Lagoon indicators
Malmö

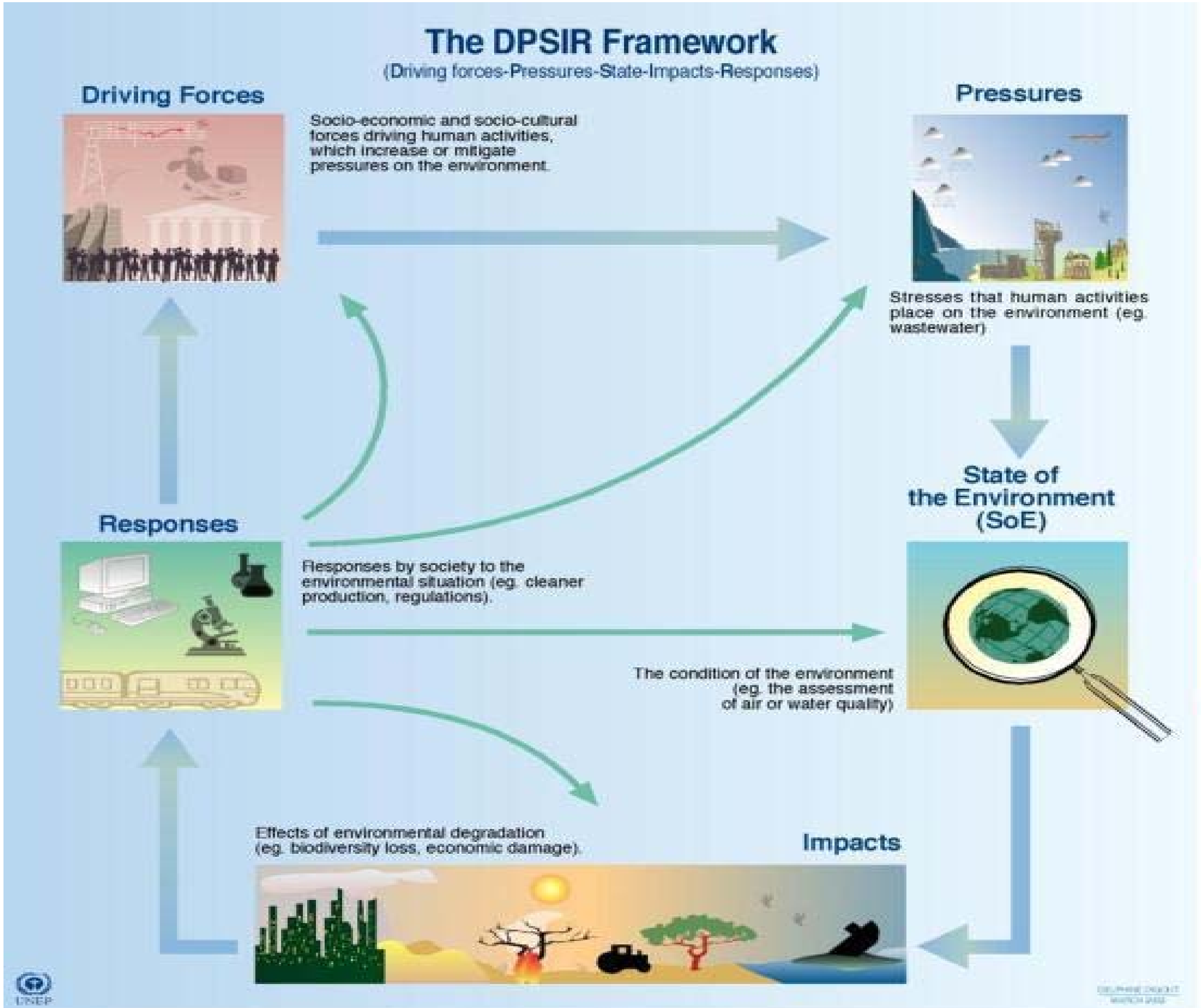
- Linear habitats as indicators (Ramunas)
- A) typology residence time (Boris, Ali)
- B) ChA and index Benthos to CHL A (Sergej A.)
- C) Phytoplonkton community structure (Sergej A.)
- Fish community structure (Arvydas & Arturas, Sergej S.)
- Water quality (sensu WFD):
- Water and nutrient budgets (Arturas, Ali)
- Sediment budget (Boris, Ali)
- Socio-economics part of development / layer existing in context of lagoon (Tomasz ?)
- Local or regional government policy or cooperation (Tomasz?)
- Nature conservation (Kazimierz)

Marine Strategy Framework Directive (MSFD) descriptors – which of them are suitable for the lagoons ???

1. Biodiversity
2. Non indigenous species
3. Commercially exploited fish stocks
4. Marine food webs
5. Human induced eutrophication
6. Sea floor integrity ???
7. Hydrographical conditions
8. Concentration of contaminants
9. Contaminants in fish & seafood ???
10. Marine litter ???
11. Energy and noise ???

Table 2 – Pressures and Impacts	
Physical loss	Smothering (e.g. by man-made structures, disposal of dredge spoil); Sealing (e.g. by permanent constructions).
Physical damage	Changes in siltation (e.g. by outfalls, increased run-off, dredging/disposal of dredge spoil); Abrasion (e.g. impact on the seabed of commercial fishing, boating, anchoring); Selective extraction (e.g. exploration and exploitation of living and non-living resources on seabed and subsoil).
Other physical disturbance	Underwater noise (e.g. from shipping, underwater acoustic equipment); Marine litter.
Interference with hydrological processes	Significant changes in thermal regime (e.g. by outfalls from power stations); Significant changes in salinity regime (e.g. by constructions impeding water movements, water abstraction).
Contamination by hazardous substances	Introduction of synthetic compounds (e.g. priority substances under Directive 2000/60/EC which are relevant for the marine environment such as pesticides, antifoulants, pharmaceuticals, resulting e.g. from losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances); Introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting e.g. from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs); Introduction of radio nuclides.
Systematic and/or intentional release of substances	Introduction of other substances, whether solid, liquid or gas, in marine waters, resulting from their systematic and/or intentional release into the marine environment, as permitted in accordance with other Community legislation and/or international conventions.
Nutrient and organic matter enrichment	Inputs of fertilisers and other nitrogen - and phosphorus-rich substances (e.g. from point and diffuse sources, including agriculture, aquaculture, atmospheric deposition); Inputs of organic matter (e.g. sewers, mariculture, riverine inputs).
Biological disturbance	Introduction of microbial pathogens; Introduction of non-indigenous species and translocations; Selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing).

DPSIR and indicators



Source : Global International Water Assessment (GIWA), 2001; European Environment Agency (EEA), Copenhagen

Typology and gradients

- Parallic ecosystem concept Guelorget et al (1983) in the Mediterranean lagoons developed including the that not the salinity, but rather the degree of confinement is the deciding factor in shaping the biological communities.

