The Gulf eDNA Network: Unifying Environmental DNA Research and Collaboration Across the Gulf

Yasmina Shah Esmaeili, Ph.D.

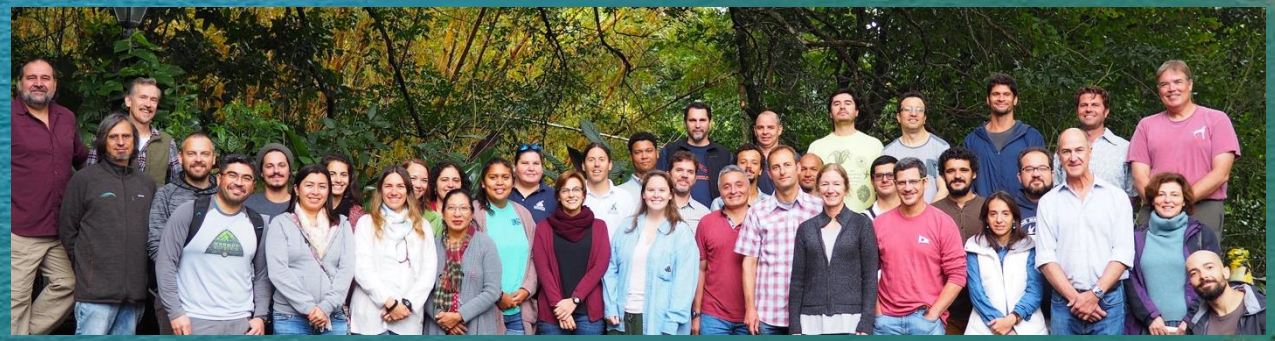
TEXAS A&M UNIVERSITY
GALVESTON CAMPUS

THE UNIVERSITY OF TEXAS MARINE SCIENCE INSTITUTE


Sydney, Australia

Ubatuba, Brazil

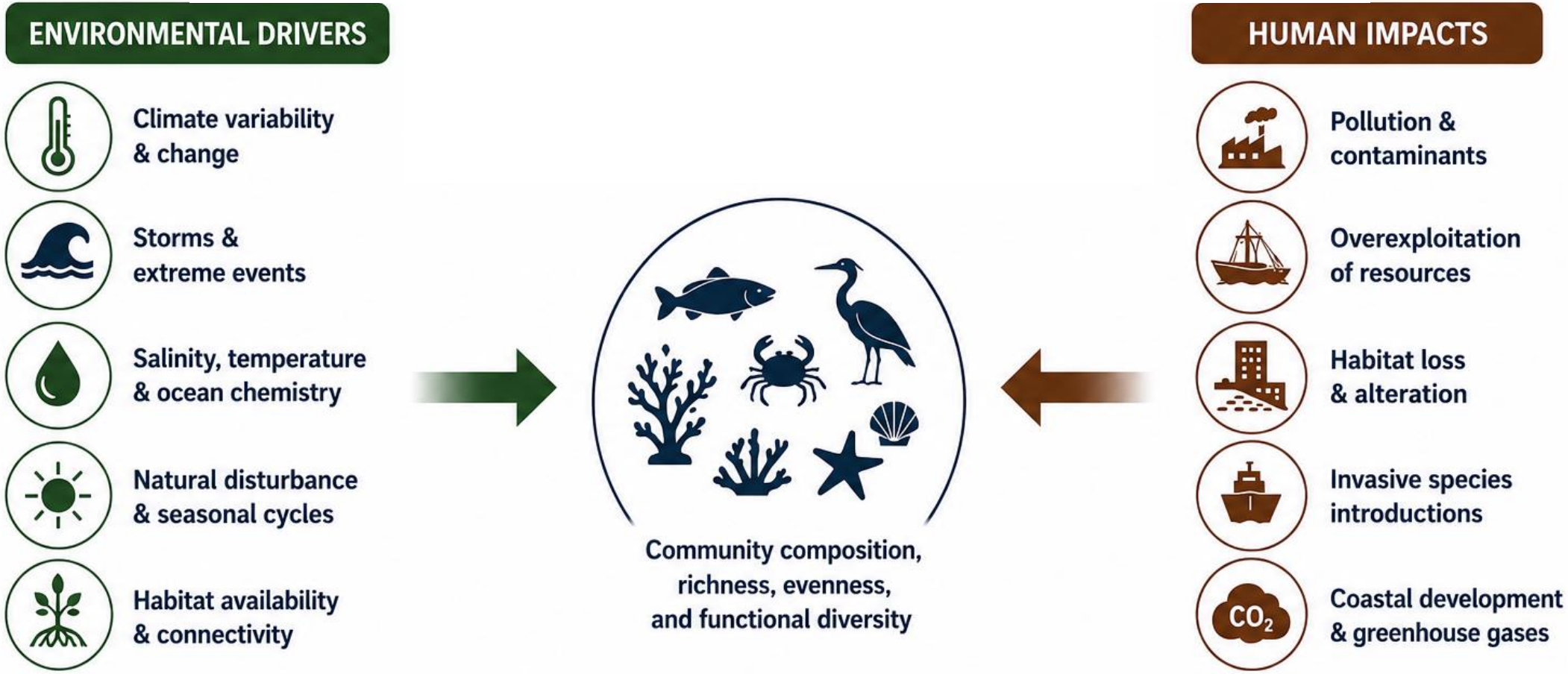
