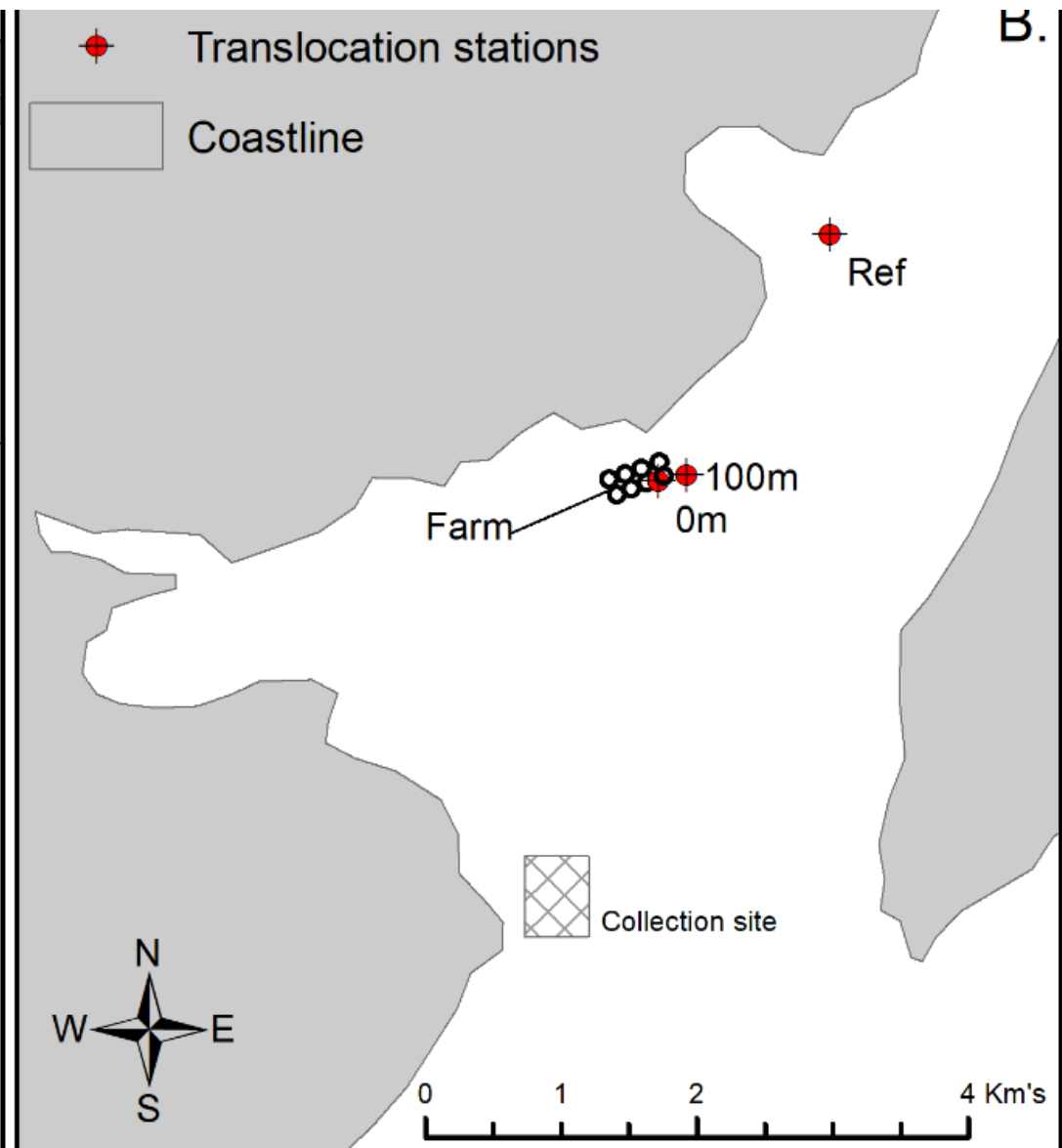