BALLOON
Baltic Lagoon Network

ARTWEI

Journal of Coastal Research	9	2	378–389	Fort Lauderdale, Florida	Spring 1993

Relationships between Benthic Communities and Physical Environment in a Lagoon Ecosystem

Bertrand Millet† and Olivier Guelorget‡

†Centre d'Océanologie de Marseille
Université d'Aix-Marseille II
Campus de Luminy
F-13288 Marseille, France

‡Laboratoire d'Hydrobiologie Marine
Université de Montpellier II
Place Eugène Bataillon
F-34095 Montpellier, France

ABSTRACT

MILLET, B. and GUELORGET, O., 1993. Relationships between benthic communities and physical environment in a lagoon ecosystem. *Journal of Coastal Research*, 9(2), 378–389. Fort Lauderdale (Florida). ISSN 0749-0208.

The Thau lagoon differs from other mediterranean lagoon sites in the apparent complexity of its benthic community structures, which seem to result from the relative complexity of its physical environment.

A statistical analysis of the relationship between the abundances and biomasses of benthic taxa and the lagoonal hydrodynamic characteristics was carried out. An ACE-type statistical algorithm is used to expose the non-linear relationships in multiple regressions. Polychaete and crustacean biomasses along with mollusc densities at 15 sampling stations are considered as dependent variables. The granulometric fraction of the sediment below 40 μ as well as hydrodynamic descriptors such as kinetic energy and the exchange term H'V', resulting from a numerical modeling of circulation forced by stochastic winds, are considered as predictors.

The results demonstrate that the exchanges resulting from the hydrodynamic conditions within the watermass have a dominant beneficial influence on the development of each of the zoological groups considered. In addition, the importance of the sedimentary substrate is confirmed, but gives an interesting non-linear result, with a threshold between 3 and 6% of the fraction of fine particles below 40 μ. Apart from the quantification of this sedimentological indicator it appears that the dominant influence of the hydrodynamic exchange processes throughout the lagoon on the development of the benthic biological structures, quite independently of any bathymetric considerations, could give a new insight into the spatial organization of benthic communities in lagoonal ecosystems.

ADDITIONAL INDEX WORDS: *Coastal zone, benthos ecology, granulometry, hydrodynamic model, statistical analysis.*

INTRODUCTION

The Thau lagoon is unlike most other mediterranean lagoons, where observations typically show a biological organization along a very marked confinement gradient relative to the sea. On the

shallow water bodies studied by GUELORGET *et al.* (1986, 1987, 1989, 1990), and by NICOLAIDOU *et al.* (1988), may be connected with a certain heterogeneity of the environment. This heterogeneity is linked in particular to the unusually diffuse nature of its contacts with the sea (two true chan-

Biological diversity shows a gradient from maximum to minimum, from the communication channels to the confined areas. Meanwhile, **benthic biomass** and abundance of individuals show the inverse pattern, with maximum biomass and abundance of individuals in the intermediate areas.

South Baltic
PROGRAMME

In zones where the environmental conditions are more stable (near the channels due to the buffered influence of the open sea environment) the settlement of species exhibiting K-selection strategies is possible. As stated above, these species are larger, reproduce later in life, and develop more slowly. They are, however, superior competitors to r-species in such stable environments. The K-strategists can control, through predator-prey relationships, the r-strategists, which would proliferate exponentially in their absence (top-down control), allowing the establishment of several species spread by the different trophic levels. The diversity is usually high with the use of all available resources available, and this leads to a highly diverse community.

Parallic gradients in the Mediterranean lagoons

- Mollusks usually are the dominant groups close to the sea, where some echinoderms can also be found (as Asterina, Holothuria or Paracentrotus); meanwhile polychaetes, crustaceans, and chironomids successively increase their relative abundance with confinement.

Parallic gradients in the Baltic lagoons

- As the Oder and Curonian lagoons are river dominated the confinement is decided not only by the proximity to the exchange channels, but also by the proximity to the river outlets or deltas
- Vistula lagoon could be more similar to the Mediterranean lagoons

Parallic gradients in the Baltic lagoons (continued)

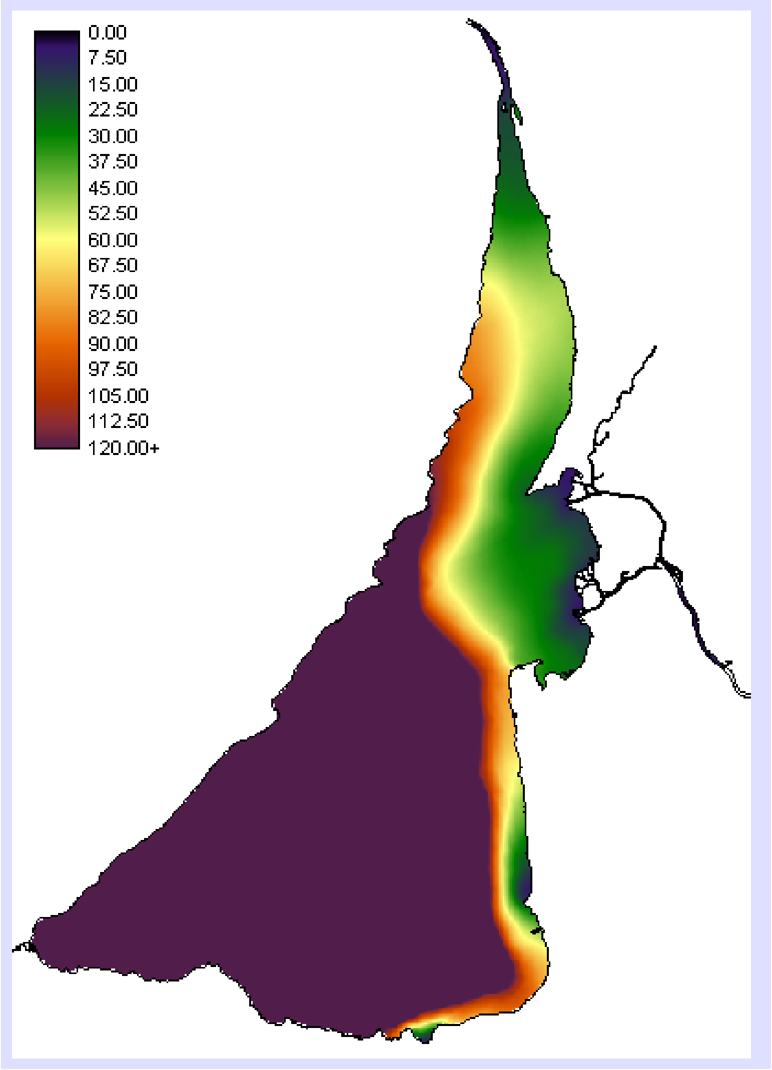
- Baltic (*Haffen coast*) lagoons are planktonic primary production dominated while the Mediterranean lagoons are mostly benthic primary production dominated (including opportunistic macroalgae species)

Parallic gradients in the Baltic lagoons (continued)

- Question: Could the calculated residence time be the proxy for the lagoon gradients ?

