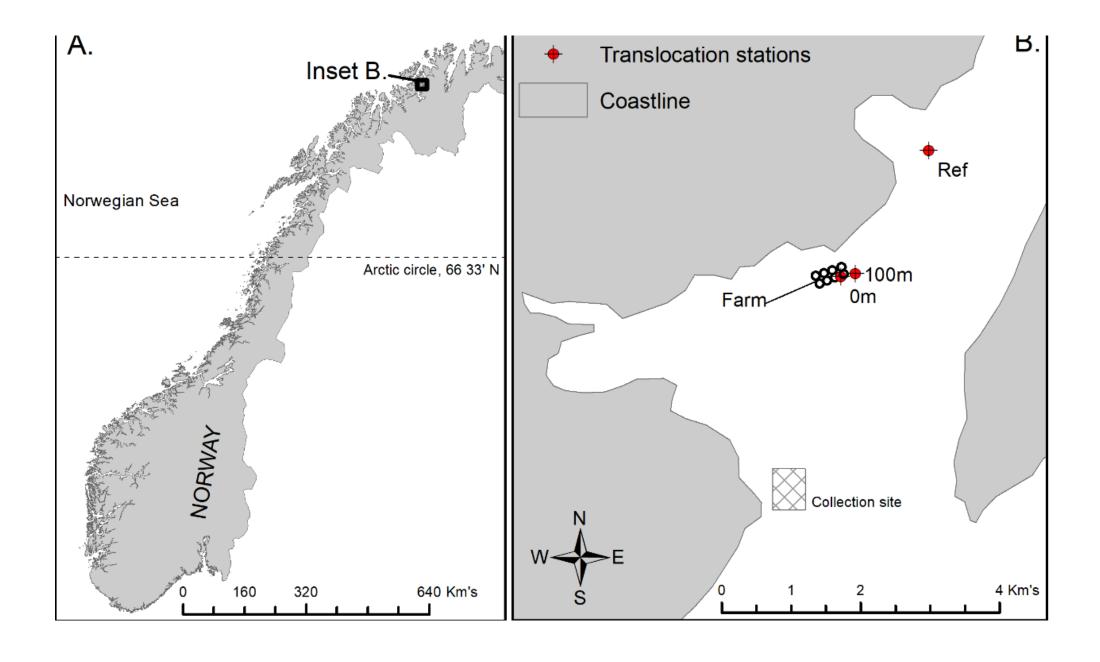


Effects of fish farm activities on sessile benthic taxa and their associated microbiota: A case study with *Polymastia sp*.

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.

# layer nformation

### Gene expression

Microbiome

Fatty acids

Stable isotopes

#### Specific objectives

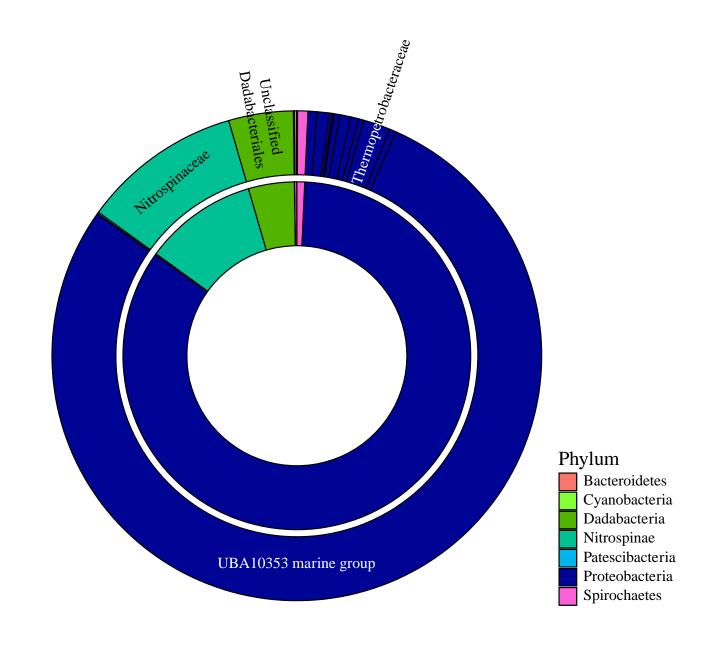
Characterize *Polysmastia*'s microbiome, fatty acid and stable isotope profiles;

