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SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

A Question of Scale – The Regional Science Approach

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Fluid motion

$$\vec{F} = m\vec{a} = m\frac{d\vec{v}}{dt} = m\frac{d^2\eta(t)}{dt^2}$$

Photosynthesis

$$6CO_2+6H_2O \Rightarrow C_6H_{12}O_6+6O_2$$

Enzyme kinetics

$$V=V_m*S/(K_s+S)$$

Population growth

$$\frac{dN}{dt} = rN$$

Iron precipitation

$$Fe_2O_3+3H_2S=2FeS+3H_2O+S$$

$$FeS+2H_2CO_3=Fe(HCO_3)_2+H_2S$$

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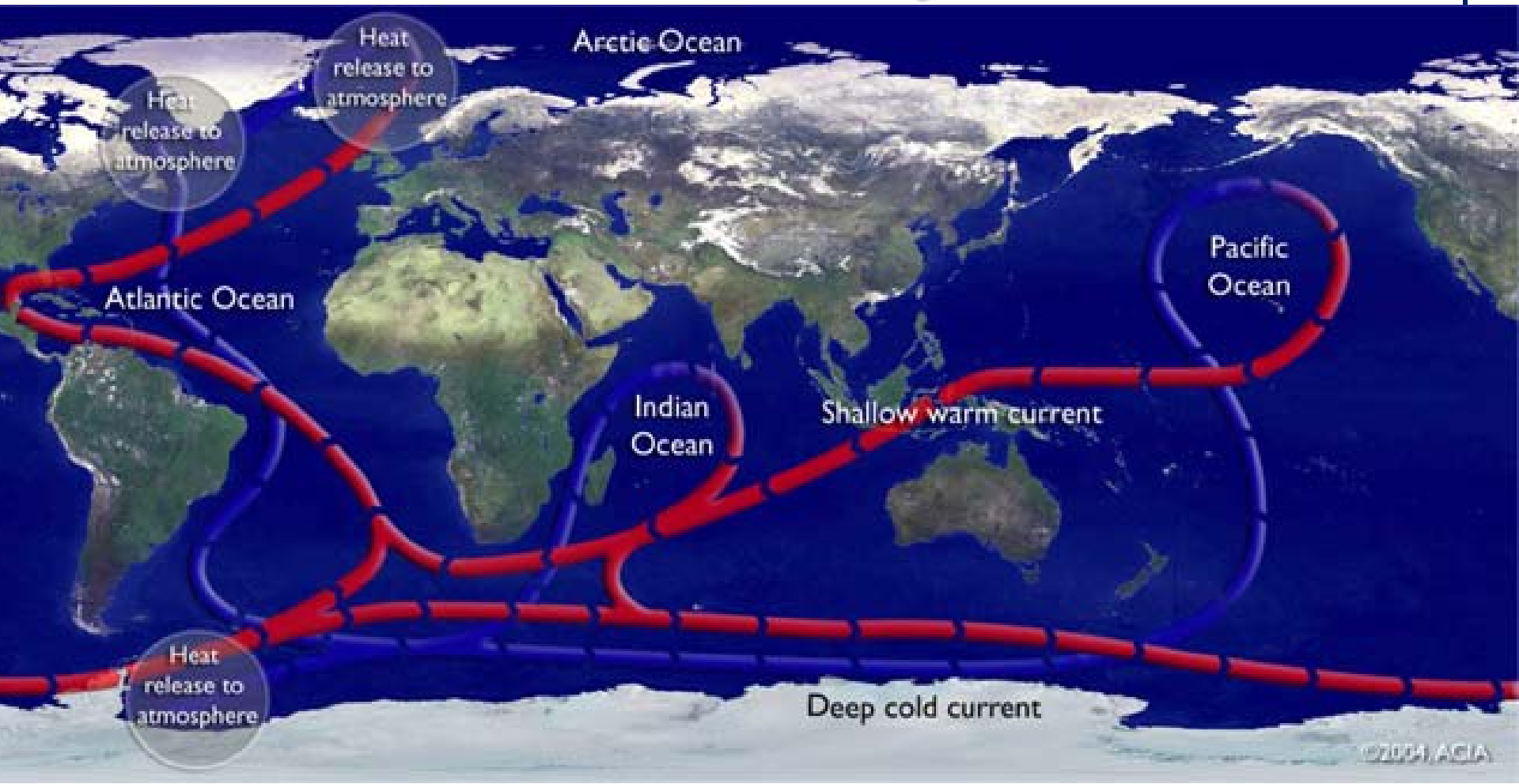
Global thermohaline circulation

