



eDNA Monitoring for Fish and Biodiversity in the NERRS

Alison Watts

,Jason Garwood , Shimi Rii, Chris Peter, Shon Schooner, Jason Goldstein, Laura Crane, Devin Thomas, Nikki Dix, Thomas Grothues, Jeff Miller

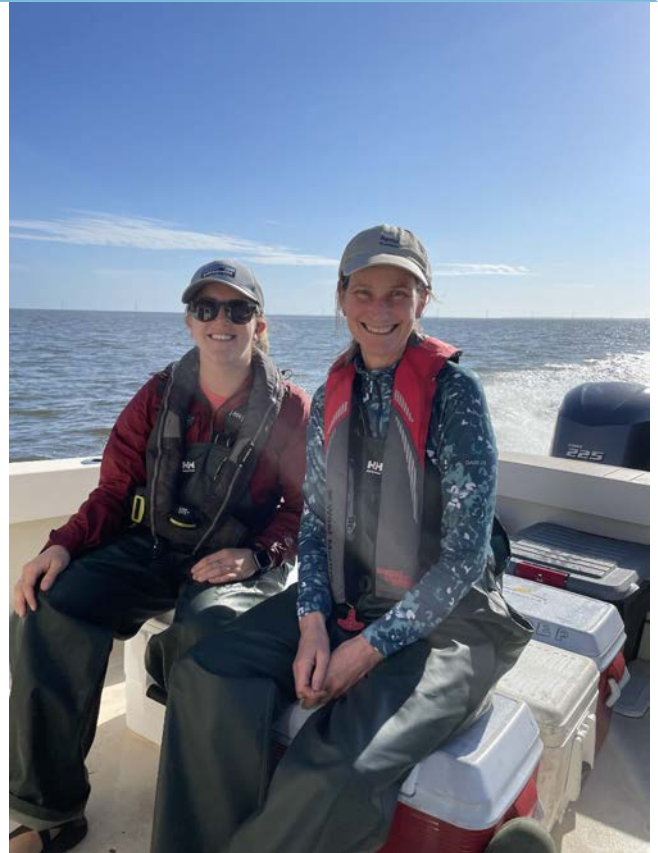
And many more!



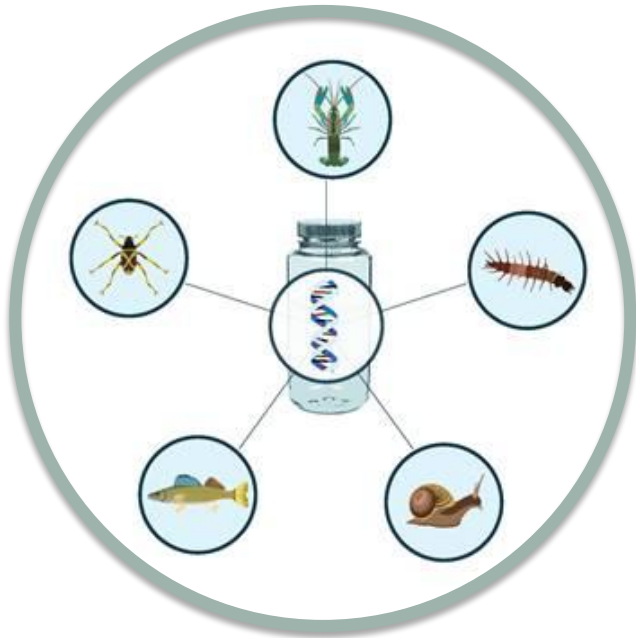
A little introduction to me...

I got to visit Apalachicola a few weeks ago!

Alison Watts
Research Assistant Professor,
University of New Hampshire
**Dept of Civil and
Environmental Engineering**



What is eDNA?



Environmental DNA (eDNA)

- Living things have and shed DNA
- eDNA is DNA released from an organism into the environment
- eDNA can come from:
 - Hair, scales, skin
 - Waste products
 - Reproductive cells

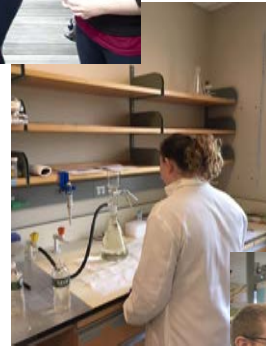
Some species and lifecycles shed more DNA!

