

# Microscale variations in a blue mussel *Mytilus edulis* population: Morphometry and oxidative stress

Korshunova Ekaterina<sup>1,2\*</sup>, Vitra Amarante<sup>2</sup>, Petes Laura<sup>3</sup>, Frantzen Marianne<sup>1</sup> and Nahrgang Jasmine<sup>2</sup>

(1) Akvaplan-niva AS, Fram Centre 9296 Tromsø, Norway

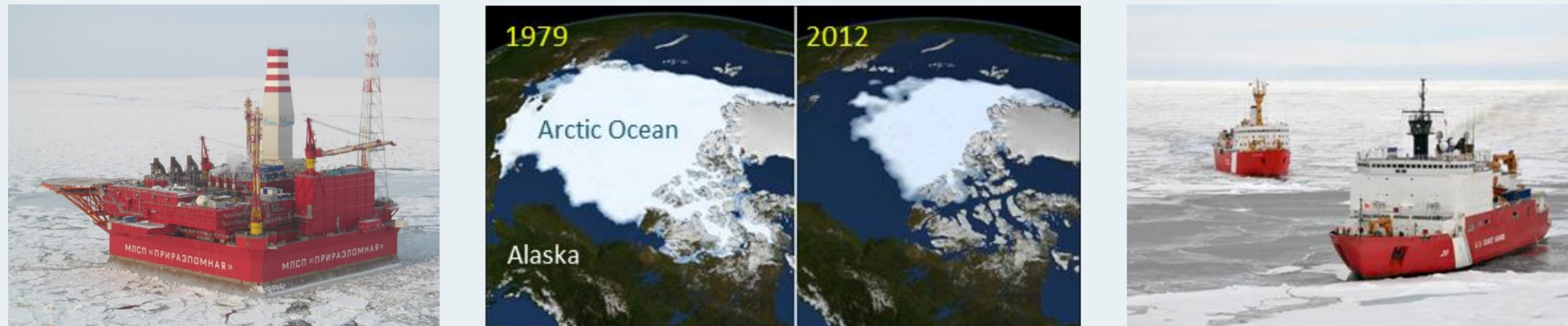
(2) Department of Arctic and Marine Biology, UiT The Arctic University of Norway, Breivika 9037 Tromsø, Norway

(3) NOAA Climate Program Office, 1315 East-West Highway, Silver Spring MD 20910, USA

(\*) Corresponding author: [ekaterina.korshunova@uit.no](mailto:ekaterina.korshunova@uit.no)

## / INTRODUCTION

Anthropogenic activities are increasing in the Arctic and sub-Arctic regions along with an increasing risk for both accidental oil spills and continuous diffuse pollution. In order to implement environmental monitoring programmes in these remote regions, there is a need to select indicator species and study their baseline biological responses to their specific habitats.



Source: NASA

## / MATERIALS AND METHODS

Study site:  
Mussel bed in Kvalsundet



Intertidal and subtidal locations  
(n=15 per location)

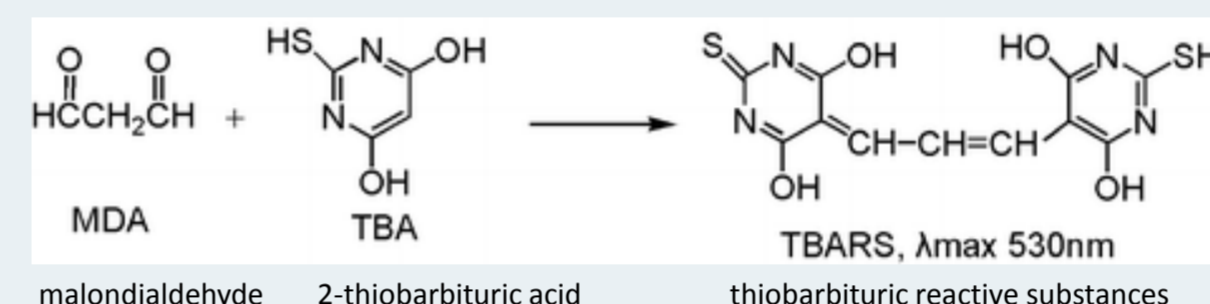


## / THE GOAL OF THE PRESENT STUDY:

Investigate microscale variations in morphometry, oxidative stress (lipid peroxidation) and antioxidants (total carotenoids) in blue mussels (*Mytilus edulis*) within a sub-Arctic bed.

