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# Students Help Track Climate Impact on Marine Species



By [Gemma Alexander](#)

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As [ocean temperatures rise](#), species are forced to flee their natural homes in search of cooler waters. In the long term, [marine protected areas](#) may no longer match the places where species live. The UN Sciences Organization has decided to combine STEM education and [citizen science](#) with its project to map marine species habitats in an effort to accelerate data collection. Environmental DNA Expeditions is a global citizen science initiative. It will help measure marine biodiversity and the probable impacts of climate change marine life distribution patterns across UNESCO World Heritage sites before it's too late.

## The Science

In the past, population sampling was an invasive process. Scientists had to trap and remove everything living in a portion of the study area, identify the sacrificed specimens, and extrapolate their numbers to the larger area. The [Environmental DNA Expeditions](#) project depends on an advanced forensic technique called

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environmental DNA (eDNA). Ocean species shed DNA<sup>CLOSE</sup> to the water around them. A single liter of water contains enough genetic material from waste, mucus, and shed cells to identify the species present. By sampling aquatic environmental DNA, researchers can determine species richness without extracting organisms from their environment. Collecting water samples is cost-effective, noninvasive, and much simpler than collecting specimens.

Scientists analyze the collected water samples in the laboratory. They use a common methodology established by UNESCO under the supervision of a high-level advisory board of experts. UNESCO has selected 25 marine World Heritage sites located around the world, including sites in Australia, Brazil, Costa Rica, Denmark, Germany, the Netherlands, Bangladesh, Belize, France, Mauritania, Mexico, Panama, United States, Sudan, and even Yemen. The [initial pilot phase](#) began in September 2022 and will continue through April 2023.

## The Students

Simple sampling techniques make collecting eDNA suited to citizen science. They also provide an excellent opportunity to engage students in STEM learning. Working with local schools, UNESCO is training hundreds of students to participate in environmental DNA expeditions. During the expeditions, students collect ocean data themselves. By using students for the project, a love of science is fostered in the next generation of scientists and leaders who will have acquired their [climate literacy](#) through hands-on experiential learning. At the same time, the project will raise broader awareness about biodiversity loss in the coastal communities where the students live.

At [Brazilian Atlantic Islands](#), local youth aged 6 to 12 collected water samples at three different locations across the UNESCO World Heritage site. While they were out on the boats, the students spotted sea turtles and dolphins. These sorts of vivid, communal animal encounters have been shown to [cultivate pro-conservation attitudes](#) by building empathy. [In Australia](#), teenagers worked together with the indigenous community to collect samples. In addition to learning proper collection methods, students learned about the species native to their Shark Bay study site. Participating in a traditional ceremony to launch the project also gave the students a cultural context for the protection of the site.

Students even helped develop the Expeditions program. In spring 2022, in the Gulf of Porto, off the French island of Corsica, youth aged 7 to 11 collected samples. They then worked directly with local scientists and site managers to fine tune the sampling methodology for the global rollout of the student program in the fall.

## Outcomes

With citizen science projects, the benefits to the participants sometimes outweigh the value of the data collected. The eDNA expeditions international advisory board developed a standard set of protocols. These protocols ensure the data collected is consistent and useful. Projects like the French students' testing of the methodology and the Australian students' supplemental lessons in avoiding contamination contribute to quality control. Not only are the sampling protocols and analysis techniques standardized, but these and all resulting data will be openly available through the [Ocean Biodiversity Information System](#) (OBIS), the world's largest open science marine species database. Final results

from the pilot project will be available in early 2024. <sup>CLOSE</sup> data could be useful for many different research projects. For example, biologists studying a specific marine species could use the maps to determine their study sites.

Maps of the marine species across some two dozen ocean preserves will provide a snapshot of species distribution. Ideally, UNESCO will replicate the project over time to detect and document changes. But first, combining the snapshots with IPCC heat scenario projections will help visualize and predict changes in species distribution. These forecasts of geographic and distribution shifts resulting from climate change will inform policy decision-making to better manage marine biodiversity in a warming climate.

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Gemma Alexander has an M.S. in urban horticulture and a backyard filled with native plants. After working in a genetics laboratory and at a landfill, she now writes about the environment, the arts and family. See more of her writing [here](#).

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