BENTHIS

SEVENTH FRAMEWORK PROGRAMME

Determining the impacts of trawling on benthic function in European waters: a biological traits approach

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Cefas

ICES Symposium: effects of fishing on benthos :16 – 19th June, 2014, Tromso, Norway

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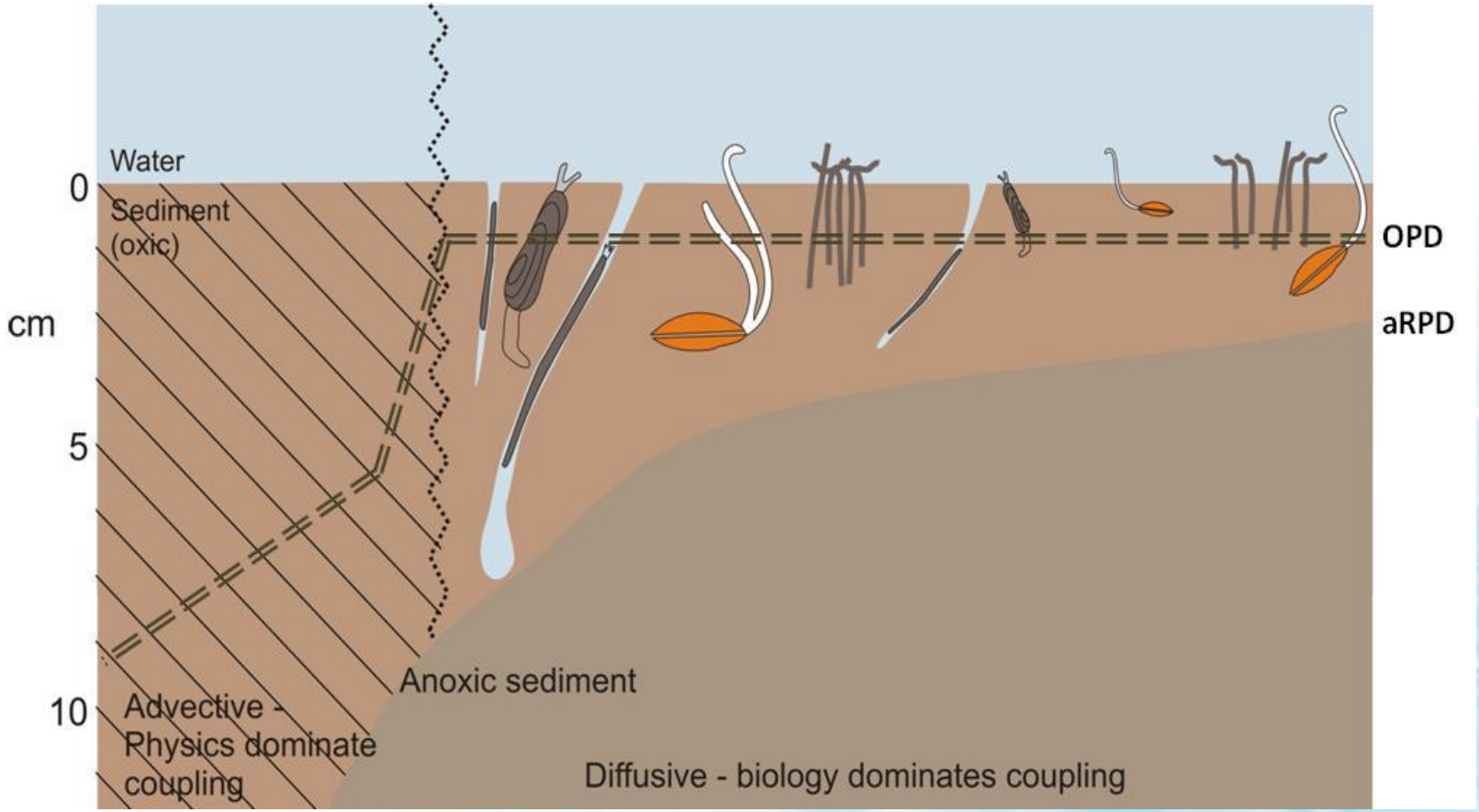
Why use traits?

Interactions between habitat and the biota....
structure and function attributes



Emphasis on what species **do** rather than what they **are**!

TRAITS

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Why use traits?

Traits	Processes	Functions	Goods and services
		Regulation functions	
Sessile infauna – conveyor belt deposit feeder	Bioturbation	Nutrient fluxes. Carbon storage.	Maintenance of primary production. Climate regulation.
Sessile epifauna – filter feeder	Benthic-pelagic coupling	Nutrient and carbon fluxes	Water purification.
		Habitat functions	
Sessile epifauna 'reef' building suspension feeder	Production of biogenic structures	Nursery & refugia function for other species	Recruitment and survival of commercially important species Presence of high biodiversity areas
		Production functions	
Soft body epifauna etc.	Prey for higher trophic predators	Secondary production of invertebrates and fish	Fish catches

Traits → Processes → Functions → Good & Services

The relative importance of traits, processes and functions will vary between different habitat types.