MBON Pole to Pole

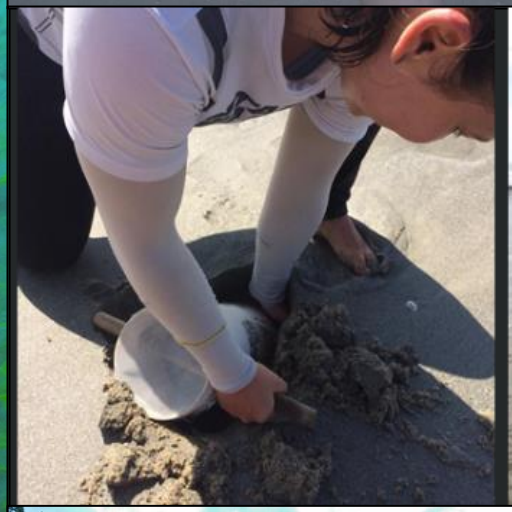


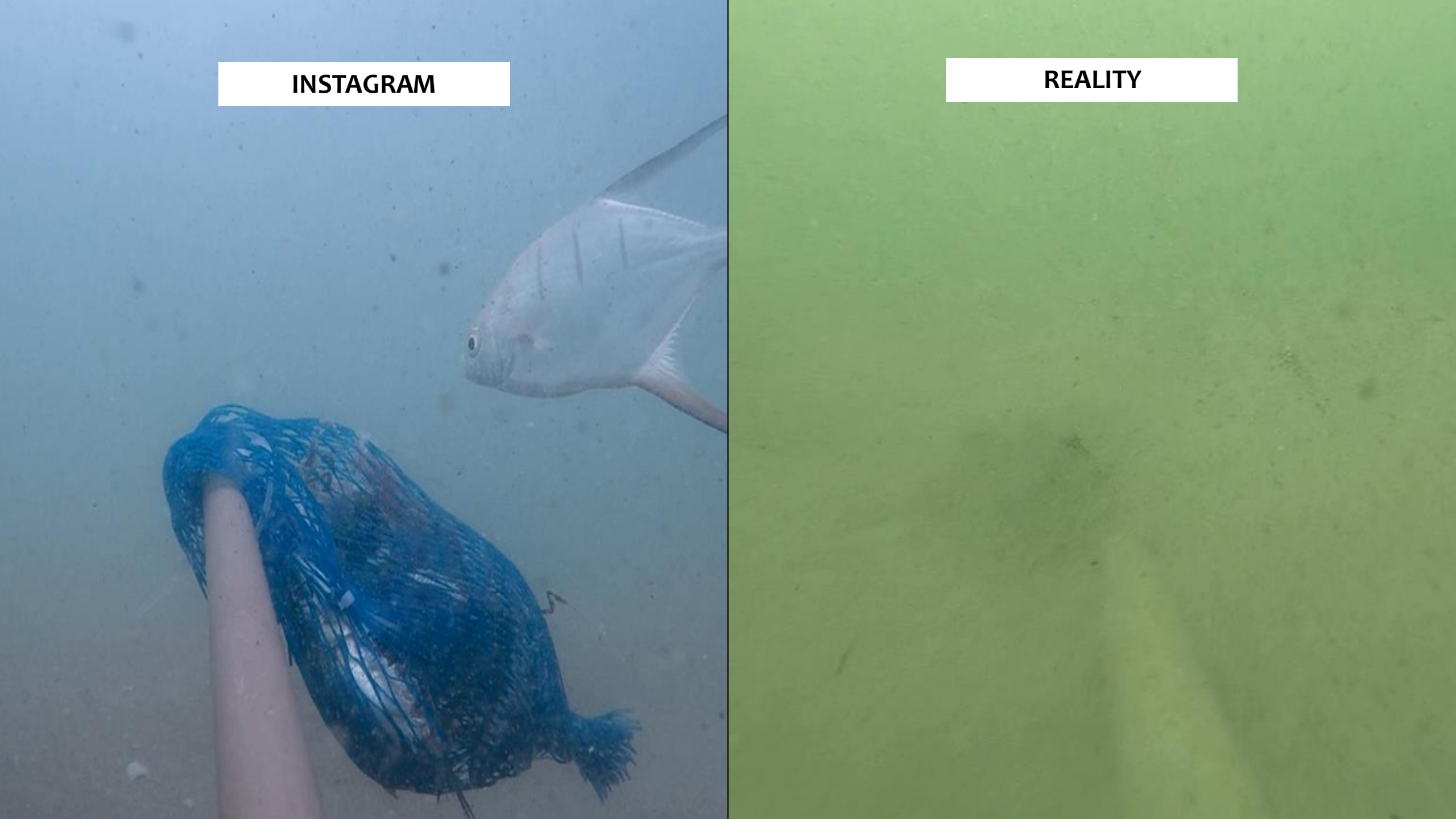

Maine, USA

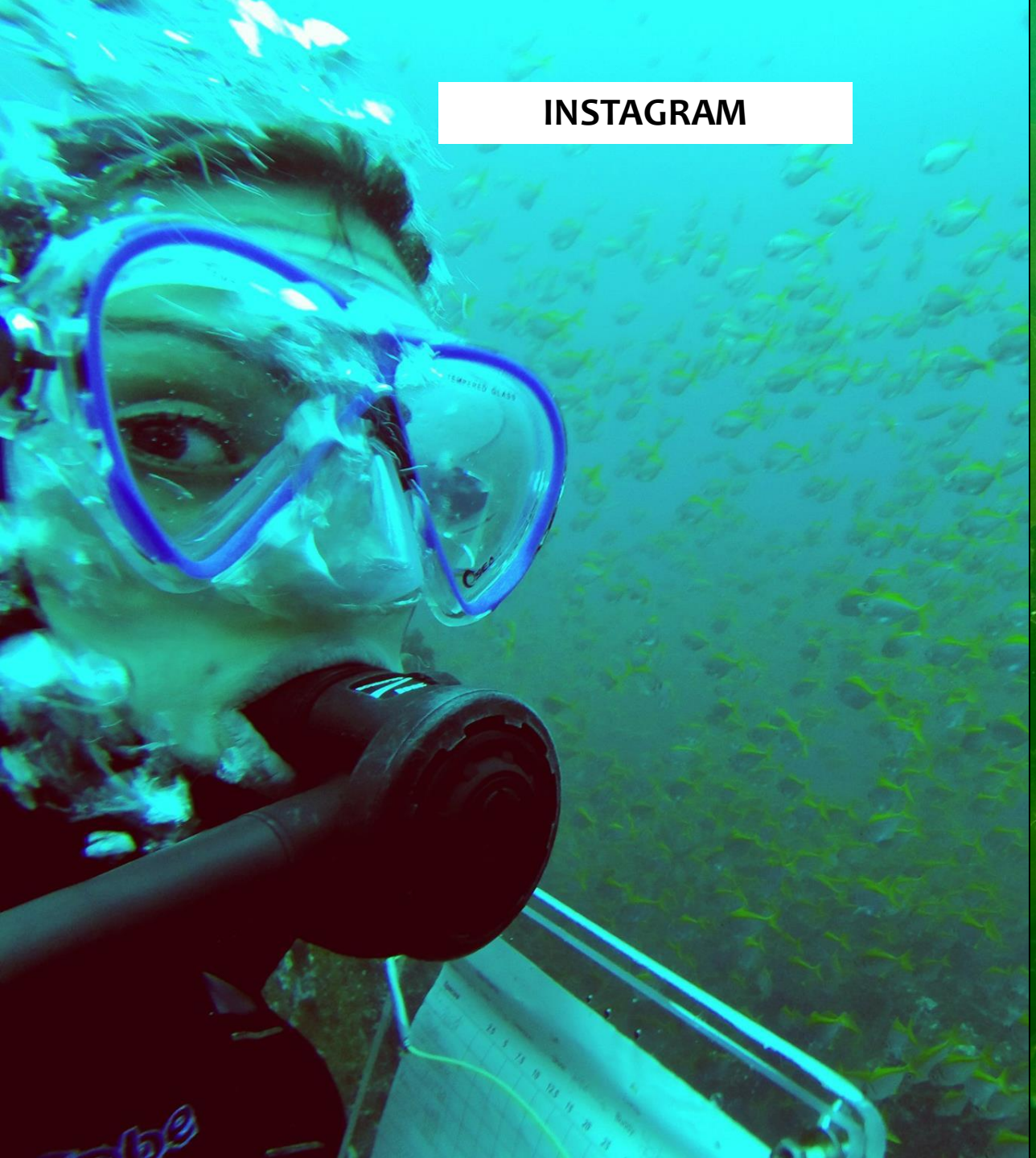

Texas, USA

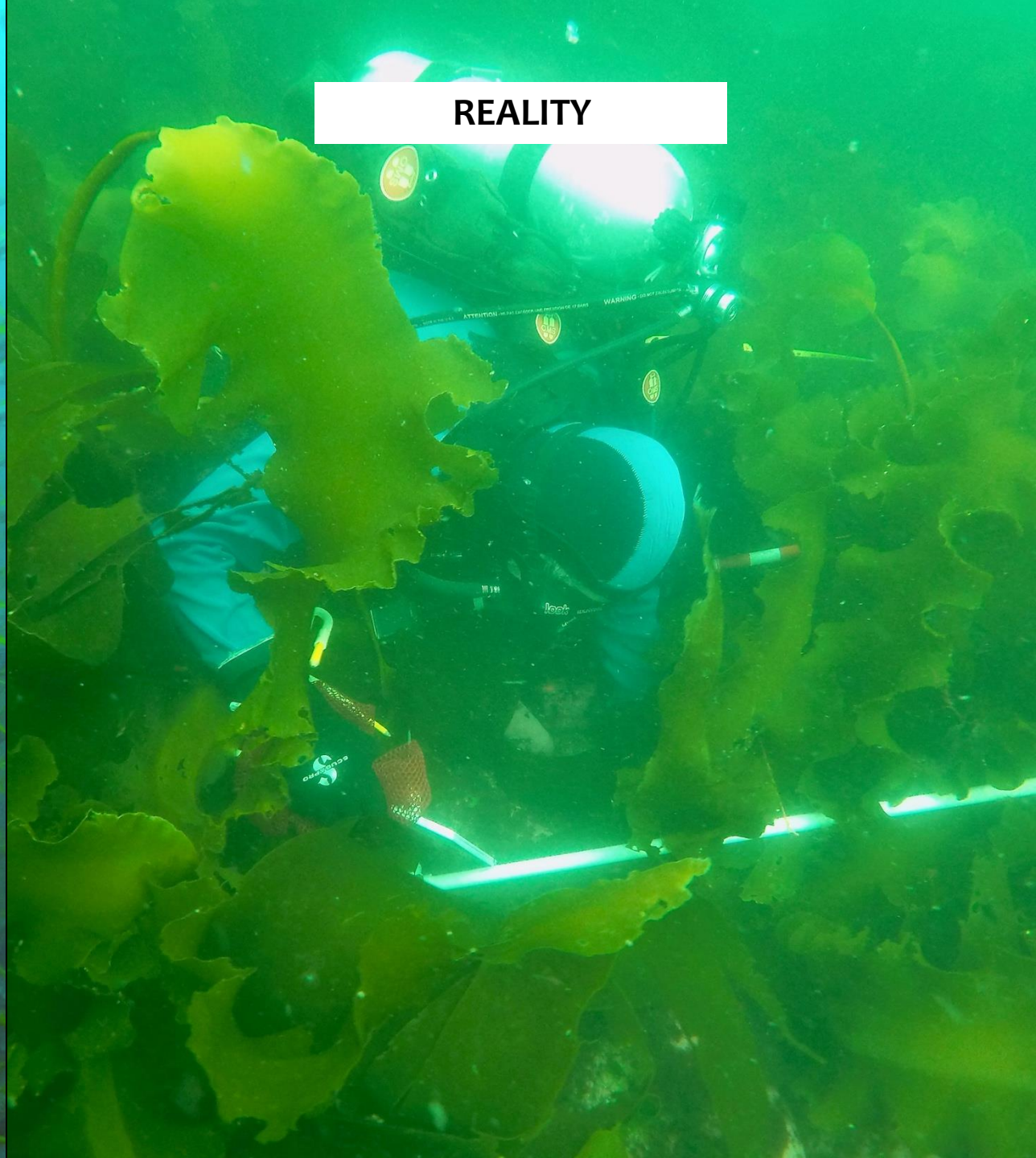
My research focuses on understanding how environmental drivers and human impacts shape biological diversity





