



Impact of the Danube River on the Black Sea



JTWG Indicators (i)

- Nutrient loads to the Sea & nutrient concentrations in the Sea
- Secchi depth/turbidity/suspended solids
- Pollutants
- Macroalgae/higher plants
- Dissolved oxygen content



JTWG Indicators (ii)

- Phytoplankton/ chlorophyll-a conc's
- Zooplankton
- Macrozoobenthos

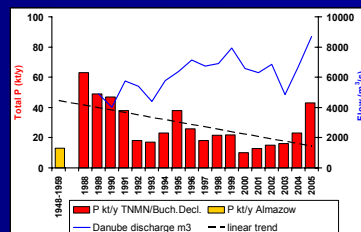
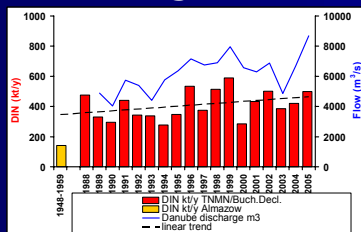


Nutrient Loads to the Sea

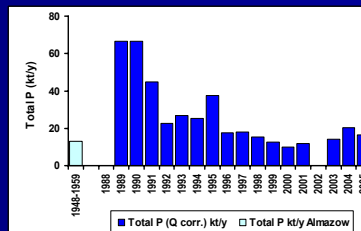
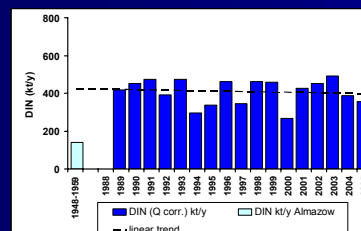
Actual loads

Inorganic N

Total P



Flow – corrected loads

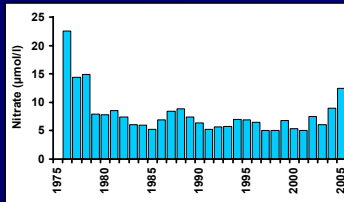




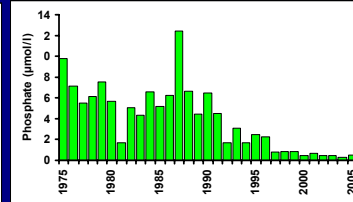
Nutrient Conc's in the Sea

Constanta

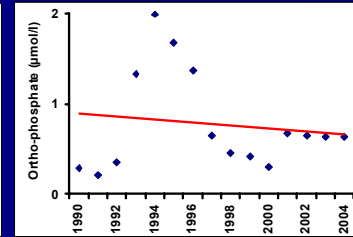
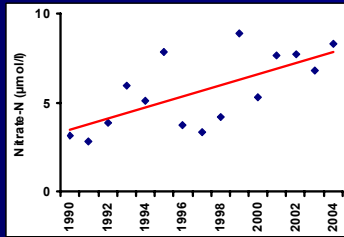
Nitrate



Phosphate

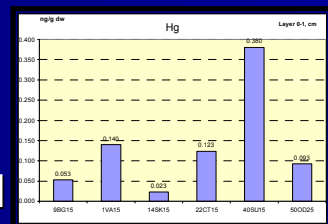


Amalgamated Romanian data



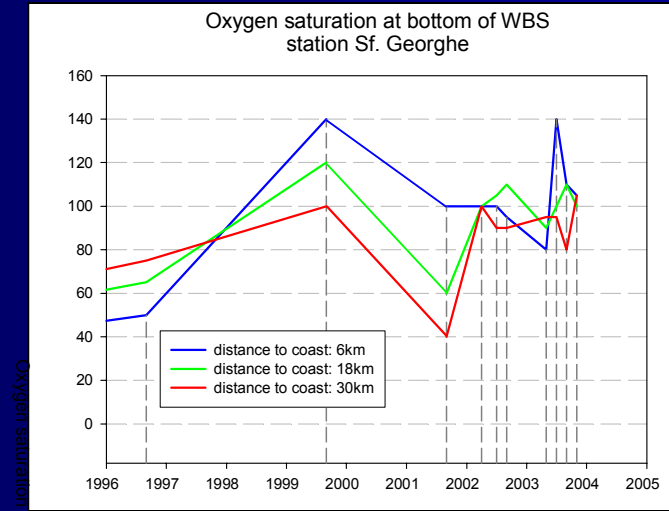
Pollutants

- Some evidence of contamination (particularly with heavy metals) associated with Danube inputs
- Lesser contamination by selected PCBs and pesticides also associated with the Danube
- Ukrainian sediment contamination likely to reflect inputs from Dnipro and Dniester





