Fish Environmental DNA (eDNA)



Innovative Science for a Sustainable Future

Sampling in Pensacola and Perdido Bays

Background

EPA researchers are conducting a pilot study in Pensacola and Perdido Bays, Fla. using **environmental DNA (eDNA)**[1] to assess fish community assemblages (the variety and abundance of fish species in a given waterbody).

Living organisms constantly shed DNA into their surrounding environment, and this genetic material can be used to more precisely identify organisms that live in, or periodically visit, different aquatic habitats. eDNA can be readily obtained from environmental samples such as water.

Goals of this research

Over the next 12 months, genetic material will be extracted and processed from water samples collected during fall 2022 through late-spring 2023. The data produced will provide genetic "fingerprints" that can be used to identify likely fish species that visit or take refuge in local estuarine habitats. Results may be indicative of the suitability of local waters to support thriving fish populations. Meaningful information gained from this fish eDNA pilot study may allow for future expansion of this research effort to other estuarine systems across the Gulf of Mexico.

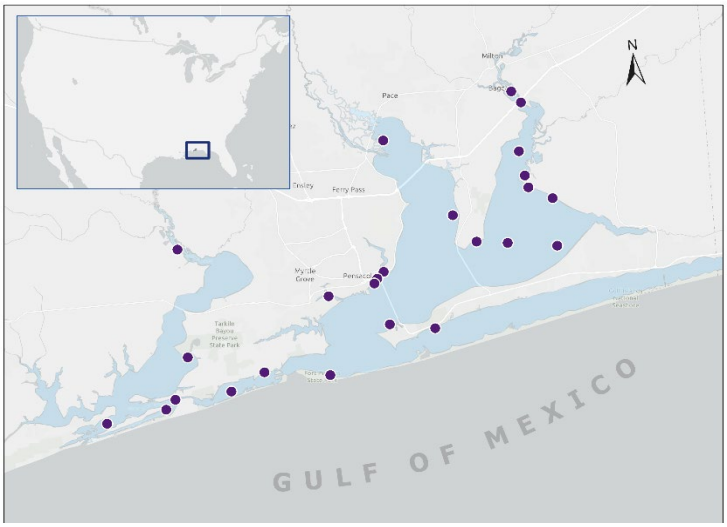

Figure 1. Map of sampling locations for fish eDNA pilot study in the Pensacola and Perdido Bays.

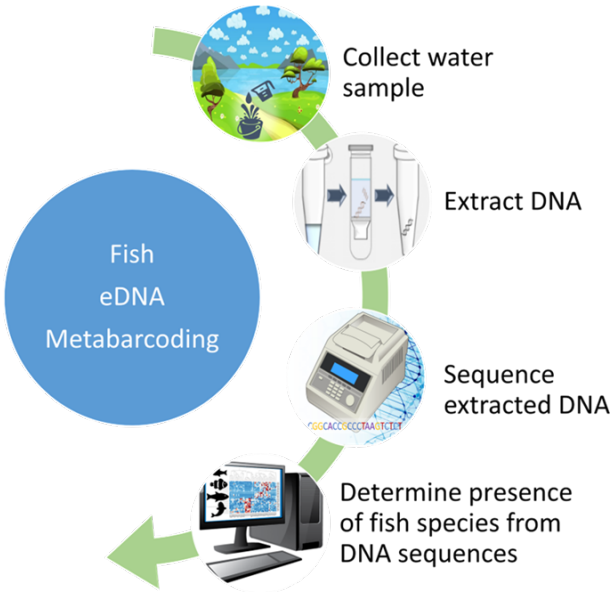

Figure 2. Process for eDNA metabarcoding from sample collection to species identification.

The goals of this research are to:

- Assess the use of eDNA methods as a viable and less environmentally impactful way to detect changes in fish communities that are dependent on healthy estuarine habitats, such as seagrasses, oyster reefs and marsh-edge.
- Evaluate the use of eDNA results to complement or add value to existing fish monitoring efforts.

Study Area

The study area includes two estuarine systems: Pensacola and Perdido Bays, located in northwest Florida. These bays receive waters from five riverine watersheds. Land use patterns in the study area are primarily urban, agricultural, military, and recreational, with rapid suburban and exurban growth. In total, 25 sites in Pensacola and Perdido Bays are being sampled as part of this eDNA pilot project.

Why study fish communities?

- **Estuaries**[2] are impacted by many different human activities including nutrient and sediment loading from runoff, upland development, dredging, and overfishing. Restoration of impaired aquatic habitats can help improve degraded estuarine conditions.
- Evidence of sentinel (pollution sensitive), **keystone**[3], and high-value (market value) fish species, such as those in and around restored locations, can indicate when estuarine conditions are changing.
- Fish community data provide important indicators that can help increase our understanding about ecological stressor-response relationships; socio-economic benefits; climate-change impacts; and restoration/conservation effectiveness.

Figure 3. Archosargus probatocephalus (Sheepshead). A popular fish species among recreational and subsistence anglers that is commonly found in the Pensacola and Perdido Bays.

Why eDNA sampling?

Conventional fish monitoring methods (e.g., trawl or net counts) are resource intensive and can potentially damage ecologically sensitive areas. Consequently, information about fish communities is often limited.

- **eDNA metabarcoding**[4] offers a low effort, lesser impact, and more accurate way to identify the presence of fish species in a location by collecting samples from the water.
- eDNA can detect fish species that are rarely seen (e.g., threatened and endangered species) or unexpected, such as invasive species.
- Advancements in molecular techniques have made eDNA methods practical for biomonitoring.

Who are our partners?

The Pensacola and Perdido Bays Estuary Program (PPBEP) works with local partners to inform environmental managers and the public about these estuarine systems. Local EPA researchers are working collaboratively with PPBEP, The Nature Conservancy, and the Florida Fish and Wildlife Conservation Commission to help ensure the best possible utility and outcome for this pilot study.

Key Terms

1. **Environmental DNA (eDNA):** A molecular genetic technique that uses environmental samples like water to detect the presence of organisms.
2. **Estuary:** A partially enclosed, coastal water body where freshwater from rivers and streams mixes with salt water from the ocean.
3. **Keystone:** A species that is critical to the survival of other species in a system.
4. **eDNA Metabarcoding:** Simultaneous identification of many species or groups within the same water sample.

Spring 2023