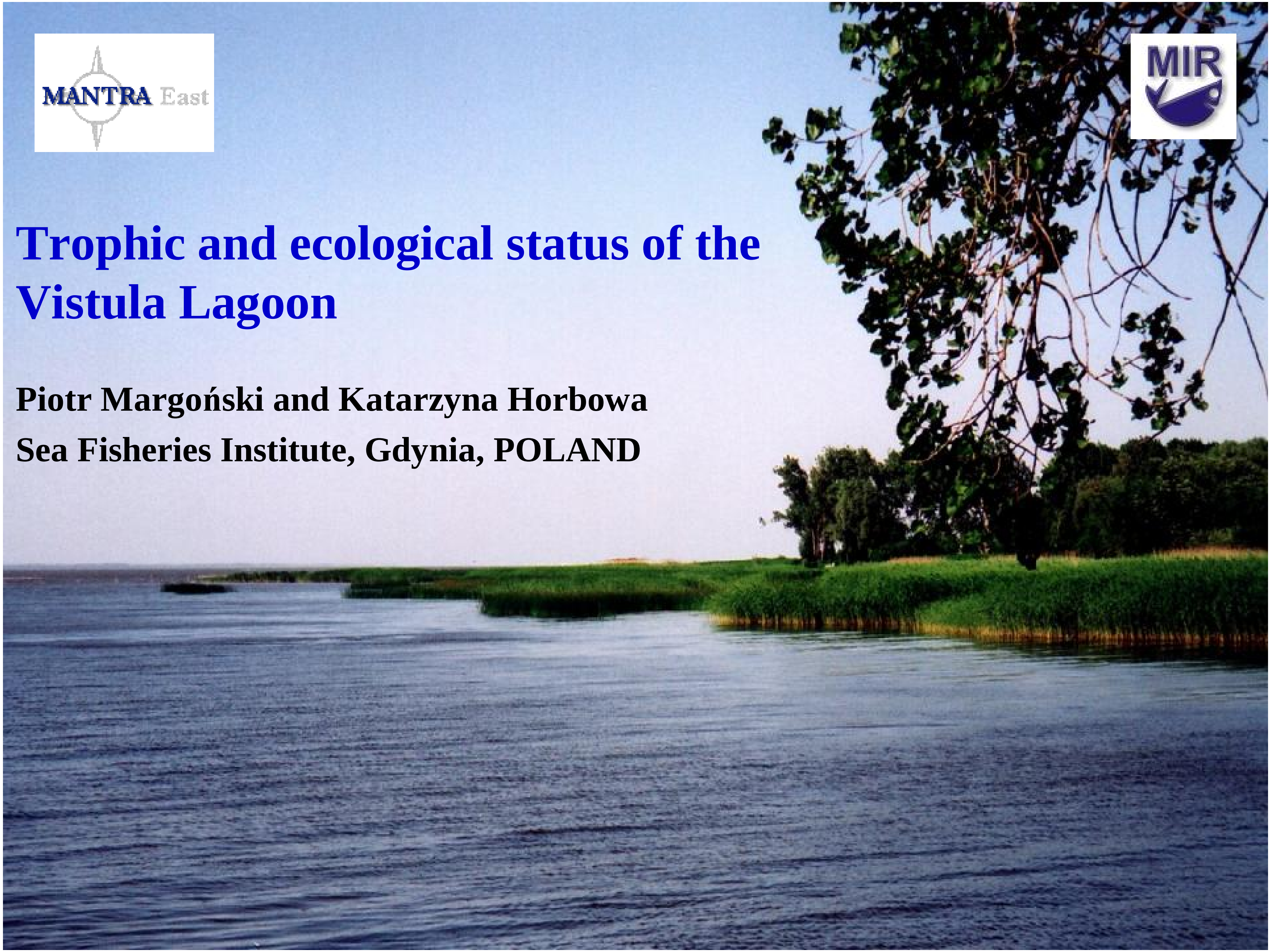

MANTRA East

MIR

Trophic and ecological status of the Vistula Lagoon

Piotr Margoński and Katarzyna Horbowa

Sea Fisheries Institute, Gdynia, POLAND

Piotr Margoński and Katarzyna Horbowa

Trophic and ecological status of the Vistula Lagoon

Area: 838 km² (Russia – 56%, Poland – 44%)

Length: 90 km

Width: 10-19 km

Average depth: 2.7 m

Salinity: 0.1 - 4.5 PSU

Water volume: 2.3 km³

Average retention time: 6 months

Drainage area: 23,871 km² within Poland and Russia

Connection with the Gulf of Gdańsk: narrow, dredged channel near Baltiysk (Russia)

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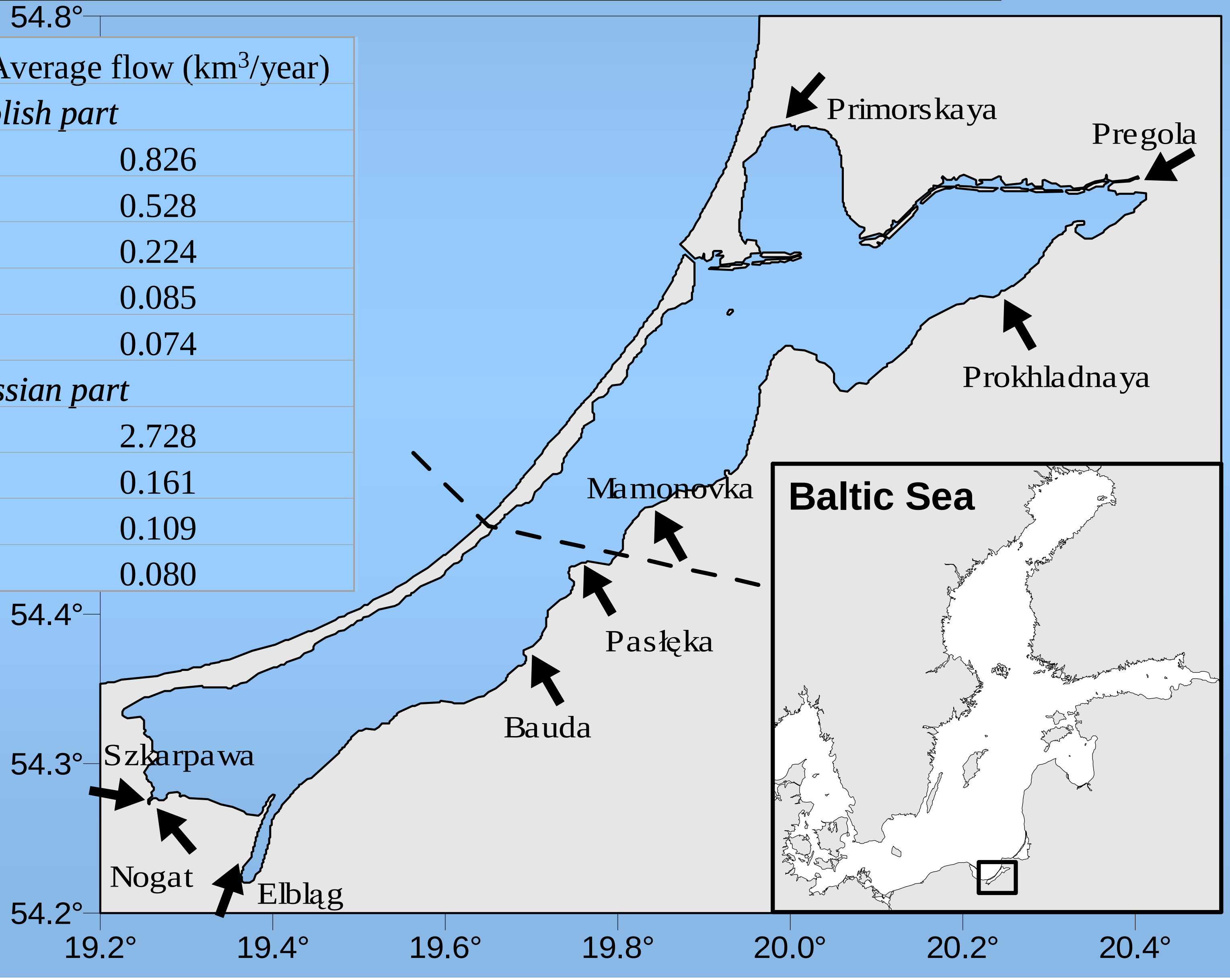
River	Average flow (km^3/year)
Polish part	
Elbląg	0.826
Pasłęka	0.528
Nogat	0.224
Bauda	0.085
Szkarpawa	0.074
Russian part	
Pregola	2.728
Prokhladnaya	0.161
Mamonovka	0.109
Primorskaya	0.080



