RTG 2350 Biota-Mediated Effects on Carbon Cycling in Estuaries



Tracking spatial and temporal pattern in zooplankton trophic dynamics in the eutrophic Elbe estuary (Germany): A multiple stable isotope approach

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Background

- The ecosystem of the Elbe estuary is affected by recurring dredging activities, eutrophication and climate change
- Zooplankton plays a crucial role in the trophic transfer within aquatic food webs
- Critical gaps exist in understanding trophic pathways in the planktonic food web of the Elbe estuary
- Here we present preliminary data on the spatio-temporal variability of trophic structures and the use of different carbon sources

Methods

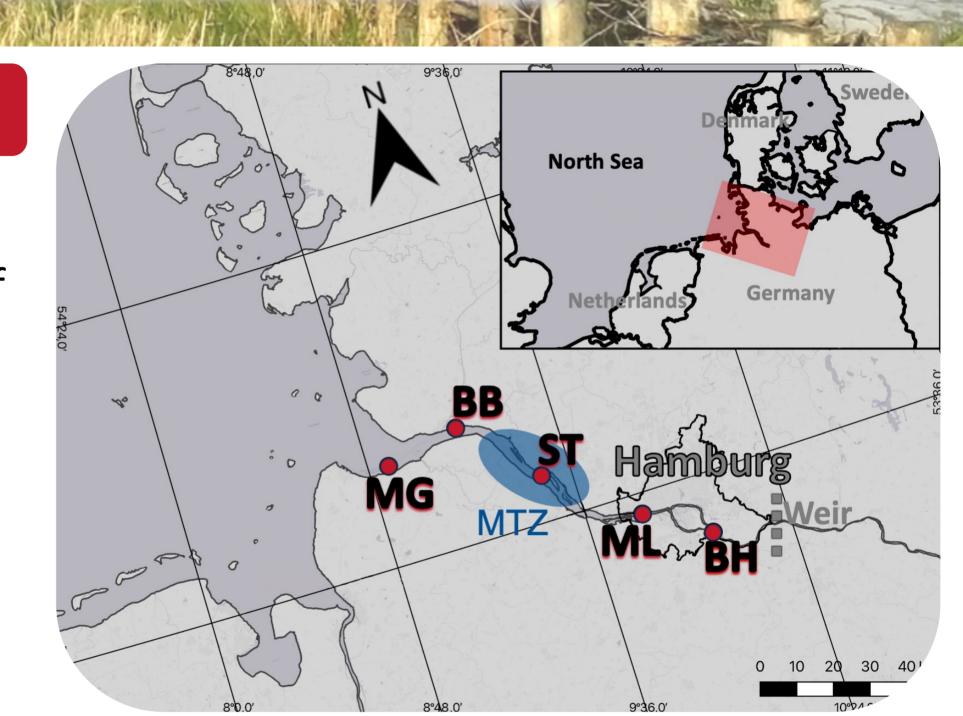
Five dominant planktonic taxa and POM What?

Where? Five stations along the salinity gradient of the Elbe estuary

At all seasons in year 2022 When?

Sampling of zooplankton with two nets (100 & 1000 μm mesh size) and POM by filtration; application of multiple stable How?