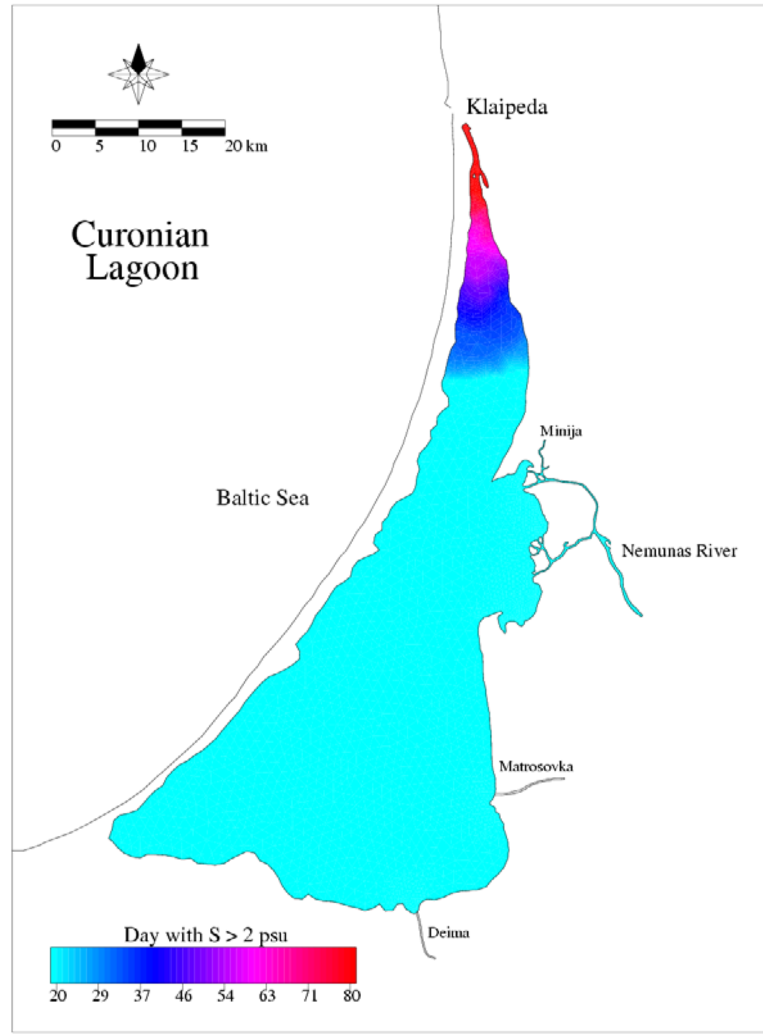
Average residence times

Monthly residence time distribution were averaged with GIS for the simulated period.



Salinity

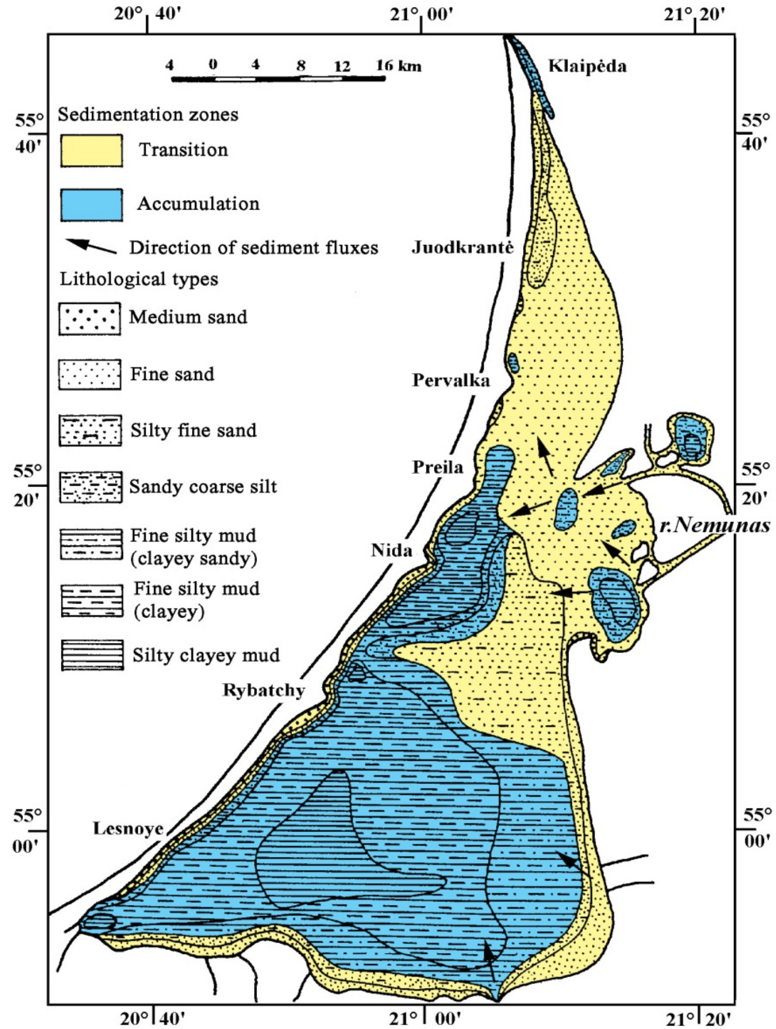
Salinity events have been expressed as day/year that salinity reach 2 psu (which is a limit for Curonian Lagoon organisms)



South Baltic PROGRAMME

Sediment distribution

In function of sediment type and bathymetry evolution we compute the t



11:30-13:30 Discussion on the Baltic lagoon indicators

•Ramunas Linear & Areal Lagoon Indicators

Arturas & Arvydas Fish communities as an indicator

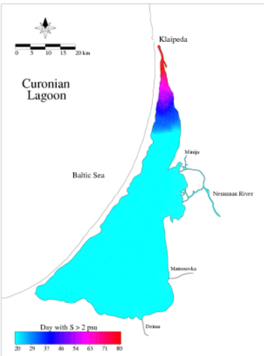
Data issues (external experts)

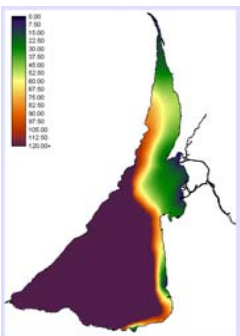
•13:30-14:15 Lunch (at Klaipeda Science and Technology Park)