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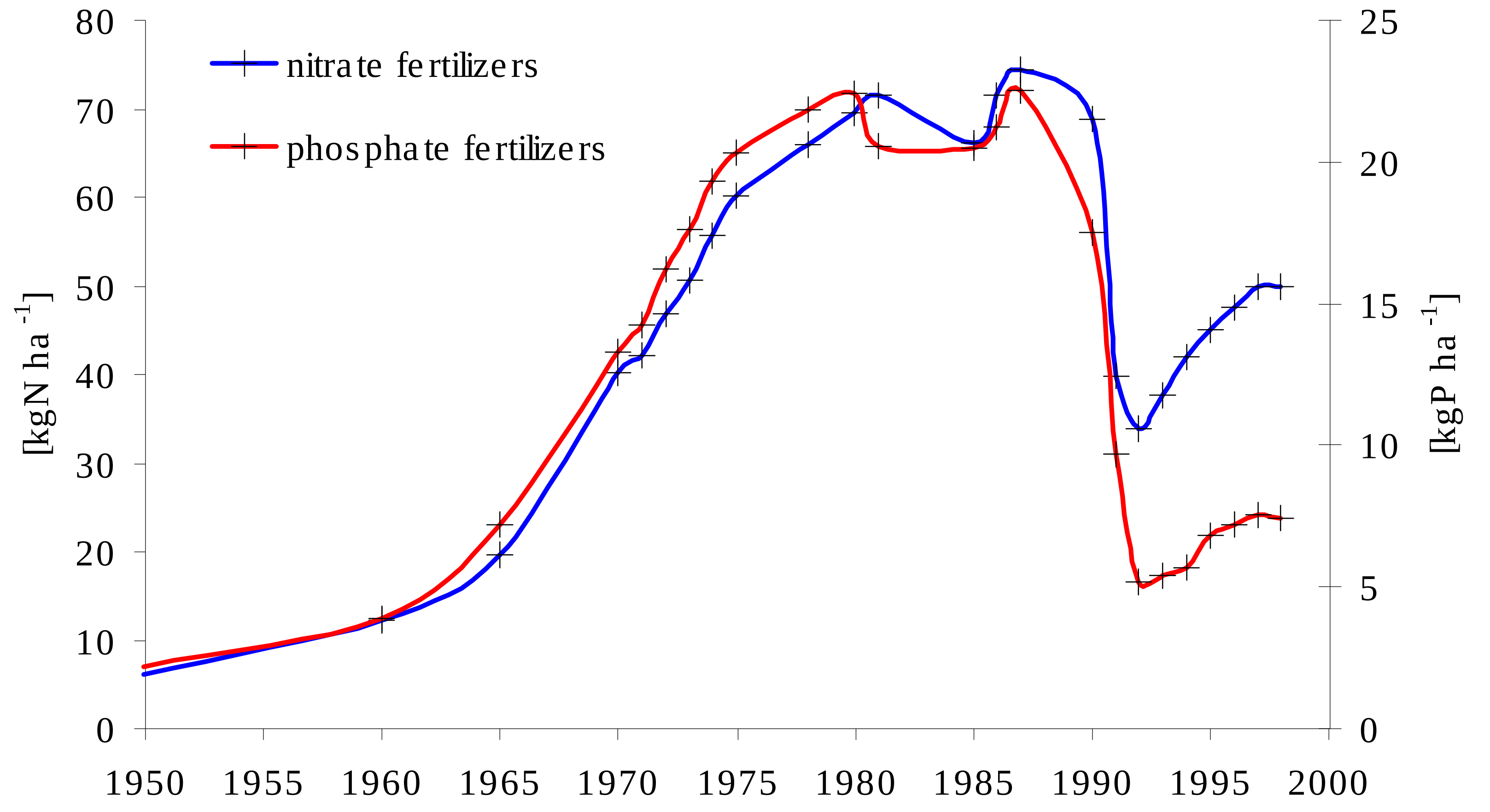
Trophic and ecological status of the Vistula Lagoon

Use of fertilizers in Poland



Source: Pastuszak M., Wielgat M., and Sitek S. 2001. Nutrient status in the Szczecin Lagoon – past, present and future prospects. Oceanological Studies, 30 (1-2): 59-86 (after GUS. 1951-1998. Central Statistical Office (GUS) Annual Reports from years 1951-1998. Central Statistical Office, Warsaw)

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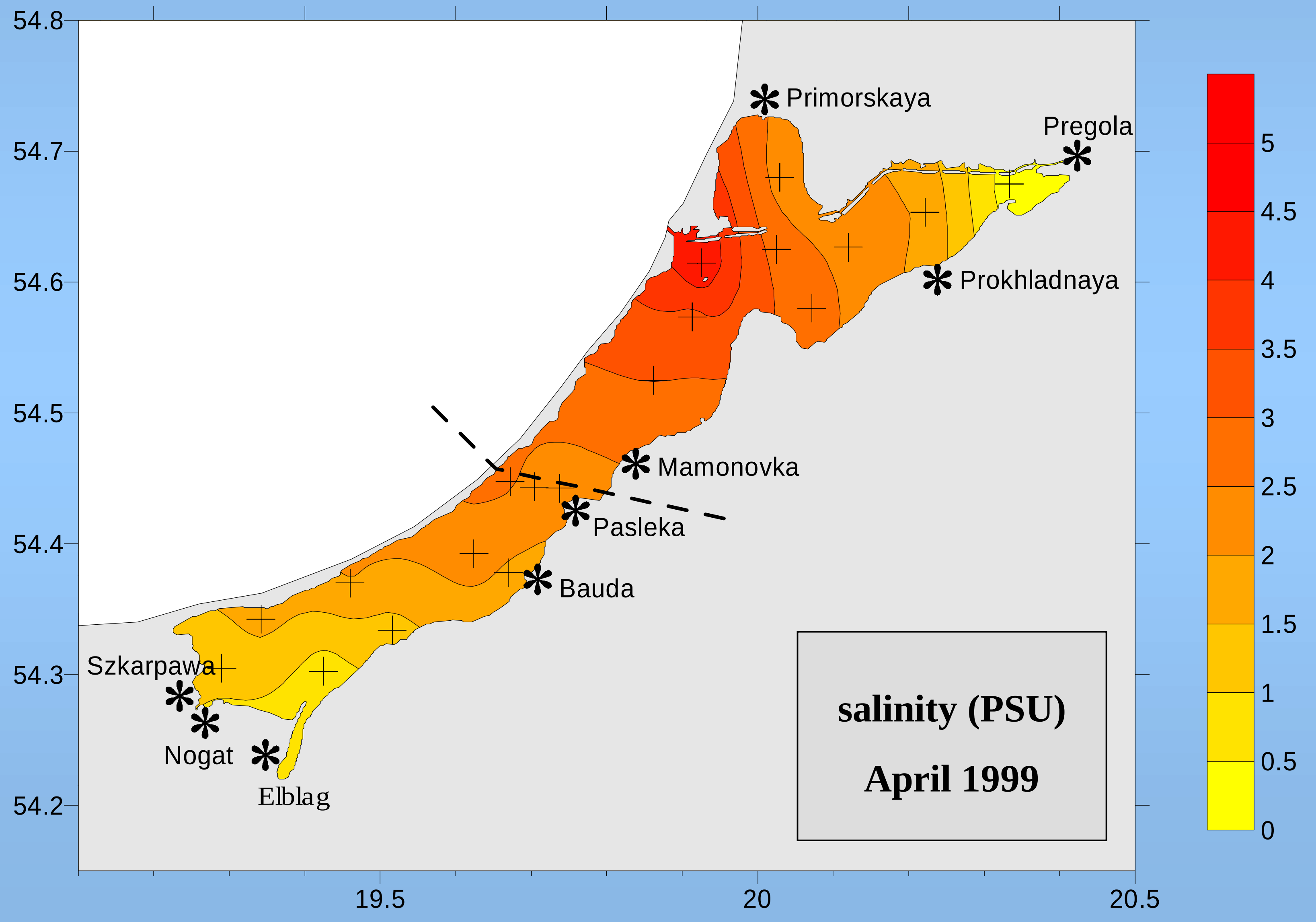