## / BIOCHEMICAL ANALYSES

### 1. Lipid peroxidation (TBARS) in gills, gonads and mantle tissues



Lipid peroxides such as MDA are products of lipid peroxidation which were detected and measured using TBA as a reactant. (Buege and Aust, 1978)

### 2. Total carotenoids in mantle tissues

were extracted according to Desnica et al. (2011)



Picture: Amarante analysing samples

## / MORPHOMETRIC MEASUREMENTS



$$\text{Volume}_{\text{ellipsoid}} = \frac{4}{3} \pi \frac{L \cdot W \cdot H}{2}$$

**Hypothesis 2:** Intertidal mussels have a reduced size due to reduced food availability compared to subtidal mussels.

/ Statistical analysis is in progress.

## / BLUE MUSSELS, *Mytilus edulis*

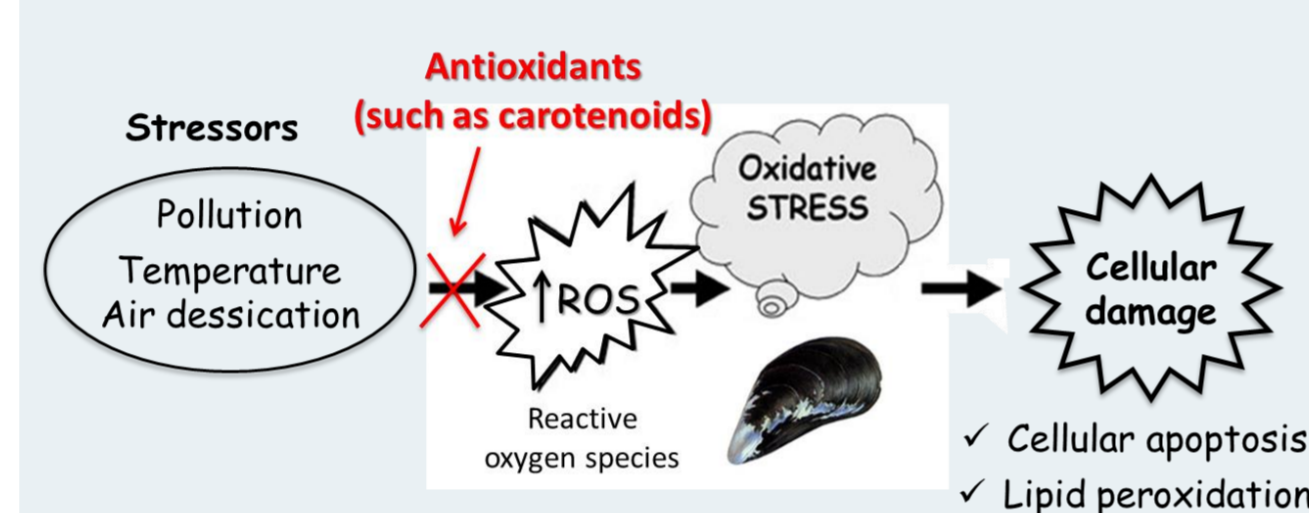
Bivalves are considered excellent bioindicators. Indeed, they are filter feeders, and can accumulate high levels of contaminants.