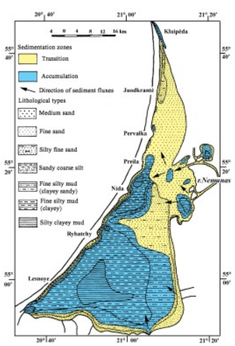
•14:15-17:00 Round table discussion

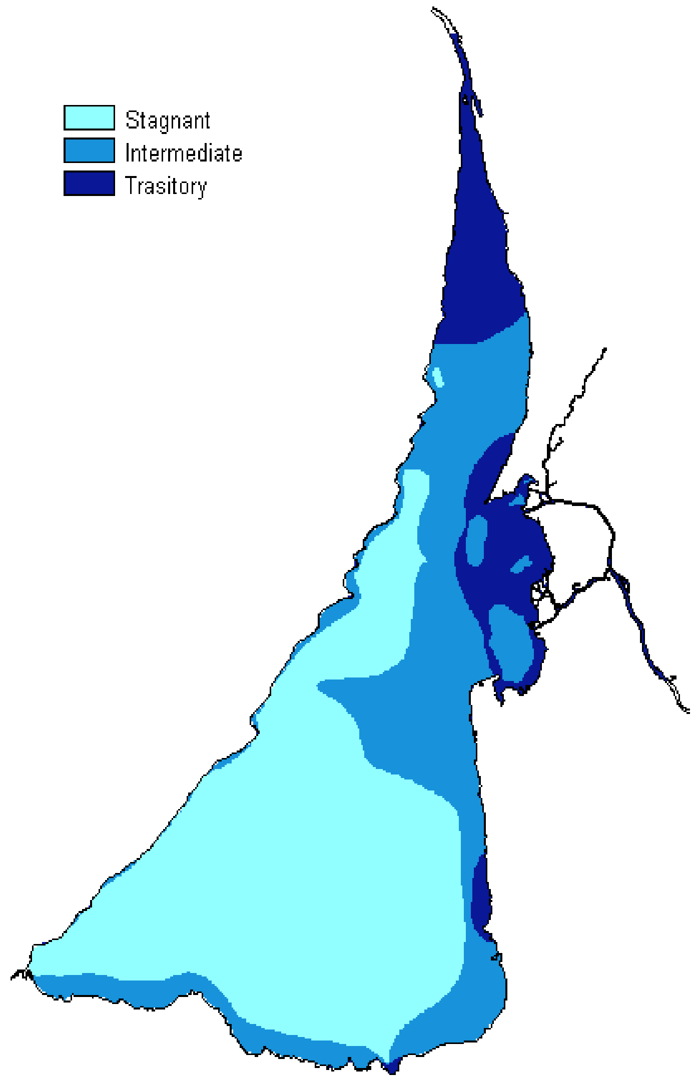
.

Lagoon zonation









Proposed structure of the white paper

- Introduction
- Typology of the Baltic lagoons
- Applicability of WFD and MSFD descriptors
- DPSIR approach – identification of pressures

Indicator classification (after Tomasz)

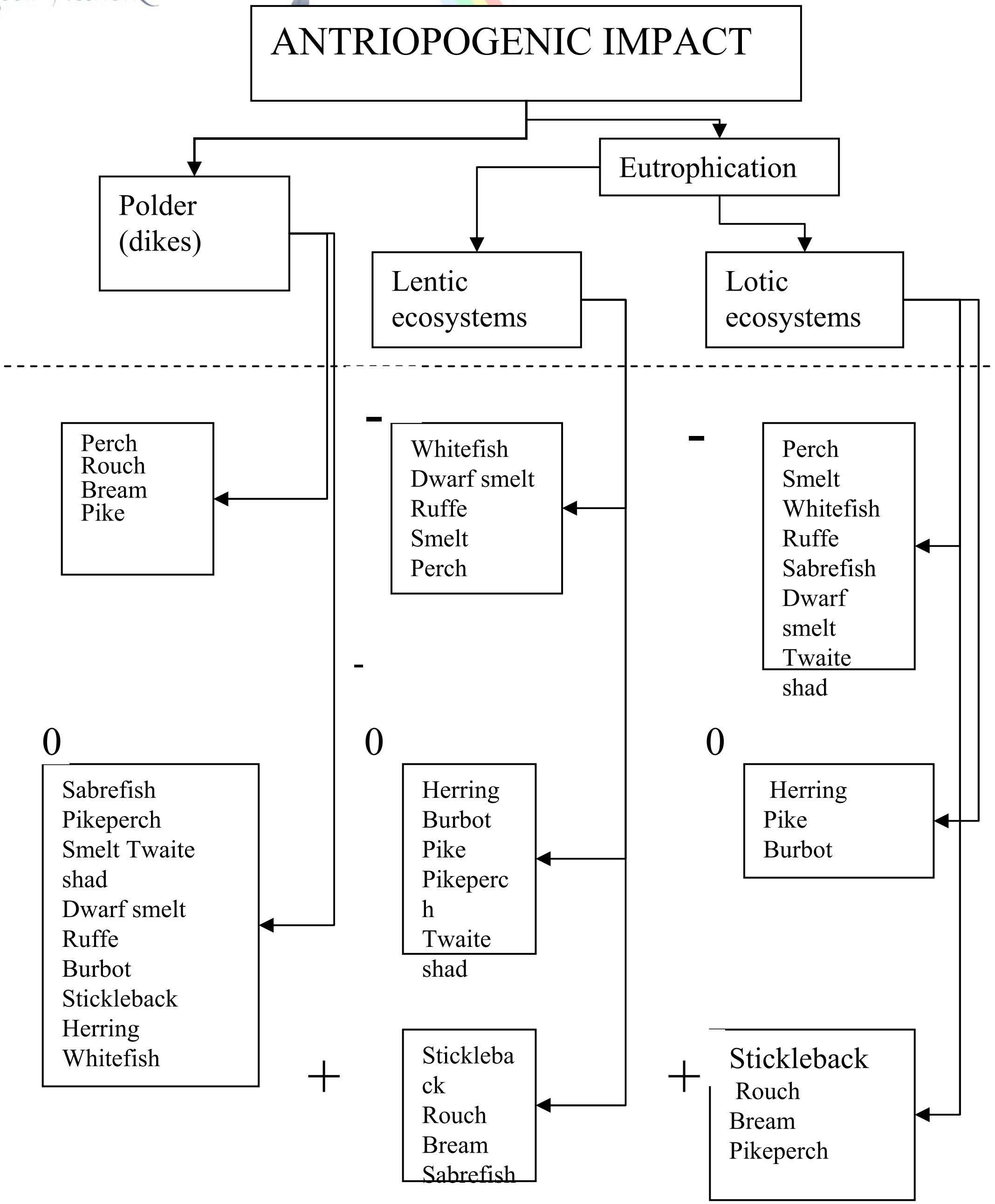
- Natural processes - and nature conditions (clear , not polluted etc.)
- Socio-economics part of development / layer existing in context of lagoon
- Local or regional government policy or cooperation
- Endangering for habitats (biodiversity, conditions) and human economy influence/ factors - natural and anthropogenic ones

THE DEADLINES !!!

