National SCIENCE Challenges | SUSTAINABLE SEAS | Ko ngā moana whakauka

Sustainable Seas
Ko ngā moana whakauka

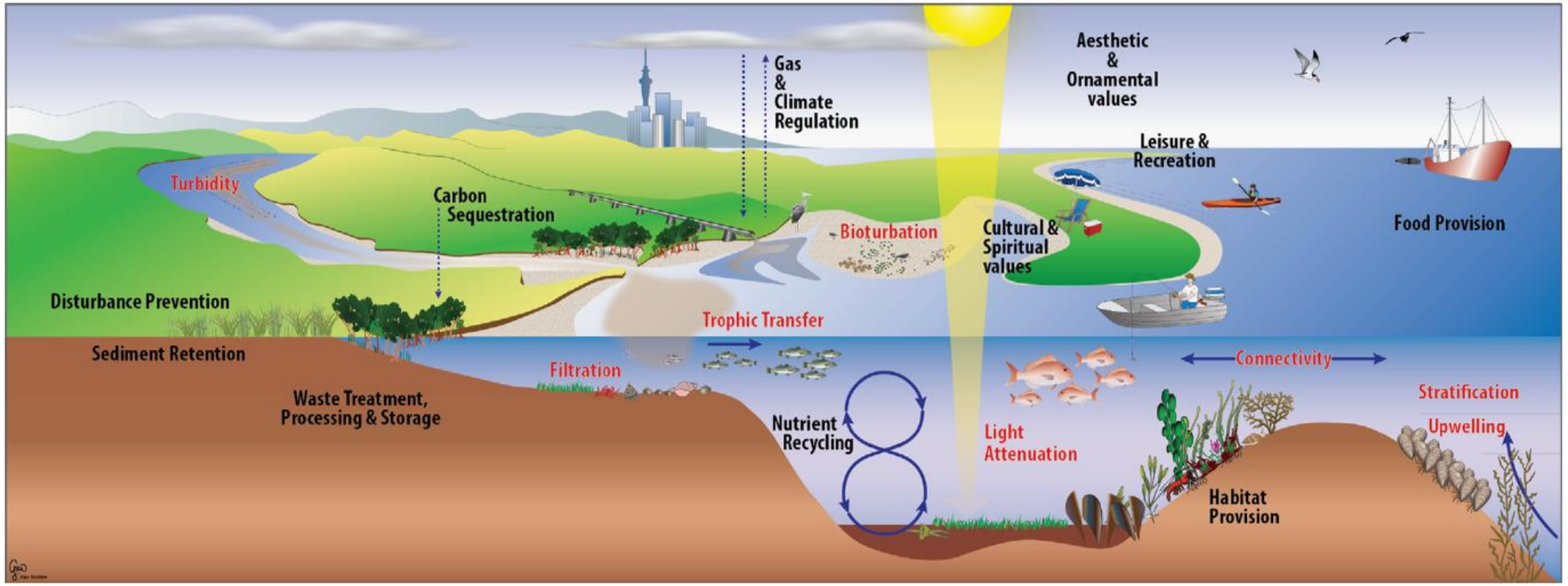
CAWTHRON INSTITUTE | GNS SCIENCE TE PŪ AO | NIWA Taihoro Nukurangi | THE UNIVERSITY OF AUCKLAND NEW ZEALAND | UC UNIVERSITY OF CANTERBURY Te Whare Wānanga o Waitaha CHRISTCHURCH NEW ZEALAND | THE UNIVERSITY OF WAIKATO Te Whare Wānanga o Waikato | UNIVERSITY of OTAGO Te Whare Wānanga o Otāgo NEW ZEALAND | VICTORIA

Valuable Seas

- Developing ways to incorporate economic, social, environmental, spiritual and cultural marine values in decision-making, and
- Identifying innovative ways to add value to the marine economy.

Measuring Marine Ecosystem Services

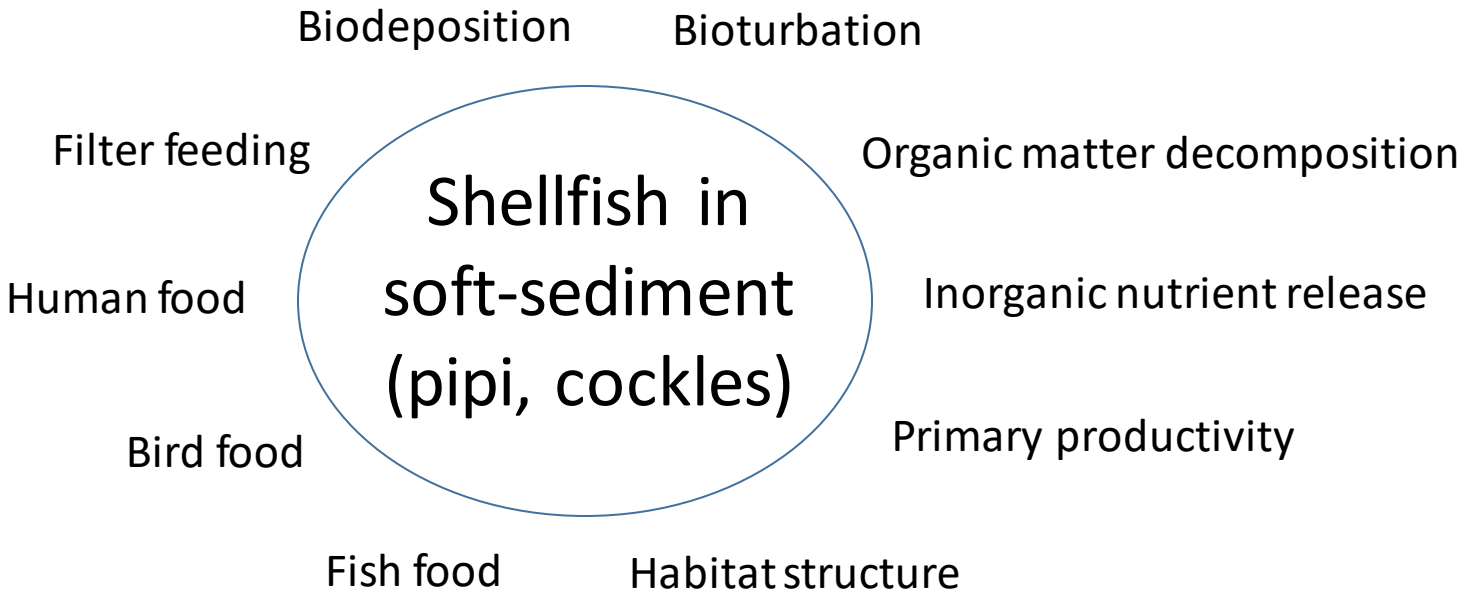
- Clarifying links between marine ecosystems and their benefits to humanity
- Defining specific ecosystem services (ES) that underpin and support social and cultural values



Why does biodiversity matter?