40 000 km, 2000 years



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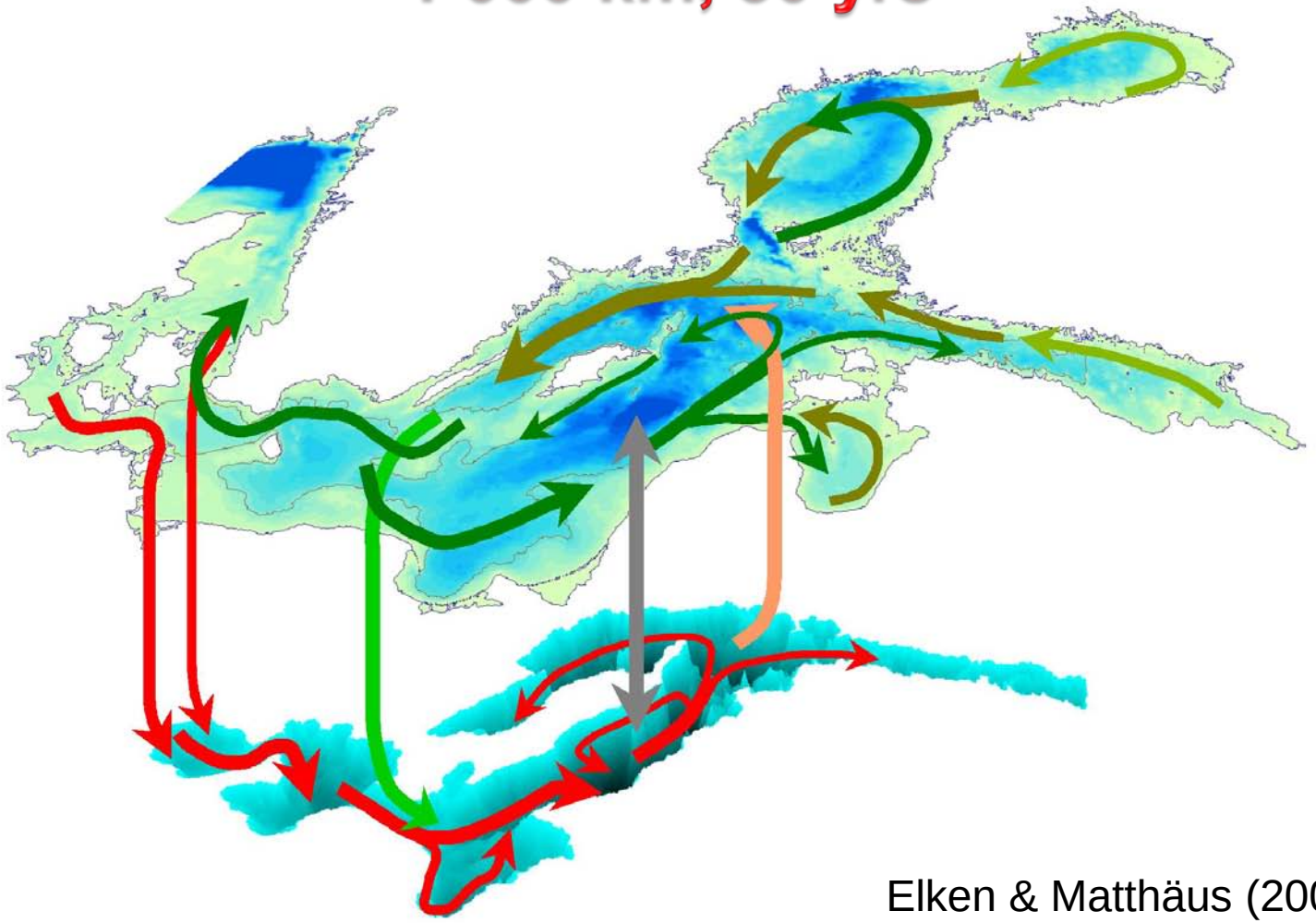
Baltic Sea thermohaline circulation

1 000 km, 30 yrs



Elken & Matthäus (2008)

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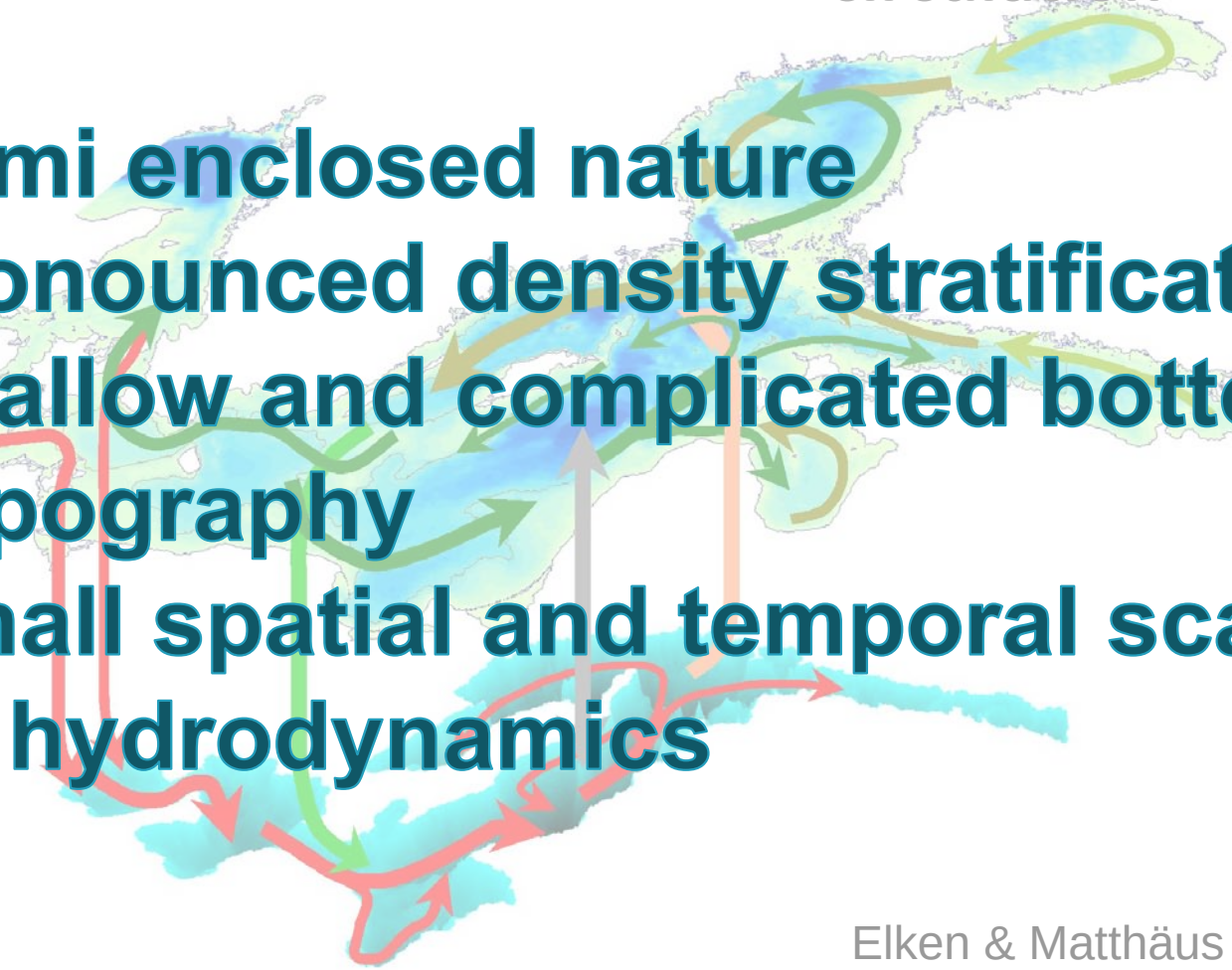
Baltic Sea thermo-haline circulation



