The impacts of non-indigenous oysters on biodiversity and ecosystem functioning

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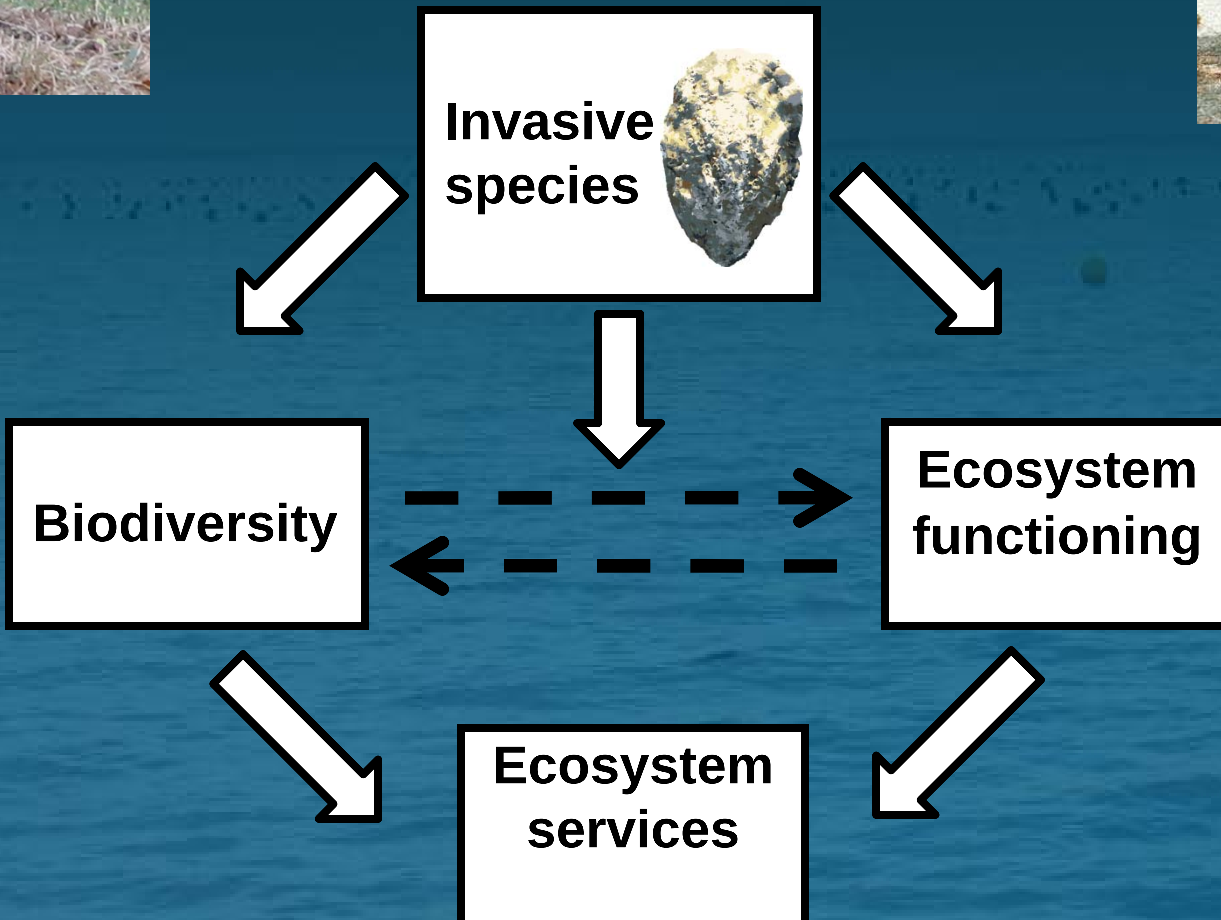
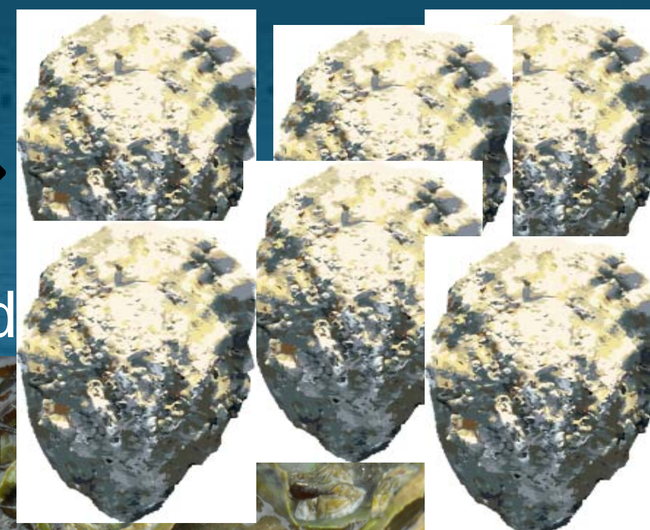
NDP
SSTI Funded as part of the Strategy for Science, Technology and Innovation
epa Environmental Protection Agency An Ghníomhaireacht um Chaomhnú Comhshaoil

