

The European Water Framework Directive: A river basin – coastal sea approach - The Baltic Sea -

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The EU Water Framework Directive

- Integrated river basin management in Europe -

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council established a framework for the Community action in the field of water policy" or short the EU Water Framework Directive

It is a framework for the **protection** of inland surface waters (rivers and lakes), **transitional waters (mostly estuaries)**, **coastal waters** and groundwater.

The key objectives are general protection of the aquatic ecology, specific protection of unique and valuable habitats, protection of drinking water resources, and protection of bathing water. All these **objectives must be integrated for each river basin.**

EU Water Framework Directive

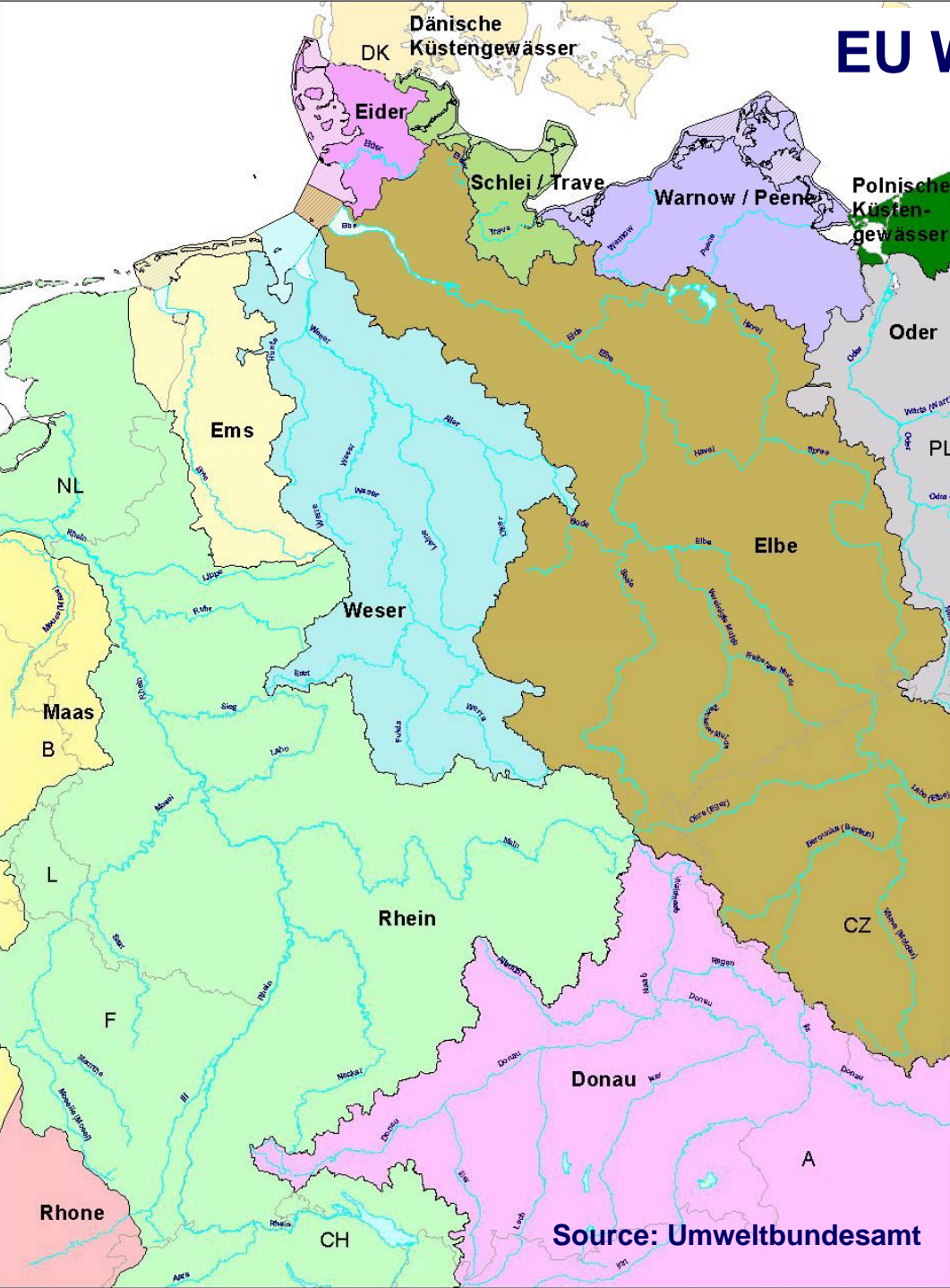
German river basin districts

News aspects

Spatial integration of coastal waters and river basins.

