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Effects of temperature and salinity on the blue mussel (*Mytilus edulis*) using biochemical and lipid analyses

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► To cite this version:

Colleen Guinle, Ridho Wiranda Gurning, Tom Roussel, Clément Baratange, Gaëtane Wielgosz-Collin, et al.. Effects of temperature and salinity on the blue mussel (*Mytilus edulis*) using biochemical and lipid analyses. SETAC, Nov 2023, Louisville (Kentucky), United States. hal-04653273

HAL Id: hal-04653273

<https://hal.science/hal-04653273v1>

Submitted on 18 Jul 2024

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CONTEXT AND OBJECTIVES

In a context of climate change and human impact on coastal marine environments, marine organisms are and will be subject to significant variations in their habitat, including variations in seawater temperature and salinity. Among these organisms, the blue mussel (*Mytilus edulis*) is a key species in intertidal ecosystems and is commonly used as a sentinel organism as well as an effective bioindicator in environmental monitoring studies.

The need to detect and assess the effects of environmental stressors has led to the development and application of precise monitoring tools based on biomarker and “omics” methods. The SPECTROBS project aims to develop an alternative and innovative approach based on the use of biomarkers, multiomics, biometry and histology coupled with Raman and near-infrared spectroscopy. In this poster, we focus on the preliminary results obtained from multi-biomarker and lipid analyses.

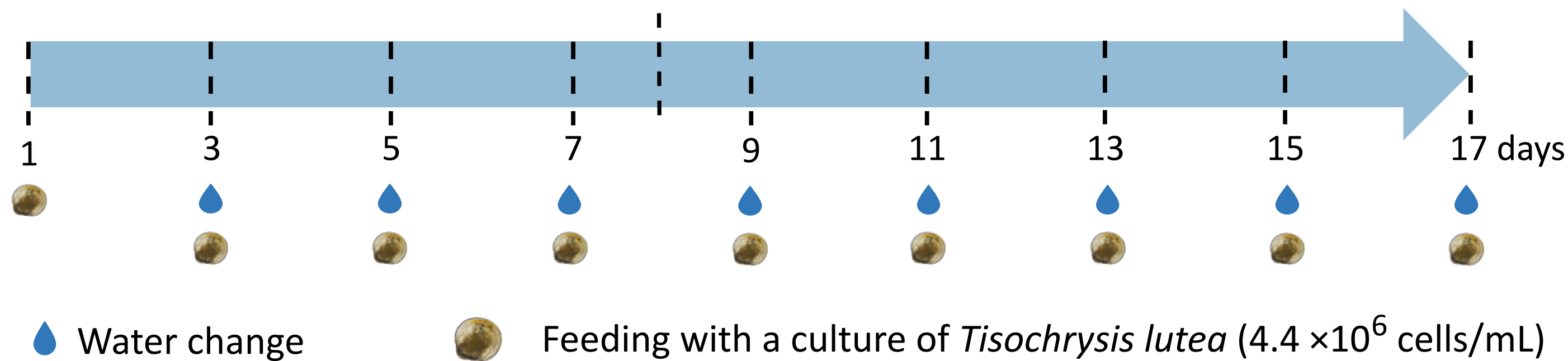
EXPERIMENTAL DESIGN

Acclimation (8 days)

15 tanks (18 L)
18 mussels/tank
Artificial seawater (33 PSU)
17°C
Continuous oxygenation
Photoperiod 12h:12h

Exposure (9 days)

