

Development of a low-cost hydrophone for research, education and citizen science

Launched under the auspices of the POGO and the IQOE, our Task Team on Low-Cost Hydrophones for Research, Education, and Citizen Science was created in 2023 to promote affordable hydrophone technology dedicated to research, education, and citizen science. Comprising biologists, engaged citizens, and engineers, our volunteering collective has pinpointed key enhancements in hydrophone design to optimise their application in scholarly, pedagogical, and conservationist contexts.

The integration of affordable hydrophone technology plays a pivotal role in advancing marine bioacoustics, a field essential for understanding and protecting marine biodiversity. By deploying low-cost, open-source hydrophones, we enable continuous, widespread monitoring of underwater soundscapes. This democratisation of technology not only supports scientific research but also empowers community scientists and educators in underserved regions, enhancing global participation in ocean monitoring and conservation.

Objectives:

1. Design an affordable and open-source hydrophone autonomous system, without compromising quality and performance, catering to research, education, and community science needs
2. Develop software to manage and program device settings
3. Develop a global digital platform to promote, distribute and facilitate the use of the device, complete with educational resources

Implementation plan:

Step 1: Design and development of prototype meeting both technical specifications and user requirements for passive acoustic monitoring devices.

Step 2: Production and distribution of up to 100 prototypes to be distributed to a selected group of beta testers (inc. researchers, students, citizen scientists, conservationists).

Step 3: Feedback collection and refinement into a final, market-ready device.

Step 4: Establishment of a distribution platform and educational resources (inc. workshops and training sessions). The design and construction of the device will also be made open source and shared on the bespoke platform.

Funding:

July 2024: received EUR 10,000 from POGO for the production of 25 prototype units and shipping to selected beta testers representing typical end-users around the world (Step 1, 2 and 3).

We are actively looking for funding for the following future implementing states:

Step 3:

- EUR 20,000 (scale up production of prototypes to 100 units).

Step 4:

- EUR 70,000 (establishment of distribution platform and educational resources, production of first devices to be sold)

Some of the funding schemes selected for future applications: Wildlabs awards 2025, i4N 2025, NSF Ocean Technology and Interdisciplinary Coordination, WHOI Ocean Propeller Grant.

Team:

Dr Lucille Chapuis (Uni of Bristol - UK, Uni of Auckland - NZ, chair), Mihai Burca (OGS, Italy), Shlomi Dahan (Uni of Haifa, Israel), Dr Tess Gridley (Sea Search, South Africa), Dr Xavier Mouy (NOAA & WHOI, USA), Artash Nath (citizen scientist), Dr Sophie Nedelec (Uni of Exeter, UK), Jim Theriault (Ocean Environmental Consulting, Canada), Rob Williams (Oceans Initiative, USA), Dr Walter Zimmer (Independent, Italy).

Past and ongoing activities:

We have now recruited a diverse team of 10 voluntary members from diverse expertise (biologist, acousticians, engineers, computer scientists, citizen scientists, conservationists) from around the world. We are looking to get more inputs from end-users from developing countries, either by expanding the team or by organising a survey to evaluate specific needs and challenges.

We have two upcoming participations to international conferences: OCEANS 24 in Halifax (Sept 23 – 26, poster) and at the African Bioacoustics Community Conference in Cape town (Sept 1 – 6, oral presentation). We have one peer-reviewed article in preparation which will be published as part of the OCEANS24 conference in IEEE Xplore.

→ At this time (July 2024), the first two prototypes are almost ready to be tested 'in house' by some members of the panel. The selection of the first 25 beta testers will be discussed at the next meeting. The 25 prototypes to be built and shipped to selected beta testers will be created by then end of 2024.

→ We aim to scale this to 100 units for April 2025, pending funding.

→ July 2025: creation of educational material, feedback retrieval and prototype refinement.

→ August 2025: another peer-reviewed article focused on outreach and education & community-based article.

→ January 2026 (TBD, depending on device refinement rounds): launch of distribution platform.

Call to action:

We aim to revolutionize marine bioacoustics and conservation by democratising robust and calibrated aquatic acoustic observations. Furthermore, bringing essential monitoring tools within reach of researchers, conservationists and students across the globe, we foster a deeper understanding of the marine soundscape and its role in marine conservation.