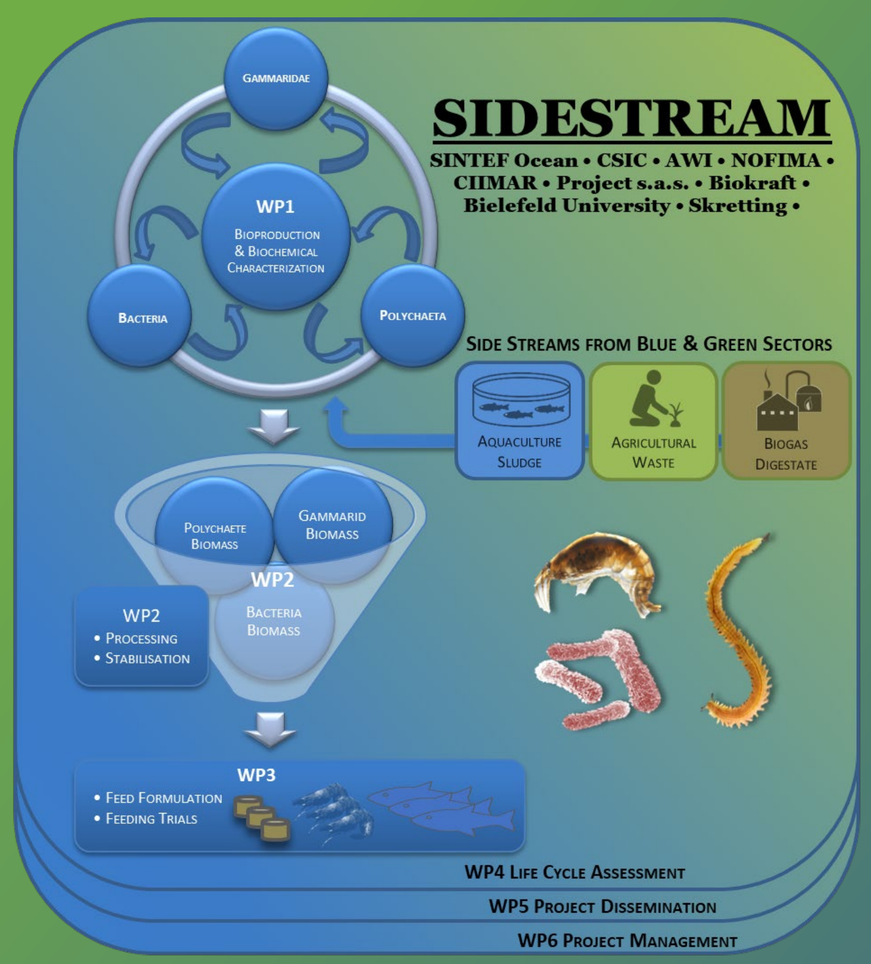
Effects of Temperature, Salinity and Diet on Fatty Acid Composition of the Ragworm *Hediste diversicolor* (Annelida: Nereidae)



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Introduction

There is an urgent need in food and feed production to change from linear systems towards circular, recycling based solutions. Many wastes or rest raw materials from linear systems are in fact valuable side streams containing precious compounds. The common ragworm *Hediste diversicolor* is an omnivorous, burrowing polychaete showing high potential as an extractive species in IMTA systems.

It has recently been shown that this species has the capacity for endogenous production of omega-3 long-chain polyunsaturated fatty acids (Kabeya, et al., 2020), however it is yet not understood how environmental conditions affect this ability. We conducted two sets of experiments to assess the combined effects of diet, temperature and salinity on total body fatty acid composition in *H. diversicolor* juveniles.

Materials and Methods

To investigate the effects of diet and temperature on fatty acid (FA) composition of *H. diversicolor*, worms were fed mixes of solid biogas digestate (SBD) and salmon aquaculture sludge (AS) along a 4-step feed gradient ranging from pure SBD to pure SS, and a 5-step temperature gradient ranging from 5.8 to 17.1 °C, for 15 days, using fish feed (FF) as a control.

A second experiment was conducted to investigate the effects of salinity and temperature on the same variables. Here, the worms were fed the diet which yielded the highest growth rates in the first experiment (33:66 % SS:SBD) along 5-step salinity- and temperature gradients ranging from 5 to 40 ppt and 7.7 to 17.9 °C, respectively, for a duration of 28 days.

In both experiments, worms were fed isonitrogenous diets equalling 30 % of the worms' total body nitrogen per day (Wang et al., 2019).

Results and Discussion

- No temperature- nor salinity-driven segregation patterns could be identified in the FA profiles of the polychaetes, however a clear diet-driven segregation was found between worms fed lipid-rich fish feed (control) and lipid-poor AS and SBD diets.
- The fatty acid composition of polychaetes fed side stream diets showed high concentrations of EPA (14–19%) comparable to the polychaetes fed fish feed (13%).
- Further, the percentage of PUFAs in the worms was high for both (38–40%) diets and comparable to worms fed fish feed (46%).
- DHA was higher in polychaetes fed fish feed (5%) than in polychaetes fed aquaculture sludge and SBD diets (1–2%).

