Final Evaluation Report

Your Details	
Full Name	Guilherme Azevedo Barreiros Maricato
Project Title	Dolphins of the Green Coast: Evaluating the effectiveness of Marine Protected Areas towards an endangered cetacean in south-eastern Brazil
Application ID	33877-1
Date of this Report	03/02/2022

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
To analyse the overlapping of the Guiana dolphin feeding areas with the MPAs boundaries				20% of Sepetiba Bay (BSEP) is suitable for feeding behaviour of Guiana dolphins, while at Ilha Grande bay (BIG) suitability reaches 26%. However, the marine protected area (MPA) of BSEP holds 62% of these more suitable areas, while the MPA of BIG holds only 25%.
To measure the proportion of acoustic space used by the Guiana dolphins within the MPAs				Guiana dolphins' vocalisations range from 1.41 to 63.1 kHz in tonal sounds (whistles) and 122.1 kHz in pulsed sounds (pulsed calls and echolocation clicks). There is already anthropophony that may occupy all frequency bands up to 96 kHz. Thus, this represents an overlap of 100% of the tonal emissions and 78.6% of the pulsed emissions. We estimate that sounds of Guiana dolphins can propagate on average about 4 km in both bays. In BSEP, emissions propagate mostly within the limits of the MPA. On the other hand, at BIG, given the small size of the MPA, all emissions propagate beyond the limits of the MPA.
To investigate whether MPAs provide acoustic refuges for Guiana dolphins				In general, most of the anthropogenic noise was detected inside the MPAs. About 57% of the noisiest areas are within MPAs, this anthropogenic noise overlaps in frequency with dolphins' vocalisations. Although noisier, in both bays, dolphins tend to emit more whistles inside MPAs (BIG - $\bar{x}$ = 0.48 outside MPAs, $\bar{x}$ = 0.60 inside MPAs; BSEP - $\bar{x}$ = 0.22 outside MPAs; $\bar{x}$ = 0.24 inside MPAs) and whistle richness (BIG - 40.9% outside MPAs; 87.3% inside MPAs, 46.4% exclusive to

				MPAs and SEP - 44.6% outside MPAs; 82% inside MPAs, 55.4% exclusive to MPAs). Despite MPAs being the main acoustic habitat of the Guiana dolphin, it is not effective as an acoustic refuge, emphasising the importance of considering acoustic aspects in the management of MPAs.
To investigate whether the core areas of resident individuals are within the MPAs				We identified that most of the Guiana dolphins core areas are not within the MPAs. However, the data collected was not enough to identify the most resident individuals.
To map human activities that occur within and outside the MPAs boundaries				We identified the following activities in each bay: BIG - fishing and tourism (MPA); fishing, tourism, and boat traffic (non-MPA). BSEP - fishing, tourism, and boat traffic (MPA); fishing, tourism, boat traffic, and industrial and port activities (non-MPA).
To model the effects of human activities on Guiana dolphins' habitat use				In both bays, the most suitable areas for the Guiana dolphin were areas with less vessel traffic. At BSEP, there was also less suitability in noisier areas.
To promote awareness in local communities about the importance of MPAs and the Guiana dolphins				We directly reached almost 300 students in elementary and high school classes. In addition, we indirectly reached employees of local businesses and tourists through scientific communication.
To determine the effectiveness of MPAs based on human activities that occur within them				Both MPAs have been entered into the Marine Protected Area Guide (MPA Guide) of the Marine Protection Atlas (MPAtlas). The MPA of BSEP has been classified as "lightly protected". The MPA of BIG was classified as "highly protected".

2. Describe the three most important outcomes of your project.

a). We showed that both MPAs are not effective to protect Guiana dolphin feeding grounds and acoustic space. Most of the suitable areas that dolphins use to feed are outside the MPA limits, for both bays. Similarly, MPAs are noisier than the areas outside their limits, affecting dolphin communication.

b). The MPA in BIG had a greater potential to mitigate human activities, since most of them are prohibited within its limits, granting its status of 'fully protected'. The MPA in BSEP, however, allowed many anthropogenic activities (e.g., fishing, tourism, dredging), which granted its status of 'lightly protected'. Nevertheless, it is important to state that most of the suitable areas for dolphins were outside the MPAs, which are subject to even higher anthropogenic impact. This reinforces the importance of MPAs with larger areas.

c). We reached more than 300 students and carried out awareness-raising activities. Most students had little knowledge about Guiana dolphin populations and their ecological role inside BSEP and BIG. We were able to show the potential of the MPAs to protect biodiversity and ecosystem services, with special regards to Guiana dolphins.