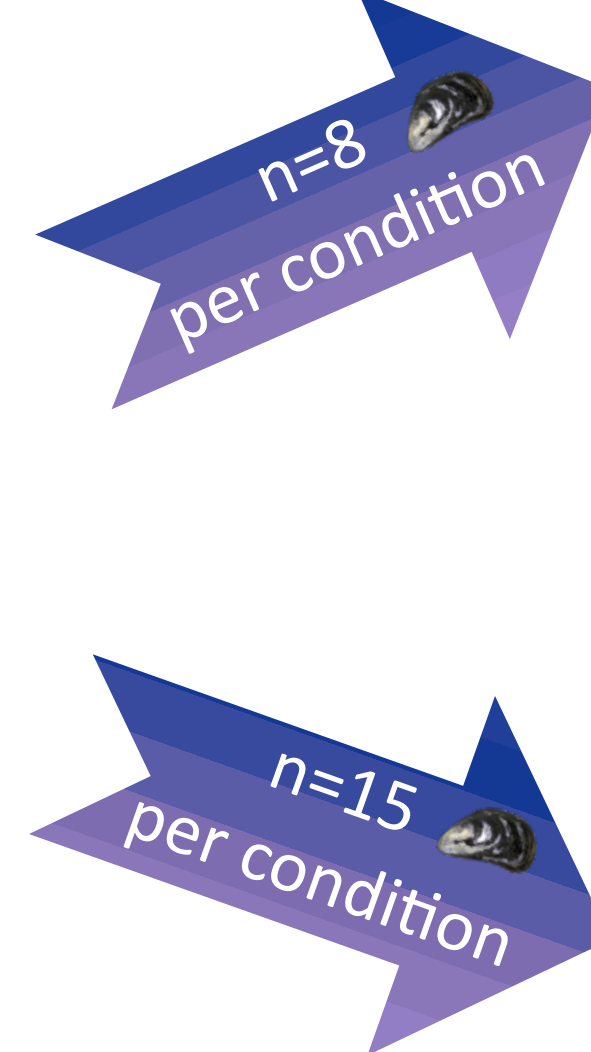
5 conditions (n=3 replicates)
▪ Control (17°C, 33 PSU)
▪ Low warming (20.5°C, 33 PSU)
▪ High warming (23°C, 33 PSU)
▪ Low hyposalinity (17°C, 27 PSU)
▪ High hyposalinity (17°C, 21 PSU)



Immediately frozen in liquid N₂

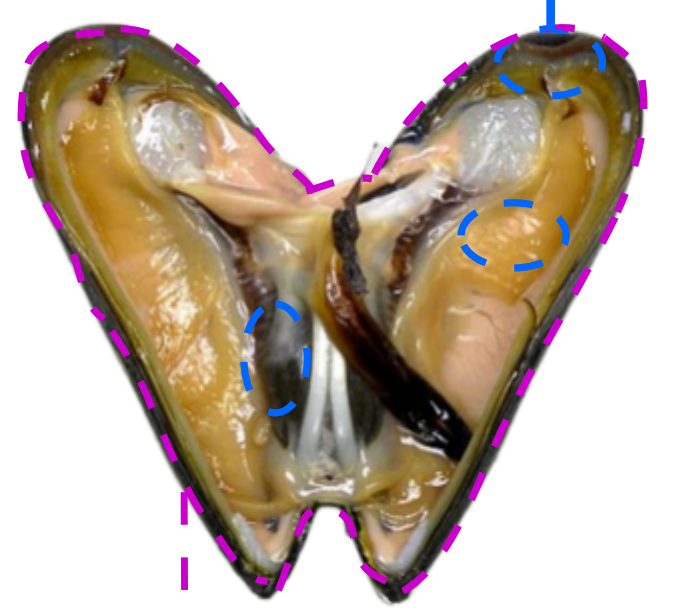


Storage at -80°C until analysis



Digestive gland, gills, mantle

- Catalase (CAT)
- Glutathione-S-Transferase (GST)
- Acetylcholinesterase (AChE)