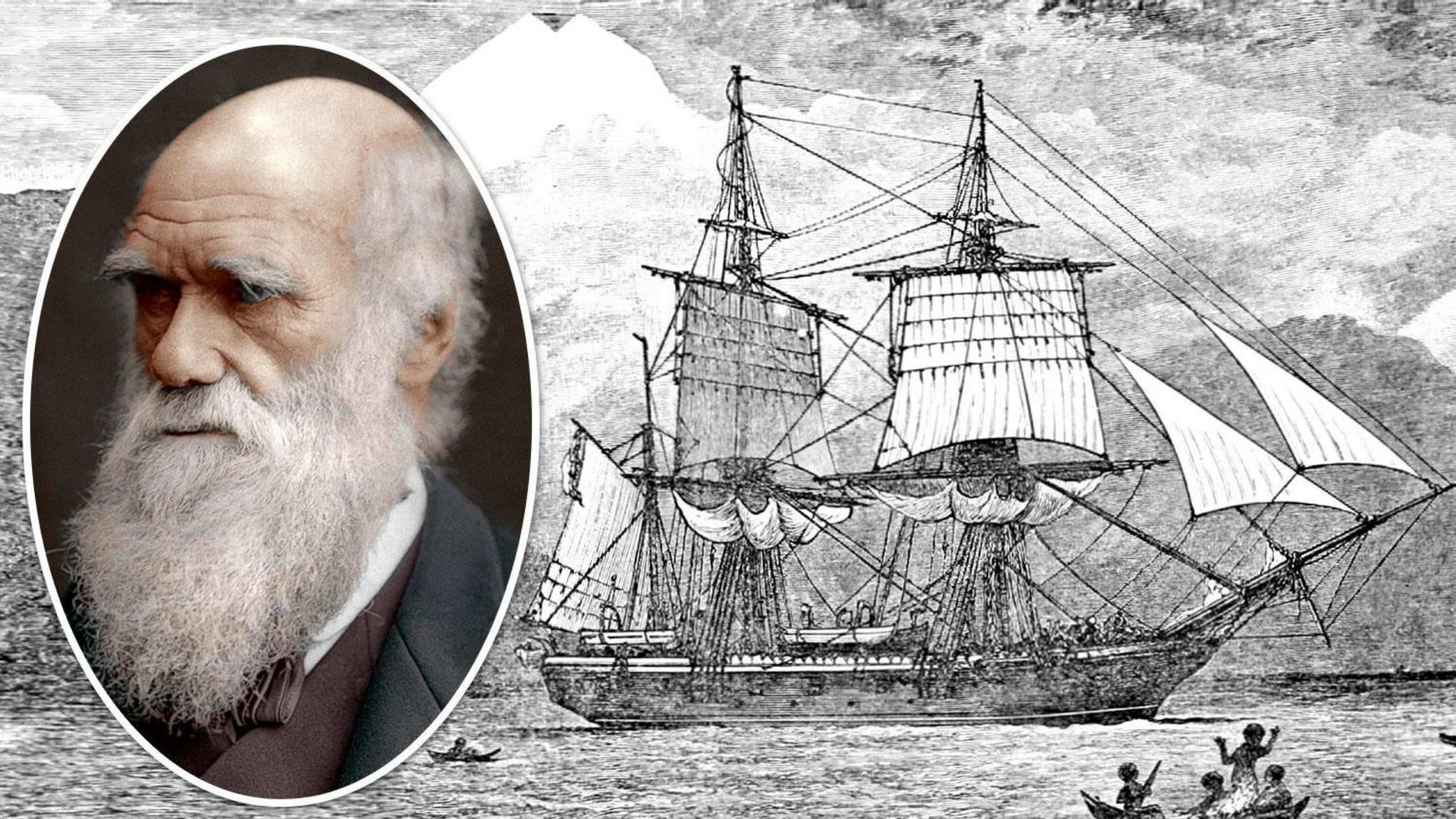

INSTAGRAM
REALITY

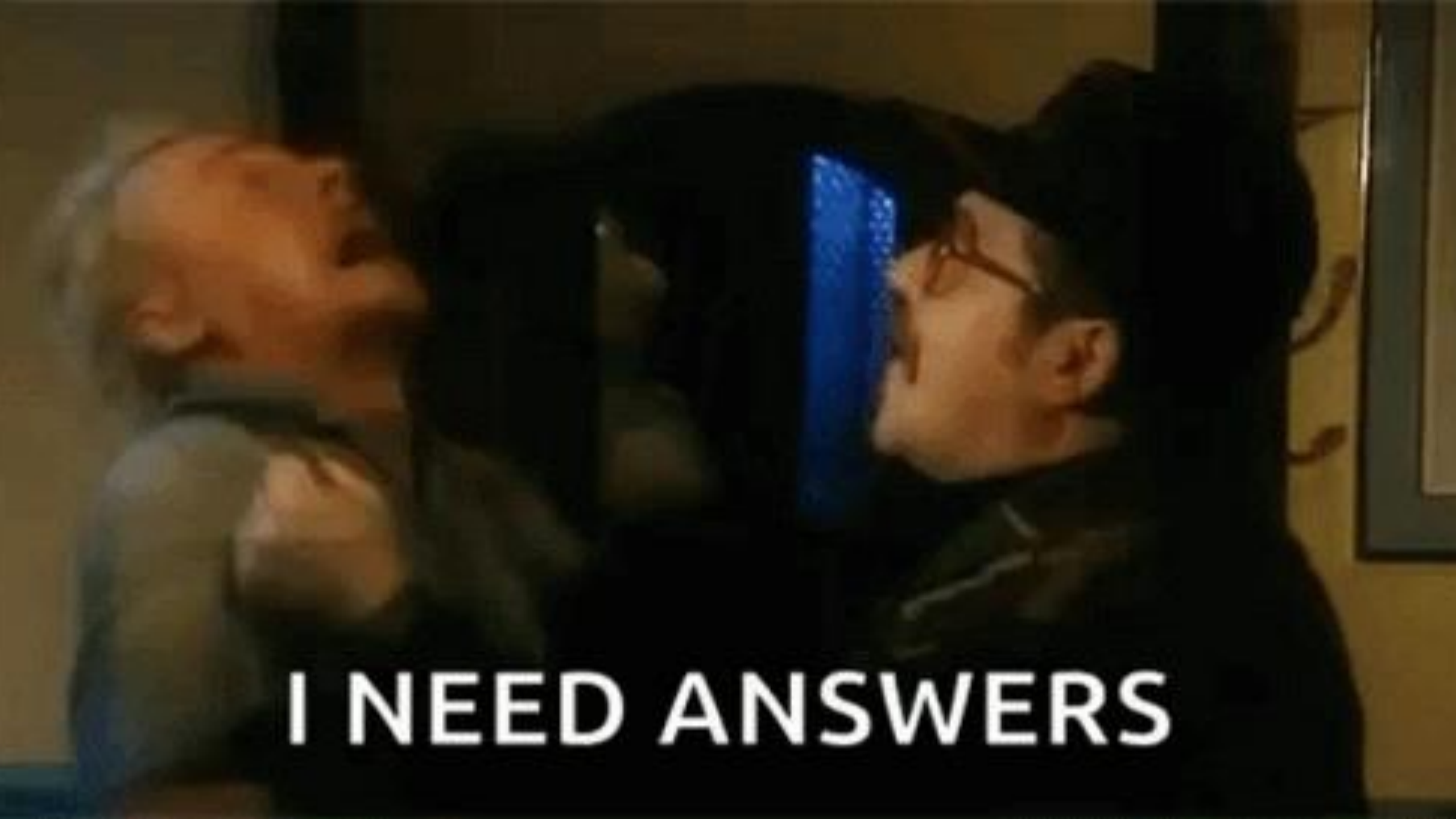

INSTAGRAM

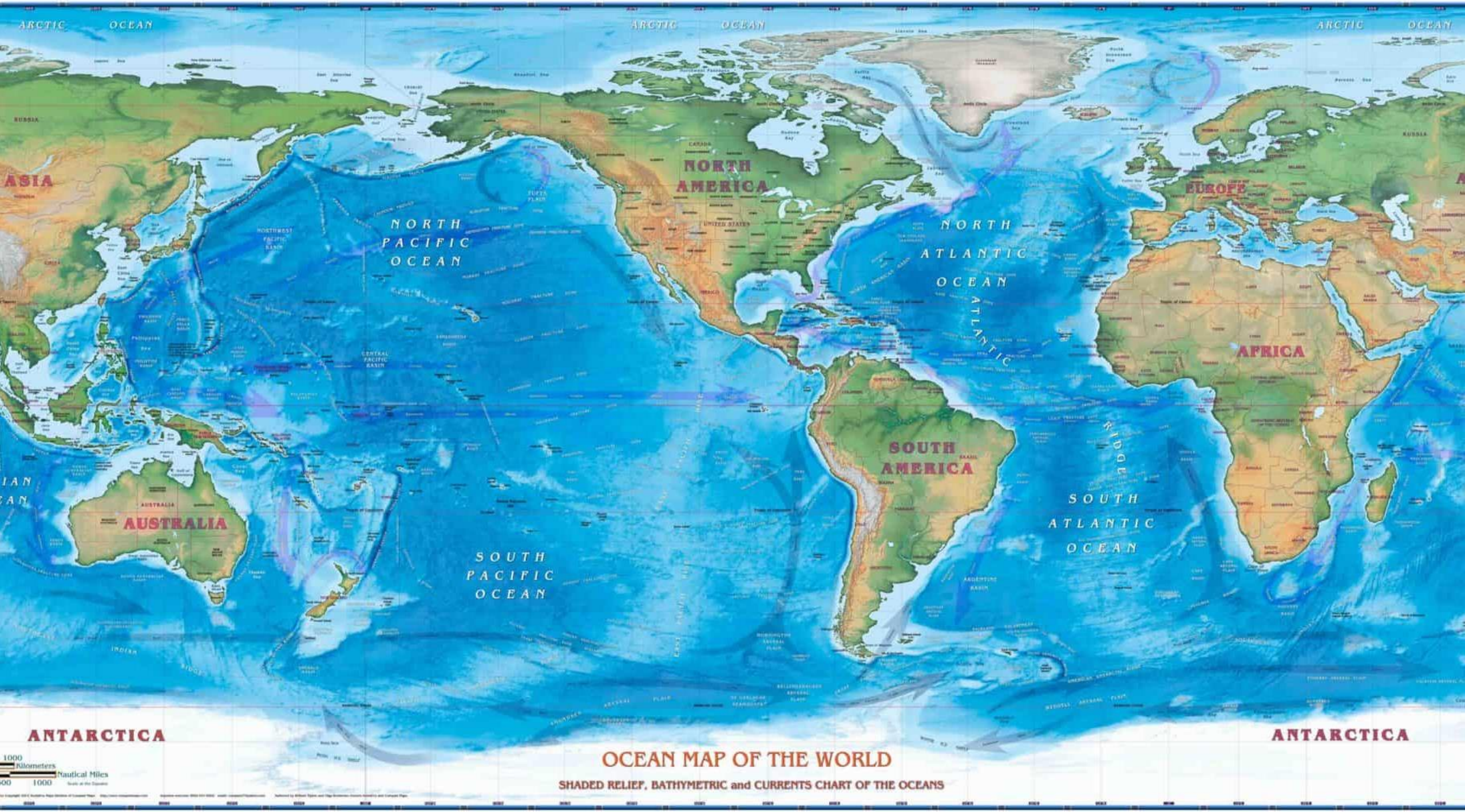

REALITY

INSTAGRAM

REALITY



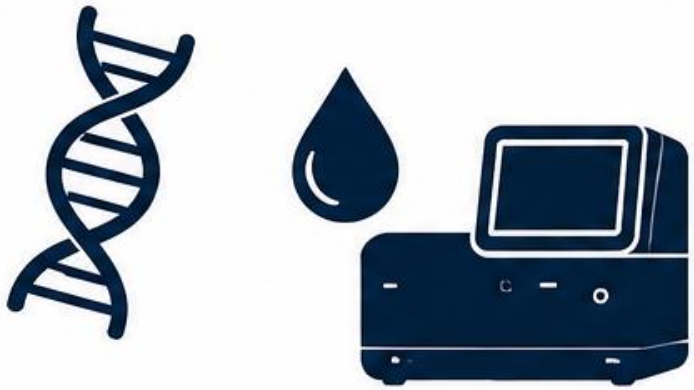

I NEED ANSWERS



OCEAN MAP OF THE WORLD

SHADED RELIEF, BATHYMETRIC and CURRENTS CHART OF THE OCEANS

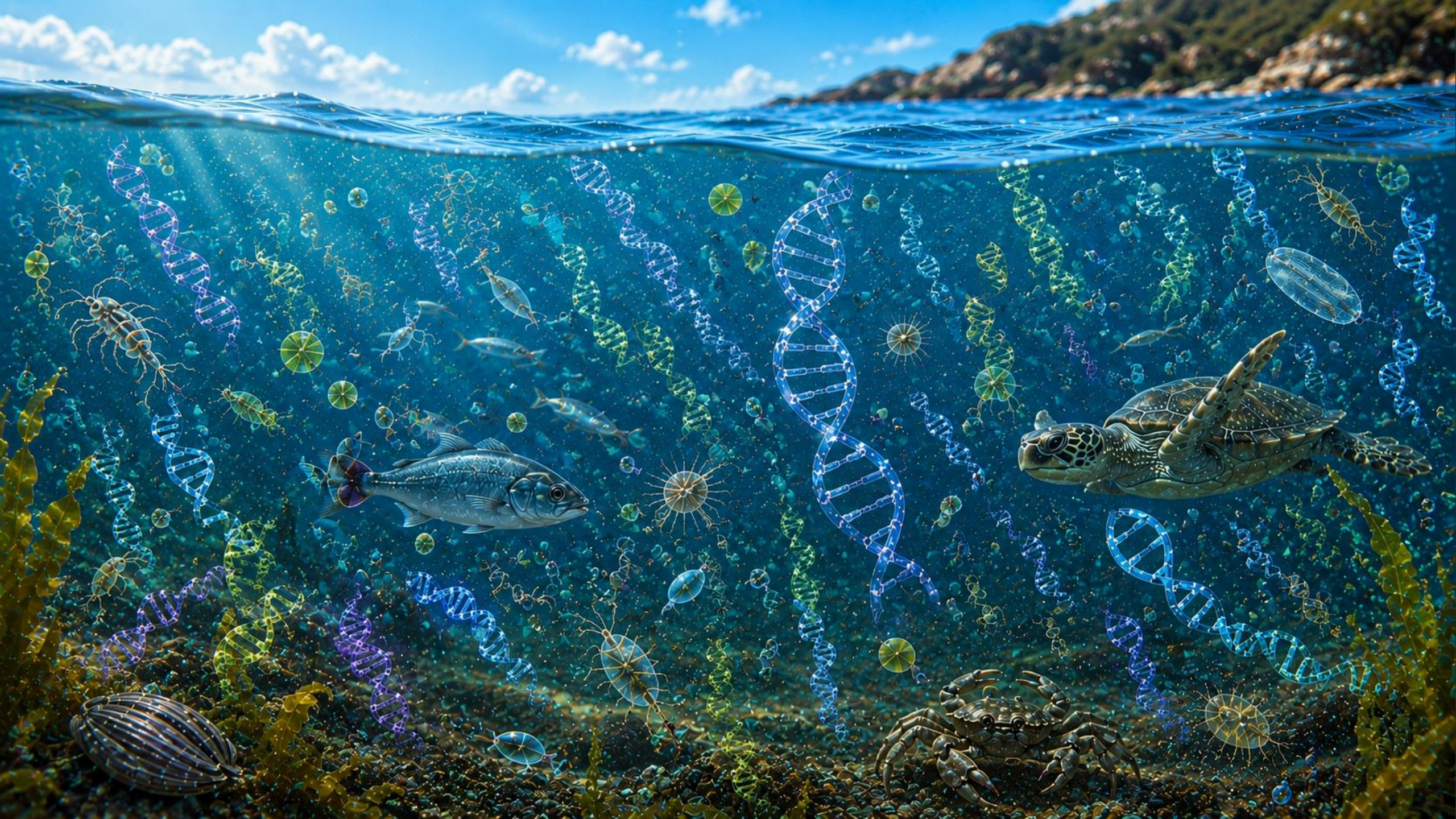
TECHNOLOGY



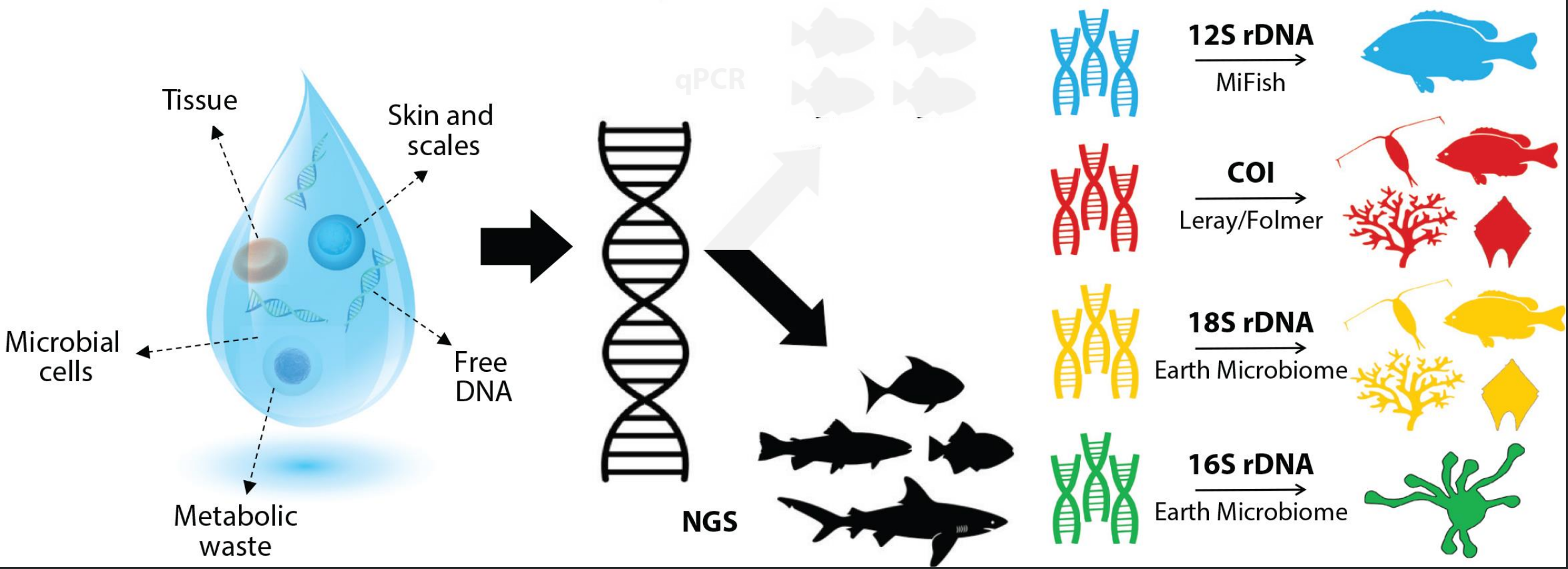