- Week prior to Malmoe meeting - 18 September

Task leaders sending the outlines and basic ideas to all partners

Check the National WFD progress


ANTRIOPOGENIC IMPACT
Polder (dikes)
Eutrophication
Lentic ecosystems
Lotic ecosystems
Perch
Rouch
Bream
Pike
-
Whitefish
Dwarf smelt
Ruffe
Smelt
Perch
-
Perch
Smelt
Whitefish
Ruffe
Sabrefish
Dwarf smelt
Twaite shad
-
0
Sabrefish
Pikeperch
Smelt Twaite shad
Dwarf smelt
Ruffe
Burbot
Stickleback
Herring
Whitefish
0
Herring
Burbot
Pike
Pikeperch
Twaite shad
0
Herring
Pike
Burbot
+
Stickleback
Rouch
Bream
Sabrefish
+
Stickleback
Rouch
Bream
Pikeperch

Background

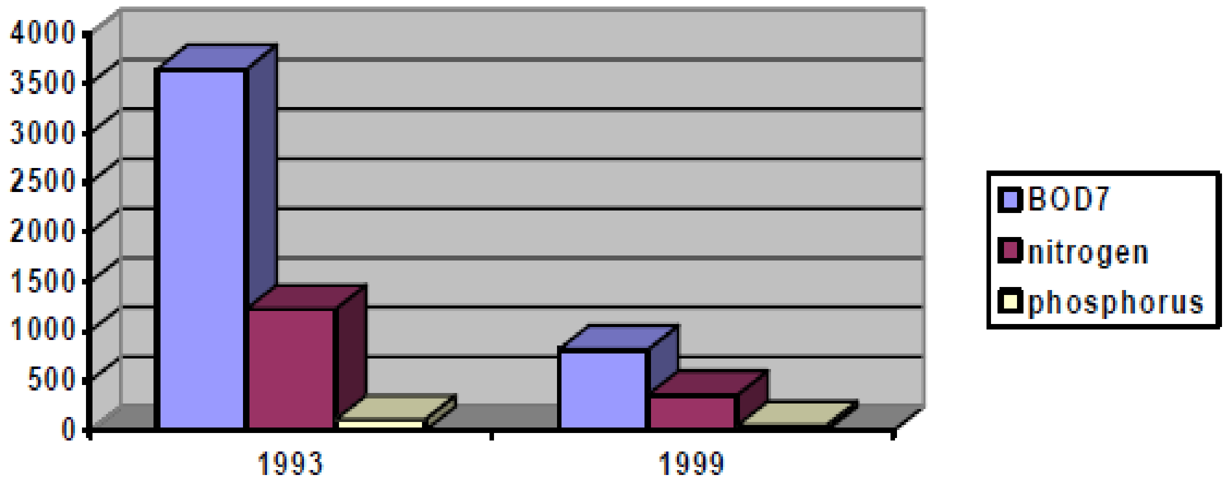
"The first symptom of the eutrophication of the waters in the Lagoon occurred in prewar times. But year by year, the volumes of the agricultural, industrial and municipal waste water increased, especially following the period between 1955 and 1965. This period marked the beginning of the heavy eutrophication of the Curonian Lagoon, due to the poor water quality of the River Nemunas"

HELCOM Thematic report (October 2000)

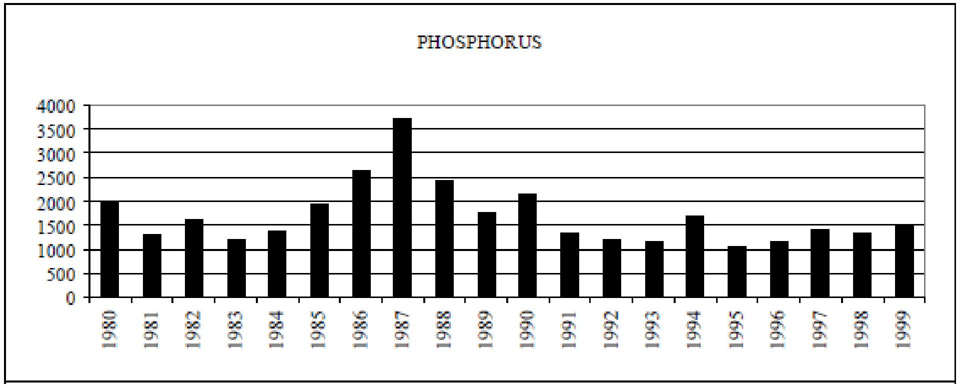
HOTSPOTS WITHIN THE AREA

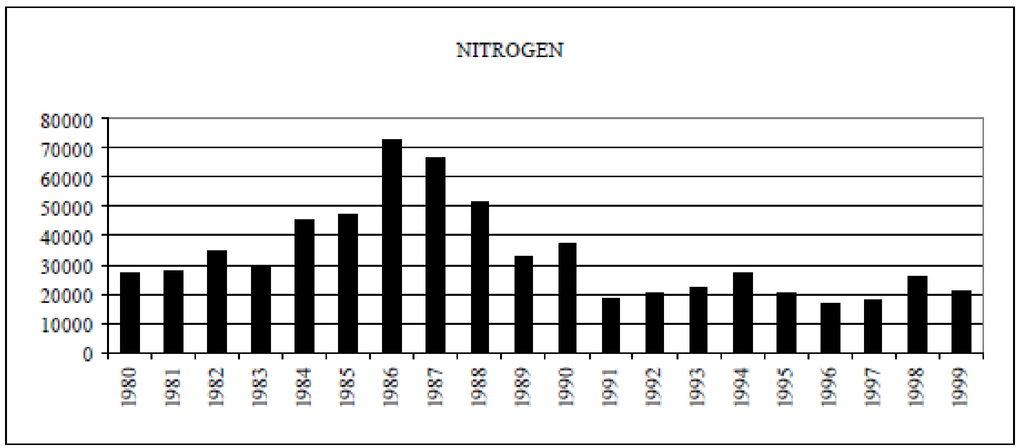
Klaipėda WWTP hot spot (deleted in 2001)