isotope approach



Results

Osmerus eperlanus

Mysidacea

* Neomysis integer

Amphipoda

Calanoida

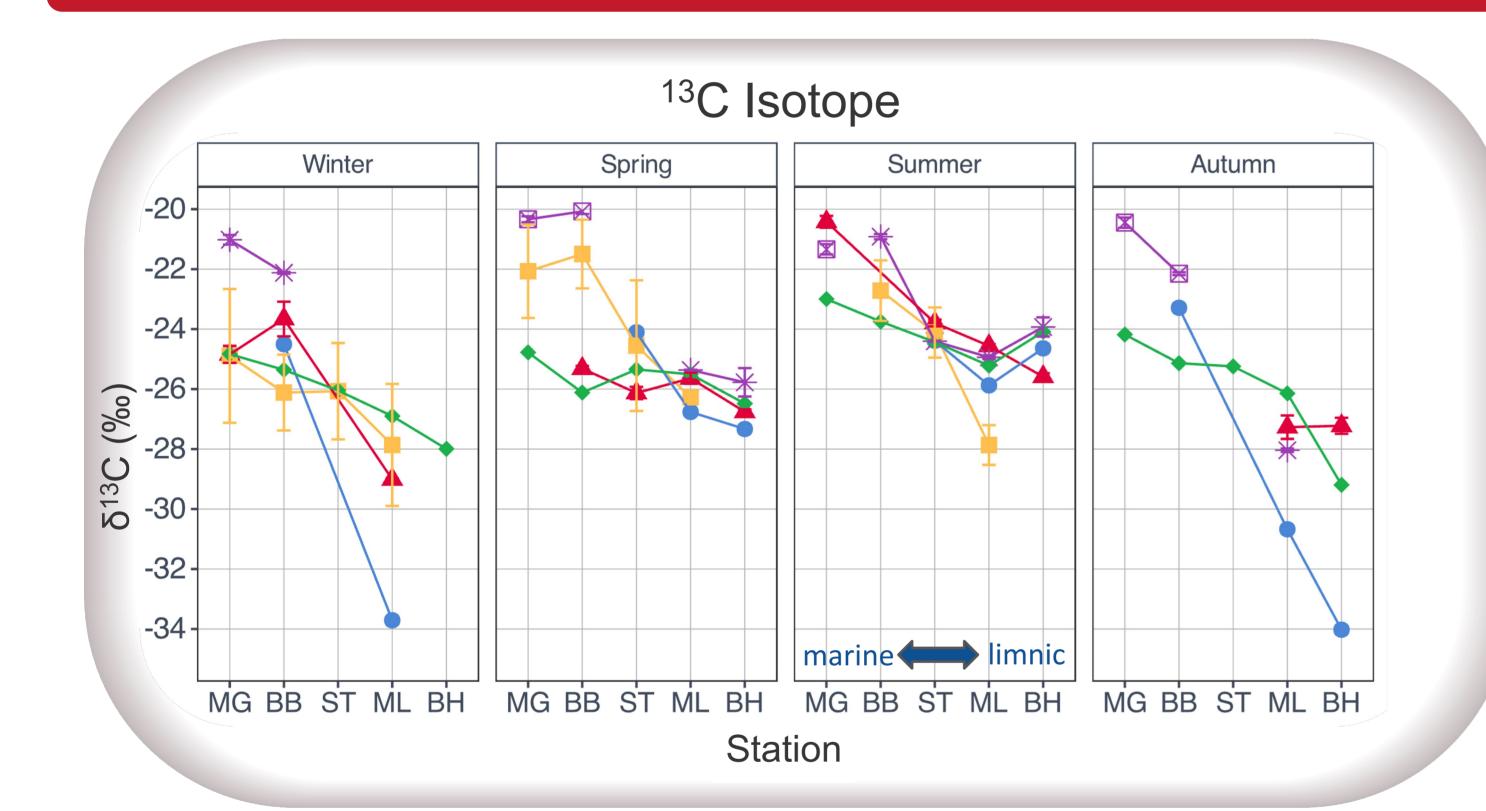
Eurytemora affinis

Particulate organic

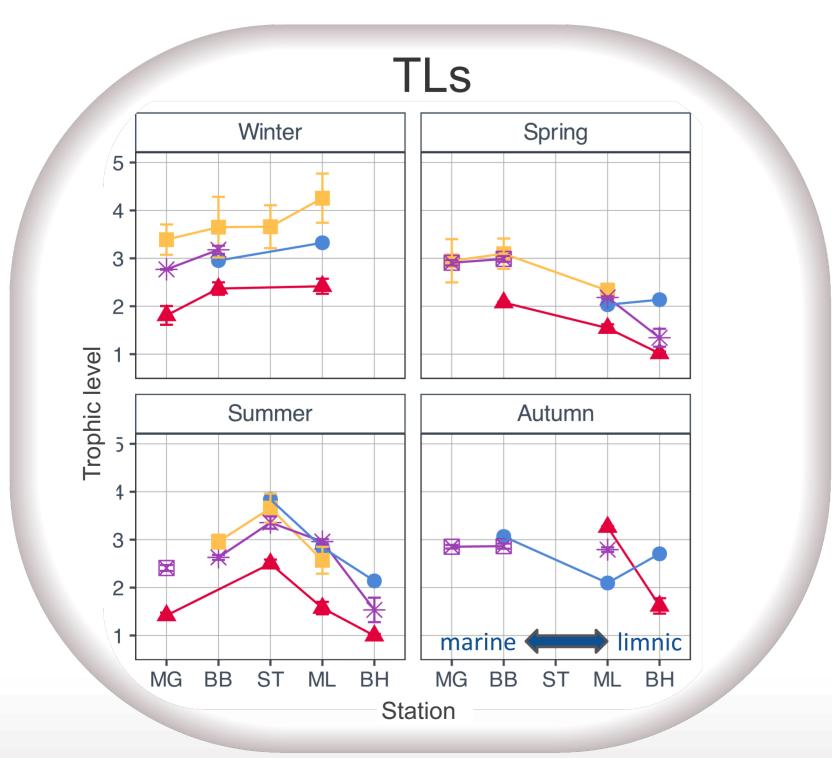
matter (POM)

