

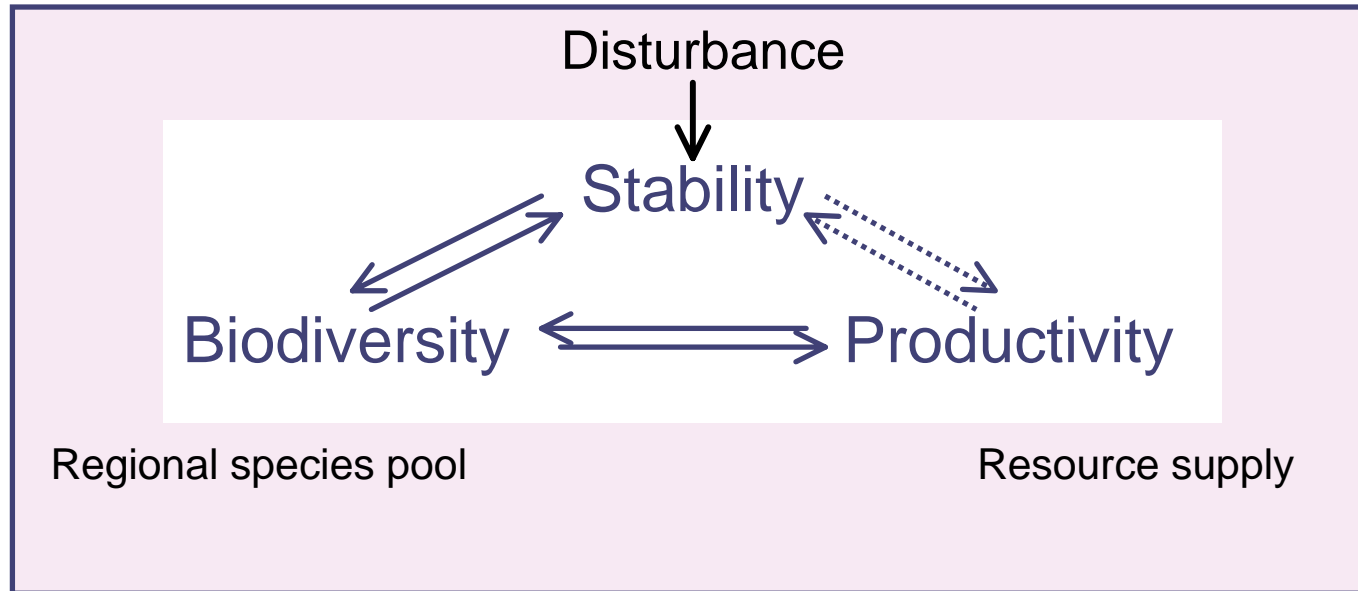
Biodiversity of littoral communities in the eastern Gulf of Finland under eutrophication and success of introduced species



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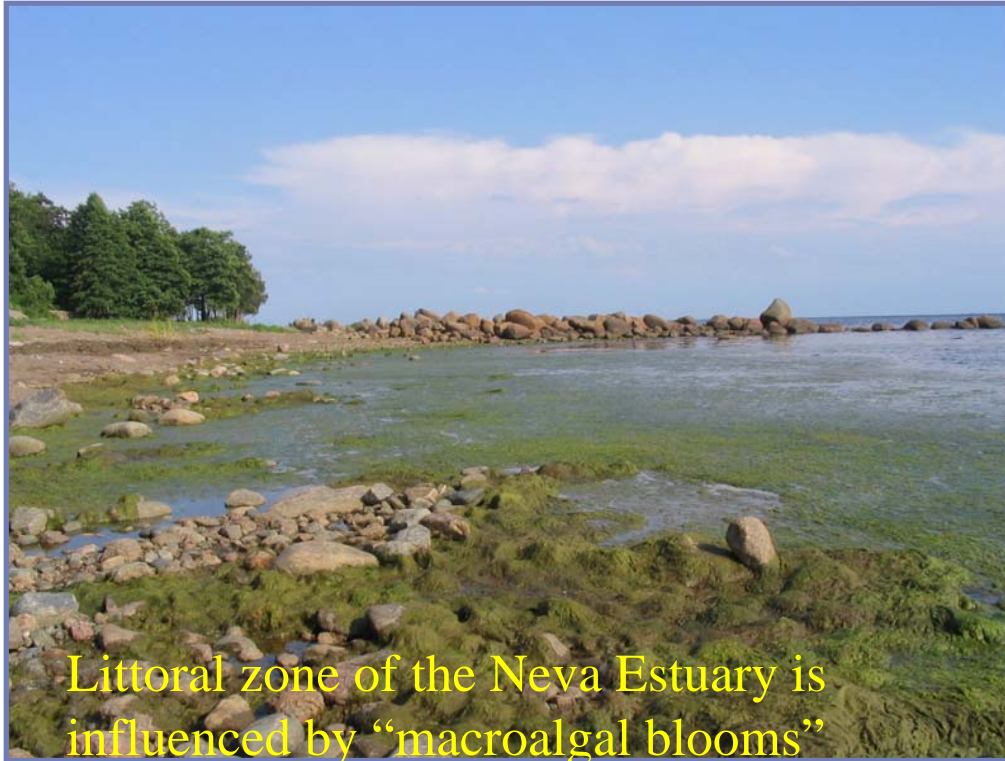
Biodiversity, productivity and stability relationships