We showed that there is a relevant spatial mismatch between the important areas for Guiana dolphins and the MPAs. Consequently, at the present, MPAs are not effective to protect Guiana dolphins and their ecological roles in these bays. This information will be able to subsidise changes in MPA limits and regulations to better protect Guiana dolphin populations. Also, it was possible to sensitise many students to the role that dolphins play in these bays.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

The main difficulty was the pandemic. Our awareness campaigns had to be postponed because there were no face-to-face classes. Everything else was done following the safety protocols against COVID-19. In the last campaign at Ilha Grande Bay, our SoundTrap broke down and we did not record the acoustic data.

4. Describe the involvement of local communities and how they have benefitted from the project.

The communities were very receptive and interested in our work. Through our outreach campaigns, they learned about the importance of the bays, the local protected areas, and the dolphins for the local communities (for example, sentinel species reflecting the environmental health).

5. Are there any plans to continue this work?

Yes, there are. Please find the description of the plans in item 10.

6. How do you plan to share the results of your work with others?

We plan to share the results through a short documentary, our social media, scientific papers, and students' thesis available in public repositories.

7. Looking ahead, what do you feel are the important next steps?

The important next steps are directed to conduct an Ecological Risk Assessment to understand the spatio-temporal cumulative impacts of human activities on Guiana dolphins. This approach will be able to highlight the most vulnerable areas for dolphin conservation. Also, as we detected other species that use the bays (Atlantic spotted dolphin, bottlenose dolphin and franciscana), this approach will be also extended to them. Since noise was an important source of human impact at both bays, we will seek to deepen our understanding on the magnitude of the impacts of noise by conducting playback experiments. Finally, we will expand our awareness activities with the local community and engage with local managers (MPA managers, environmental agencies, fishing community leaders, etc.) to evaluate their perception and include their knowledge in our risk assessment.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

Yes, we used the Rufford Foundation logo in posts on social media (@ecomar_ufrj on Instagram and Twitter), posters and presentations at conferences, and in the short documentary we made.

9. Provide a full list of all the members of your team and their role in the project.

M.Sc. Guilherme Maricato (PI) - collected data in all fieldwork. He also ran the spatial analysis, wrote the report, and participated in the discussions.

Dr. Maria Alice dos Santos Alves (Co-PI 1) - advised Guilherme, reviewed the report, and participated in the discussions.

Dr. Rodrigo Tardin (Co-PI 2) - advised Guilherme, collected data, ran the spatial analysis, wrote and reviewed the report, and participated in the discussions.

Dr. Israel Maciel - collected data, ran the acoustics analysis, wrote and reviewed the report, and participated in the discussions.

M.Sc. Ana Luiza Mello - participated in the outreach campaigns discussions.

B.Sc. Júlia Cristina - participated in the outreach campaigns discussions.

New members:

Dr. Gabriel Melo-Santos - participated in the discussions.

MSc. Tomaz Cezimbra - participated in the discussions.

B.Sc. Pedro Fróes - collected data, ran the acoustics analysis and participated in outreach campaigns analysis and discussions.

Ana Beatriz Silva (undergraduate student) - collected data and participated in the outreach campaigns analysis and discussions.

Larissa Melo (undergraduate student) - collected data, ran the acoustics analysis and participated in outreach campaigns analysis and discussions.

Rodrigo Pedrosa (undergraduate student) - collected data and helped in the spatial and outreach campaigns analysis.