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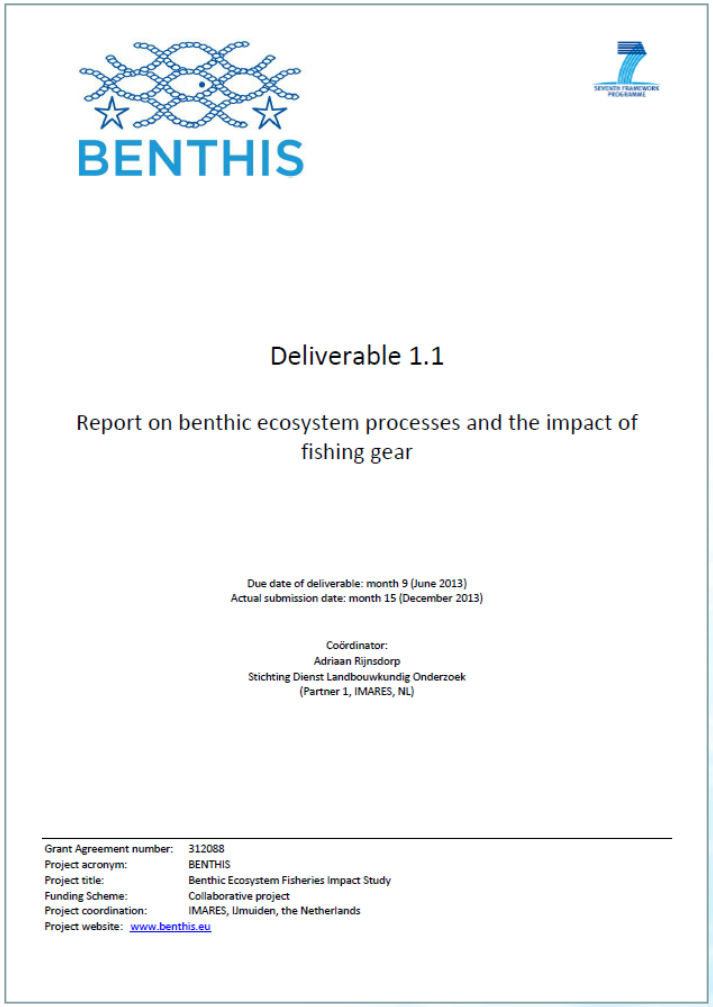

