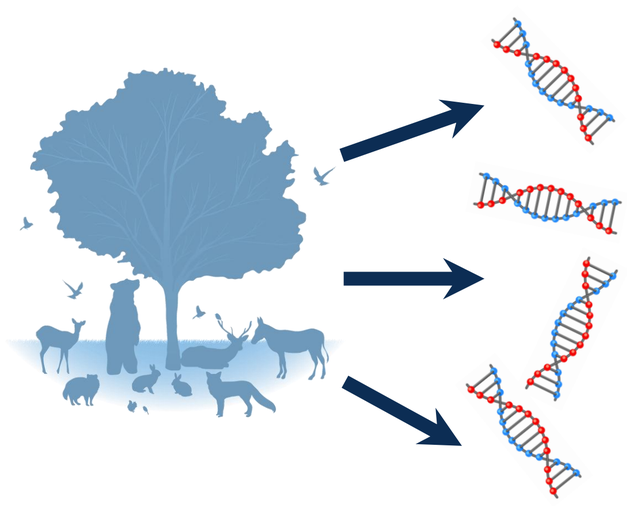
Solutions for rapid biodiversity detection using environmental DNA

Willette Lab of Applied Ecology, Loyola Marymount University, Los Angeles, California

Environmental DNA (eDNA) is the free-floating DNA that organisms leave behind in their environment. Now, with new accessible tools, researchers can sample eDNA from water, soil, and air to detect and identify which species are in the area, without the need to physically see the plant, animal, or microbe.

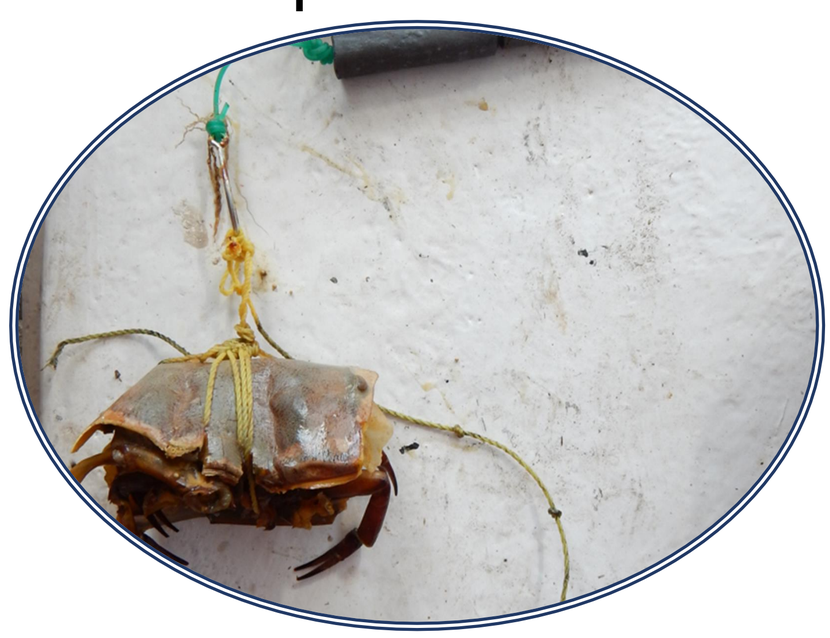


Our team has developed & tested a non-destructive, passive eDNA method that enables identification of multiple species simultaneously in ~12 hours. This tool is portable - using a mobile genetics lab that fits within two large suitcases. Below are three applications of the tool to detect biodiversity.

Endangered Mexican crab species hidden in octopus bait

In the Yucatán, some fishermen are using an endangered horseshoe crab species (*Limulus polyphemus*) as bait for hunting octopus. *Limulus polyphemus* is on the Mexican protected species list, yet visual inspection for the species in bait containers is time-consuming and difficult. The advantage of eDNA-based monitoring is we do not need to see the species to detect it.

In collaboration with the fisheries improvement non-profit COBI Mexico, we used eDNA metabarcoding to screen for the presence of *L. polyphemus* in fishermen's bait supplies. Horseshoe crab DNA was detected in 87% (13/15) of water samples from six fishing ports along the Yucatan. Horseshoe crab was detected in 87% (13/15) of samples. Findings were shared with the fishing communities and suggest rapid eDNA screening could be a potent aid for sustainable fisheries practices.



eDNA + satellite tracking in Ecuadorian fisheries

The decline in wild-caught fisheries paired with increasing global seafood demand is pushing the need for seafood sustainability to the forefront of national and regional priorities. Validation of species identity is a crucial early step, yet conventional monitoring and surveillance tools are limiting.

To overcome the need to individually view each fish and together with Escuela Superior Politecnica del Litorial, we used forensic eDNA metabarcoding to profile catch composition from fishing vessel meltwater in Ecuador. Genetically identified fish were contrasted to target fish list reported by the vessel's crew. Next, we used publicly available fishing vessel route data to determine if identified species could be reasonably expected in the catch.

Biological invasions arriving to Antarctica coast

Biological invasions are altering the planet's ecosystems, including at the poles. Once isolated from the rest of the world by the powerful Circumpolar Current, increasing fishing, tourism, and a shifting climate are bringing invasive species to Antarctica that may disrupt this fragile ecosystem and drive endemic species to extinction.

Collaborating with the Chilean Antarctic Institute, we are conducting an eDNA field survey to detect both invasive and endemic Antarctic species from water samples collected along the continent's coastline. Used in parallel with traditional monitoring tools, eDNA will help us identify which and how invasive species are reaching Antarctica; data that can inform international conservation policy to protect this place that belongs to everyone.

Want to learn more?

Contact our research team at:
www.willettelab.com

Contact our biotech startup partner at:
www.speciestracks.com

Supported by:

Loyola Marymount University

Escuela Superior Politecnica del Litoral ESPOL

FULBRIGHT United States Fulbright Program

Instituto Antartico Chileno

NSF United States National Science Foundation

COBI Comunidad y Biodiversidad, Mexico