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Less is more ? How the choice of a recording duty cycle could affect monitoring results of passive acoustic studies on cetaceans

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Introduction

This study examines the impact of different temporal subsampling strategies on two types of cetacean acoustic behavior: seasonal blue whale songs and daily delphinid presence based on click detections. The research aims to understand the effectiveness of duty cycle recording strategies in long-term passive acoustic monitoring. It provides insights into the relationship between recording strategies, acoustic behavior, and research questions that are crucial to the interpretation of collected data.

Material & Methods

Acoustic data collection

Delphinids dataset:

- **Clicks** produced by dolphins
- **Daily presence** : number of positive detection hours per day during 6 months (Figure 1)
- **CETIROISE** : 2 sites in the Iroise Sea (France) equiped with F-PODs

Blue Whales dataset:

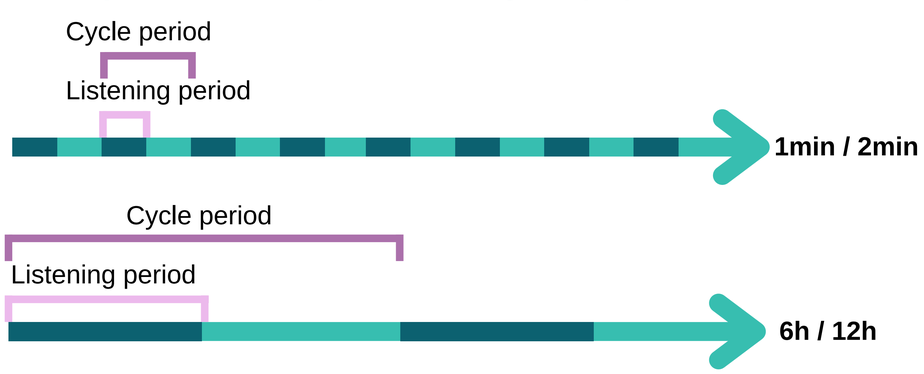
- **Songs** produced by 2 subspecies of blue whale and 2 populations of pygmy blue whales (Torterotot et al., 2020)
- **Seasonal patterns** : number of detections per week during 8 years with contrasted seasonal species occurence (Figure 2)
- **OHASISBIO**: 2 sites in the SouthWestern Indian Ocean equiped with large band hydrophones

Subsampling analysis

- **21 subsampled datasets**: listening periods (from 1 minute to 6 hours) and duty cycles (50%, 33% and 25%)
- Computing the **(1-R²)** linear regression model to assess the relevance of using subsampled data to visualize seasonal trends compared to using continuous data