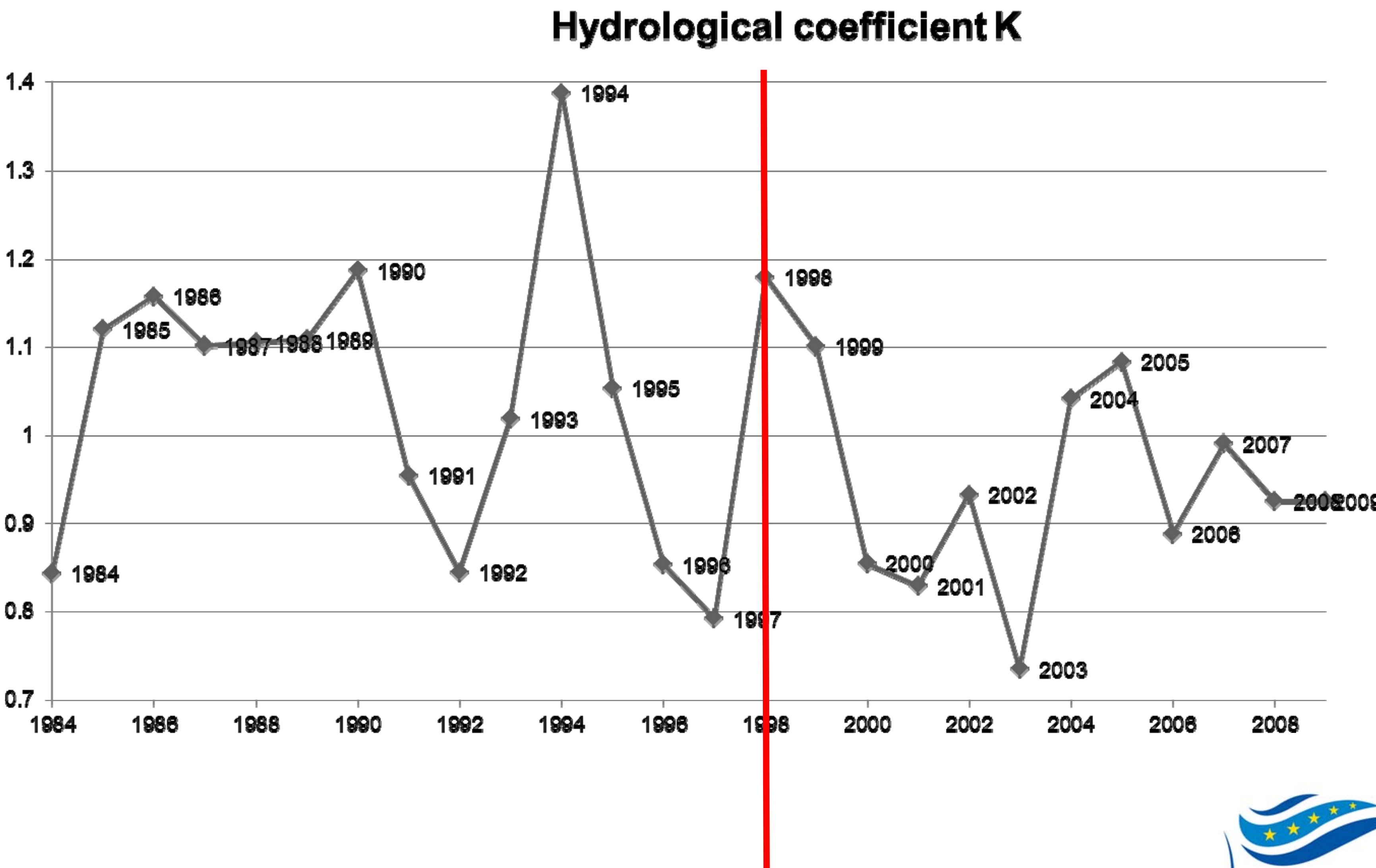
- The secondary and tertiary treatment of waste water introduced in 1998-1999



Nutrient loads (from the above report)