Intertidal mussels are exposed to:

- Air desiccation
- Fluctuating temperature
- Fluctuation in food availability



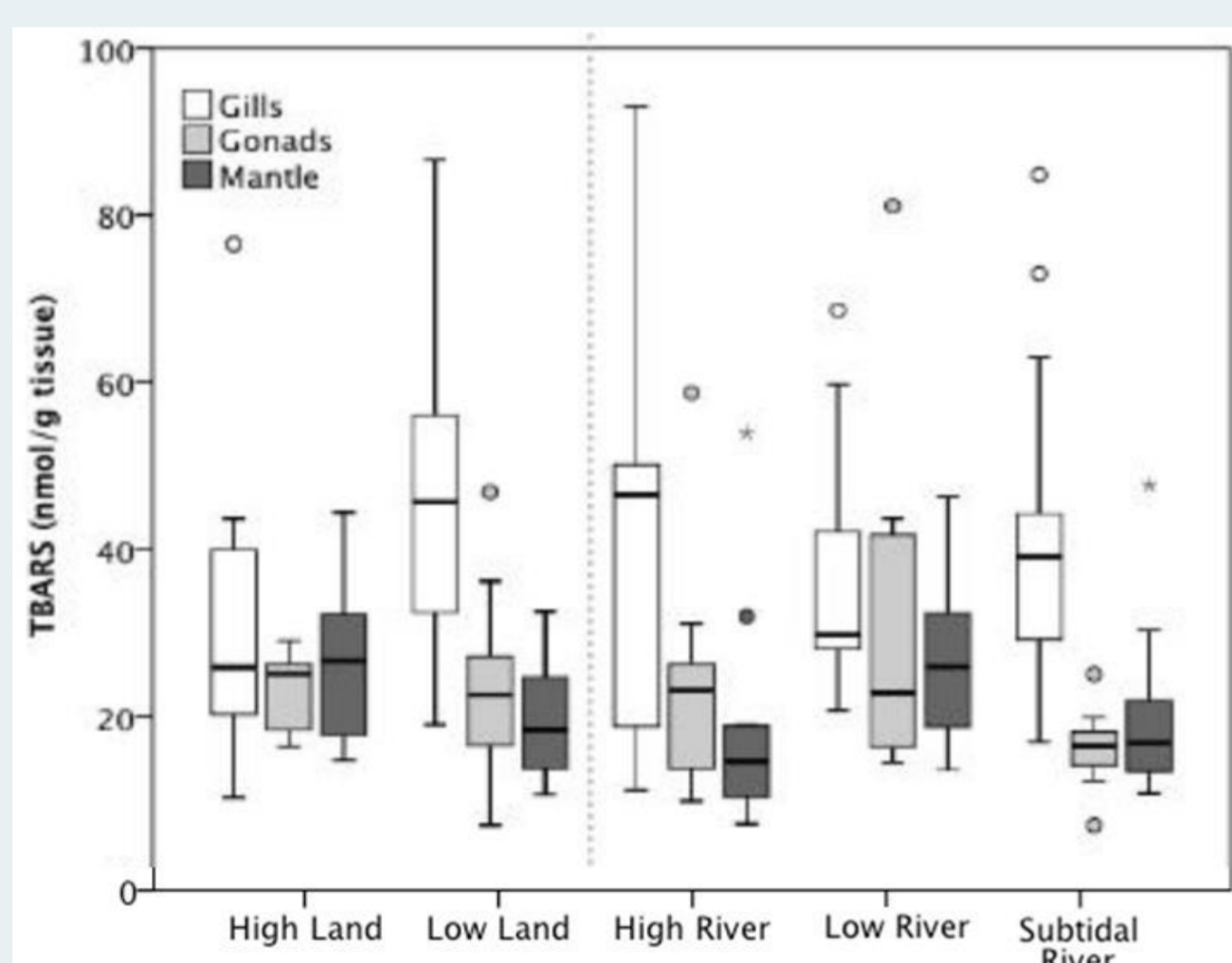
## / DEFENSE AGAINST OXIDATIVE STRESS



**Hypothesis 1:** Intertidal mussels are more exposed to oxidative stress and have therefore elevated carotenoid levels than subtidal mussels.

