BALLOON
Baltic Lagoon Network

ARTWEI

LAGOON HEALTH & INDICATORS

South Baltic
PROGRAMME

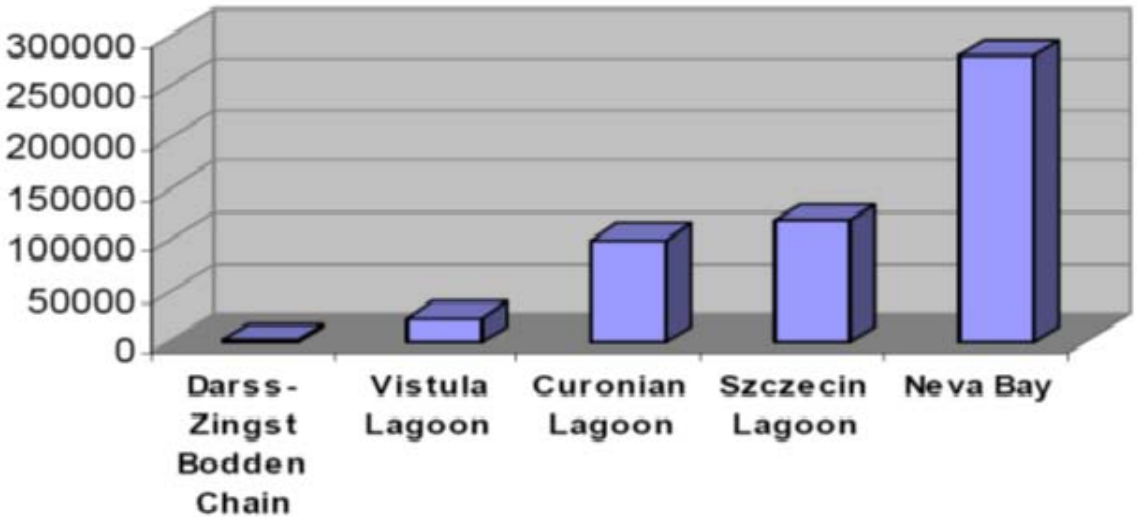
Main principles

- Subset of MSFD
- Transitional water specific
- Strong link to salinity, hydraulics and morphometry
- Organized in a google forms database

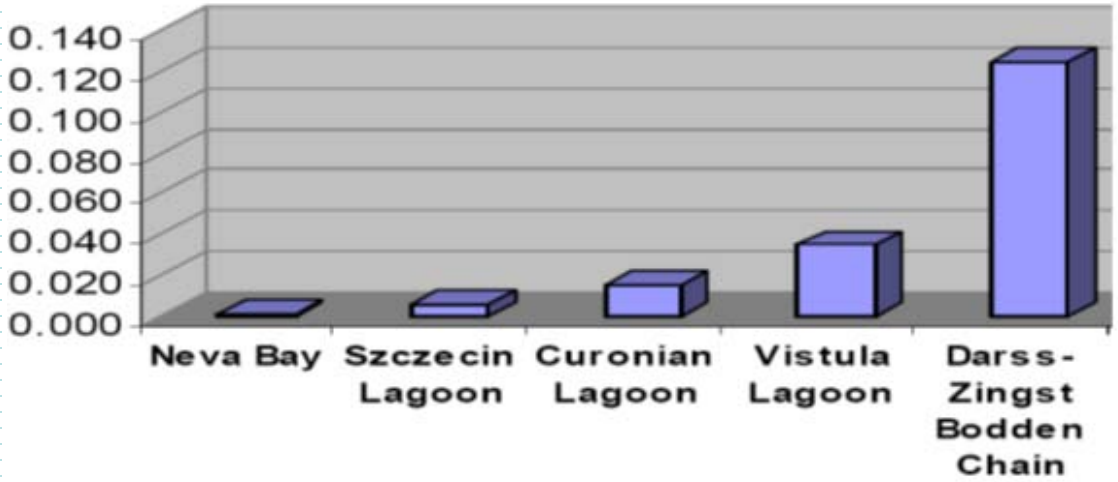
Typology (spatial dimension)

- Depth
- Residence time
- Salinity
- Bottom sediment type
- Depth and wind fetch

- ✓ Salinity
- ✓ Surface area
- ✓ Degree of confinement
- ✓ Sediment type
- ✓ Vegetation type
- ✓ Depth
- ✓ Oxygen
- ✓ Time (seasonality)



Catchment area



Surface Area : Catchment ratio

(after B. Chubarenko)

Catalogue of biological indicators

*Required

1. Name of indicator *

2. Attributes/components of biodiversity addressed

Components of biodiversity addressed *

- [ ] Birds
- [ ] Mammals
- [ ] Cephalopods
- [ ] Fish
- [ ] Seafloor (soft, hard, reefs etc)
- [ ] Water column (phyto- or zooplankton)