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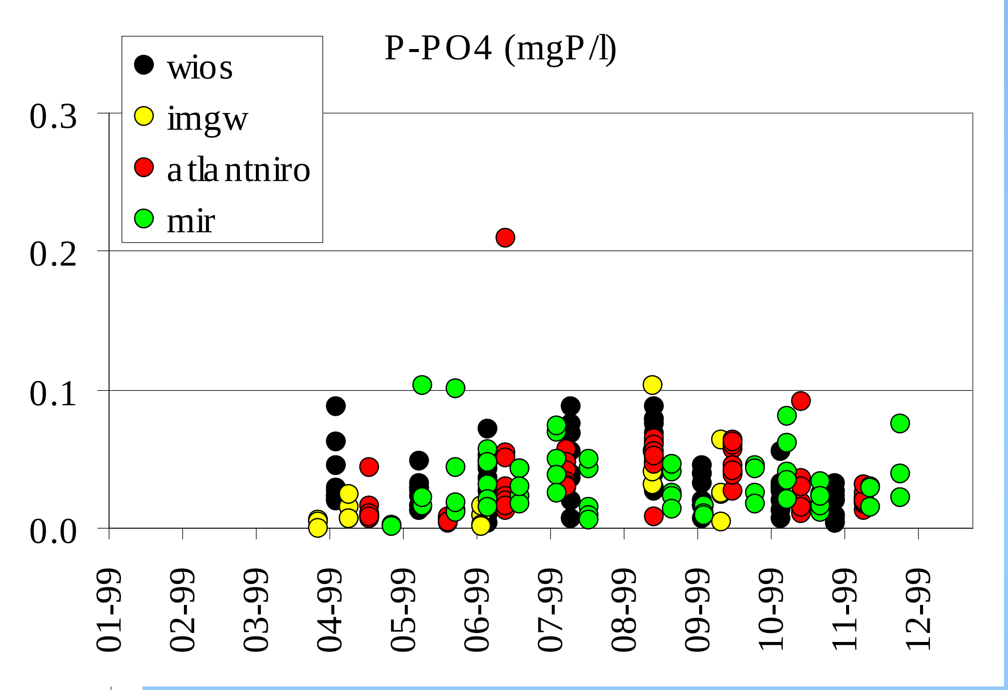
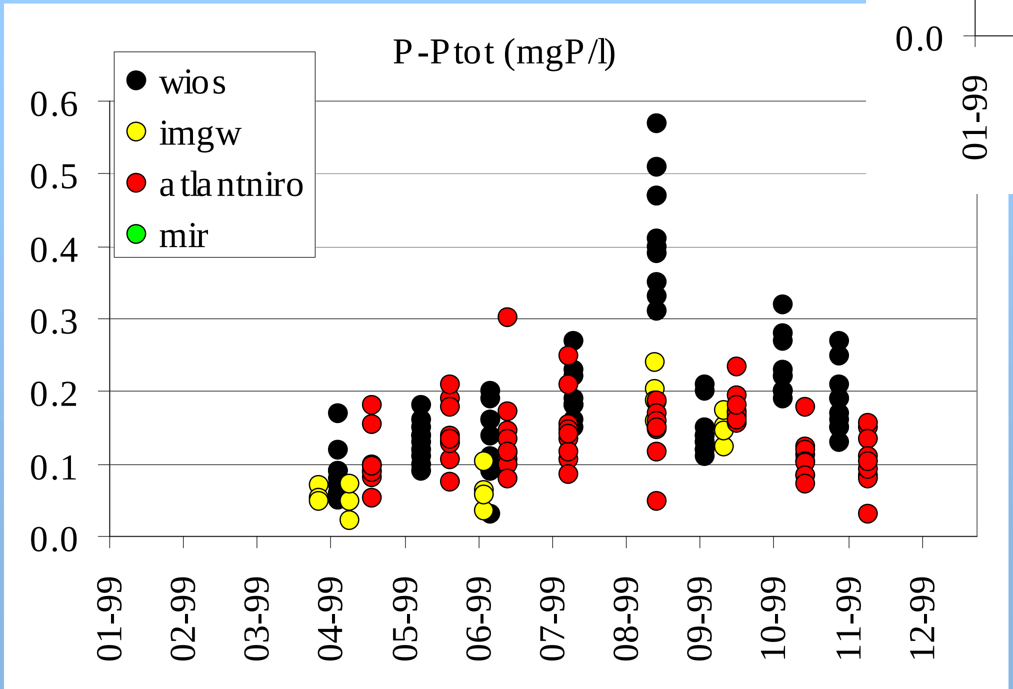
Trophic and ecological status of the Vistula Lagoon

Data comparison (1/2)