- Because it is interesting
- Because it "does stuff"

Do people care about these things ?



Ecosystem Services

What biodiversity "does"

What people "care about"

Ecosystem Services being studied

ES that resonated with NZers who were surveyed

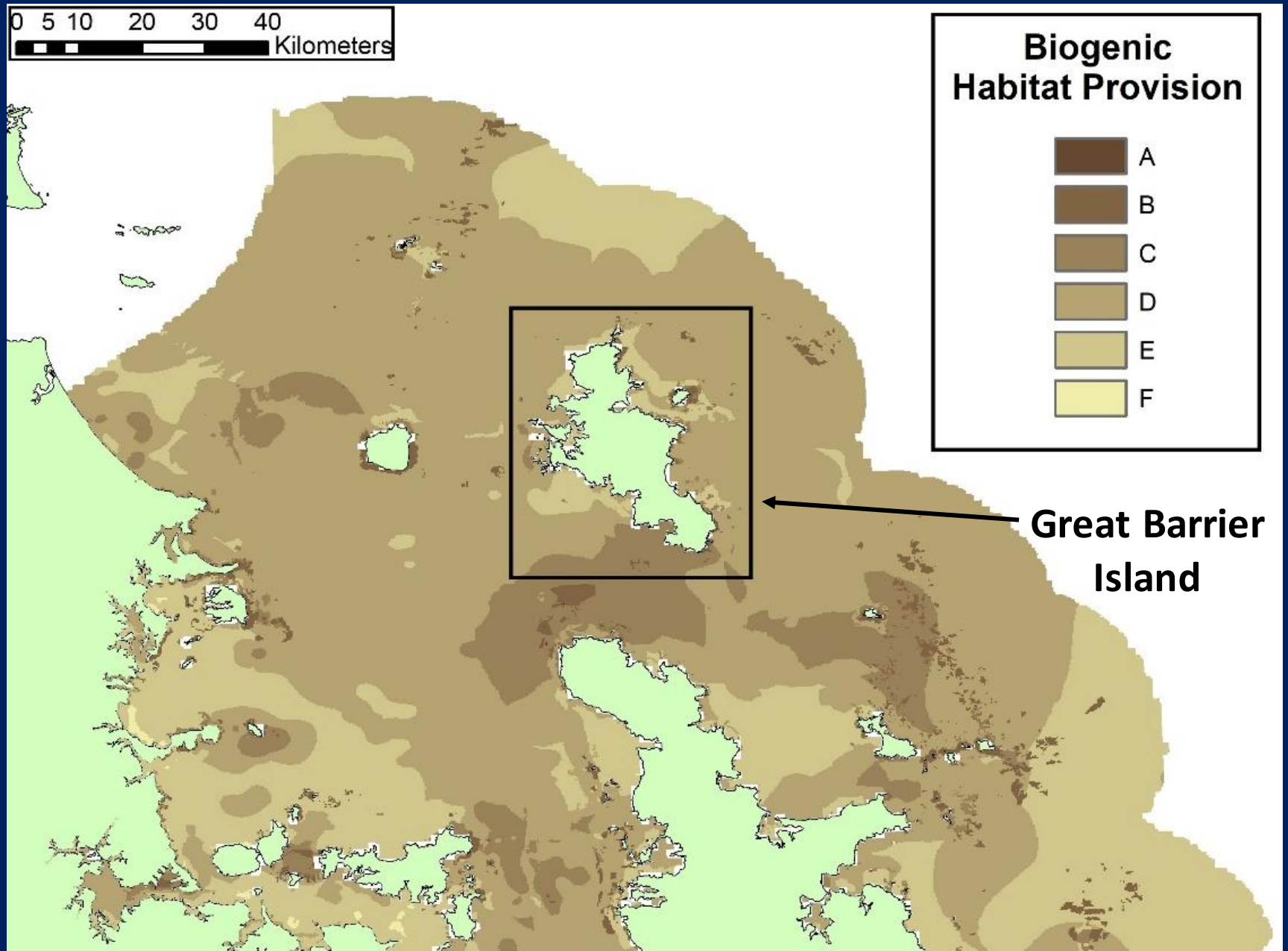
1. Refuge/nursery habitat for juvenile fish and invertebrates
2. Removal of pollutants (particularly nutrients, e.g., nitrogen)

