

Culturing mussels near fish cages, lessons learned towards the future implementation of Integrated Multi-Trophic Aquaculture (IMTA) in the Galician Rías



Jade IRISARRI*, María José FÉRNANDEZ-REIRIZ, Uxío LABARTA

* jadeirisarri@iim.csic.es -Instituto de Investigaciones Marinas (IIM-CSIC), Vigo, Spain



1. INTRODUCTION

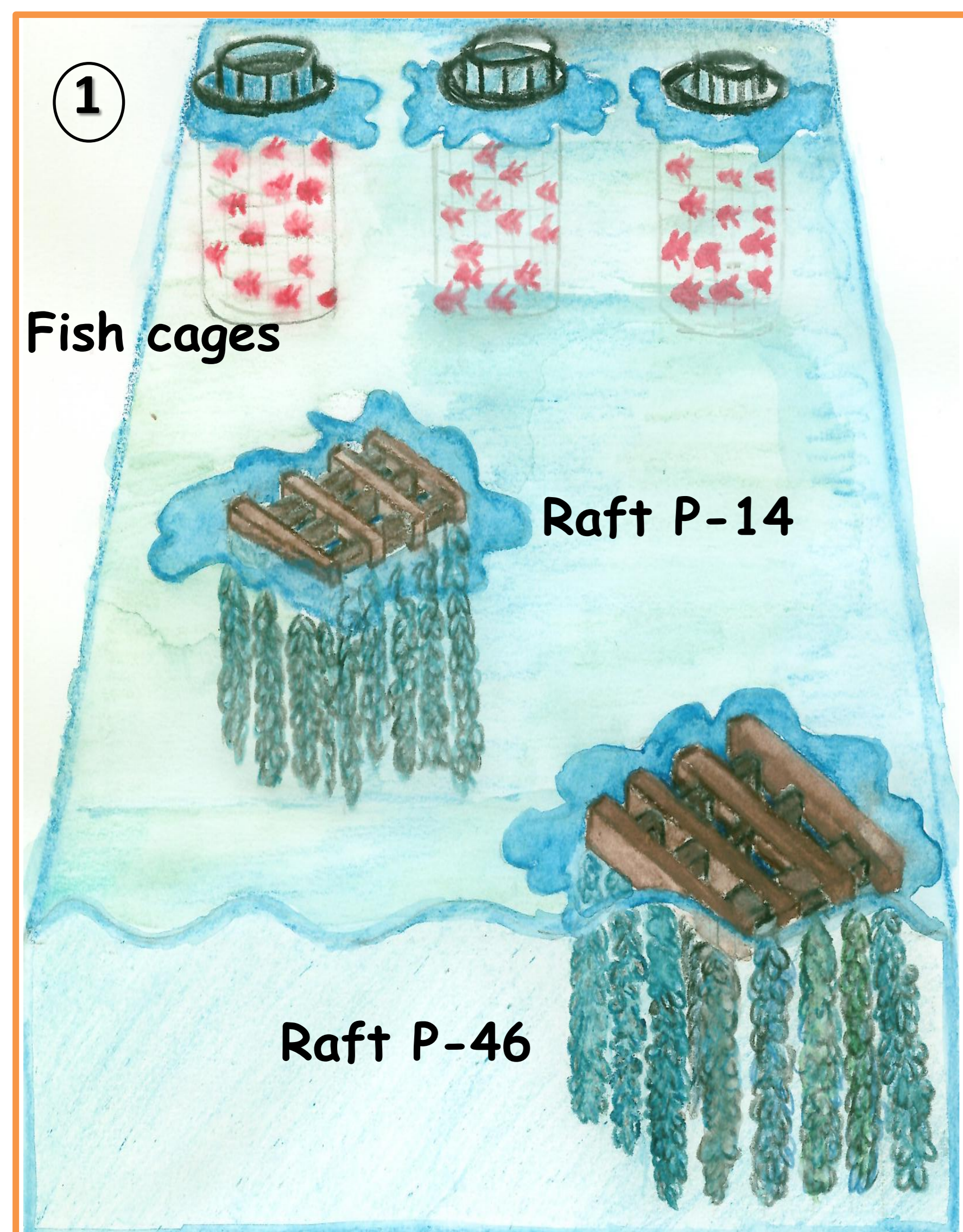
Mussels are potential biomitigators of finfish uneaten feed particles when reared together in **Integrated Multi-Trophic Aquaculture (IMTA)**, a system in which waste from high trophic levels is potentially recycled by extractive species.

