Size diversity and Normalized Biomass Size-Spectrum as suitable ecological indicators for lower trophic levels

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Background

Biodiversity

- used as stability indicator
- “healthy ecosystem“
- good environmental status (GES)
- MSFD Descriptor 1

Problems

- difficult to establish taxonomic diversity for lower trophic levels
- specific expert knowledge required
- How does biodiversity affect higher trophic levels?
- Suitability for management

Food for thought

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Size diversity

Advantages

size can be measured:

- automatically
- using flowcam, LOPC, ZooScan, VPR, etc.
- very fast
- remotely on buoys, ships or ROVs
- objectively

potential for quick detection of composition changes

Methods

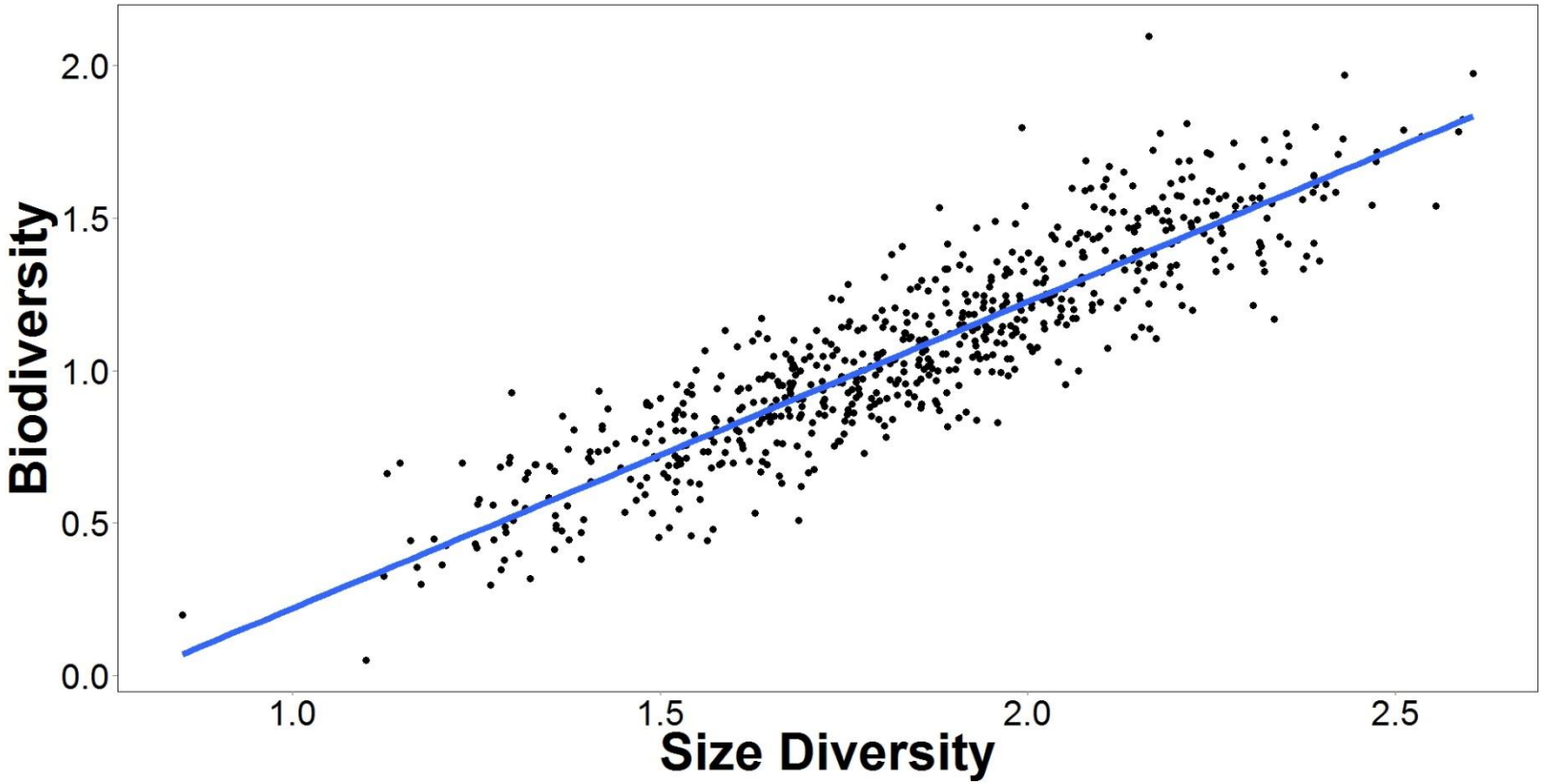
- Size diversity
  - size bin range: from 300µm to 13200µm
  - varying bin widths: scaling experiments from 1 (linear scale) to 2 (exponential scale)