Refuge / Nursery habitat was predicted using an Ecosystem Principles Approach

Resolution
200 m x 200 m

Mapped area
14,000 km^2

- Depth
- Substrate type
- Current velocity
- Turbidity

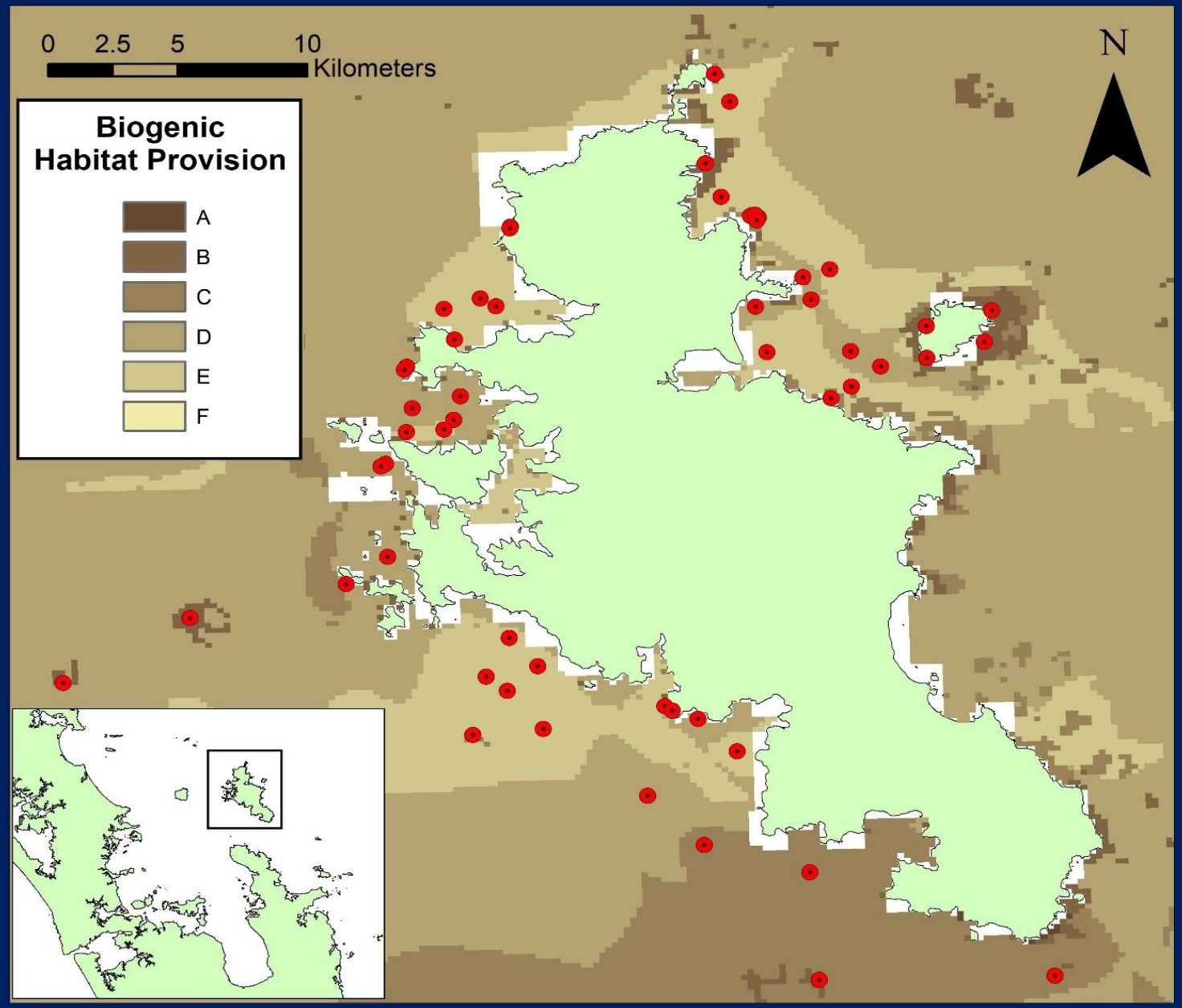


Field validation of the Refuge / Nursery Habitat ES map (57 sites around GBI)

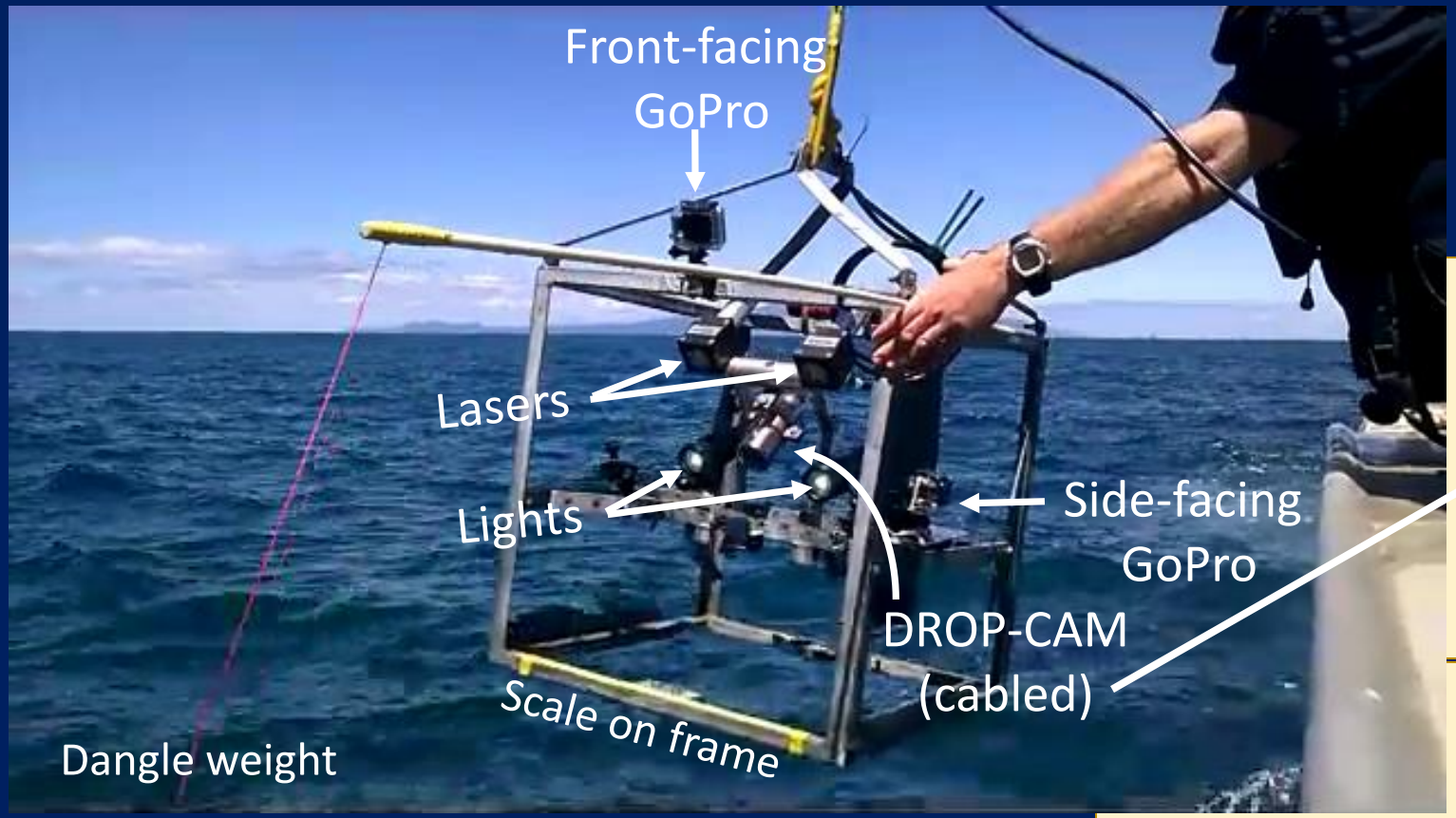
High and low habitat complexity scores in close proximity

High and low scores in areas of similar depth and substrate type, etc.

Each “site” (red dot) is a 200 m x 200 m map cell



Drop camera survey technique to sample lots of cells quickly



Targeted map cell (200 x 200 m)

100 m drift transect thru cell centre

Biogenic habitat structure was ranked on a five point scale (5 low, 1 high)