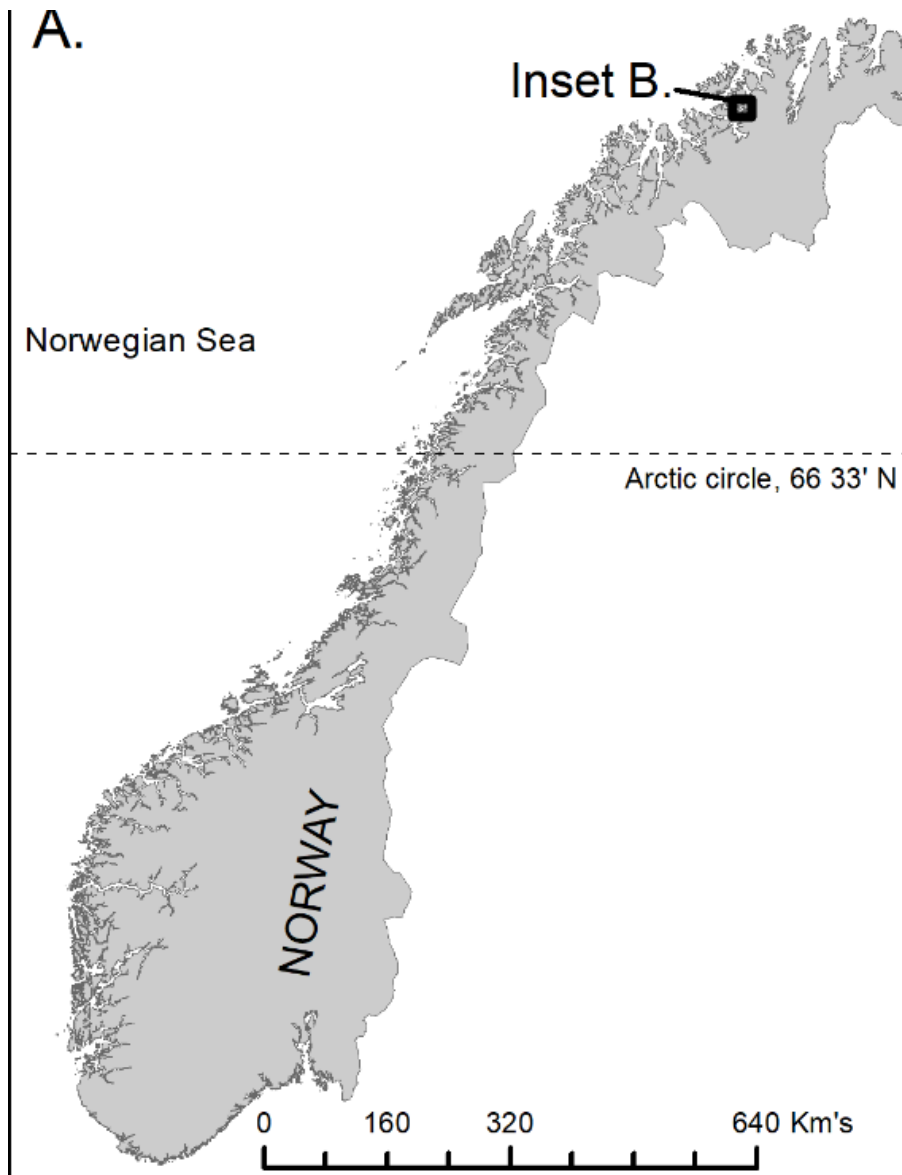