BENTHIS

Deliverable 1.1

Report on benthic ecosystem processes and the impact of fishing gear

Due date of deliverable: month 9 (June 2013)
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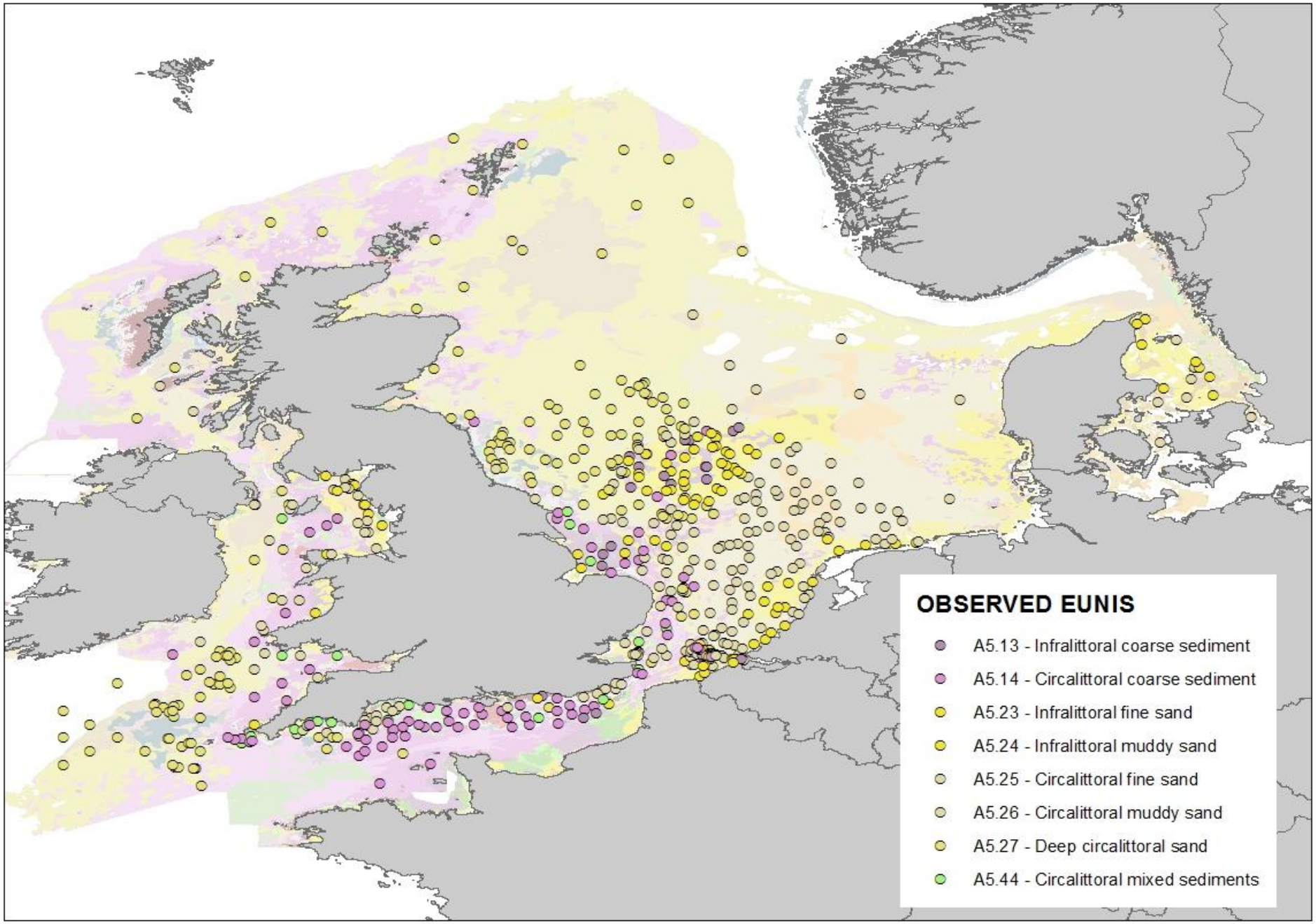
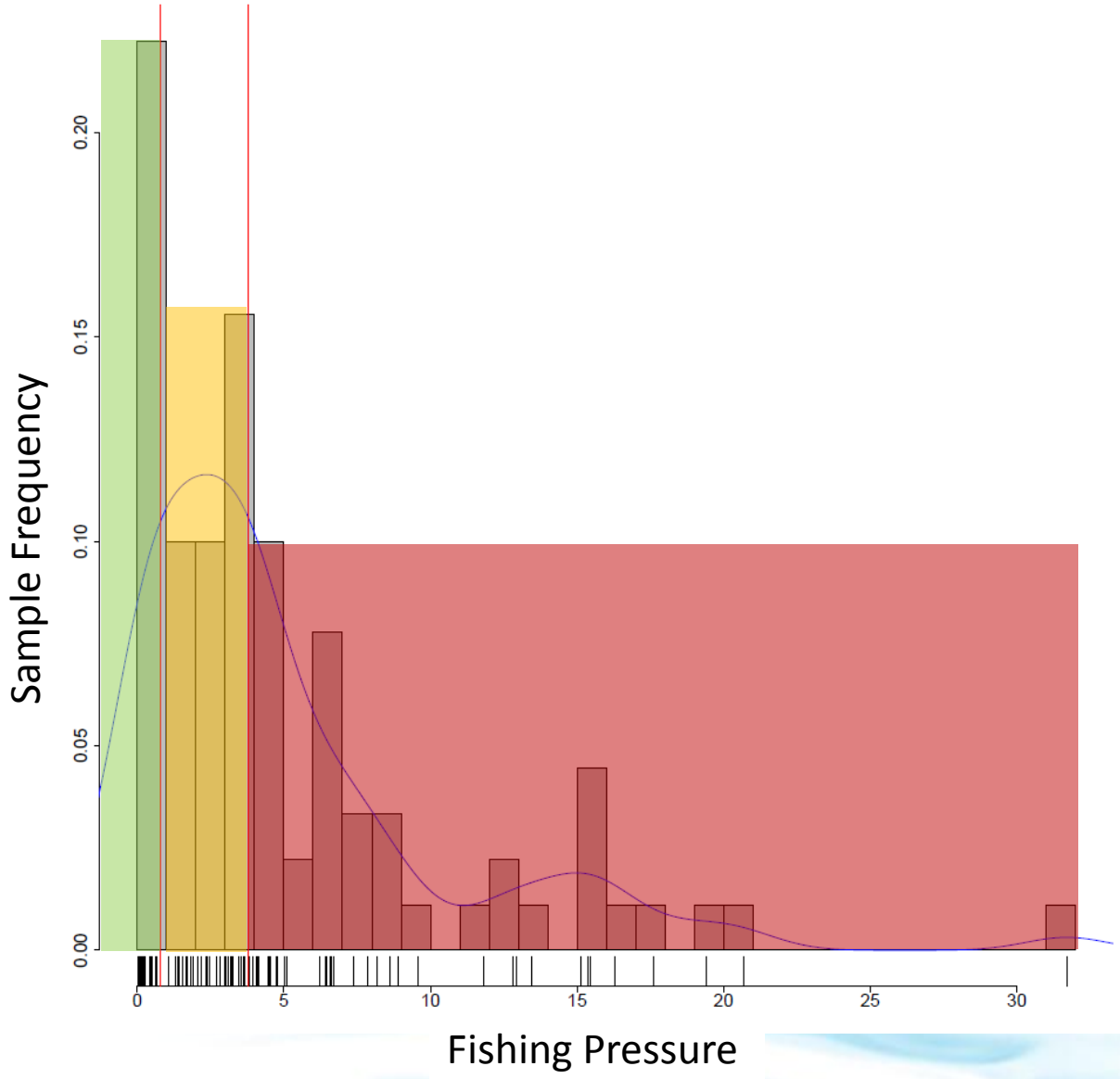
http://www.benthis.eu/en/benthis/Results.htm

