

The Importance of a Healthy Seafloor in the Mitigation of Eutrophication

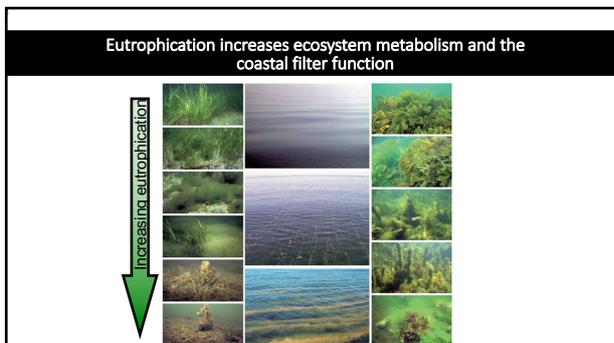
Alf Norkko

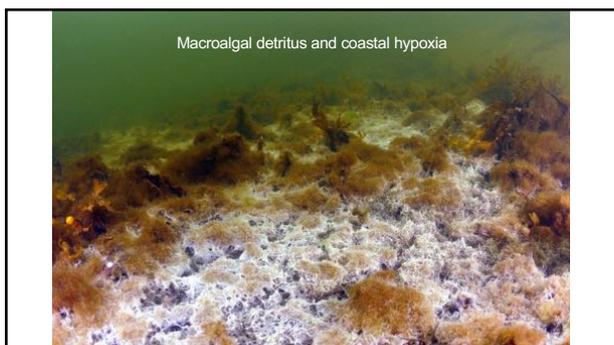
Tvärminne Zoological Station, University of Helsinki, Finland
Baltic Sea Centre, Stockholm University, Sweden

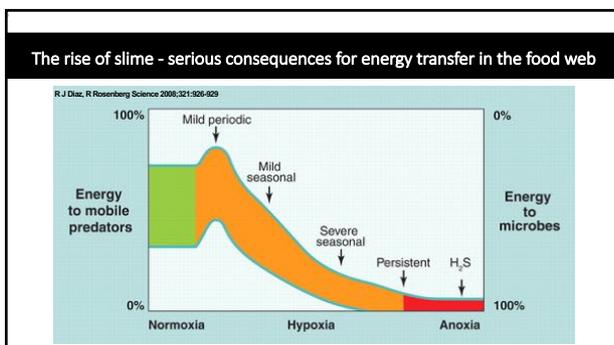














Macrofauna modify organic matter transformation and retention

- Current global models of biogeochemical cycling ignore benthic macrofauna
- Critical for understanding eutrophication and climate change impacts
- Quantification difficult

Snelgrove et al. (2018) Global Carbon Cycling on a Heterogeneous Seafloor. TREE

Figure 1. Summary of the Contrasting Geochemical (G) and Biological (B) Views of Organic Matter Decomposition. Building Differences in Emphasis on the Predominant Processes and in the Relative Contributions of the Two Perspectives.

Making biodiversity research matter – from the bucket to the real world

Tractability ← → Complexity & Reality

cm m km 10 km

MESOCOSM PATCH CROSS-HABITAT ECOSYSTEM SOCIETAL RELEVANCE

- Mobility
- Density
- Hydrodynamics
- Connectivity
- Source-sink
- Trophic links
- Context dependency
- Seascape
- Restoration
- Spatial planning
- Ecosystem services
- Economic benefits
- Ethical values

Snelgrove, Thrush & Wall & Norrka (2014). Real world biodiversity-ecosystem functioning: a seafloor perspective. Trends in Ecology and Evolution 29: 398-405

Seafloor biodiversity out there really does matter - even in hypoxic conditions
BONUS HYPER and BONUS COCOA

Estuaries and Coasts (2015) 48:487–498
 DOI 10.1007/s12237-014-9325-7

Coastal Hypoxia and the Importance of Benthic Macrofauna Communities for Ecosystem Functioning

Johanna Gunnar¹, Janina Norrko², Christel A. Friðrik³, Alf Norrko^{1,2}



ECOSYSTEMS

Seafloor Ecosystem Function Relationships: In Situ Patterns of Change Across Gradients of Increasing Hypoxic Stress

Janina Norrko,^{1,2*} Johanna Gunnar,¹ Jari E. Hovita,³ Alf B. Jonsson,⁴ Susu Carmona,⁵ and Alf Norrko^{1,2}




How do they matter?

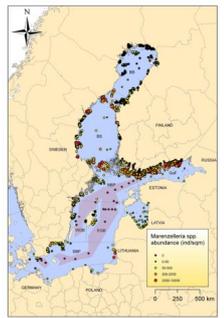


Invasive species – and changing biodiversity

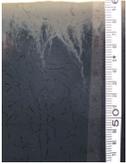
Polychaete *Marenzelleria* tolerates low oxygen conditions

Large increases in *Marenzelleria* abundances have coincided with improved near-bottom oxygen conditions

Kauppi, Norrko & Norrko - 2015 (Biological Invasions)

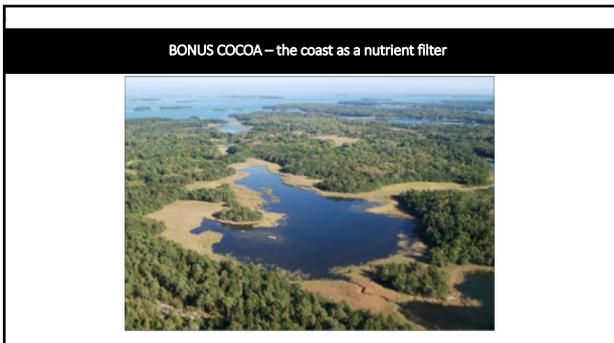


A welcome can of worms? - worms provide important ecosystem service oxygenating sediments and binding nutrients




- Reactive Transport Model shows that *Marenzelleria* bioirrigation increases sediment P retention.
- This effect can be larger than the external P loading in the Stockholm area!

Norrko J & Reed D et al (2012), Global Change Biology, 18: 422–434.



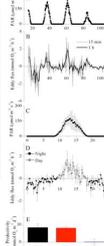




Quantifying the Breathing Seascape with AEC



"The breathing seascape: resolving ecosystem metabolism and habitat-function relationships across coastal habitats"
(Academy of Finland 2016-2020; FIN, DEN, SWE, NZ)



The figure shows two photographs on the left: an Autonomous Ecosystem Camera (AEC) instrument deployed in the water and a diver using it. On the right, there are several line graphs showing data over time, with a legend indicating 'CO2' (black) and 'O2' (red).

Size matters and who you are matters – not only for ecosystem functioning but also for ecosystem services!

Small changes – large impact!



Photo: High Watermark



The image shows a screenshot of The Guardian news website. The main headline is "Climate report: Scientists urge deep rapid change to limit warming" by Matt McGrath. Other headlines include "IPCC report: World leaders have moral obligation to act after UN report" and "Economists win Nobel for work on climate and growth".