## / RESULTS AND DISCUSSION

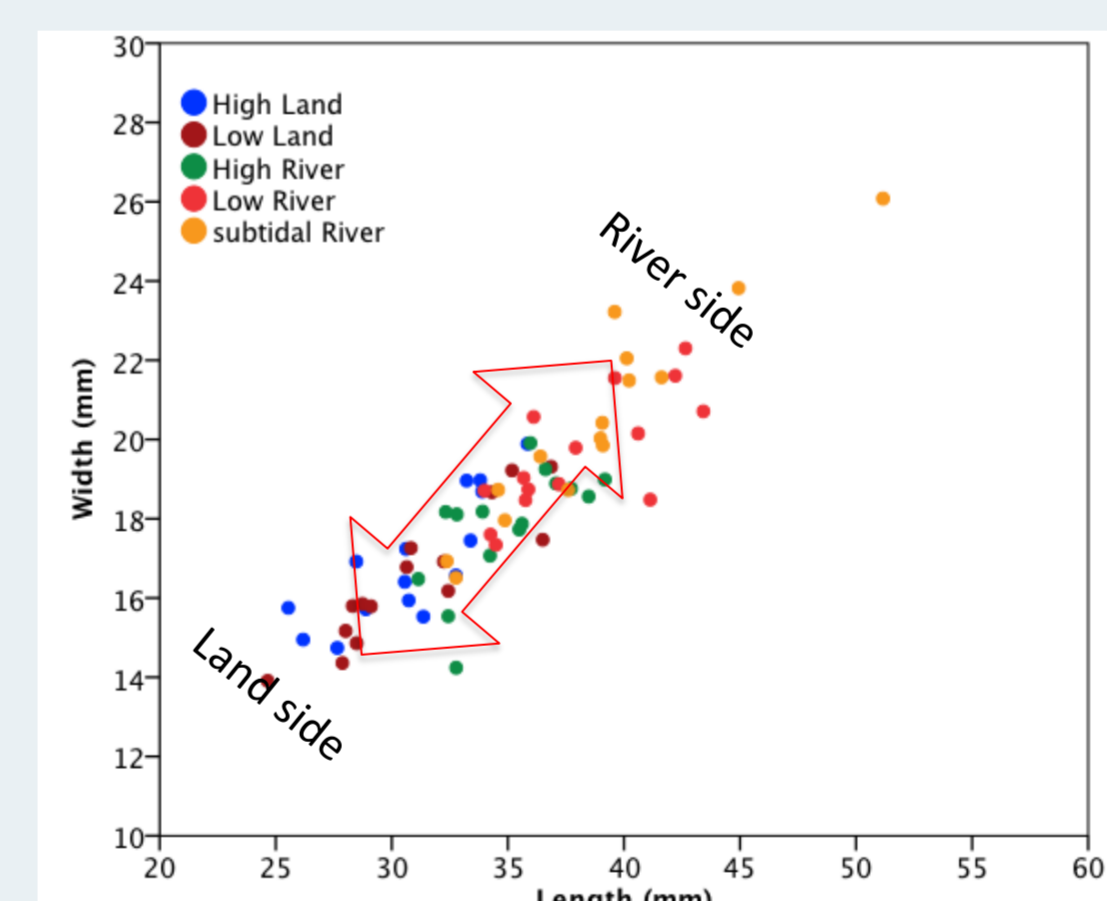
### 1. Lipid peroxide levels in gills, gonads and mantle