Water quality is determined by the ecological status

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Water Framework Directive: Requirements

- **Typology** for coastal waters in the entire Baltic region.
- Development of **indicators** to evaluate the ecological status of coastal waters.
- Information on **reference conditions** as a basis for the definition of a 'good ecological status'.
- Development of water quality **classification** systems.

The WFD will be implemented during the next years and requires urgently ecological information!



Water Framework Directive:

Options for deriving reference conditions

(Directive 2000/60/EC of the European Parliament and of the Council, Annex II 1.3.(iii))

Hierarchical approach in the following order
(after CIS working group 2.4):

- Existing undisturbed sites
- Historical data and information
- **Models**
- Expert judgement

1) GUIDANCE ON TYPOLOGY, REFERENCE CONDITIONS AND CLASSIFICATION SYSTEMS FOR TRANSITIONAL AND COASTAL WATERS BY CIS WORKING GROUP 2.4 (COAST)



Deriving reference conditions: A simulation study

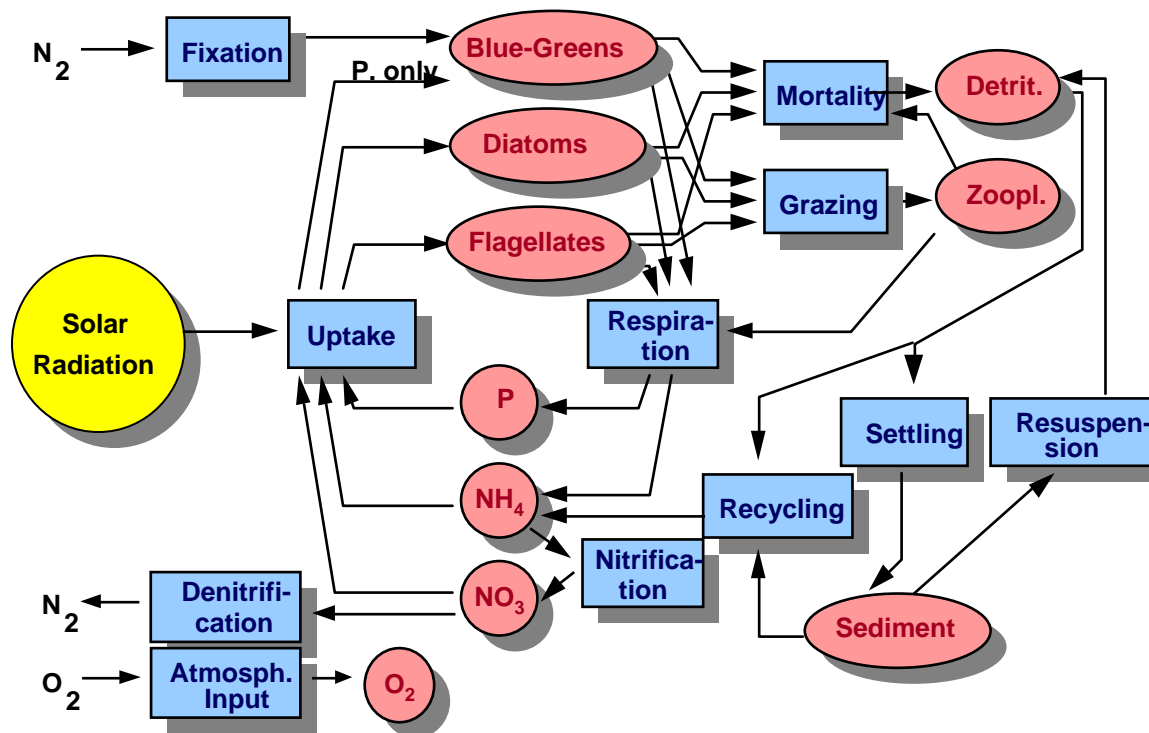
Our approach:

- Reconstruction of historical loads to the Baltic Sea.
- **Baltic Sea:** Application of a 3 D- bio-geo-chemical model covering the entire Baltic Sea using these loads as input.
- Long-term simulation (20 years) on the basis of historic river discharge and meteorological conditions of the 1980's.