Worm & Duffy, 2003

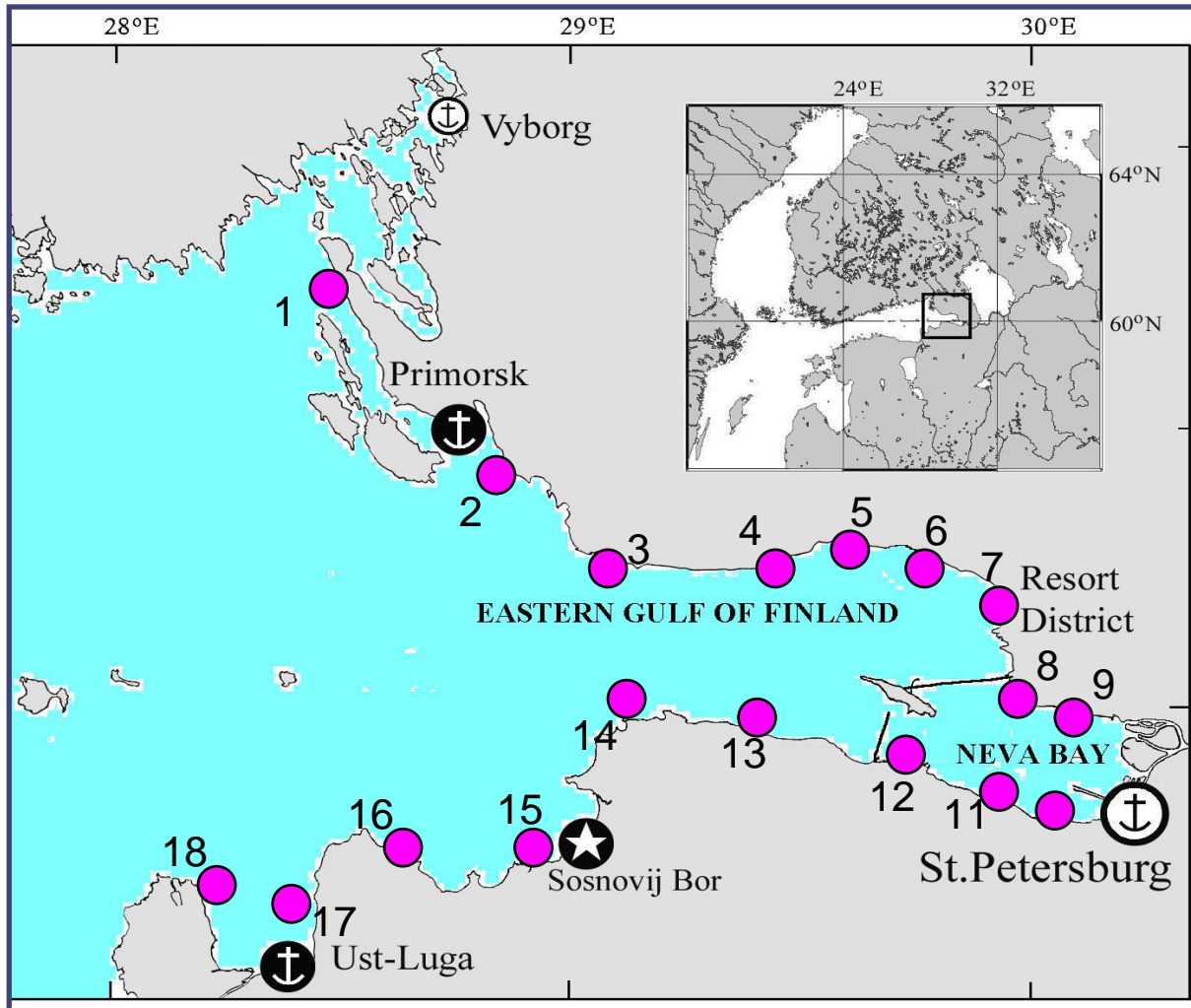
- The relationships biodiversity - stability of communities are often bi-directional; changes in biodiversity (species composition and richness) can be both a cause and a consequence of changes in productivity (the rate of production of organic matter) and stability (temporal constancy of a community resistance to environmental change and resilience after disturbance).
- Disturbance induce destabilizing fluctuations in community biomass and effects on local biodiversity.