Effects of fish farm activities on sessile benthic taxa and their associated microbiota: A case study with *Polymastia* sp.

By Olivier Laroche, Sonnich Meier, Astrid Harendza, Svein A. Mjøs, Raymond Bannister & Nigel Keeley



## Main objective

Fill knowledge gap on how benthic sessile organisms living on mixed or hard-substrate habitats respond to the effects of salmon farming.

## Information layer

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Gene expression

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Microbiome

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Fatty acids

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Stable isotopes

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## Specific objectives

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Characterize *Polysmastia's* microbiome, fatty acid and stable isotope profiles;

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Test sensitivity of the different layers of information towards the impact of salmon farming;

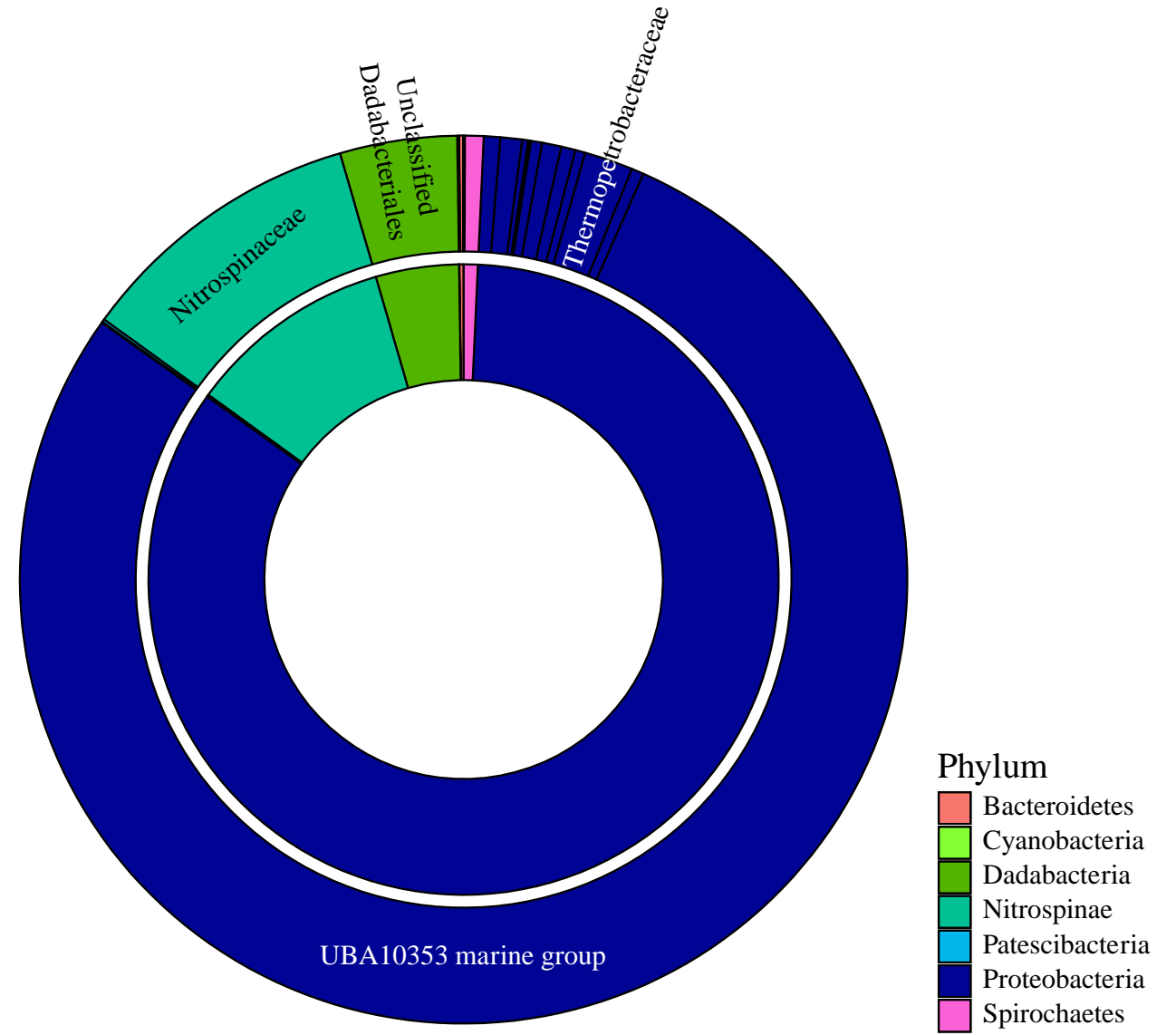
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Identify meaningful indicators of fish farm activities that could be subsequently used in routine monitoring programs.