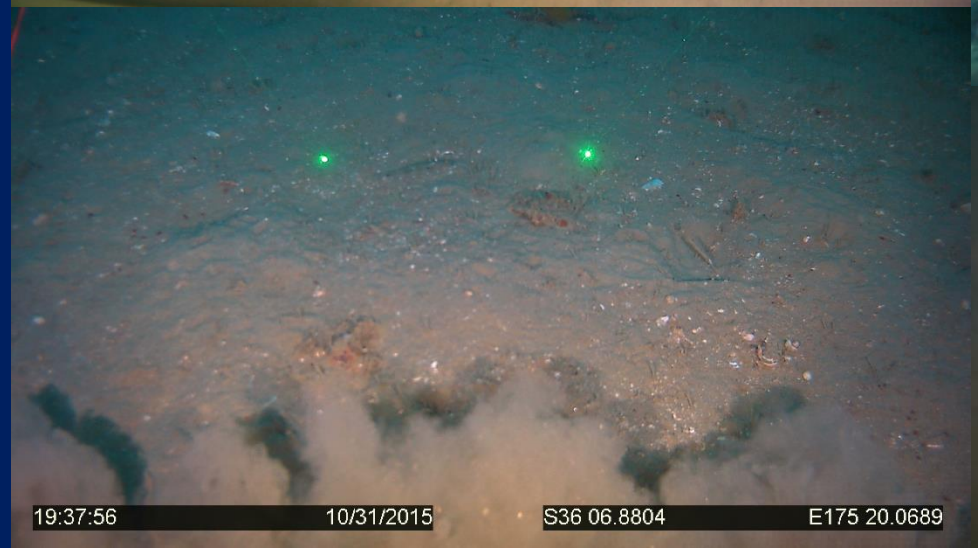
Rank

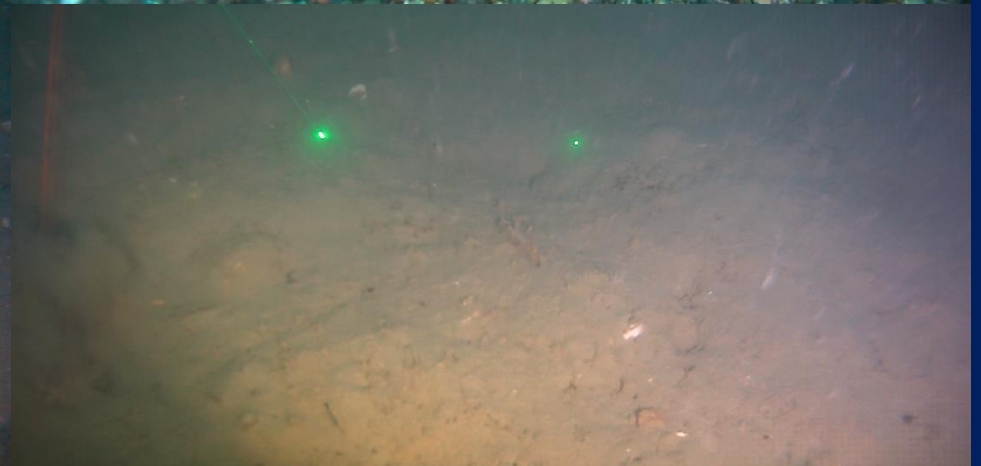
5

Biogenic habitat structure was ranked on a five point scale (5 low, 1 high)

Rank

4

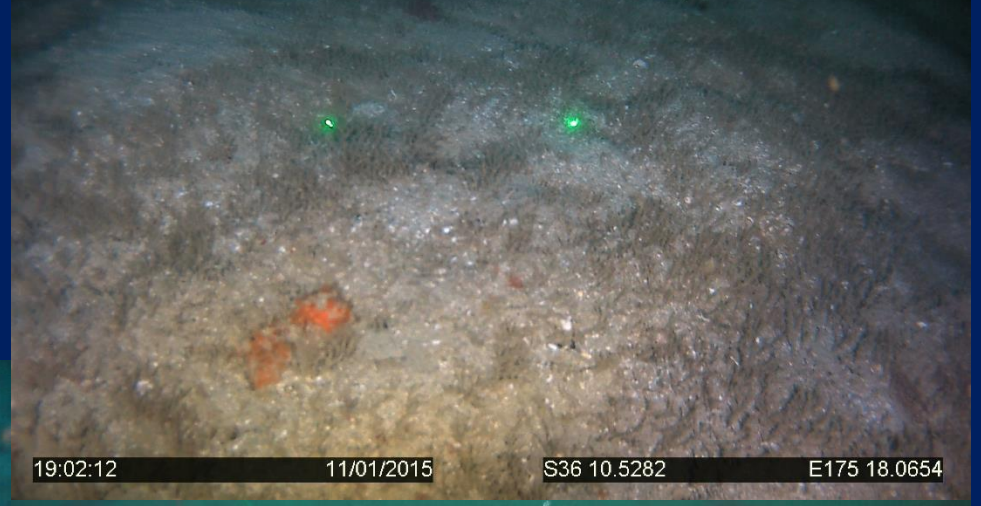




Biogenic habitat structure was ranked on a five point scale (5 low, 1 high)

Rank

3



Biogenic habitat structure was ranked on a five point scale (5 low, 1 high)