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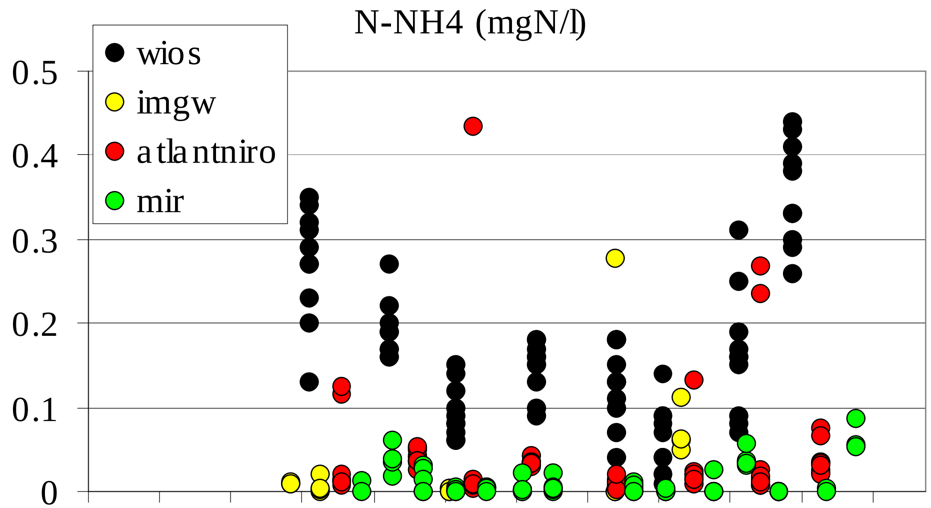
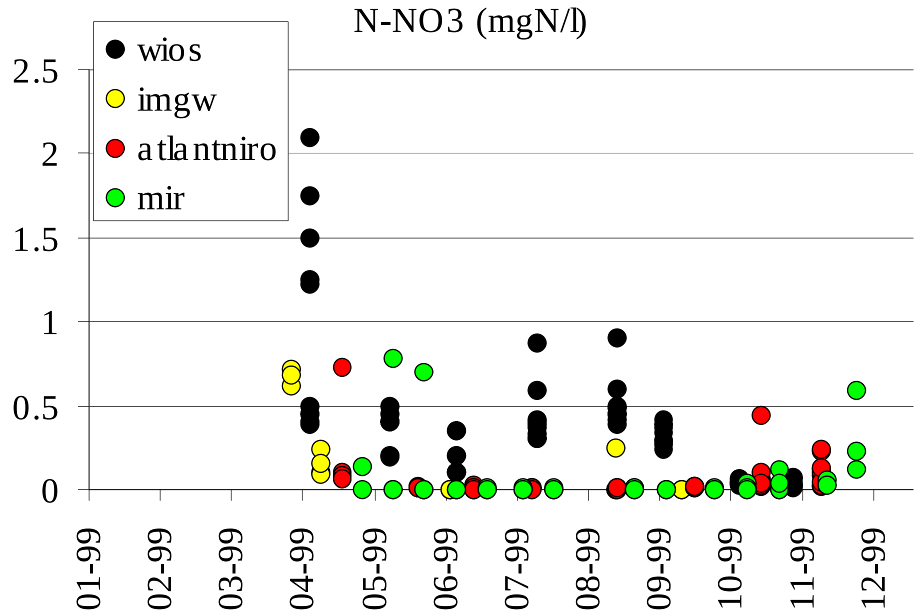
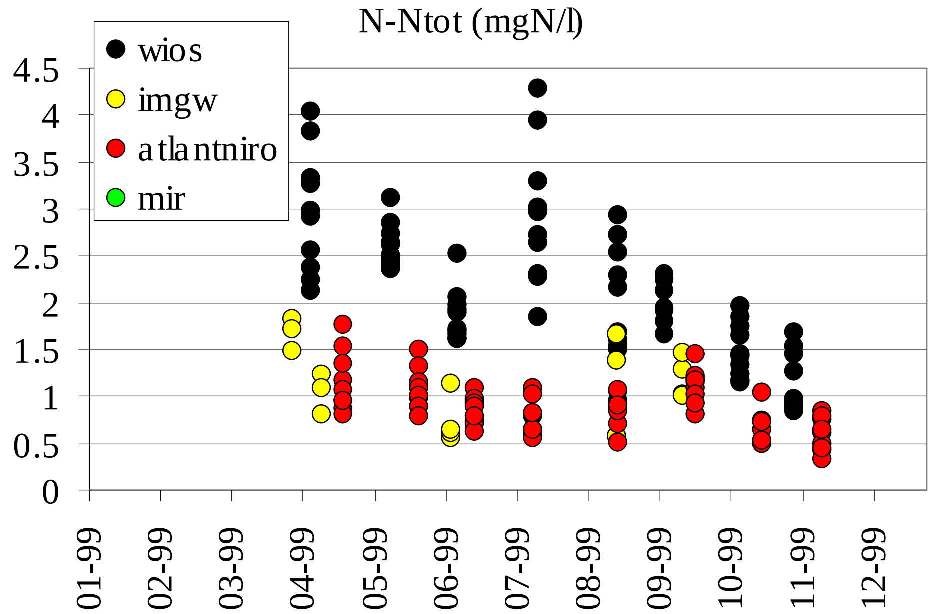
Trophic and ecological status of the Vistula Lagoon

Data comparison (2/2)







Trophic State Index (Carlson, 1977)

Secchi depth	TSI(SD)=10*(6-(lnSD/ln2))
Chlorophyll *a*	TSI(Chl)=10*(6-((2.04-0.68*lnChl)/ln2))
Total phosphorus	TSI(TP)=10*(6-(ln(48/TP)/ln2))
Total nitrogen	TSI(TN)=54.45+14.43*ln(TN)
	(Kratzer and Brezonik, 1981)

Trophic types – classification systems:

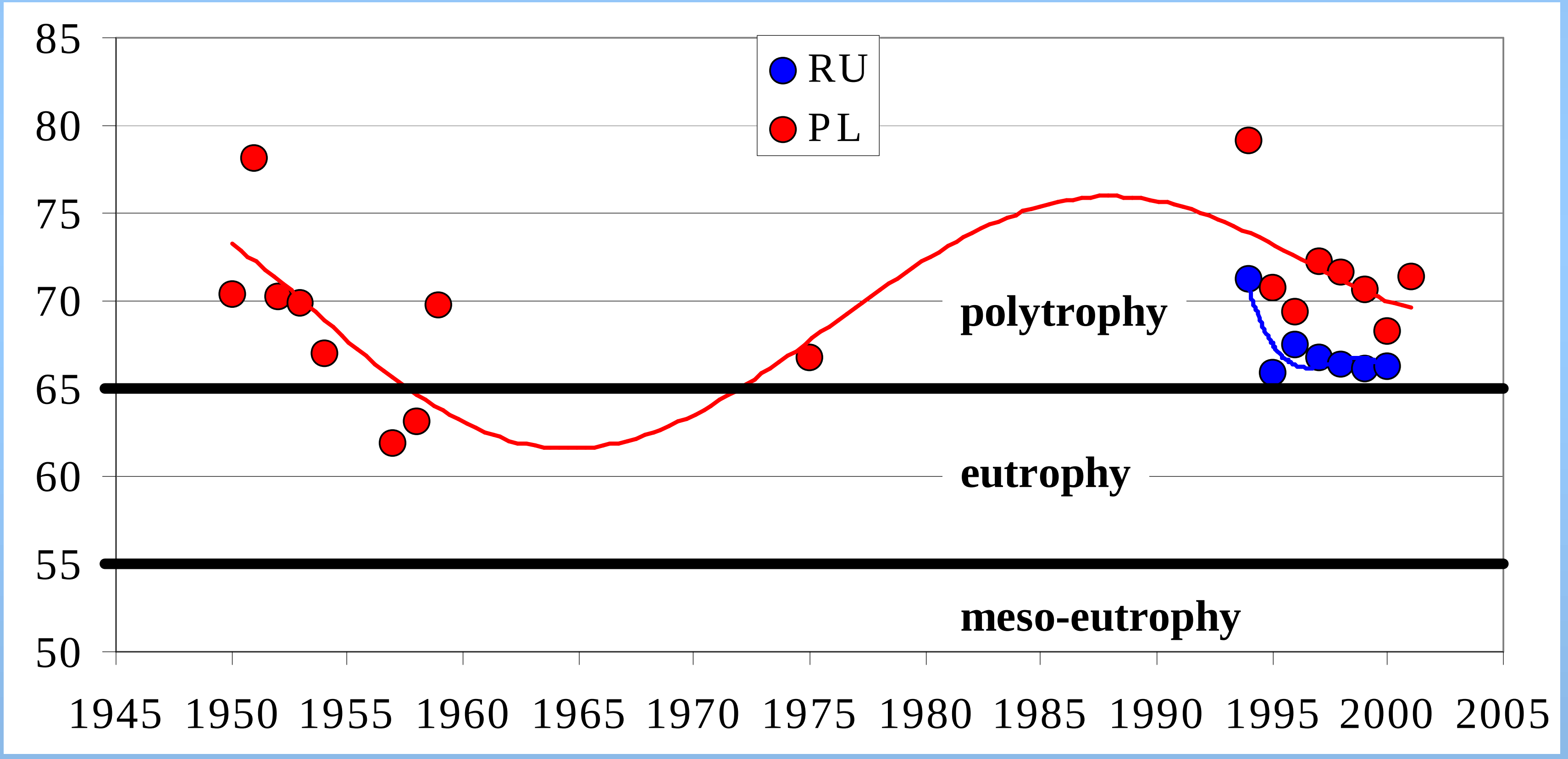
(Karabin, 1985)