Deriving reference conditions: A simulation study

The model:

- A 3-D flow model of the Baltic Sea (MOM 3)
- with a bio-geo-chemical module (9 state variables)



- 700,000 grid points (3 nm horizontal grid and 2 m layer thickness).
- temporal resolution of 1 minute.
- Model run over 22 years with over 11.4 million time steps.

Nutrient loads: N

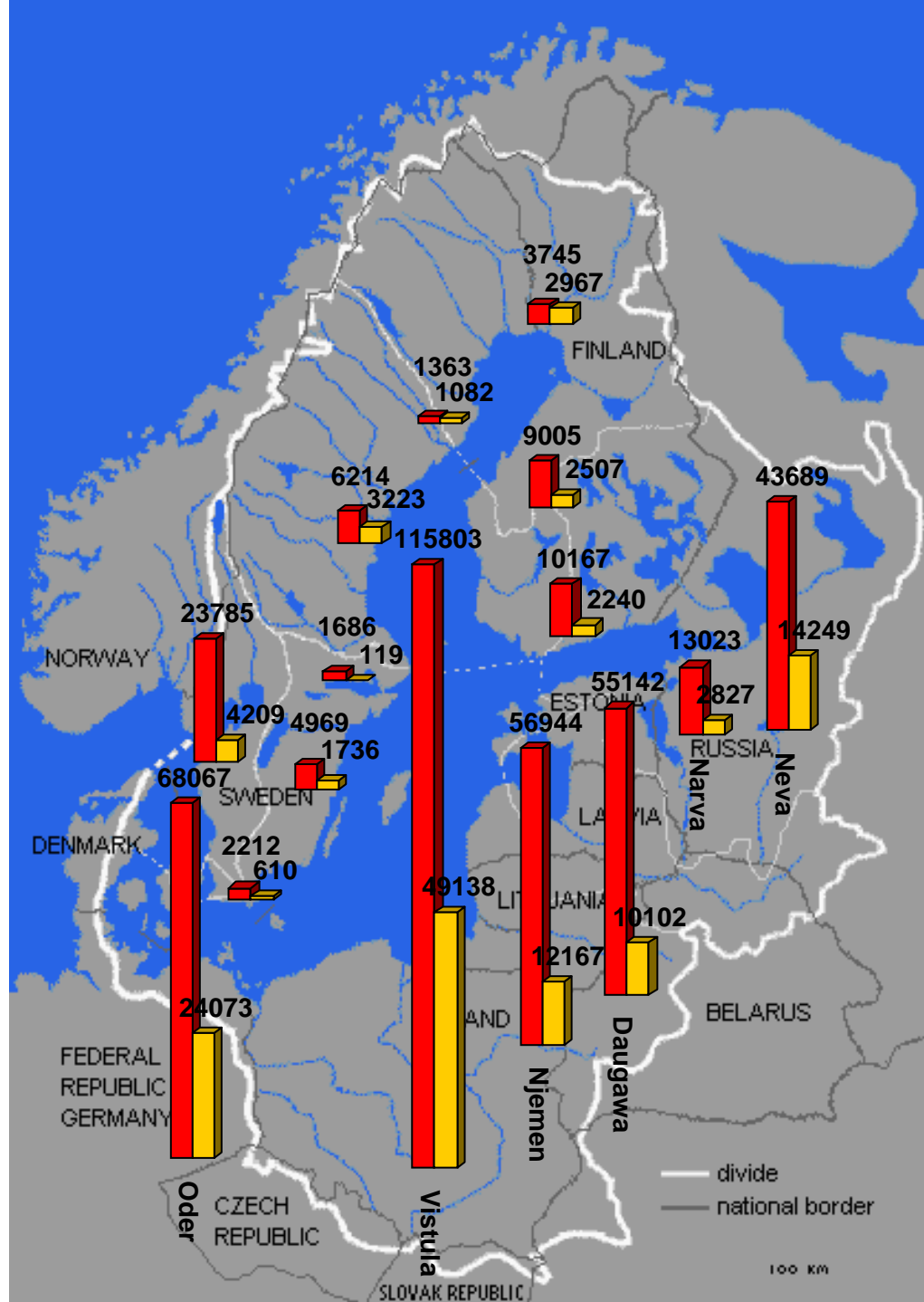
Average nitrogen loads to the Baltic Sea (1980-1990) as well as the historic loads. All loads are attributed to the 15 major rivers

■ Nitrogen loads of the 1970-1990
(total loads: 416 kt)

■ Nitrogen loads historic
(total loads: 131 kt)