Whole organism

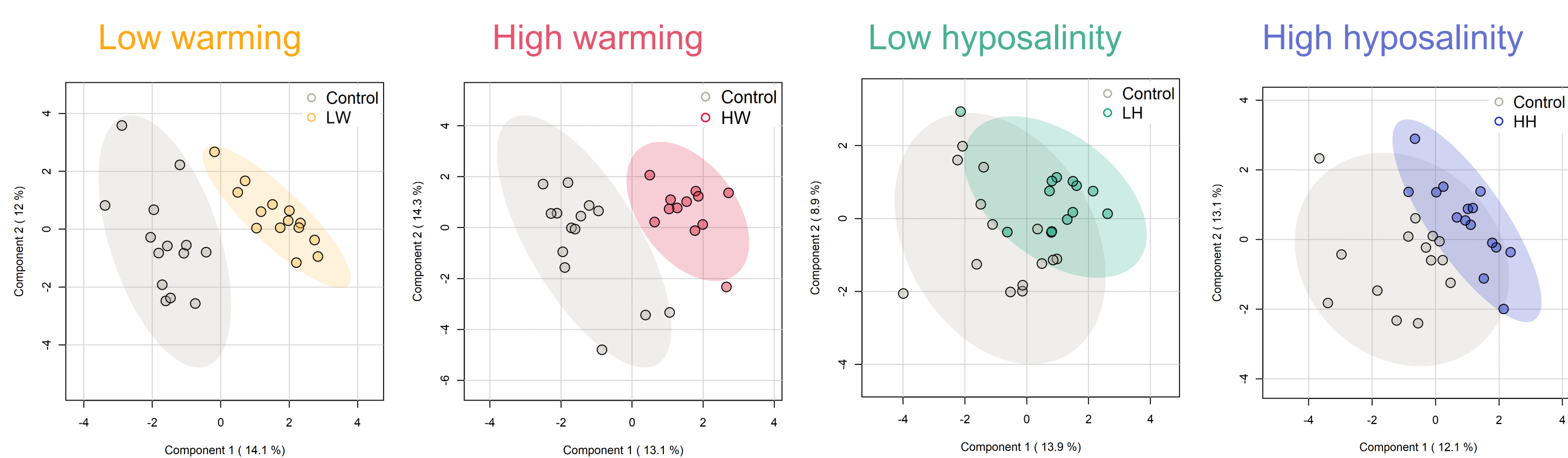
Total lipid content
Fatty acid composition

LIPID ANALYSIS

Total lipid content: no significant effect (mean: 4.4 % mg dry weight)
% in saturated, monounsaturated and polyunsaturated acids: no significant effect (mean: 31.4, 13.7 and 42.3% of total fatty acids, respectively)

Discriminant analysis (PLS-DA) of fatty acid composition

26 fatty acids (FAs) having a proportion higher than 0.5% of total FAs were considered