Littoral zone of the eastern Gulf of Finland



The Neva Estuary is impacted by a number of human activities such as discharges of large amounts of waste waters from Sankt-Petersburg and its province, intensive ship traffic, development of new ports and oil terminals, commercial fishery and recreation. Increased nutrient loading to the estuary have caused eutrophication and wide spread disruption of the littoral ecosystem

Species richness of macrobenthic groups in littoral zone (0.3 – 2 m) of the eastern Gulf of Finland (2002-2005)

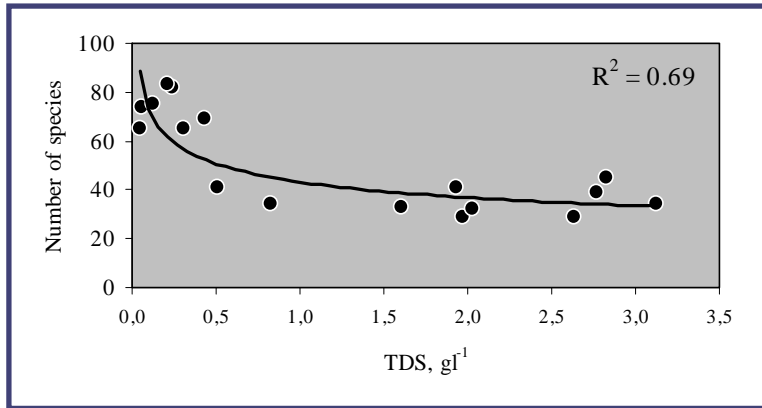


Number of species:

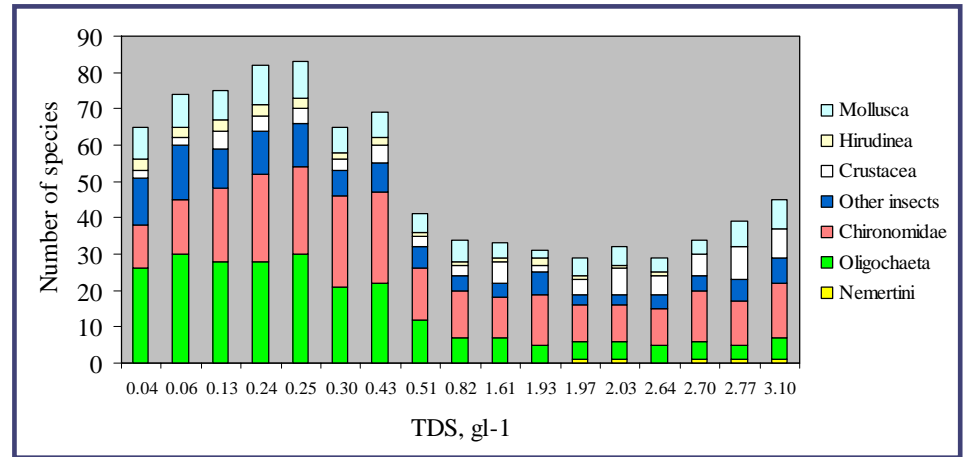
Nemertini -	1
Oligochaeta -	39
Hirudinea -	3
Mollusca -	14
Isopoda -	4
Mysidae -	1
Amphipoda -	10
Chironomidae -	35
Other insects -	19
<u>Total -</u>	<u>126</u>

Depths of 0.3 – 2 m

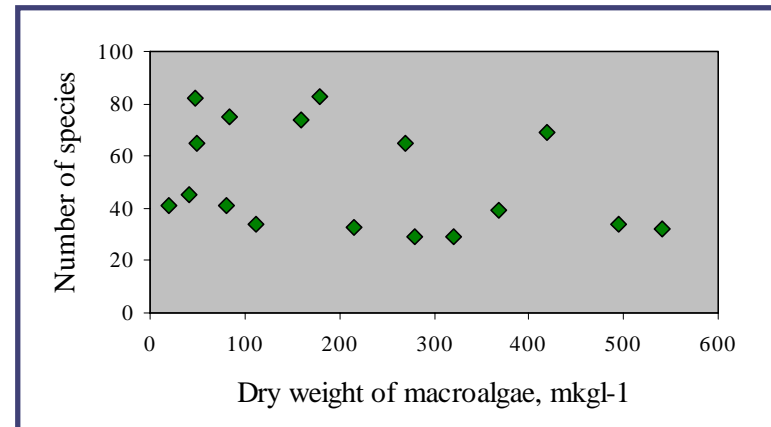
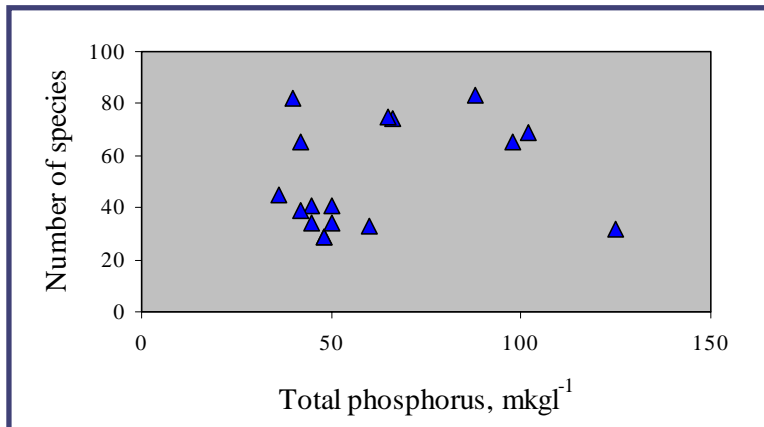
Number of species (NS) depending on water salinity