- Semi enclosed nature
- Pronounced density stratification
- Shallow and complicated bottom topography
- Small spatial and temporal scales of hydrodynamics

Elken & Matthäus (2008)

Seasonal pecularities of the Baltic Sea

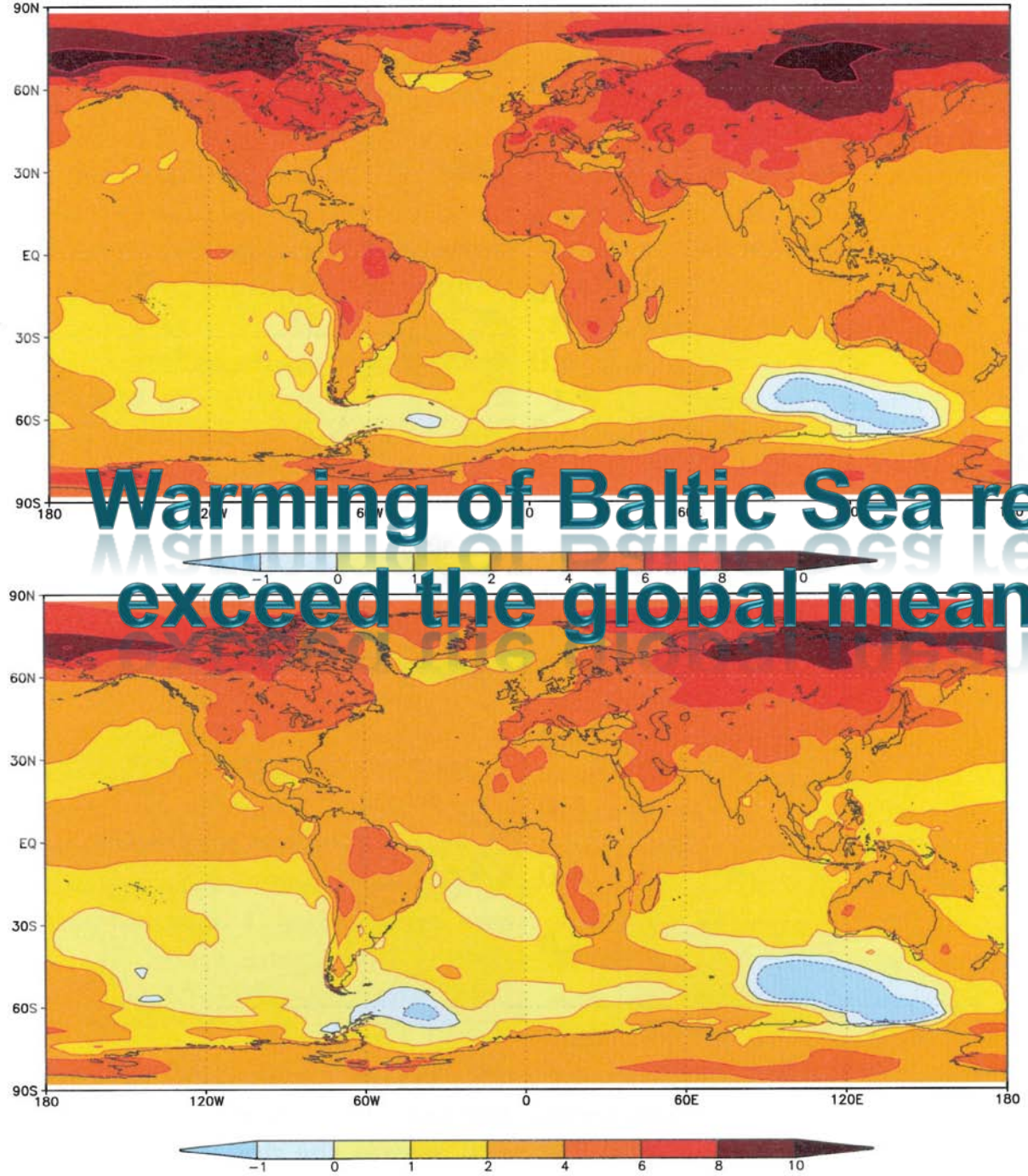
January
Ice cover

July-August
Cyanobacterial blooms

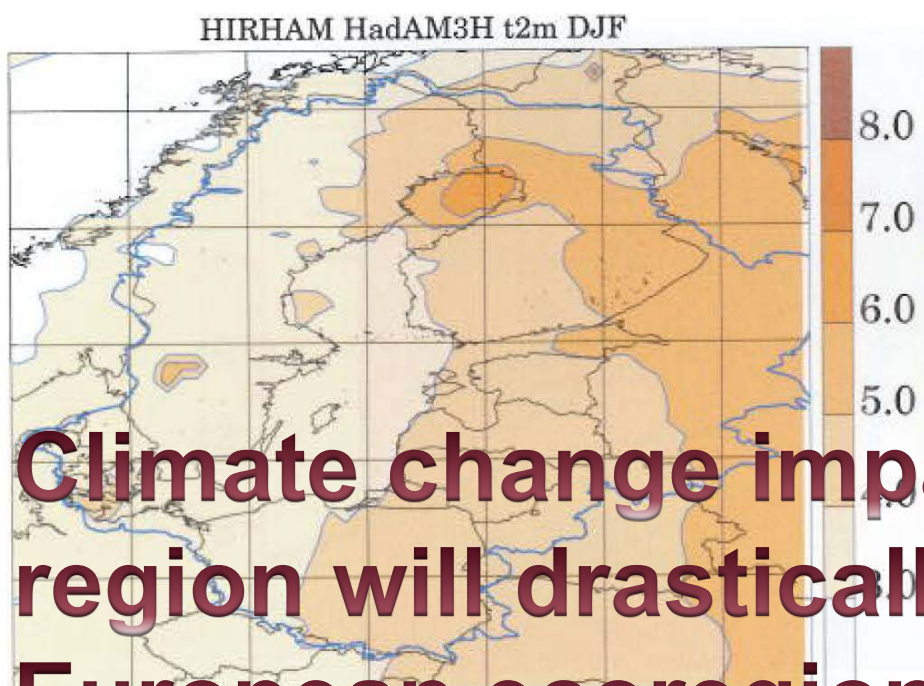
Biodiversity in the Baltic Sea

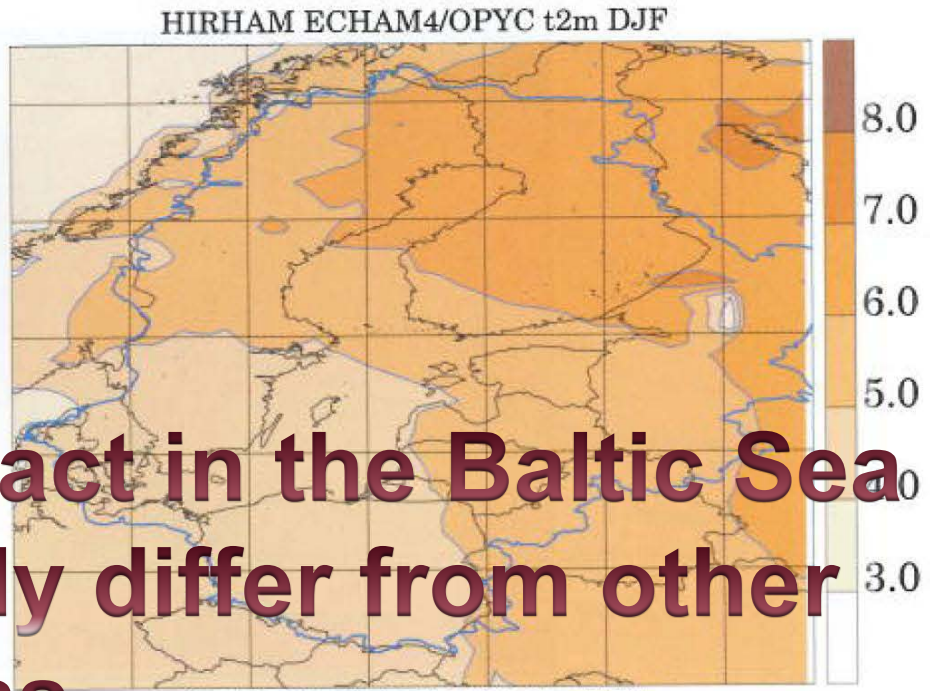
Jansson 2008

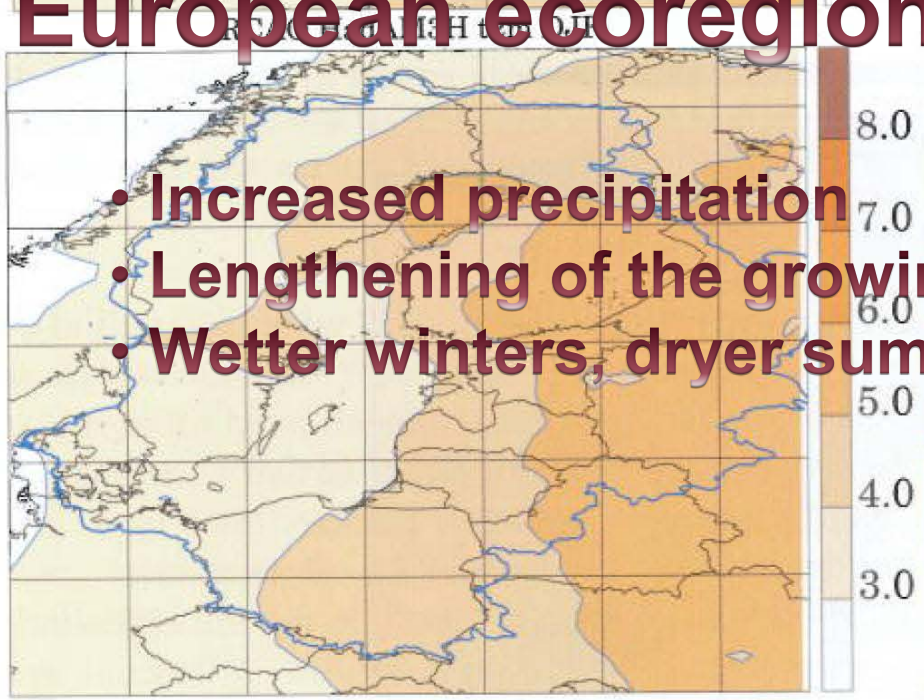
Climate change