eDNA, sequencing, bioinformatics & AI to detect more, faster, and farther

COLLABORATIONS

Sharing data, expertise, samples, and resources across institutions and regions



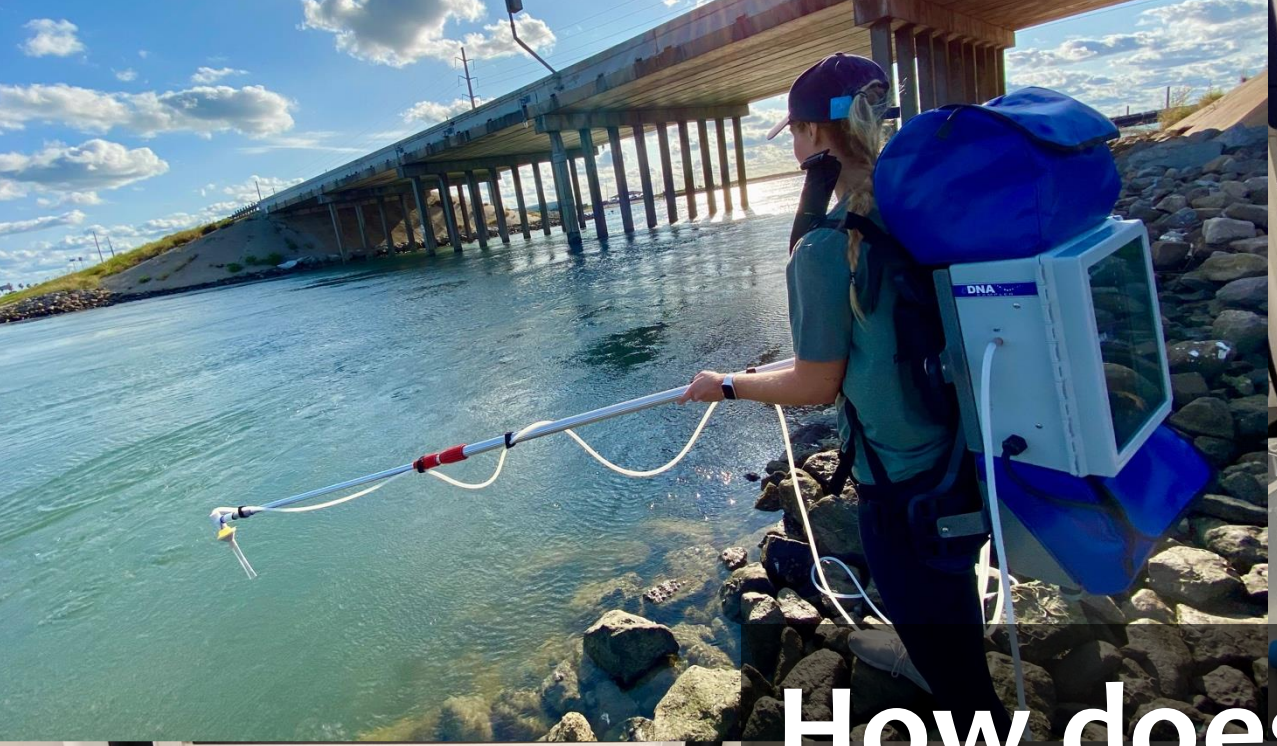
Environmental DNA metabarcoding



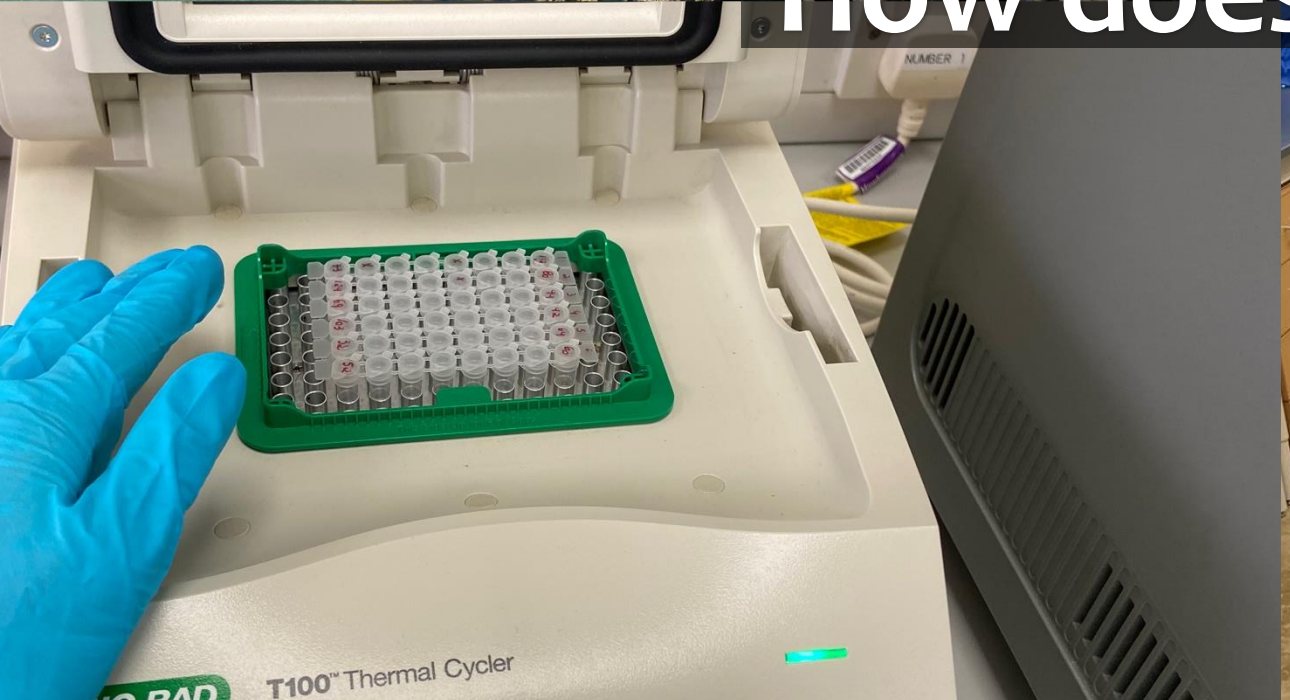
Chavez et al. 2021

eDNA advantages

- Non-invasive method
- Sensible to capture low abundance/cryptic species
- Fewer environmental limitations
- Ease of sampling: Large scale monitoring



How does it work?