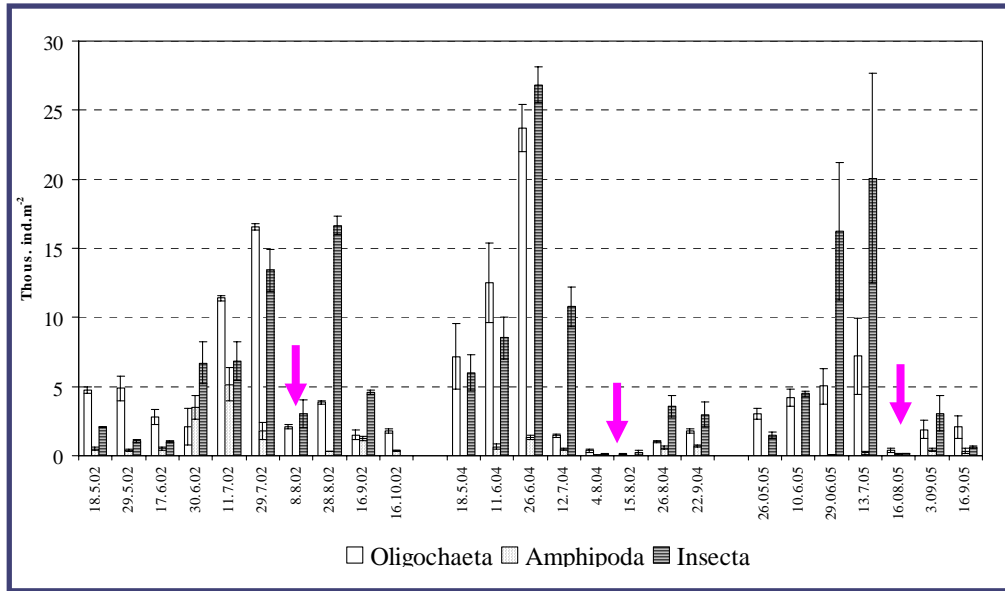
TDS is total dissolved salts (at 25 C)



Phosphorus and macroalgae biomass have no direct influence on NS.

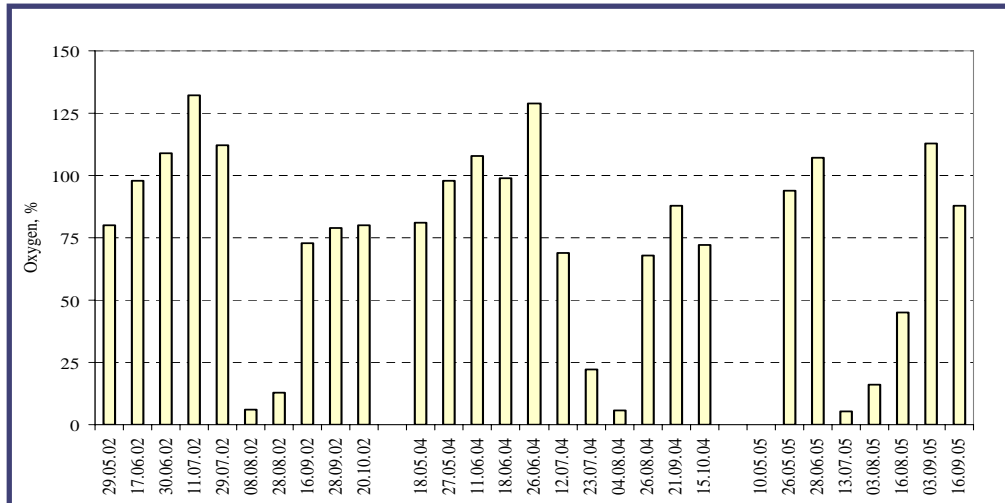


Effects of “*Cladophora* blooms” on dynamics of invertebrates in littoral communities