# Microbiome

## Taxonomic profile

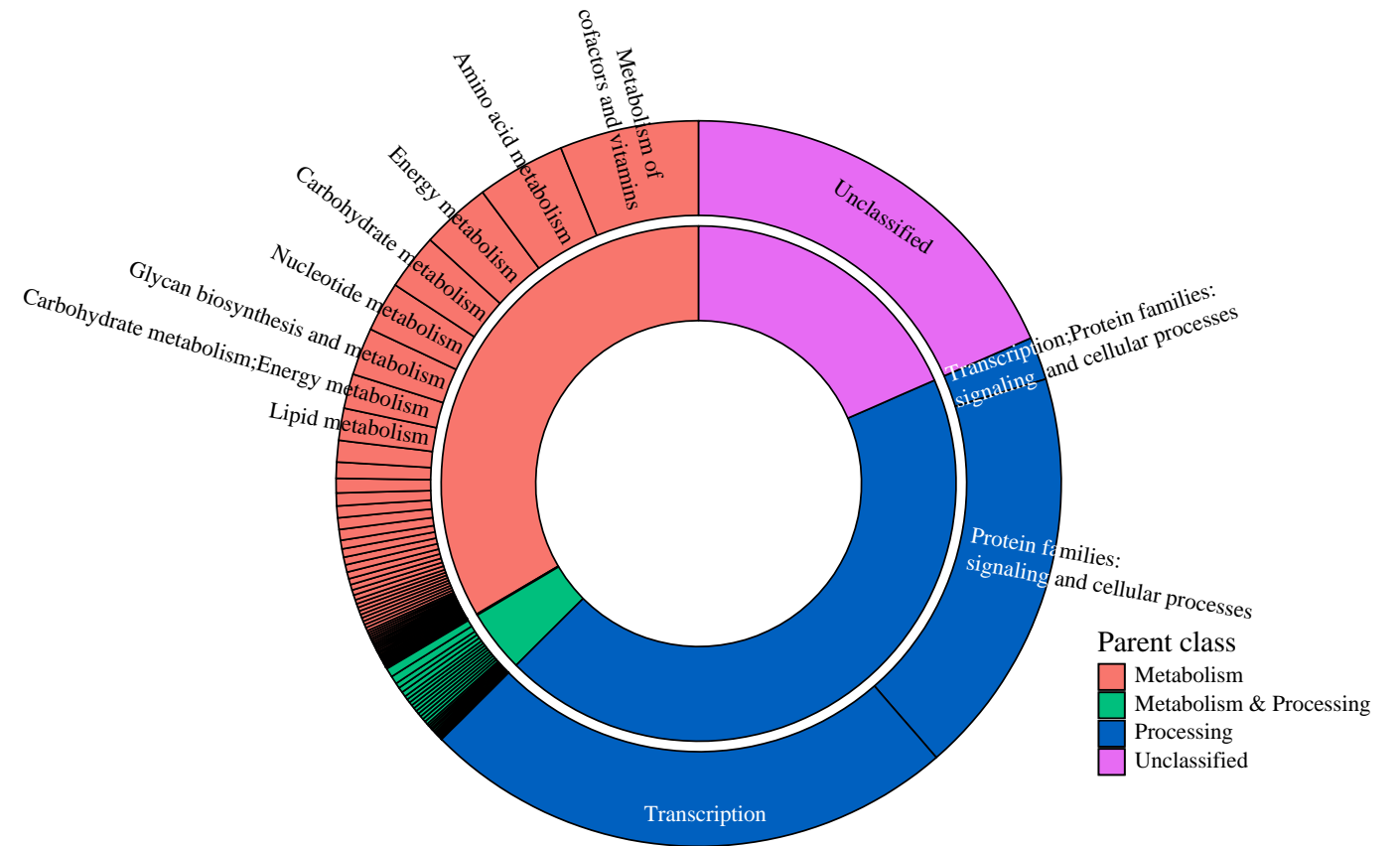
- Sponges exert firm control over their microbiome;
  - Only 49 ASVs across all specimens.
- Dominance of Proteobacteria, Nitrospinaceae and Dadabacteriales.