eDNA 101

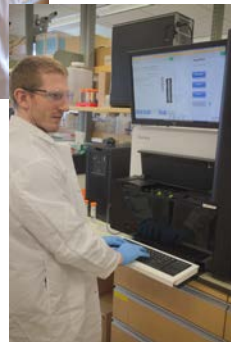
- Collect it



- Sometimes filter or other post-processing



- Concentrate, extract, amplify, analyze and Interpret (Bioinformatics)

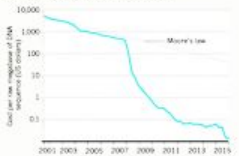


Key Advantages of eDNA (theoretically)

Cost & Speed

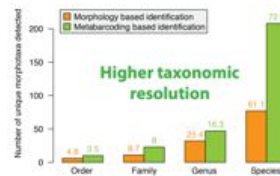
PLUNGING COSTS OF SEQUENCING

Since 2008, new sequencing technologies have driven the costs of DNA sequencing down faster than the rapid improvement in microprocessor power represented by Moore's Law.



- Costs can be a fraction of morphological analyses
- DNA results within days/weeks, not months

Sensitivity & Accuracy



Elbrecht et al. 2017, Methods Ecol. Evol

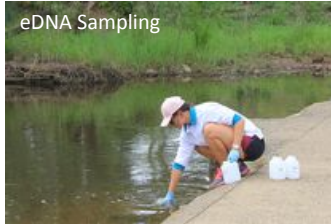
- Able to resolve cryptic species complexes or ambiguous morphology
- Repeatability

Non-invasive sampling

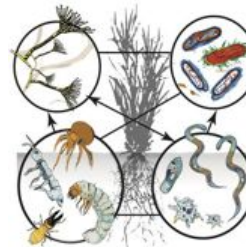
Traditional Sampling



eDNA Sampling



Multi-trophic approach



- Targeting multiple phyla in single sequence runs
- Linking trophic networks

eDNA Can be used to detect fish and other species...



TO TRACK SEA TURTLES, GET DNA FROM THE SAND

MAY 26TH, 2022

POSTED BY [NATALIE VAN HOOSE-FLORIDA](#)

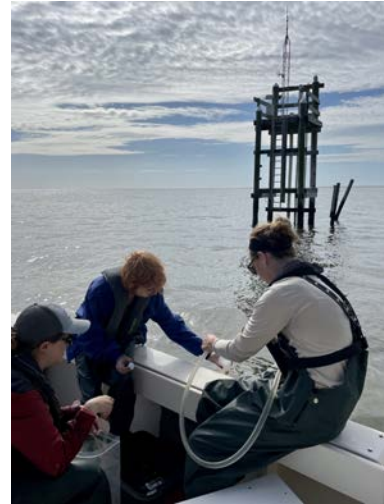
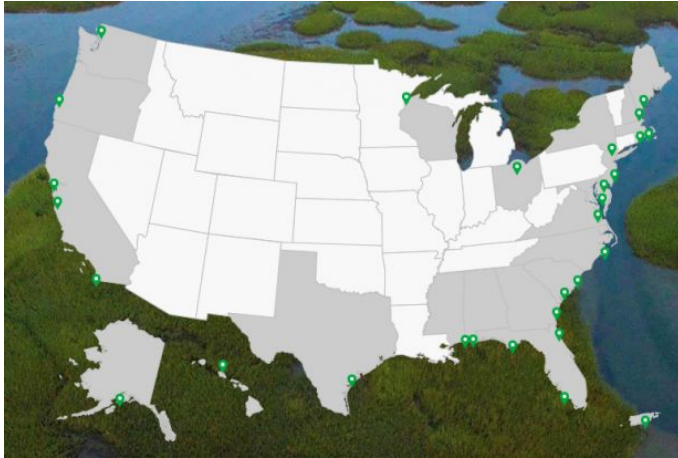
"You don't need to be a highly trained scientist to collect eDNA, which makes this technology a lot more democratic," David Duffy says. "This really opens up the ability to monitor wildlife non-invasively to a much wider pool of people." (Credit: [ericdalecreative/Flickr](#))

The DNA "fingerprints" that sea turtles leave behind offer scientists a way to track the health and whereabouts of the endangered animals, say researchers.