Taxonomic distinctness	Fish, Seafloor (soft, hard, reefs	Scientific information/ research		These are	Single-species
Fish Indices	Fish	Scientific information/ research	1.2.1.4Fish	Measurement of the	Single-species
Phylogenetic structure	Birds, Mammals, Seafloor (soft,	Scientific information/ research		Measures that	Large-scale species
Number of species	Birds, Mammals, Cephalopods,	Scientific information/ research		Simple concept, but	Single-species
Higher taxonomic diversity	Birds, Mammals, Cephalopods,	Scientific information/ research		Individuals in	Large-scale species
Gut contents of key predators	Fish			Uses the concept of	Single-species
Death assemblages	Seafloor (soft, hard, reefs etc)	Scientific information/ research		Compares the living	Large-scale species
Measurement of functional diversity	Birds, Mammals, Cephalopods,	Scientific information/ research		Must identify to	Single-species
Genetic markers	Birds, Mammals, Cephalopods,	Scientific information/ research	1.3Population	Genetic diversity is	Specialist/expensive
Satellite imagery	Seafloor (soft, hard, reefs etc),	Scientific information/ research		Satellite sensors	Specialist/expensive
Acoustic ground discrimination systems	Seafloor (soft, hard, reefs etc)	Scientific information/ research		AGDS is an	Specialist/expensive
Soft-bottom macrobenthic fauna: sampling and	Seafloor (soft, hard, reefs etc)	Scientific information/ research		Soft bottom	Large-scale species
Epibenthic sampling using dredges or trawls	Seafloor (soft, hard, reefs etc)	Scientific information/ research		Epibenthic	Single-species

Innovations

- Due to strong annual and interannual variability combined with spatial differences (within and between lagoons) use of taxonomic indicators is rather complicated (all lagoons are dominated by opportunistic species)
- Focus on food webs as integrating component

Proposed metrics 1

$\delta^{15}N$ and, possibly, $\delta^{34}S$ values in widely distributed and dominated macro species. This metrics could be used across the number of different ecosystems and presumably could be indicators of trophic organization (particularly eutrophication status). Analysis now are comparatively cheap and robust.

Proposed metrics 1 (continued)

- Macrozoo- and nektobenthos:
- Gammarids (separate size classes)
- TAKE CARE OF THE SALINITY FOR INTERPRETATION
- Bivalves (dreissena ???)
- Worms (Hediste)

Proposed metrics 1 (continued)

- Fish:
- Bream, pikeperch, ruffe (different size
- Birds:
- Cormorants, seagulls

TAKE CARE OF THE SALINITY FOR INTERPRETATION

FOOD WEB METRICS

Pros:

Should integrate the most robust and stable properties. Could provide detailed and sophisticated information about the trophic organisation of marine ecosystems, especially network analysis related indices (e.g. (Sandberg et al., 2007; Tomczak et al., 2010),

FOOD WEB METRICS

Pros:

Could be reused for the management (especially fish stocks)

FOOD WEB METRICS

Cons:

Requires quite detailed knowledge on the biomass and diets of dominant species needed to reconstruct the food webs.
Possibly could be successfully applied on reduced number of trophic compartments of higher trophic levels (macrozoobenthos and higher).

Trends (for all 3 lagoons)

- Nutrient loads (Arturas)
- Chlorophyll A (Sergey A.)

DEALAYED !!! Contract with Sergej Aleksandrov ready only now !!!

