

# Blue whale acoustic monitoring in the South-West Indian Ocean: an overview from large array of hydrophones

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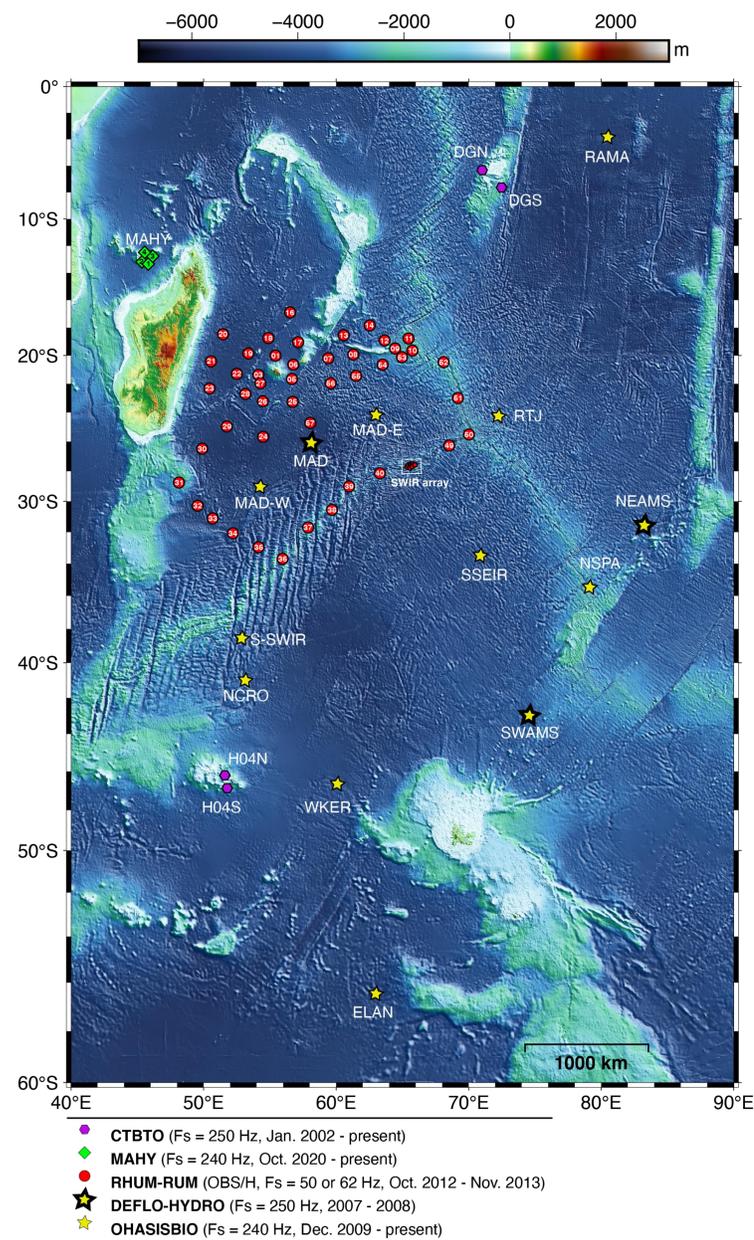
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## Introduction

In 1979, the International Whaling Commission established the Indian Ocean whaling sanctuary, protecting a breeding area where baleen whales were heavily hunted during the 20<sup>th</sup> century. Until 2010, knowledge on blue whale presence in this area was mostly inferred from whaling log books and sparse visual observations. Since then, the Southwest Indian Ocean has been instrumented with multiple hydrophone arrays dedicated to geophysical or nuclear explosion monitoring (sampling frequency < 250 Hz). In this soundscape the low-frequency, high-intensity, stereotyped songs of multiple blue whale populations are predominant. The record analysis highlights a great diversity of whale populations in this area (fin whales, 3 pygmy blue whale acoustic populations and Antarctic blue whales) and revealed new unattributed large whales' songs. Such wide range and long-term monitoring is thus worth pursuing as it provides invaluable information to design and implement conservation and management measures and to assess the effects of global environmental changes for these endangered whale species.

