

eDNA: An Introduction

LCRA WQ Advisory Meeting

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Agenda

Traditional sampling

What is eDNA?

Applications

**Case Example: Benthic
Macroinvertebrates**

**Case Example: Freshwater
Mussels**

Traditional Biological Surveys



What if there was a different way?

- Monitor species through environmental samples
- Non-invasive
- Accurate





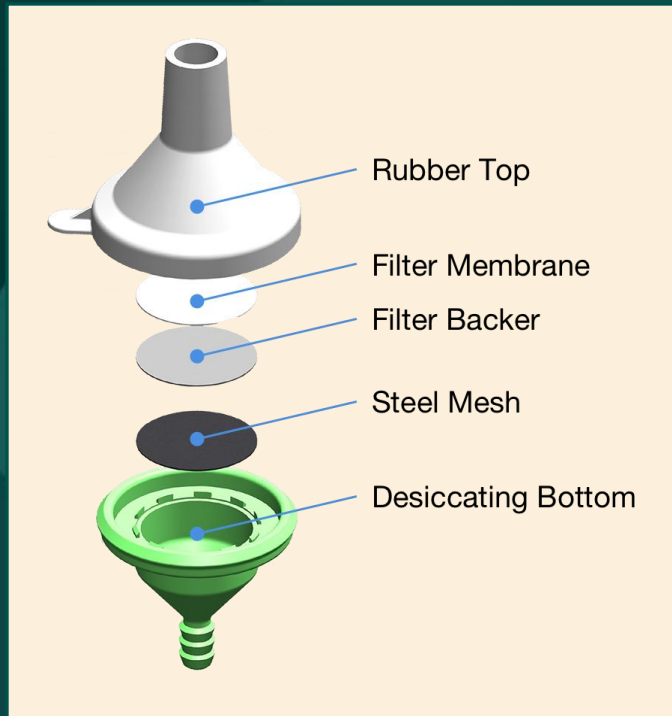
eDNA is...

eDNA stands for **environmental DNA**. It refers to genetic material that organisms leave behind in the environment—like in **water, soil, air, or ice**—without needing to capture or even see the organism itself.

Why eDNA Matters

- Traditional wildlife surveys can be:
 - Time-consuming
 - Expensive
 - Disturbing to wildlife
- eDNA provides:
 - **Non-invasive monitoring**
 - **Accurate** taxonomic detection
 - High **sensitivity** for rare species

How eDNA Works (Basic Process)



Step-by-step overview:

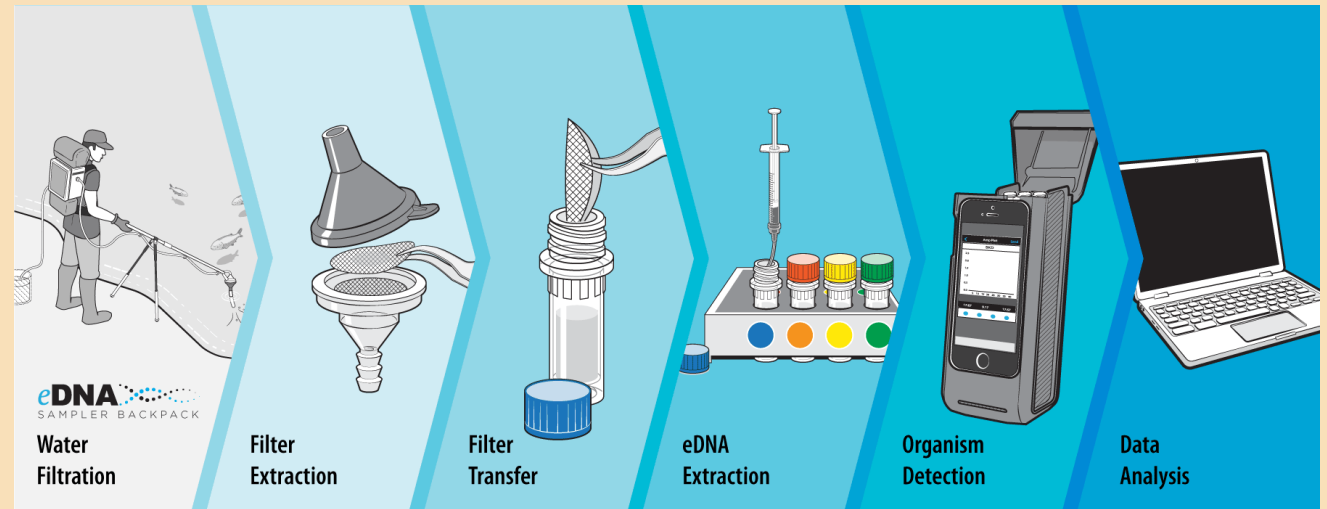
Collect environmental sample (water, soil, etc.)