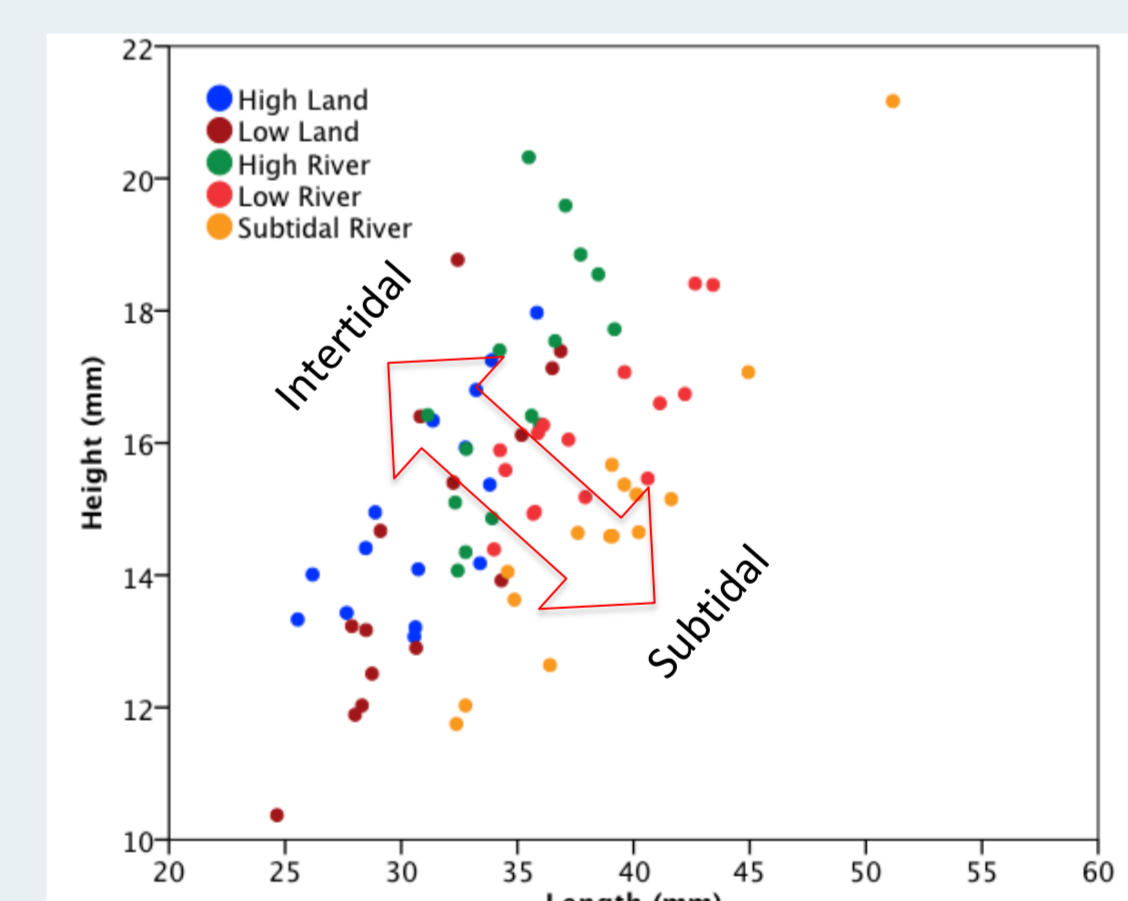
- The gills showed the highest lipid peroxide levels at all locations.
- This can be explained by gills playing the role as first barrier between the internal organs and the environment.
- The gills are thus more exposed to oxidative injury from external agents.