The pronounced differences in fatty acid composition found in the different feeds were not as pronounced in the polychaetes reared on these diets (Fig. 1). We here demonstrated that short-term (≤4 weeks) alterations of environmental parameters have neglectable effects on the fatty acid profile in wild caught *H. diversicolor* juveniles.

In conclusion, our results indicate that the major influence on fatty acid composition in *H. diversicolor* is diet.

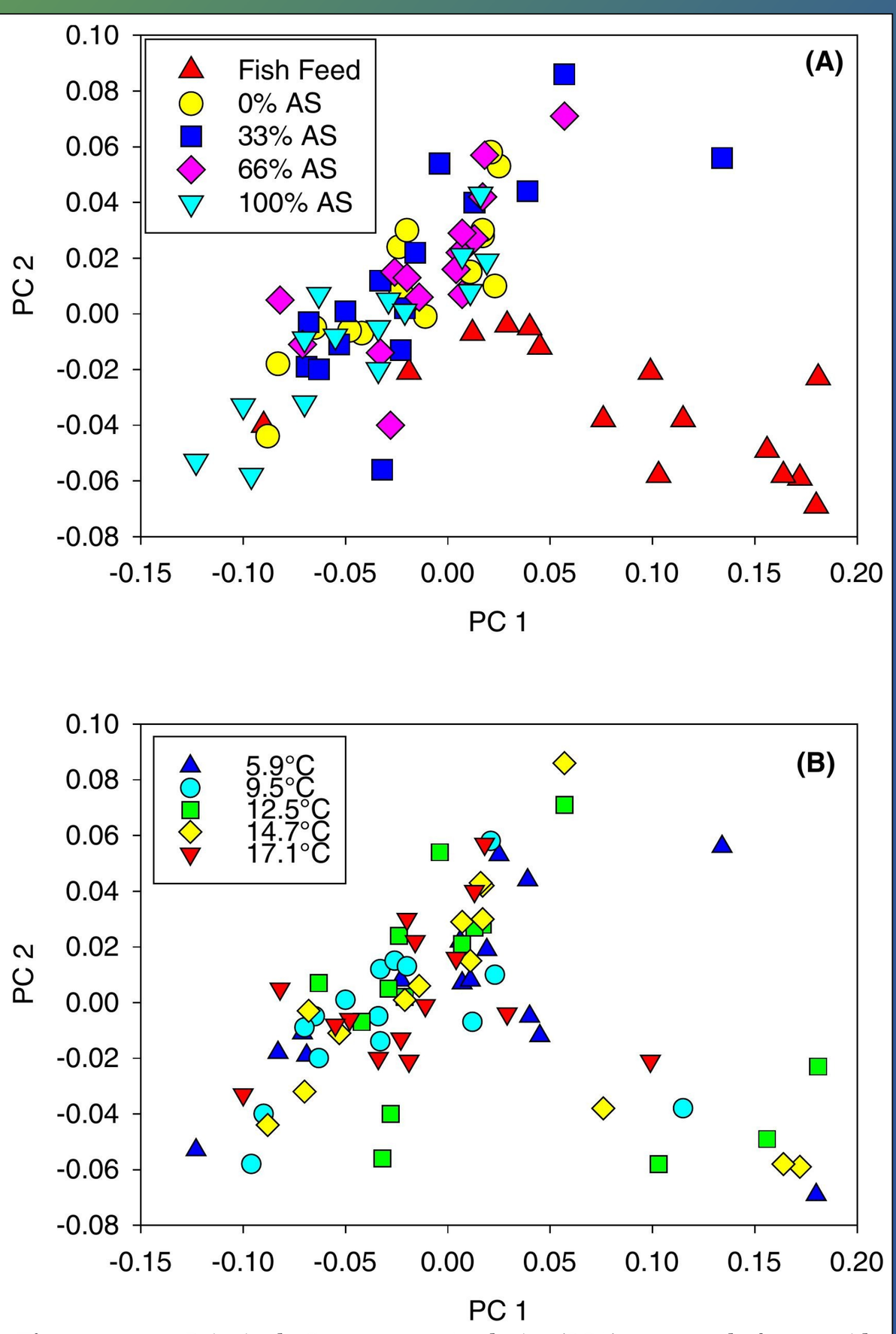

Figure 1: *: Principal Component Analysis (PCA) on total fatty acids composition of H. diversicolor fed different diets at different temperature visualized by (A) feed type (% AS in the diet or fish feed and (B) by the five different rearing temperatures (°C). PC1= 56%, PC2= 14%*

Acknowledgements

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References

Kabeya, N. et al. "Unique fatty acid desaturase capacities uncovered in *Hediste diversicolor* illustrate the roles of aquatic invertebrates in trophic upgrading." Philosophical Transactions of the Royal Society B 375.1804 (2020): 20190654.

Wang, H. et al. "Potential of the polychaete *Hediste diversicolor* fed on aquaculture and biogas side streams as an aquaculture food source." Aquaculture Environment Interactions 11 (2019): 551-562.