Continuous recording: duty cycle 100%

Examples of subsampled recording: duty cycle 50%



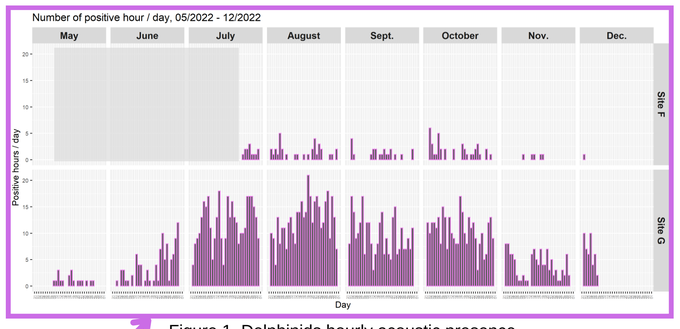


Figure 1. Delphinids hourly acoustic presence

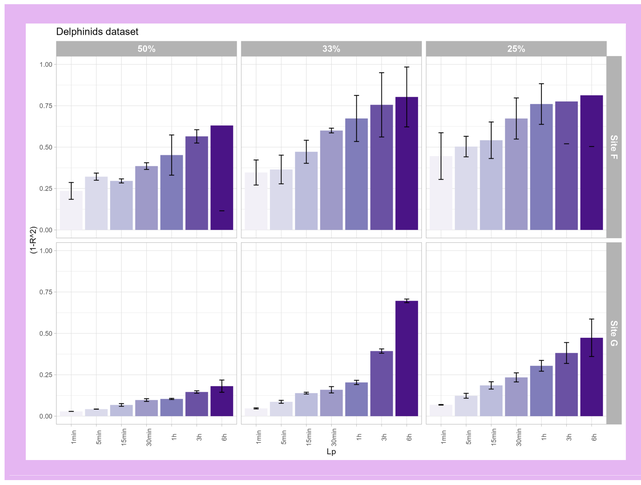


Figure 3. Different (1-R²) comparing the effect of subsampling schemes on the daily presence of Delphinids datasets.

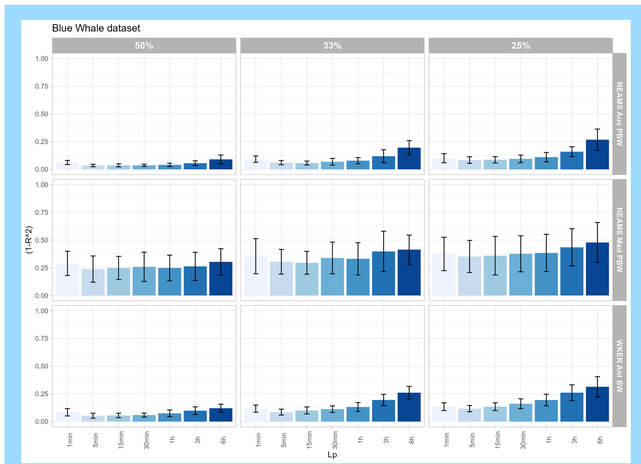


Figure 4. Different (1-R²) comparing the effect of subsampling schemes on the seasonal patterns of Blue Whale datasets.

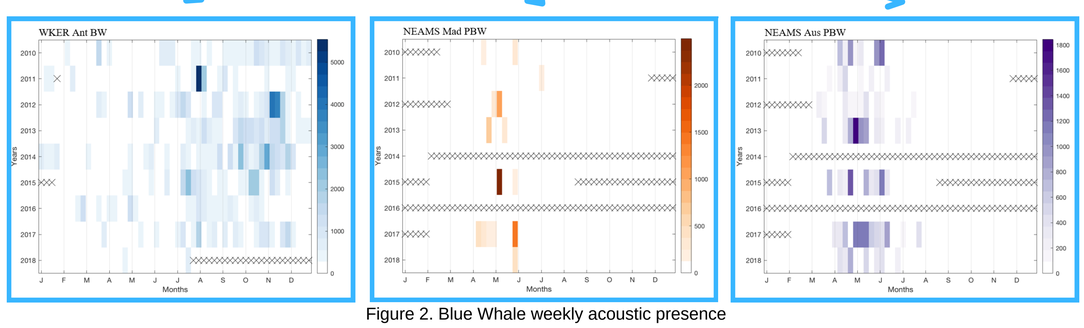


Figure 2. Blue Whale weekly acoustic presence

Results & Discussion

Blue Whale & Delphinids datasets (Figure 3 & 4):

- Higher duty cycles and shorter listening periods lead to a more accurate representation of seasonal patterns
- Less detections lead to less representative subsampled datasets (>25% information loss)
- The accuracy of the seasonal trend representation is not affected by detection distribution

Duration of signals of interest must be taken into consideration:

- For Blue Whale songs, short listening periods (1 min) can cut off long calls
- For impulse Delphinids clicks, 1 minute listening periods is the optimal representation

References

- Torterotot M, Samaran F, Stafford KM, Royer JY. Distribution of blue whale populations in the Southern Indian Ocean based on a decade of acoustic monitoring. Deep Sea Research Part II: Topical Studies in Oceanography. sept 2020; 179:104874.
- The CETIROISE project benefits from the financial support of the European Union, NextGenerationEU and France Relance.