10. Any other comments?

Short documentary: https://youtu.be/lY5DIC_N7N8

Supplementary material

Research items:

Melo et al. 2021. Evaluating the effectiveness of Marine Protected Areas as acoustic refuges at Sepetiba and Ilha Grande bays. [PDF] [Twitter]

Maricato et al. 2022. Dolphins of the Green Coast: Evaluating the effectiveness of Marine Protected Areas towards an endangered cetacean in south-eastern Brazil. [PDF]

Fróes et al. 2022. As unidades de conservação podem ser ambientes favoráveis à comunicação do boto-cinza? [PDF]

Melo et al. 2022. Marine protected area as an acoustic refuge not effective for Guiana dolphins. [PDF]

Maricato et al. 2023. Current Marine Protected Areas are not effective in protecting Guiana dolphins feeding hotspots. [PDF]

Student training:

Fróes 2022. Um lugar silencioso: avaliando a efetividade das unidades de conservação marinha como refúgios acústicos para o boto-cinza. Undergratuate thesis.

Figure 1. Pedro Fróes presenting his undergraduate thesis at the Federal University of the State of Rio de Janeiro (UNIRIO). September 2022. Rio de Janeiro - RJ, Brazil.

Conferences:

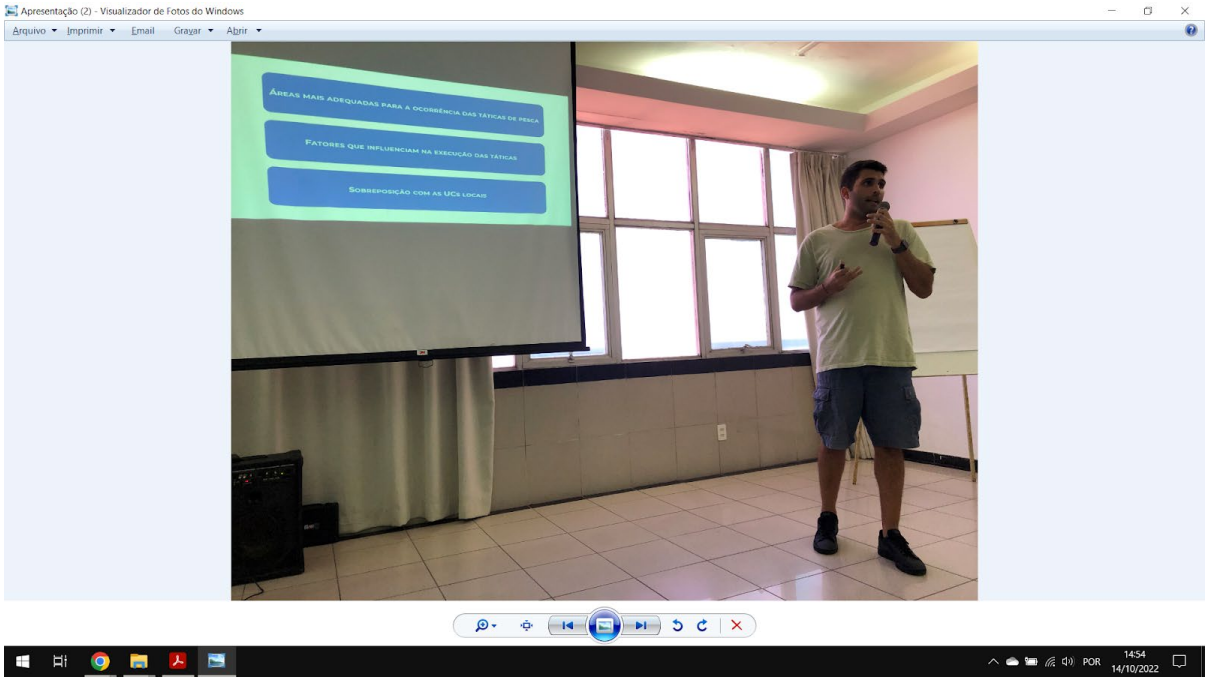

Figure 2. Guilherme Maricato (PI) presenting his abstract in the Brazilian Rufford Conference. April 2022. Recife - PE, Brazil.

Figure 3. Guilherme Maricato (PI) in the Brazilian Rufford Conference. April 2022. Recife - PE, Brazil.

