



Aqua Case

Mussel culture area- Chalastra Thessaloniki

Exercise

Environmental Impacts of mussel farming
on water quality.

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Major issues

- Mussels are filter feeders and material processors
- Mussel farming removes nitrogen and phosphorus from the water column but enhances nutrient retention
- Nutrients are released from previously deposited sediments
- Oxygen depletion
- Reduced phytoplankton densities available as food

The challenge

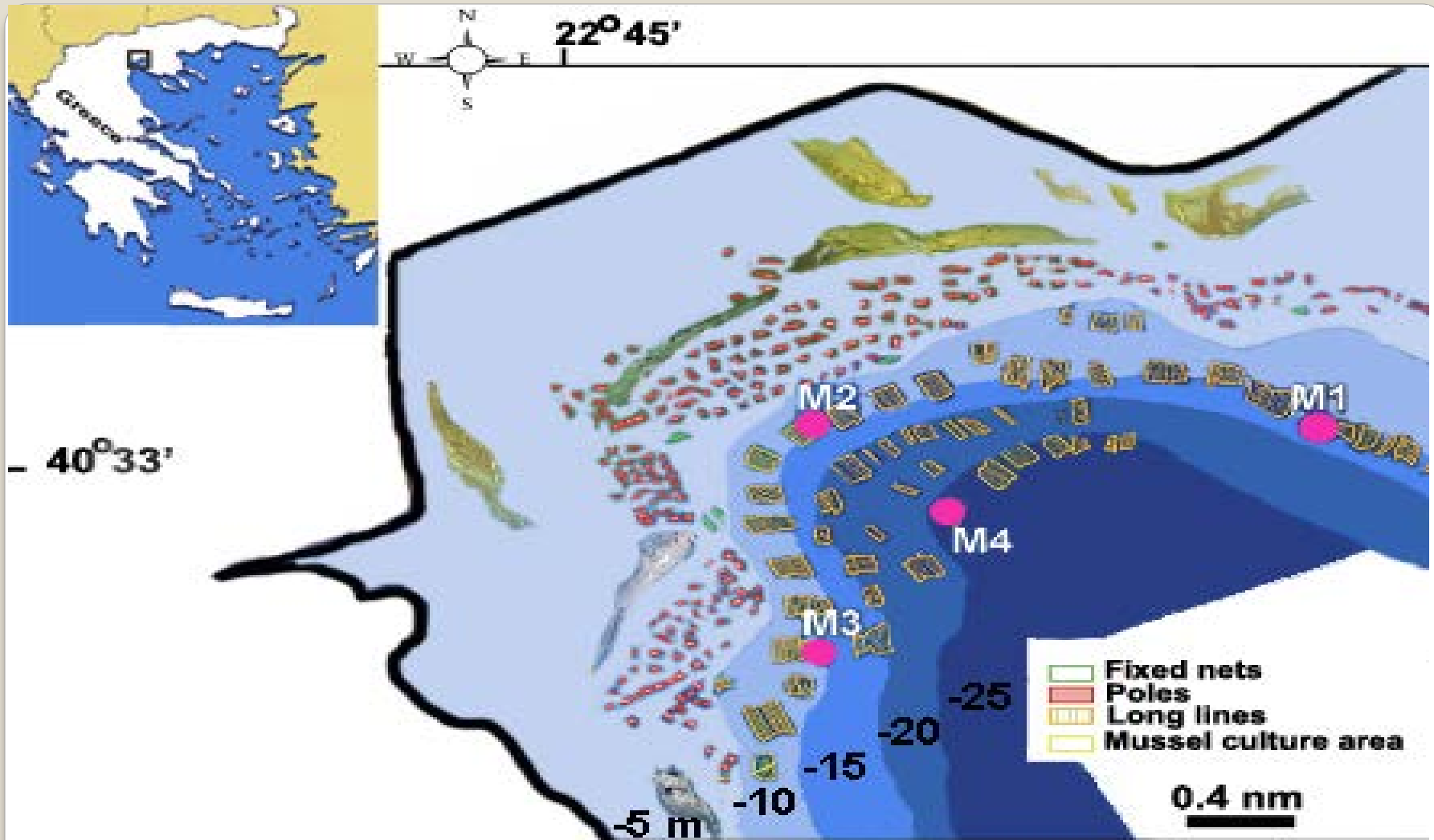
- The sustainability of this economic activity depends on the impacts of mussel populations on the ecosystem
- Changes in phytoplankton abundance and nutrient cycling have implications on the growth of the cultured mussels
- Large increases in the density of bivalves potentially change the patterns of nutrient distribution

