

## **Project Update: November 2023**

I am excited to announce that we have successfully completed the data collection phase of the project! We have processed a substantial amount of the gathered data and have uncovered compelling results. These findings are significantly enhancing our understanding of the impacts of human-generated sound on the acoustic landscapes of coral reefs. To give you an overview of the project's development, I am pleased to present an abstract below.

Noise pollution harms marine life, impacting communication and animal health. Acoustic landscape ecology provides insights into ecological relationships, highlighting the effects of human-generated sounds on reef ecosystems. In Brazil, the scarcity of studies on noise pollution in coral reefs underscores the need for investigation into this issue. This study aimed to compare reef acoustic landscapes from different regions, considering the impacts of anthropophony during different types and seasons of tourism in the Costa dos Corais Environmental Protection Area and Guadalupe Environmental Protection Area. Specifically, (1) identifying and characterising the sound contributors found; (2) analysing the relationship between the diversity and abundance of marine fish and the acoustic complexity of the ichthyofauna; and (3) investigating how anthropophony and variables such as temperature and depth affect the acoustic complexity of coral reefs. Sub-aquatic recordings were made at various points of interest, covering different types (regional and seasonal) and tourism seasons (high and low), using a hydrophone and a digital recorder. Analysis of the recordings revealed the presence of contributors representing biophony, geophony, and anthropophony. To assess the diversity of local fish, visual censuses were conducted, revealing a correlation between fish diversity and abundance with acoustic complexity and the number of sound profiles found. Generalised Linear Model analysis indicated that, among the human-related factors assessed, proximity to the coast had the greatest impact on acoustic complexity, followed by season and type of tourism. Additionally, depth and temperature data were collected to investigate their influences on acoustic complexity, showing a relationship with values, albeit less pronounced. Temporally, periods of significant declines in the Acoustic Complexity Index coincided with activities associated with human influence, resulting in drops of ~50%, especially in locations near the coast during the high tourist season. Spectrograms displayed a similar pattern, characterised by the presence of human-generated noises in lower frequency bands. In summary, the study identified how tourism directly acts as a source of anthropophony, exerting influence on the acoustic complexity of soundscapes in northeastern coral reefs, as well as being affected by environmental conditions such as temperature and depth. Furthermore, the fish community was shown to be a significant part of the observed soundscapes, and it is widely impacted by human-generated noise. These findings also carry significant implications for marine ecosystem management and conservation strategies, where the discoveries of this study can guide the implementation of stricter regulations related to coastal tourism and the reduction of noise pollution in coral reefs.

During this period, we also had the opportunity to present the results already obtained to the management team of the Costa dos Corais Environmental Protection Area (APACC) in the Tamandaré region, precisely where the data collection for the project took place. The meeting took place virtually and was warmly received by the management team, who showed significant interest in the presented results.

Furthermore, they expressed interest in continuing the monitoring of human sound impacts in the area, planning for future formats and measures to mitigate these impacts in the region.

Recently, we also obtained approval from the Brazilian Congress of Zoology to present our results at the event. This opportunity will be of great significance in sharing the outcomes of our project with the scientific community, significantly expanding the visibility and reach of these discoveries.



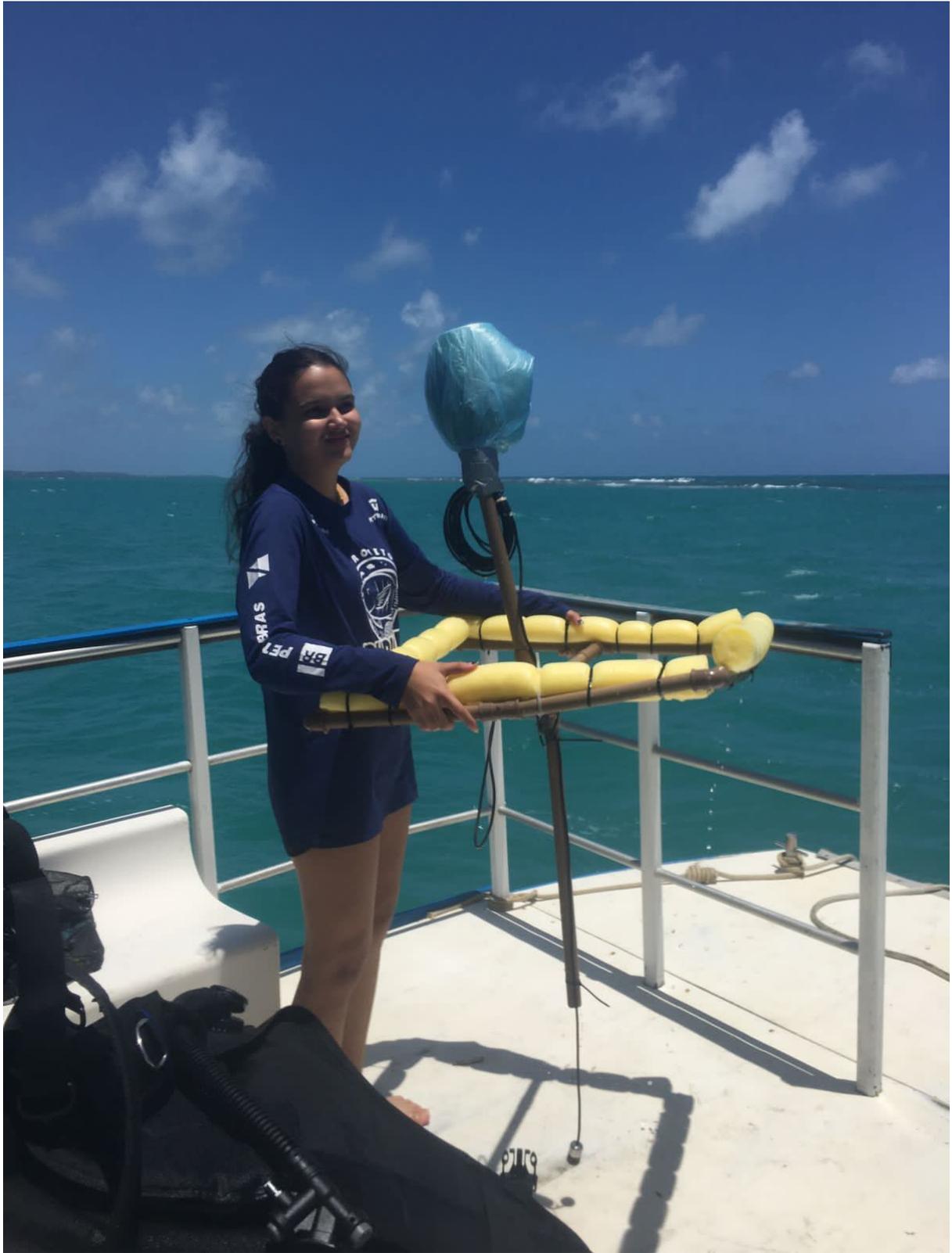
Project team members in data collection.



Project team members in data collection.



Project team members preparing recording equipment.



Project team members preparing recording equipment.



Recording equipment installed and positioned in the coral reef ecosystem.

Members of the marine community meets at data collection sites.