Potential impacts of invasive species

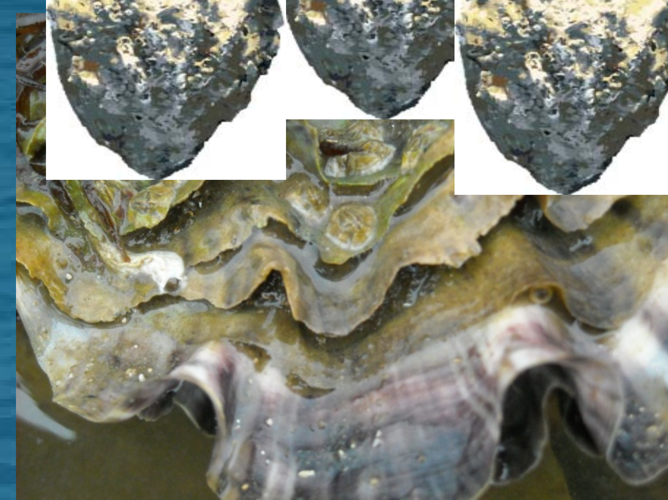


Physical structure of oysters

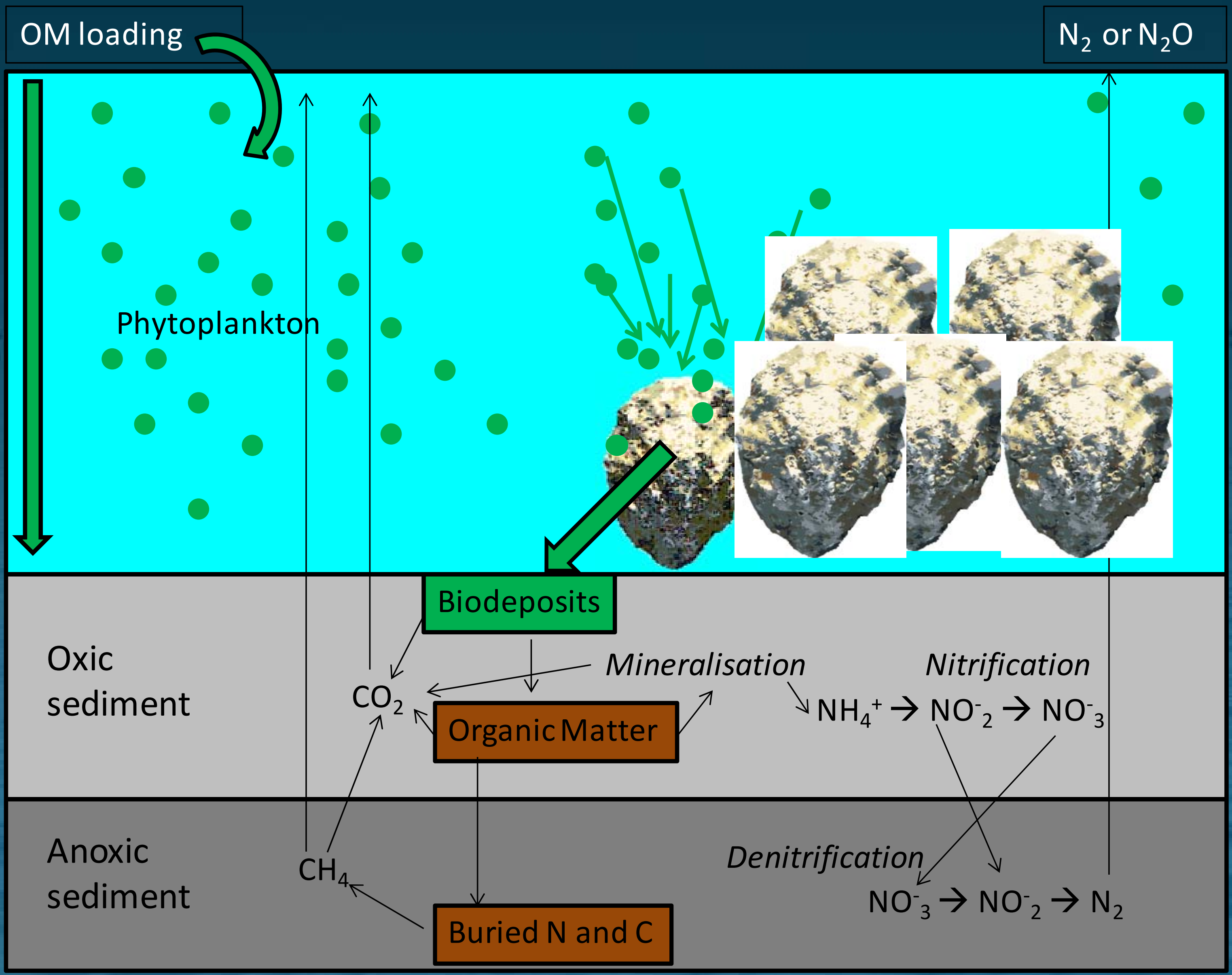
Hard substratum → new habitat for colonisation