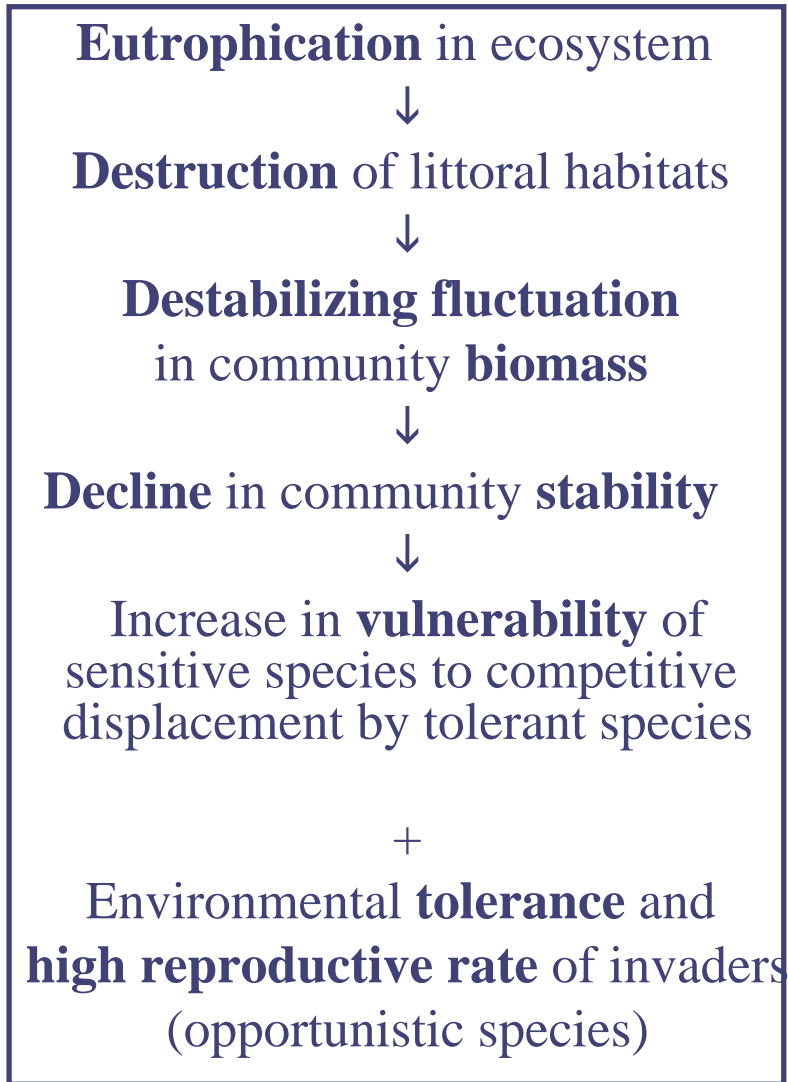
in littoral communities

- Unfavorable conditions in littoral zone appeared as consequences of *Cladophora* “blooms” since the middle of summer and represent a serious threat to abundance of intolerant invertebrates and local biodiversity



- Hypoxic conditions and considerable decrease in density of amphipods, oligochaetes and aquatic insects were recorded in littoral habitats during decomposition of drifting filamentous algae (July-August)

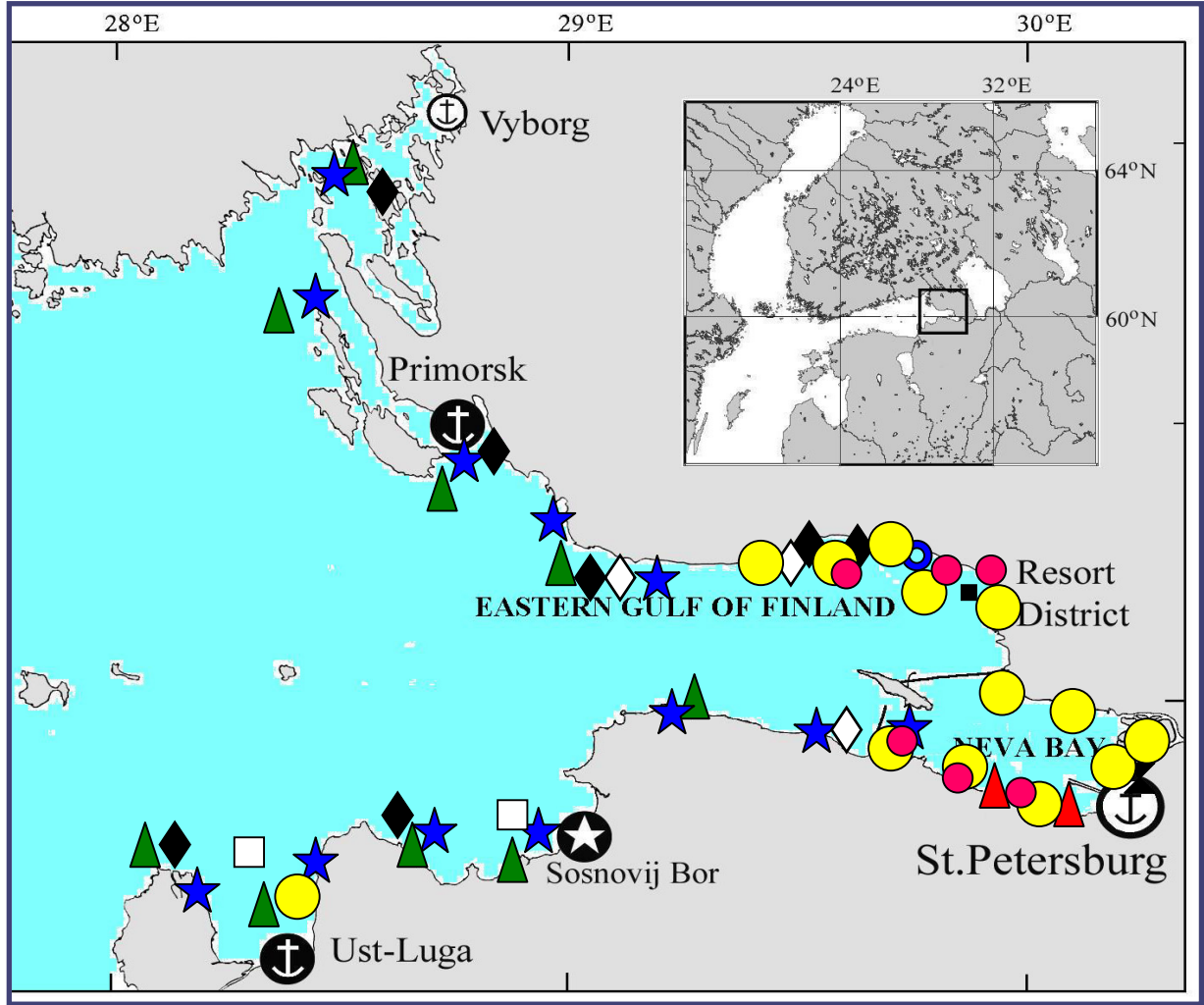
Causes of non-indigenous species success in new habitats of the eastern Gulf of Finland