Xie et al. 2018

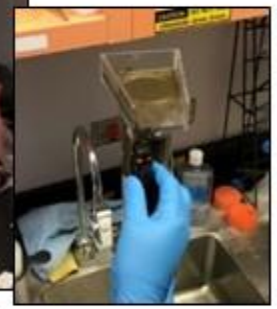
1 DNA released to the environment

DNA sequences are unique

2 Collect the sample

From water

3 Extract DNA



From sediment

Thermal Cycler

4 Amplify it

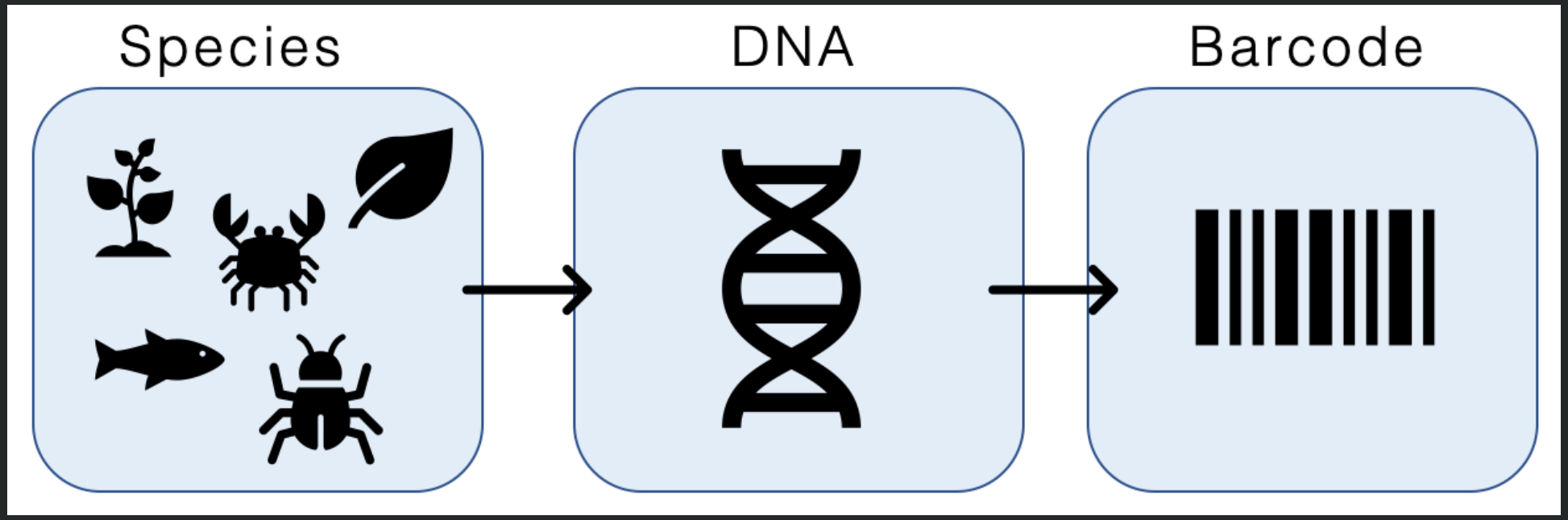
NextSeq 5000 DNA Sequencer

5 Sequence it

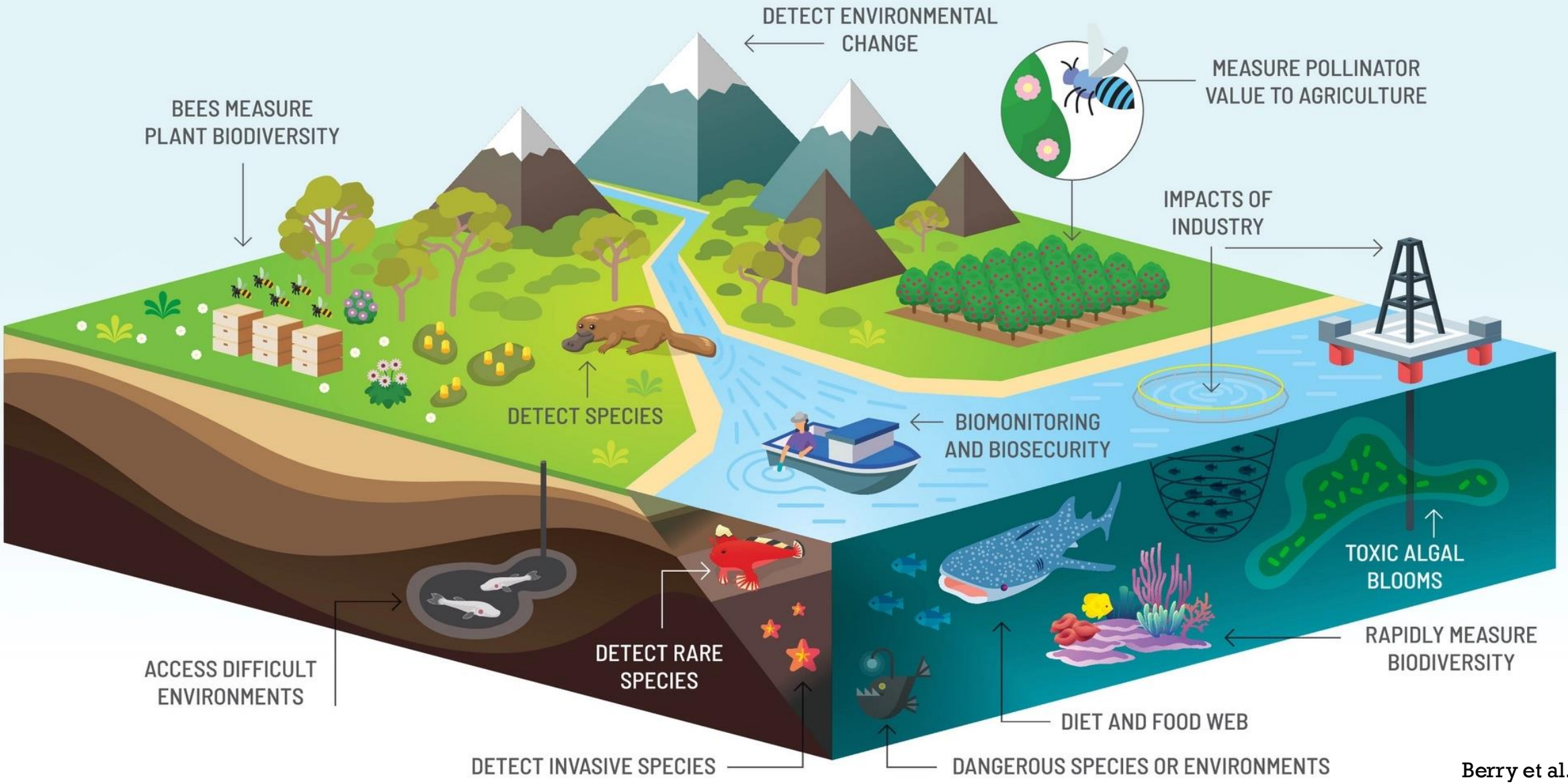
6 Species ID

eDNA barcoding and bioinformatics

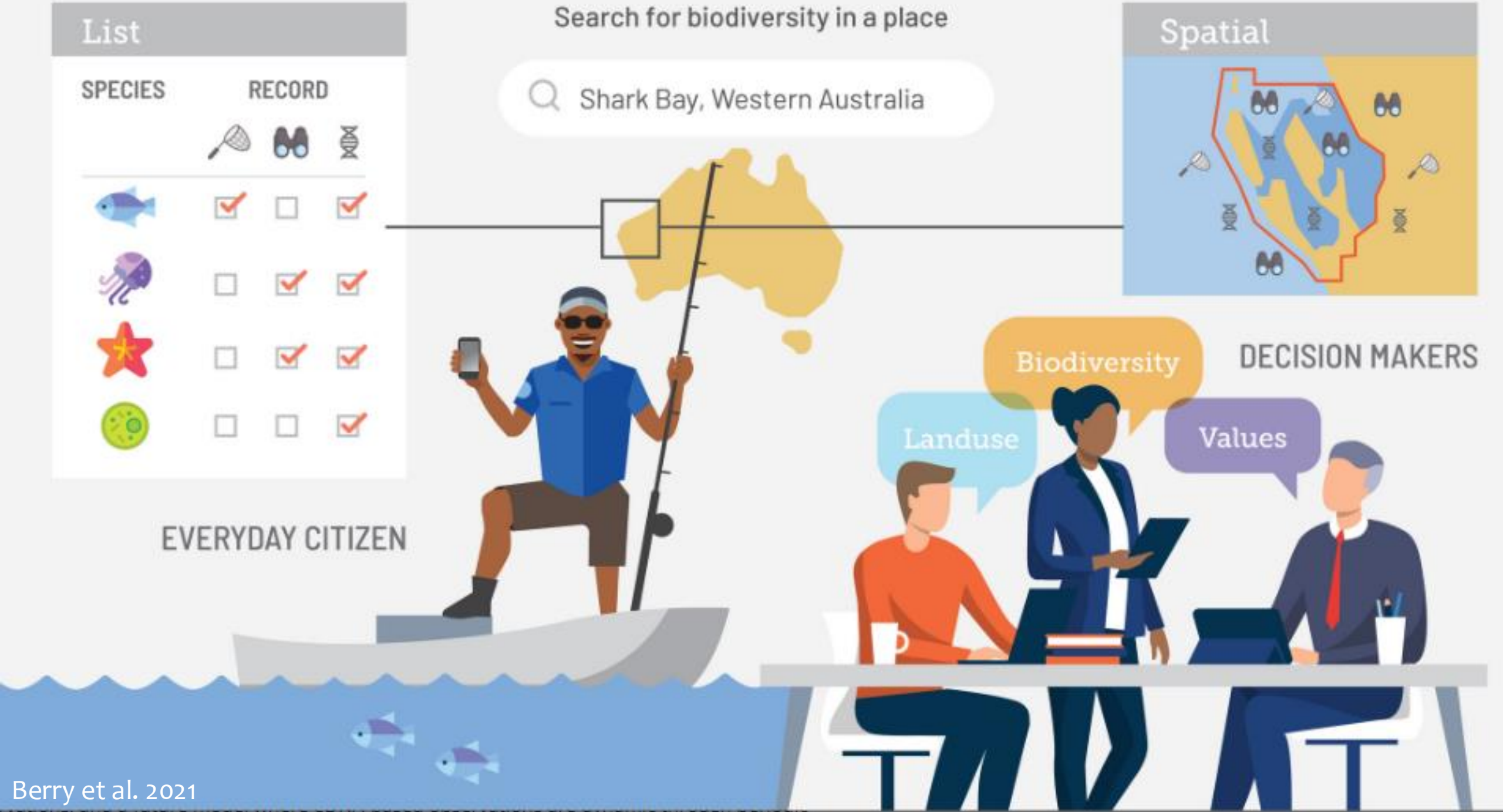
A **reference database** is like a **dictionary of known DNA sequences** linked to known species