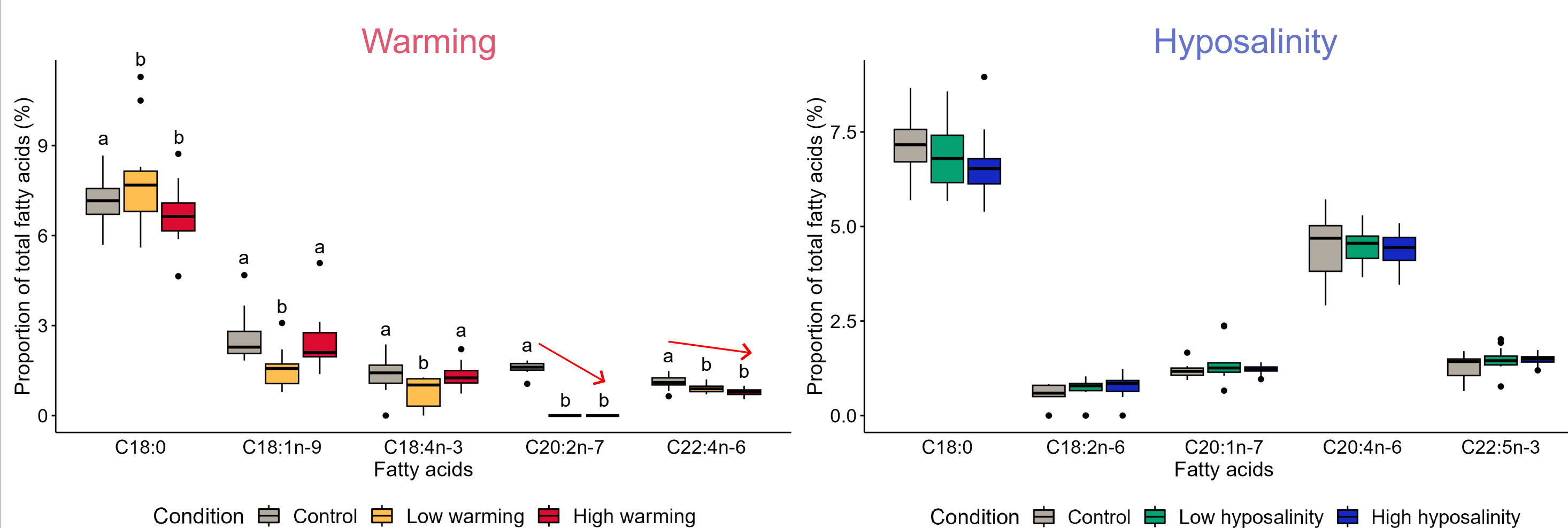
Clear separation between mussels from warming and control conditions

Overlap between mussels from hyposalinity and control conditions

→ Greater effect of warming on fatty acid composition compared with hyposalinity

Proportion of most discriminating fatty acids

The FAs having a Variable Importance in Projection (VIP) score higher than 1.5 were tested for comparisons between conditions

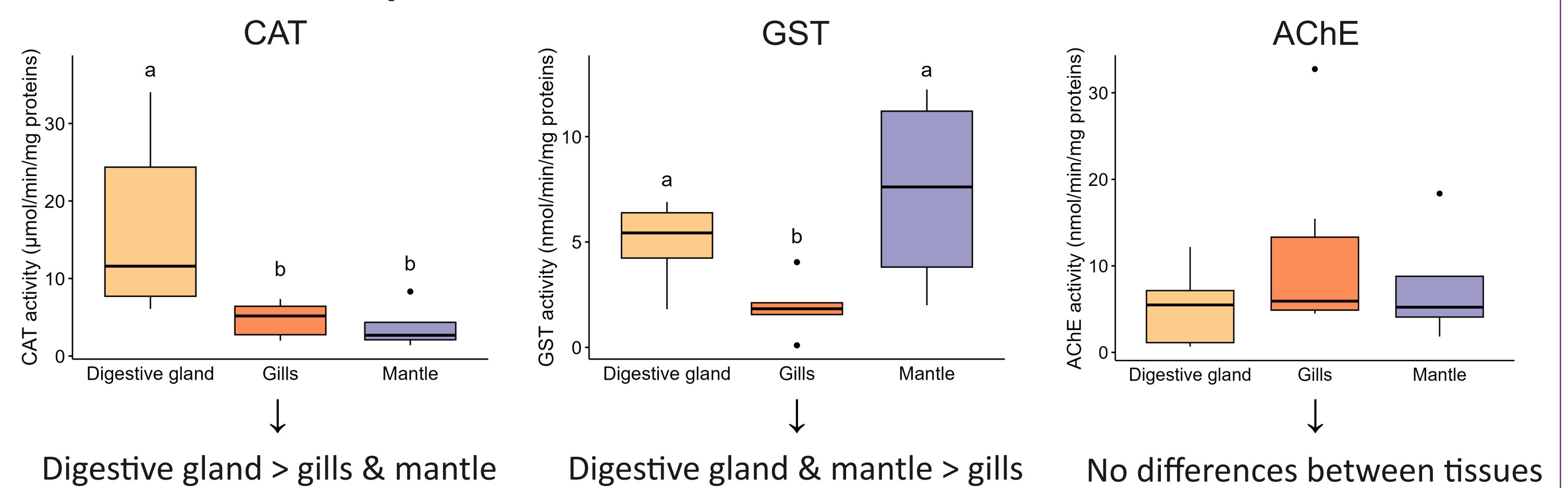


→ Significant changes in fatty acid composition after exposure to warming but not to hyposalinity