### 3. Average size of blue mussels according to five locations

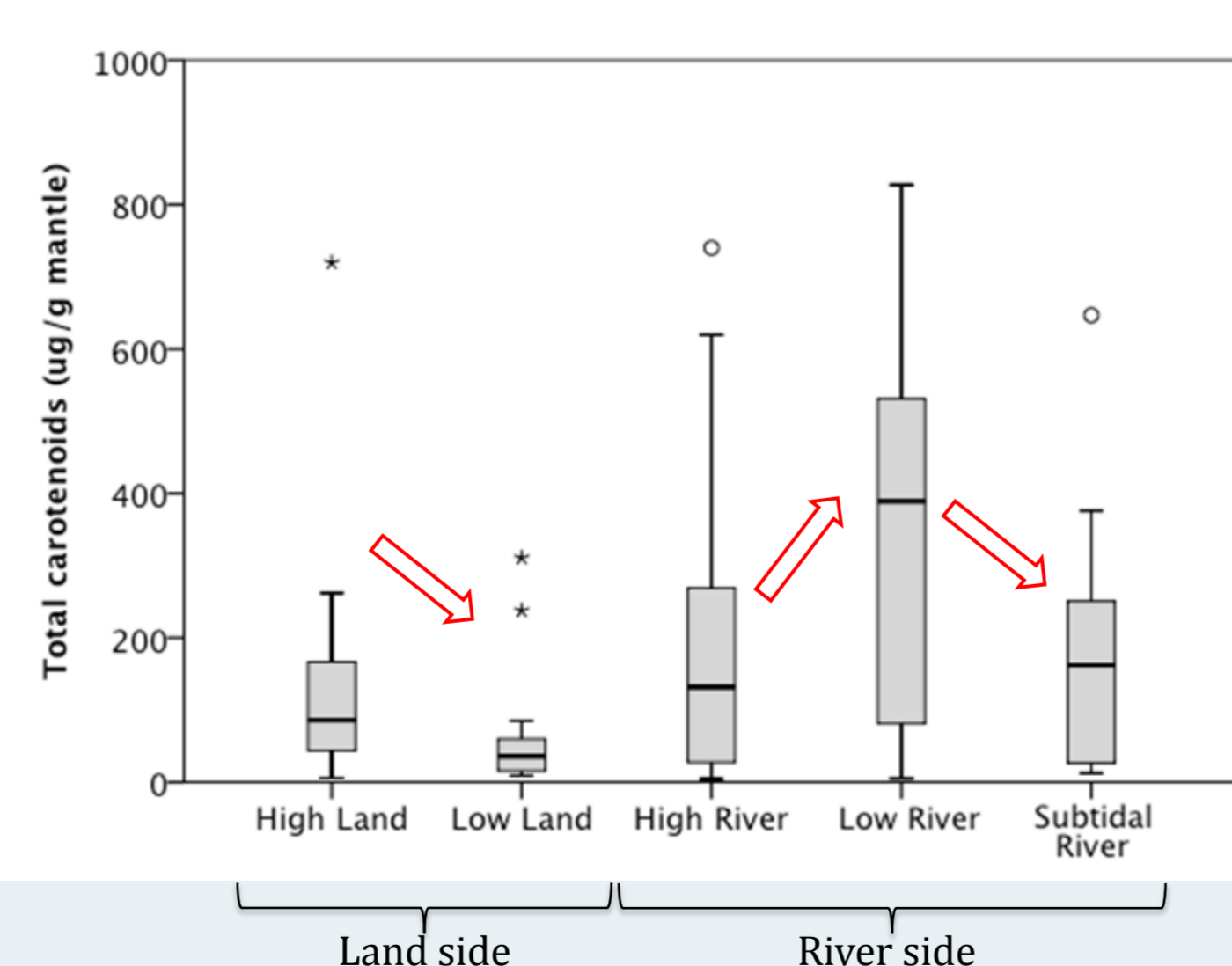
