Improving Fish Production in Central European Aquaculture: Evaluating Periphyton Communities on Different Substrates

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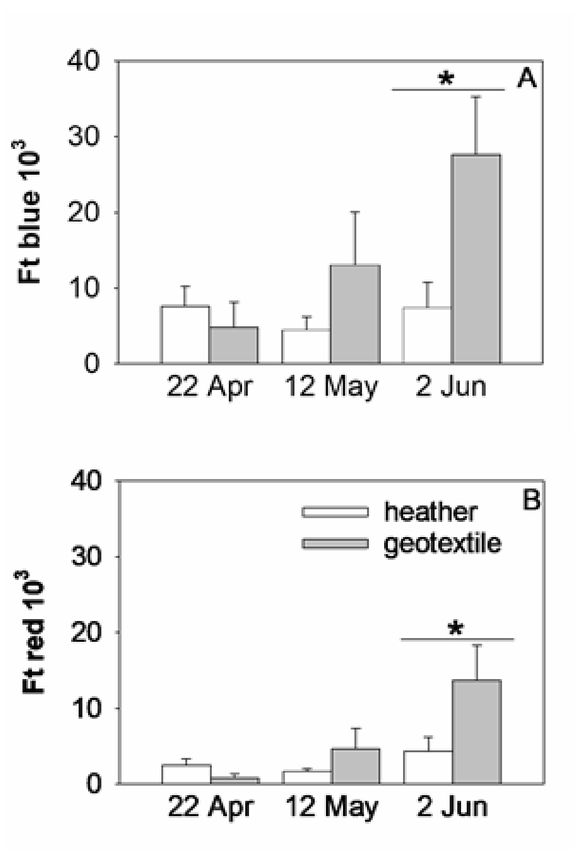
Aim Periphyton, a complex and diverse community comprising microorganisms, algae, bacteria, and various other aquatic invertebrate organisms, is crucial for freshwater health. It improves water quality, breaks down organic matter, and boosts productivity. In aquaculture, periphyton grows on artificial surfaces, providing food for fish and improving their well-being. This study compares the growth of periphyton on two different artificial substrates to find the better option for carnivorous fish production in Central Europe.

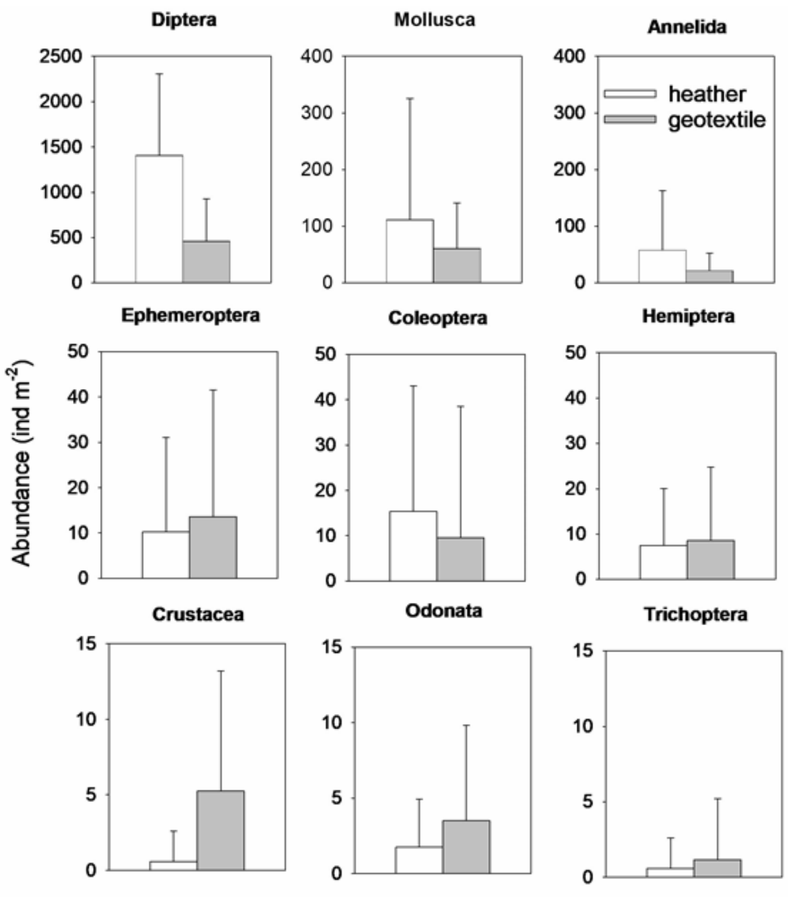
Conclusion This study suggests heather mats, compared to geotextiles, could significantly increase fish production in Central European aquaculture by supporting a richer food web with more invertebrates, especially chironomid larvae.