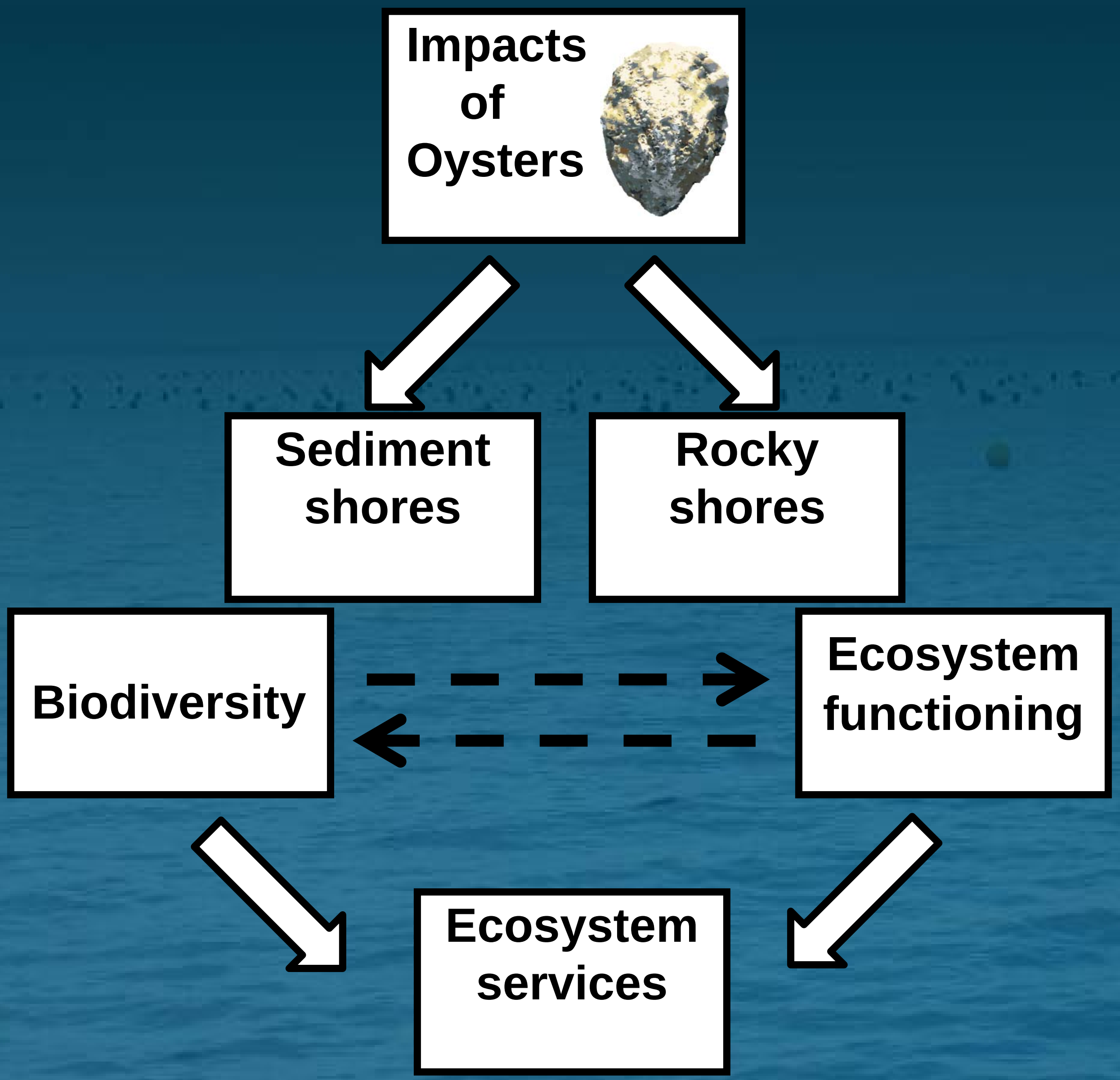
Complex shell stru → biod



Biological activities of oysters



Environmental context



My objectives

1. Characterise potential impacts of Pacific oysters on:

(a) Biodiversity

(b) Ecosystem functioning

2. Test whether impacts vary under different environmental contexts and at different oyster abundances

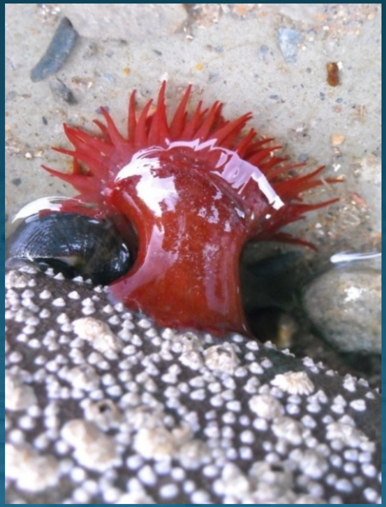
Experiments

Objectives have been addressed using field experiments:

- Expt. 1: Biodiversity and the establishment of a protected biogenic habitat in boulder-fields.
- Expt. 2: Biodiversity and ecosystem functioning of mud-flat and mussel bed habitats.
- Expt. 3: Microbial diversity and functioning in mud-flat habitats.

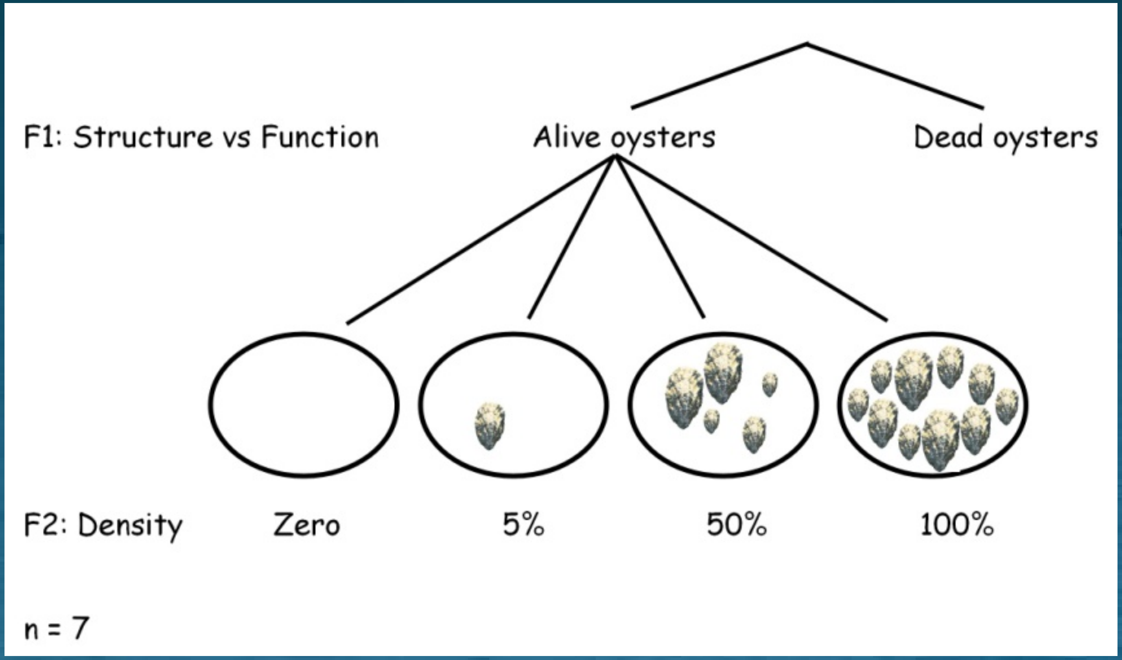
Experiment 1

- Effects of oysters on boulder-field communities especially the honeycomb worm, *Sabellaria alveolata*