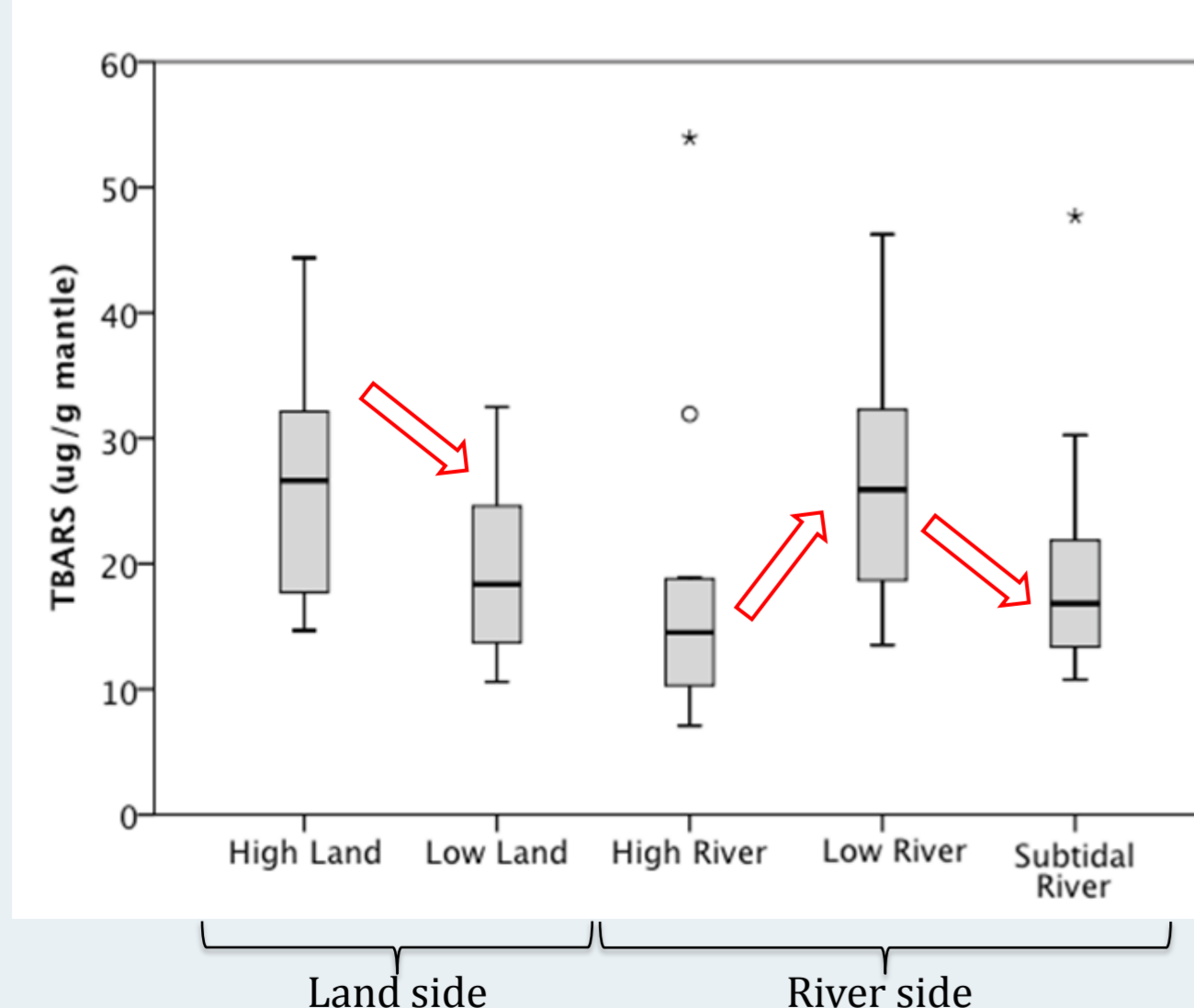
Length vs Width  
Reduction of growth on the land side