Trait	Category (example)
Maximum size	<10mm 10-20mm 21-100mm 101-200mm >201mm
Morphology	Soft Tunic Exoskeleton Crustose Cushion Stalked
Maximum longevity	<1 year 1-3 years 3-10 years >10 years
Larval dev.	Pelagic Planktotrophic Pelagic Lecithotrophic Benthic (direct)
Egg dev.	Asexual / budding Sexual – shed eggs (pelagic) Sexual – shed eggs (benthic) Sexual – brood eggs
Living habit	Tube-dwelling Burrow-dwelling Free-living Crevice/hole/under stones Epi/endo zoic/phytic Attached to substratum
Sediment position	Surface Shallow infauna (0-5cm) Mid-depth infauna (5-10cm depth) Deep-infauna (>10cm)
Feeding mode	Suspension Surface deposit Sub-surface deposit Scavenger / opportunist Predator Parasite
Mobility	Sessile Swim Crawl/creep/climb Burrowers
Bioturbation	Diffusive mixing Surface deposition Upward conveyor Downward conveyor None

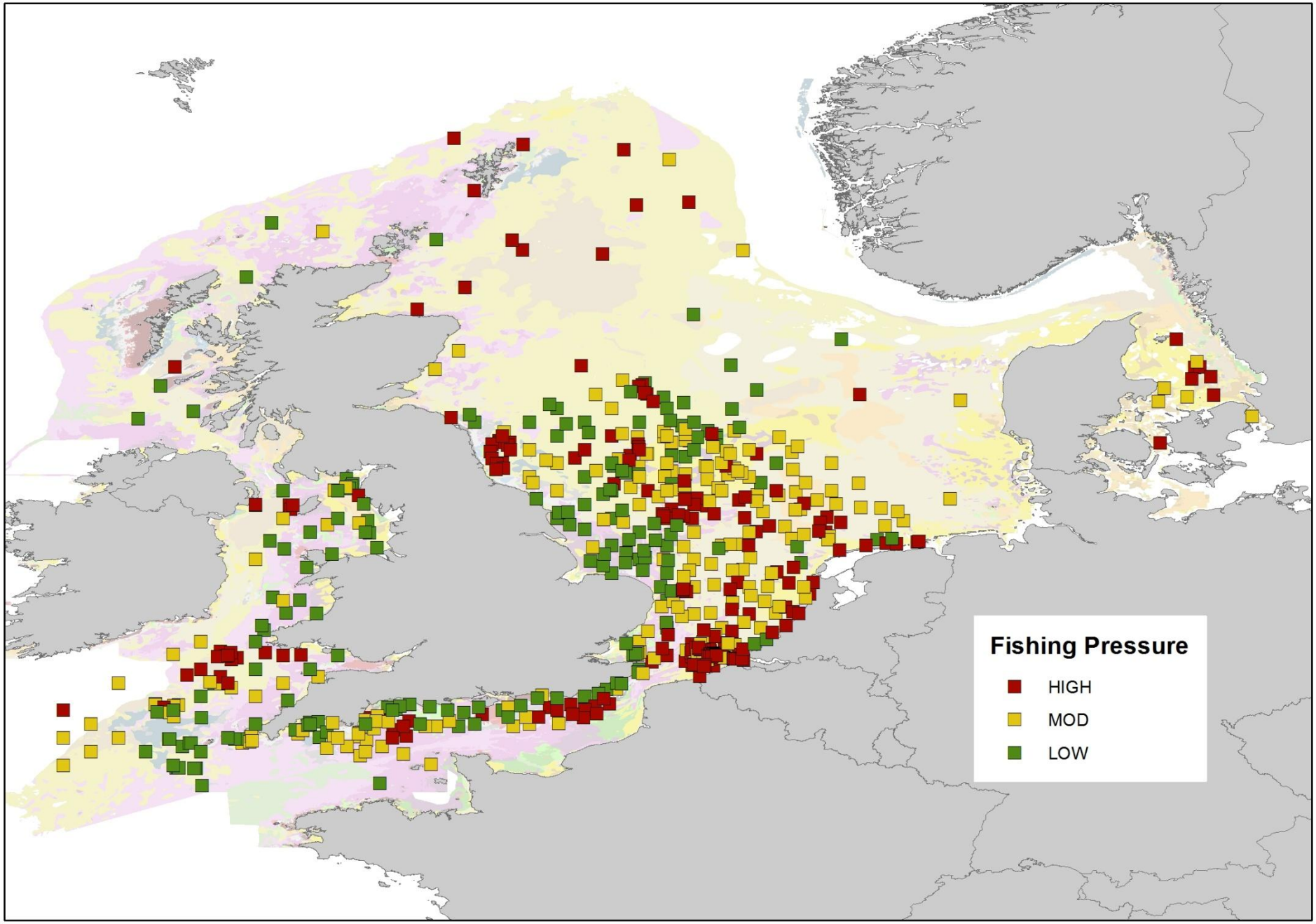
Benthic Grab Samples (610)



