MARINE BIOSECURITY TOOLBOX

www.biosecurity-toolbox.org.nz

Sampling Approaches and Designs Using Environmental DNA & RNA for Marine Biosecurity Surveillance

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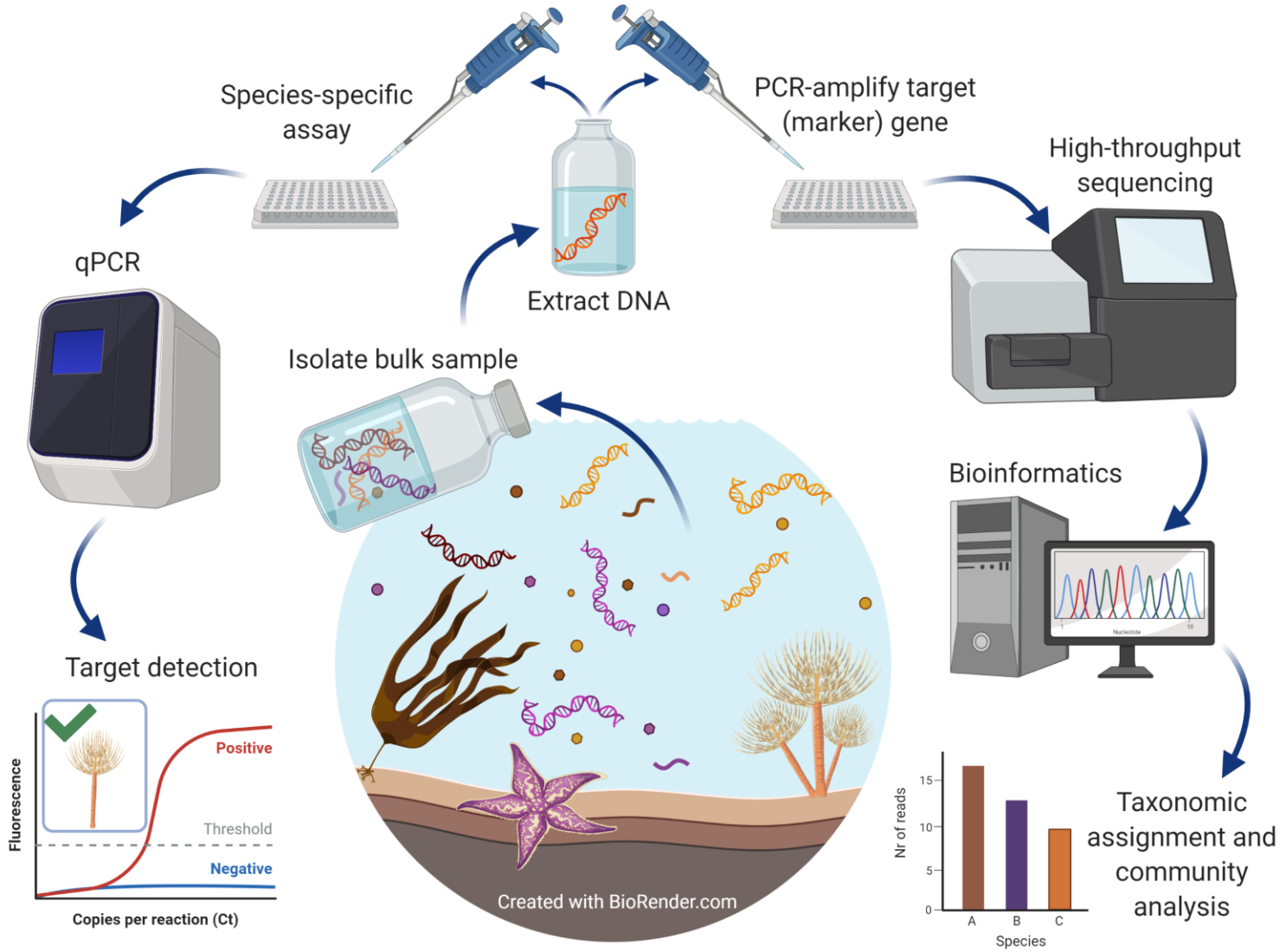


MARINE BIOSECURITY TOOLBOX

Kia tirotiro mangōpare, arā ko ngā tai e whā
Look through the eyes of the mangōpare, observing in all directions

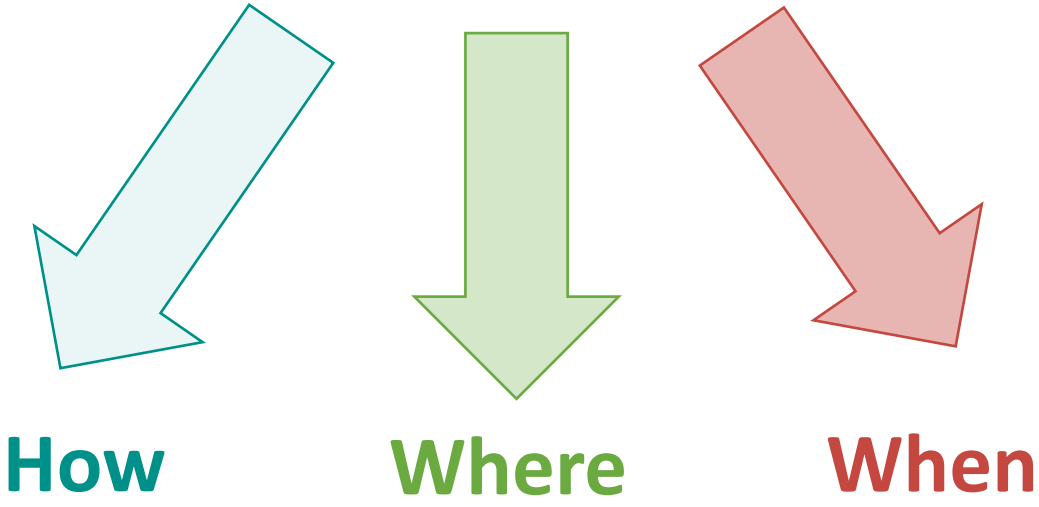
PROTECT

DETECT

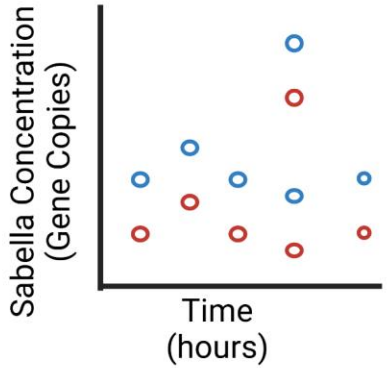
MANAGE & RESPOND

ECONOMICS & DECISION-SUPPORT

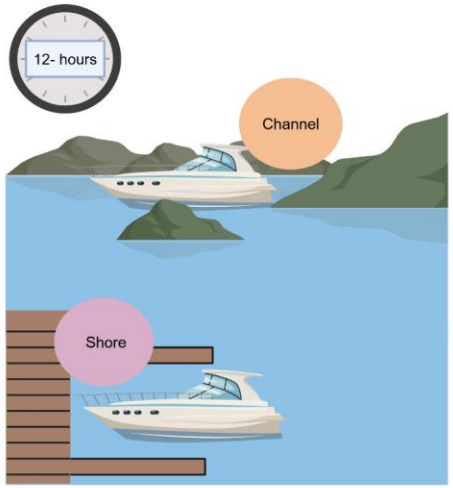
🎯 Optimise eDNA/eRNA sampling approaches and designs for marine biosecurity applications