# Microbiome

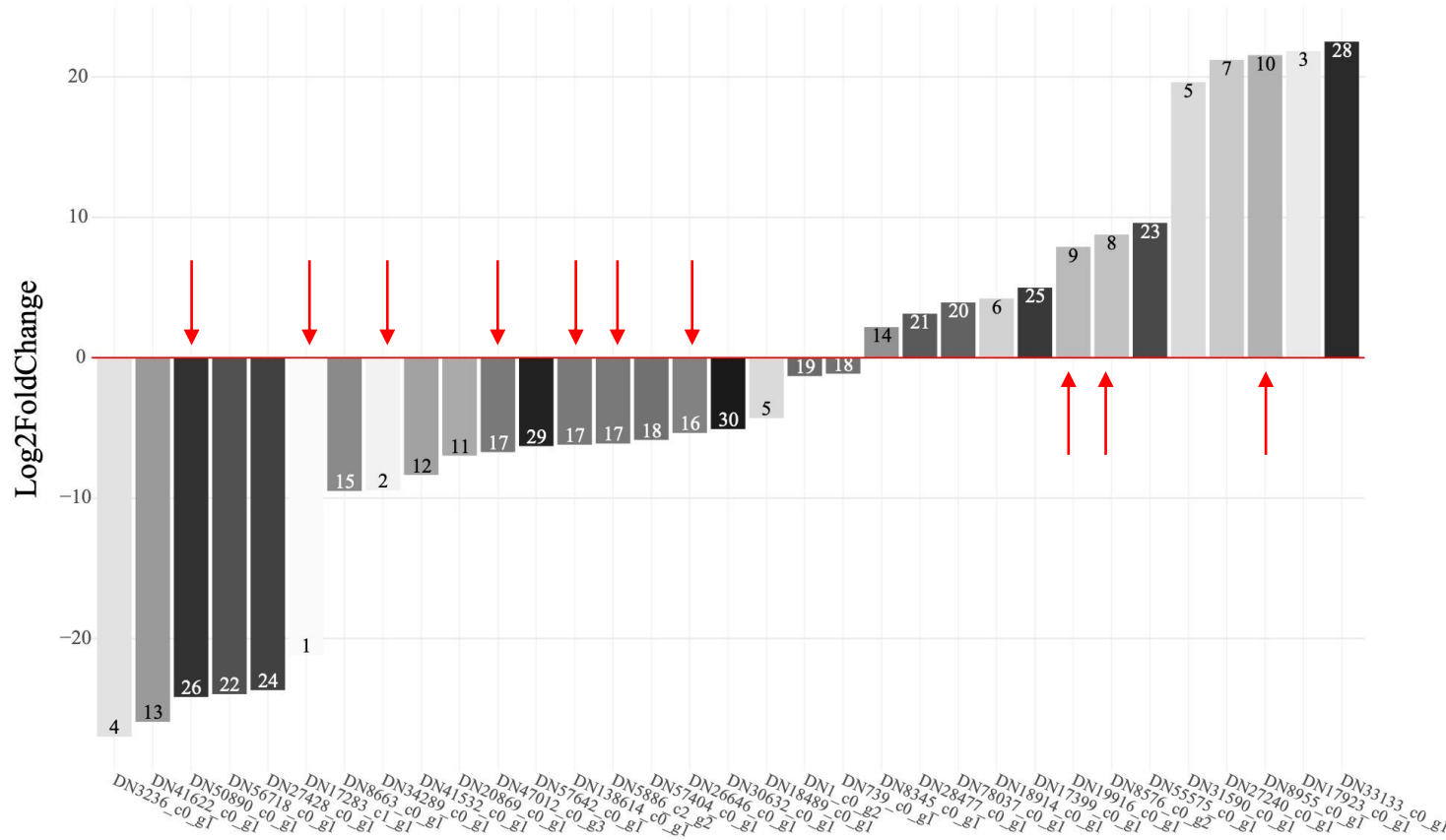
## Functional profile

- Sponges often rely on their microbiomes for synthesizing vitamins and for carbon metabolisms.
- Dominance of KOs responsible for:
  - Cofactors and vitamins metabolism
  - Energy & carbohydrate



Permutational analysis of variance per data source  
across the fourth root of distance from the pen