Applications of **environmental DNA** (eDNA) in the environment



Berry et al. 2021



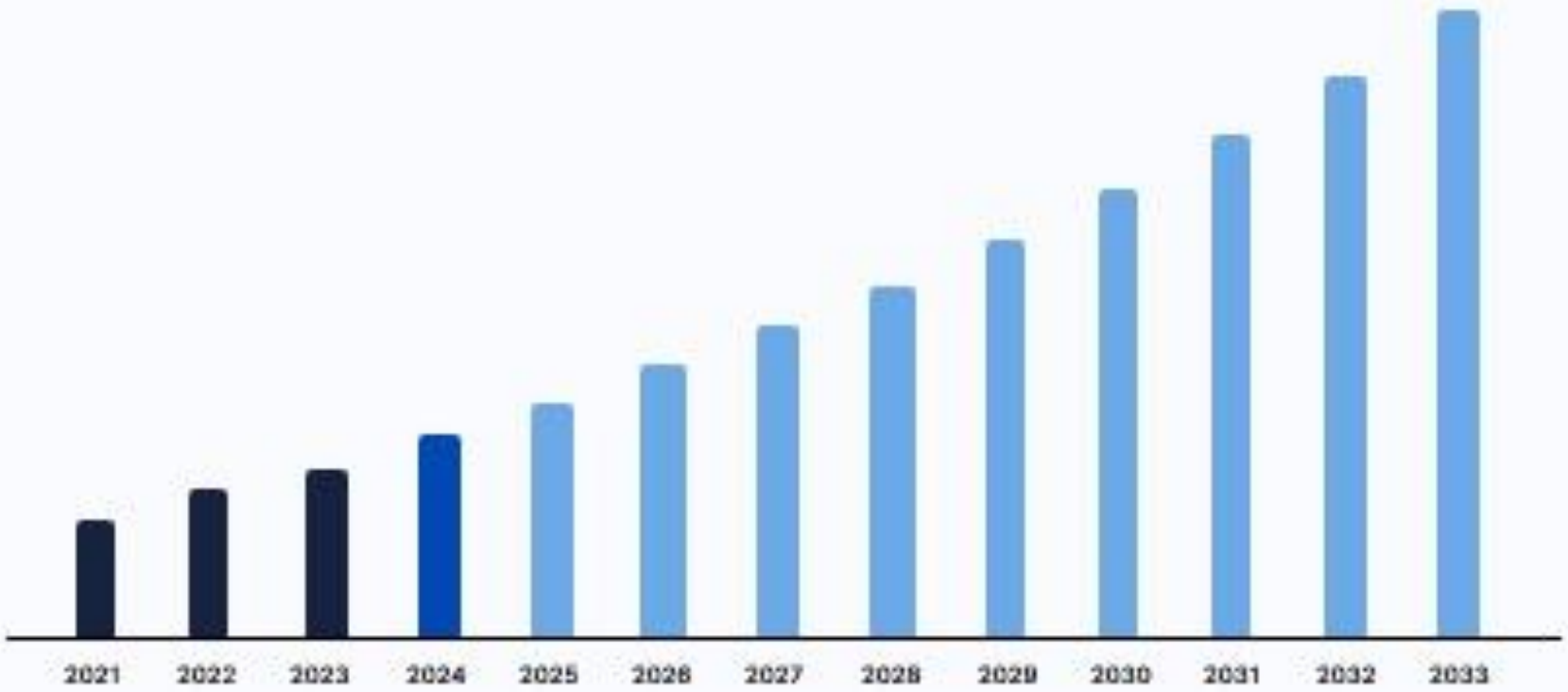
Berry et al. 2021

National Aquatic Environmental DNA Strategy

A Plan towards an eDNA reference library and data repository for Aquatic Organisms, navigating Europe towards the next generation biodiversity monitoring

DNA Sequencing Market

Forecast 2025-2033



straits research

Source: www.straitsresearch.com

Market Size in 2024

USD 14.88 billion

17.62%

CAGR (2025-2033)

Market Size in 2033

USD 74.89 billion

THERE IS ALWAYS SOMEONE

WILLING TO DO IT CHEAPER

What are the limitations of eDNA?

Detection ≠ Abundance

- PCR stochastic/bias
- Different shedding rates
- eDNA stability vs degradation

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Contamination & degradation:

- Environmental conditions
- Sample preservation
- Streamlined protocols

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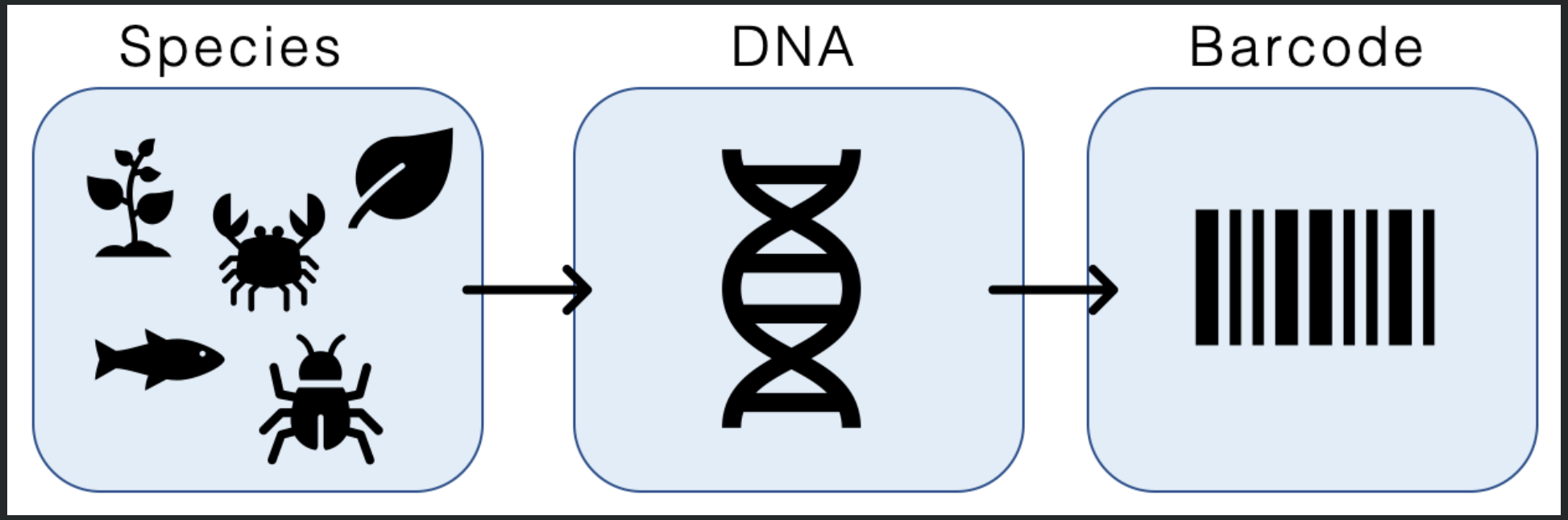
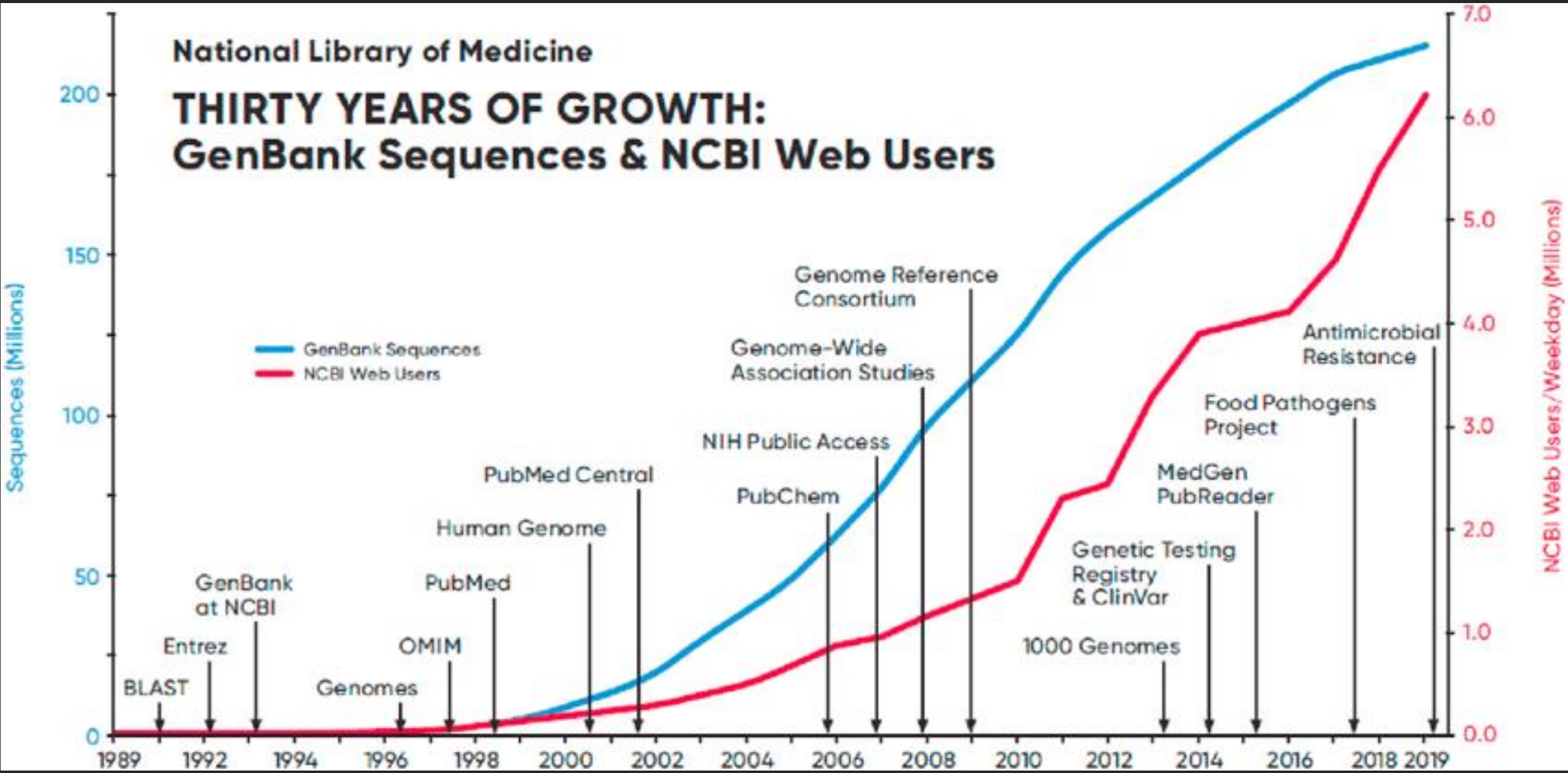
Reference database gaps