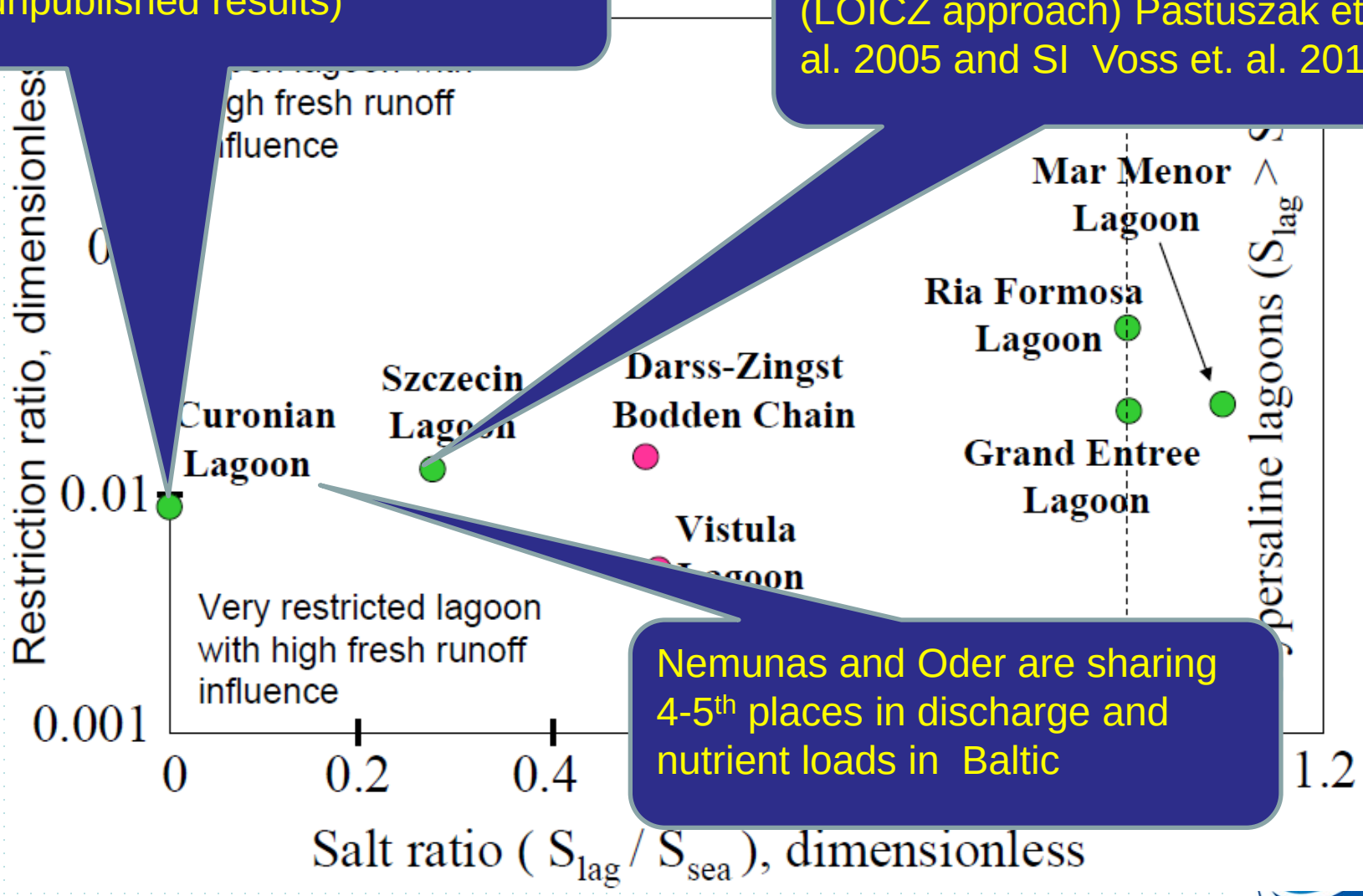
composition)(Tomas R./Arturas)

- Fish catches & community structure (Nardine)

Nutrient loads and retention (in a view of BSAP targets reviewing process)

In situ experimental approach and balance calculation (our unpublished results)

Balance based calculation (LOICZ approach) Pastuszak et al. 2005 and SI Voss et. al. 2010