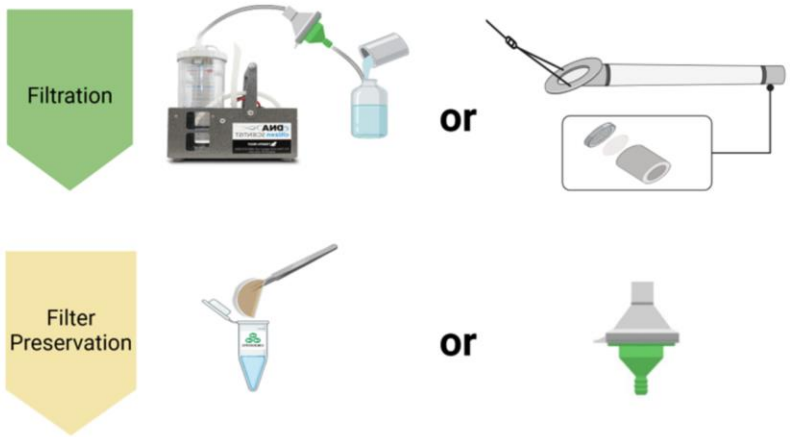
In Situ Dynamics



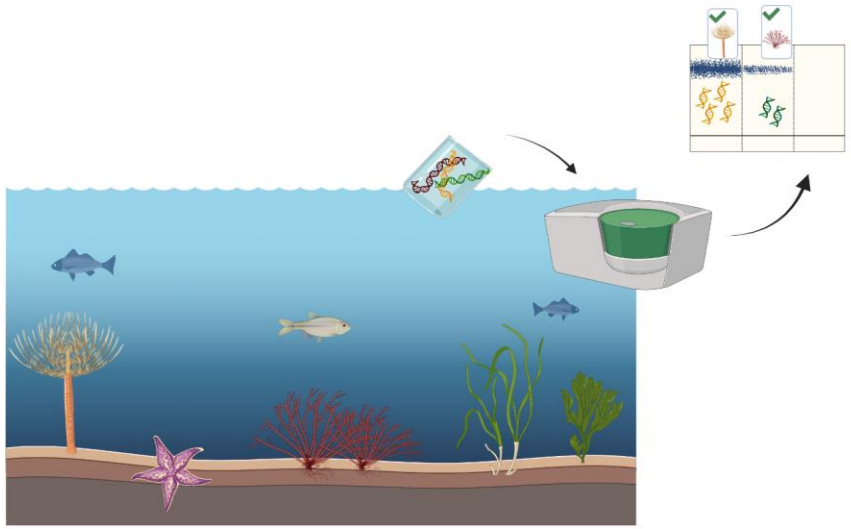
Distribution & Dispersal



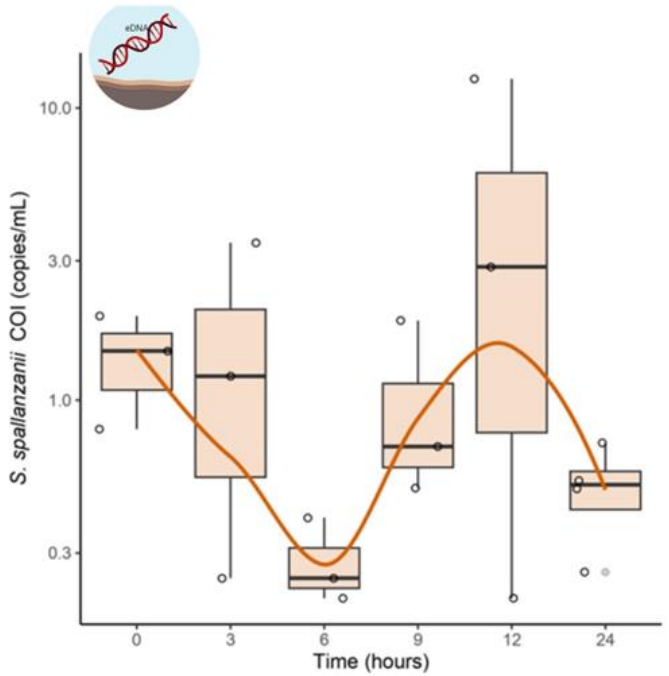
Optimal Sampling Workflows

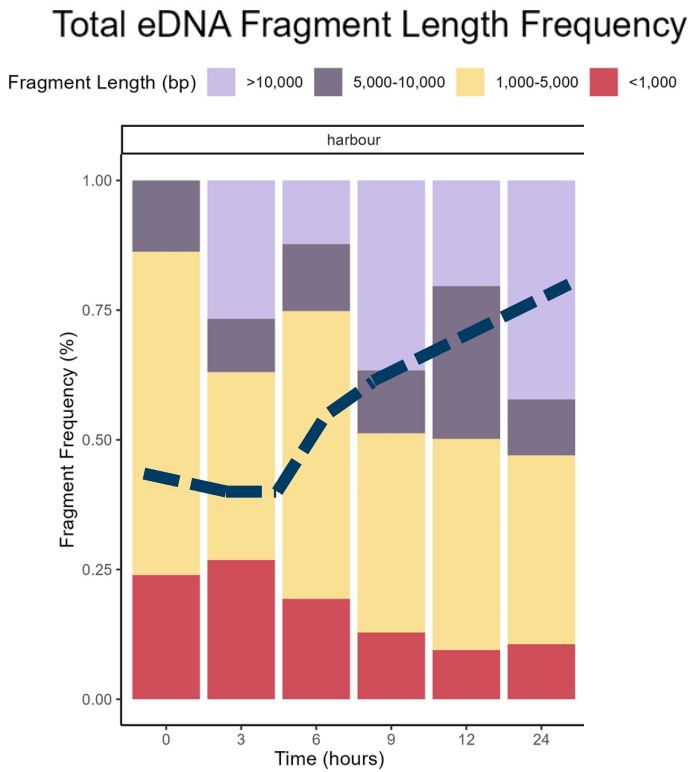


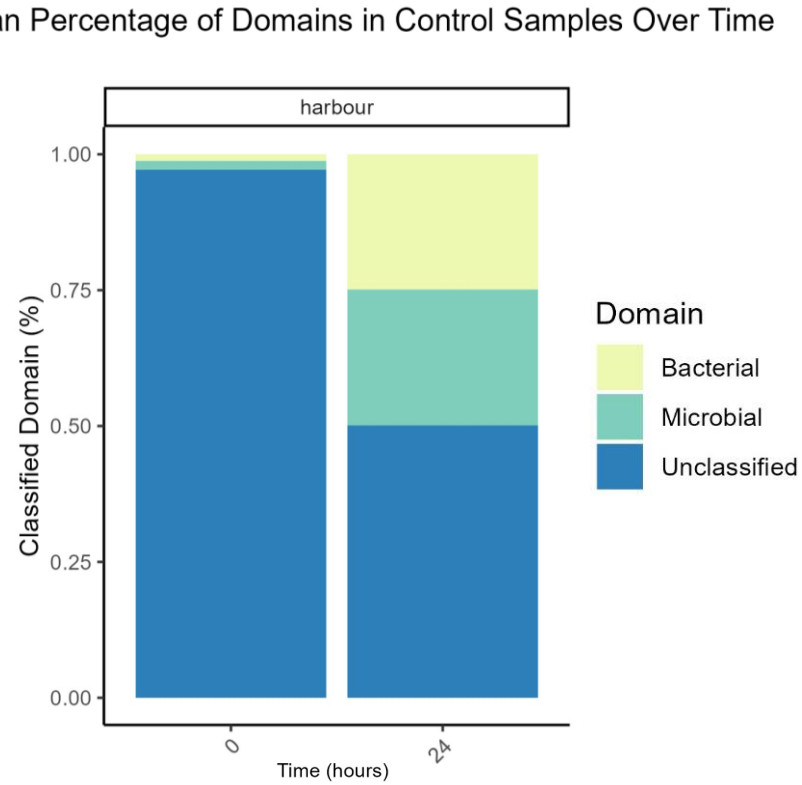
Innovative Sampling Methods



In Situ Dynamics







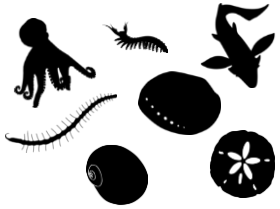
When: In-Situ Dynamics

What: More insight with new technologies

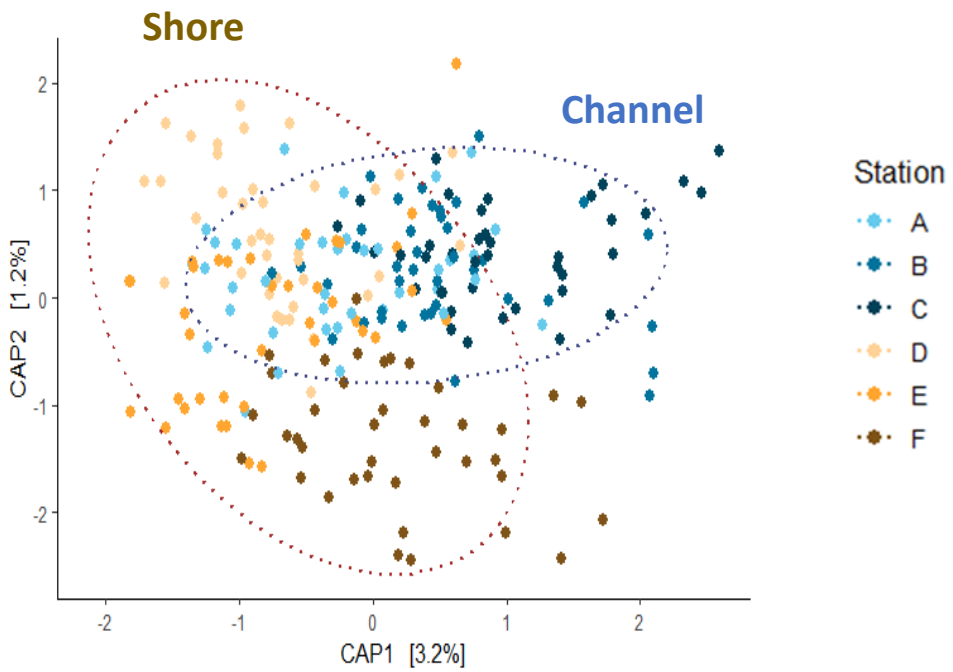