- Barcoding is limited in some groups
- Erroneous sequences
- Low representation of other markers

A **reference database** is like a **dictionary of known DNA sequences** linked to known species

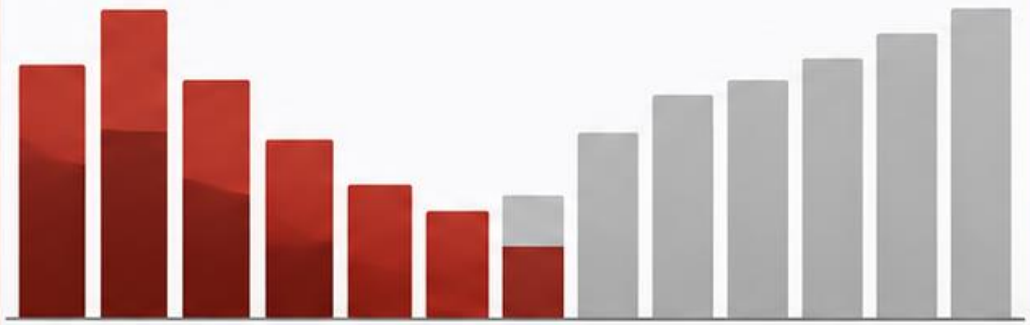




Gaffney et al. 2020

Without local reference libraries

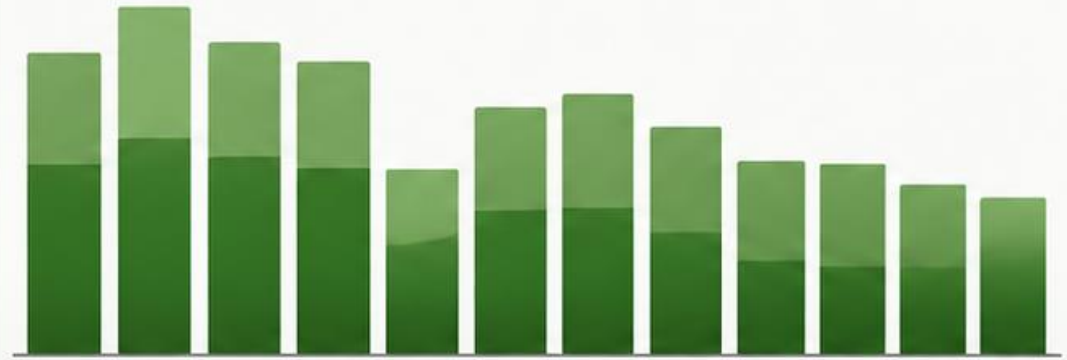
Many sequences have no match.
Diversity is underestimated.



BIODIVERSITY MISSED

With local reference libraries

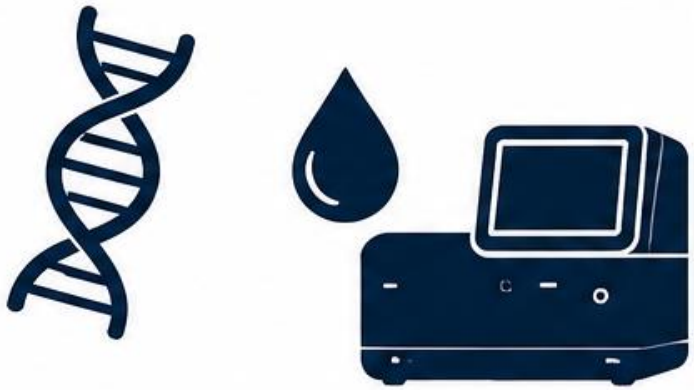
More matches.
More species detected.



HIGH BIODIVERSITY DETECTED

Local knowledge => **regional reference library**

TECHNOLOGY



eDNA, sequencing, bioinformatics & AI to detect more, faster, and farther

COLLABORATIONS

Sharing data, expertise, samples, and resources across institutions and regions


gulf
eDNA
network

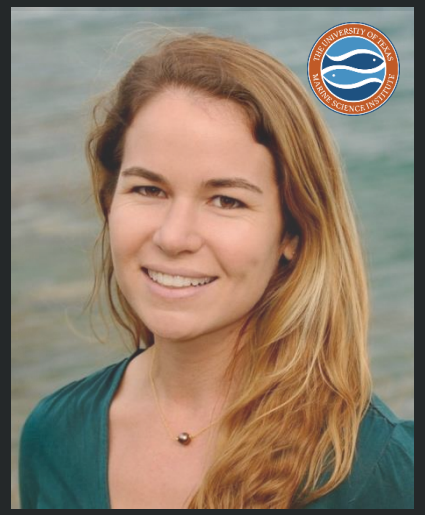
THE GULF eDNA NETWORK TEAM

gulf eDNA network

A BUDDING COLLABORATIVE FOR eDNA RESEARCH IN THE GULF

Dr. Sheila Kitchen

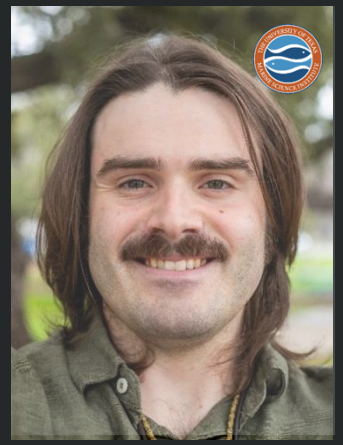
Dr. Yasmina Shah Esmaeili



Dr. Jordan Casey

Jaelyn Rodriguez

Ingrid Bunholi



Lance David Malcom Jr.

Marissa Kordal

gulf eDNA network

A BUDDING COLLABORATIVE FOR
eDNA RESEARCH IN THE GULF

CONNECT

Join our growing network and connect with Gulf researchers across the region.

COLLABORATE

Form new partnerships across institutions and share knowledge.

CULTIVATE

Expand your research with collective data, tools, and other resources.


≈125
MEMBERS
4 COUNTRIES
11 STATES
70 UNIVERSITIES
or ORGANIZATIONS
Join us!