- Biodiversity
  - coarse taxonomic groupings: copepoda, *Candacia armata*, *Temora sp.*, calanoida, echinodermata, chaetognaths, malacostraca, zoea larvae, amphipods, shrimp-like, cumacea, appendicularia, polychaeta, cladocera

- Index
  - Shannon Index using size bins instead of species

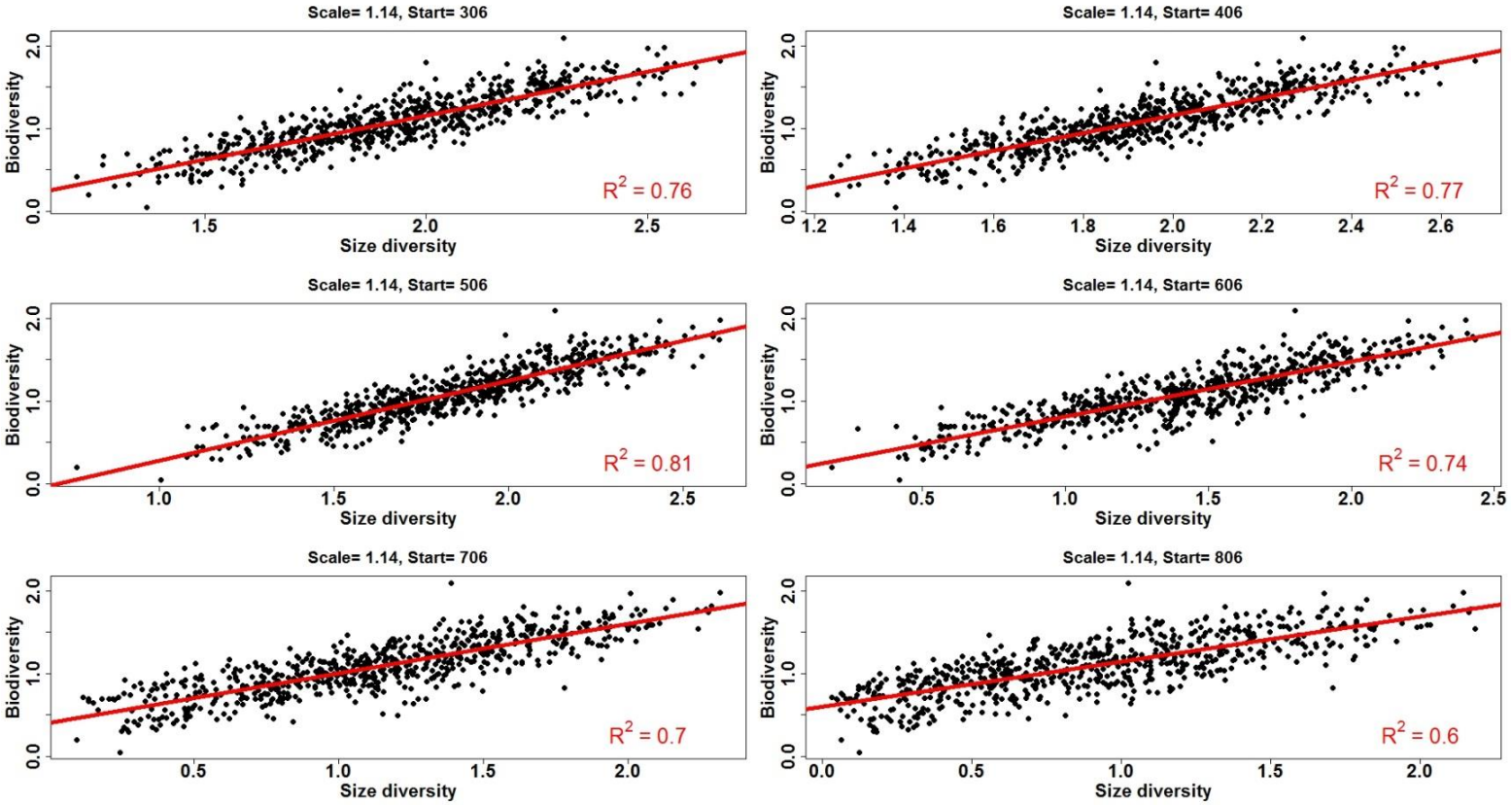
Diversity

- correlation between biodiversity and size diversity is significant
- $R^2 = 0.80$, $p < 0.0001$



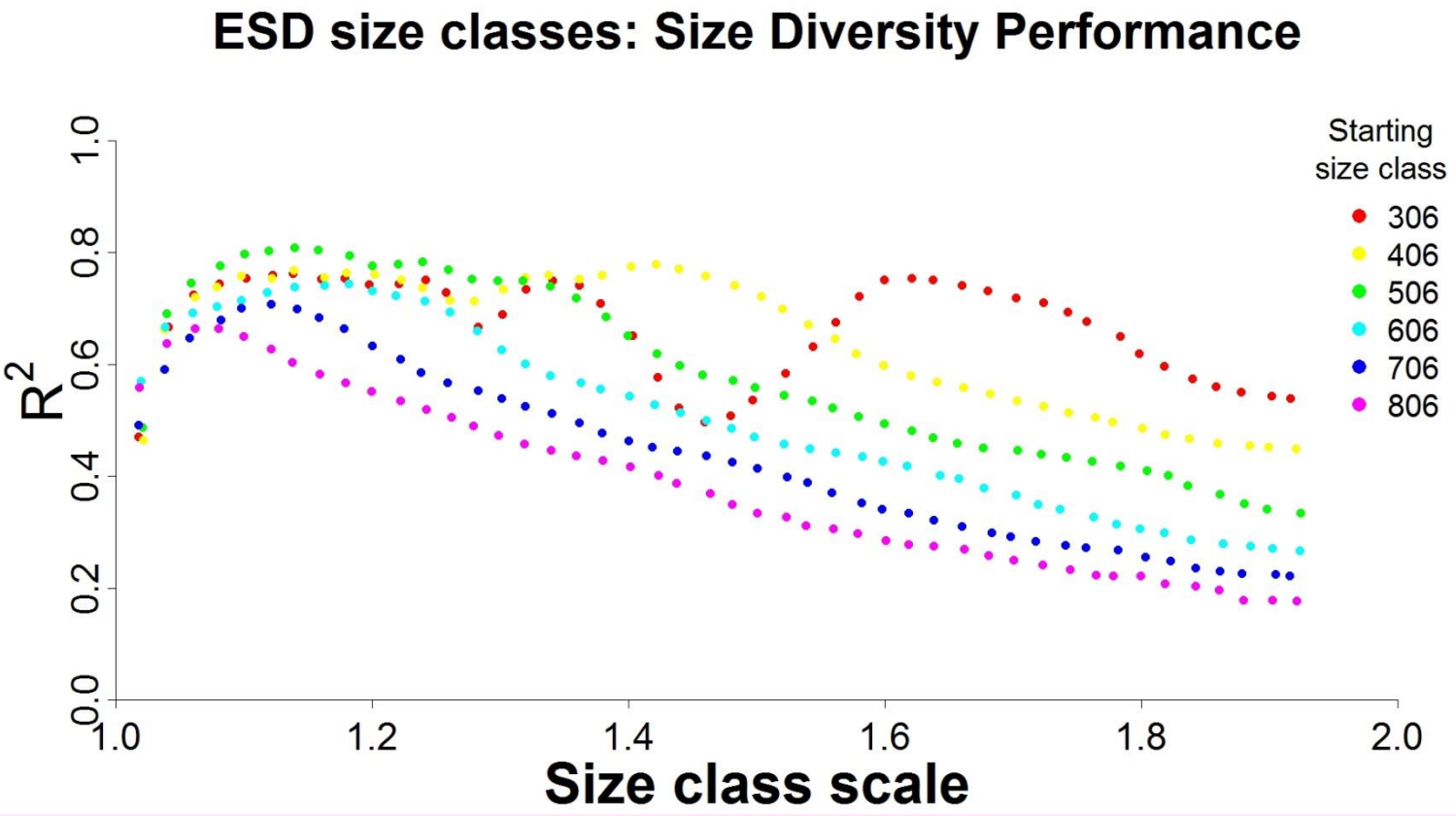
Diversity

- correlation between biodiversity and size diversity changes when different starting bins are chosen (mesh test)