Load reduction: 68 %

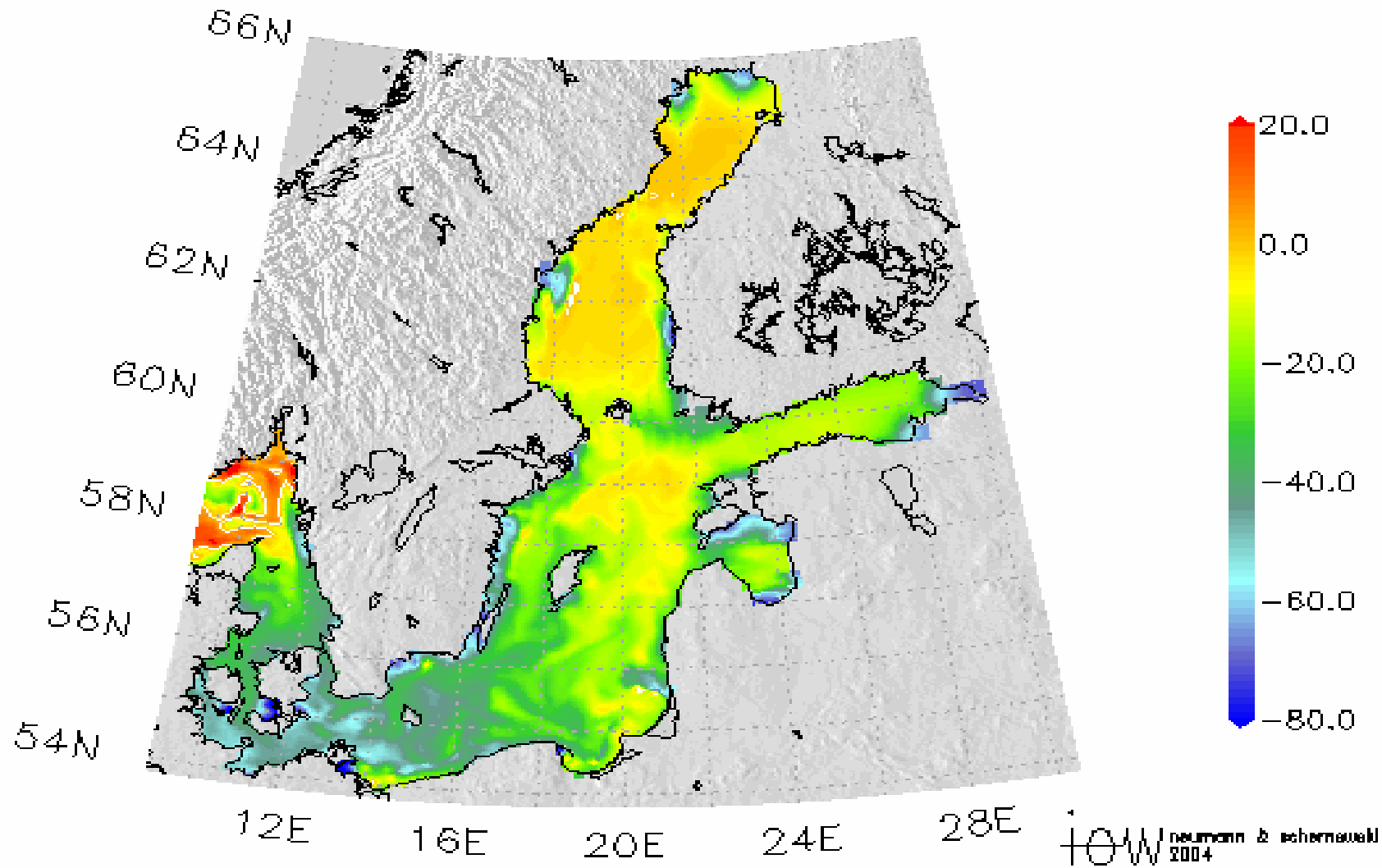
**River basin loads largely
control the trophic state of the
Baltic Sea !**



Relative reduction a century ago (movie)