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

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

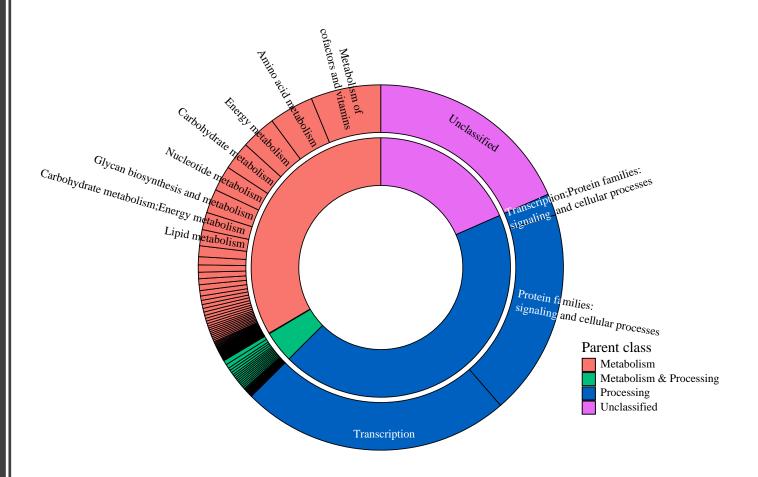
## Microbiome Taxonomic profile

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



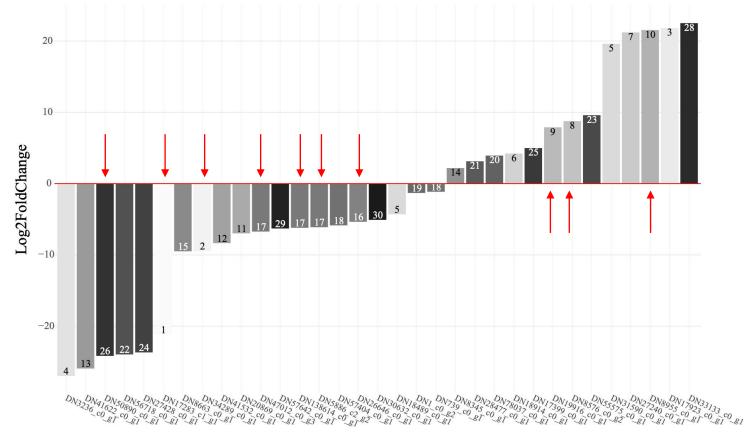
## Microbiome Functional profile

- 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	$\mathbb{R}^2$	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	0.02
	Residuals	8	41.528		0.614	
Stable isotopes	Distance	1	14.954	1.4913	0.157	0.28
	Residuals	8	10.027		0.843	

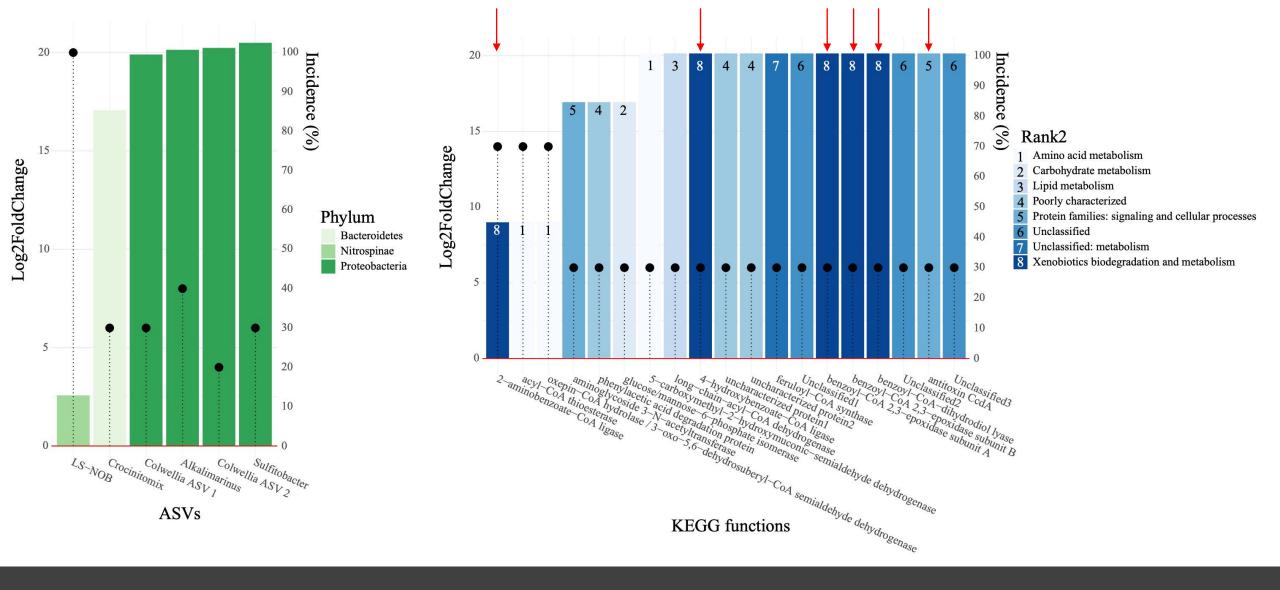


#### Protein / Gene

- 1 40S ribosomal protein S29
- 2 40S ribosomal protein S5
- 3 AMOP domain protein
- 4 Androgen-induced gene 1 protein
- 5 ANK REP REGION domain-containing protein
- 6 ATP12-domain-containing protein
- 7 Calx-beta
- 8 Caspase-3
- 9 Cytochrome c oxidase subunit 1
- 10 death domain
- 11 Eukaryotic translation initiation factor 5B
- 12 Ferritin
- 13 Fibrinogen-like molecule
- 14 Fibronectin type III domain
- 15 Helicase ATP-binding domain-containing protein
- 16 L9 (rRNA binding;structural constituent of ribosome)
- 17 Large subunit ribosomal ribonucleic acid
- 18 Mothers against decapentaplegic homolog
- 19 Pre-mRNA-processing ATP-dependent RNA helicase prp11
- 20 Predicted protein
- 21 Protein BMH1
- 22 Putative collagen and fibronectin-binding protein FneE
- 23 Putative structural protein
- 24 S-crystallin SL11
- 25 Sema domain-containing protein
- 26 Small nuclear ribonucleoprotein Sm D2
- 28 transmembrane protein 14C-like
- 9 Trigger factor
- 30 TYR\_PHOSPHATASE\_2 domain-containing protein

mRNA contigs

Differentially expressed genes



## 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.