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ARTICLE



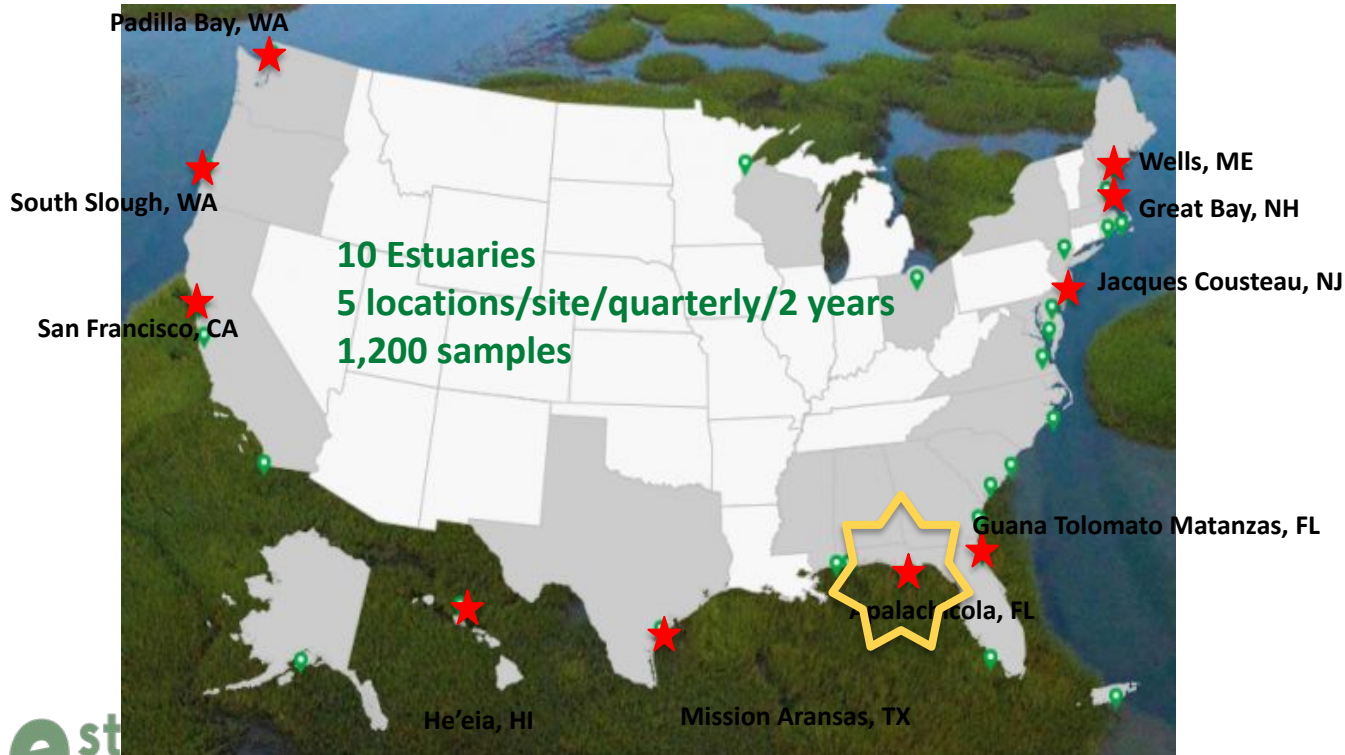
eDNA Monitoring for Fish and Biodiversity in the NERRS



All NERRs participate in the System Wide Monitoring Program (SWMP)
Collect monthly water samples for Water quality and **nutrients**
All data goes to central public database

What happens when we add eDNA samples to this data set?

eDNA Monitoring for Fish and Biodiversity in the NERRS



Resource Manager questions

How many fish species are detected by eDNA sampling in a given estuary?

How does eDNA-based monitoring compare to traditional fish surveys?

And what is the relative cost of these methods?



Seine sampling at South Slough

Staff at each site collect and filter samples



Send to UNH for extraction and analysis



Initial Results - Mostly still being sequenced

May and August sampling at all sites:

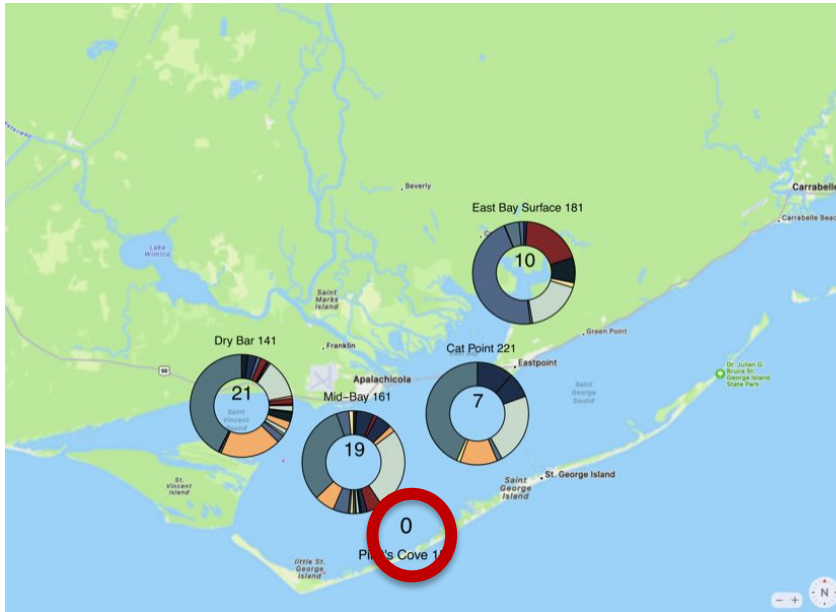
No. Samples	290
Fish Species per sample	0-43
ASVs/Sample	0-135
Total fish species	181