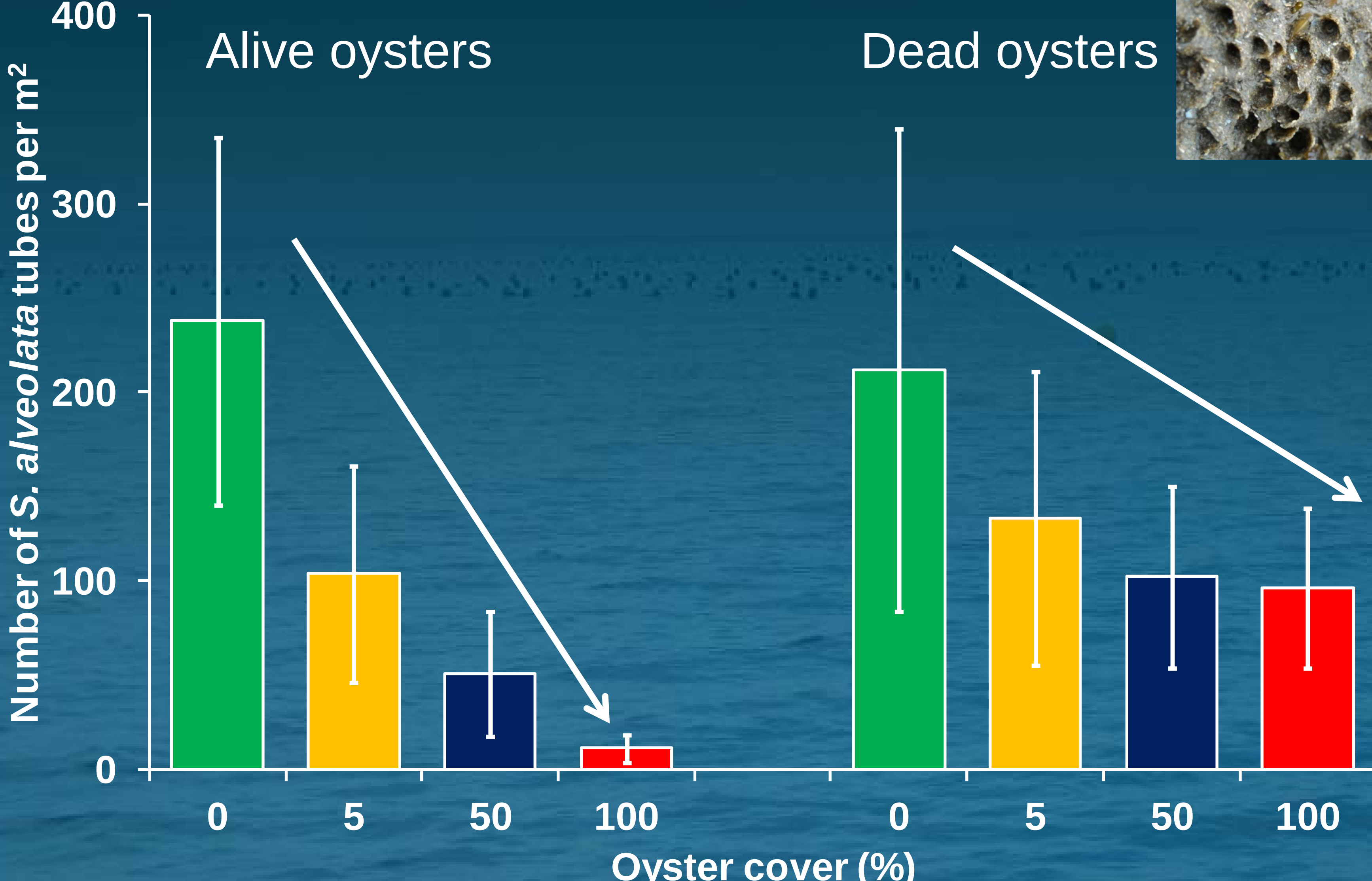


Experiment 1

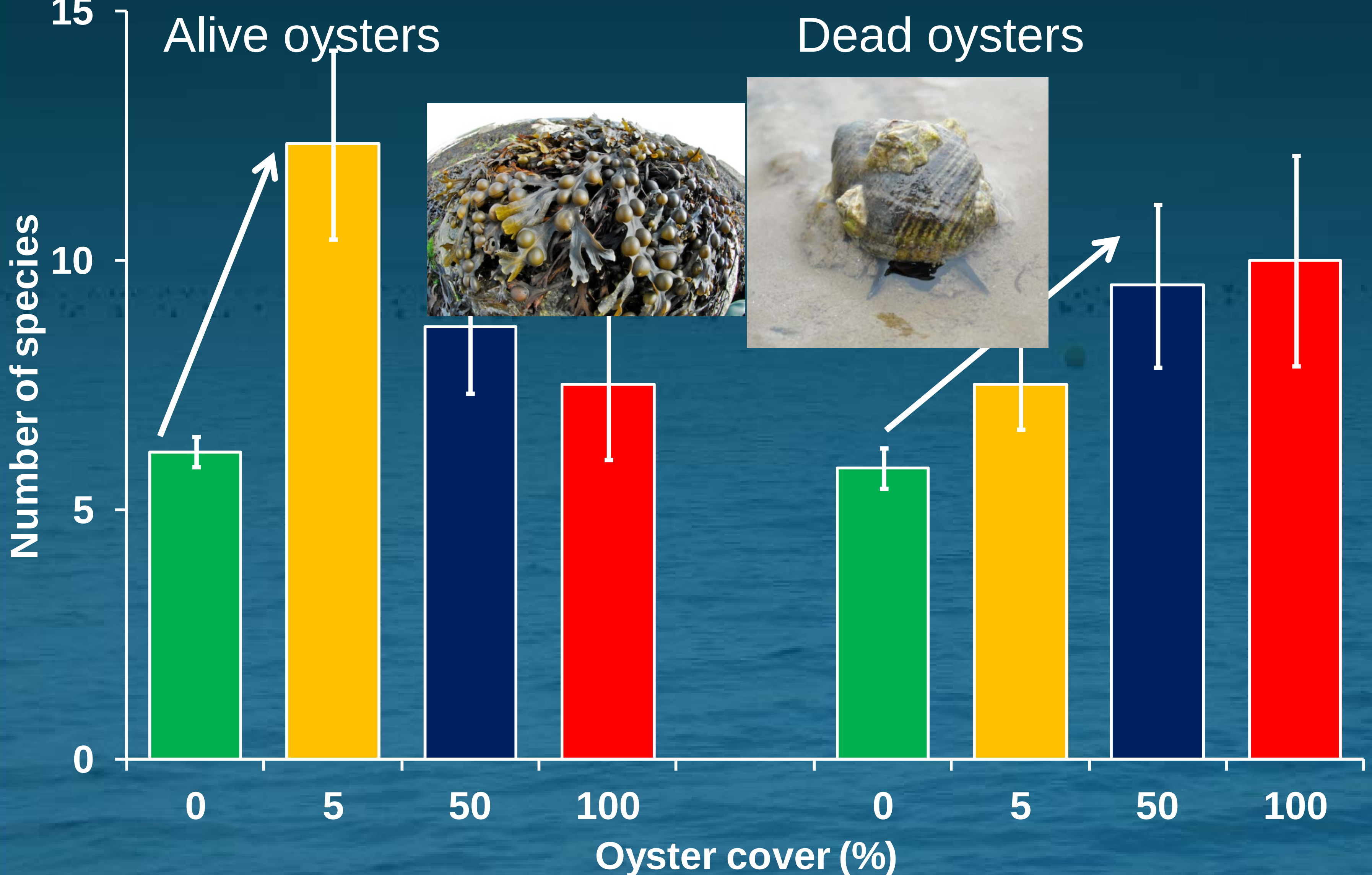
- Increasing cover of alive and dead oysters were added onto boulders