trophic type	TSI
mesotrophy	
	45
meso-eutrophy	
	55
eutrophy	
	65
polytrophy	

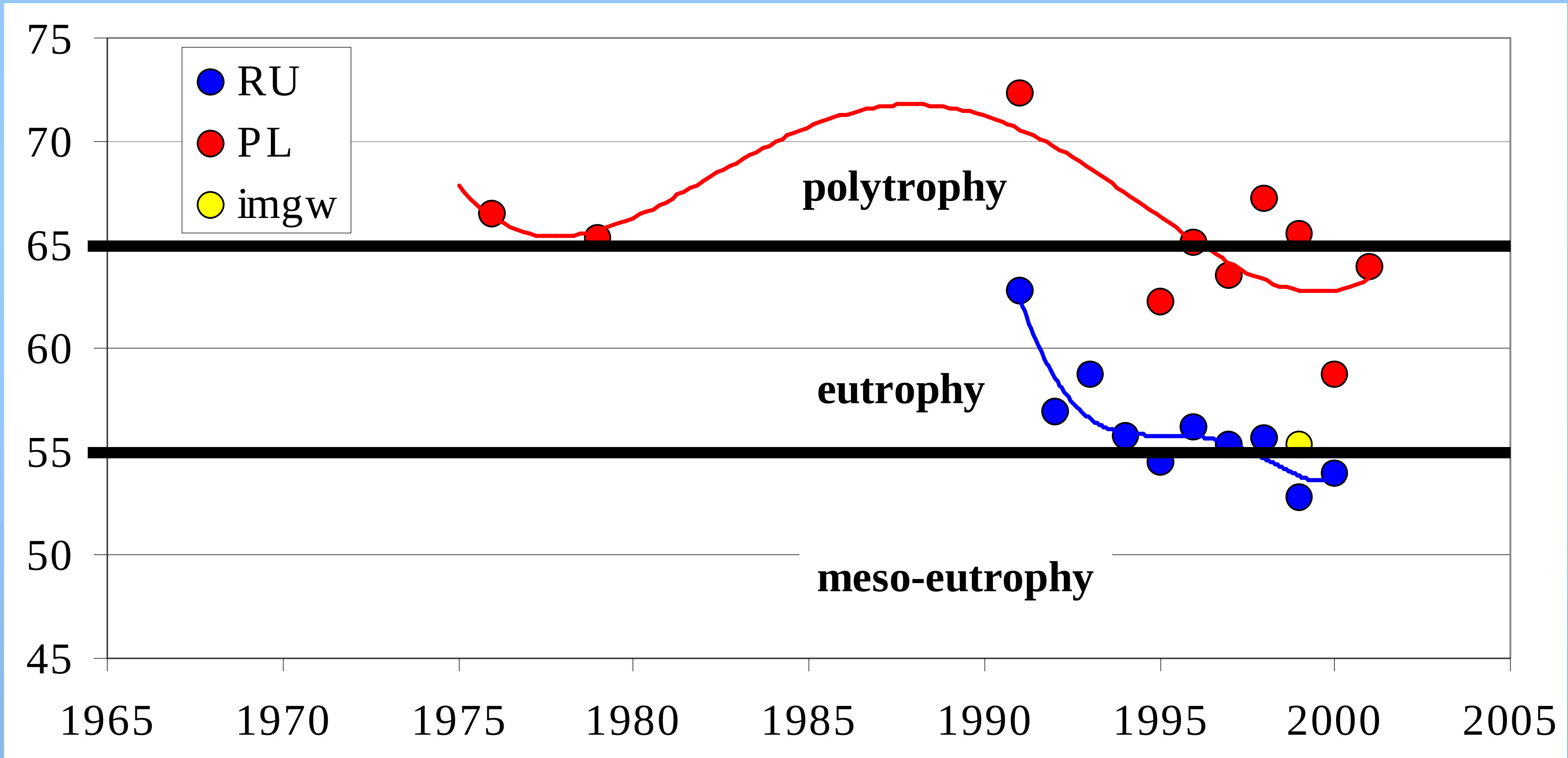
(Kratzer and Brezonik, 1981)

trophic type	TSI
ultraoligotrophy	0-20
oligotrophy	30-40
mesotrophy	45-50
eutrophy	53-60
polytrophy	70-100

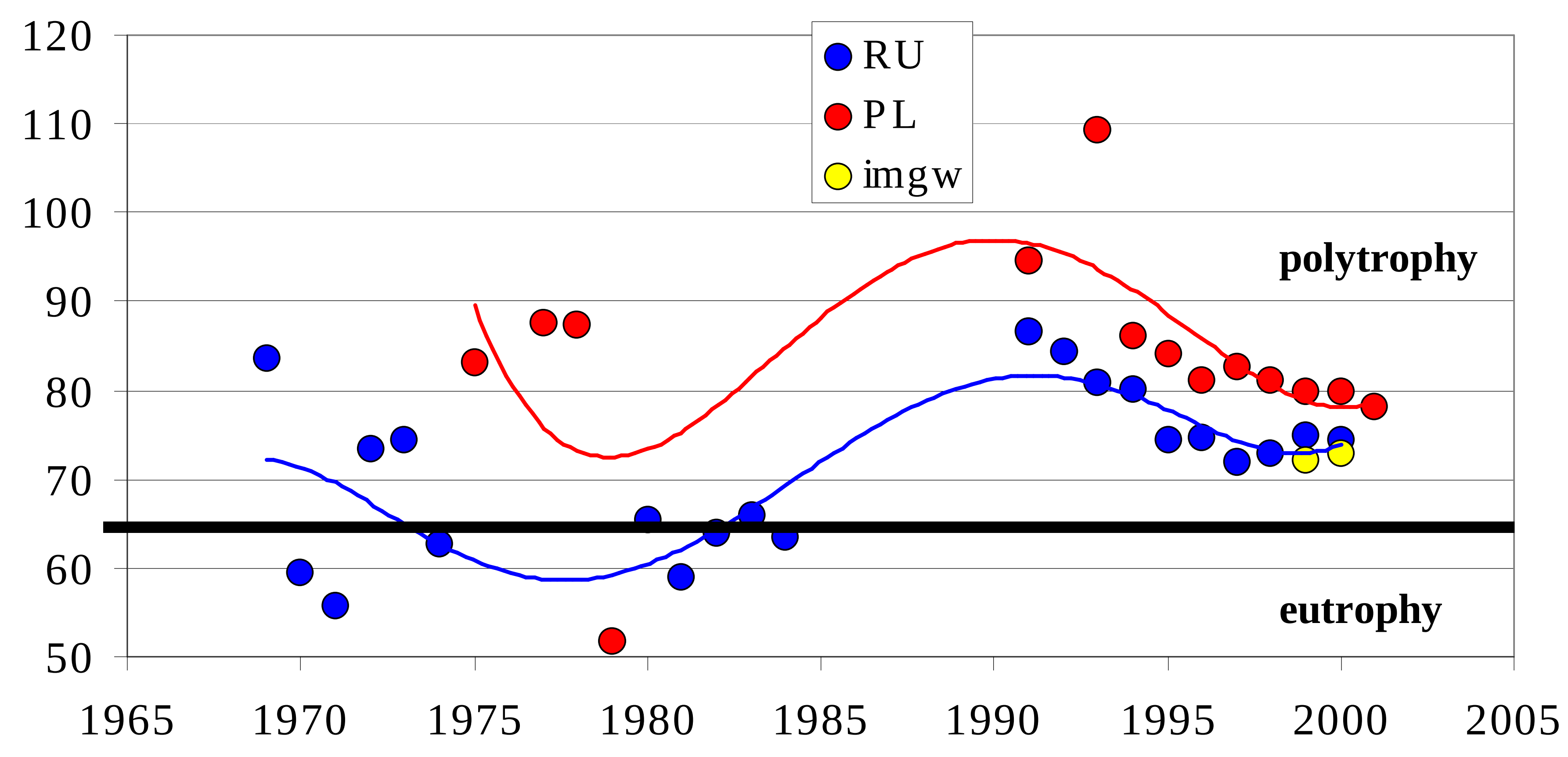
Trophic State Index (Secchi depth)