Rank

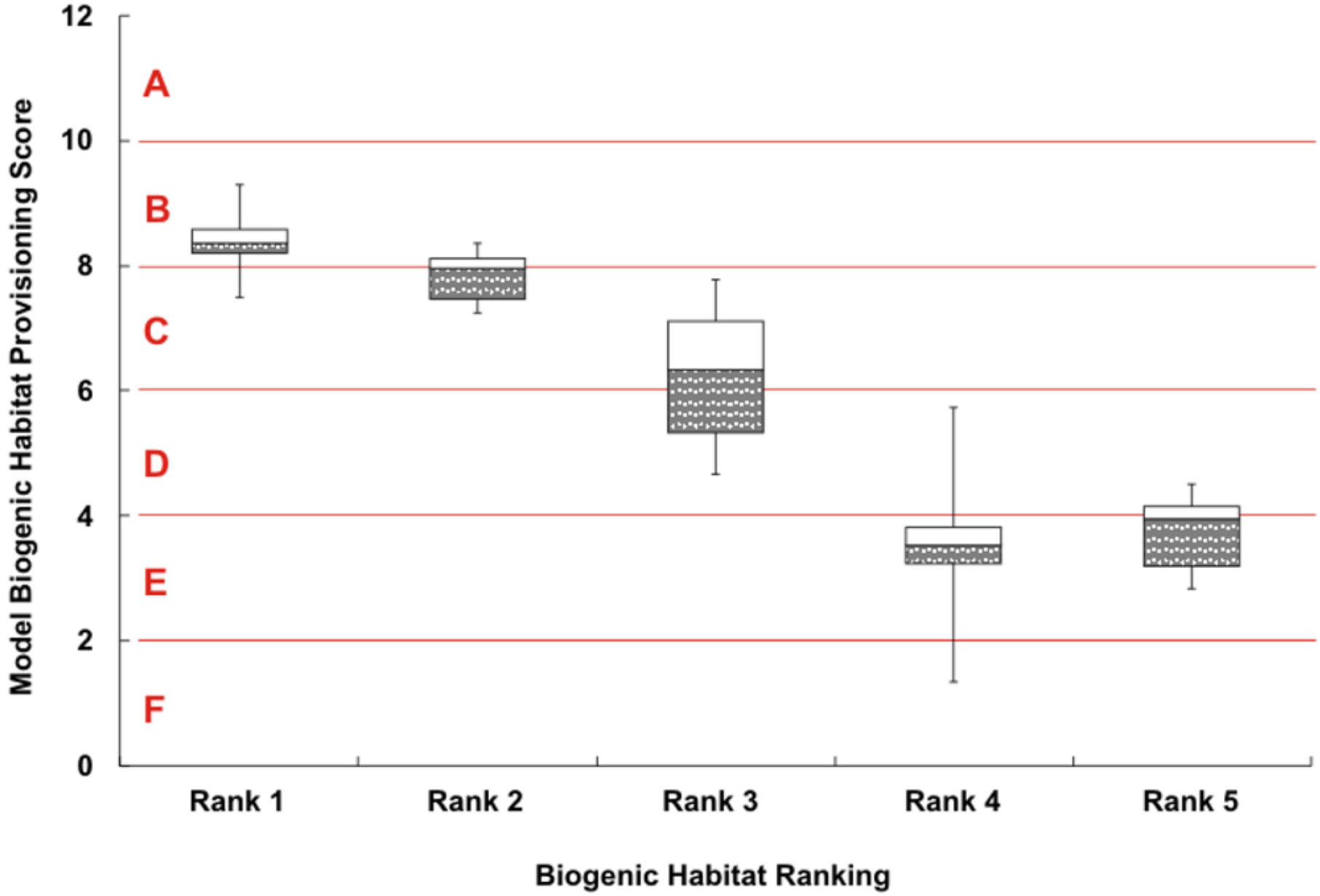
2

Biogenic habitat structure was ranked on a five point scale (5 low, 1 high)