Reduction of *S. alveolata* with oysters on boulders



Impacts on biodiversity in boulder-fields

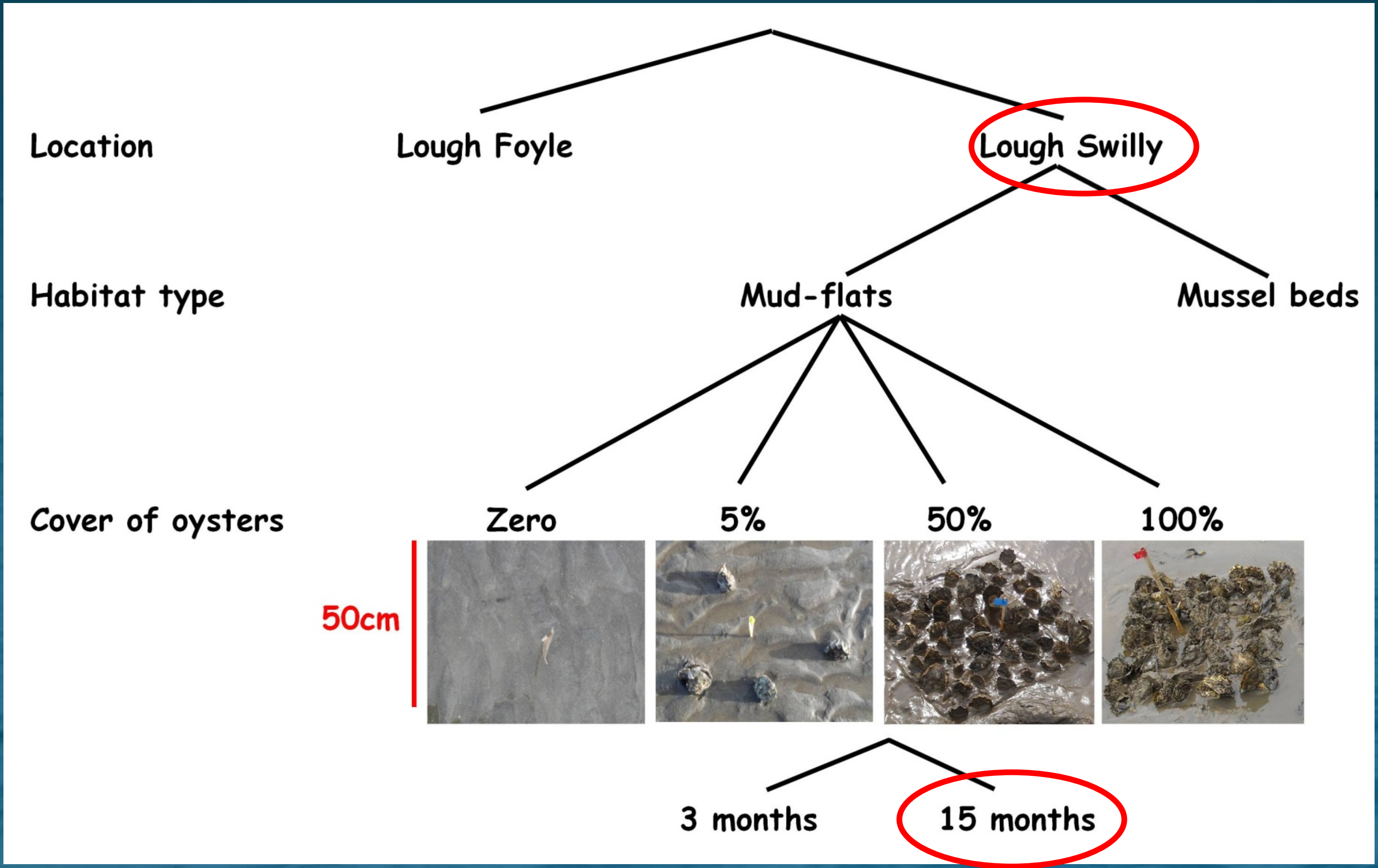


Key impacts on boulder-field biota

- The honeycomb worm, *Sabellaria alveolata* was negatively impacted by oysters.
  - Not due to competition for space
- Biodiversity was enhanced at the lowest cover of living oysters but peaked at greater cover.
- *Fucus vesiculosus* and *Littorina littorea* were facilitated by oysters and may have indirectly reduced *S. alveolata* establishment.
- Effects were due to both the physical structure and the biological activities of oysters.