Gammarus zaddachi

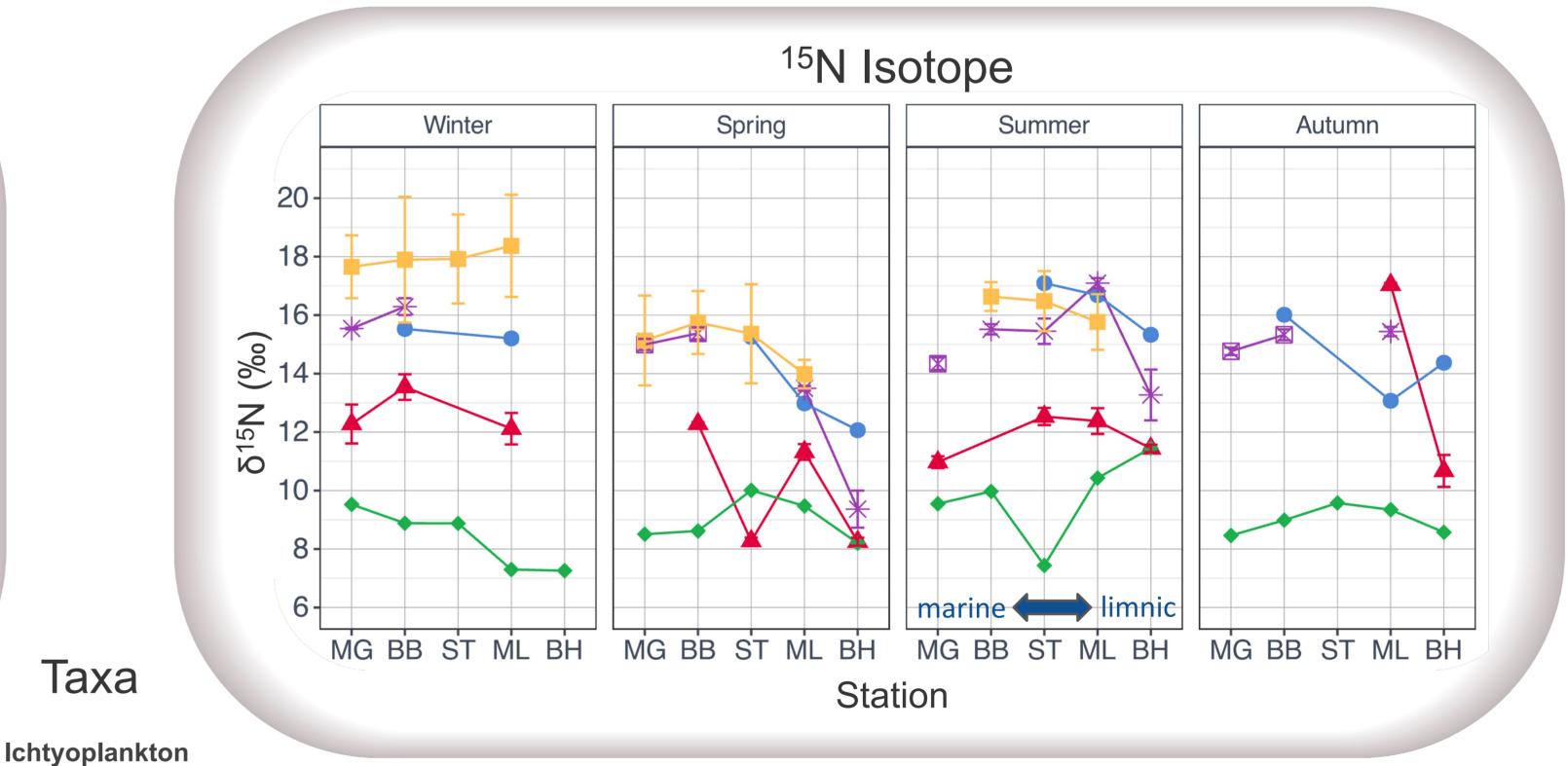
Mesopodopsis slabberi



- Downstream enrichment in $\delta^{13}C$ ratio of all taxa by conservative mixing of riverine and coastal POM sources
- River discharge rates significantly impact carbon sources, with more depleted $\delta^{13}C$ values in winter than in spring and summer (Dunn's test, p<0.01), since the terrestrial carbon source shifted downstream due to high discharge rates
- Mesopodopsis slabberi is significantly more enriched in $\delta^{13}\text{C}$ than other taxa (Dunn's test, p<0.05) suggesting that the diet is mainly based on marine phytoplankton or microphytobenthos



- Calculations of trophic levels (**TLs**) assuming an enrichment factor of 3.4‰ based on POM
- Higher TLs occupied by taxa in winter and in the MTZ likely indicate a transition to carnivorous feeding strategies



- Increased $\delta^{15}N$ ratio for taxa located close to the maximum turbidity zone (MTZ) due to a change to more carnivorous feeding behavior
- Due to reduced primary production rates in winter, carnivorous feeding strategies gained importance reflected in the enriched $\delta^{15}N$ ratios of most taxa
- Low $\delta^{15}N$ values of *Gammarus zaddachi* indicate benthic associated trophic sources

Take home message

- Our study highlights the importance to include spatial and temporal gradients when assessing trophodynamics of a highly variable estuarine environment
- Increased carnivorous feeding exists in winter and at stations close to the MTZ when primary production is limited

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