During last decade
some allochthonous
species of
amphipods have
penetrated the
eastern GoF and
established in the
coastal zone



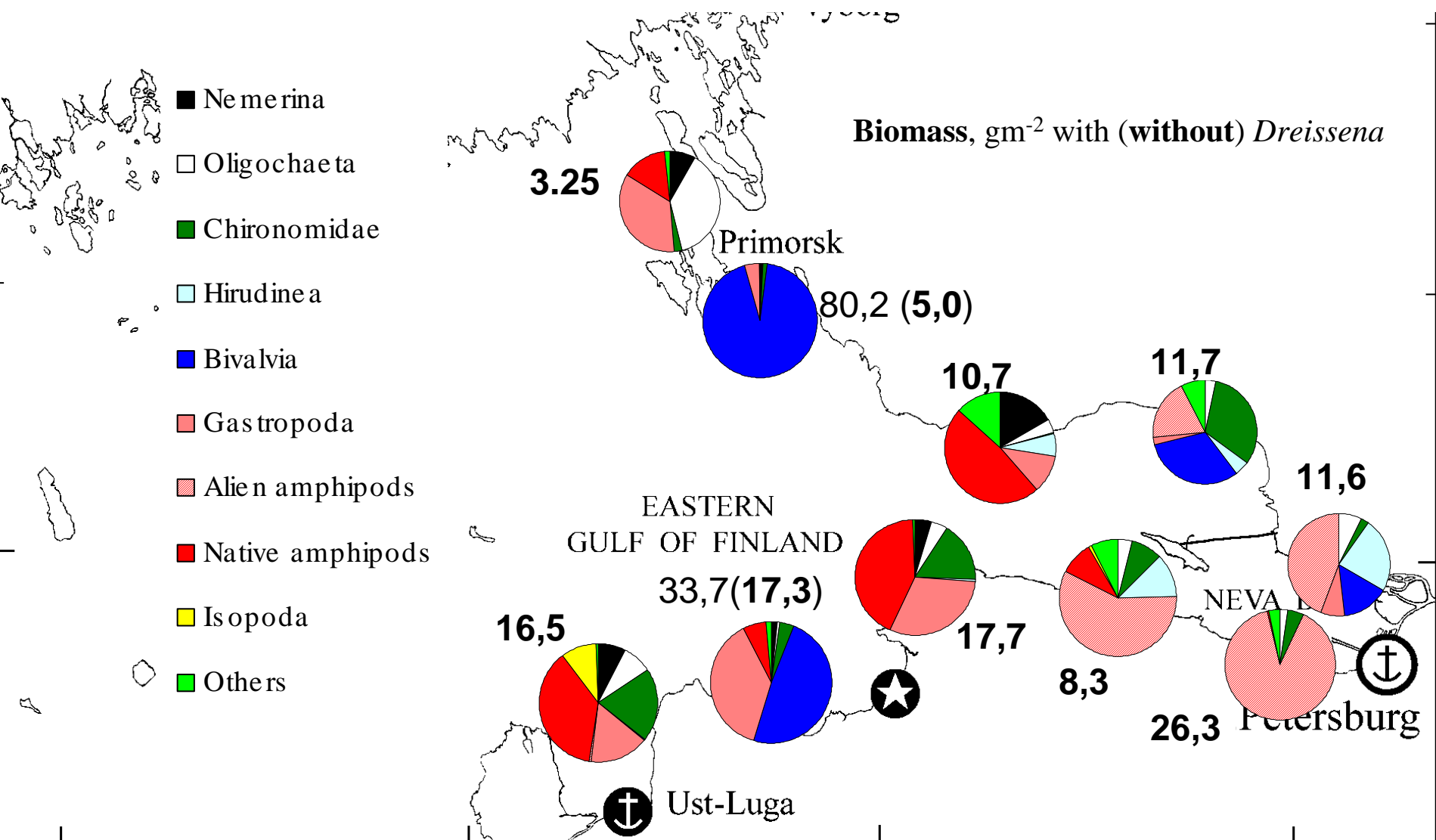
Current distribution of amphipods in the eGoF (2005)