Scriver et al., 2024. Environmental DNA–RNA dynamics provide insights for effective monitoring of marine invasive species.

Distribution & Dispersal

Mitochondrial COI

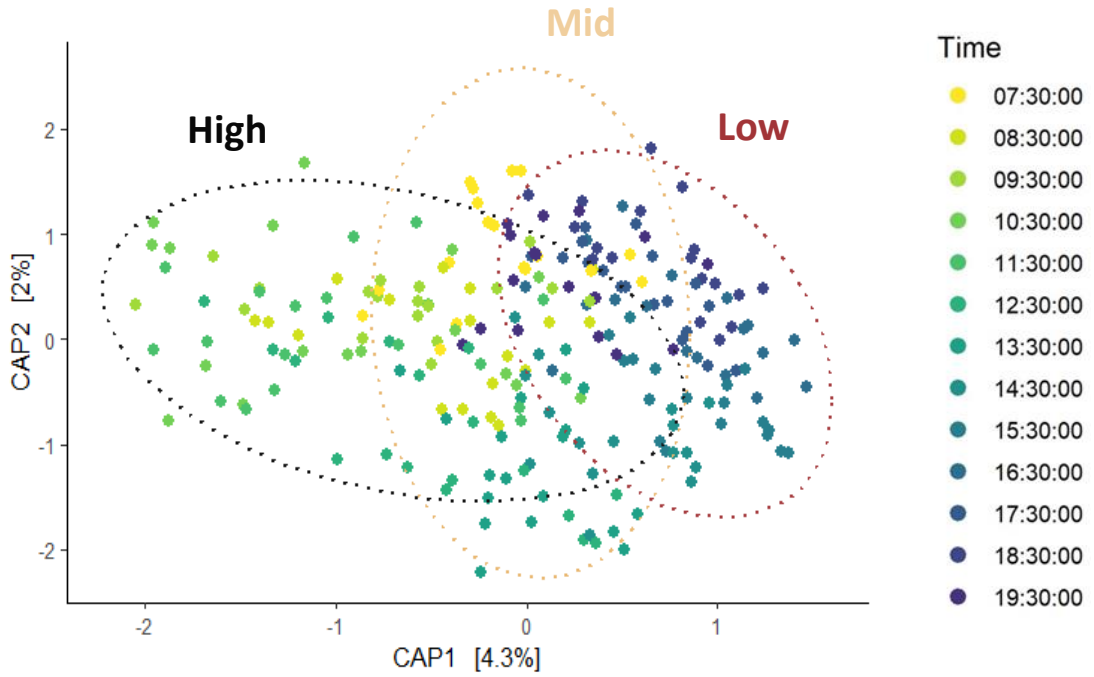


Location



Time

70% of biodiversity (ASVs)

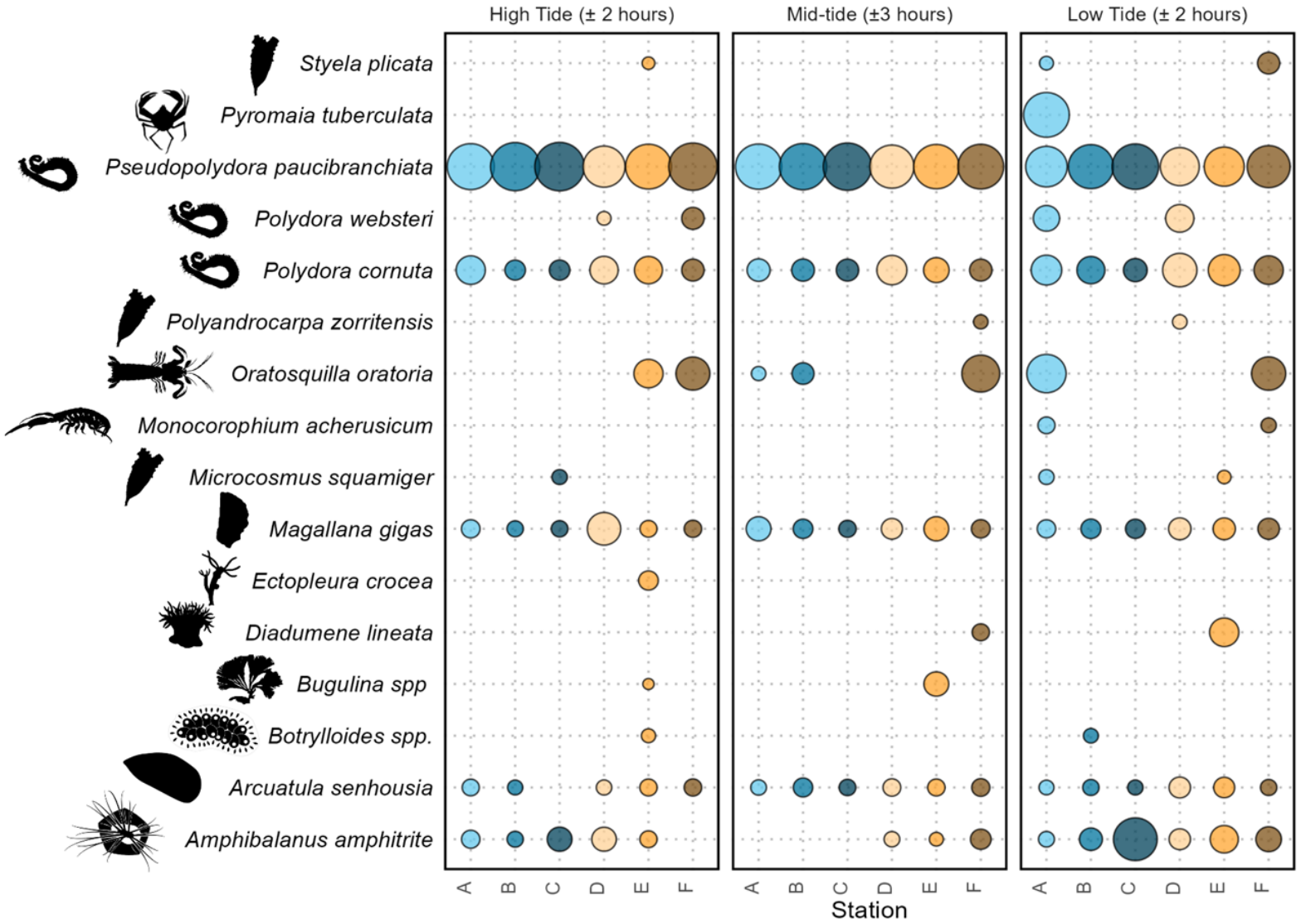


Scriver et al., 2024. Ebbs and Flows of Marine Biodiversity: Navigating Spatiotemporal Patterns of Environmental DNA in a Coastal Tidal Ecosystem.