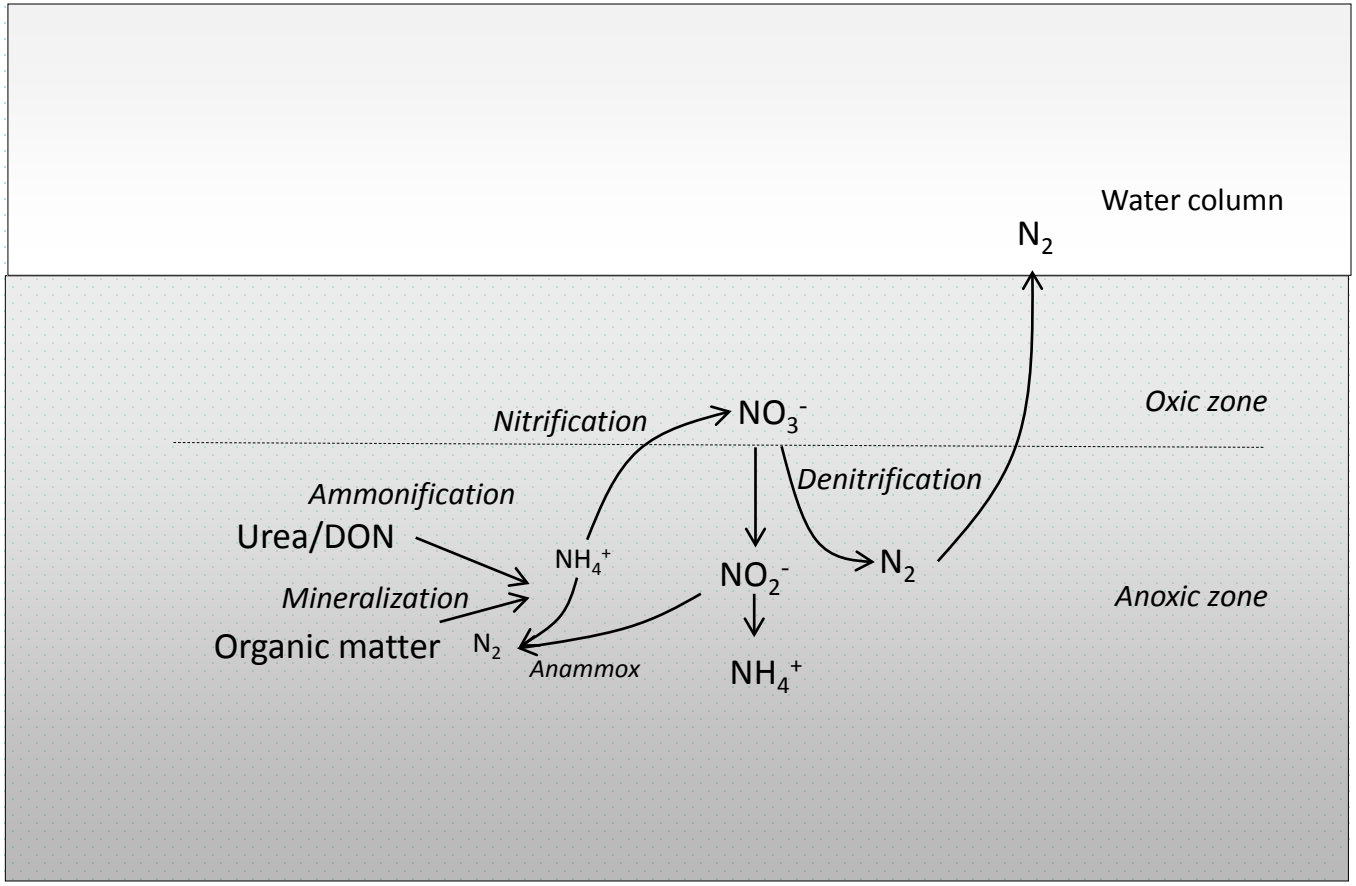


Nemunas and Oder are sharing 4-5th places in discharge and nutrient loads in Baltic

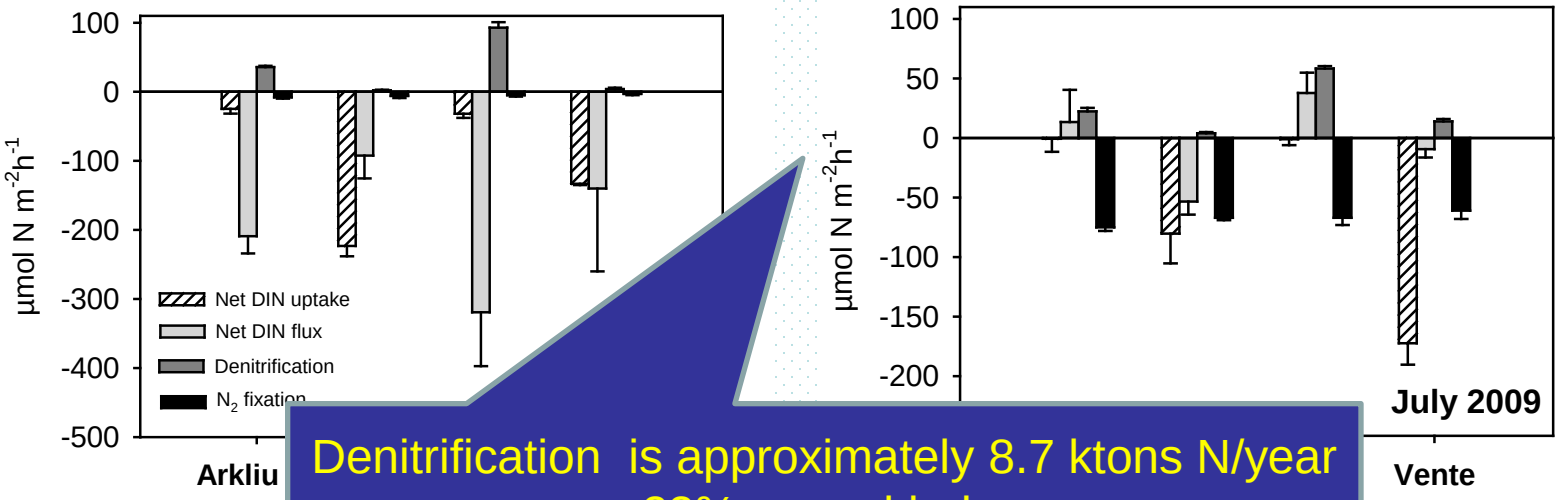
South Baltic PROGRAMME

Where nitrogen could disappear ?