Length vs Height  
Increase in height of the intertidal mussels



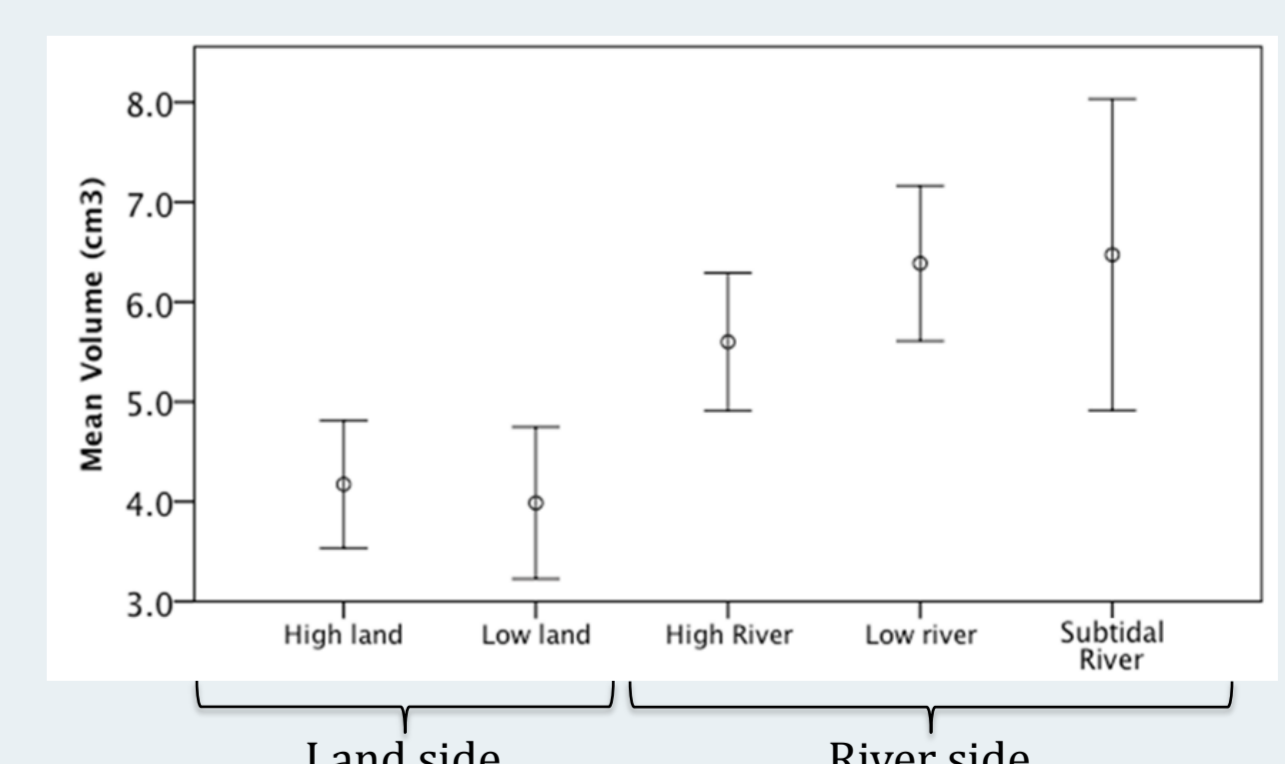
### 2. Lipid peroxide levels and carotenoid levels in mantle



- Similar pattern of lipid peroxide levels and carotenoid levels among locations.

- On the land side, the intertidal mussels showed higher lipid peroxide levels and carotenoid levels in mantle compared to the subtidal mussels.
- On the river side, lipid peroxide levels and carotenoid levels were highest in the mantle of the subtidal mussels.
- The intertidal mussels exposed to increased oxidative stress may more actively store carotenoids in their tissues, although they have a reduced access to food.

### 4. Mean shell volume of blue mussels according to five locations



Possible explanations:  
? Differential growth  
? Age structure  
? Water column mixing  
? Water temperature  
? Predation

## / ACKNOWLEDGMENTS

We kindly thank Salvatore Cotronei, Luca Tassara, Mathilde Loubeyres and Trym Raddum Berge for helping us during the field work.

The project was financed by the Research Council of Norway and Russian Foundation for Basic Research through the NORRUS program (project no.225044).

## / REFERENCES

- Buege, J.A. and Aust, S.D. (1978). Microsomal lipid, Peroxidation. In: Fleischer S. and Packer L. (Eds.), Methods in Enzymology. Vol. 52. Academic Press, New-York, pp. 302-310.
- Desnica, N., Jensen, S., Þórarinsdóttir, G.G., Jónsson, J.O., Kristinsson, H.G. and Gunnlaugsdóttir, H. (2011). Icelandic blue mussels - a valuable high quality product. Report Matis 44-11.

## / CONCLUSION

Variations in shape and balance between oxidative damage and antioxidant defense suggest that mussels from the same bed but experiencing different environmental conditions, are subjected to different energy trade-offs between growth and other metabolic processes.

A knowledge of their response to their environment is critical for a sound interpretation of their biological responses in the context of environmental monitoring.