Fishing Pressure Categories



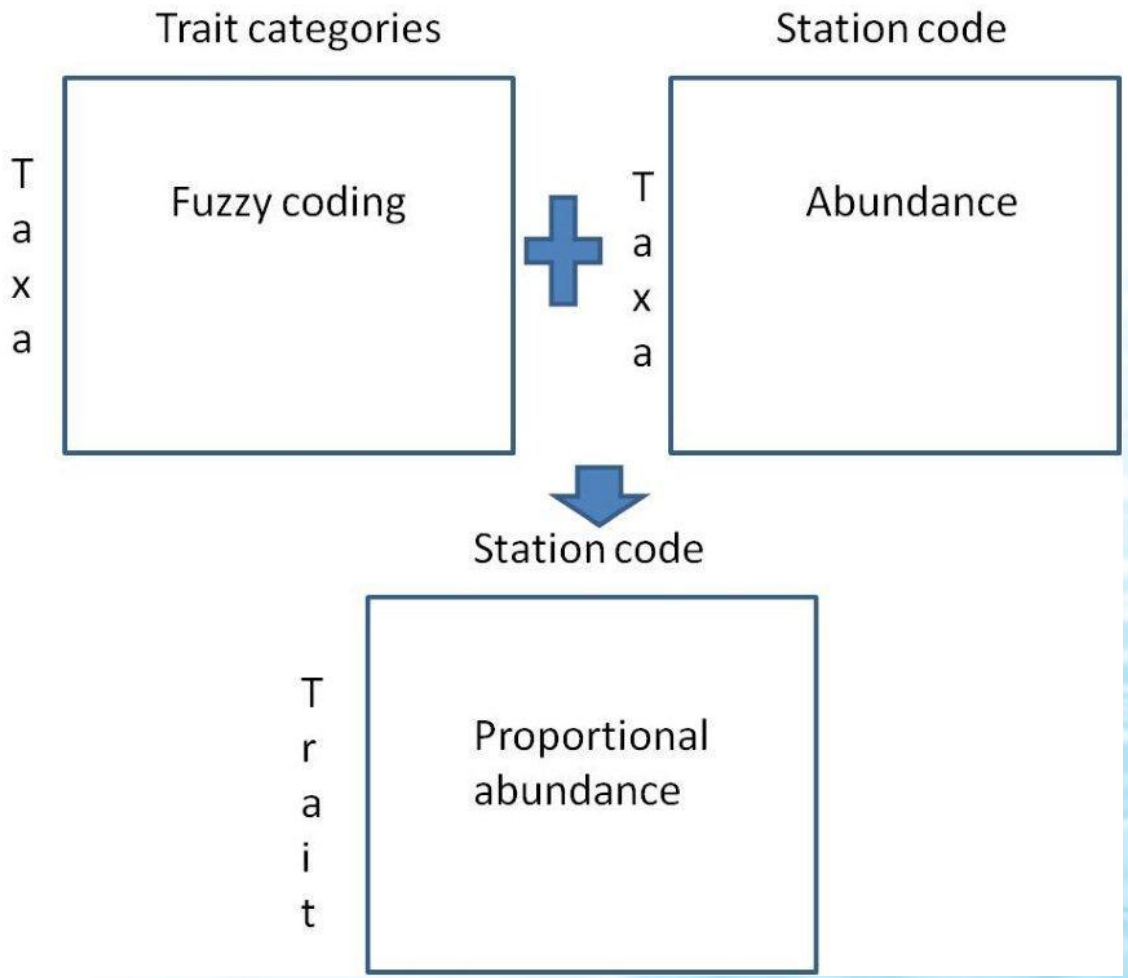
Fishing Pressure



Trait/Station Matrices

10 traits : 48 trait categories

1072 Macrobenthic infauna taxa



