DETECTING ARTIFICIAL REEFS' USEFULNESS FOR PEOPLE USING INDUSTRY 4.0 TOOLS

Ana Madiedo[1,3], Francisco Leitão[2] and Jorge Ramos[3]

1.FCT, University of Algarve
2.CCMAR, University of Algarve
3.CinTurs, University of Algarve

INCREaSE 2023
INternational CongRess on Engineering and Sustainability in the XXI cEntury
JULY 5–7, 2023
Algarve – Faro, PORTUGAL

INTRODUCTION

Artificial reefs (AR) are structures that are currently used not only to provide ecosystem services and additional functions [1] but also to increase coastal sustainability [2]. AR are deployed in the seabed and despite being detected by technology, are usually not seen by people [3]. It is thus important to know AR usefulness to human users, namely those people who may benefit from the structures deployed (e.g., fishermen and divers/tourism). This knowledge – i.e., to know whether fishing or tourism activities become more appealing and worthy due to AR deployed – is of great value for coastal managers.

In the southern coast of Portugal, there were deployed the first modular AR between 1990 to 2003. More recently, between 2010 and 2020 AR there were sunk on the western coast. Our case study is based on Algarve AR (Figure 1).

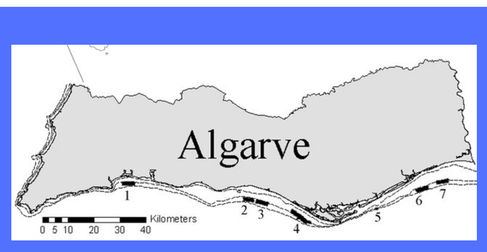

Figure 1. South coast of Portugal mainland, location of AR. Source: [4]

MATERIALS AND METHODS

In this study, we are taking advantage of industry 4.0 tools such as cloud computing and Internet of Things (IoT) [5,6]. With the aid of these tools, we are able to design a sampling strategy to know about actual AR use (Figure 2).

Figure 2. Industry 4.0 tools used to collect data from AR. Source: [5,6]

EXPECTED RESULTS

Information will be compiled from questionnaires (online and/or paper) using cloud computing and the navigational records of vessels. It is expected to identify the main stakeholders (Figure 3) of the artificial reefs as well as their patterns of use. The data gathered will allow designing a Bayesian approach that represents the perception of the usefulness of the artificial reefs.

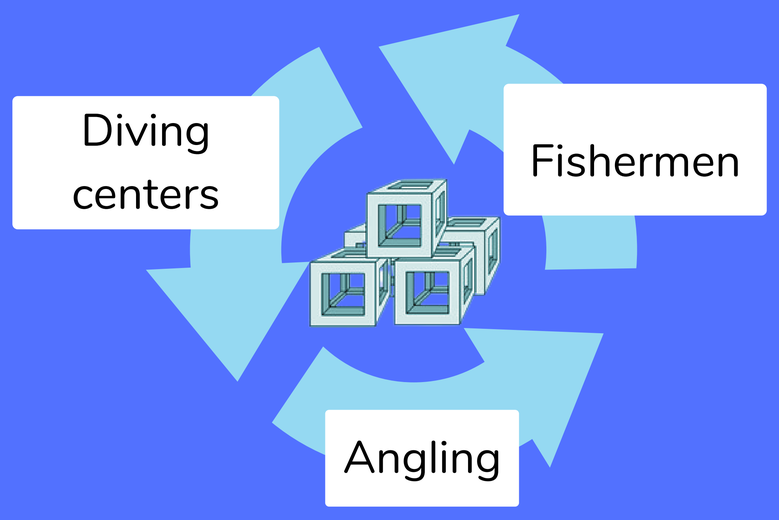

Figure 3. Main stakeholders identified for the use of AR

DISCUSSION

When interacting with the stakeholders related to the artificial reefs [7] it's important to take into consideration the approach to use as different groups require different methodologies. This in order to effectively gather information, without being intrusive or disruptive to their workflow or privacy.

It's crucial to recognize that stakeholders can vary greatly in their needs, preferences, and expectations [8]. Therefore, the approach to be chosen must be based on their specific characteristics.

CONCLUSIONS AND FURTHER WORK

With this methodological approach and the tools we are able to:

- Identify main operational stakeholders
- Know their proportion (i.e., vessel type and occurrence)
- Find patterns (daily, weekly, seasonally, by vessel type)
- Still missing: Data from small fishing boats

ACKNOWLEDGEMENTS

This work is funded by National Funds through FCT – Foundation for Science and Technology within the scope of the projects UIDB/04020/2020 (Portugal), 2022.01783.PTDC, AM is a MSc student at FCT (UAlg) also funded by 2022.01783.PTDC at CinTurs (UAlg), JR by 2021.02180.CEECIND, and FL by 2022.04803.CEECIND.

REFERENCES

[1] Ramos, J., Tuaty-Guerra, M., Almeida, M., Raposo, A. C., Gaudêncio, M. J., Silva, A. D., ... & Caetano, M. (2021). An artificial reef at the edge of the deep: An interdisciplinary case study. Ocean & Coastal Management, 210, 105729.
[2] Evans, A. J., Garrod, B., Firth, L. B., Hawkins, S. J., Morris-Webb, E. S., Goudge, H., & Moore, P. J. (2017). Stakeholder priorities for multi-functional coastal defence developments and steps to effective implementation. Marine Policy, 75, 143-155.
[3] Pitcher, T. J., & Seaman Jr, W. (2000). Petrarch's Principle: how protected human-made reefs can help the reconstruction of fisheries and marine ecosystems. Fish and fisheries, 1(1), 73-81.
[4] Leitão, F. (2009). Algarve artificial reefs fish assemblages and trophic ecology: implications for the local near shore fisheries.
[5]Zissis, D., Lekkas, D., & Koutsabasis, P. (2013). Design and development guidelines for real-time, geospatial mobile applications: lessons from 'MarineTraffic'. In Mobile Web Information Systems: 10th International Conference, MobiWIS 2013, Paphos, Cyprus, August 26-29, 2013. Proceedings 10 (pp. 107-120). Springer Berlin Heidelberg.
[6] Segars, A. H. (2018). Seven technologies remaking the world. MIT Sloan Management Review.
[7] Seaman Jr, W., Grove, R., Whitmarsh, D., Santos, M. N., Fabi, G., Kim, C. G., ... & Pitcher, T. (2011). Artificial reefs as unifying and energizing factors in future research and management of fisheries and ecosystems (pp. 7-30). CRC Press, Boca Raton, Florida, USA.
[8] Talhelm, D. R. (2018). The economic impact of artificial reefs on Great Lakes sport fisheries. In Artificial Reefs (p. 537). CRC Press, Chicago, USA.