OBJECTIVE: Technologies and techniques for sampling and analysis of marine environmental DNA (eDNA) are improving rapidly but many barriers remain. This SBIR topic seeks to enable widespread, inexpensive use of marine eDNA for the accurate, timely identification of biological organisms in the maritime environment using autonomous modes of collection and analysis through the development of both small, inexpensive analysis payloads and enabling technologies for such payloads; in particular, techniques that reduce the amount time for sample analysis, reduce the volume of sample water, reduce false alarms from contaminants, and automatically generate sampling strategies, among many other possibilities.

DESCRIPTION: Remote monitoring of the biologic inhabitants of the world’s ocean is extremely difficult. Advances in DNA methods present an opportunity to harness a new technology and fundamentally improve our capacity to monitor biological communities and human uses of the marine environment. Marine eDNA techniques identify genetic signatures that variously persist in the environment. Self-contained analysis payloads suitable for unmanned platforms, especially underwater ones, would greatly enable eDNA applications. This topic seeks both small, inexpensive analysis payloads and enabling technologies for such payloads; in particular, techniques that reduce the amount time for sample analysis, reduce the volume of sample water, reduce false alarms from contaminants, and automatically generate sampling strategies, among many other possibilities.

PHASE I: Develop concepts and determine feasibility of marine eDNA technologies and techniques suitable for unattended operation in an unmanned underwater vehicle, including the identification of methods to reduce eDNA vehicle payload, sample volume, analysis time, and need for filtration of nearshore samples; development of sampling approaches suitable for unmanned underwater vehicles. Develop key component technology milestones and conceptual designs for hardware. Prepare a Phase II plan.

PHASE II: Produce prototype hardware based on Phase I effort. Establish hardware performance and develop a conceptual plan for integration into an unmanned underwater vehicle. Deliver a prototype ready for integration and testing by the Government at the end of Phase II.

PHASE III DUAL-USE APPLICATIONS: Successful development of marine eDNA technology suitable for underwater vehicle use will open up tremendous opportunities for small businesses to provide marine eDNA capabilities to a wide range of Government agencies having equities in marine biological issues, for example, NOAA National Marine Fisheries, National Ocean Service, Office of National Marine Sanctuaries, Bureau of Ocean Energy Management, U.S. Geological Survey, Fish and Wildlife Service, National Park Service, Environmental Protection Agency, and National Institute of Environmental Health Sciences, among others.

REFERENCES:


KEYWORDS: Environmental DNA; Polymerase chain reaction; PCR; Marine Mammals; Bacteria; Viruses; Plankton