→ C20:2n-7 and C22:4n-6 = potential biomarkers of heat stress

BIOMARKER ANALYSIS

Basal levels of enzyme activities in tissues

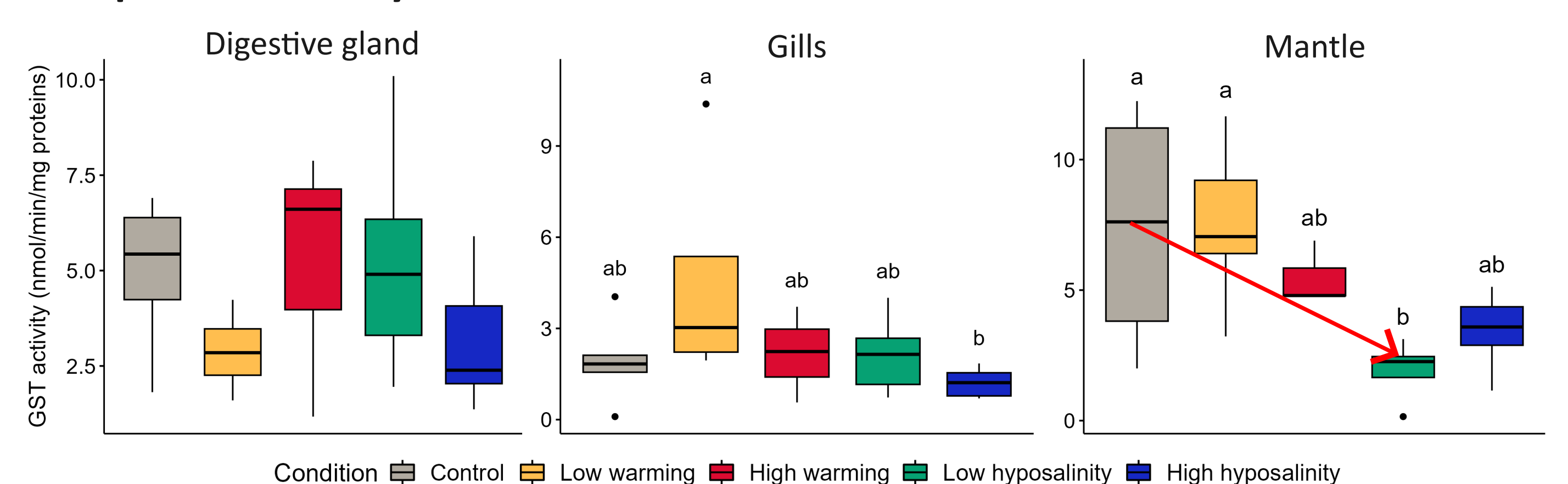


Digestive gland > gills & mantle

Digestive gland & mantle > gills

No differences between tissues

Comparison of enzyme activities between conditions



Significant decrease in GST activity in mantle of mussels exposed to hyposaline stress
CAT and AChE activities: no significant change observed across all tissues

→ No significant induction of antioxidant response (CAT)

→ No significant neurotoxic effect

CONCLUSIONS AND PERSPECTIVES

Our results suggested that thermal and hyposaline stresses have limited impact on the physiology of *Mytilus edulis*, as the species is tolerant to short-term variations in temperature and salinity. Two fatty acids (C20:2n-7 and C22:4n-6) were identified as potential biomarkers of heat stress. Further analyses, such as transcriptomics, metabolomics and spectroscopy, could reveal potential changes in gene expression and lipid metabolism.