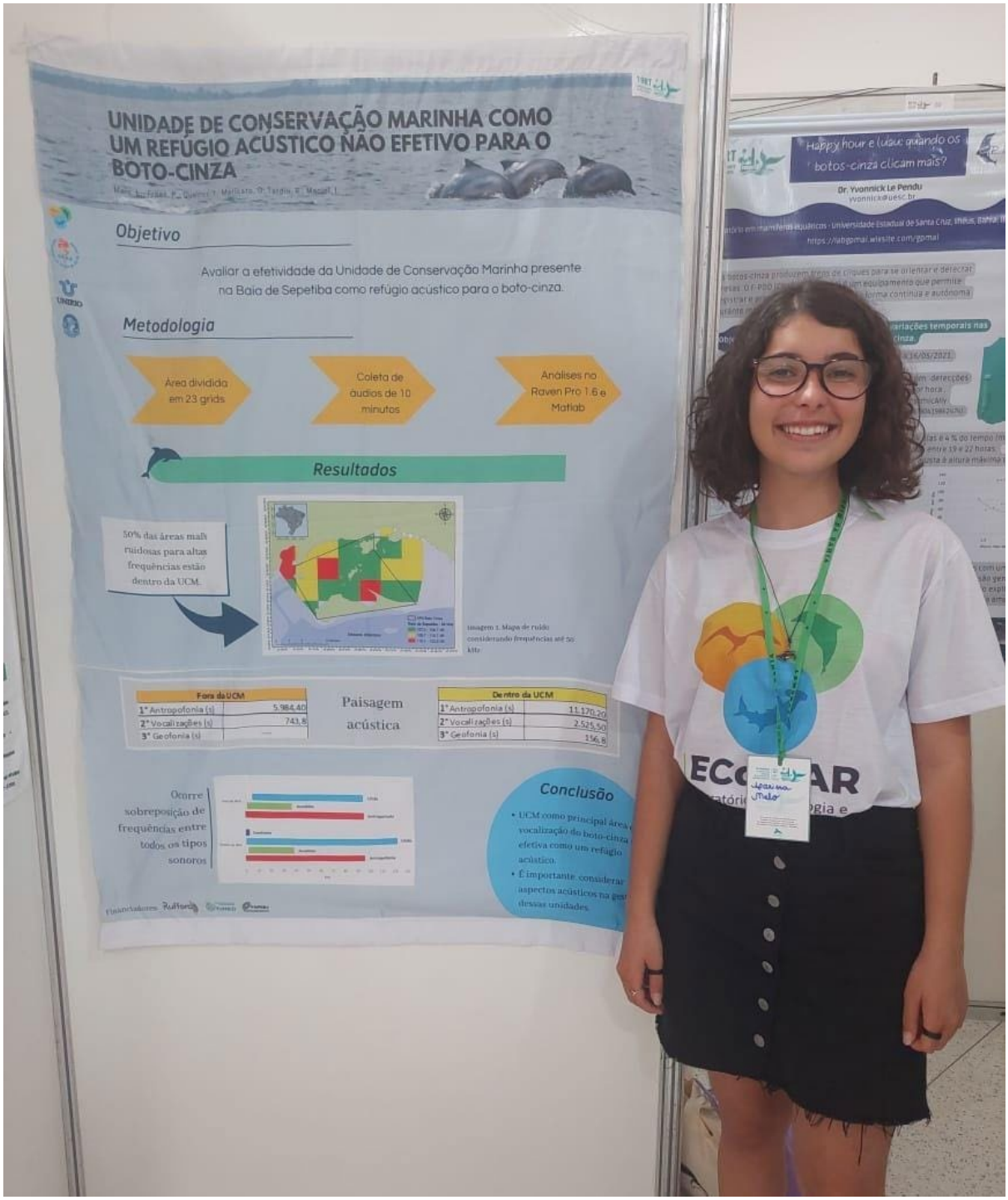

Figure 4. Larissa Melo presenting her abstract in the XIII Congreso de la Sociedad Latinoamericana de Especialistas en Mamíferos Acuáticos. September 2022. Praia do Forte - BA, Brazil.