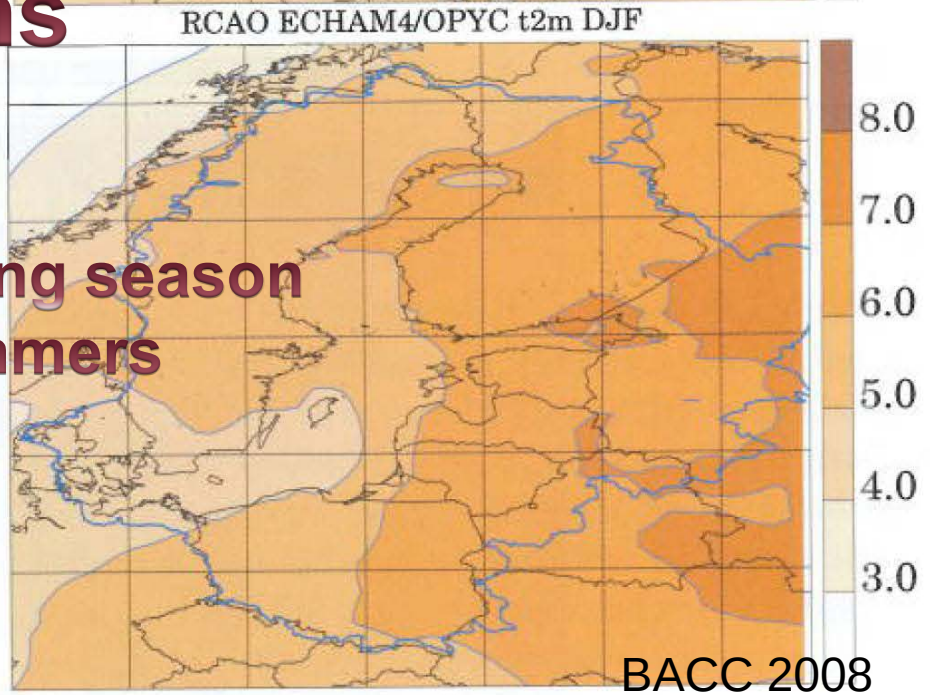


Warming of Baltic Sea region will exceed the global mean by 50 %









Climate change impact in the Baltic Sea region will drastically differ from other European ecoregions

- Increased precipitation
- Lengthening of the growing season
- Wetter winters, dryer summers

BACC 2008

STUDIES ON THE EARTH SYSTEMS ARE USUALLY LINKED TO A SPECIFIC GEOGRAPHIC AREA

From the Baltic to the World – selected examples:

- Concept of the role of '**microbial loop**' in marine ecosystems was formulated and further developed with the contribution of several Baltic sea scientists (the mid-1980s);
- Understanding of mechanisms behind the toxic **cyanobacterial blooms** was substantially enriched by studies in Baltic;
- **Baltic Operational Oceanography System** (BOOS) is one of the most active compartments of the EuroGOOS

'Blue Marble' pastel painting by Ria Haa

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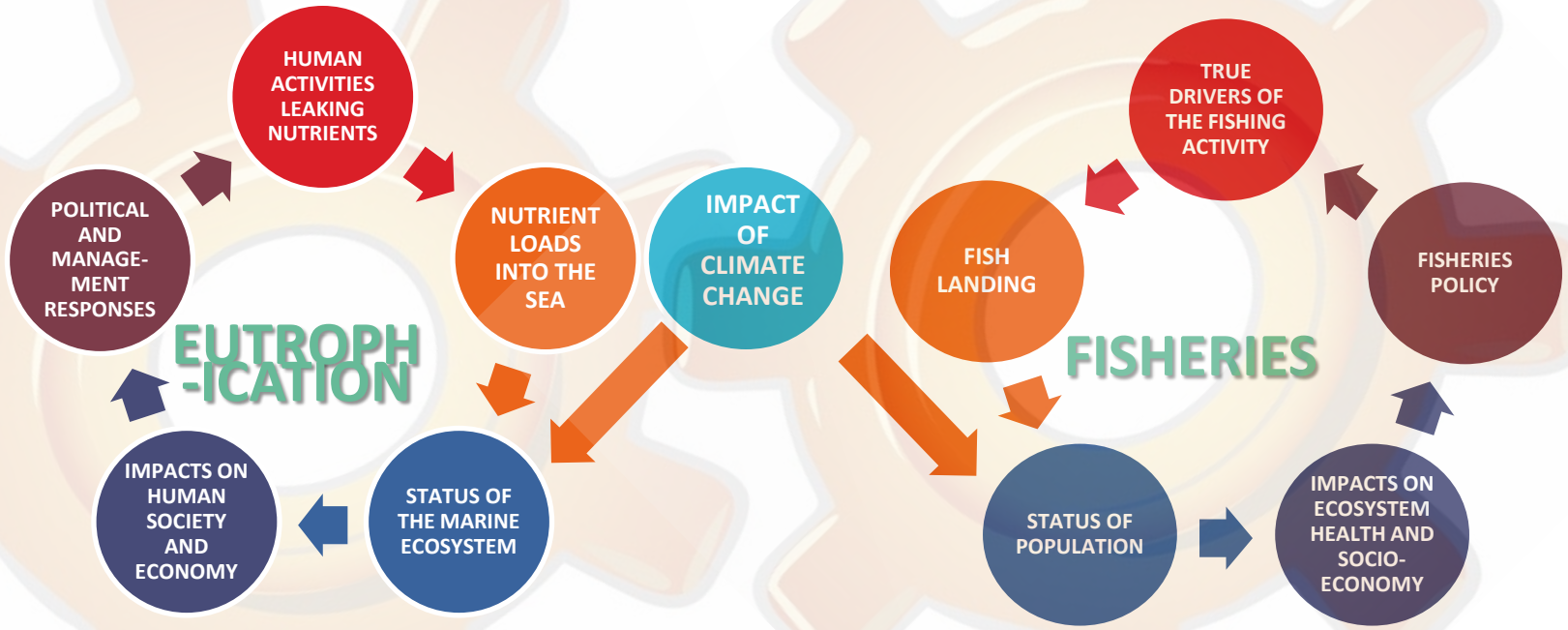
ECOSYSTEM APPROACH TO MARITIME GOVERNANCE...