- Gammarus zaddachi* ★
 - G. duebeni* ◊
 - G. oceanicus* ◆
 - G. inaequicauda* ●
 - G. salinus* ▲
 - G. Pulex* ▲
 - Corophium volutator* □
- Gmelinoides fasciatus* ●
 - Pontogammarus robustoides* ●
 - Chaetogammarus warpachowskyi* ■


Non-indigenous species

Midsummer abundance and composition of zoobenthic communities in littoral zone (2004)

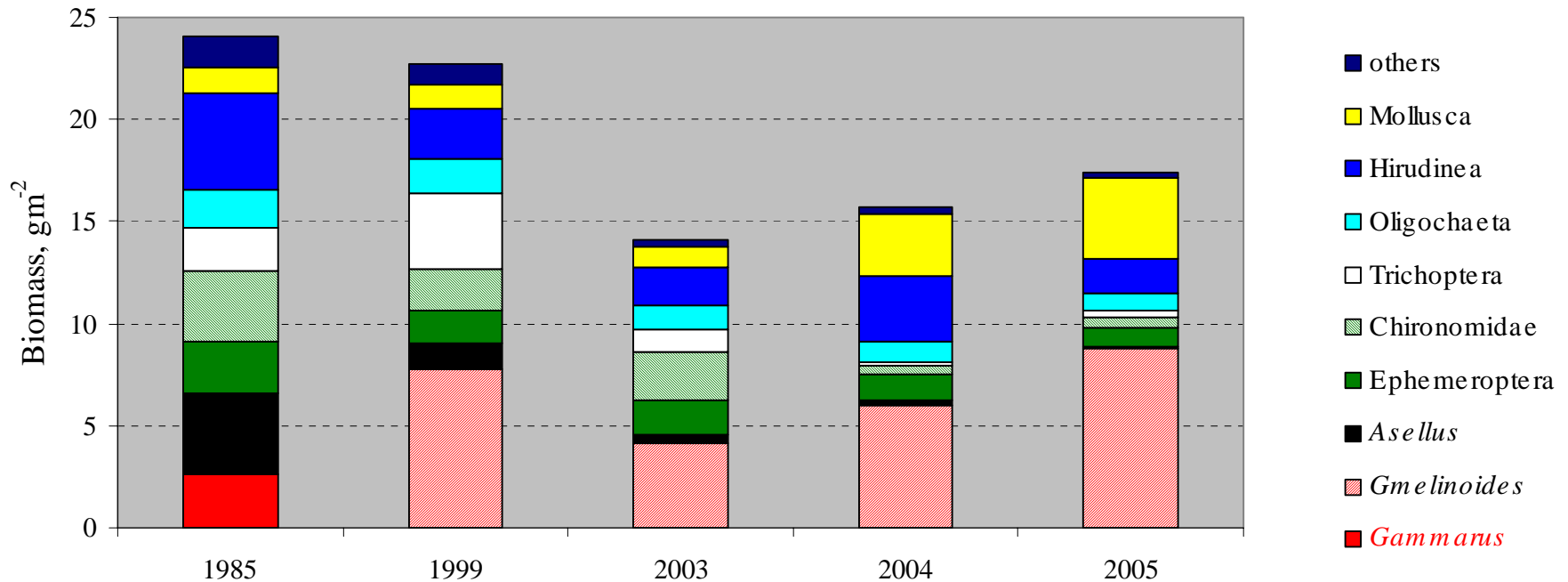


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- Add of functionally dominant species, such as keystone species, ecosystem engineers or species with many trophic connections, would have particularly strong effects and could induce rapid and violent changes in local biodiversity
 - Established non-indigenous species can enter into direct competition with native species through predation, resource competition, modification of habitats and hybridization. They can displace and even cause the extinction of species or races
 - At the global level, invasive species are considered the second cause of biodiversity loss after direct habitat destruction and environmental disturbance

Are non-indigenous amphipods the problem for biodiversity of the eastern Gulf of Finland?



Long-term changes (1985-2005) in biomass of macroinvertebrates after *Gmelinoides fasciatus* establishment in northern part of Neva Bay