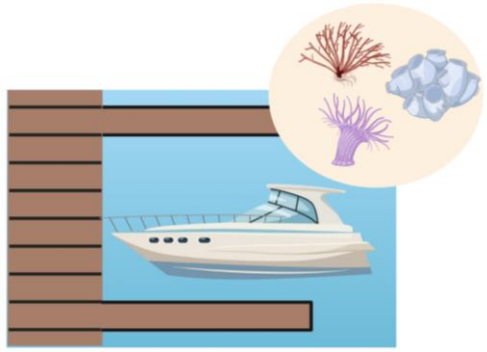
Distribution & Dispersal

MARINE BIOSECURITY TOOLBOX **Pest Alert Tool**

Mitochondrial COI- Metazoans



Where: Target species habitat



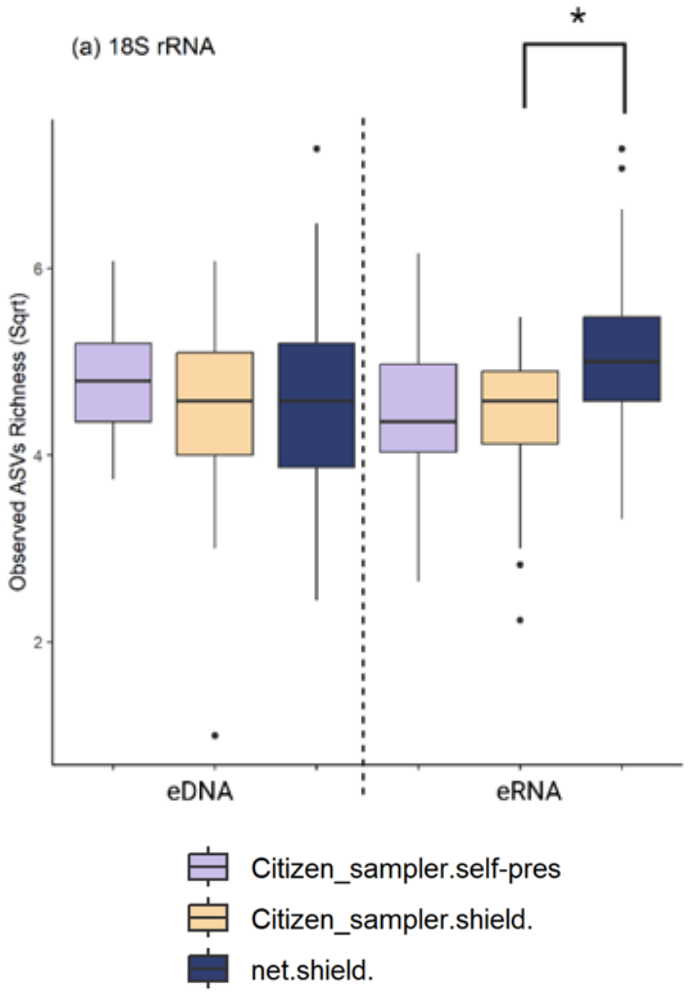
When:

Low Tide

Screening for NIS

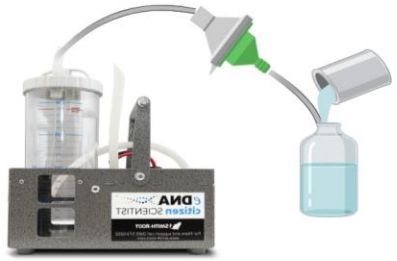
Scriver et al., 2024. Ebbs and Flows of Marine Biodiversity: Navigating Spatiotemporal Patterns of Environmental DNA in a Coastal Tidal Ecosystem.

Optimal Sampling Workflows

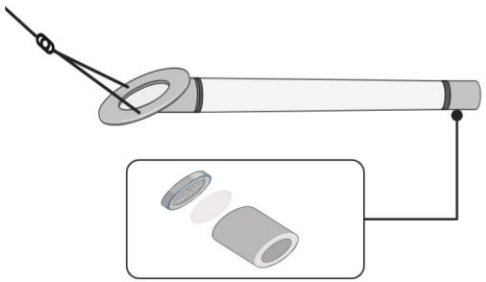


How: Adaptive Sampling for Highly Abundant Taxa (18S rRNA)

Filtration



or



Filter Preservation

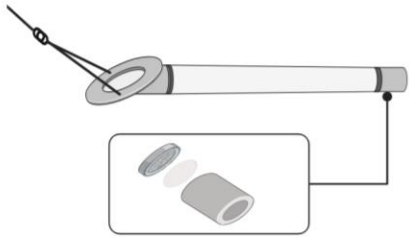
or

Scriver et al., (2025). Biodiversity monitoring in remote marine environments: Advancing environmental DNA/RNA sampling workflows. [In press]

Optimal Sampling Workflows

How: Careful Consideration for Low-Abundance and Sparsely Dispersed Taxa (16S rRNA for Fish and Vertebrates)

Filtration



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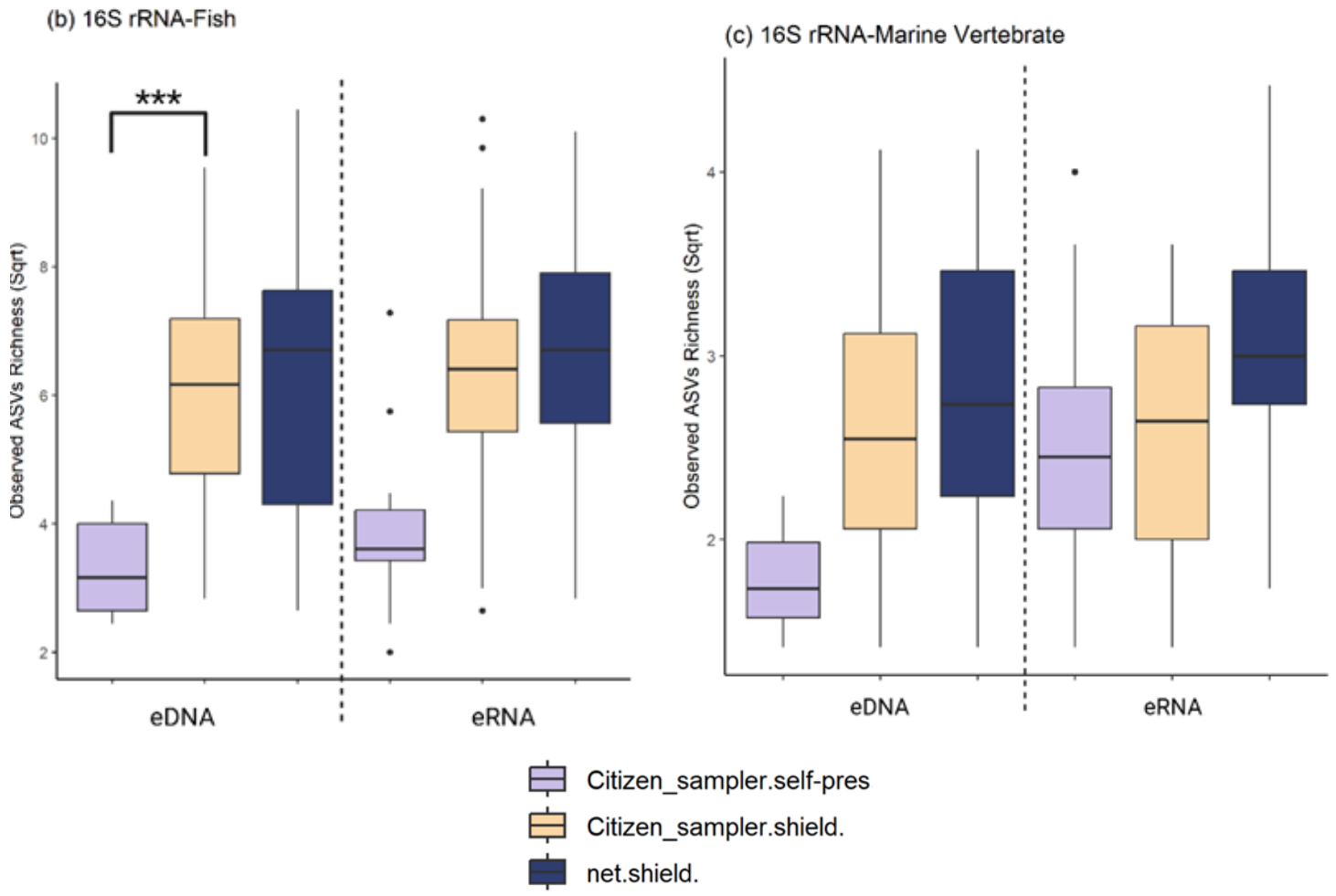