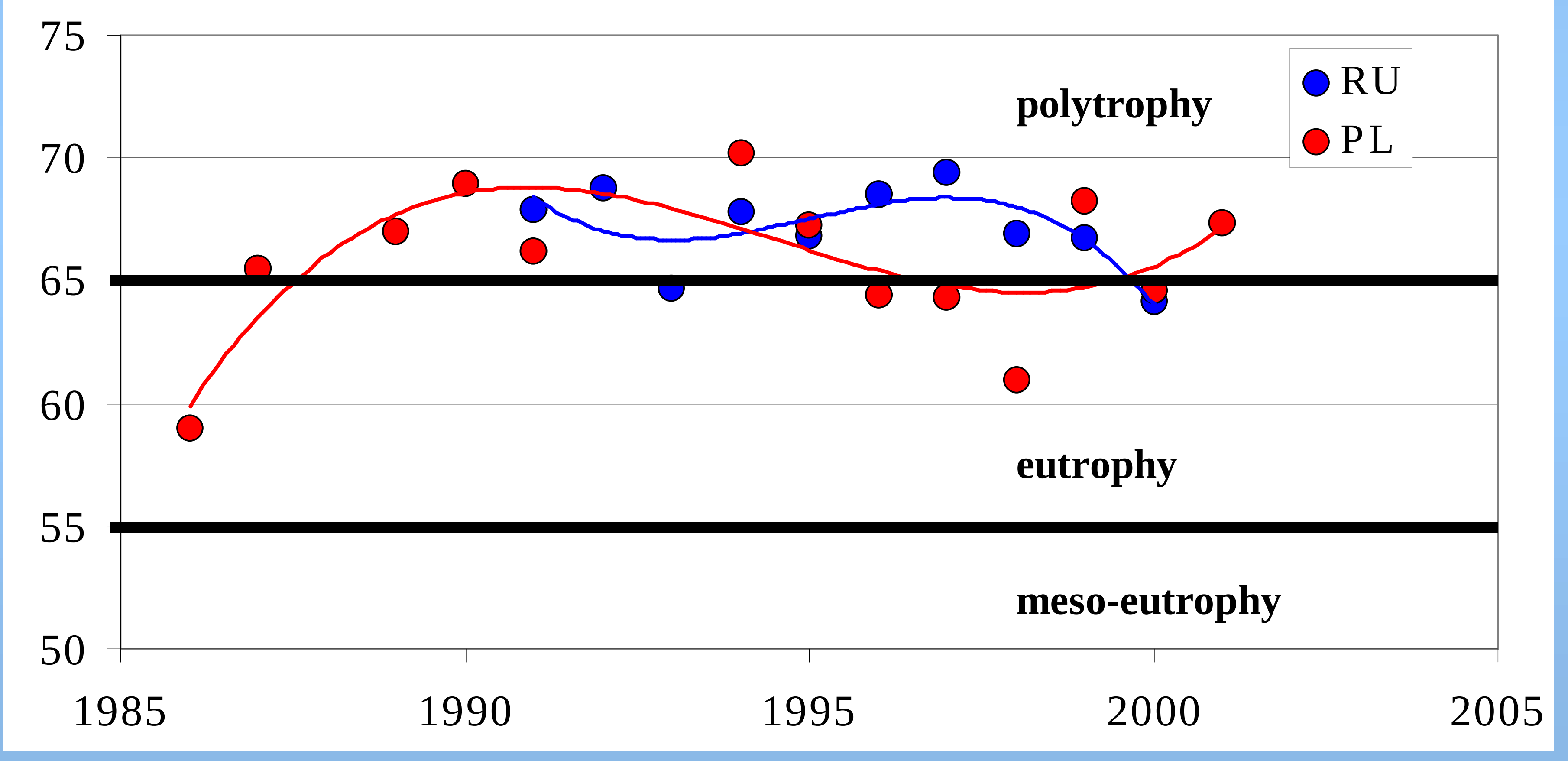
Trophic State Index (total nitrogen)



Trophic State Index (total phosphorus)



Trophic State Index (chlorophyll *a*)



Rotifer indicator community II (Karabin, 1985)

Keratella cochlearis tecta

Keratella quadrata

Filinia longiseta

Brachionus sp.

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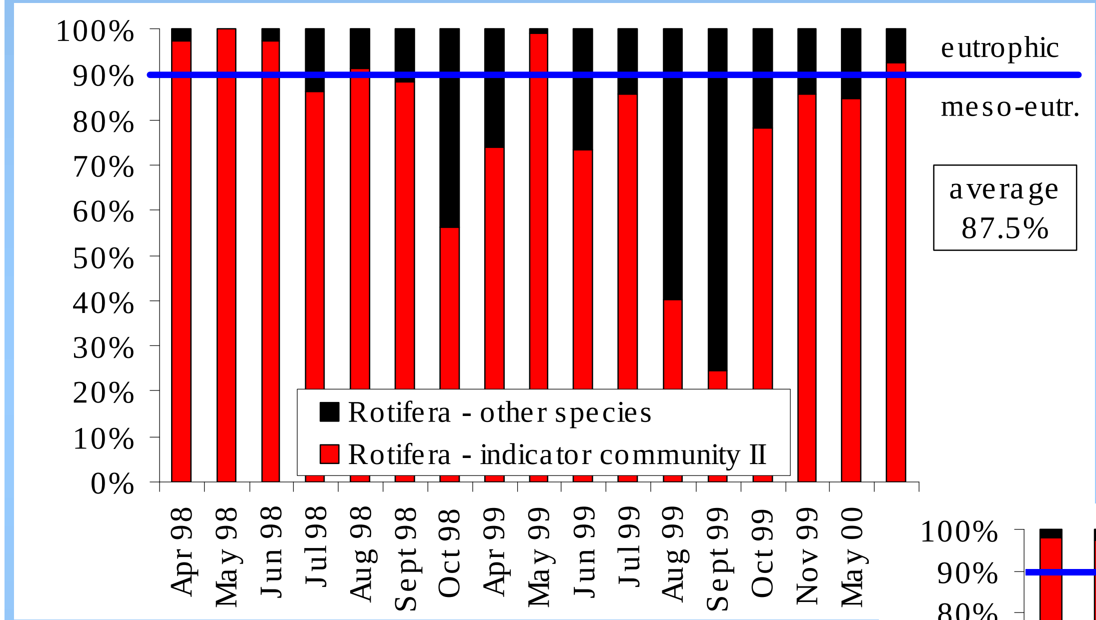
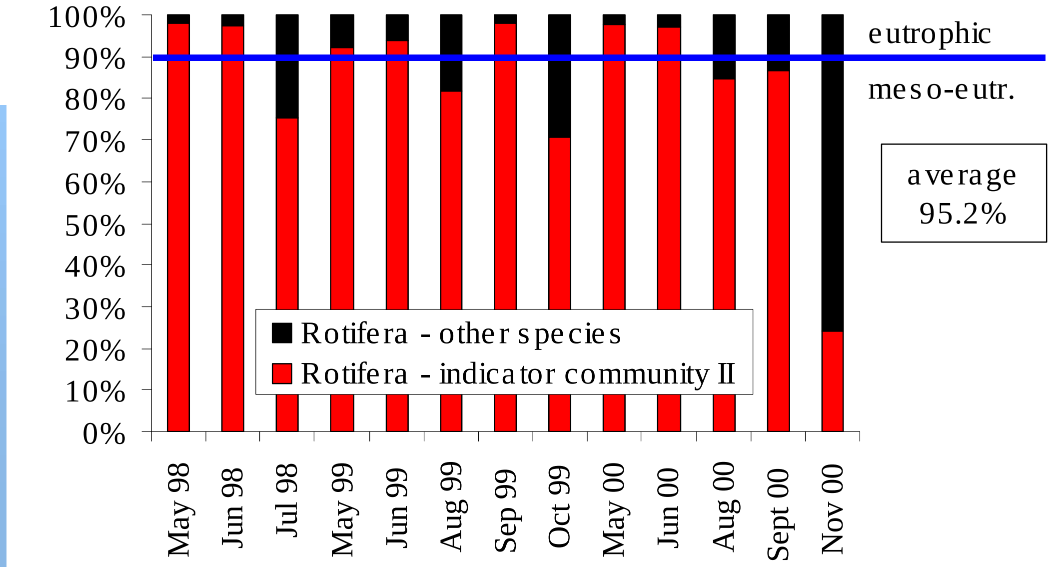
Trophic and ecological status of the Vistula Lagoon