Case study

- Seasonal variation of water quality
 - Potential Impact of nutrients-local change in the nutrient balance
 - Hydrographic field data
- A whole year period (1 and a half rearing time)
 - four sampling locations in the mussel farming area
 - Water samples were collected twice per month from three depths; 1 m and 5 m from the sea surface and 1 m above the bottom

Parameters investigated

- dissolved oxygen
 - suspended solids
 - particulate organic carbon
 - dissolved organic carbon
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- nutrients
 - Nitrates
 - Nitrites
 - Ammonium
 - Phosphates
 - Silicates
 - chlorophyll *a*



Study area

Results

- Suboxic levels of dissolved oxygen near the bottom (range between 1.8-6.2 ml O₂/l),
- Low values of phytoplankton abundance expressed as chlorophyll *a*. Chlorophyll *a* values were below 0.2 mg/m³
- Low values of nutrients were present throughout spring and summer
- Phosphates: 0.01-1.02 µg-at P/l (mean value 0.25 µg-at P/l)
- The values of phosphate correlate well with ammonium values
- Ammonium: 1.5 to 15.14 µg-at N/l (mean value 5.02 µg-at N/l)
- Phosphate and ammonium values were elevated at the maximum depth, near the bottom.
- Nitrate values: 0.13 -9.81 µg-at N/l (mean value 2.34 µg-at N/l)
- Nitrite values ranged between 0.01-1.07 µg-at N/l (mean 0.21 µg-at N/l) and were elevated in the bottom depth
- Silicates: 1.51-21.44 µg-at Si/l, (mean value 7.97 µg-at Si/l)
- Silicates presented the higher concentrations in the surface waters and the lower in the depth of 5 m were the mussel longlines are located.

Conclusions

- Severe reduction of phytoplankton attributed to the high filtration rates of mussels in the longlines of the cultures
- Signs of nitrogen retention
- Release of nutrients from the sediments

Additional work in the future

- Laboratory experiments for estimating metabolic parameters difficult to measure in the field such as mussel's filtration rate or clearance rate
- Possible integration of field data in an ecological model
- Measuring sediment data such as organic content and oxic state

Questions for evaluation

- What are the possible effects of mussel culture on the water column?
- What is the potential impact on nutrient cycling?
- How does the metabolism of mussels affects total particulate matter and total inorganic matter?
- Are the environmental data interconnected to mussel production and mussel quality?
- Is there a possible influence of existing environmental pollutants and other human activities?

Learning goals

- Comprehensive understanding of the influence of mussel farming on coastal water quality
- To understand the implications of water quality for the sustainable management of mussel culture

Notes for teachers

- Available data on water quality in the water column
- Hydrodynamic data and water circulation model
- Data on mussels production and quality of the produced mussels



References

- Savvidis Y., Antoniou A., Dimitriadis X., Koutitas Ch., Moriki A., Galinou-Mitsoudi S., Petridis D., and Alvanou L., (2007). Hydrodynamic Circulation in a Mussel Culture Area in NW Thermaikos Gulf (Greece). Proceedings of the eighth International Conference on the Mediterranean Coastal Environment, MEDCOAST 07, Alexandria, Egypt, 13-17 November 2007, 1263-1274.
- Moriki A., Galinou-Mitsoudi S., Petridis D., Kosti D., Savvidis Y., Dimitriadis X., Koutitas Ch. and Alvanou L., 2008. Environmental Impacts of Intensive Mussel Culture in the Coastal Waters of the Gulf of Thessaloniki (N. Greece), *Fresenius Environmental Bulletin*, Vol. 17, No 11b, pp 1945 - 1955.