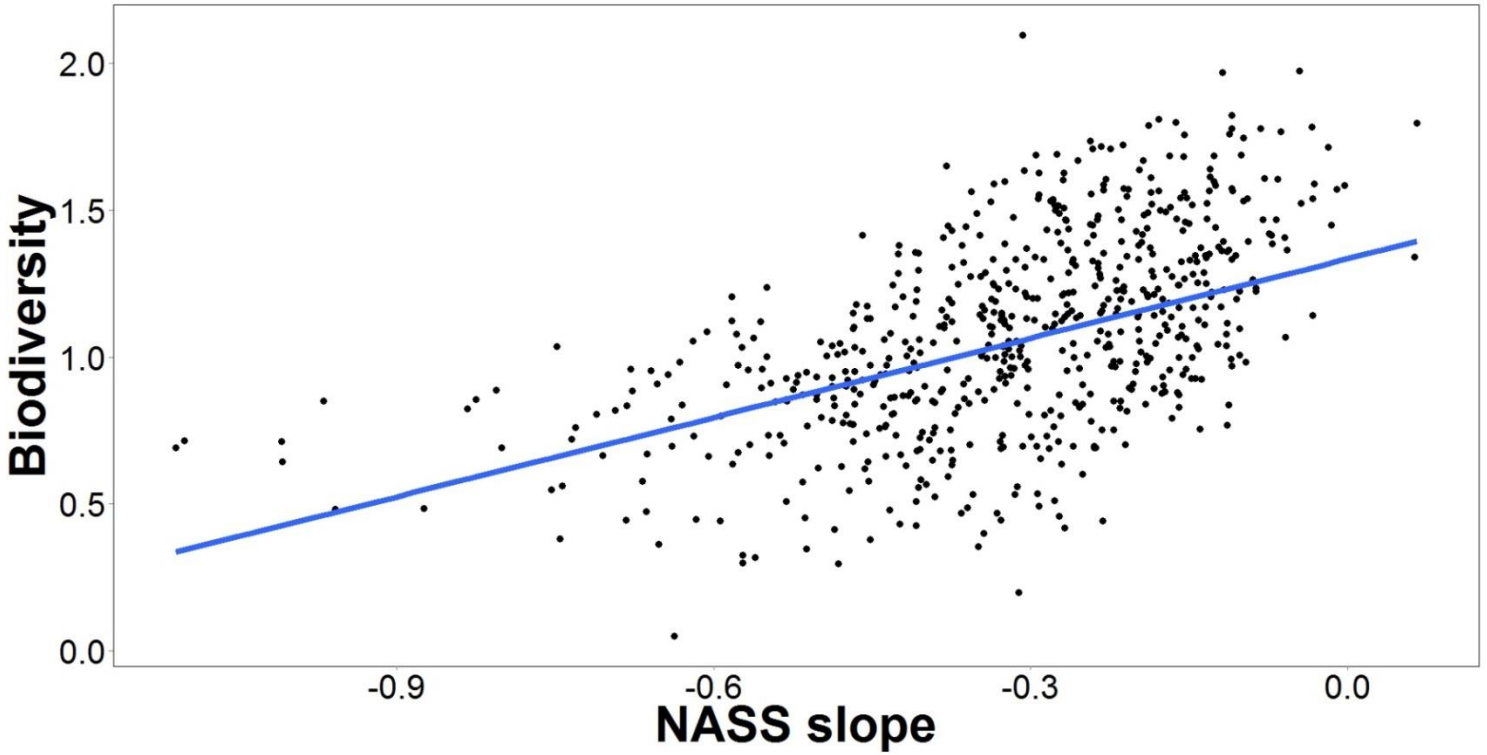
Diversity

- correlation tested using different scaling for size bin widths (and as a result also their number)



