Effects of a cellulose mill on the Fenholloway estuary and coastal area

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Abstract & Introduction

The Fenholloway river:

- The Fenholloway River is located in northern Florida near the city of Perry in Taylor County and has been historically polluted by a cellulose mill.
- The state reassigned the river from industrial to recreational, and this forced the company to relocate their waste pipeline and alter the processing of their waste. The relocation of the wastewater discharge point was completed in 2020, and it is located near the mouth of the river, near the Gulf of Mexico.

Figure 5: view of the Fenholloway from the surface.

Meiofauna:

- Meiofauna are tiny invertebrates that dwell in aquatic environments, commonly living on the bottom (benthos).
- Meiofauna (such as copepods and nematodes) are known to be indicators of the ecological quality of sedimentary environments (Alves et al. 2013) while playing a key role in ecosystem processes and functions (cf. Schratzberger & Ingels, 2018).

Main objectives

- This study will assess whether the new effluent discharge point from the cellulose mill has adverse effects on the ecological health of the Fenholloway estuary and nearby coastal area.
- Biomass and abundance of nematodes and copepods will be analyzed to get insights into ecological status.
- Sediment samples were taken from 11 locations in Fenholloway and Econfina (control) river estuaries and nearby coast.
- Comparison with samples taken before pipeline installment in the Fenholloway estuary will serve as a temporal control to assess changes over time.

References & acknowledgements

Alves, A.S., et al. “Benthic Meiofauna as Indicator of Ecological Changes in Estuarine Ecosystems: The Use of Nematodes in Ecological Quality Assessment.” *Ecological Indicators*, vol. 24, 2013, pp. 462–475., https://doi.org/10.1016/j.ecolind.2012.07.013.

Schratzberger, M. and J. Ingels (2018). "Meiofauna matters: The roles of meiofauna in benthic ecosystems." Journal of Experimental Marine Biology and Ecology 502: 12-25

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Methods

- To remove the meiofauna from the sediment samples, they were first washed over stacked 500 µm and 63 µm sieves.
- The sediment from the 63 sieve was then subjected to density separation using Ludox HS40 and three 3000rpm centrifuge cycles to separate meiofauna.
- Nematodes and copepods from each sample were then counted and 120 nematodes and 50 copepods were randomly picked. They were then mounted onto glass slides for measuring and calculation of biomass.

Figure 3: copepods

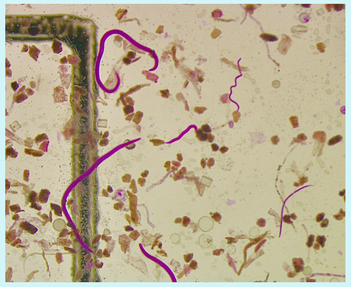

Figure 4: nematodes

Figure 1: Fenholloway sample sites. Station 2 is nearest the relocated wastewater pipeline.

Figure 2: Econfina river sampling sites.

Preliminary results

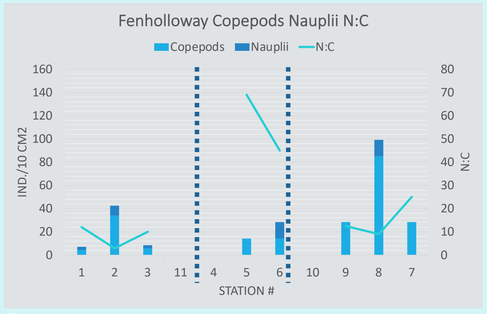

Figure 6

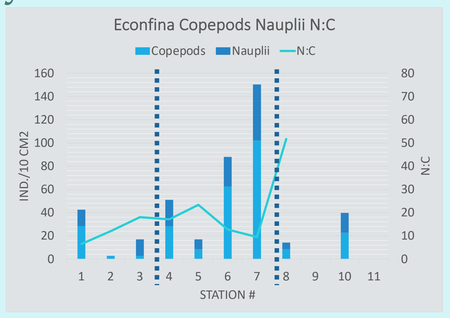

Figure 7

From figure 6 and figure 7, we can see that copepod abundance is highly variable, but increases with distance away from the river. Higher copepod abundance and lower N:C ratios are observed in the Econfina samples compared to the Fenholloway samples, indicating that the environment sampled in the Econfina area is less disturbed/degraded.

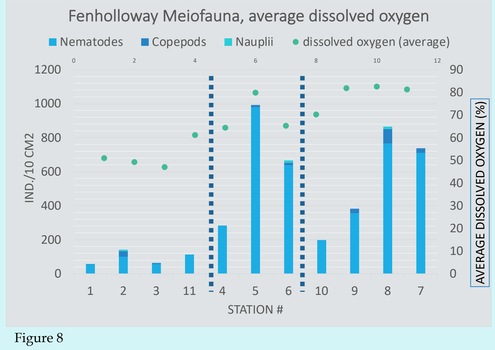

Figure 8

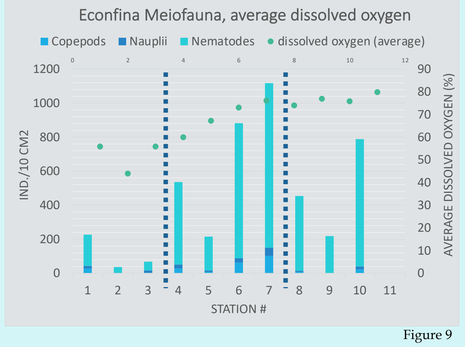

Figure 9

From figure 8 and 9, we see that dissolved oxygen levels progress similarly along the Fenholloway and Econfina transects, with very low levels up the estuary. Differences between Fenholloway and Econfina in meiofauna abundance is therefore unlikely to be driven by oxygen, but rather other, yet undetermined conditions – these could include effluents and pollution.

Discussion

- Meiofauna densities (based on nematodes and copepods/naupliids as dominant components) are variable, but there seems to be consistent trend with increasing densities with increasing distance away from the river mouth. This suggests environmental conditions improve further away from the river, both in the Fenholloway and Econfina systems.
- Preliminary results with regards to abundance have been collected. The nematode : copepod ratio is lower in some Econfina sections, indicating a less-disturbed environment.
- Total copepod abundance is more sensitive to environmental change than nematodes, so the lower counts of copepods and higher N:C ratios in the Fenholloway samples indicates that the Fenholloway river estuary is more degraded or disturbed than the Econfina estuary.

Next steps:

- Measurement of nematodes and copepods and calculation of biomass will be completed summer 2022.
- Collection of more samples in summer 2022 to account for interannual variation in meiofauna density.