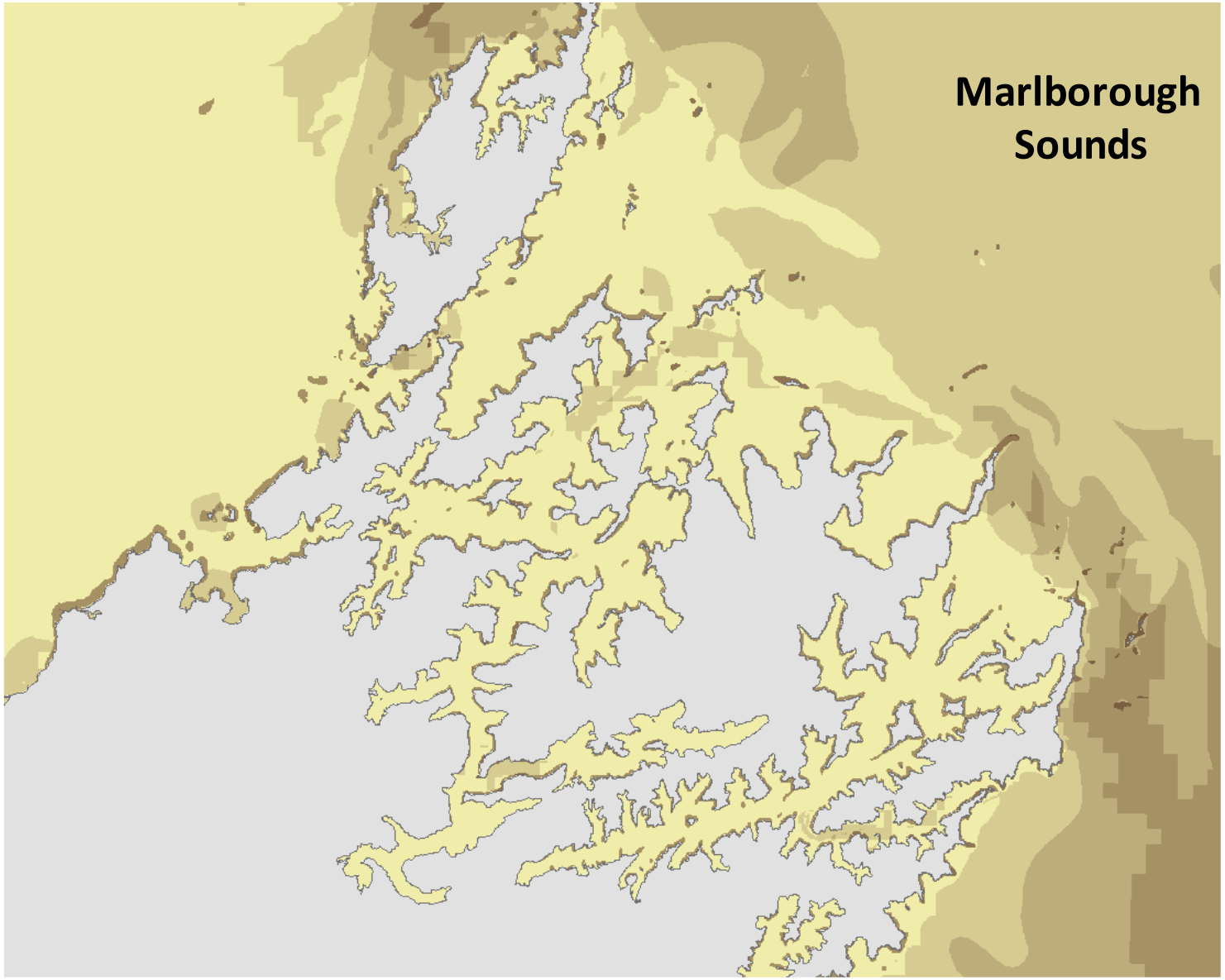
Rank

1

Refuge / Nursery Habitat was well predicted by the method

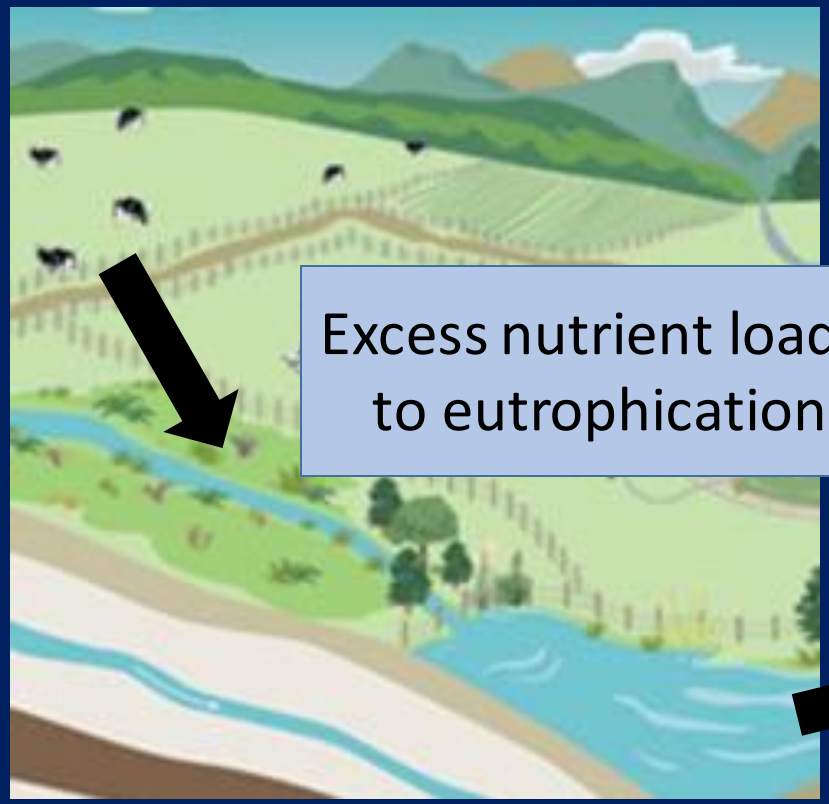


Now we are constructing maps in other areas



Pollution removal and remediation of wastes are valued ES

Nutrients are an emerging pollutant in some NZ estuaries



Excess nutrient loading can lead to eutrophication symptoms

Denitrification

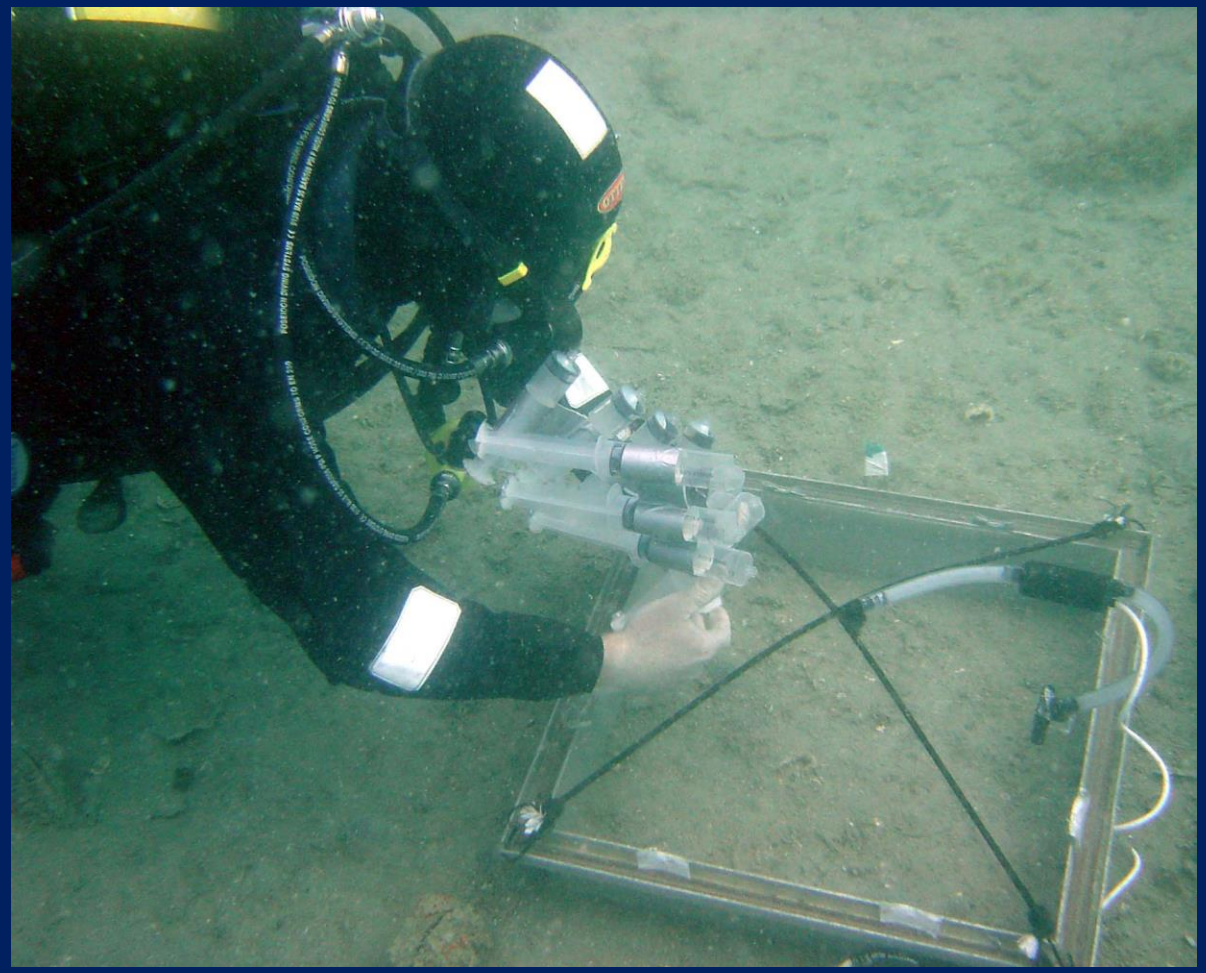
- a natural biologically mediated pathway that eliminates bioavailable nitrogen

