

The Importance of a Healthy Seafloor in the Mitigation of Eutrophication

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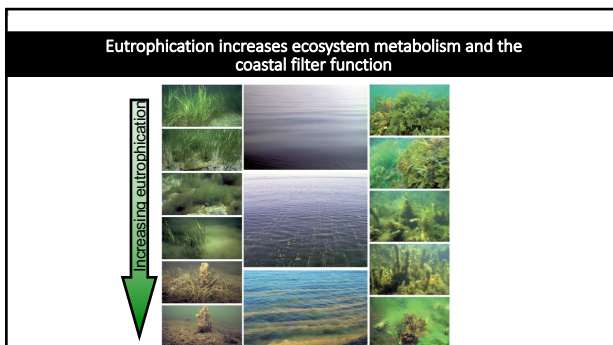
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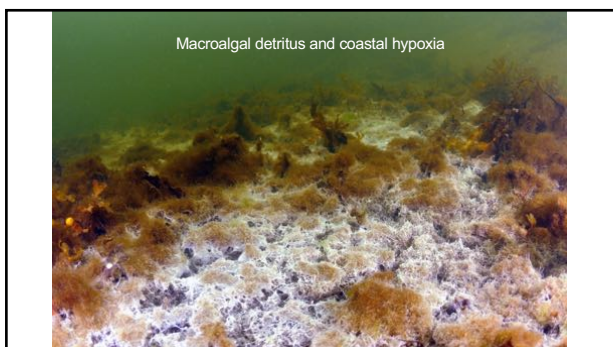
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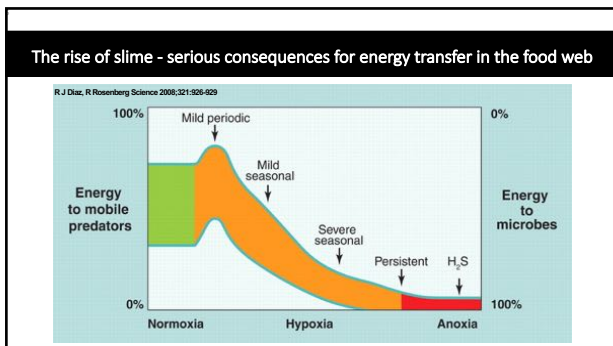
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### Macrofauna modify organic matter transformation and retention

- 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.

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

Tractability ← → Complexity & Reality

cm m km 10 km

MESOCOSM PATCH CROSS-HABITAT ECOSYSTEM SOCIAL 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

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**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 Gunnar<sup>1</sup>, Janina Norrko<sup>2</sup>, Christel A. Friðrik<sup>3</sup>, Alf Norrko<sup>1,2</sup>



ECOSYSTEMS

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

Janina Norrko,<sup>1,2\*</sup> Johanna Gunnar,<sup>1</sup> Jari E. Hovitz,<sup>3</sup> Alf B. Jonsson,<sup>4</sup> Susie Cameron,<sup>5</sup> and Alf Norrko<sup>1,2</sup>

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**How do they matter?**

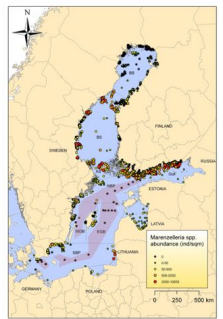


**Invasive species – and changing biodiversity**

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)



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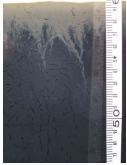

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**A welcome can of worms? - worms provide important ecosystem service oxygenating sediments and binding nutrients**

- 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.

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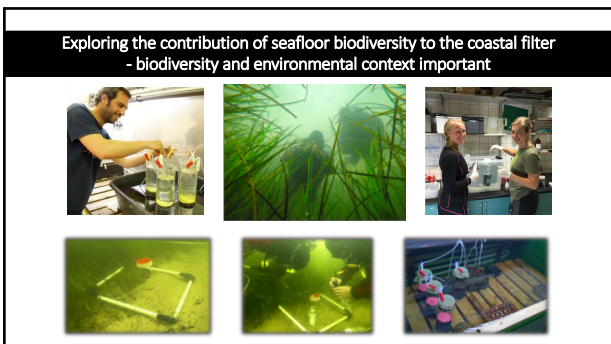
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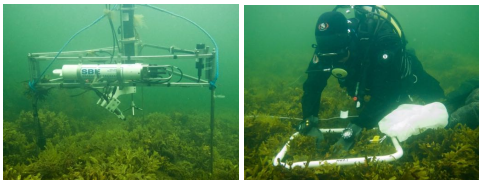
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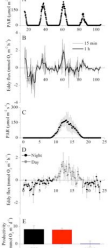
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**Quantifying the Breathing Seascape with AEC**



*"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 panels on the left: an Autonomous Ecosystem Camera (AEC) instrument deployed in a shallow, green, vegetated coastal habitat, and a diver in a black wetsuit and mask operating the AEC. On the right, there are several line graphs showing data over time. The top graph is labeled 'Net Ecosystem Exchange (g C m<sup>-2</sup> d<sup>-1</sup>)' and shows a clear diurnal cycle with positive values during the day and negative values at night. Below it are other graphs showing 'Net Ecosystem Exchange (g C m<sup>-2</sup> d<sup>-1</sup>)' and 'Net Ecosystem Exchange (g C m<sup>-2</sup> d<sup>-1</sup>)' for different depths or locations. A legend at the bottom indicates 'Net Ecosystem Exchange (g C m<sup>-2</sup> d<sup>-1</sup>)' with a color scale from black to red.

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

**Small changes – large impact!**

Photo: Hugo Weisstaub

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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, dated 28 October 2018. Below the headline is a photo of hands holding a globe. Another headline reads "Economists win Nobel for work on climate and growth". The page also features a "Climate change / World leaders have moral obligation to act after UN report" section.

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