New studies cast doubt on the legitimacy of the conservation status of *Sabellaria spinulosa* reefs: A case study that demonstrates the importance of evidence to support MPA design

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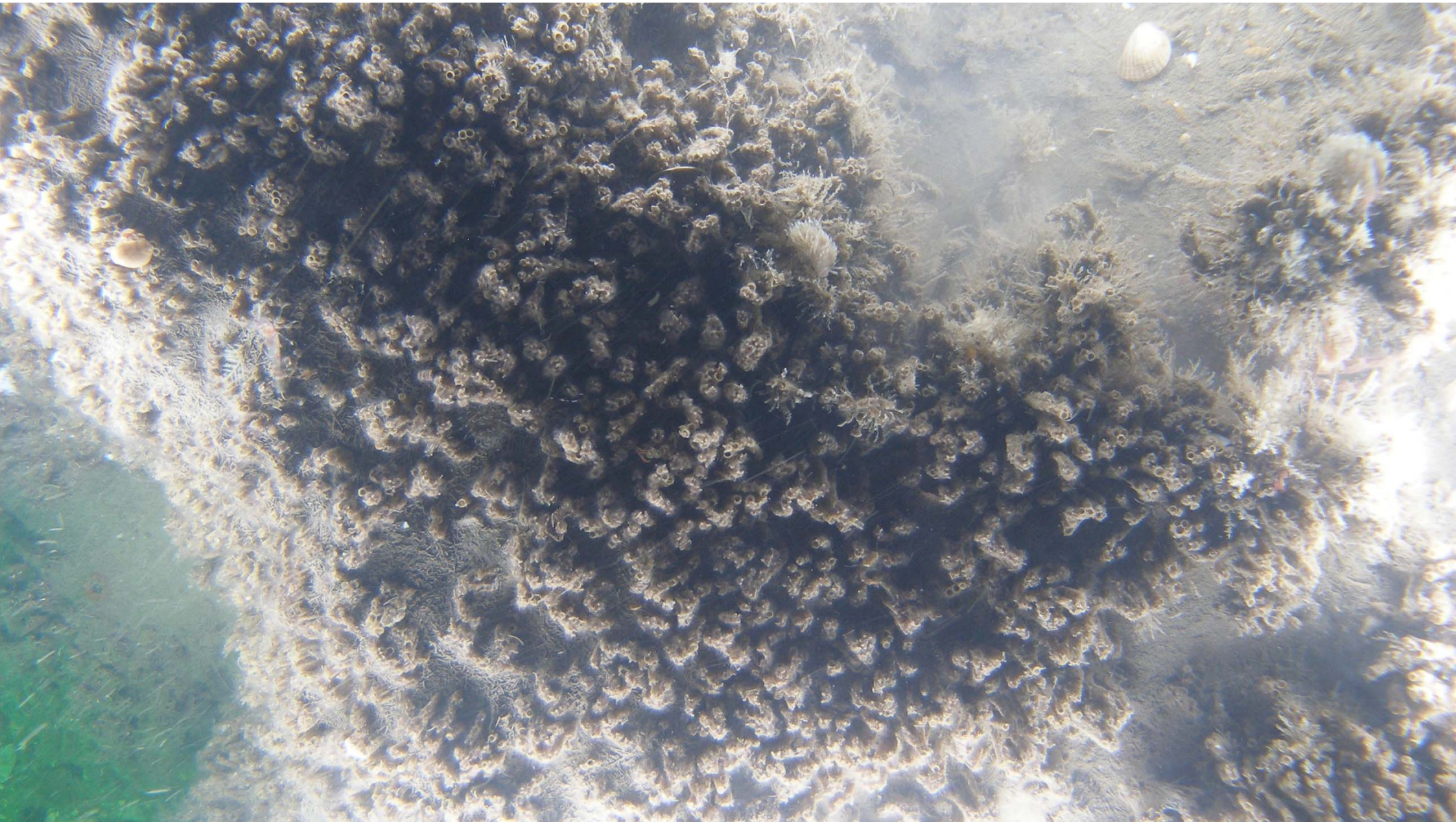
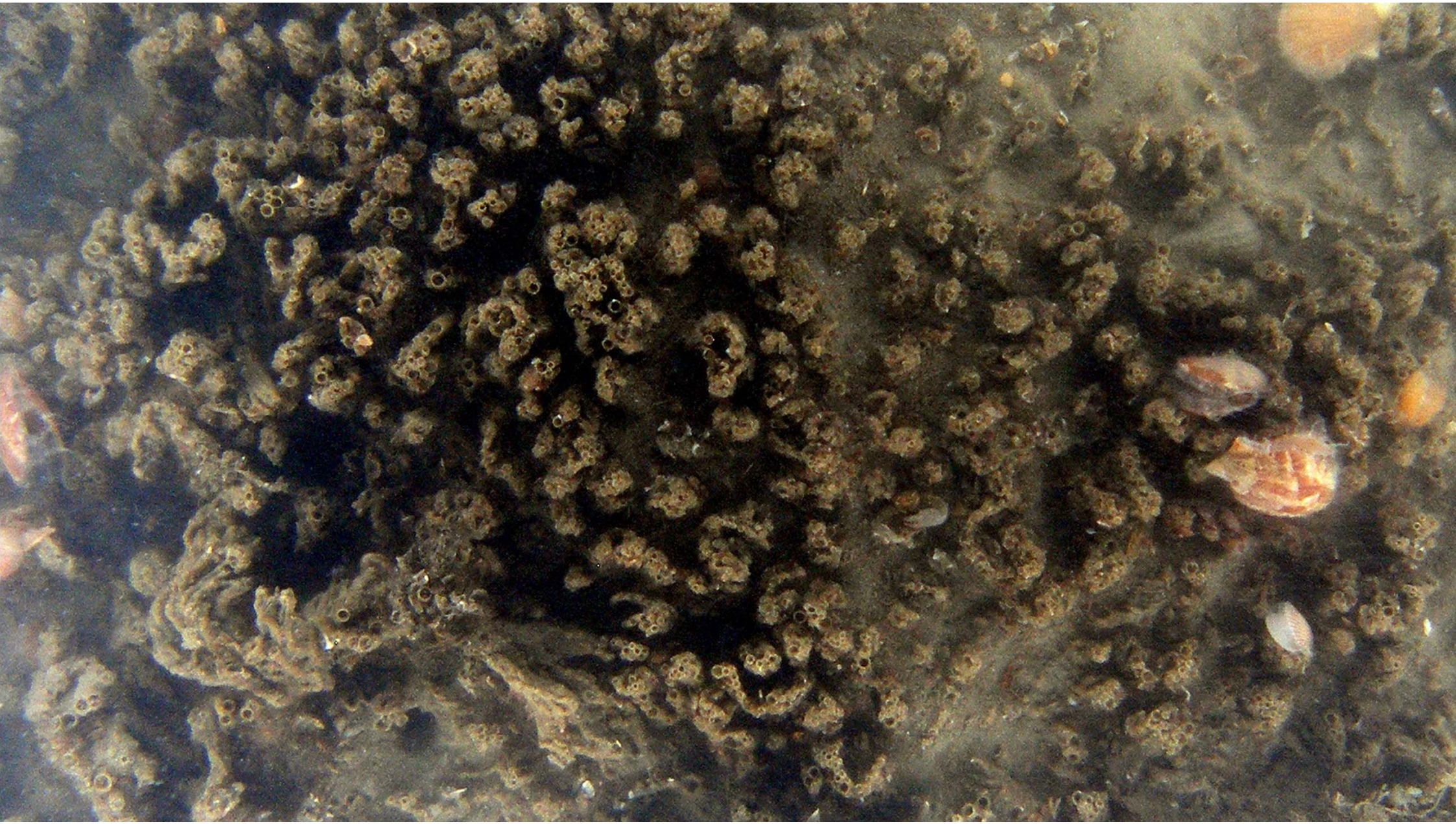
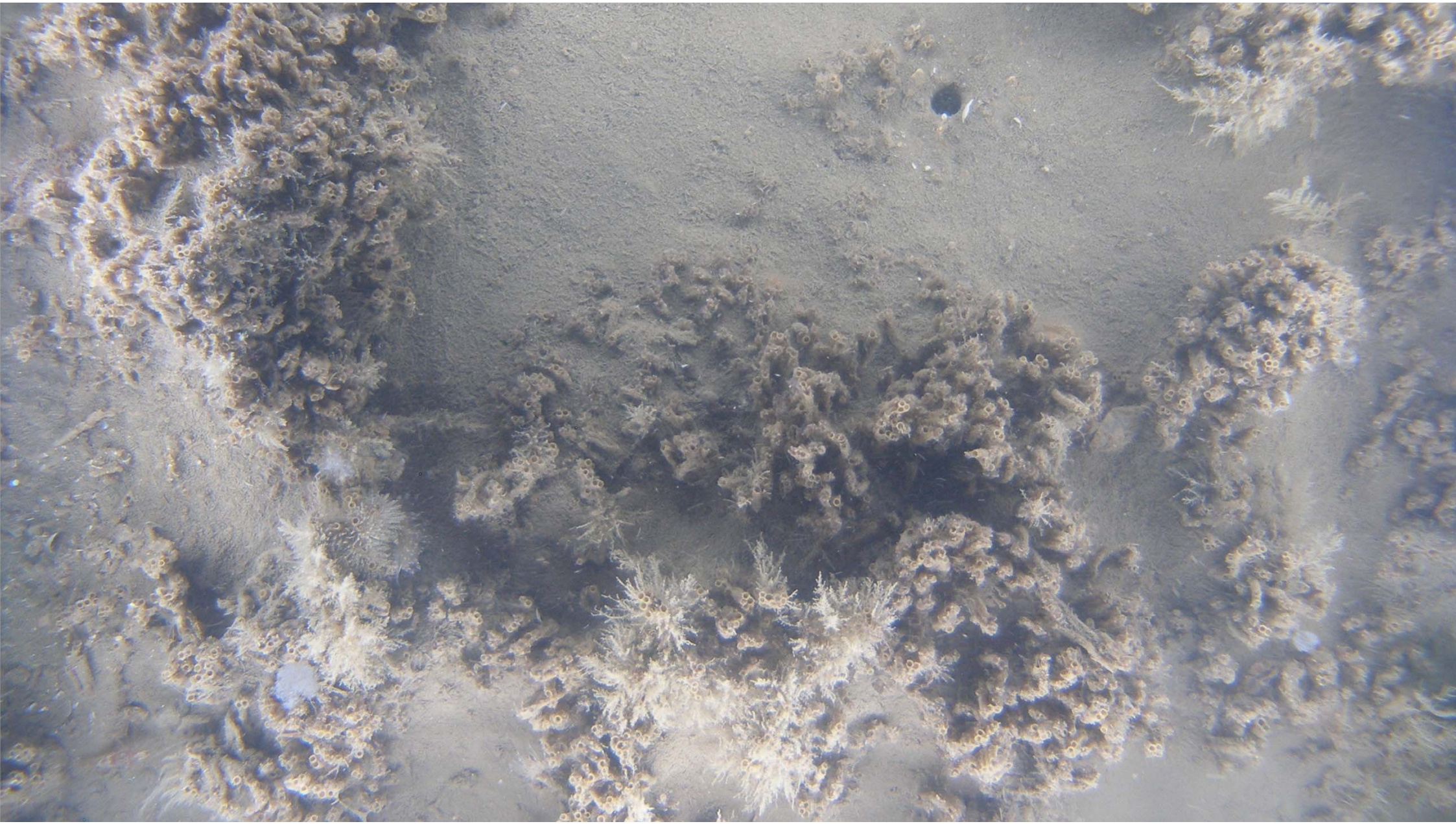