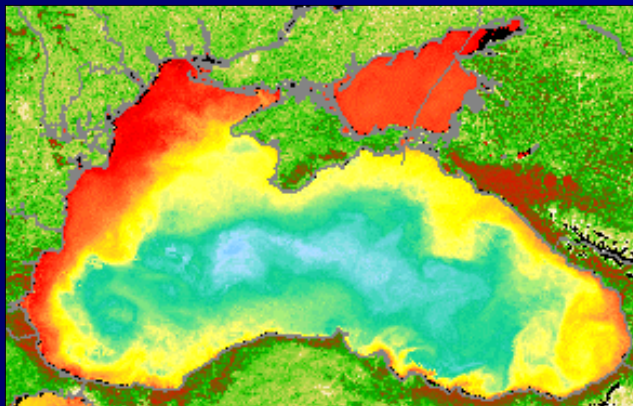
Dissolved Oxygen Content



Oxygen saturation [%]



Chlorophyll-a

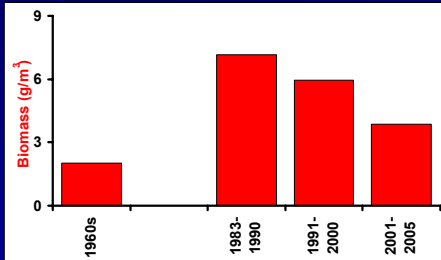


● Appears to have improved since 1997

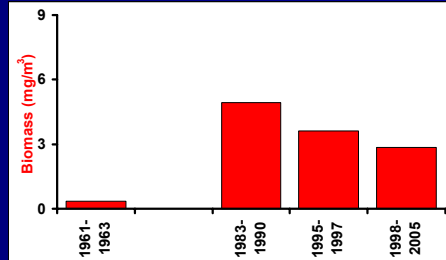


Phytoplankton Biomass

Constanta, Romania



Cape Galata, Bulgaria

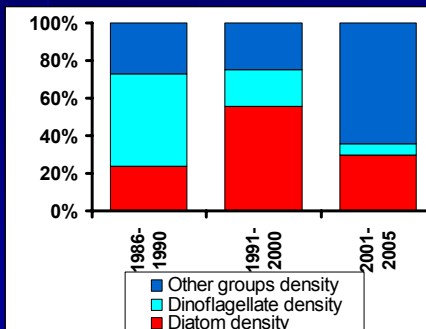


Good news

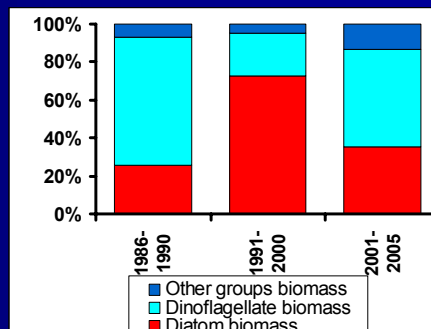


Phytoplankton Community Composition (Constanta)

Abundance

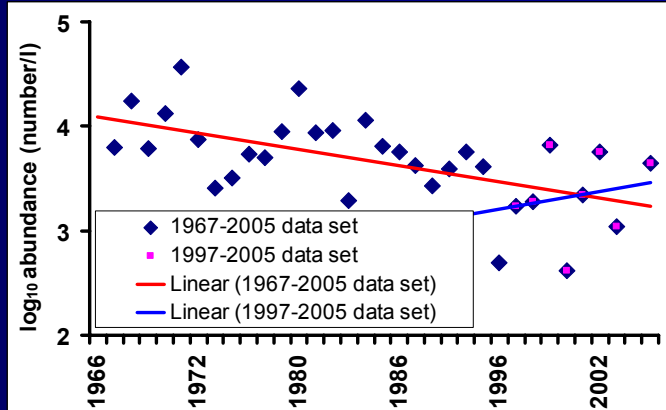


Biomass



Not so good

Zooplankton (Cladocera and Copepoda –Cape Galata, Bulgaria)