NASS

- correlation between biodiversity and NASS is significant, but the correlation is not apparent
- not as suitable an indicator as size diversity
- $R^2 = 0.31$, $p < 0.001$

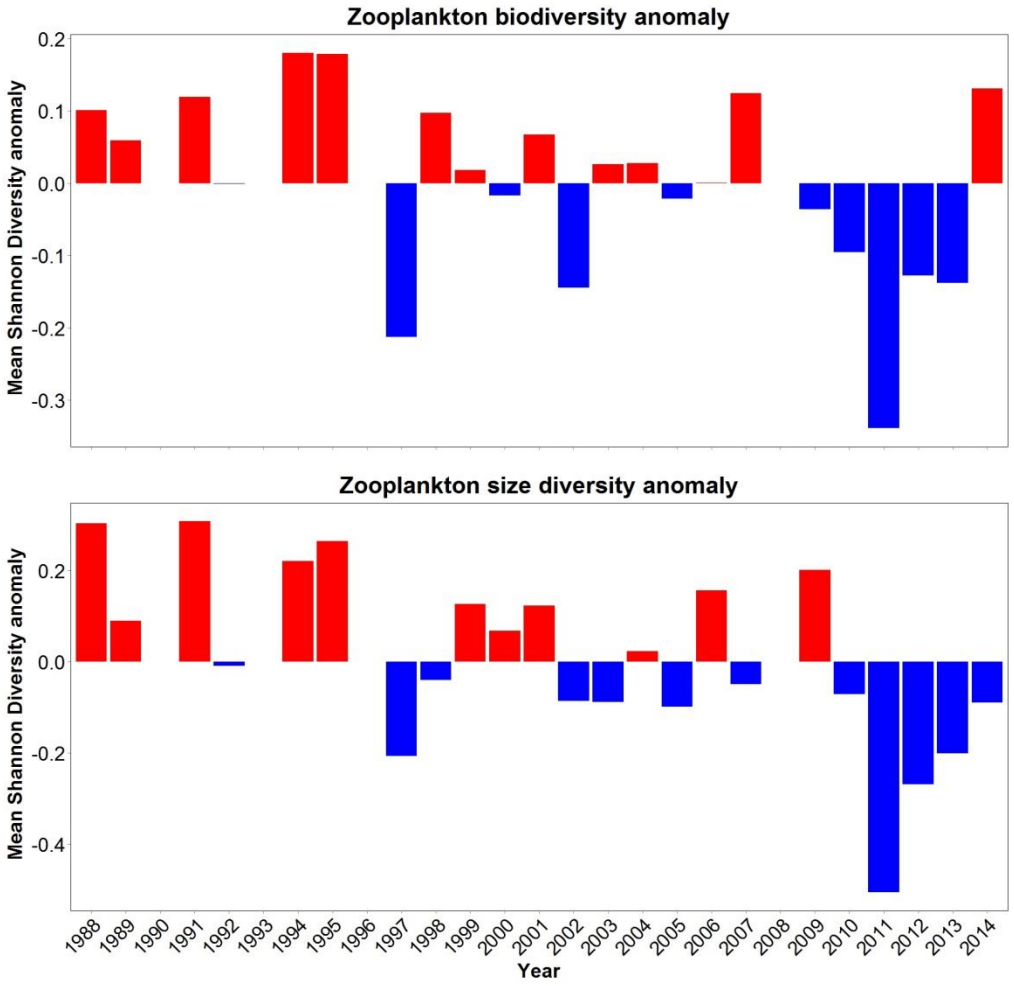


Diversity

- zooplankton diversities show decreasing trends since 1988

- 3 diversity periods:
  - 1988 – 1996 high
  - 1997 – 2009 varying
  - 2010 – 2013 low

- size diversity also detected the shifts



Outlook

- food for thought for management purposes and monitoring
- complementary indicator for automatic monitoring using optical or acoustic sensors
- changes in size composition may alter energy available for predators
    - implications for fisheries management and good environmental status

Thank you for your attention!

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