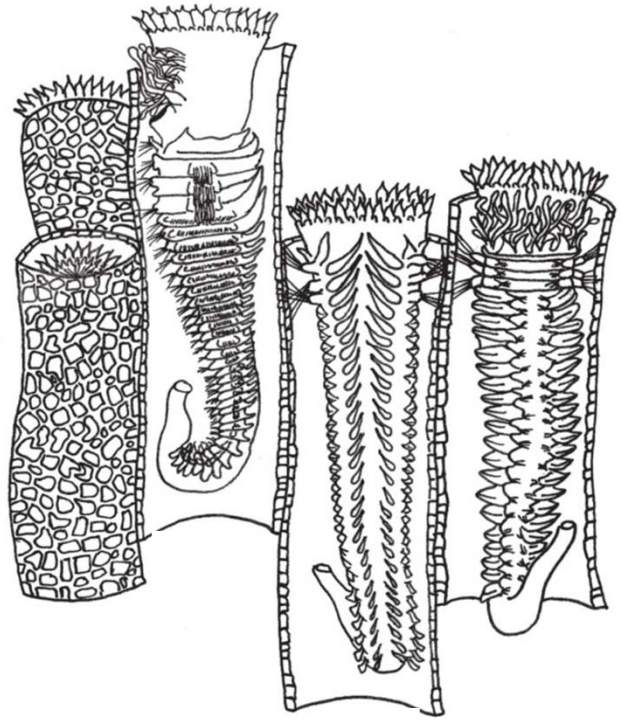
Sabellaria spinulosa (Leukhart, 1849)