Objective: To study if mussels *Mytilus galloprovincialis* cultured near fish cages:

- 1) Increased their energy available for growth and reproduction: **Scope for Growth (SFG)**
- 2) Enhanced the **biochemical reserves** (proteins, carbohydrates, lipids) and assimilated **fish feed fatty acid (FA) biomarkers** in the mantle, digestive gland and feces
- 3) Showed greater **growth rates** and **Condition Index**

These physiological, biochemical and biometric ecological indicators were compared with those of mussels cultured distant from the net-pens.

2. MATERIALS AND METHODS

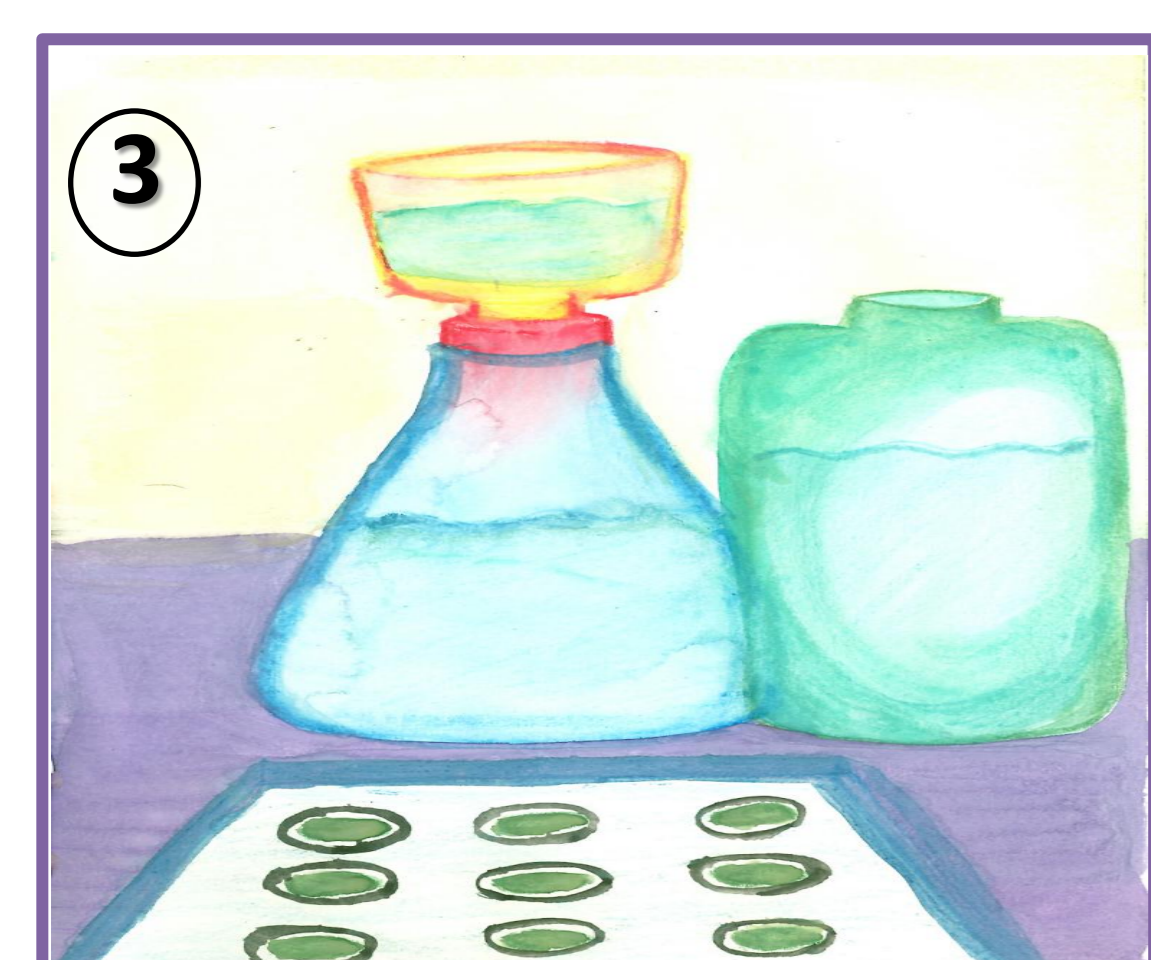


Mussels were sampled from a raft near (170 m N) and further (550 m N) from fish cages in Ría Ares-Betanzos (Galicia, NW Spain).