Proportion of indicator community II in total rotifer biomass



Polish part



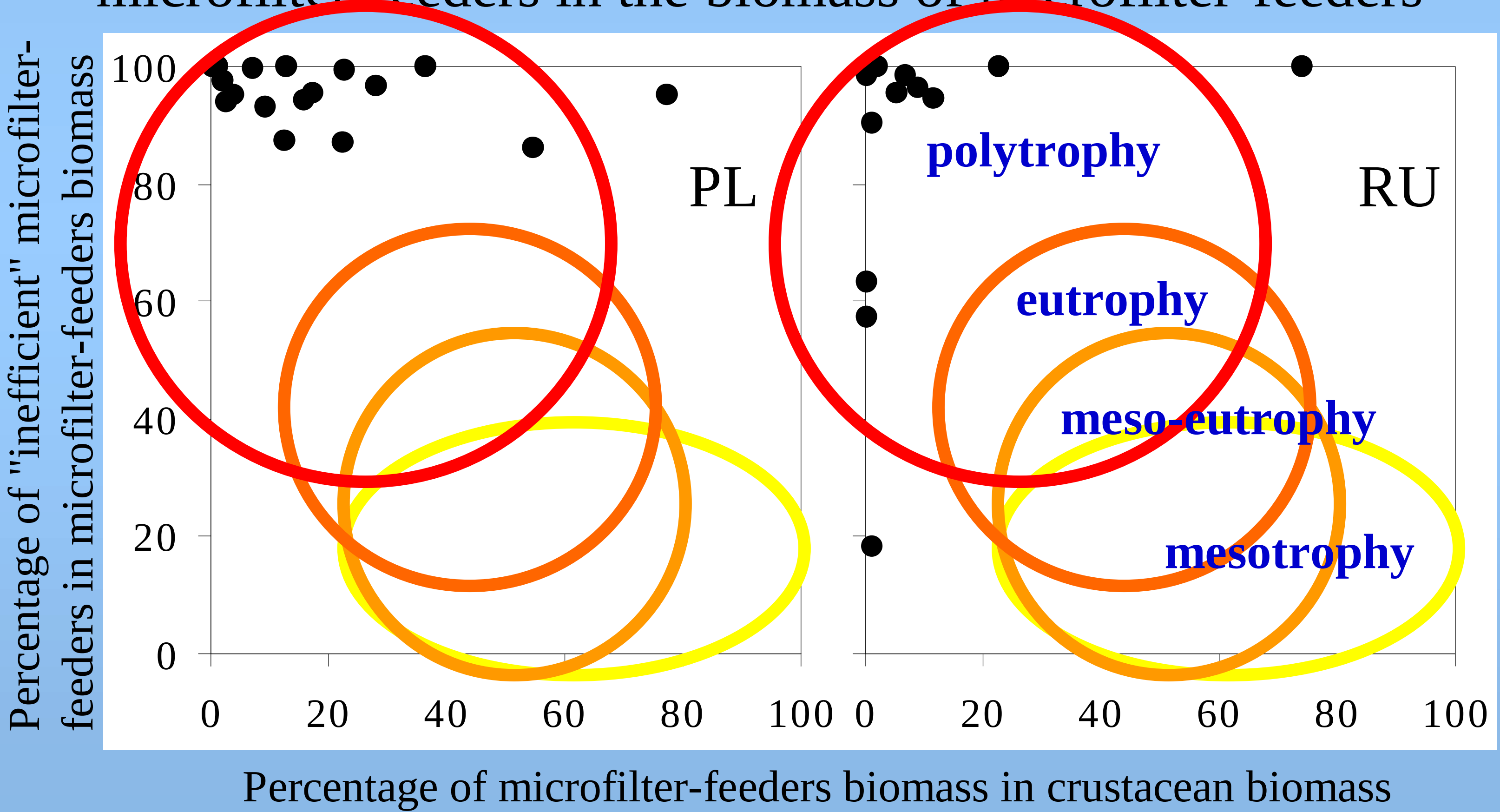
Russian part

Proportion of microfilter-feeders and "inefficient" microfilter-feeders in crustacean community biomass (Karabin, 1985)

microfilter-feeders ("inefficient" microfilter-feeders):

Chydorus sphaericus
Bosmina longirostris
Diaphanosoma brachyurum
Daphnia sp.
Bosmina sp.
Ceriodaphnia quadrangula

Relationship between the proportion of microfilter-feeders in crustacean community biomass and the proportion of "inefficient" microfilter-feeders in the biomass of microfilter-feeders



Trophic status:

- TSI(Secchi depths) – not useful in our case,
- TSI(total nitrogen) – decreasing slowly

  polytrophic/eutrophic (PL) and eutrophic/meso-eutrophic (RU),
- TSI(total phosphorus) – decreasing but still polytrophic,
- TSI(chlorophyll *a*) – stable: eutrophic/polytrophic,
- rotifer indicator community II

  – seasonal changes: meso-eutrophic/eutrophic,
- "inefficient" microfilter-feeders: polytrophic.

Reference conditions for TP concentrations:

morpho-edaphic index (MEI) by Vighi and Chiaudani (1985)

MEI_{alk} = alkalinity (meq/l) / mean depth of the lagoon (m)

$MEI_{alk} = 3.6733/2.7 = 1.3605$

$\text{Log}(TP_{ref}) = 1.48 + 0.33 * \text{Log}(MEI_{alk})$

$\text{Log}(TP_{ref}) = 1.524$

$TP_{ref} = 33.4\ \text{mg/m}^3$

present average 100 mg/m^3 (RU), 200 (110-120) mg/m^3 (PL)

Ecological quality ratios (EQRs):

According to the EU WFD, the class boundaries in quality classification should be set on the basis of ecological quality ratios (EQRs).

EQR is a numeric index showing the degree of deviation of parameters from the initial reference value.

$TP_{good} = 1.5 * TP_{ref}$ (the Lake Peipsi case)

Then 10^{th}, 25^{th}, 75^{th} and 90^{th} percentiles were used to delimit boundaries between ecological classes

