

Empowering Citizen Science in Coastal Oceanography through low-cost open source devices: The SECOSTA Project at the Intersection of Technology and Education

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Abstract – The SECOSTA project emerged in 2018 as a groundbreaking citizen science initiative based on low-cost open-source devices with a dual mission: (i) educating high school students about the climate crisis' impact on coastal regions, and (ii) actively engaging them in scientific research to fill observational gaps in coastal oceanography. Since then, the project has achieved remarkable success, fostering a harmonious partnership among researchers, regional government bodies, and secondary schools, engaging over 4,000 students from nearly 35 educational institutions.

Keywords - Citizen Science, Coastal monitoring, ARDUINO technology, Low-cost instrumentation.

I. INTRODUCTION

Although the term 'Citizen Science' was coined in 1989 [1], it gained momentum only in 2009, when it started appearing in academic papers [2]. Over the past decade, a paradigm shift has unfolded, driven by the widespread adoption of mobile devices, DIY sensors, and open data platforms, which serve as catalysts for democratizing science and transforming citizen science into a collective and transdisciplinary endeavour with a significant impact in environmental monitoring [3,4]. In this context, the SECOSTA project emerged in 2018 as a groundbreaking citizen science initiative with a dual mission: (i) educating high school students about the climate crisis' impact on coastal regions, and (ii) actively engaging them in scientific research to fill observational gaps in coastal oceanography.

II. THE SECOSTA PROJECT

The SECOSTA project involves the development of low-cost instrumentation based on ARDUINO open-source technology to collect precise data crucial for understanding coastal oceanography.

Following an initial phase where educators are trained to guide students in constructing these devices, teachers initiate cross-disciplinary educational projects. These educational projects take also advantage of a collection of resources selected by the SECOSTA team to help teachers from different backgrounds to participate in the project. Then students actively participate in hands-on data collection, and their observations undergo rigorous processing, transforming them into valuable supplementary datasets for researchers (see Fig. 1).



Fig.1 . SECOSTA Phases. Throughout the project, educators undergo training to guide students in constructing devices (A), students actively participate in hands-on data collection (B), and the obtained results are shared at the SECOSTA Student Conference (C, D).

At present, five different devices are proposed to the secondary schools (see Fig. 2). They have different degrees of complexity in terms of construction and operation, so, depending on the characteristics of the participating students the teachers can choose those that best fit their educational project

SECOSTA has achieved remarkable success, fostering a harmonious partnership among researchers, regional government bodies, and secondary schools, engaging over 4,000 students from nearly 35 educational institutions. A pivotal milestone was the SECOSTA2022 Student Conference, with over 140 students from 10 schools presenting year-long research findings. This success continued in the SECOSTA2023 Student Conference, with 170 students from 12 schools.

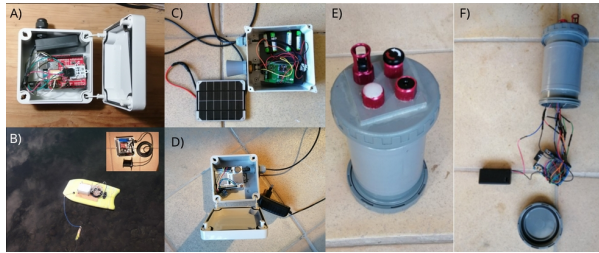


Fig 2. SECOSTA's low-cost equipment for coastal oceanography data collection: beach profiler (A), bathymetric probe (B), tide gauge (C), barometer (D), and bathythermograph (E, F).

III. CONCLUSIONS

Our SECOSTA project, deploying low-cost measurement tools and DIY technology, exemplifies the practical implementation of technological advancements fostering citizen science initiatives in recent years. By providing secondary school students with accessible equipment, we enable them to actively participate in the scientific exploration and protection of the marine environment. To date, students have made substantial data contributions, including topographic records for 19 Balearic beaches and time-series data on sea level and water temperature, currently under analysis by the research team. This presentation not only unveils SECOSTA's phases, offering valuable insights for implementing citizen science initiatives in secondary schools but also serves as a testament to SECOSTA's success. Additionally, it delves into the wider implications of marine technology, sparking a global movement where citizens actively contribute to addressing critical issues that threaten our society.

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