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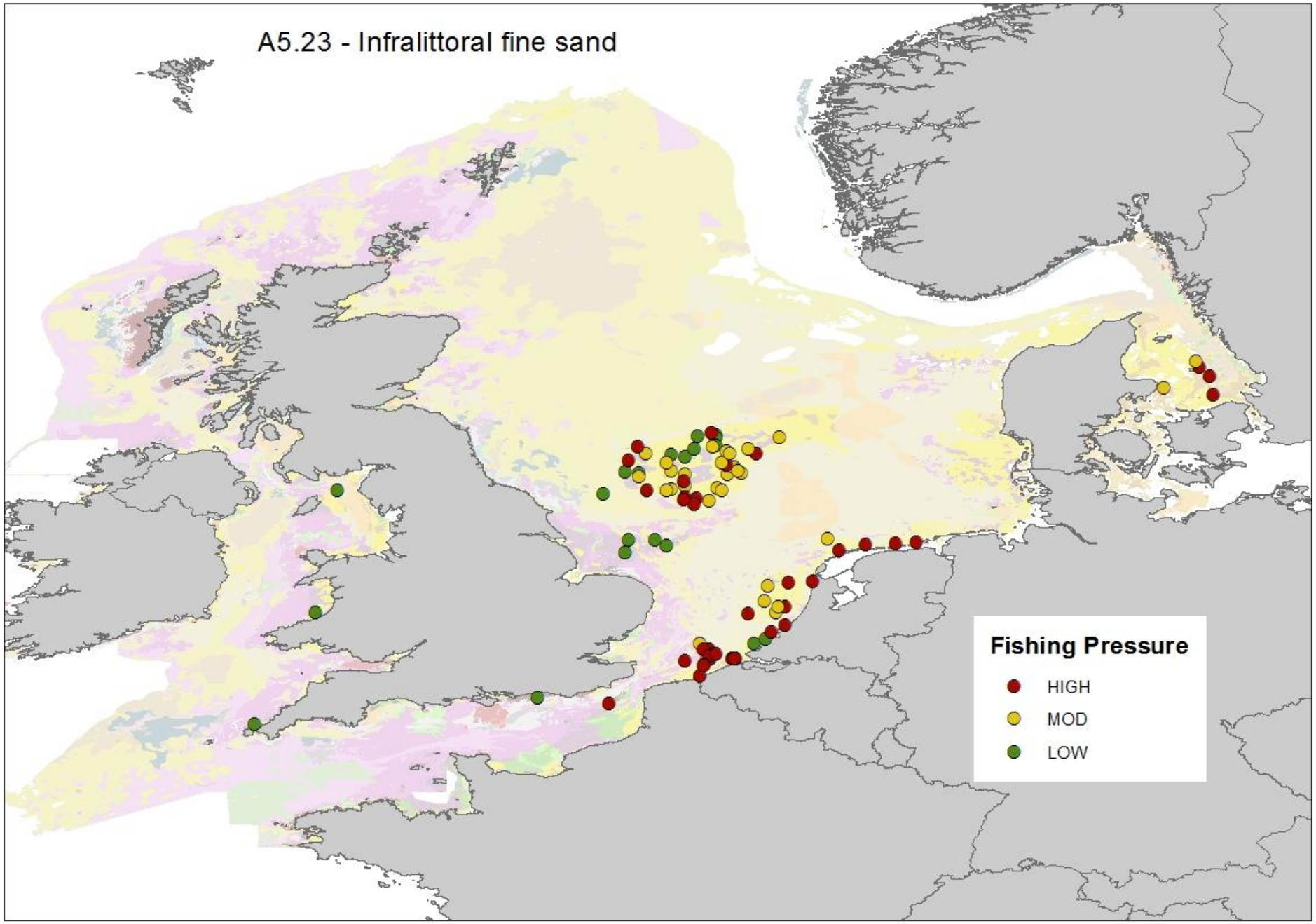
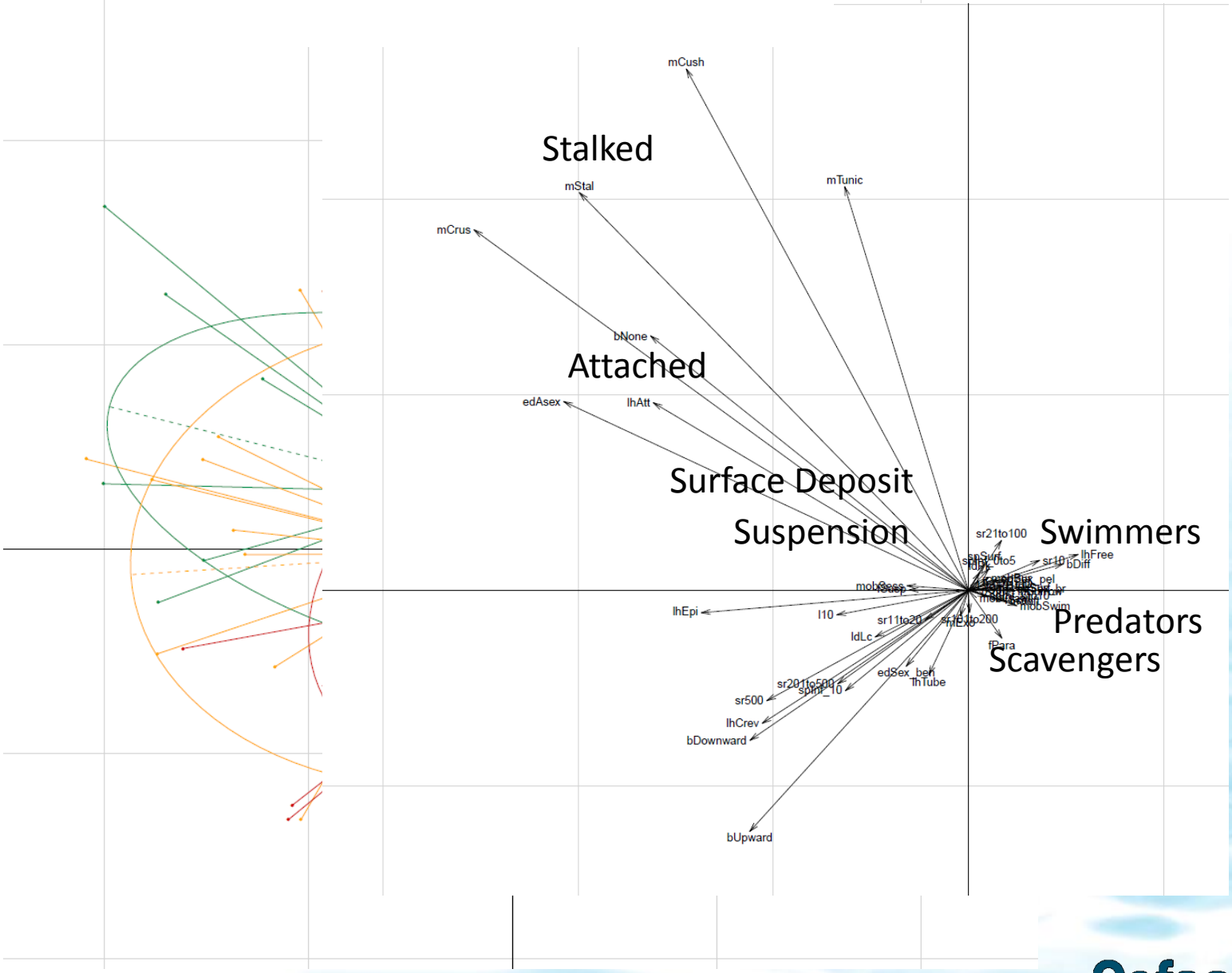
Habitat Specific Analysis