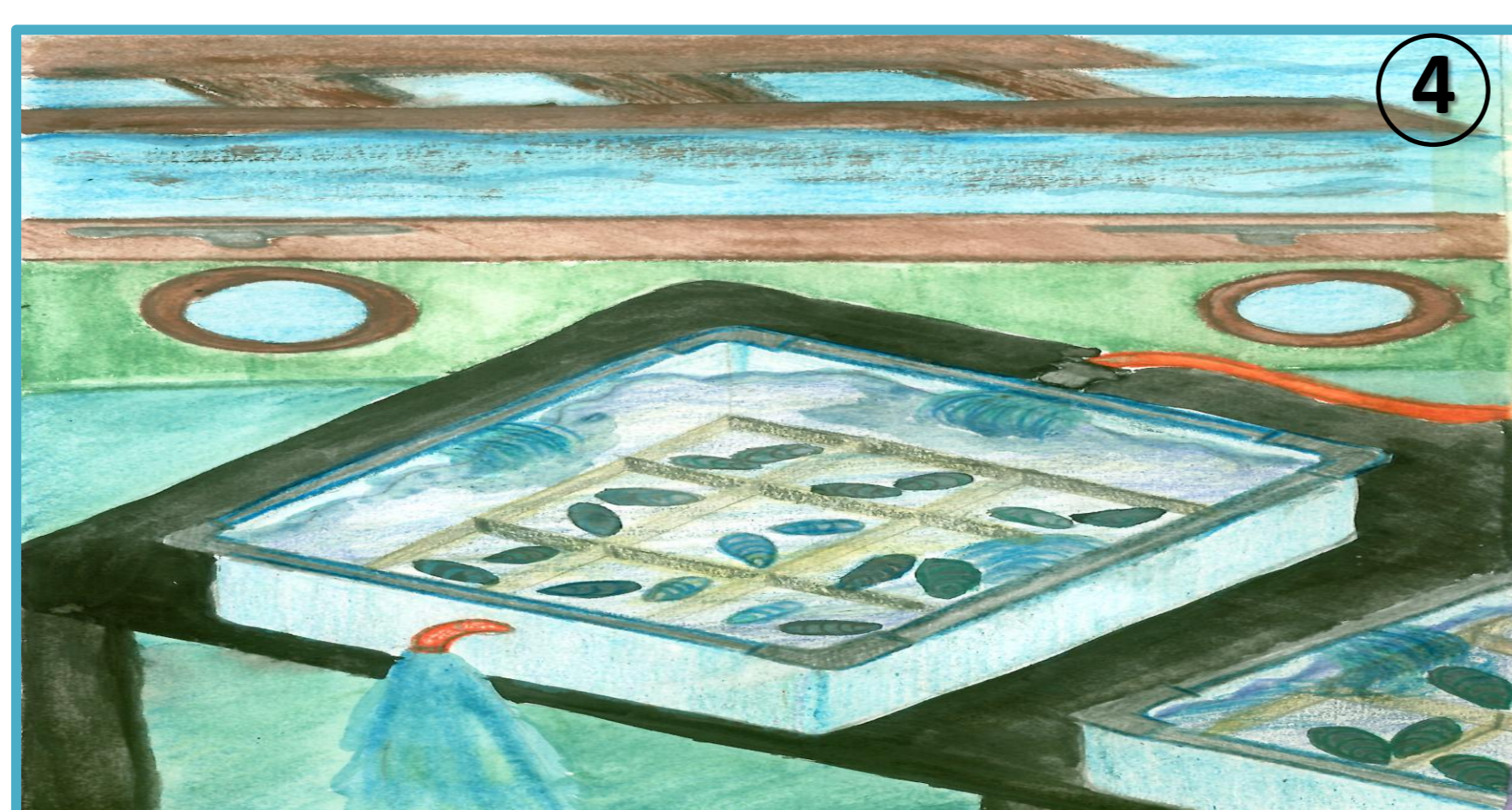


Physiological energetics, proximate composition and FA analyses were performed seasonally.

Growth rates were measured at 1 and 6 m depth during 9 months from the onset of the culture



