Whistle behaviour of Indian Ocean humpback dolphins (*Sousa plumbea*) in South Africa

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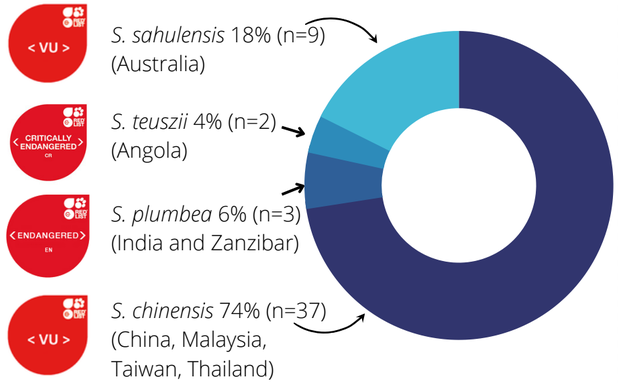
Introduction

- Indian Ocean humpback dolphins (IOHD) are **globally threatened** and South Africa's **most endangered marine mammal**
- With **less than 500 individuals left** in South Africa, traditional boat mased monitoring methods are slow and costly
- **Passive acoustic monitoring offers a cost effective method** to observe and monitor the population along their coastal range. This requires building regionally specific species classifier models *(SWORD Project)*
- However, with very **little knowledge on their acoustic repertoire** and no published acoustic studies on South African IOHD, we provide the first look at their whistle repertoire in South Africa

Published acoustic research on global Sousa spp.
(1977 - 2022 50 published papers)



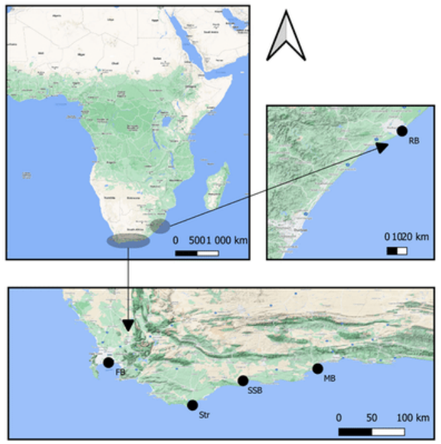
S. sahulensis 18% (n=9) (Australia)

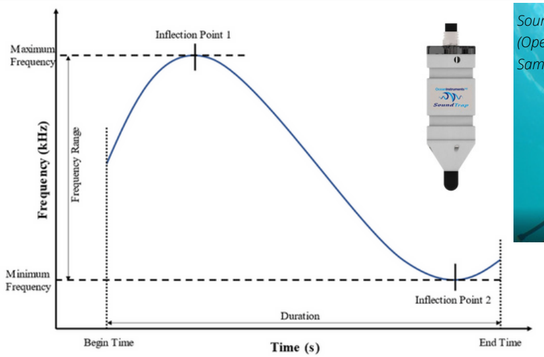
S. teuszii 4% (n=2) (Angola)

S. plumbea 6% (n=3) (India and Zanzibar)

S. chinensis 74% (n=37) (China, Malaysia, Taiwan, Thailand)

Methodology





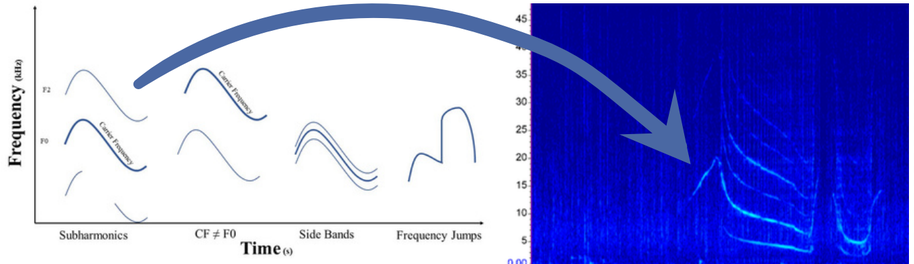
SoundTraps 300 (STD and HF) and Hydromoth (Open Acoustics) used for data collection
Sample Rates: 96kHz & 384 kHz

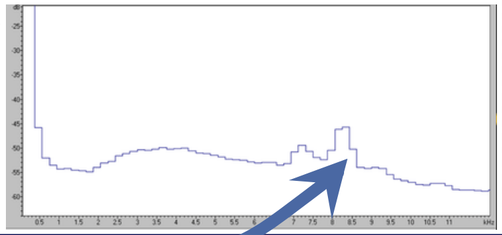
- Data collected from **5 separate locations** over 21 days from 2016 - 2021
- Used **confirmed single species group recordings only** with concurrent behaviour and group size data
- Measured only **fundamental frequency** whistle contours in main analysis
- **Five temporal and spectral variables** measured (See descriptions on graph above)

Results

1293 Whistles
(across 21 days)

Freq Range: 0.38-46.57 kHz
Mean Min Freq 6.48kHz
Mean Max freq 11.26 kHz
Mean duration 0.4 secs
77% 0 or 1 inflection points





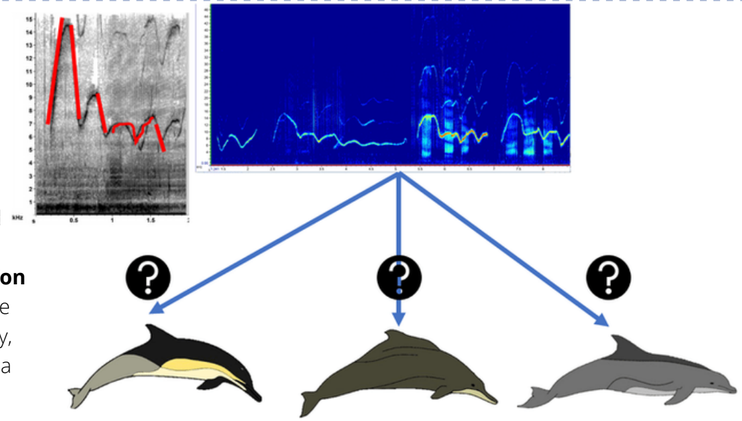
Top Left: Four examples of nonlinear phenomena
Top Right: Example of sub harmonics (NLP) in an IOHD whistle
Bottom Right: Power spectral analysis of an IOHD whistle, showing the carrier frequency in F2 harmonic

Nonlinear phenomena (NLP) were present in recordings at all study sites
For example, there were 43 examples where the carrier frequency was present in the second harmonic (F2) and not the fundamental frequency

Conclusions

- SA IOHD have a **broad repertoire,** including the presence of ultrasonic whistles and nonlinear phenomena
- High prevalence of the **carrier frequency** in the 2nd harmonic, instead of the fundamental frequency
- There was **no significant microgeographic variation** between study sites, which differs to existing literature
- The ultrasonic frequencies, range of harmonic energy, and other NLP seen in this species are thought to be a general feature of this genus

It is important to include these features when designing automated species classifiers. Training data must be regionally specific and account for these phenomena



Top left: fragments of whistle contour traced in whistle and moan detector in PAMGuard.
Top Right: Development of an automated species classifier is essential to effectively monitor IOHD in regions where sympatric whistling dolphins occur

Many thanks to all my collaborators who have helped and continue to support me throughout this project.
If you have any questions or would like to discuss the project in more detail please don't hesitate to get in contact!

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