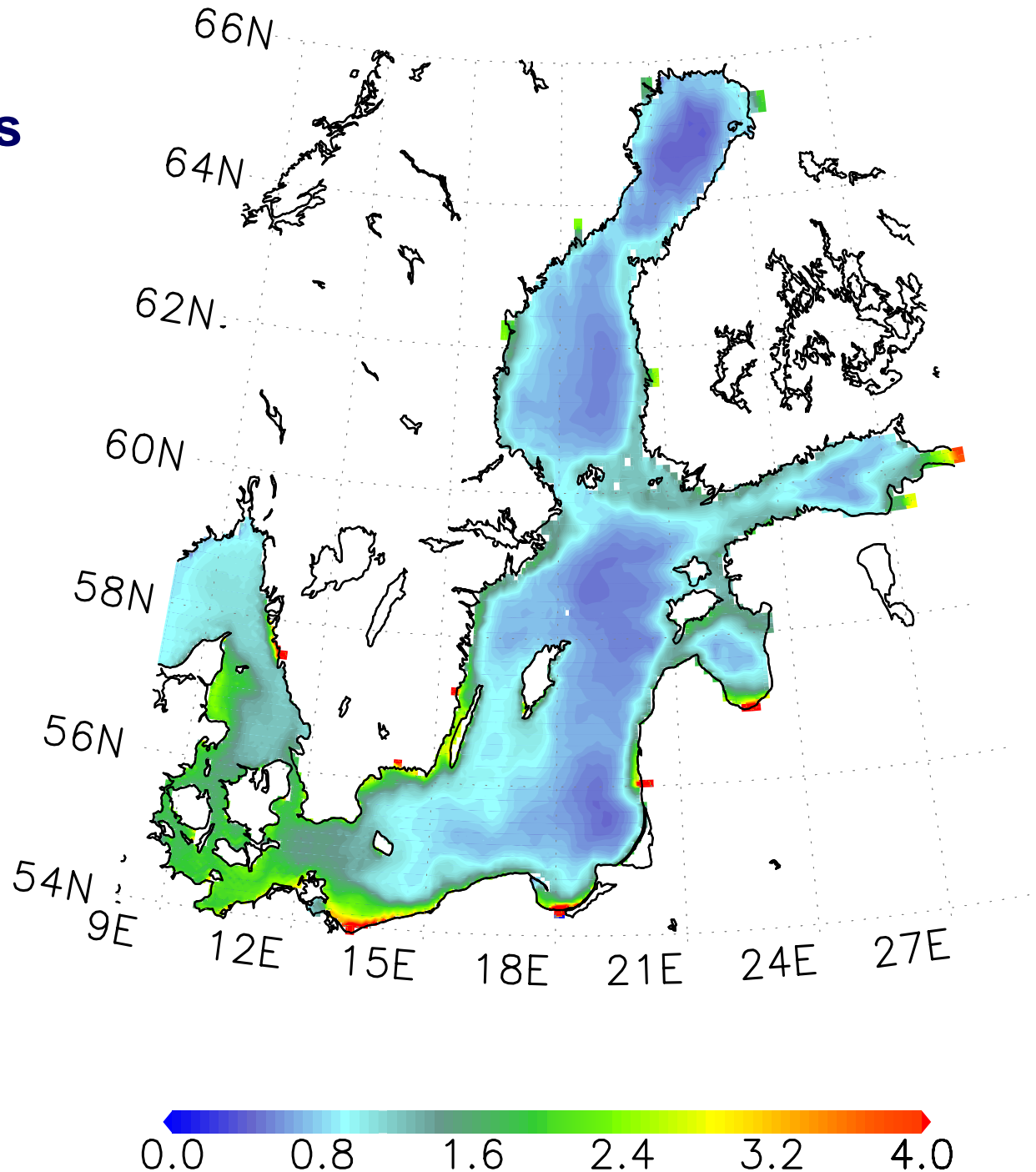
Surface (10m avg) Chlorophyll change [%]
pre-industrial loads; recent forcing

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Reference values in Baltic coastal waters: chlorophyll

Average annual surface
concentrations (3 years)
mg/ m³ a century ago



Summary

River basin management is coastal water and regional sea management !!

The Baltic Sea 100 years ago:

- Received only 32 % (24 %) of the recent nitrogen (phosphorus) loads.
- As a consequence, the algae biomass (chlorophyll) in the open sea was 20-30 % lower compared to today.
- Algae blooms were a common feature.
- In most cases, coastal waters showed a much stronger reduction of chlorophyll concentration than the open sea (about 50 %).
- Due to relatively lower phosphorus inputs (compared to nitrogen) the P limitation in coastal waters was slightly spatially extended.
- During the last century a spatial shift in nutrient loads took place.

Outlook

This modelling approach still has many uncertainties and might be regarded as overloaded with assumptions and simplifications.



Schernewski & Neumann (2005): J. Marine Systems 53, 109-124

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