- converts nitrate into molecular di-nitrogen gas

$$NO_3^- \longrightarrow N_2$$

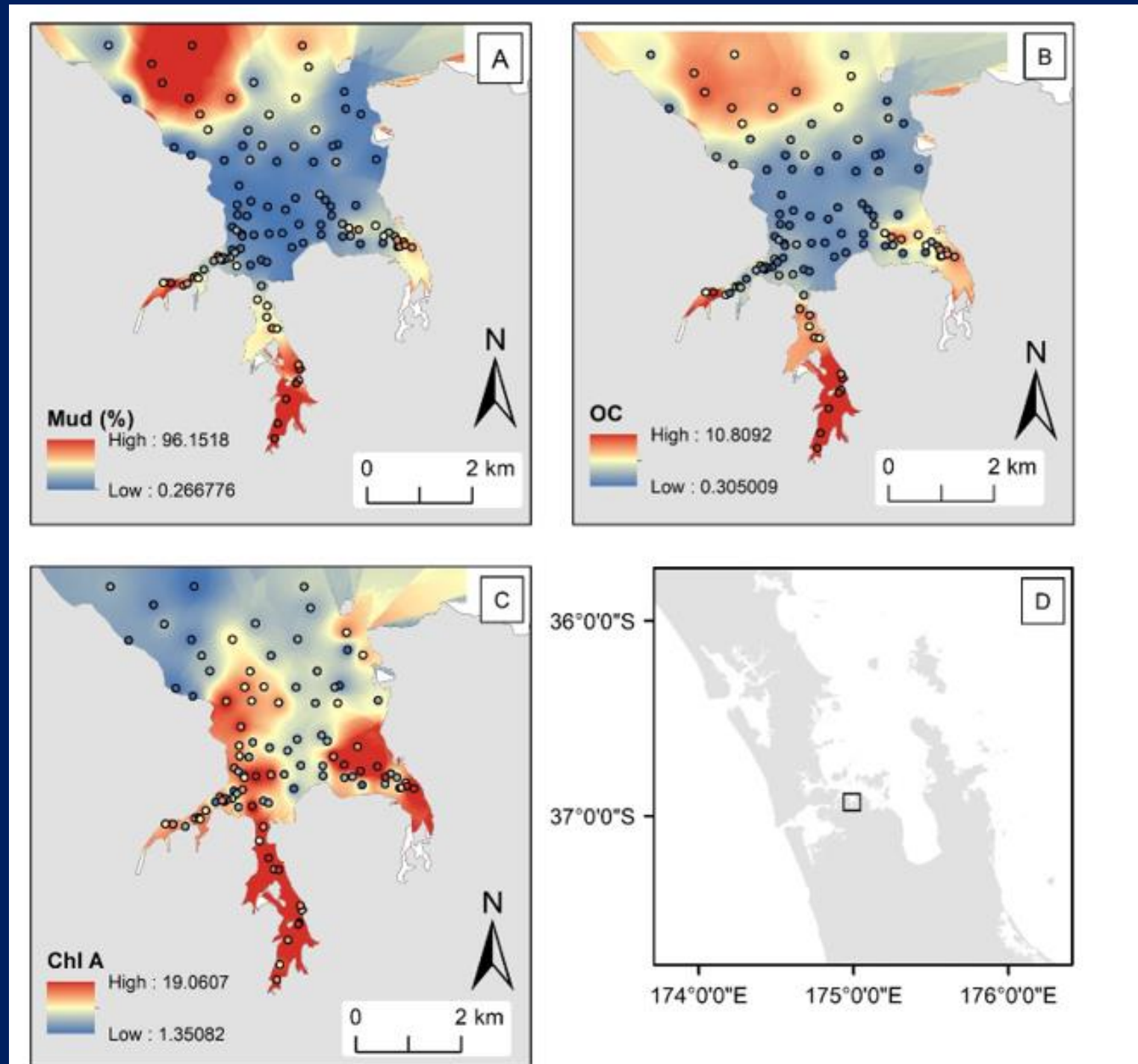
Methods for measuring denitrification

N_2 gas flux (MIMS)

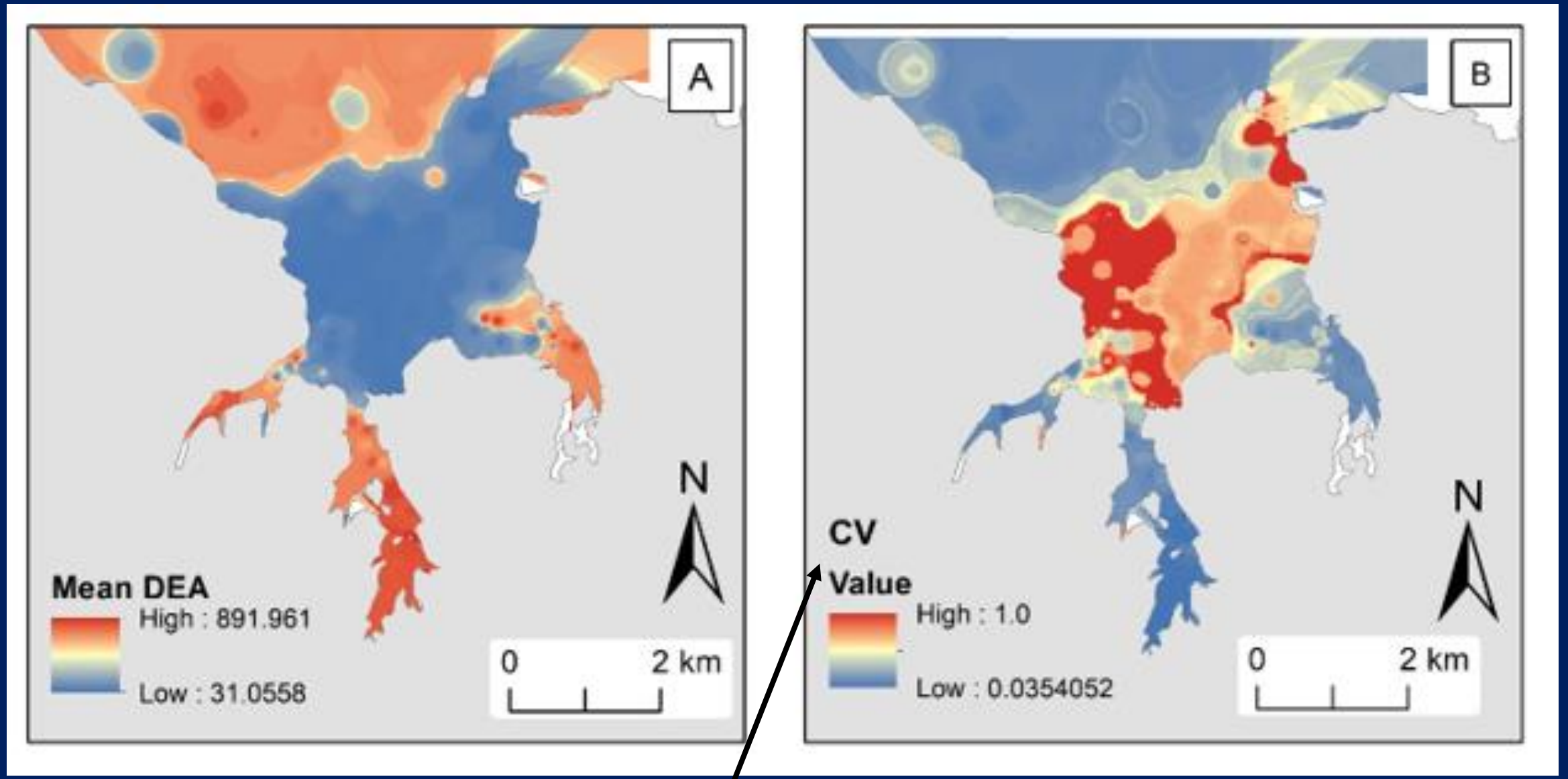


Denitrification Enzyme Activity

- Identify variables correlated with denitrification
- Find areas where we have mapped these correlated variables
- Predict areas of high denitrification rate
- Report the uncertainty of the predictions
- Validate with field collected data from the mapped domain