Seston was filtered for particulate, chlorophyll, proximate and FA analyses

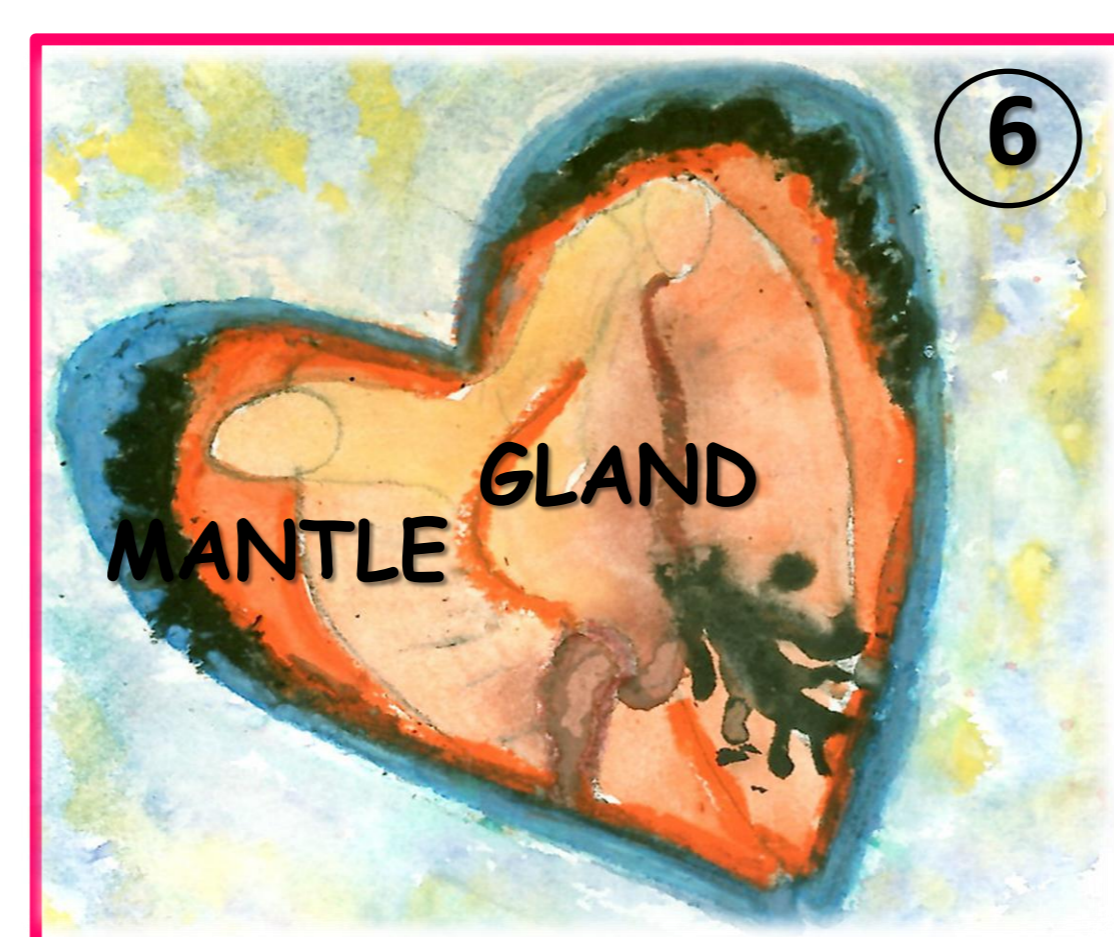


Mussels' feces were collected to determine the absorption efficiency. We also analyzed the proximate and FA composition of the feces