A5.23 Infralittoral Fine Sand



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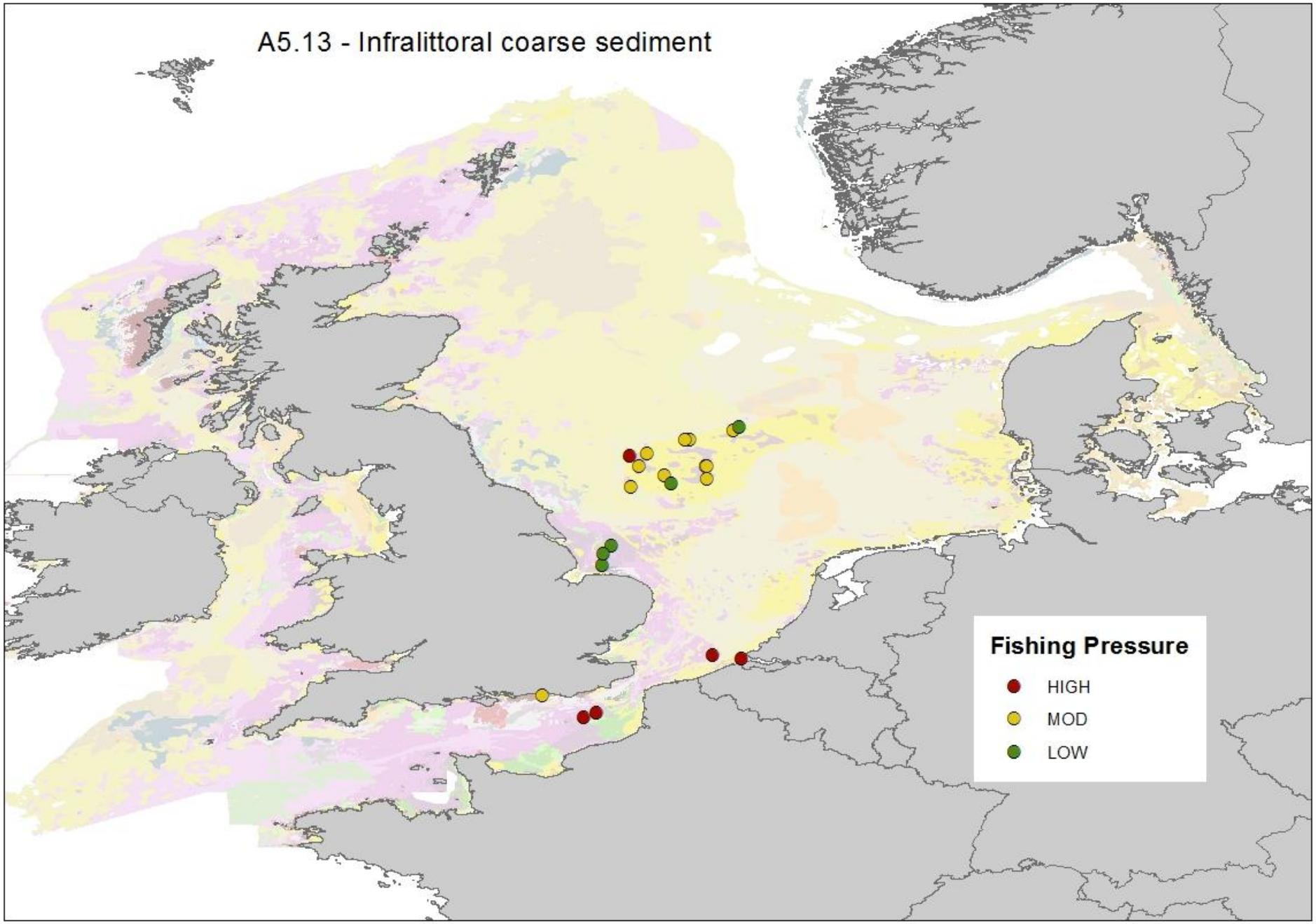
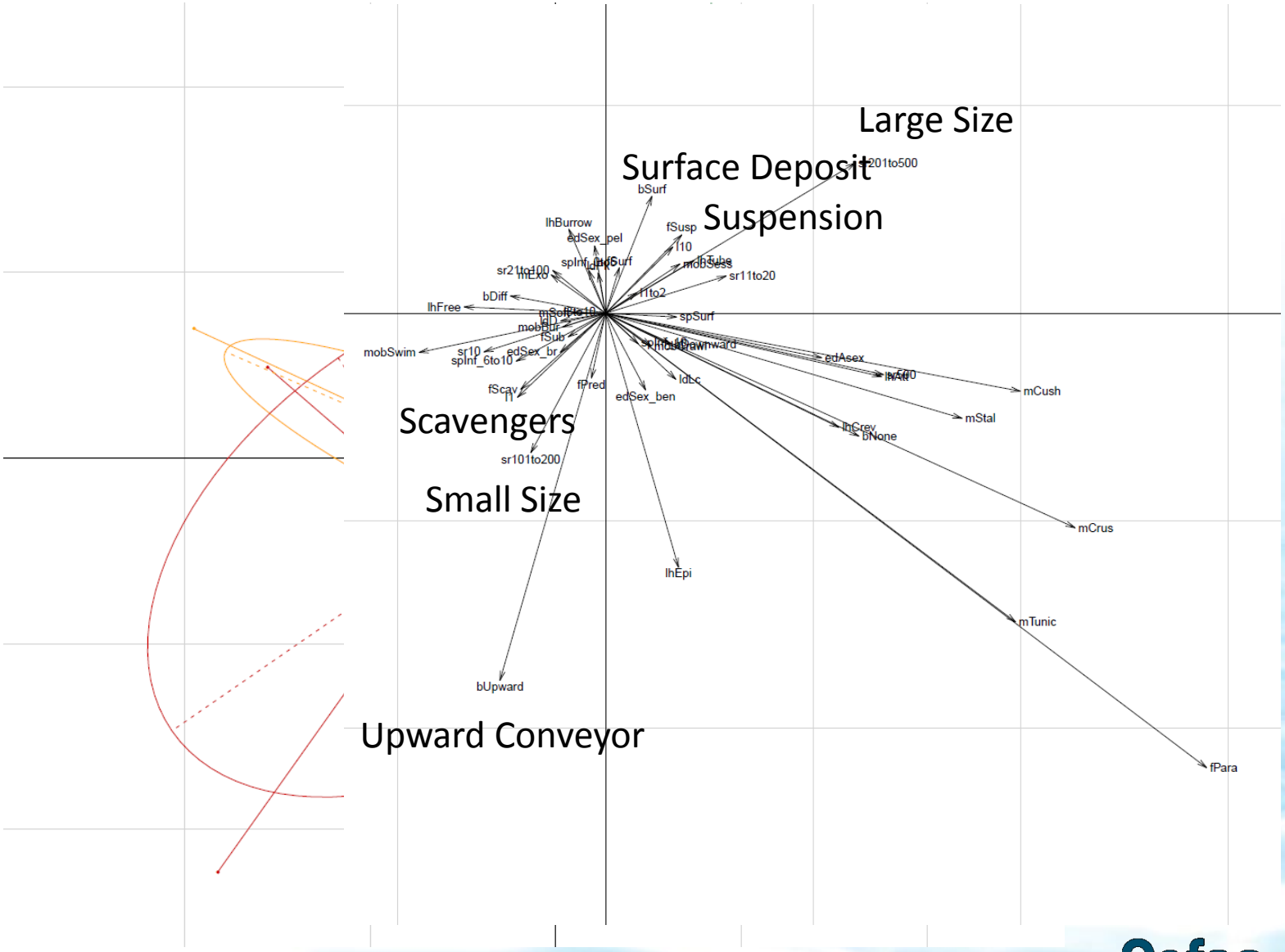
Habitat Specific Samples