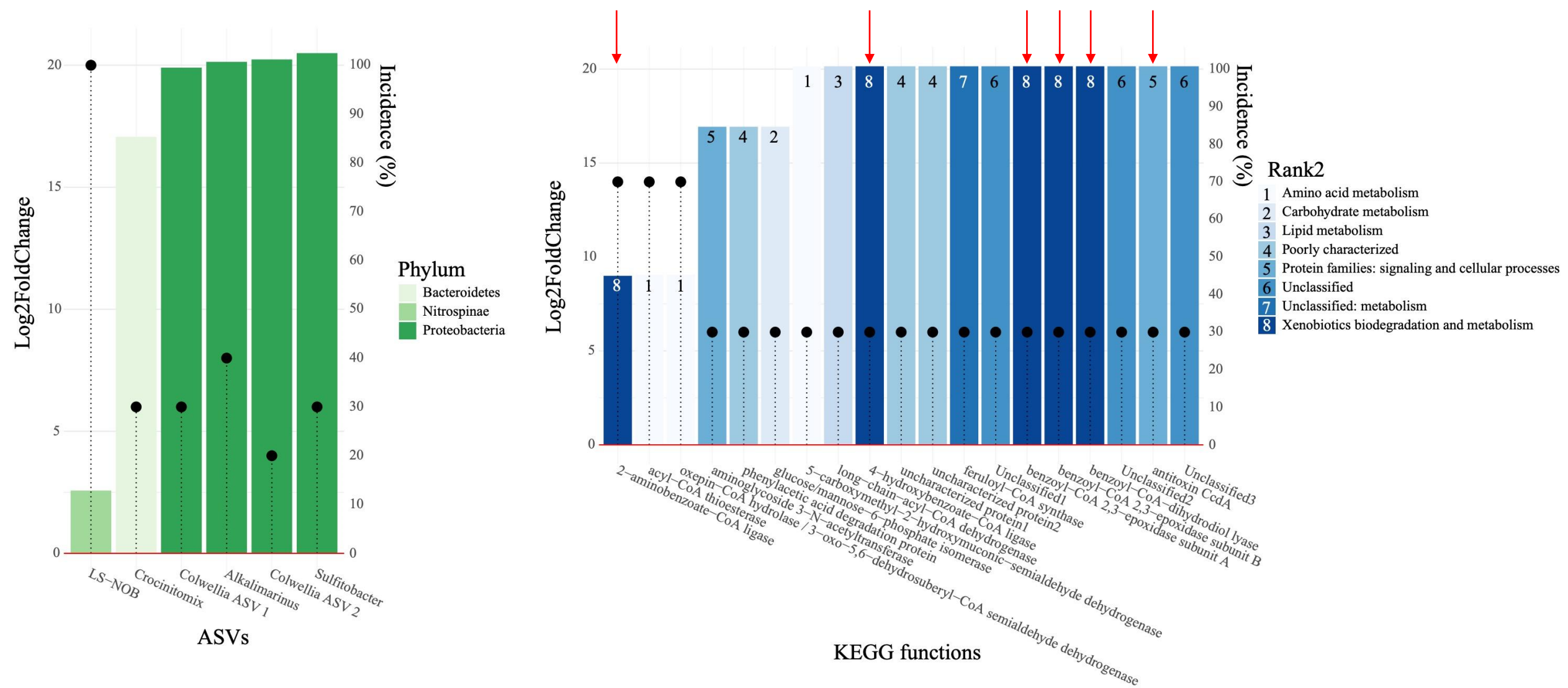
Data type	Terms	Df	MeanSqs	F.Model	R <sup>2</sup>	p.value
mRNA	Distance	1	78917	1.029	0.093	0.264
	Residuals	10	76698		0.907	
16S rRNA (ASVs)	Distance	1	31.831	0.1893	0.129	0.279
	Residuals	8	26.778		0.871	
16S rRNA (KOs)	Distance	1	3307.6	0.941	0.105	0.443
	Residuals	8	3514.8		0.895	
Fatty acids	Distance	1	26.056	5.02	0.386	<b>0.02</b>
	Residuals	8	41.528		0.614	
Stable isotopes	Distance	1	14.954	1.4913	0.157	0.28
	Residuals	8	10.027		0.843	



mRNA contigs

Differentially expressed genes





# Microbial indicator taxa and functions

# Take home message

- *Polymastia* appear more resilient to organic enrichment than previously thought;
- Future studies should consider investigating the effects over longer exposures (ca. 1-3 years);
- Several potential indicators of fish farm activities identified:
  - genes associated to cell activity and growth, and cell apoptosis;
  - microbial taxa with functions responsible for anti-toxin and xenobiotic biodegradation;
- Additional research necessary to validate these putative indicators for uptake in benthic monitoring surveys.