- Sabellariid polychaete which can form dense aggregations constructed from a multitude of sand-grain tubes

- Frequently reported as supporting an unusually rich and diverse fauna

- Significant declines in *S. spinulosa* reefs across Europe

- As such, reefs formed by *Sabellaria spinulosa* have been identified as a priority habitat for conservation



Conservation Status

Legislative Instrument	Mechanism for Protection
European Habitats Directive 1992	Special Areas of Conservation (SACs)
OSPAR Convention 1992	OSPAR Marine Protected Areas (MPAs)
Natural Environment and Rural Communities Act 2006	England's Biodiversity Strategy Environment Strategy for Wales
Wildlife and Natural Environment Act (Northern Ireland) 2011	Northern Ireland's Biodiversity Strategy
Water Framework Directive 2000	"Good Ecological Status" of water bodies
Marine Strategy Framework Directive 2008	"Good Environmental Status" targets (particularly under D1 and D6)
Marine and Coastal Act 2009	Marine Conservation Zones (MCZ)
The Marine Works (Environmental Impact Assessment) Regulations 2007	Impacts of new developments minimised through the EIA process

OSPAR Convention 1992

"*S. spinulosa* reefs can provide a biogenic habitat that allows many other associated species to become established and acts to stabilize cobble, pebble and gravel habitats. **They contain a more diverse fauna with more than twice as many species and almost three times as many individuals** than nearby areas where *S. spinulosa* is absent (NRA, 1994). The reefs are or particular nature conservation significance when they occur on sediment or mixed substrata areas as they **enable a range of species to occur that would not otherwise be found in such areas**." (OSPAR, 2010).

European Habitats Directive 1992

"These **enable a range of epibenthic species with their associated fauna and a specialised 'crevice` infauna, which would not otherwise be found in the area, to become established.** Studies have compared an area of *S. spinulosa* with other macrofaunal communities in the Bristol Channel and found that the former had a **higher faunal diversity (more than 88 species) and higher annual production** (dominated by suspension-feeders) than other benthic communities in the area." BAP, 2000

Evidence Base

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National Rivers Authority (NRA) – 1994, Wash Zone Report

- Unpublished
- Not peer reviewed
- Unavailable for scrutiny

George & Warwick – 1985, Bristol Channel

- Article makes no direct comparisons between reef and non-reef habitats
- Bristol Channel fauna naturally impoverished as they are exposed to periods of anoxia and high levels of scouring (Mettam et al., 1994; Warwick and Somerfield, 2010)