A5.13 Infralittoral Coarse Sediment



Changes in trait composition attributed to fishing pressure

(green traits are winners, red traits losers)

	Bioturbation	Egg devel.	Feeding mode	Larval devel.	Living habit	Longevity	Max. size	Mobility	Morphology	Sediment Pos.
A5.13	Upward conv	Direct dev Benthic eggs	Surface deposit Suspension Predators Scavengers	Planktonic	Tube-dwelling Free-living	<1yr	200-500mm <10mm 10-20mm	Sessile	Tunic Stalked	X
A5.14	X	X	X	X	X	X	X	*Sessile Crawlers*	X	X
A5.15	*Downward conv* *Upward conv*	X	X	Planktonic	*Tube-dwellers* *Crevice*	X	X	X	X	X
A5.23	X	Direct devel	Surface deposit Suspension Predators Scavengers	lecithotrophic	X	X	X	Swimmers	Stalked	X
A5.24	X	X	X	Planktonic Direct	X	X	X	Swimmers	Stalked	Surface-dweller
A5.25	X	X	X	*Lecithotrophic* *Direct dev*	X	X	X	X	X	X
A5.26	X	X	X	X	*Free living*	X	X	X	X	*Surface-dweller*
A5.27	X	X	X	X	Attached Free-living	X	X	*Swimmers*	X	X
A5.35	*Upward conv* *Non-bioturbator*	X	*Scavengers*	X	Epifaunal Attached	<1yr	X	Sessile Swimmers	Stalked Crustose	Surface-dweller 0-5cm 6-10cm
A5.37	X	X	X	X	*Attached*	<1yr 3-10yr	10-20mm	Sessile Crawlers	Cushioned Stalked Crustose Tunic	0-5cm
A5.43	Downward conv Upward conv	X	X	X	Attached	3-10yr <1yr	X	X	X	X

Conclusions

1. Generally observe with increasing fishing pressure an increase in scavengers, predators, free living swimmers, short lived and smaller sized animals, but……

2. Not all habitats appear to respond the same way, e.g. the size of animals is most affected when fishing occurs in coarse sediment.

3. An overall decline in the proportion of suspension and surface deposit feeders and size of animals is likely to have implications for the functioning of marine ecosystems.

Refinements!

1. Define more realistic habitat categories based upon observed environmental data.
2. Assess impact of different gear types in swept area fishing pressure calculations.
3. Conduct further statistical tests to rule out differences due to sample bias (e.g. spatial/temporal variation).
4. Integrate these findings with data on epifauna.
5. Better understand the functional implication of these findings in relation to recycling of nutrients and carbon, and trophic interactions in the benthic food-web.


Thank you