Hydrological coefficient K
1.4
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1984
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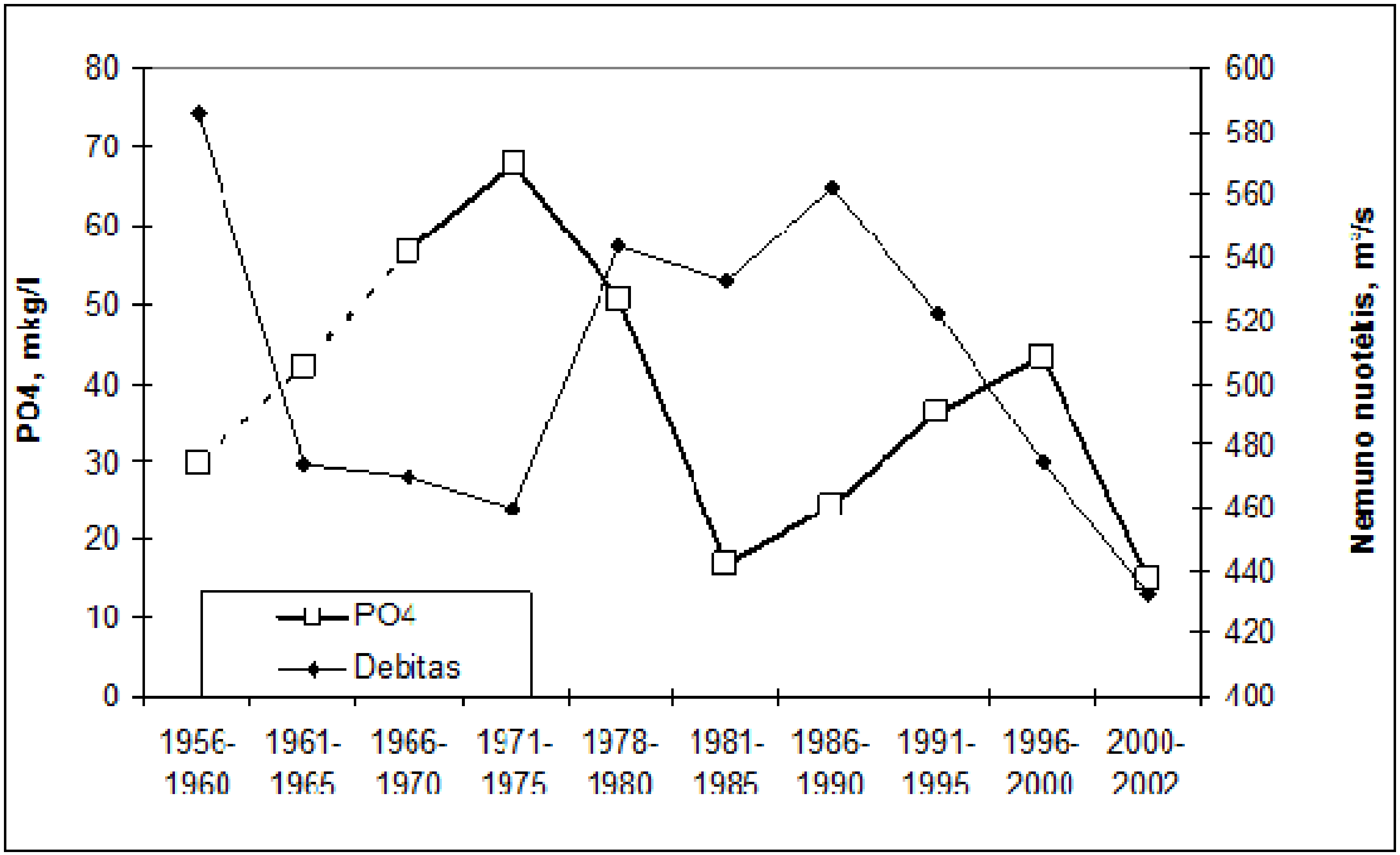
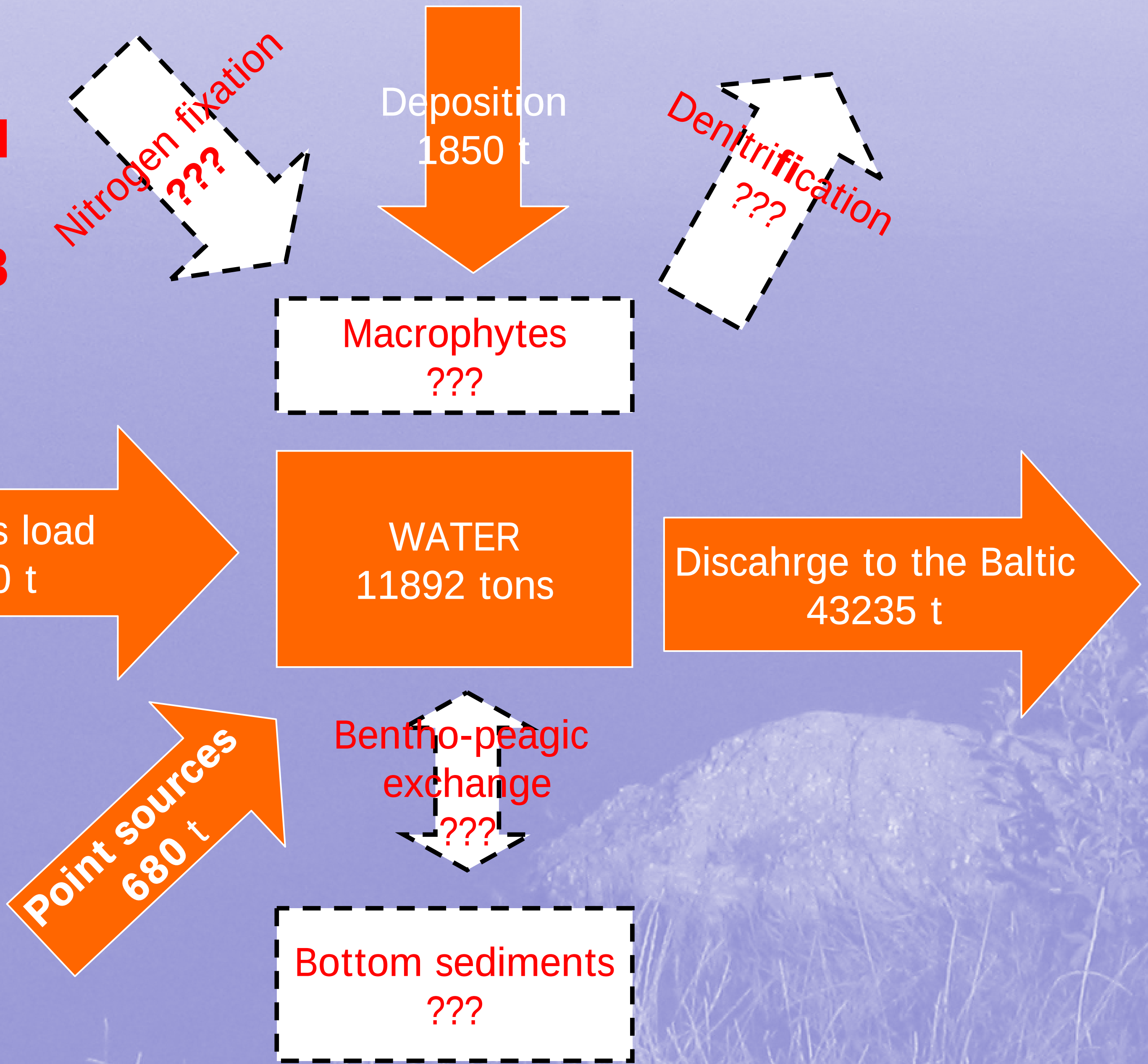
Phosphate concentrations and runoff



Curonian lagoon total N budget after Swaney, 1998



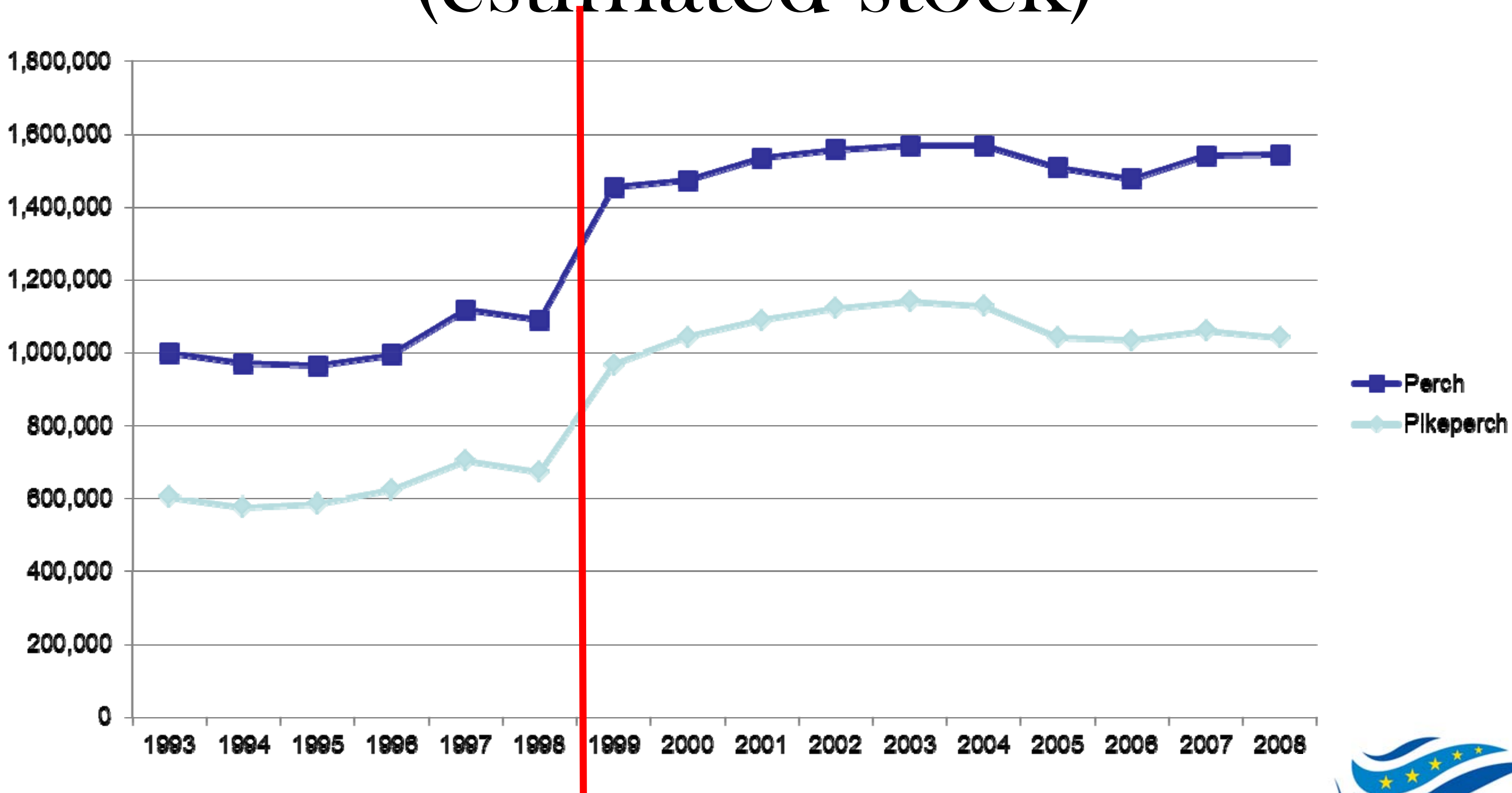
Total N Budget revised (for 2000-2006)

