

Will eDNA Revolutionize Our Ability to Monitor Marine Species?

IOOS Advisory Committee - June 2023



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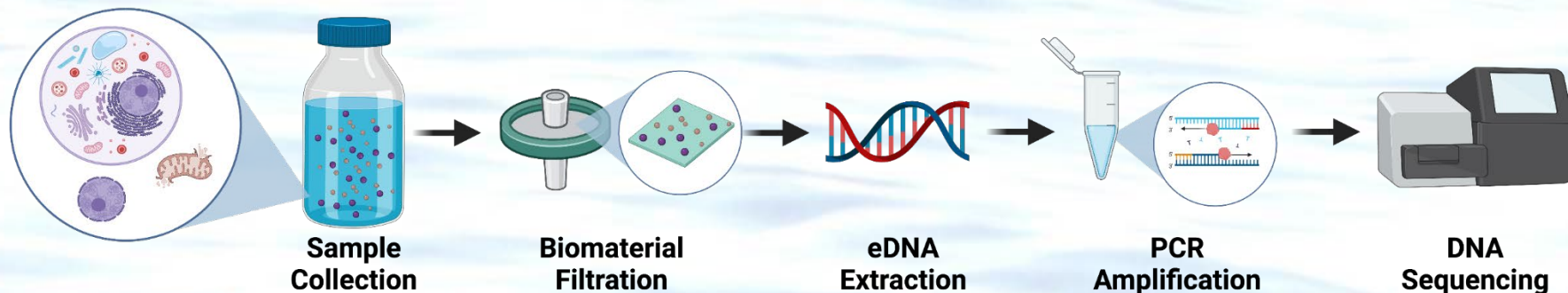
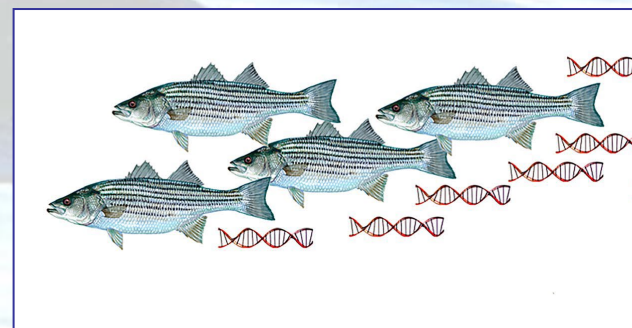
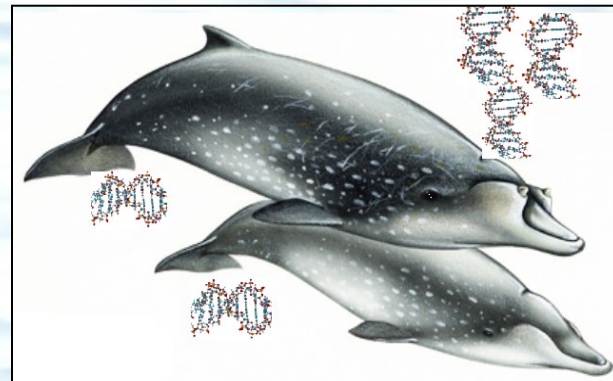
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Environmental DNA (eDNA) - Overview

- All living things shed DNA
- DNA released from organisms into the environment is eDNA
- Applications include:
 - Field-forward genetic epidemiology research (i.e. Covid, Ebola, Zika, etc.)
 - Biodiversity monitoring – microbes to whales
 - Freshwater, terrestrial, marine systems
 - Rare, endangered, invasive species ID
- Metabarcoding & qPCR



Marine eDNA

A relatively low-cost, low-impact technology for ocean monitoring

Objectives & Naval Relevance

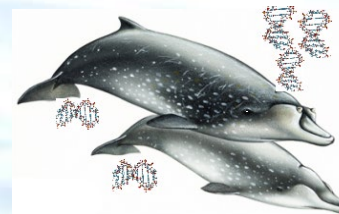
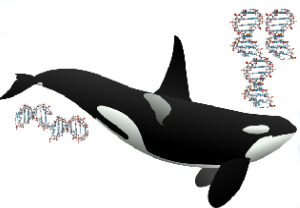
- Improve ability to detect and classify marine mammals to support Navy's risk assessments and compliance monitoring
- Scalable, autonomous 'genomic weather stations'

Applications

- Presence / Absence of species, stocks; changes during sound exposure
- Density (#'s/area) of species, stock structure; changes during sound exposure
- Characterize prey fields (spp, #, density) that drives MM distribution, abundance and response

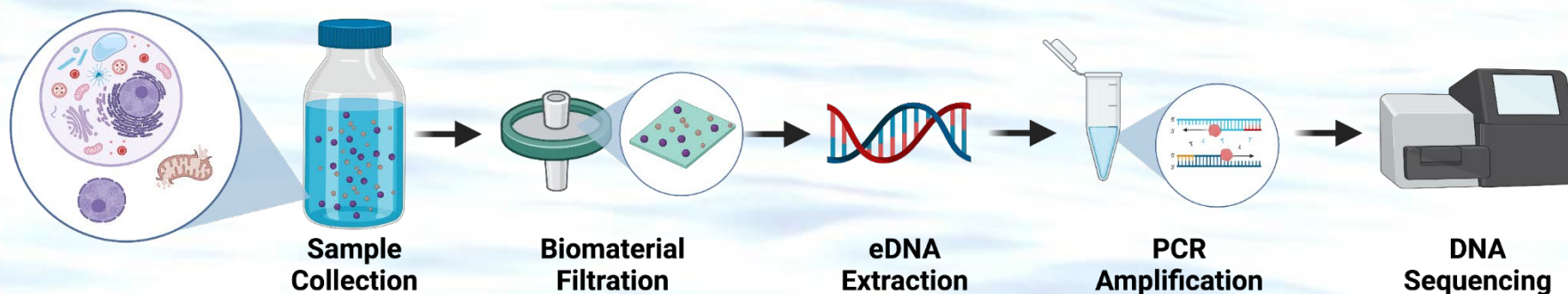
Hard Problems

- Labor intensive, lab-based assays
- Incomplete reference libraries & challenge to manage large, diverse data flows
- Challenge to estimate animal density (#'s/area) or biomass



Research Thrusts – Lab & Field-based

- Sampling Strategies
 - Fate & transport of DNA
 - Survey Design
 - Validation (i.e. PAM, visual)
- Sample Processing (i.e. cost, skill, time)
 - Standards, lab inter-calibration
 - Primer bias, marker design, QA/QC
 - Need for automation
- Technology Development
 - Microfluidics
 - Miniaturize (i.e. sequencers)
 - Automation of work flow
- Bioinformatics
 - Reference libraries
 - Big data management
 - Data integration across fields and existing networks
- Community Building
 - Develop monitoring network
 - Best Practices / Standards



Interagency Partnerships

SOST Biodiversity-IWG / eDNA Task Team

Objectives

- Coordinate current and future research and investments across the federal government on the topic of marine eDNA
 - NOPP Topic
- Coordinate across the federal government engagement and outreach with industry, academia and the public on marine eDNA
 - National Strategy
 - UN Ocean Decade – OBON, Marine Life 2030