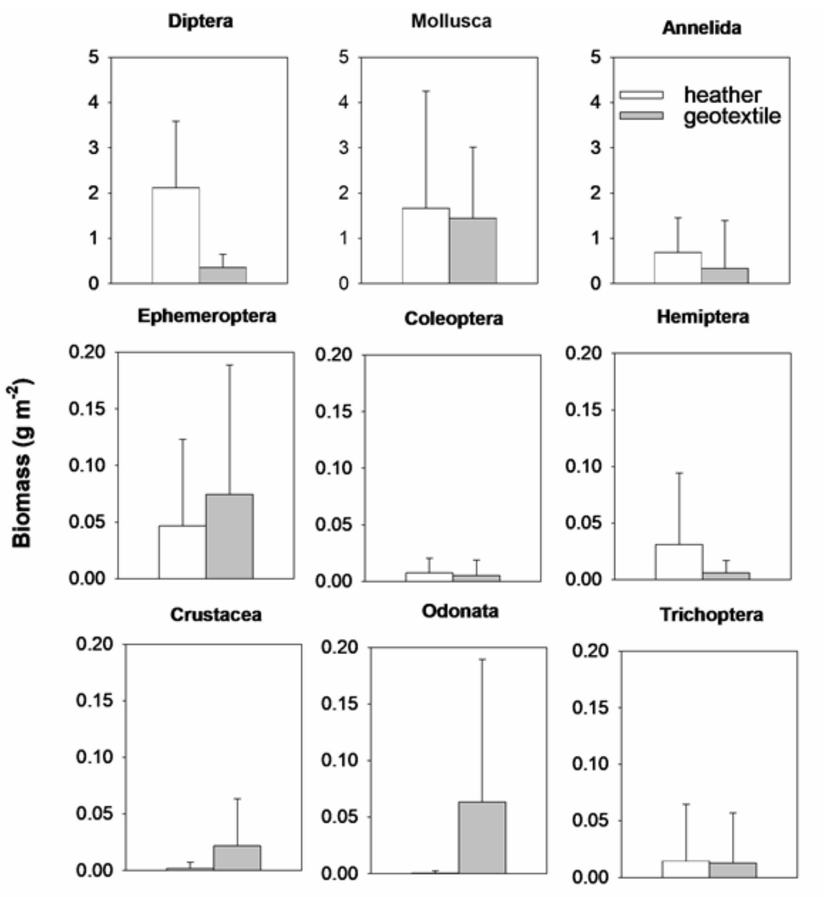
Results 1 Periphyton fluorescence (blue and red light) significantly differed between substrates, sampling times, and between substrates in individual sampling time. Notably, geotextile had higher fluorescence than heather on the last sampling date, indicating more active algae on geotextile.

Result 2 The total number of animals on heather mats was nearly three times higher than on geotextiles, with Diptera (mostly chironomid larvae) being the most abundant group overall. Interestingly, only Diptera showed a significant difference in abundance between the two substrate types.

Result 3 Animal biomass followed similar trends to abundance, with heather mats having more total biomass and Diptera (mostly chironomid larvae) being the most dominant group. Mollusks were the main contributor to biomass on both substrates, but ponds also played a role, with one pond having noticeably lower mollusk biomass.

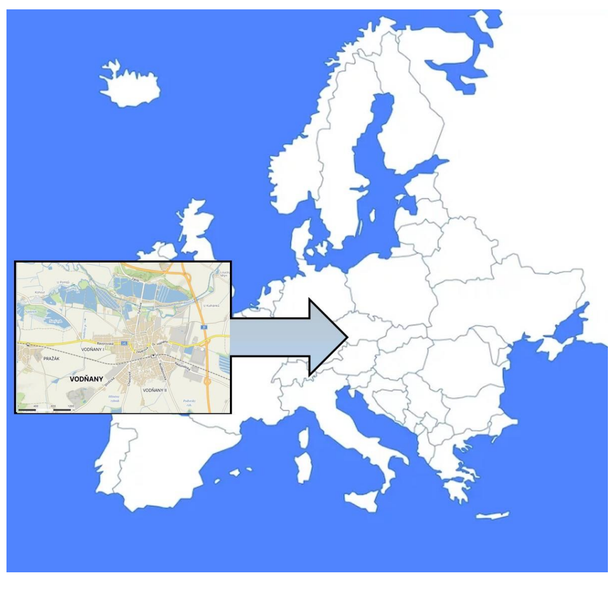






Methods

- The experiment used four small ponds (0.2 ha) with average depth of 1.27 m and Secchi depth of 1.19 m. Average water temperature was 16.4 °C, with total nitrogen and phosphorus concentrations of 2.34 mg/L and 0.14 mg/L, respectively.
- Two substrates were tested: heather mats and geotextile. Strips (0.1 x 1.5 m) were attached to mesh frames and placed in the ponds in April.
- Periphyton was sampled three times (April, May, June) using a special tube to prevent organism loss. Invertebrates were collected with sieves and tweezers.
- A separate strip was used to measure photosynthetic activity (fluorescence) of periphyton in blue and red light, indicating green algae and cyanobacteria levels.
- Collected invertebrates were preserved, identified, and counted. Biomass was measured after drying. Substrate area was calculated for abundance/biomass calculations per unit area.



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Abstract

Periphyton is a fundamental component of freshwater ecosystems that facilitates water quality, nutrient cycling, and productivity. Additionally, periphyton serves as a valuable food source in aquaculture. Periphyton communities were compared on two artificial substrates - heather mats and geotextile in four temperate fishponds. After 51 days of immersion, geotextiles exhibited significantly higher fluorescence, indicating a greater abundance of algae and cyanobacteria. Conversely, the abundance (and biomasses) of periphyton invertebrates on heather mats was higher than on geotextiles, and the difference became more pronounced over time. These differences resulted especially from significantly higher dipteran larvae abundances (biomasses) on heather than geotextile. The study suggests that heather mats can significantly enhance food abundance and availability within the water column under Central European conditions.