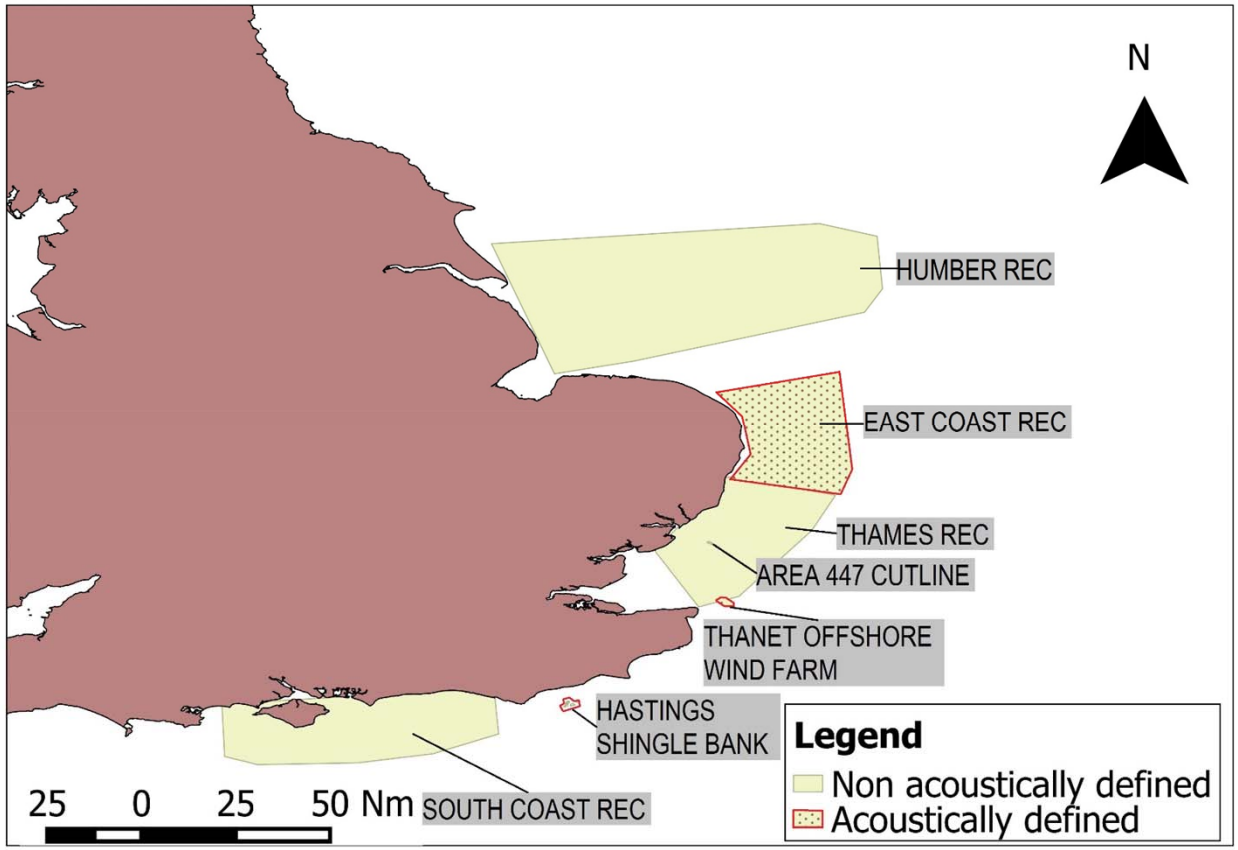
Hypotheses

H_1 = Biodiversity is higher on *Sabellaria spinulosa* reefs than in adjacent sedimentary habitats