Sedimentary nitrogen cycle



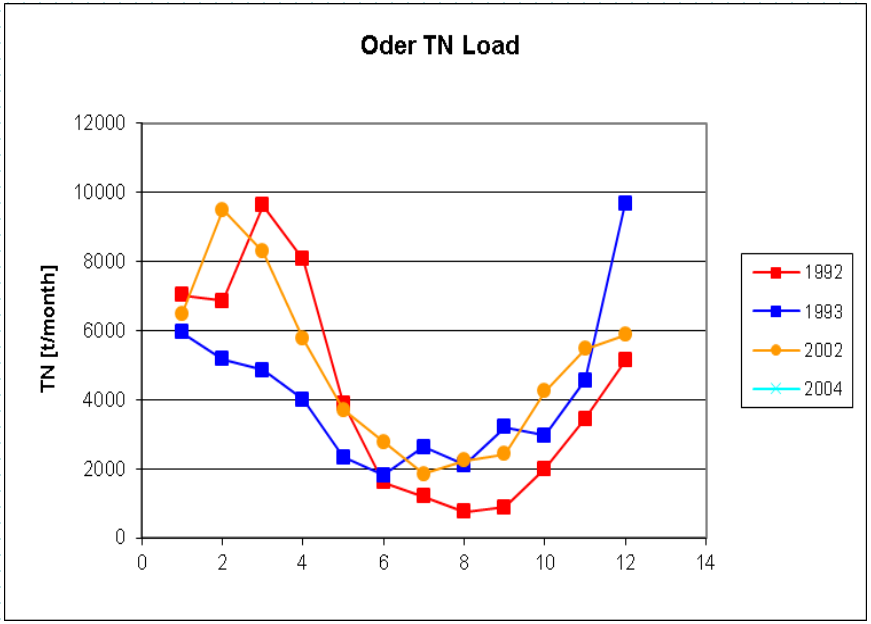
DIN bentopelagic flux, denitrification and N fixation in bottom sediments

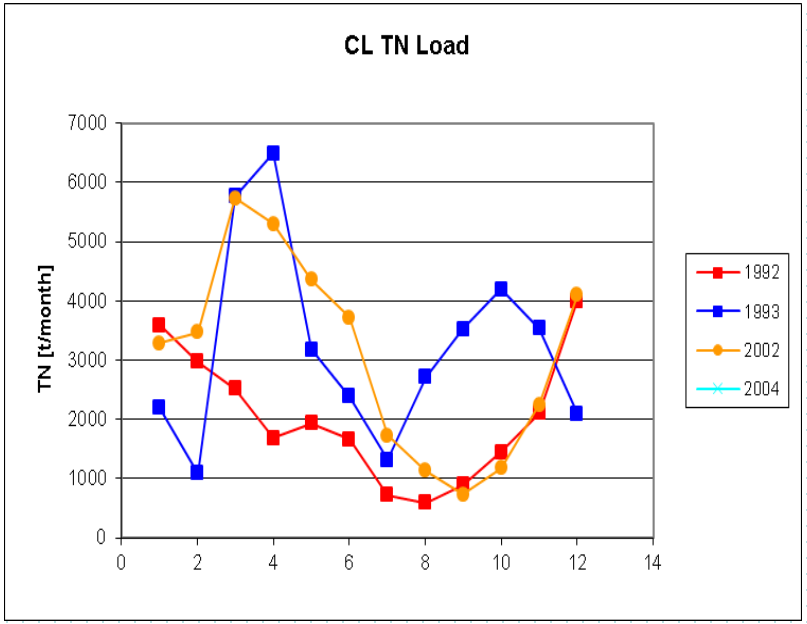


Denitrification is approximately 8.7 ktons N/year or 23% annual balance
(19 ktons N/year or 49% of annual balance in the Oder lagoon according to Pastuszak et al.)

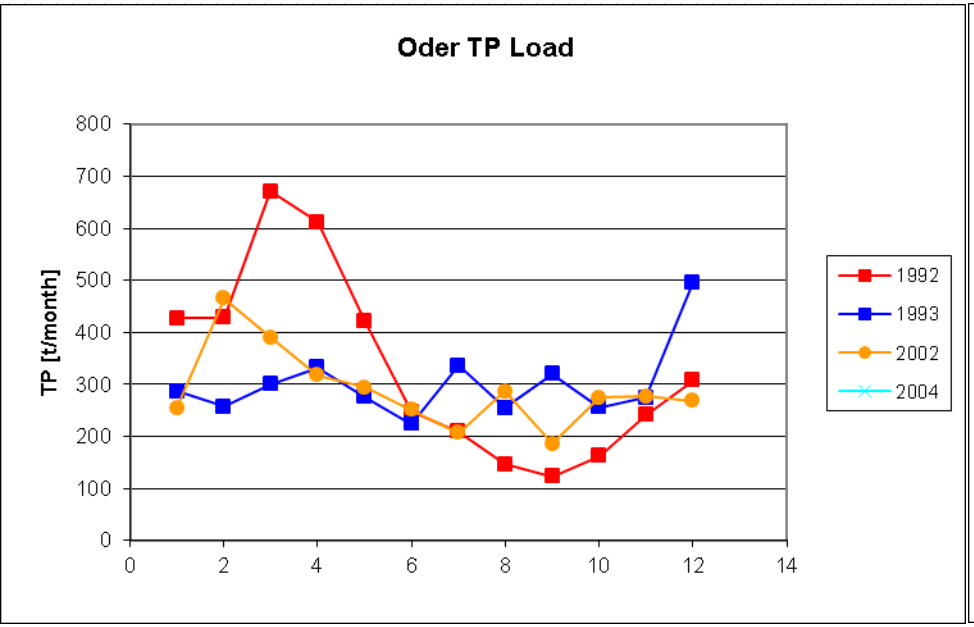
Does season matter ?