...MUST BE APPLIED AT RIGHT SPATIAL SCALE

Integrated Maritime Policy for the European Union:

"What is needed at the European level is a commitment to common principles and guidelines to facilitate the process in a flexible manner and to ensure that regional marine ecosystems that transcend national maritime boundaries are respected."

COM(2007) 575

Photo: Magnus Melin/John'er

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(a) The Marine Strategy Framework Directive establishes European Marine Regions on the basis of geographical and environmental criteria:

the Baltic Sea;

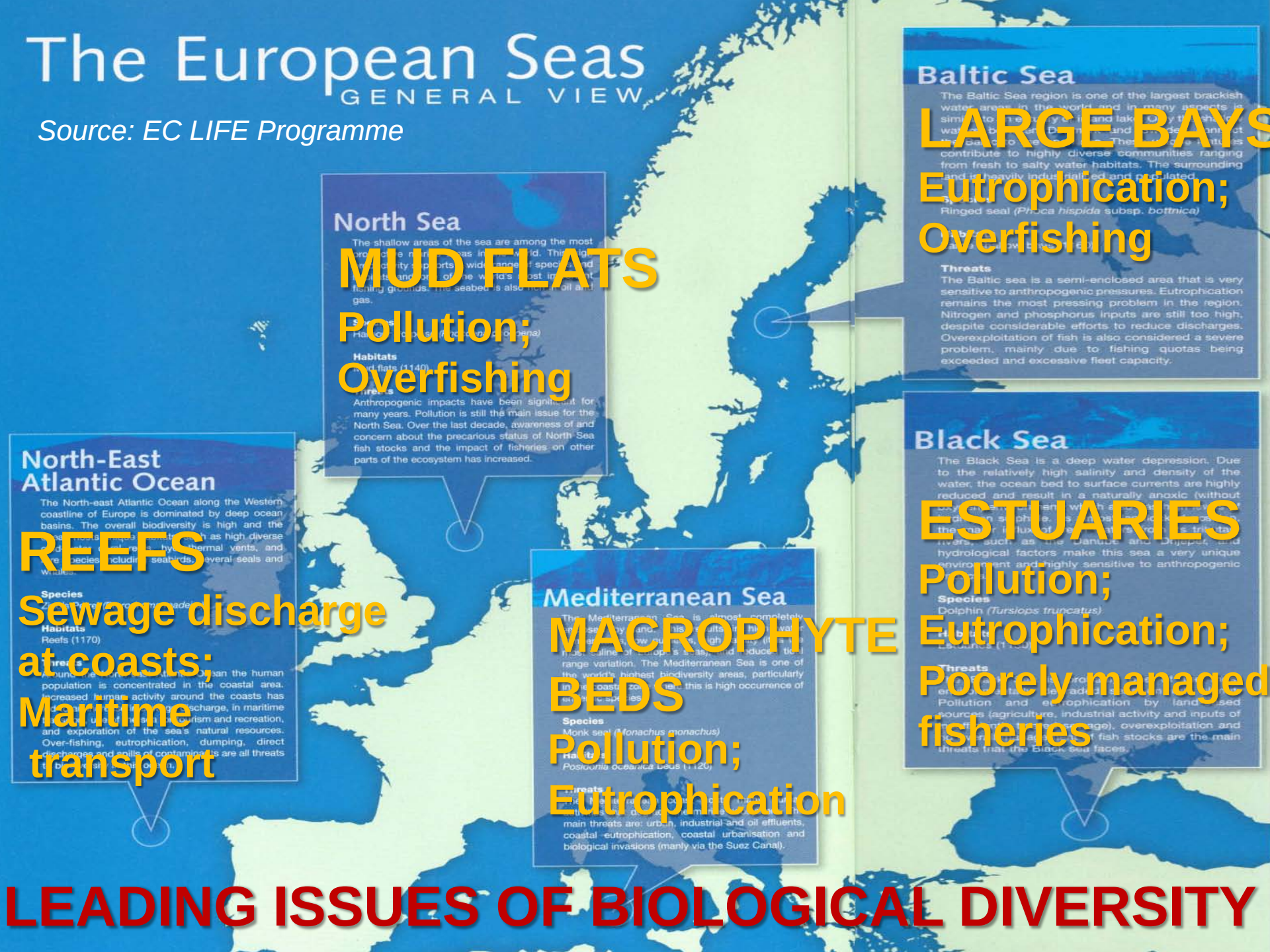
(b) the North-east Atlantic Ocean;

(c) the Mediterranean Sea;

(d) the Black Sea.