## Acoustic observatories



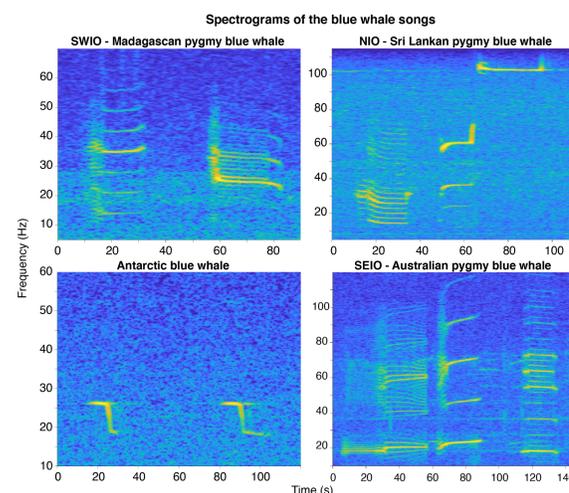
## Conclusion

Hydro-acoustic observatories primarily dedicated to geophysical or nuclear explosion monitoring can be used to improve knowledge on elusive large baleen whales. They also show the high potential of collaborations between researchers from multiple disciplines to collect and analyze data. For example, a decade of recordings in the Southwestern Indian Ocean primarily dedicated to geophysical research greatly improved the knowledge about blue whale presence and helped assessing the conservation status of this threatened species.

The work presented here focuses on blue whales, but other acoustic events from biologic, anthropogenic and geophysical sources can also be studied using these large and long-term acoustic arrays. Sharing existing datasets is therefore encouraged to broaden the scope of applications.

## What does long-term basin scale acoustic monitoring tell us about blue whales ?

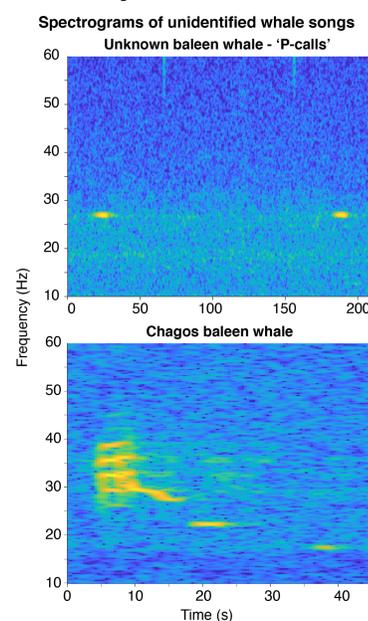
### 1- Population diversity



The acoustic recordings reveal the sympatric presence of multiple blue whale acoustic populations and highlight the importance of the area for these sub-species.

Samaran et al. 2010, Leroy et al. 2018 (b), Torterotot et al. 2020

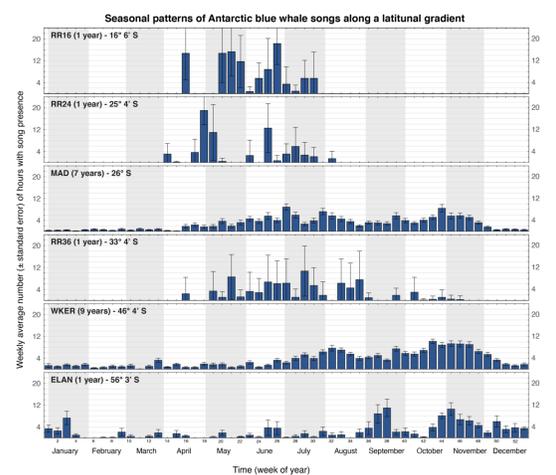
### 3- Discovery of new sounds



Passive acoustic monitoring is blind, and unknown biological sounds can be discovered. Assumptions can be made about their source, but their precise identification will require further investigation.

Leroy et al. 2017, 2021

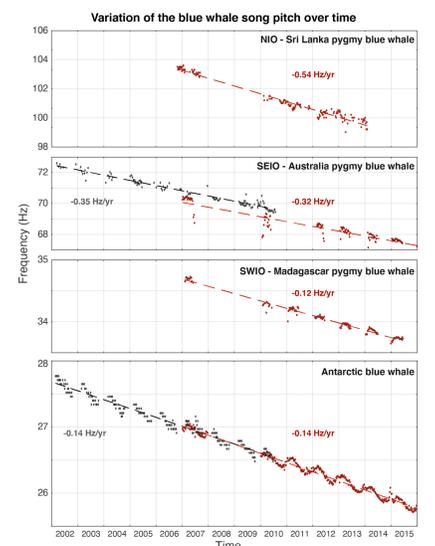
### 2- Large scale movements



Blue whale songs are recorded during different seasons over the wide-spread area covered by the hydrophones, revealing the distribution and migration patterns of the sub-species.

Samaran et al. 2013, Leroy et al. 2016, Dréo et al. 2019, Torterotot et al. 2020

### 4- Long-term and seasonal song pitch variations



The pitch of blue whale songs is consistently decreasing over the years and varies seasonally. The reason of these changes are still to be unveiled.

Leroy et al. 2018 (a)

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