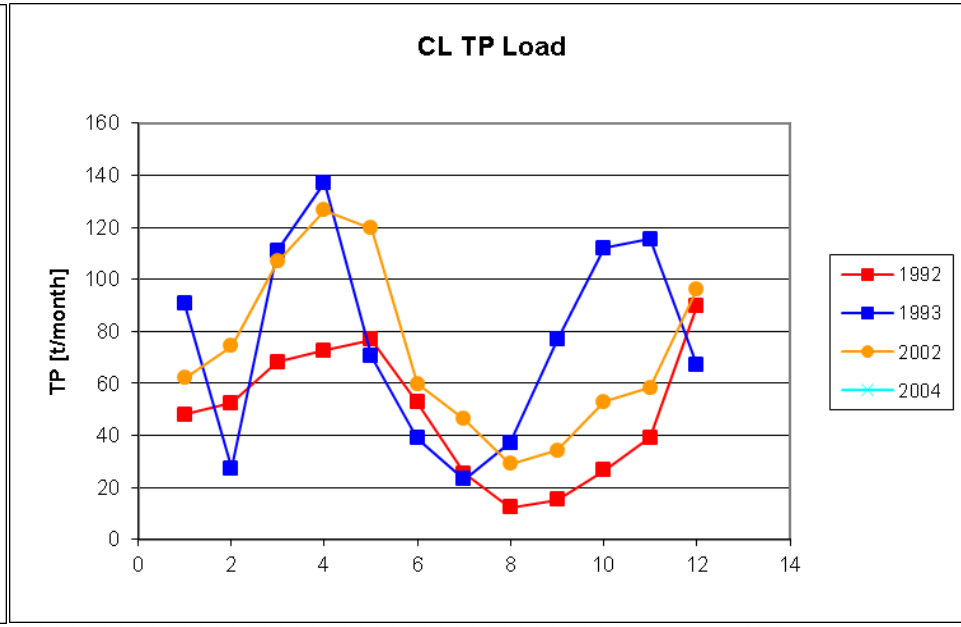
TN loads to the Oder and Curonian lagoons





TN loads to the Oder and Curonian lagoons





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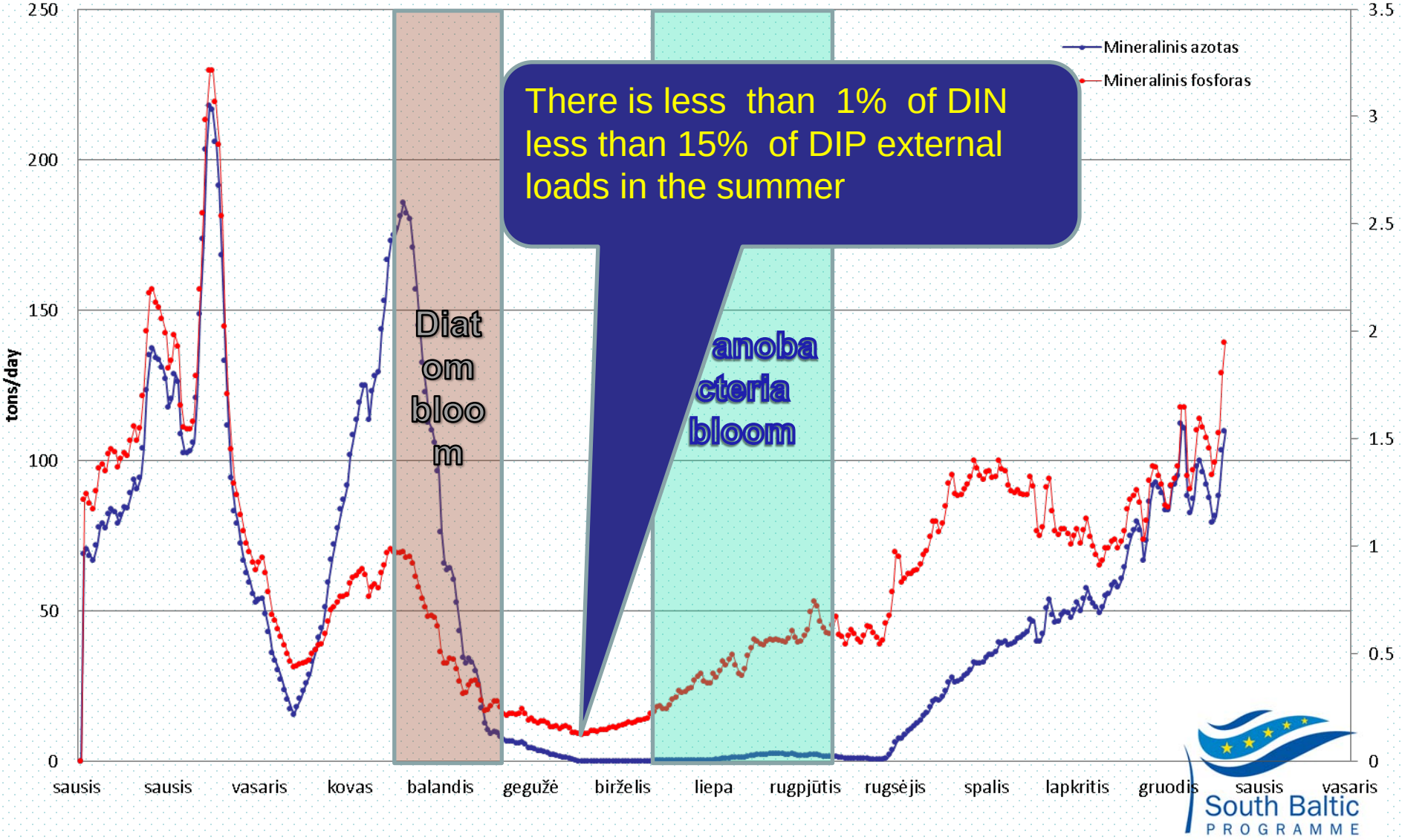
DIN and DIP loading from the Nemunas river in 2011