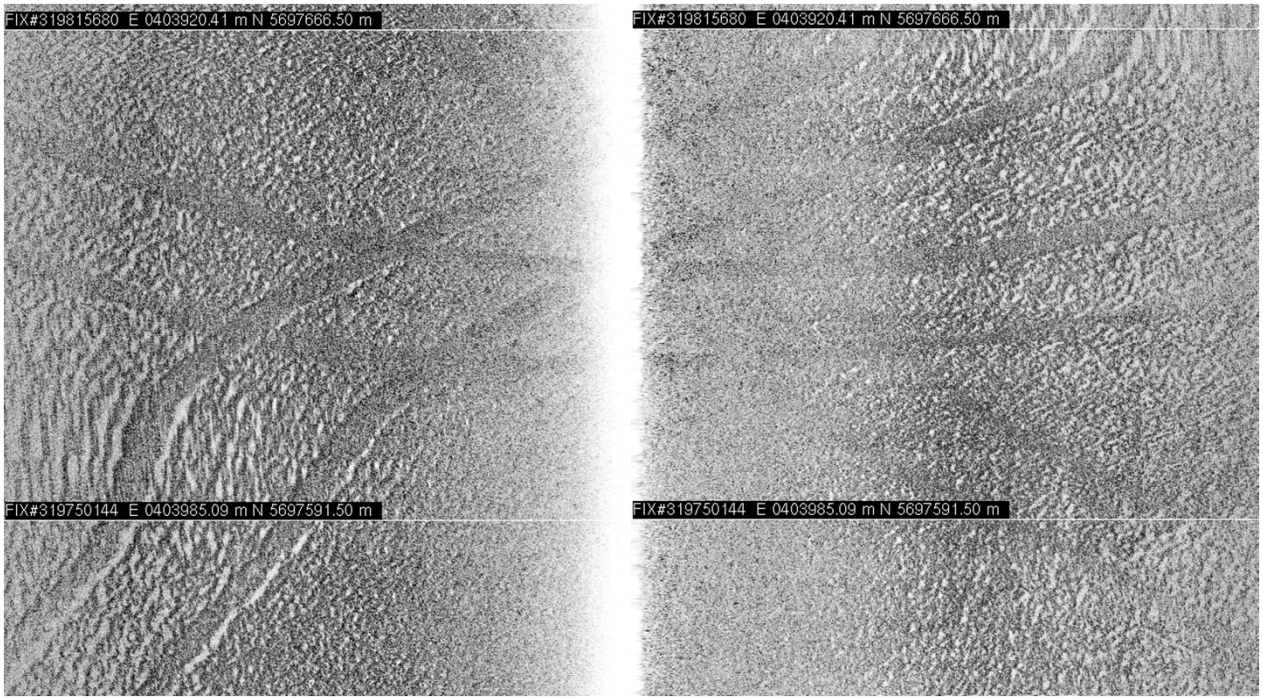
H_2 = Macrofaunal community composition is significantly different on *Sabellaria spinulosa* reefs than in adjacent sedimentary habitats

H_3 = Biodiversity is positively correlated with the density of *Sabellaria spinulosa*

Evidence Base



Acoustically Defined Reefs



Thanet Offshore Windfarm
Pearce *et al* 2014

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~~H_1 = Biodiversity is higher on *Sabellaria spinulosa* reefs than in adjacent sedimentary habitats~~

Component of Biodiversity	Measure	Average off Reef	Average on Reef	Reef Effect	F	P
Alpha Diversity (per 0.1m^2 grab sample)	No. Species (S)	17	43	↑	210.94	**0.001**
	Macrofaunal Abundance (N)	62	289	↑	100.35	**0.001**
	Pielou's Evenness (J')	0.82	0.76	↓	15.65	**0.001**
	Simpson's Diversity (1-λ)	0.83	0.84	–	0.87	0.336
	Taxonomic Distincness (Δ+)	74	74	–	0.11	0.73
Beta Diversity (per habitat)	Sample Dispersion	63	55	↓	162.95	**0.001**

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Taxa	Reef Av. Abund	Non- Reef Av. Abund	Reef Effect	Cum.%
Pisidia longicornis	220.82	25.14	↑	31.64
Balanus crenatus	26.68	11.27	↑	41.54
Lumbrineris gracilis	10.36	5.13	↑	44.07
Spirobranchus lamarcki	8.73	2.94	↑	46.45
Scalibregma inflatum	6.3	5.79	↑	48.75
Phyllodoce maculata	7.39	1.42	↑	50.35
Crepidula fornicata	7.16	1.17	↑	51.73
Harmothoe	6.64	1.8	↑	53.06
Notomastus latericeus	3.68	2.49	↑	54.38
Nemertea	4.8	2.17	↑	55.71
Ampelisca	2.55	2.72	↓	56.83
Galathea intermedia	2.59	2.18	↑	57.94
Poecilochaetus serpens	1.86	2.39	↓	59.05
Unciola crenatipalma	3.77	1.32	↑	60.03

~~H_2 = Macrofaunal community composition is significantly different on *Sabellaria spinulosa* reefs than in adjacent sedimentary habitats~~