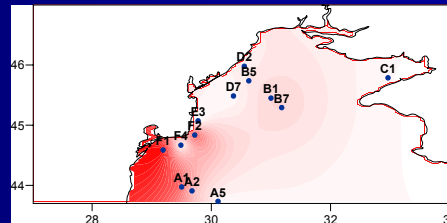
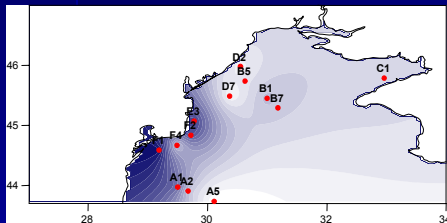


Depends how you want to interpret results

Zooplankton

All taxa abundance

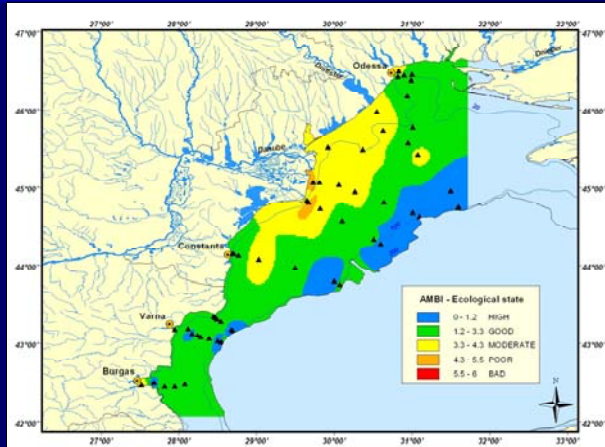
All taxa biomass



Substantial impact



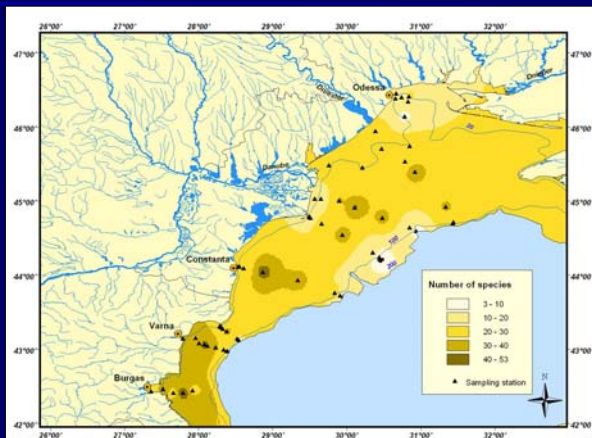
Macrozoobenthos – AZTI Results



Clear impact



Macrozoobenthos – N° of spp



Clear impact



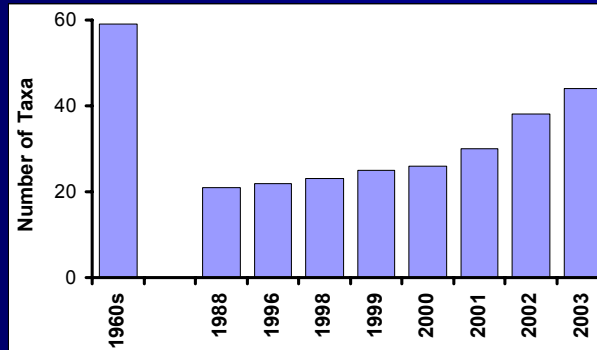
Global
Environment
Facility



UNDP | GEF
DANUBE
REGIONAL
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Macrozoobenthos – N° of spp at Constanta



🌍 However, clear improvement



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Take-Home Messages

- 🌍 Danube does have a considerable impact
- 🌍 Sometimes difficult to distinguish between effects of Danube and Dniester
- 🌍 Zoobenthos data provides best biological indicator
- 🌍 Situation has improved dramatically since early-mid 1990s
- 🌍 Ecosystem function still on a knife-edge