NE Atlantic and Mediterranean are further subdivided into marine sub-regions

DIRECTIVE 2008/56/EC ;Graph source: J.L. Suárez de Vivero, EUROOCEAN


The European Seas
GENERAL VIEW
Source: EC LIFE Programme
North Sea
The shallow areas of the sea are among the most
gas.
Habitats
Anthropogenic impacts have been significant for many years. Pollution is still the main issue for the North Sea. Over the last decade, awareness of and concern about the precarious status of North Sea fish stocks and the impact of fisheries on other parts of the ecosystem has increased.
Baltic Sea
The Baltic Sea region is one of the largest brackish
contribute to highly diverse communities ranging from fresh to salty water habitats. The surrounding
Ringed seal (Pusa hispida subsp. bottnica)
Threats
The Baltic sea is a semi-enclosed area that is very sensitive to anthropogenic pressures. Eutrophication remains the most pressing problem in the region. Nitrogen and phosphorus inputs are still too high, despite considerable efforts to reduce discharges. Overexploitation of fish is also considered a severe problem, mainly due to fishing quotas being exceeded and excessive fleet capacity.
North-East Atlantic Ocean
The North-east Atlantic Ocean along the Western coastline of Europe is dominated by deep ocean basins. The overall biodiversity is high and the
Species
Habitats
Reefs (1170)
Threats
Mediterranean Sea
The Mediterranean Sea is almost completely
range variation. The Mediterranean Sea is one of the world's highest biodiversity areas, particularly
Species
Monk seal (Monachus monachus)
Habitats
Posidonia oceanica beds (1120)
Threats
main threats are: urban, industrial and oil effluents, coastal eutrophication, coastal urbanisation and biological invasions (manly via the Suez Canal).
Black Sea
The Black Sea is a deep water depression. Due to the relatively high salinity and density of the water, the ocean bed to surface currents are highly reduced and result in a naturally anoxic (without
hydrological factors make this sea a very unique
Species
Dolphin (Tursiops truncatus)
Threats
Pollution and eutrophication by land based sources (agriculture, industrial activity and inputs of
fish stocks are the main threats that the Black Sea faces.
LARGE BAYS
Eutrophication;
Overfishing
MUD FLATS
Pollution;
Overfishing
REEFS
Sewage discharge at coasts;
Maritime transport
MACROPHYTE BEDS
Pollution;
Eutrophication
ESTUARIES
Pollution;
Eutrophication;
Poorely managed fisheries
LEADING ISSUES OF BIOLOGICAL DIVERSITY

Reform of EU's Common Fisheries Policy:

".. delegation of [the rights to regulate Member State fisheries] would need to be organized at the level of **marine regions** because of shared fish stocks …

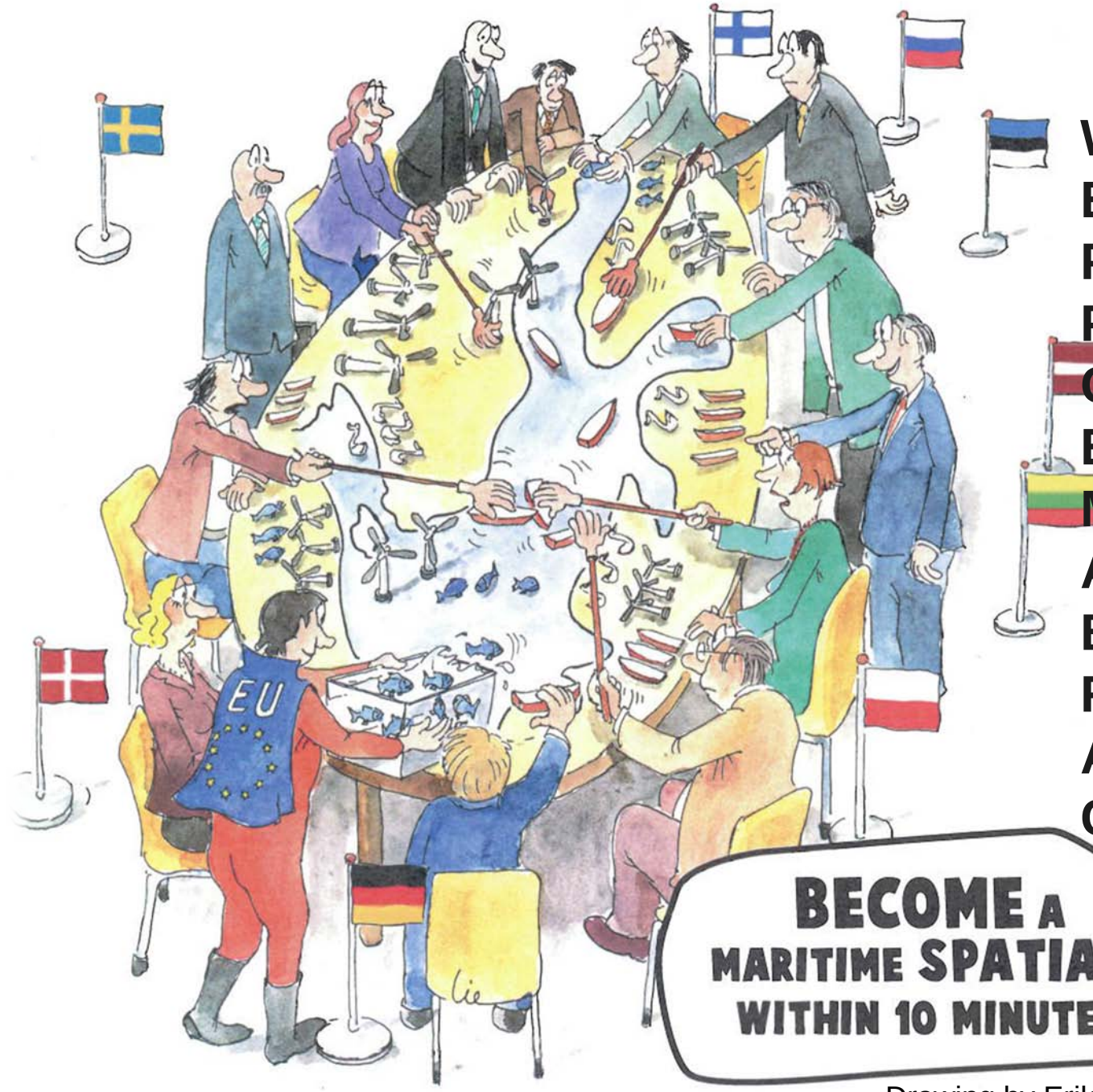
… **can not be managed by individual Member States acting in isolation".**