Experiment 2

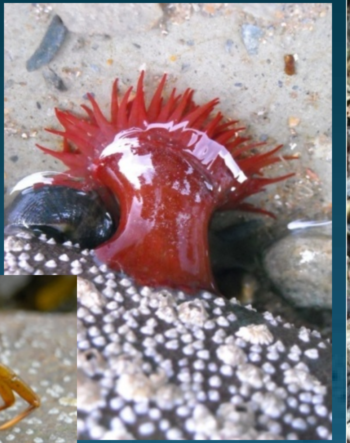
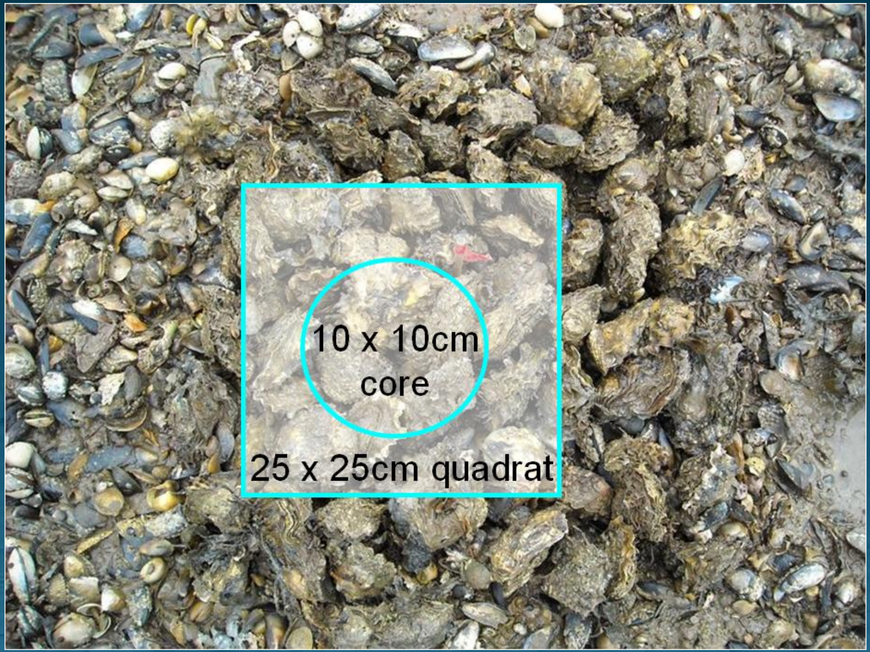
- Effects of oysters were also assessed in mud-flat and mussel beds habitats