- Recalculated and corrected N budget for 2000-2006 is significantly lower.
- Not so clear for the P (need additional calculations)

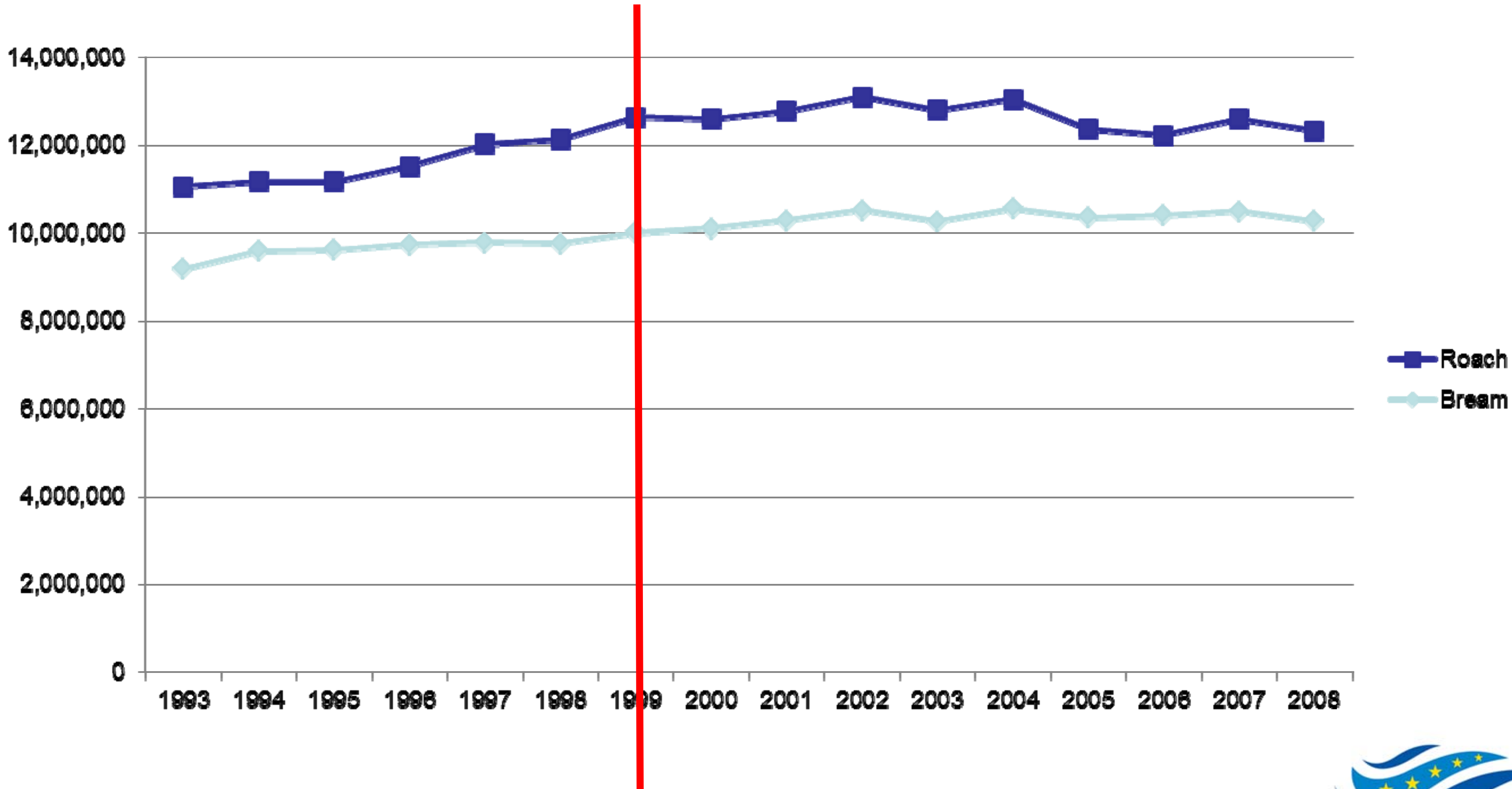
FISHERY

- Reconstruction of stock dynamics based on the population structure (Ložys & Razinkovas, unpublished)

Predatory commercial fish (estimated stock)



Demersal commercial fish stock



Fishery

- Regulation measures improved ?

Conclusions

- Some improvement in mostly N runoff to the lagoon
- Somehow improved stocks of predatory commercial fish

LAGOON INDICATORS

- 1. natural processes - and nature conditions (clear, not polluted etc)
- 2. Socio-economics part of development / layer existing in context of lagoon
- 3. Local or regional government policy or cooperation
- 4. Endangering for habitats (biodiversity, conditions) and human economy influence/ factors - natural and anthropogenic ones

WFD parameters

- Classification
- Macrophytes
- Phytoplankton
- Benthos
- Chemistry
- Residence time (modelled)

Potameid (*Potamonogeton pectinatus* & *P. perfoliatus*) distribution

Water quality class	Maximum potameid penetration depth, m	Comments
Very good	≥ 3 m	Maximum depth observed in 50ties (Minkevičius, Pipinis, 1959)
Good	1-3 m	Contrmporary potameid distribution threshold in the most suitable locations.
Average	0,6- 1 m	Average potameid distribution
Bad	0,6 – 0,5 m	Potameid zone in hydraulically active habitats
Very bas	< 0,5 m	Only *P. pectinatus* ocuurs

Fishery & food webs(MFD)

- Pelagic/benthic fish ratio
- Maximum length of fish
- Nutritional status of ke species
- ECOPATH derived parameters