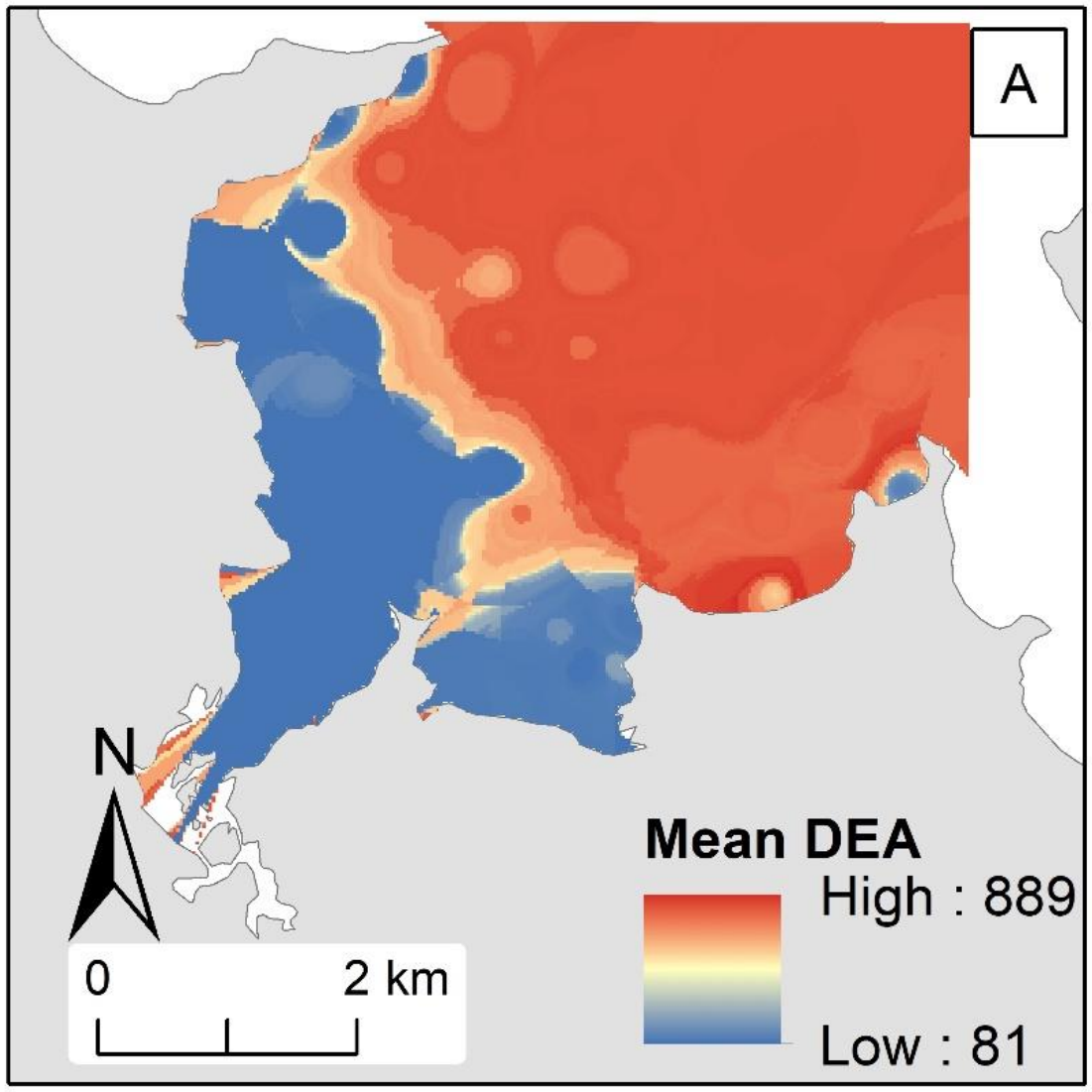


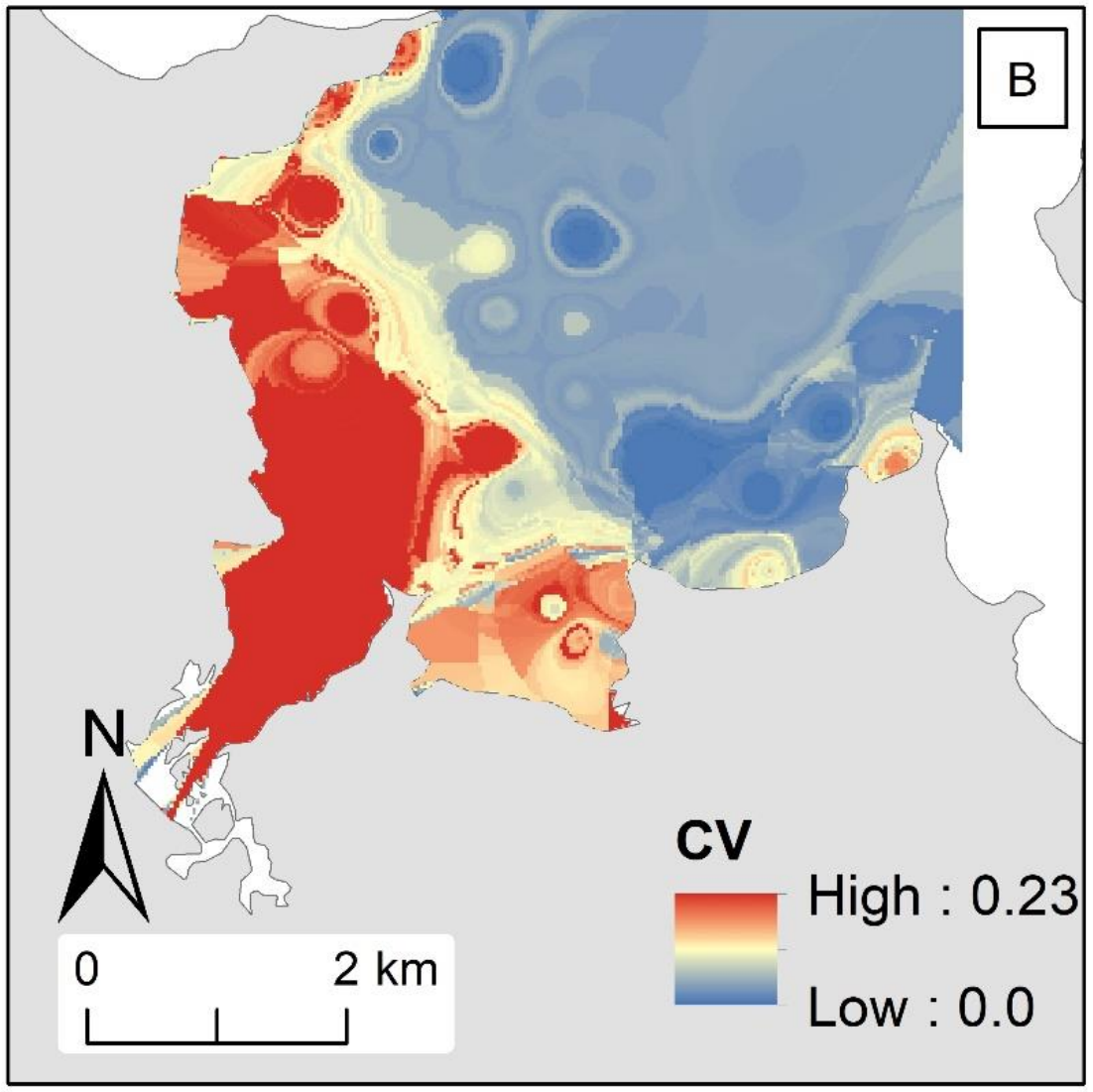
Map of Denitrification Enzyme Activity (DEA), from boosted regression trees (mud, org, Chla)



Uncertainty. Field validation results (~50 sites) being analysed

Make and validate predictions in other areas (e.g., Wairoa Embayment). Keep checking the method.





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Summary

- Validated maps of two ES in two areas each
- Assessing how human impacts affect ES and perceptions of value
- Working across projects and programmes to incorporate ES information into Ecosystem Based Management

Thanks to MBIE / SSNSC for funding, & to all collaborators

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Questions, comments, and discussion

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