Extract DNA in the lab

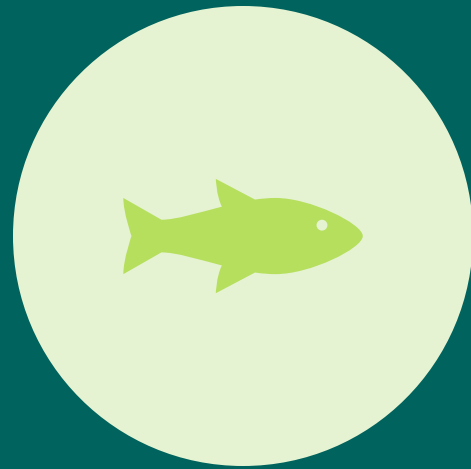
Amplify DNA using PCR

Compare sequences to DNA databases

Identify species present



eDNA detection



TARGET SPECIES
DETECTION



BIODIVERSITY
ASSESSMENT

Applications

eDNA is widely used in fields like **Conservation Biology** and **Ecology** to:

- Survey wildlife **without disturbing** them
- Detect **rare or endangered species**
- Geographic range **invasive species**
- Monitor **biodiversity** in ecosystems
- Understanding ecosystem **health**
- Bacterial **contamination**

Limitations

DNA degradation over time

Transport of DNA

Difficulty estimating population size

False positives/ negatives

Dependence on reference databases

Case Example: Benthic Macroinvertebrates

Benthic Macroinvertebrates (BMI)

- **Indicators** of stream quality (physical, chemical, biological)
- Limited mobility
- Highly **diverse**
- Taxonomic expertise
- Significant time collecting, sorting, and identifying



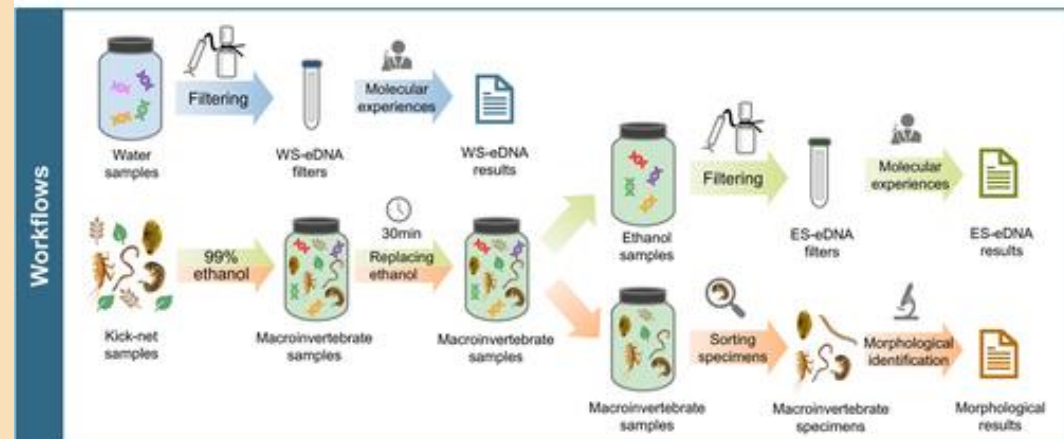
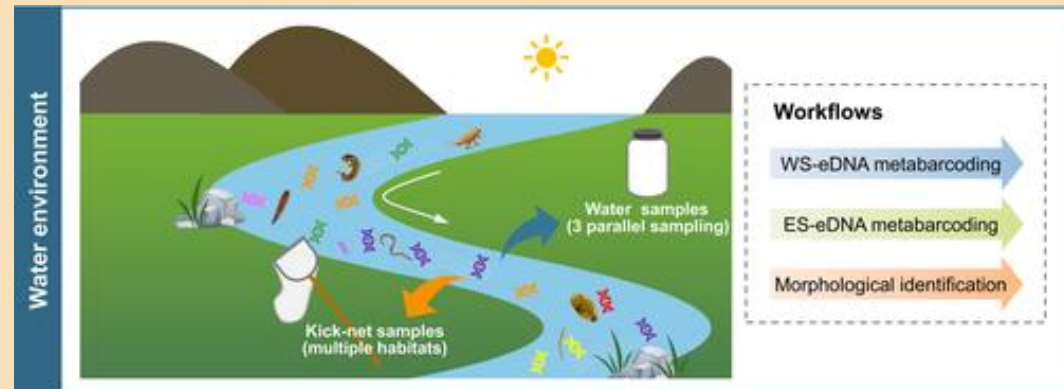
Case example: BMI

- BMI collected for surface water quality monitoring requirements
- Already going to be ID'd
- Compare different media:
 - Water
 - Ethanol
 - Sediment



BMI + eDNA

- **Test** to see if the community detected through **morphological** identification matches up with **genetic** identification
- Sample types:
 - Extract the water
 - Extract the ethanol
 - Blend the sample and take DNA



Case

- **Range** of site qualities
- **Test** to see if there is a sig difference between the community composition (ANOSIM)
- Does the primer pick up some better than others
- How is species resolution



Case Example: Freshwater Mussels

Freshwater Mussels

They belong primarily to the family **Unionidae**

Most species can live **10–50 years**, and some live **over 100 years**

North America has **the highest diversity of freshwater mussels in the world**, especially in the Mississippi River basin.

Over 70% of N. America mussel species are endangered, threatened, or **declining**.

Thank You

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City of Austin, Watershed Protection