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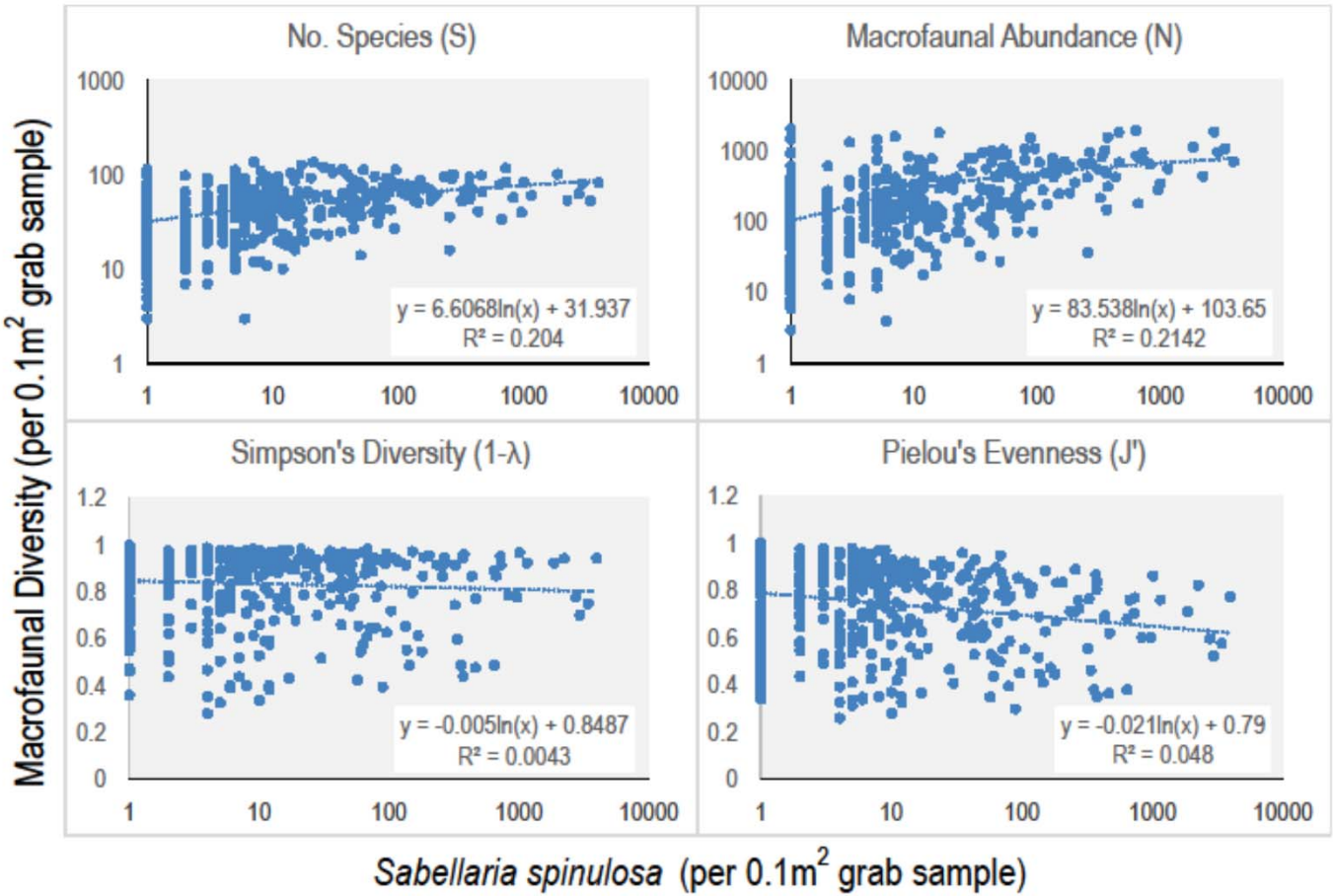

~~H_3 = Biodiversity is positively correlated with the density of *Sabellaria spinulosa*~~

The “Real Reef Effect” ?

↑ Increased density of species (alpha diversity) and individuals

↔ No change in species diversity or community composition

↓ Decrease in beta-diversity (variance between samples)

True conservation value is likely to lie in the reefs ability to increase productivity

Implications for MPA Design & Management

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- The success of Marine Protected Area (MPA) design, and associated monitoring programmes, is strongly linked to the **clarity of the conservation aims** attached to the site

- This case-study demonstrates the importance of **testing the assumptions** upon which your conservation aims are based, before monitoring programmes are designed.

- MPA design and monitoring must be based on **actual ecological functioning** in order for conservation objectives to be credible and achievable.

Evidence, Evidence, Evidence

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