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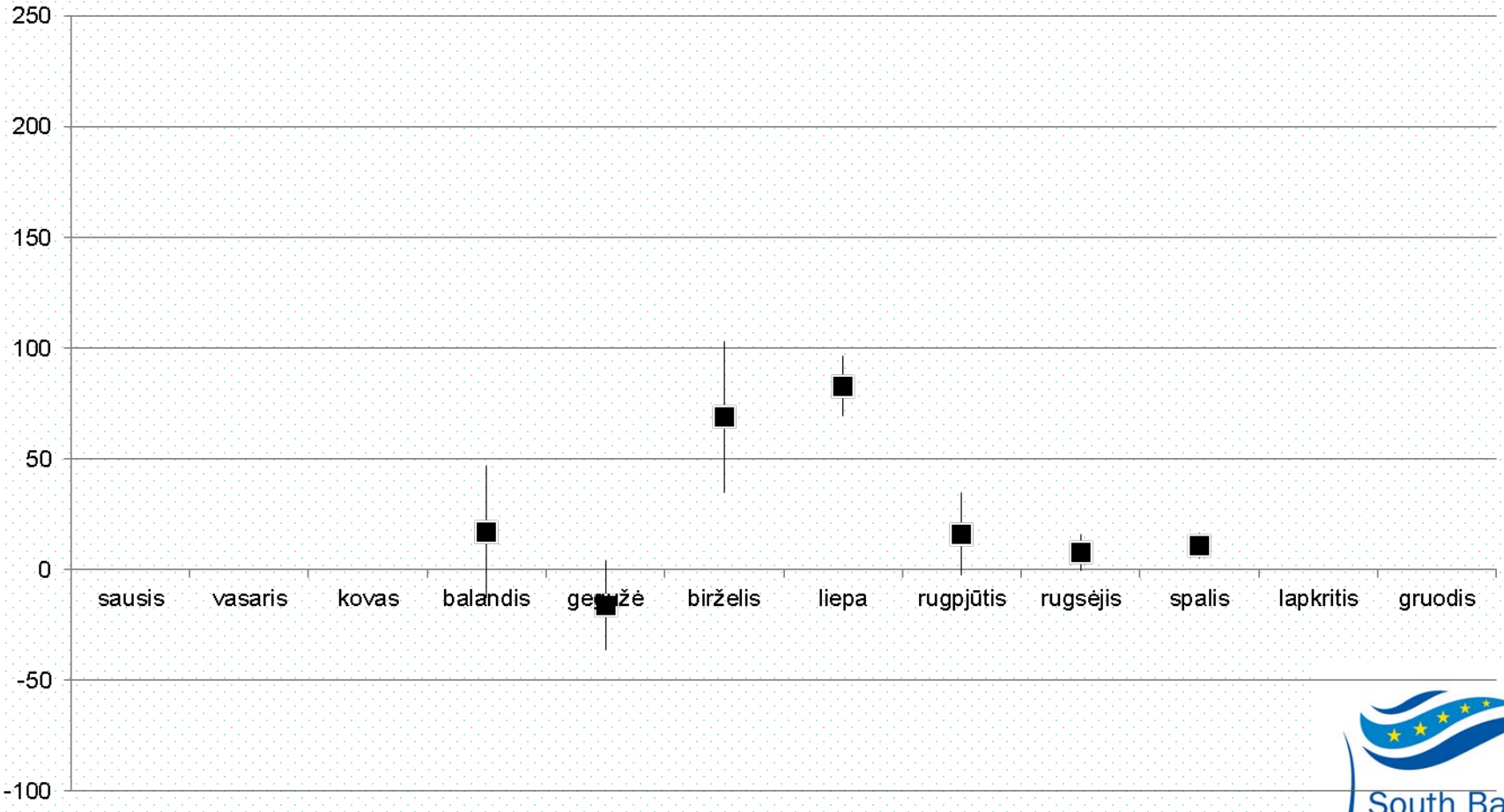
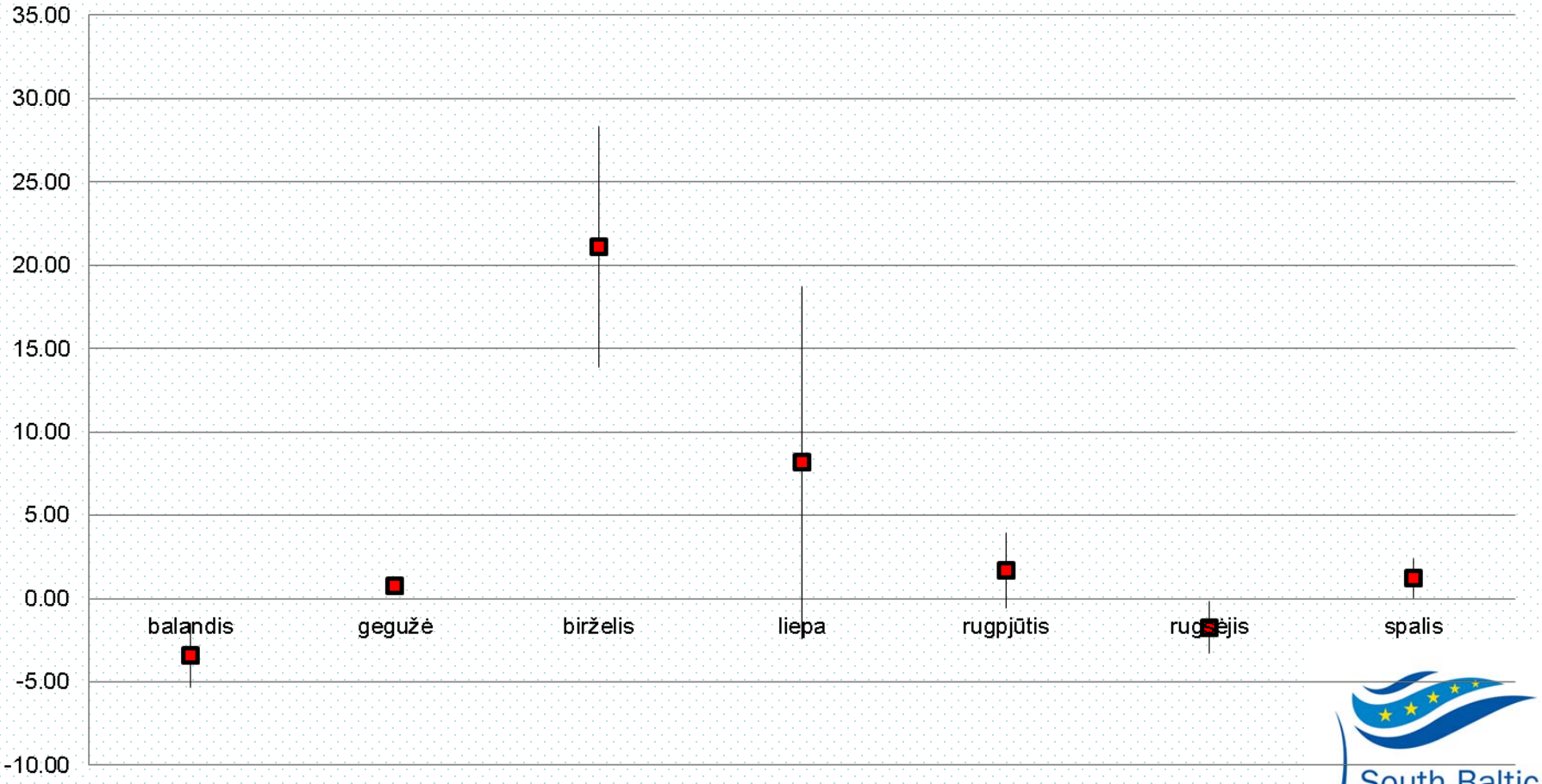
Seasonal internal DIN loads (Curonian lagoon)



Seasonal internal DIP loads (Curonian lagoon)



Conclusions

- 25-50 % of Nitrogen terrestrial loads are retained in lagoons. Main pathway – denitrification
- Presumably ~20-30 % of phosphorus are also retained
- Spring and summer water “blooms” in the lagoon are decoupled and driven by different factors
- Summer, most severe cyanobacteria “blooms” are sustained by internal loads and nitrogen fixation
- Management options aimed at the WQ improvement in coastal lagoons not necessary the same as for the Baltic sea in general.