Measures of biodiversity

- Epifauna



- Infauna

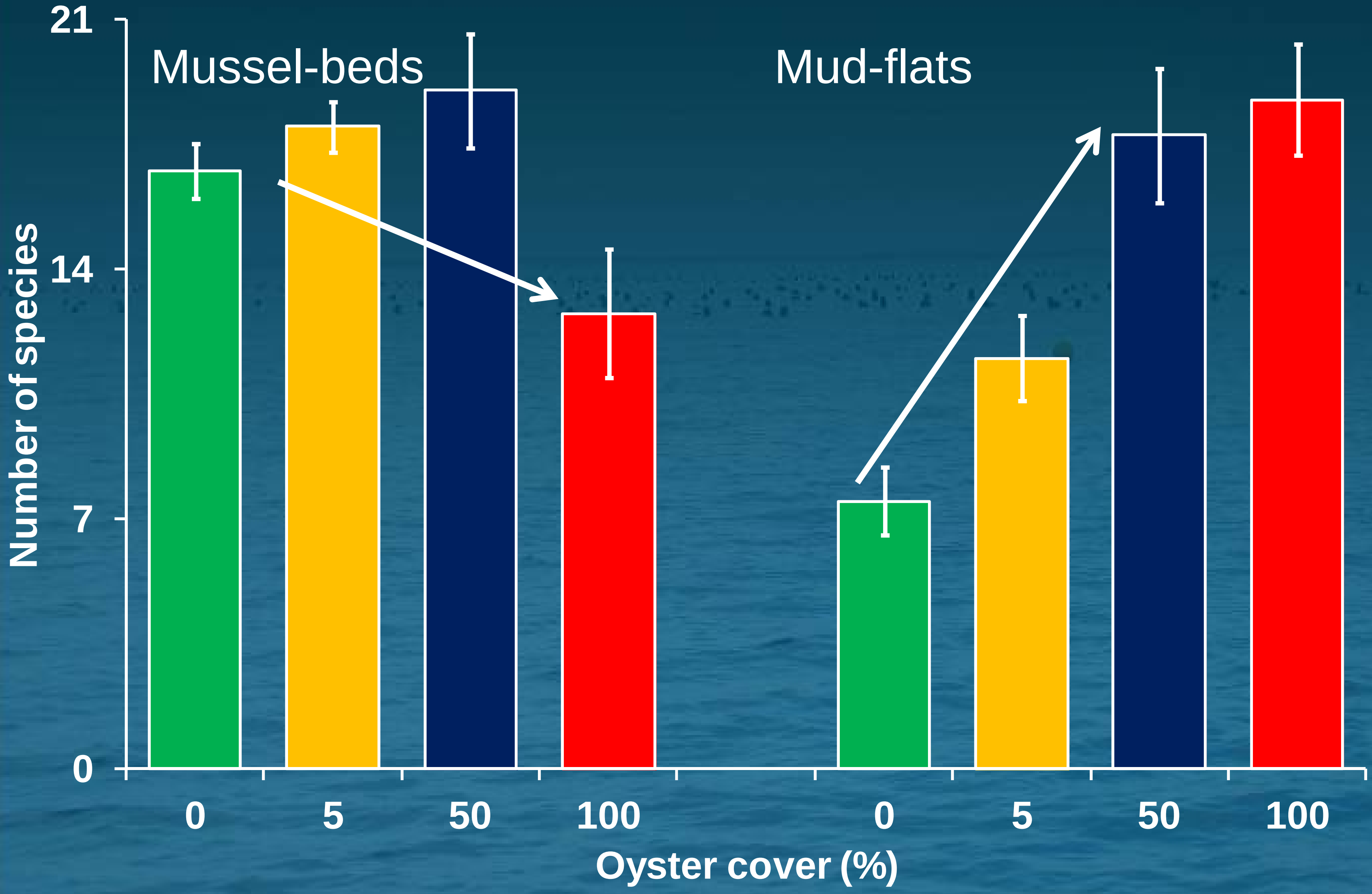



Measures of ecosystem functioning

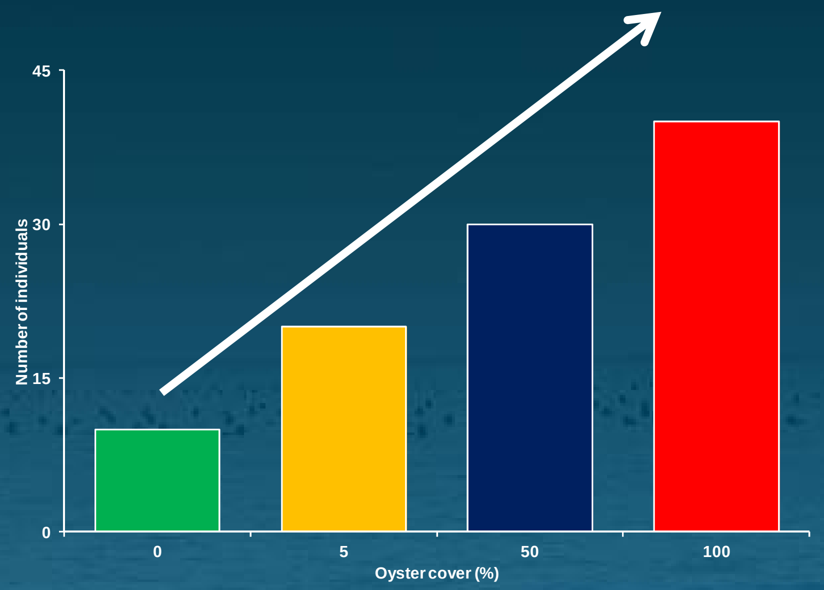
Functional measures:

- Porewater nutrient profiles
  - Sediment – water interface flux
  - Nutrient turnover rates
- Gas
  - Flux rates of CO_2, CH_4 and N_2O