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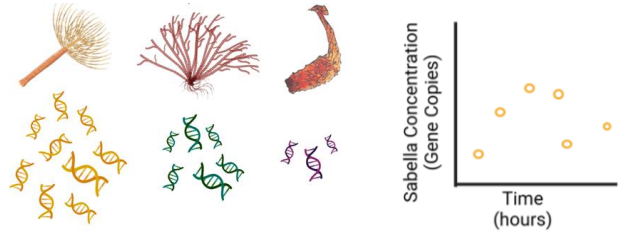
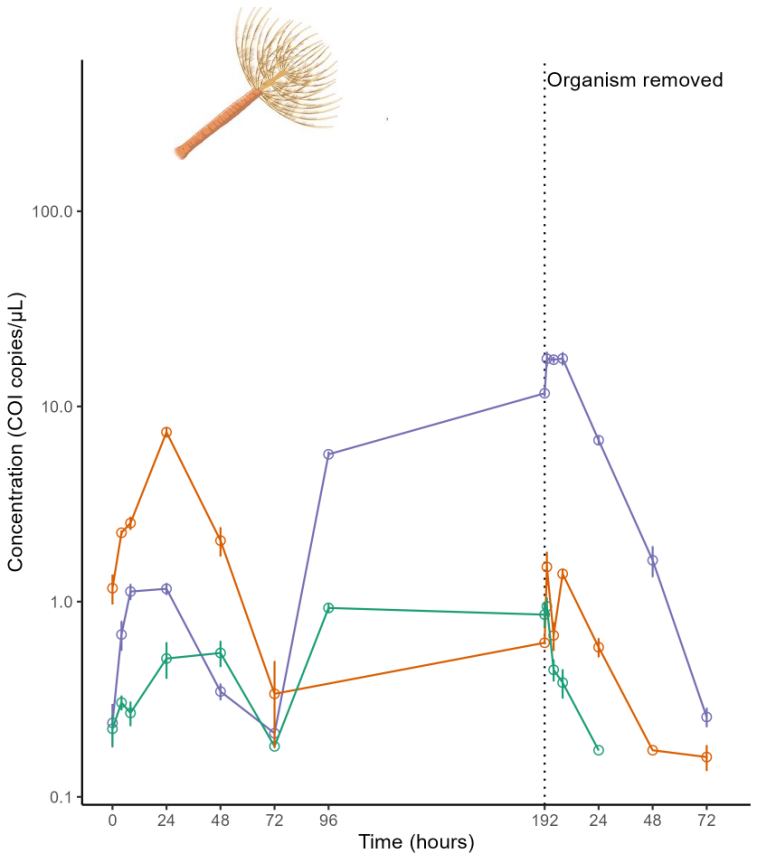
Innovative Sampling Methods

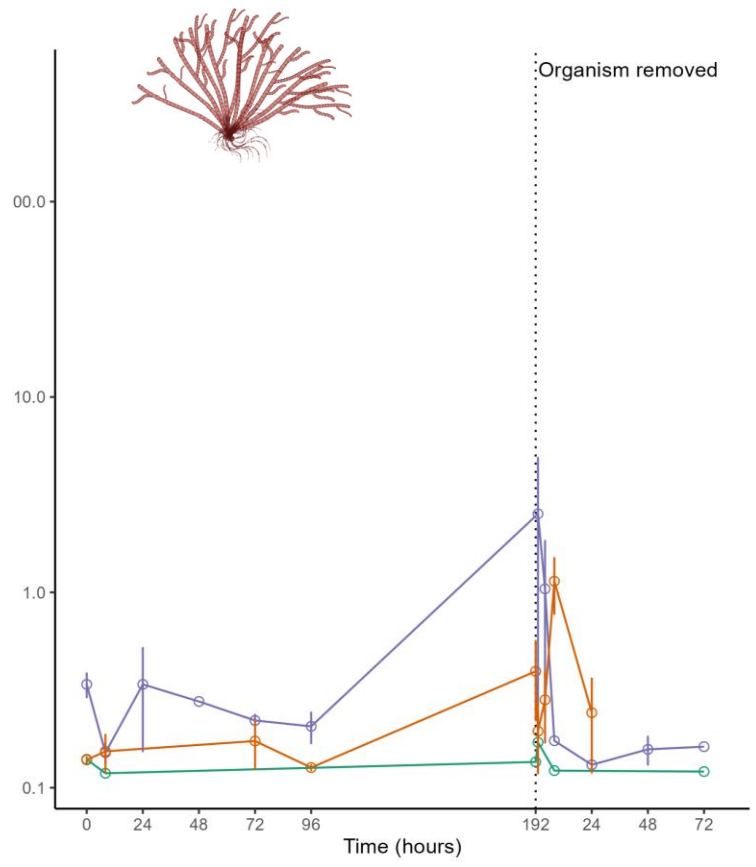
How: direct-ddPCR is possible

Considerations:

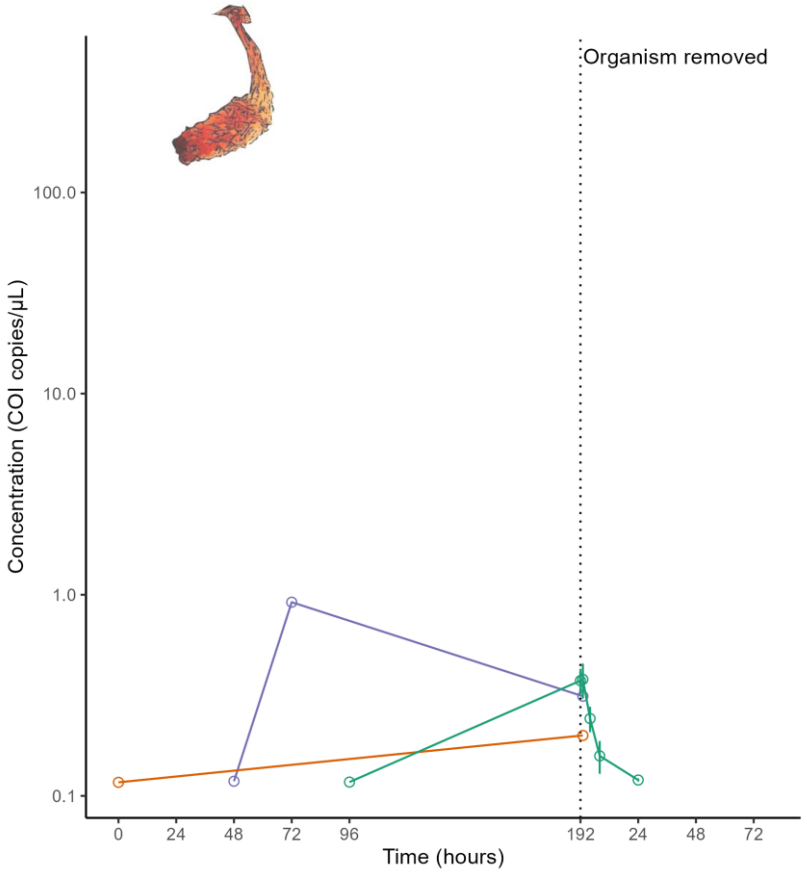




Sabella spallanzanii



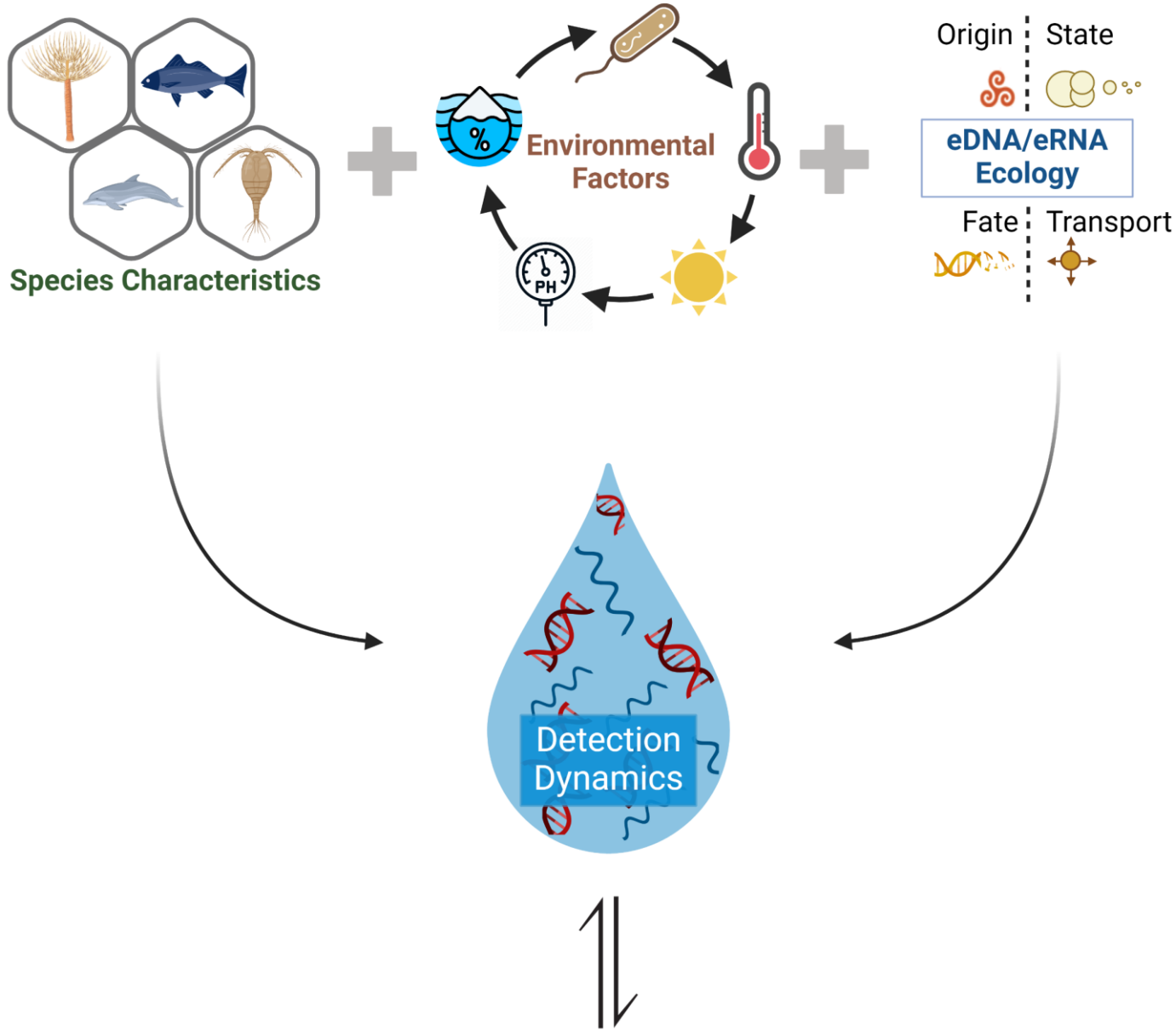
Bugula neritina



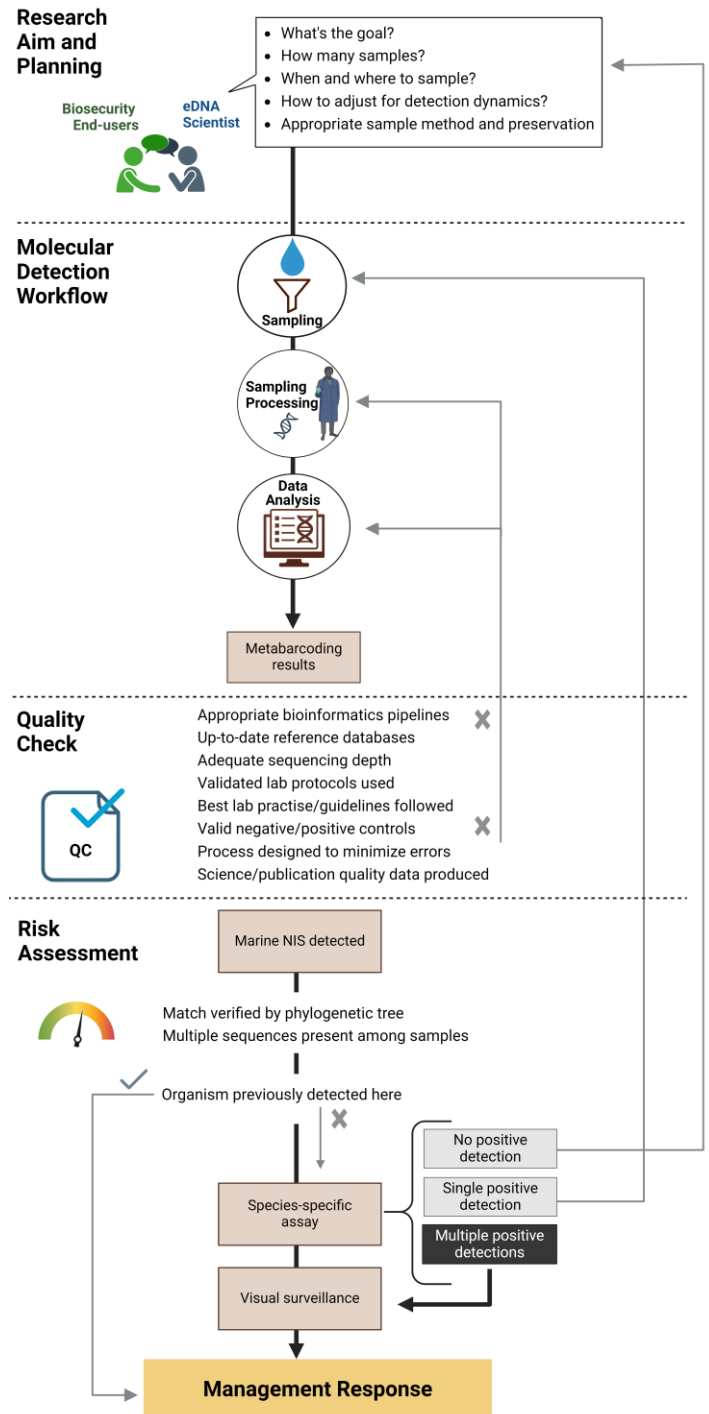
Styela Clava

Biomass — High — Medium — Low

Scriver et al. (2024). Drop it all: extraction-free detection of targeted marine species through optimized direct droplet digital PCR.