Also Human, dog, dolphin, deer, alligators...

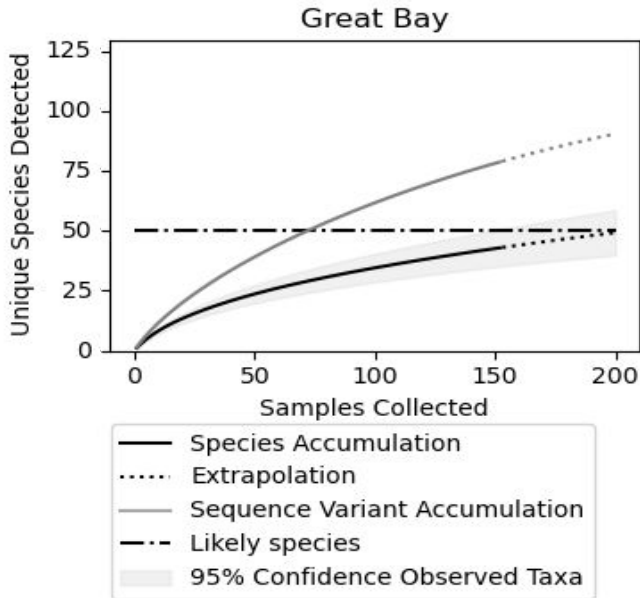


Initial Results - Mostly still being sequenced

Apalachicola – May Sampling 5 Sites, 33 Fish Species



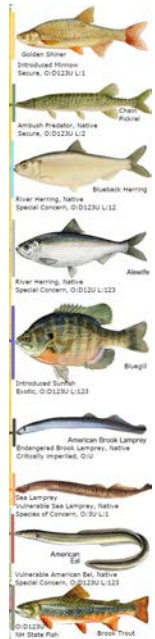
How many species are detected by eDNA sampling? 2018 Data



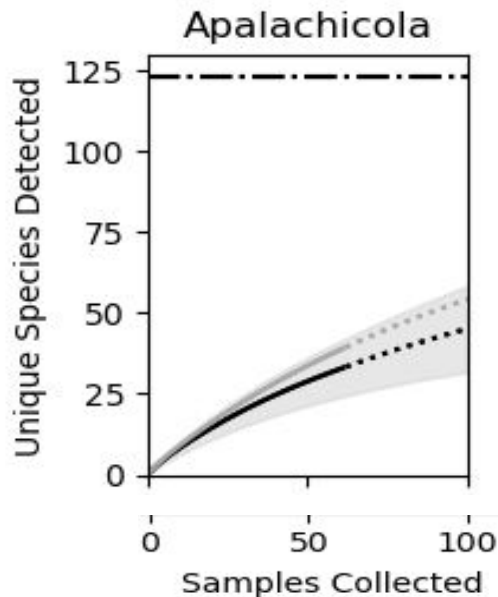
Great Bay NH:

eDNA can be used to detect all of the fish in the system (if you take a lot of samples).

Yay!



How many species are detected by eDNA sampling? 2018 Data



Apalachicola Bay, FL:
eDNA misses most of
fish species.

Yikes!

Current project:
Better sample cleanup
Different DNA target
sequences (primers)

Challenges – eDNA is not magic!

And it doesn't replicate traditional count & capture methods

- Sampling is time consuming -
Filtering and contamination control
- Primers, lab methods and
databases are changing rapidly and
preferences/recommendations
vary
- Managers need enough
information to understand results,
without becoming molecular
scientists



Products (late 2024)

Recommendations from diverse stakeholders on incorporating eDNA data into management.

Methods and protocols designed to be used by resource agencies

Potential to incorporate into a long term national monitoring program



Thank you!

Contact: Alison.watts@unh.edu

Web page www.estuarydna.org (needs updating)