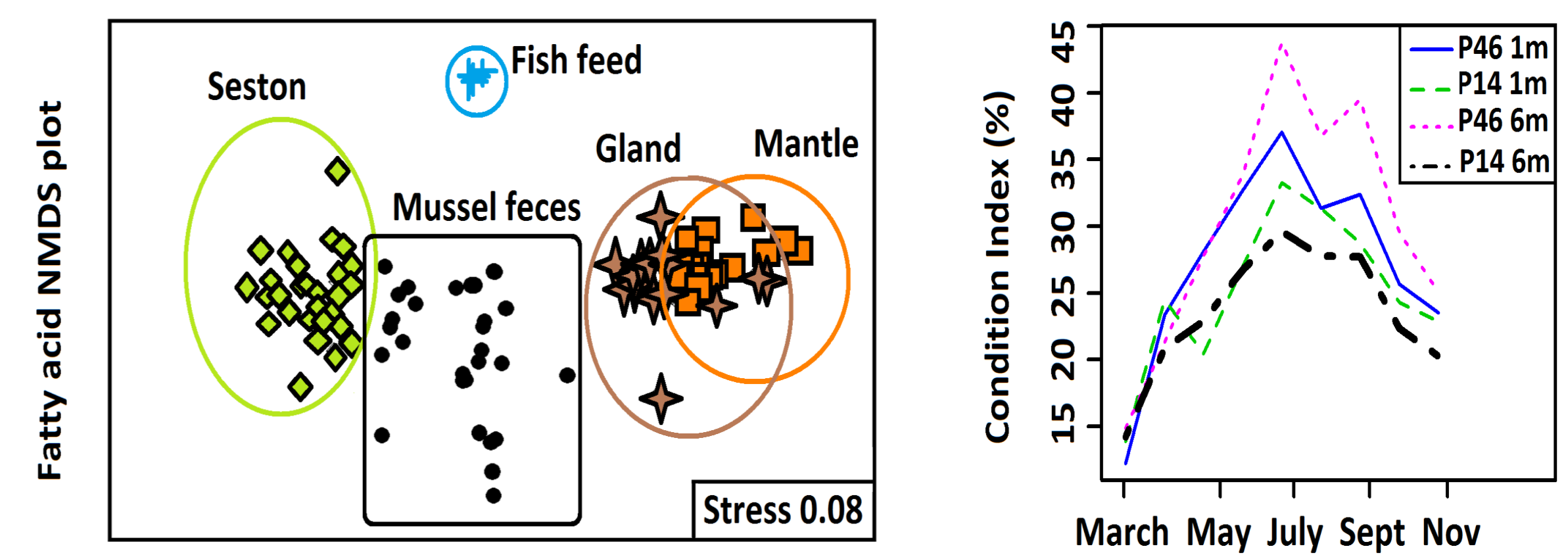
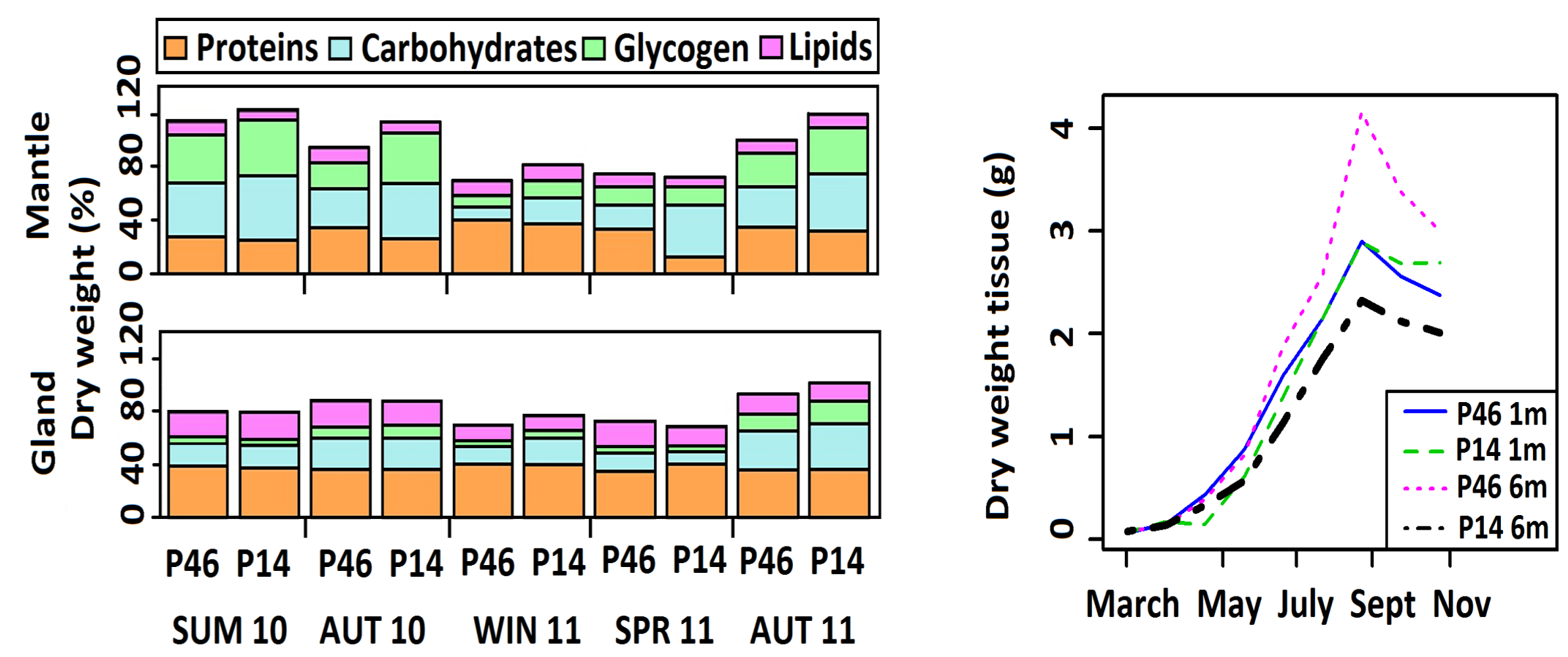
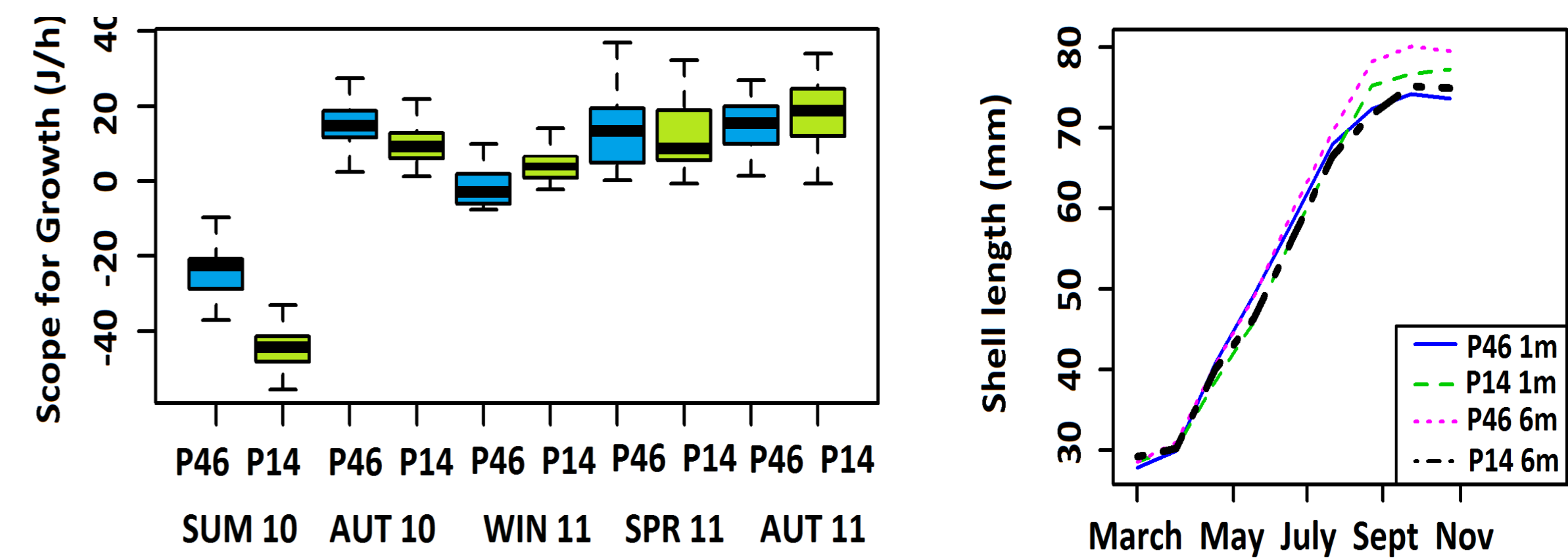
Clearance rate was determined with natural seston from 3 m depth. We also measured the ammonia excretion and respiration rate.