eDNA/eRNA Sampling Approaches and Design


Research Aim and Planning
What's the goal?
How many samples?
When and where to sample?
How to adjust for detection dynamics?
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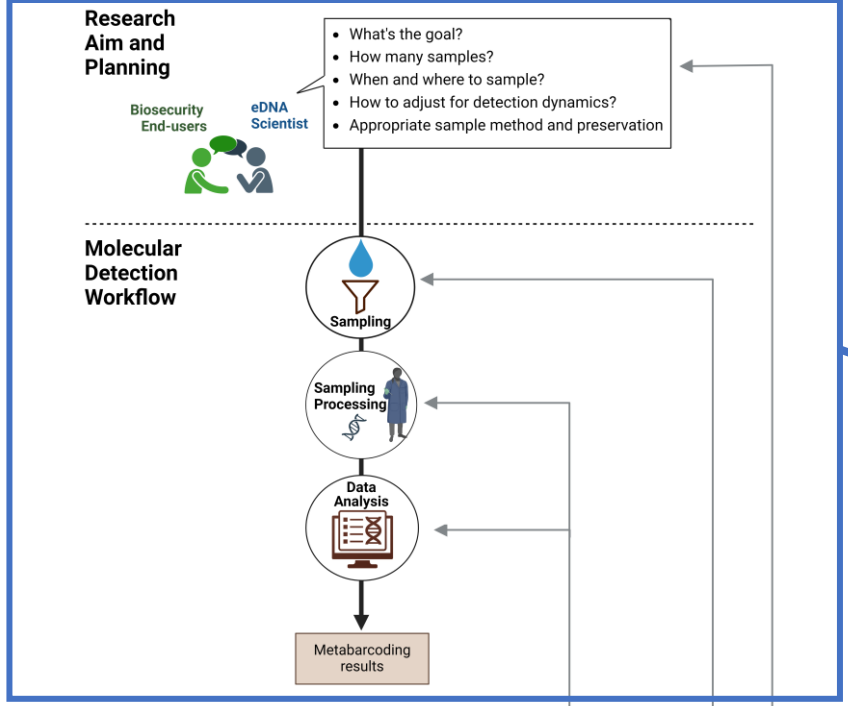
Appropriate sample method and preservation
Biosecurity End-users
eDNA Scientist
Molecular Detection Workflow
Sampling
Sampling Processing
Data Analysis
Metabarcoding results
Quality Check
QC
Appropriate bioinformatics pipelines
Up-to-date reference databases
Adequate sequencing depth
Validated lab protocols used
Best lab practise/guidelines followed
Valid negative/positive controls
Process designed to minimize errors
Science/publication quality data produced
Risk Assessment
Marine NIS detected
Match verified by phylogenetic tree
Multiple sequences present among samples