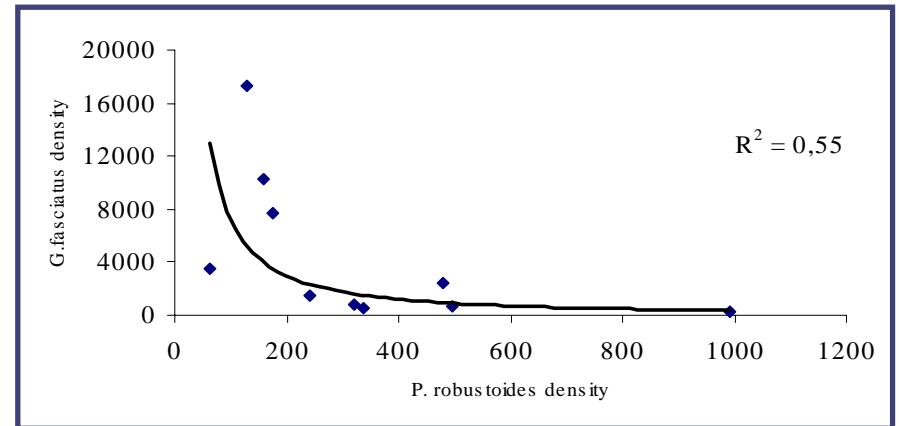
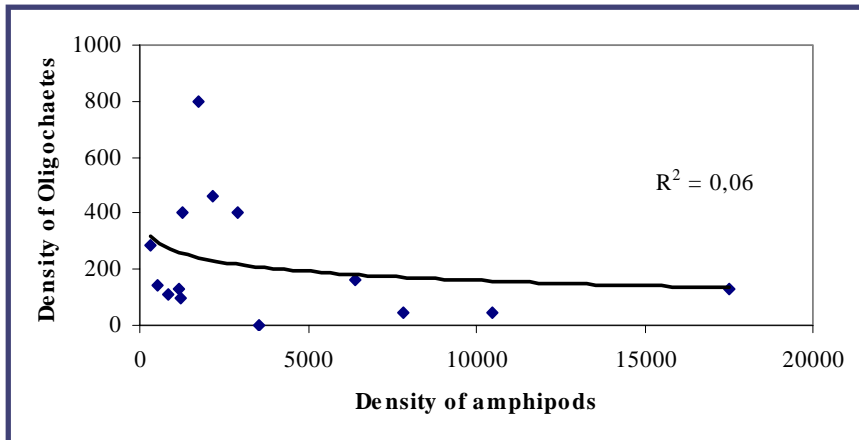
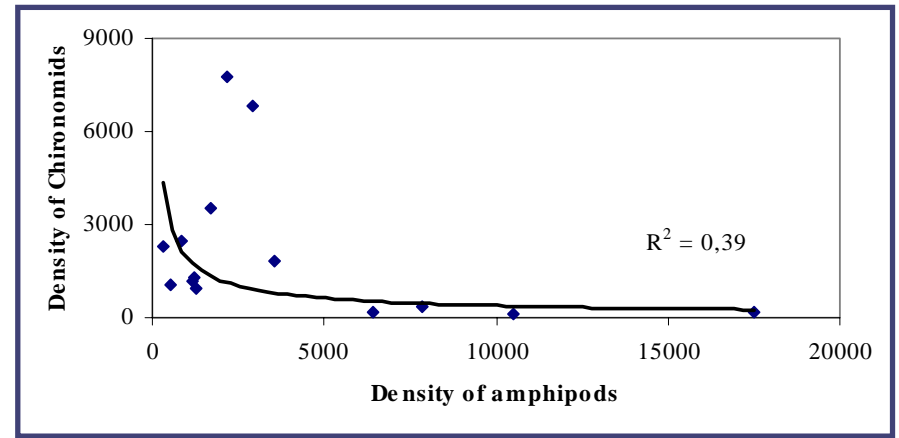
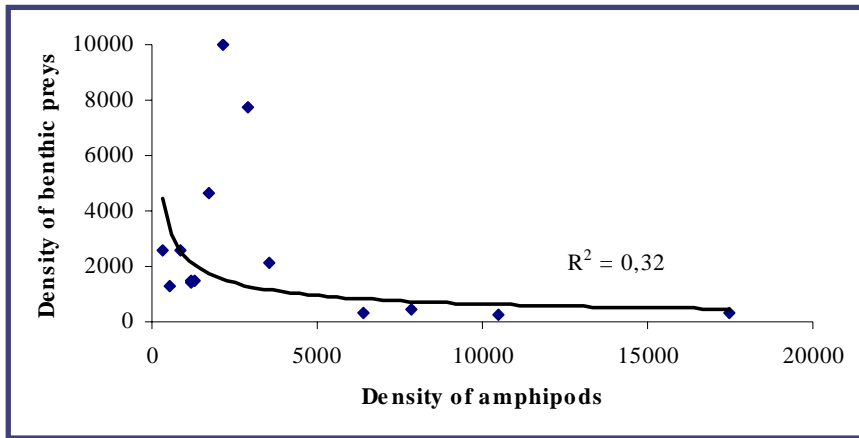


Established *Gmelinoides* has become functionally dominant species

It replaced native amphipod *Gammarus lacustris*


It entered into direct competition with native species (isopod *Asellus aquaticus*) and some insects through predation

Correlations between densities of predaceous omnivore amphipods and zoobenthic groups in littoral zone of eGoF





Conclusion

- In the case of the eastern Gulf of Finland we conclude that deoxygenation of bottom habitats due to macroalgal blooms is the main environmental reason of destabilizing fluctuations in biomass of invertebrate communities in littoral zone resulting in decrease of local biodiversity.
 - Disturbance factors such as eutrophication also may facilitate successful establishment of some opportunistic species including the introduced amphipods
 - Predation press of established amphipods on macroinvertebrates results in species replacements and alterations of community structure in the Neva estuary
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A photograph of a sunset over the ocean. The sun is a bright yellow circle on the horizon, casting a shimmering path of light across the dark blue water. The sky is a mix of orange, yellow, and light blue. In the foreground, the dark, choppy water shows a white wake from a boat moving away from the viewer.

Thank you for your attention!