Physiological rates were integrated to calculate the SFG.



The digestive gland and the mantle were dissected for proximate and FA analyses.

3. RESULTS AND DISCUSSION



Feeding conditions

The lack of meaningful increases in organic particles or chlorophyll near the fish pens at 1, 3 and 6 m depth suggested that mussel should be cultured at shorter distances from fish cages. Fish effluents seemed to be diluted by energetic currents ($2.5-13 \text{ cm s}^{-1}$) at 170 m. In addition, a low stock of fish biomass (450 tons) may supply limited nutrients for a high stock of bivalves (4000×10^3 mussels raft⁻¹).

Physiological energetics & growth

The comparable SFG, shell length, tissue weight and Condition Index at both mussel rafts suggested that fish nutrients constituted a negligible energetic input for shellfish. Resuspension events at the raft near the fish cages during autumn-winter storms significantly reduced the food quality and subsequent absorption of nutrients in the mussels' gut. The reduced absorption seemed to be compensated by enhanced clearance rate.

Proximate composition & FA markers

Mussels showed similar composition, excepting for lower lipids and proteins during resuspension events. There was no evidenced of assimilation of fish feed fatty acid markers in the seston, mantle, digestive gland and feces near the fish cages. Mussels reflected the seasonal fluctuations in the fatty acid composition of the seston.

5. CONCLUSIONS

1. The **distance** between mussels from the fish farm, **stocking density** and **seston characteristics** should be considered for the future implementation of IMTA in Galician Rías.
2. Fish effluents could be exploited by mussels feeding in ecosystems with **lower seston quality** (<50% organic content).