Organism previously detected here
Species-specific assay
No positive detection
Single positive detection
Multiple positive detections
Visual surveillance
Management Response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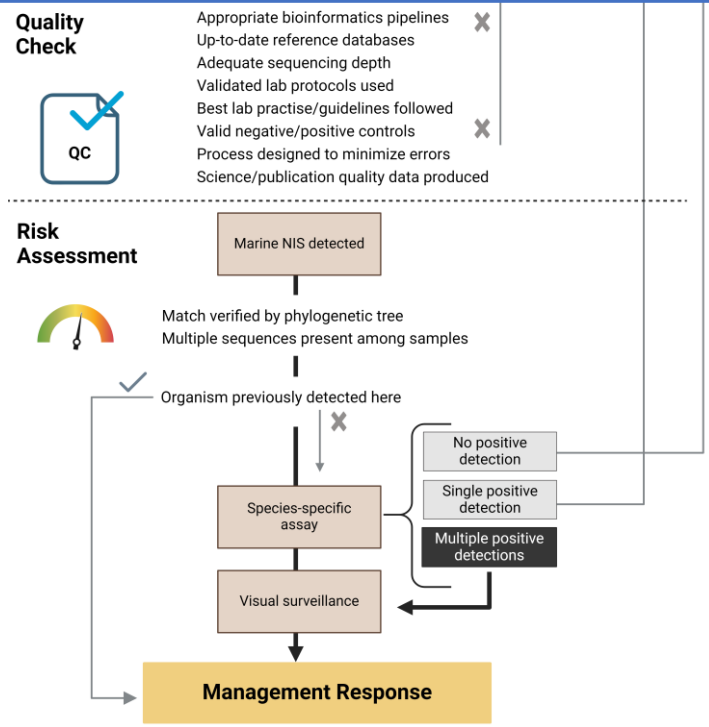
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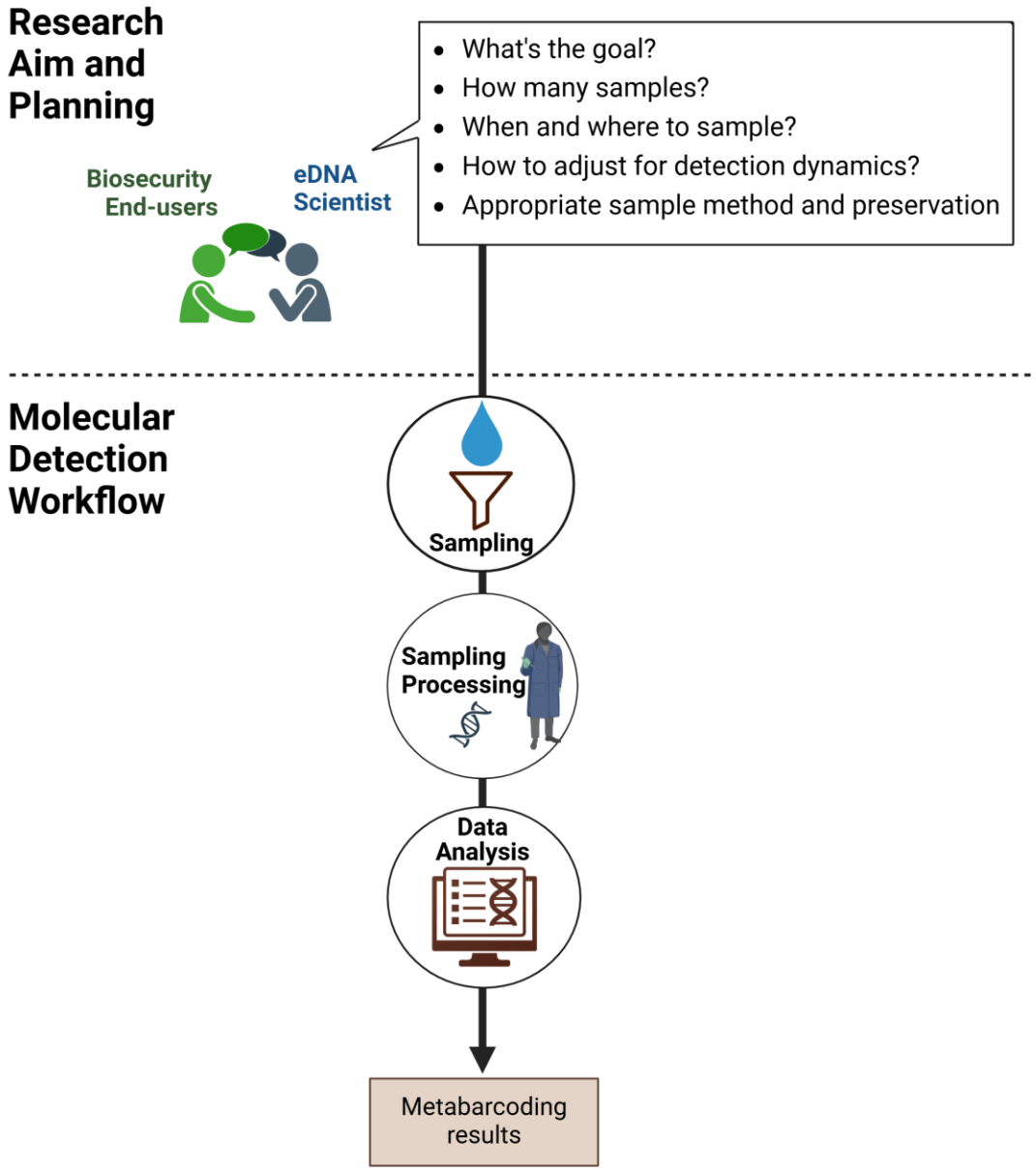
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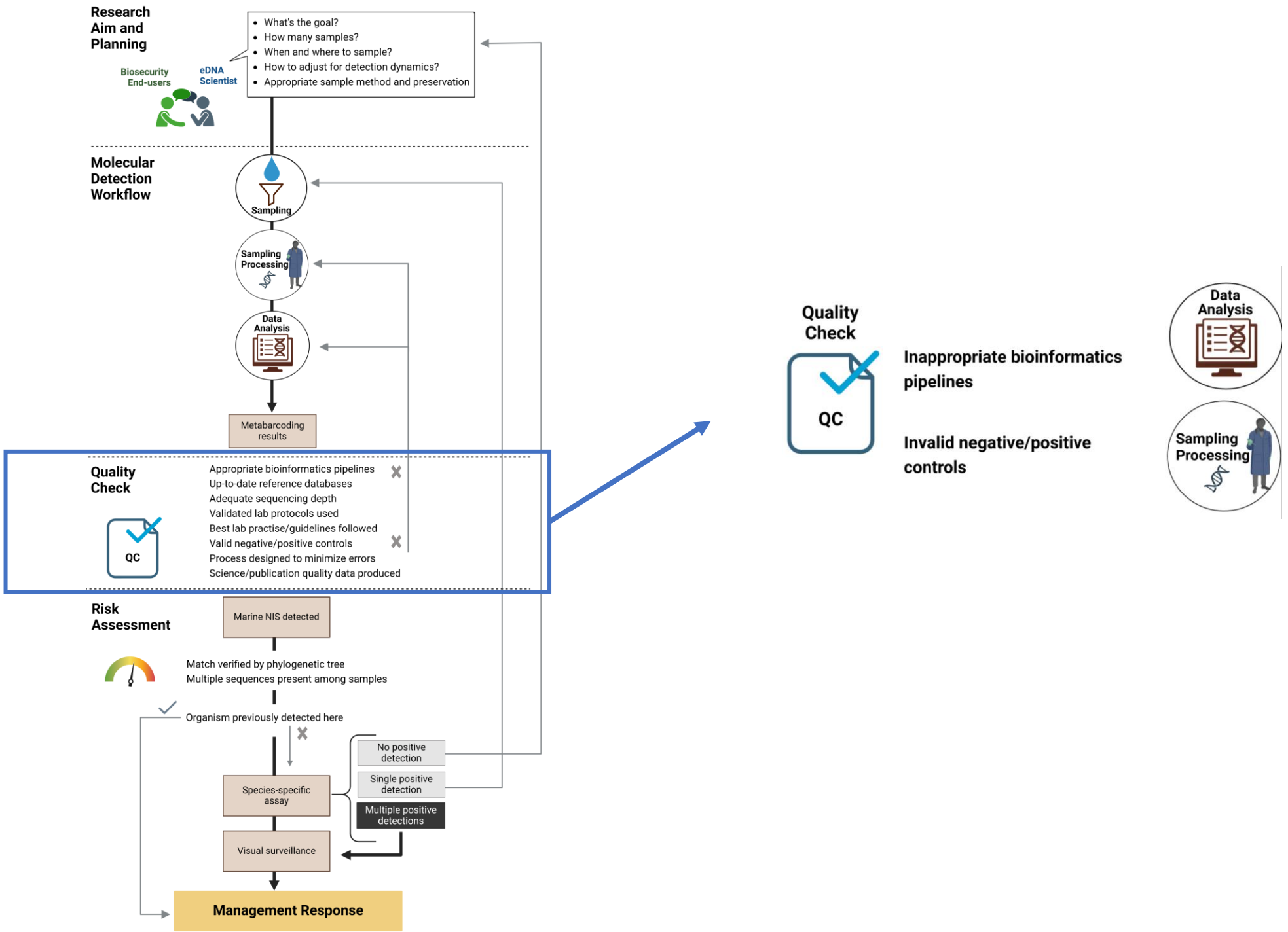
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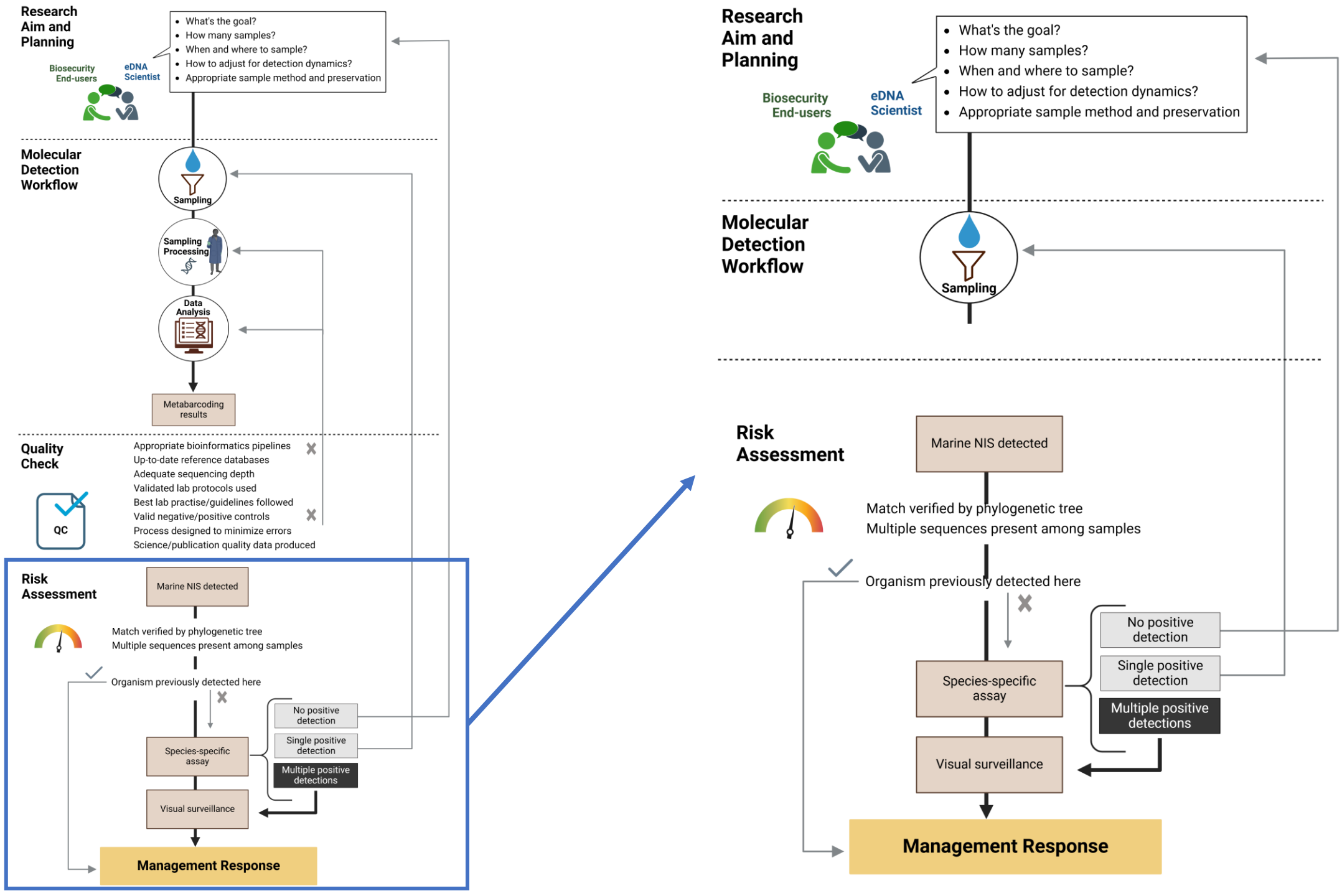
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Many thanks to the fantastic team at Cawthron and all the partnerships with the Marine Biosecurity Toolbox

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Thank-you! Any Questions?

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