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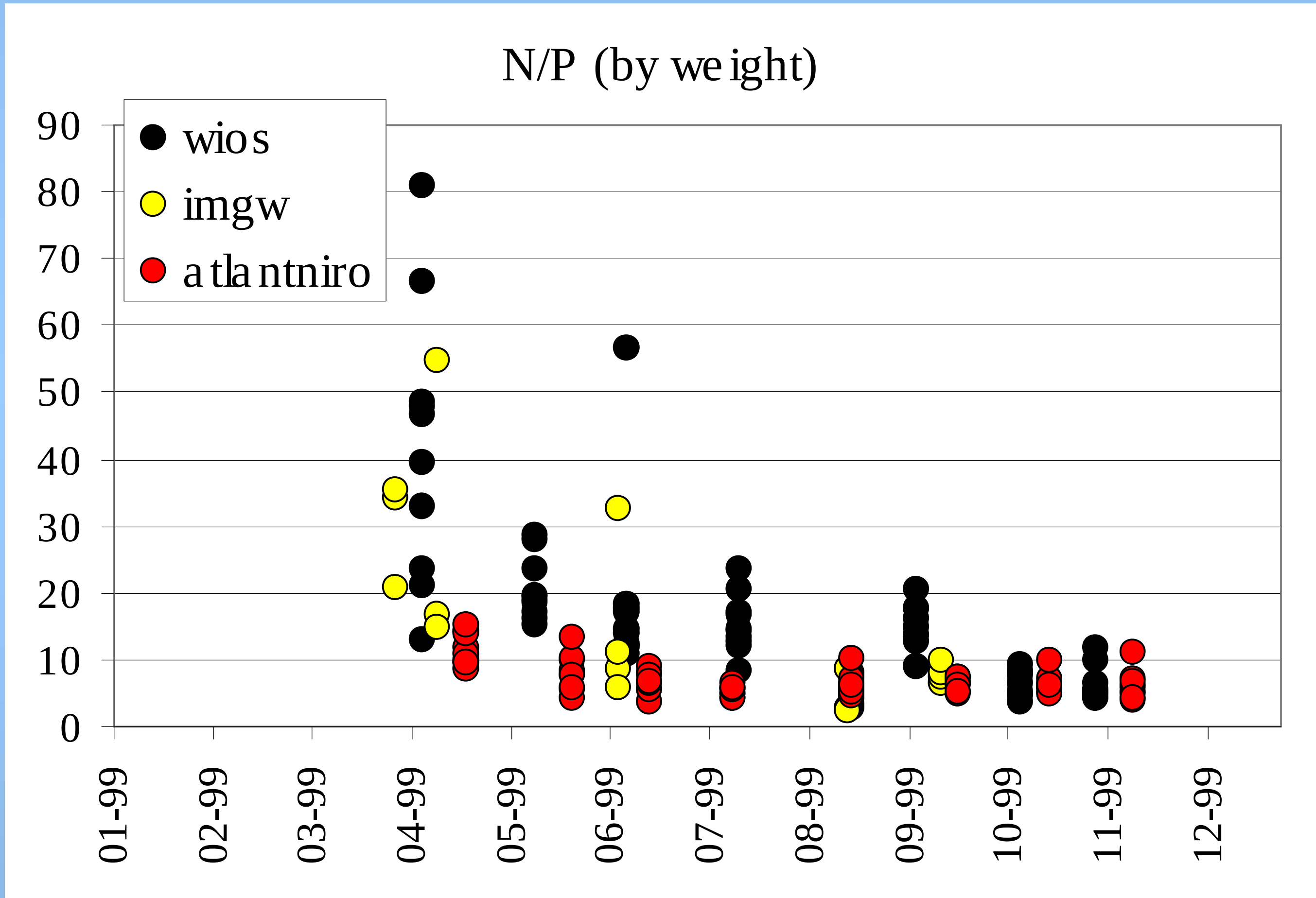
N/P ratio



WIOS – 16

IMGW – 16

AtlantNIRO – 7

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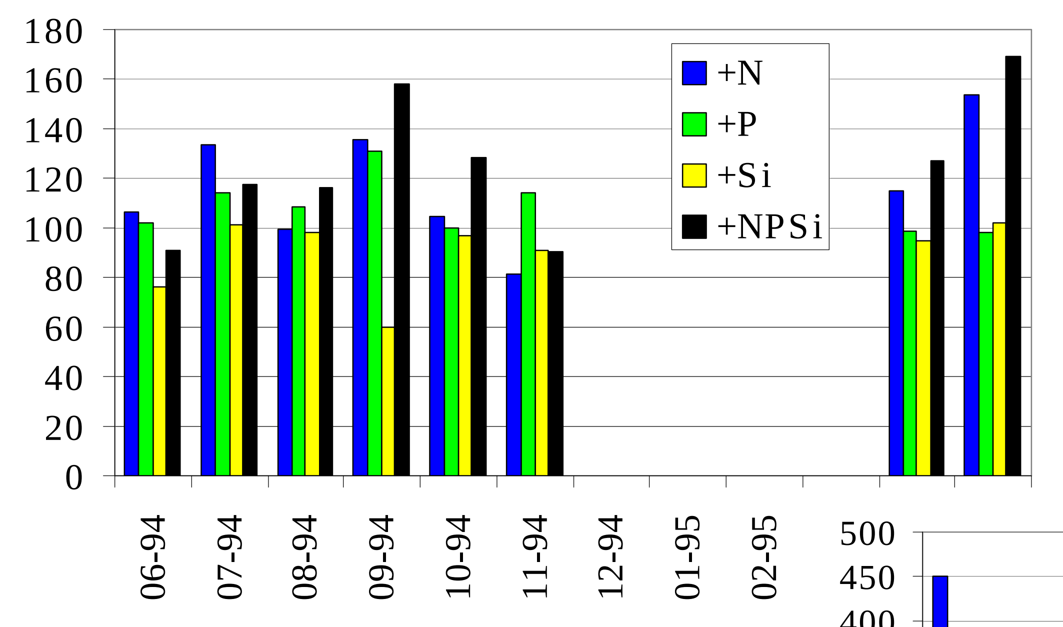
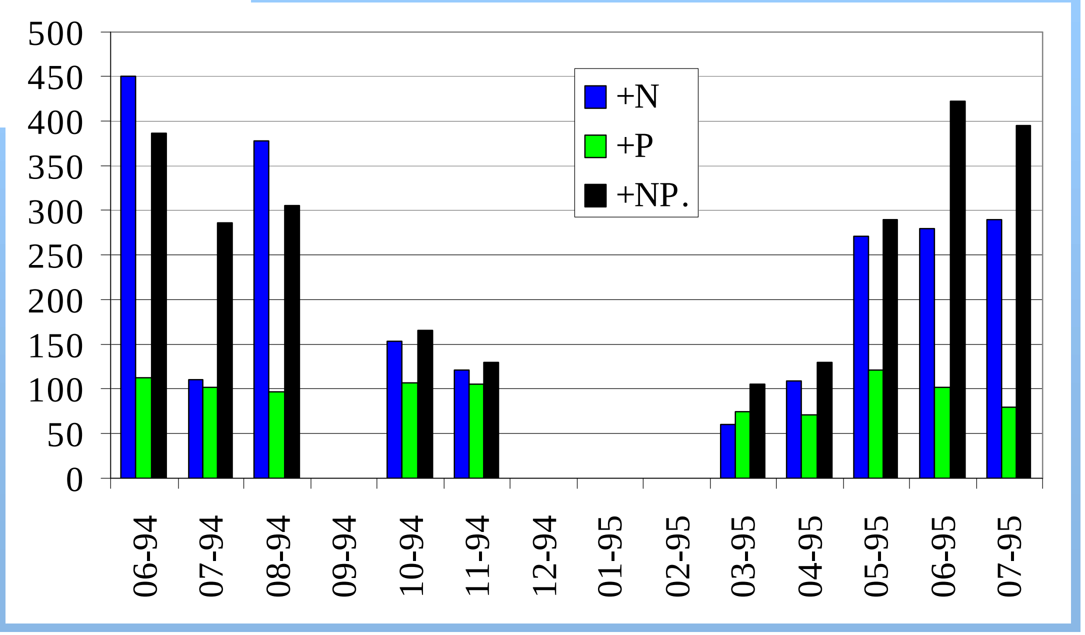
Bioassay Experiments of Nutrient Limitation on the Growth of Phytoplankton



PL (PP/h)



RU (dpm)

Ecological status:

To calculate reference conditions:

- TP_{ref} (MEI_{alk}) not useful (VL is generally limited by nitrogen)
- Historical data not useful (VL is changing from freshwater to brackishwater over the last 100 years)

It was decided to use modelling to assess reference conditions:

- „clean rivers”
- „clean atmosphere”
- „clean coastal waters of the Baltic Sea”
- changes in sediment-water exchange are not clear