gulf eDNA network

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GOAL: IDENTIFY UNDER-REPRESENTED GoM SPECIES IN GENOMIC DATABASES

SPECIES LIST

Basis for Gap Analysis

Highlights missing species



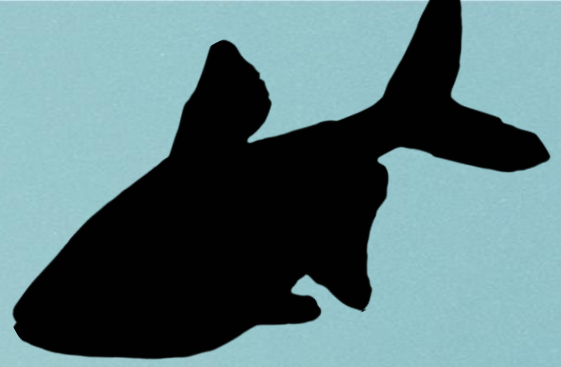






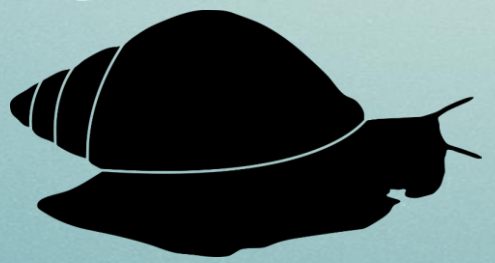
39380

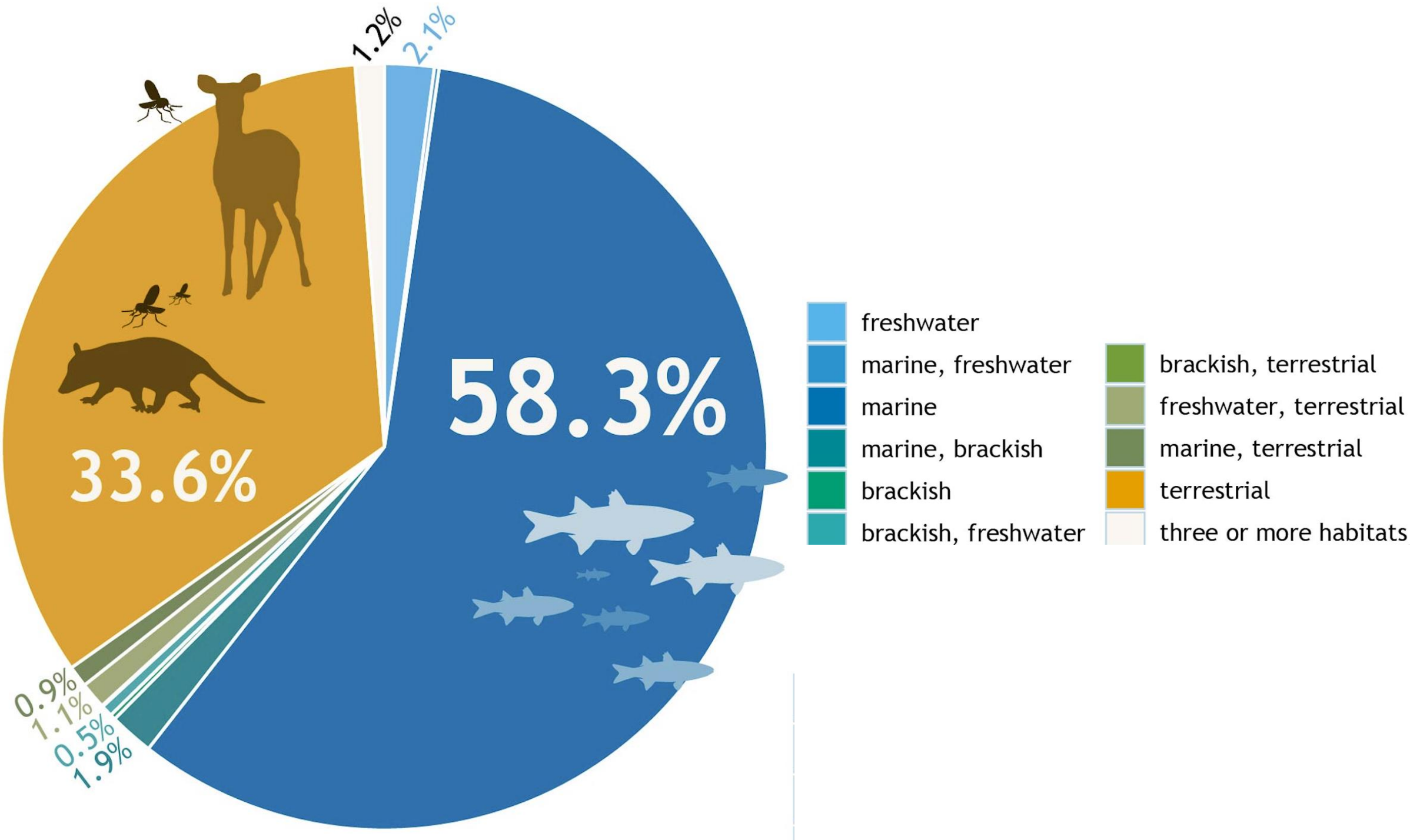
TOTAL SPECIES IN THE GoM LIST



25497

ANIMAL SPECIES

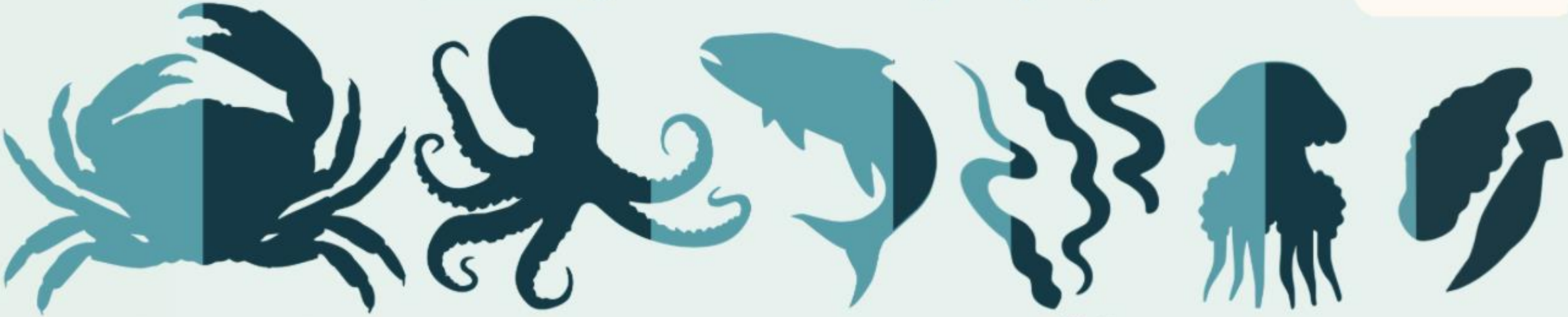




1.2%
2.1%
58.3%
33.6%
0.9%
1.1%
0.5%
1.9%
freshwater
marine, freshwater
marine
marine, brackish
brackish
brackish, freshwater
brackish, terrestrial
freshwater, terrestrial
marine, terrestrial
terrestrial
three or more habitats

top six most abundant phyla in Animalia

% COI barcodes missing in GenBank per phyla

present
absent



arthropoda
54.3% of 10766

mollusca
71.8% of 4449

chordata
22.9% of 4439

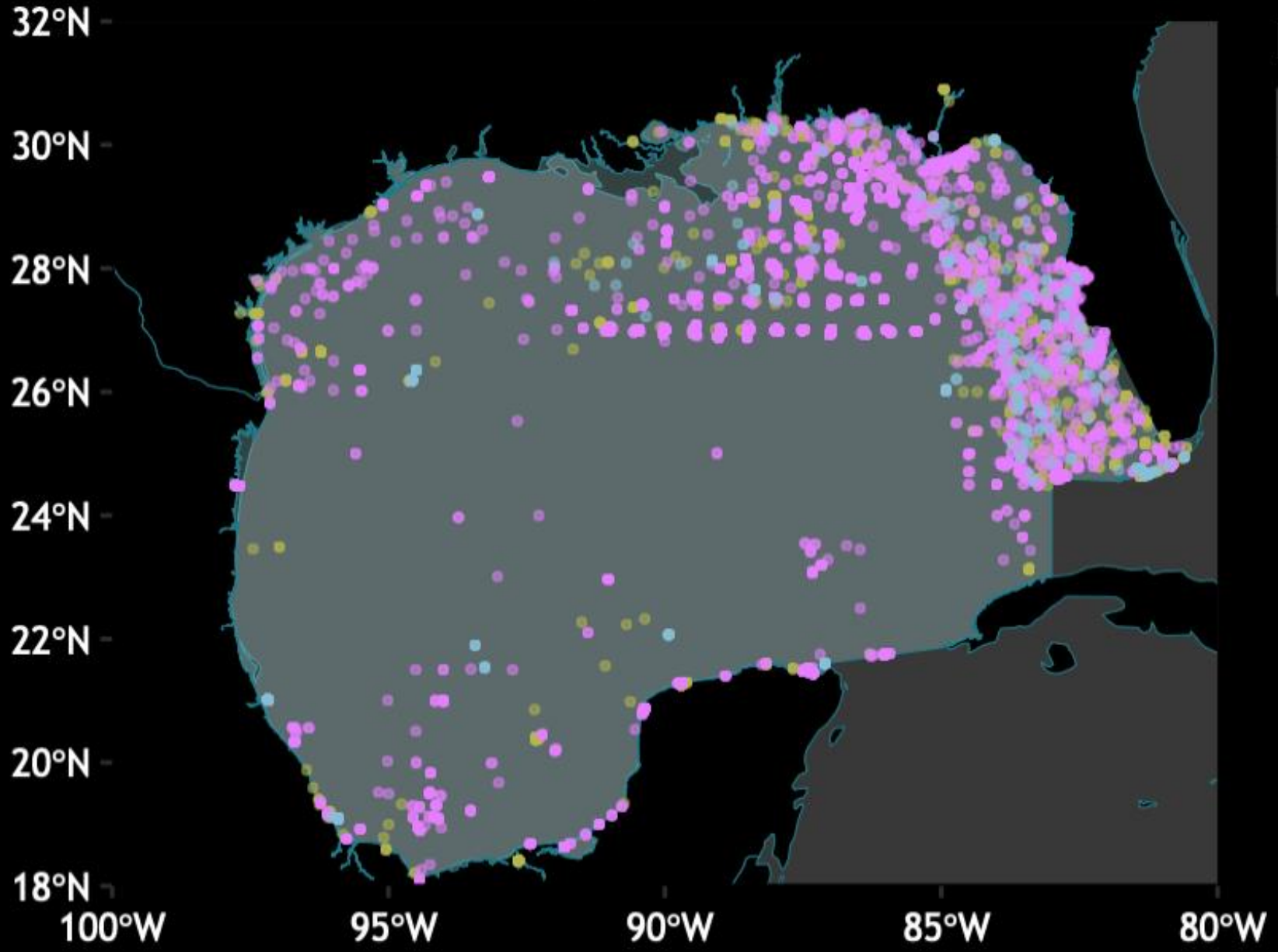
annelida
71% of 1643

cnidaria
59.4% of 1110

platyhelminthes
88.8% of 957

BOLD COI Records

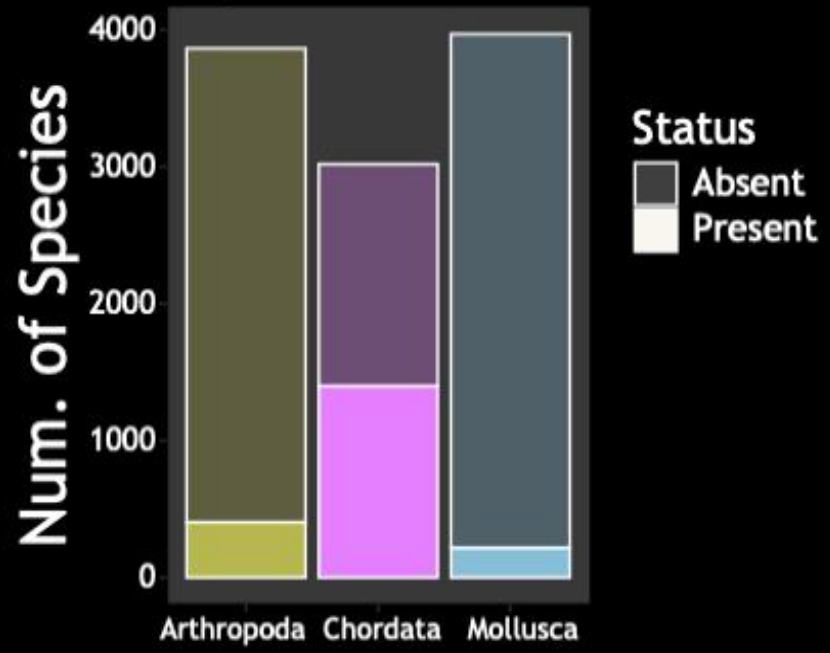
Filtered inside the Gulf region



Phyla

- Arthropoda
- Chordata
- Mollusca

Aquatic Taxa



gulf eDNA network

A BUDDING COLLABORATIVE FOR eDNA RESEARCH IN THE GULF

CONNECT

Join our growing network and connect with Gulf researchers across the region.

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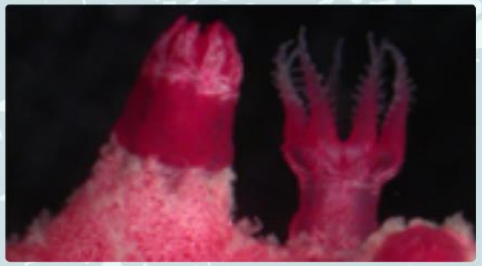
MOST WANTED

The most abundant Gulf species that have no entries in GenBank

Atlantic Calico Scallop
Argopecten gibbus
2,498 occurrences



White Eye Sea Spray
Thesea nivea
2,236 occurrences

Atlantic Giant Cockle
Dinocardium robustum
1,901 occurrences

Clown Goby
Microgobius gulosus
1,897 occurrences

The University of Texas at Austin
Biodiversity Center

Smithsonian

TUBRI

BENTHIC ECOLOGY LAB
Texas A&M at Galveston

TEXAS A&M AGRILIFE

NOAA FISHERIES

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

CASEY LAB

NEXT STEPS

 **Generate** DNA barcodes for underrepresented taxa

 **Provide** a regional reference library for the Gulf

 **Create** a platform to share knowledge/resources

COLLABORATIONS

- Expanding to Industry, Policy, and Government Organizations
- Support Research Projects
- BioBlitz
- Applying for Funding

COLLABORATE WITH US

Join as a Member

Receive our newsletter and email updates

Reach Out & Share

Share species lists, organisms, sequences, and join projects

THE eDNA COLLABORATIVE

THANK YOU!

yshahesmaeili@tamu.edu
yshah@utexas.edu

gulf-edna-network.org
gulf.edna.network@gmail.com