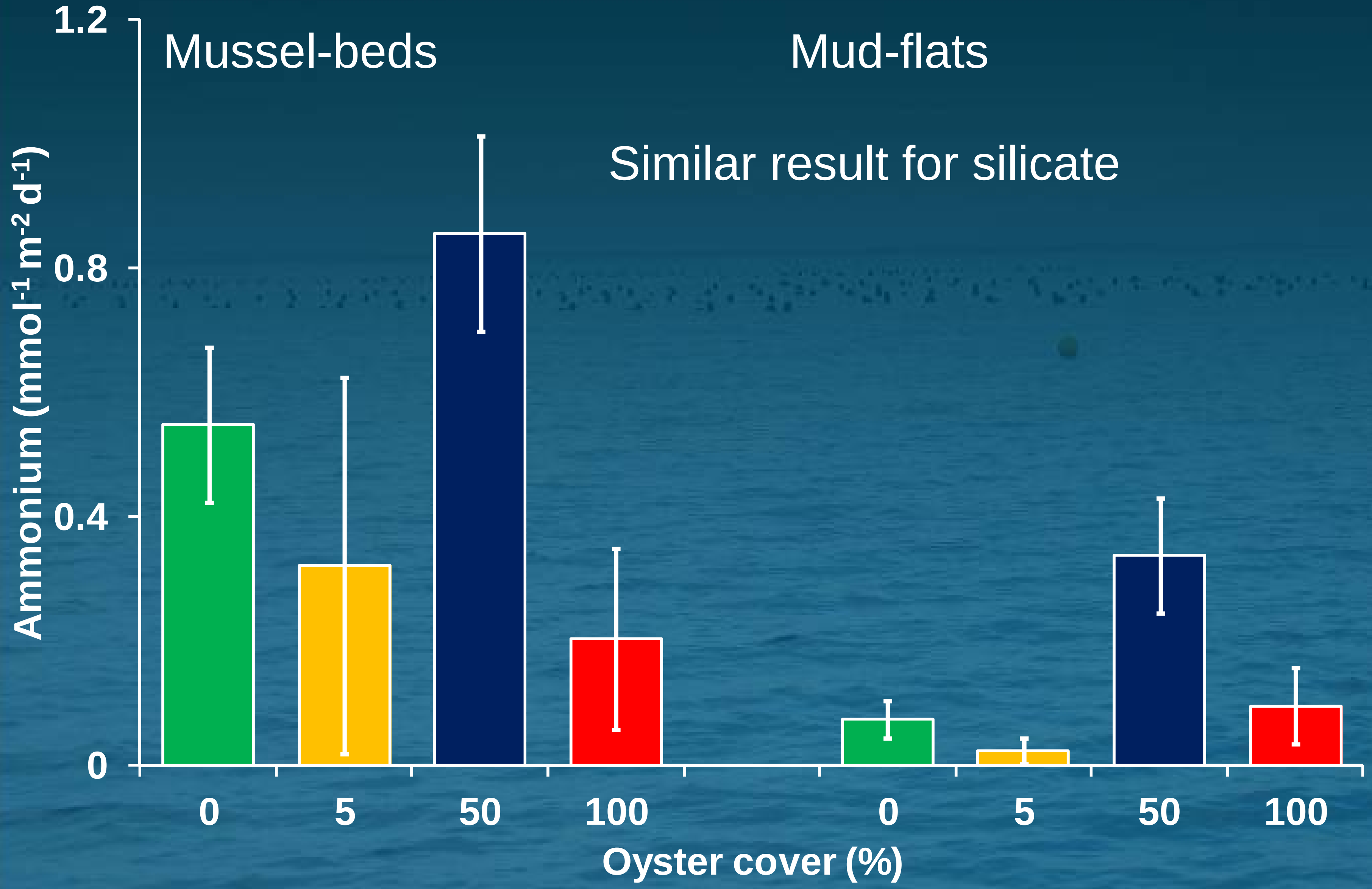
Impacts on biodiversity at L. Swilly



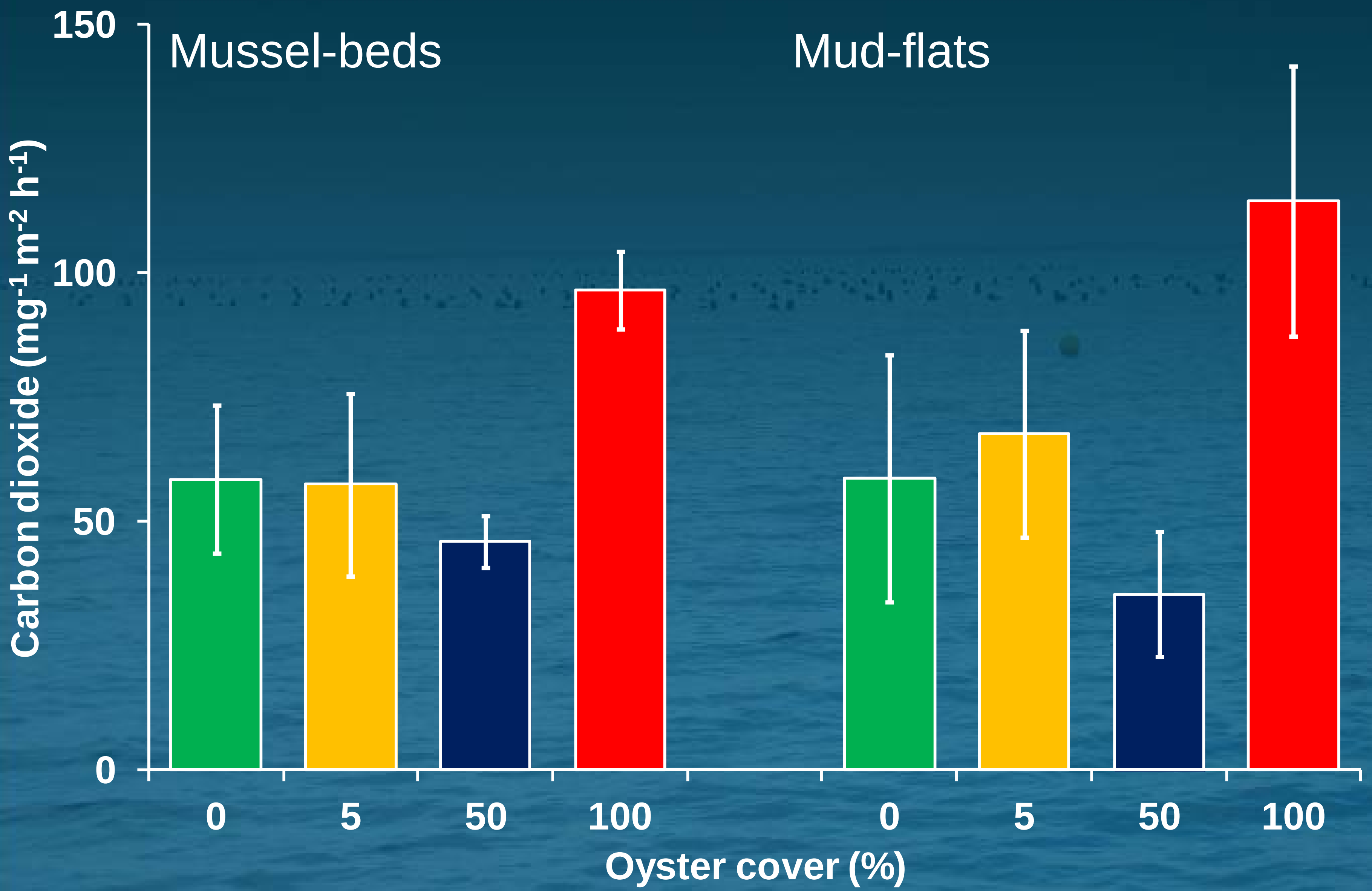
Consistent facilitation of an invasive barnacle, macroalgae and a key grazer in all habitats



Impacts on pore-water ammonium fluxes



Impacts on community respiration



Summary of impacts

- Biodiversity generally increased.
  - but in some cases peaked or declined at greater cover
  - Several taxa were consistently facilitated in all habitats
- Physical structure decreased establishment of a protected biogenic habitat.
- Pore-water nutrient fluxes were altered.
- Community respiration increased with the greatest cover of oysters.
  - Likely due to microbial activity (Expt. 3)

Conclusions

- Alteration of nutrient cycling and decomposition rates may lead to nutrient retention and changes in primary productivity.
- These changes may have consequences for ecosystem services, e.g. reduced carrying capacity for aquaculture.
- Some impacts were context dependent.
- Further research is needed to accurately scale these impacts up and predict their effects on ecosystems.

Acknowledgements

HELP and ADVICE

- Ciarán McGonigle, Loughs Agency
- Carlos Rocha, TCD
- Bas Boots, UCD

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FIELD and LAB WORK

- Bas Boots, Mark Browne, Amy Haughton, Robert Fitzpatrick, Laila Higgins, Erin Gleeson, Kelly Dunagan, Eoin O'Gorman, Juan Severino, Julien Chopelet, Myriam Callier, Paul Brooks, Angela Gallagher, Jesko Zimmermann, David Blockley, Ciarán McGonigle & colleagues, Francis O'Beirn

FUNDING AGENCIES and SIMBIOSYS coordinators

- Environmental Protection Agency, NDP, SSTI, IRCSET & IRCHSS (via UCD Graduate Research Education Programme in Sustainable Development)
- Jane Stout , Jens Dauber and David Bourke TCD

Any questions?