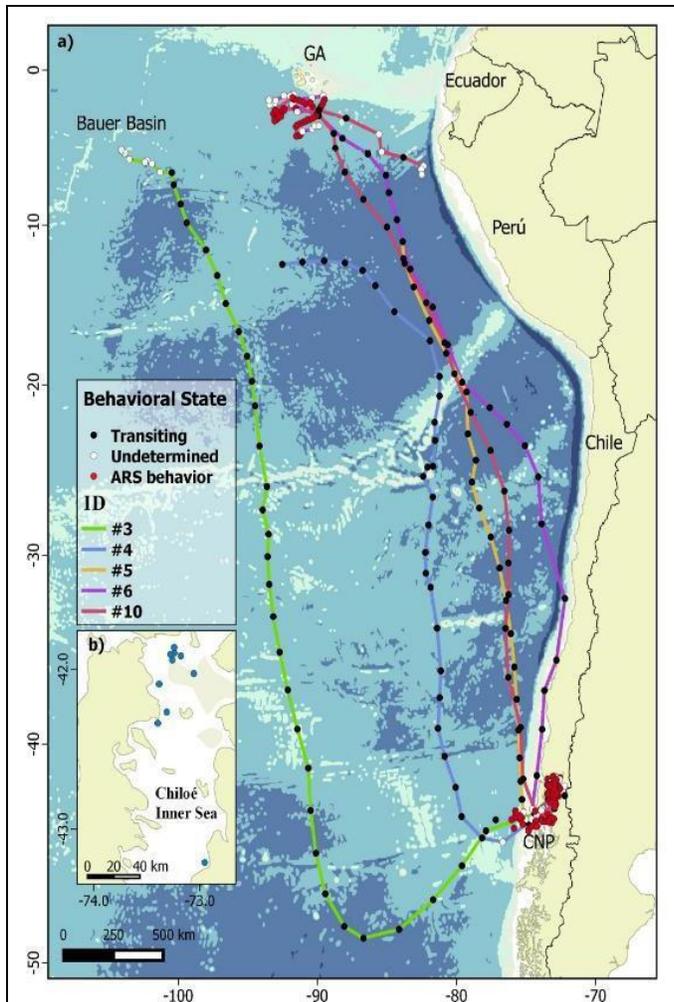


Figure 3: reprinted from Hucke-Gaete 2018: Satellite tracks of five wide-ranging blue whales tagged in Chilean Northern Patagonia's feeding ground and migratory routes along the Eastern South Pacific, showing different behavioral states.

suggesting that foraging in mesopelagic zones might also be taking place in this wintering area (Hucke-Gaete et al. 2018). This vertical movement has also been recorded in the Southern California Bight for the Eastern North Pacific population of blue whales (Goldbogen et al. 2011). Further evidence is needed to confirm use of the mesopelagic zone by the ESP population.

Finally, one of the animals swam towards Peruvian waters after visiting the Galapagos Archipelago, where blue whales have been reported consistently throughout the years, (peaking from December – March; Figure 3; Donovan 1984). Blue whales have been regularly sighted from 60 nautical miles off the coast of Peru to areas 1200 nm offshore, in areas beyond national jurisdiction, suggesting that these waters might also be important for this population (Donovan 1984; Hucke-Gaete et al. 2018). The current hypothesis is that the animals from this population travel through Peruvian waters to return to the CNP feeding ground again the following summer (Hucke-Gaete et al. 2018).

The presence of blue whales in the Galapagos Archipelago have been recorded for decades (Palacios 1999), but only recently have studies been able to confirm conjectures regarding their migratory behavior. Torres-Florez et al. (2015) demonstrated a direct connection when the same female was identified genetically in both the Galapagos Archipelago and the Chilean Northern Patagonia (Figure 2). Other studies also support this link through acoustic and genetic evidence although it was not until 2018 that telemetry evidence was presented showing movement of five whales migrating from the Chilean North Patagonia to the Galapagos Archipelago (Figure 3; Hucke-Gaete et al. 2018). These blue whales were tracked to their wintering ground in Galapagos confirming migration timing and the specific route used.

Further, information on their diving behavior indicated that at least one animal increased its diving-depth when approaching the Galapagos Archipelago (surpassing 330m),

Better understanding of the complex migratory patterns of this population is needed, particularly, direct evidence of the hypothesized return migration routes. However, the existing evidence of this population of blue whales migrating, feeding, breeding and nursing in the waters of several CPPS (Comisión Permanente del Pacífico Sur) countries and adjacent areas in ABNJ, highlights the importance of developing a strong regional and transboundary management scheme. Incorporating considerations of migratory and vertical movements will be an essential step towards reducing the impacts of anthropogenic stressors on this already threatened migratory species.

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ABNJ DEEP SEAS PROJECT

The Sustainable Fisheries Management and Biodiversity Conservation of Deep Sea Living Resources in Areas Beyond National Jurisdiction Project (ABNJ Deep Seas Project for short) is a five-year project supported by the Global Environment Facility, and implemented jointly by the Food and Agriculture Organization of the United Nations, and the United Nations Environment Programme. The UN Environment Programme project component is executed through the UN Environment Programme World Conservation and Monitoring Centre.

The Project is designed to enhance sustainability in the use of deep-sea living resources and biodiversity conservation in the ABNJ through the systematic application of an ecosystem approach. It brings together over 20 partners who work on deep-sea fisheries and conservation issues in the ABNJ globally. The partnership includes regional organizations responsible for the management of deep-sea fisheries, Regional Seas Programmes, the fishing industry and international organizations.

The Project aims to:

Strengthen policy and legal frameworks for sustainable fisheries and biodiversity conservation in the ABNJ deep-seas;

Reduce adverse impacts on VMEs and enhanced conservation and management of components of EBSAs;

Improve planning and adaptive management for deep-sea fisheries in ABNJ; and develop and test methods for area-based planning.

The ABNJ Deep Seas Project started in September 2015 and is one of four projects under the **GEF Common Oceans Programme**.

More information is available from www.commonoceans.org