EC "Green Paper" 2009

Baltic herring, photo by Riku Lumiaro SYKE

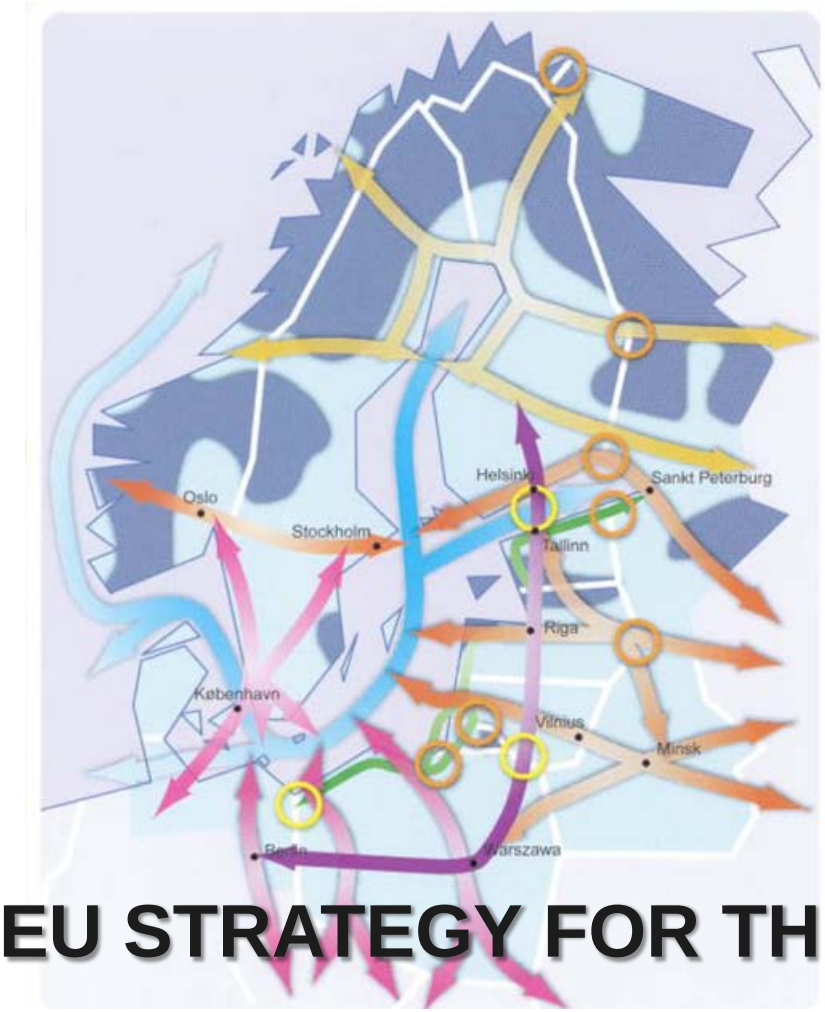
A MACROREGIONAL POLICY INTEGRATED ACROSS THE SECTORS IS URGENTLY NEEDED

Drawing by Erik Liebermann, WWF Germany



WHEN EUROPEAN PARLIAMENT PROPOSED THE CONCEPT OF EUROPEAN MACROREGION-AL POLICIES, THE BALTIC SEA REGION BECAME A NATURAL TEST CASE

Drawing by Erik Liebermann, WWF Germany



EU STRATEGY FOR THE BALTIC SEA REGION

- Environmental sustainability
- Economic prosperity;
- Accessibility and attractiveness;
- Safety and security.

Source: VASAB

The Baltic Sea Action Plan

A new environmental strategy
for the Baltic Sea region

RESTORE GOOD ECOLOGICAL QUALITY OF THE BALTIC SEA

- A Baltic Sea undisturbed by excessive inputs of nutrients
- Concentrations of hazardous substances close to natural levels
- Maritime traffic and offshore activities carried out in an environmentally friendly way;
- Favourable conservation status of biodiversity

Helsinki Commission
Baltic Marine Environment Protection Commission

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BONUS Programme

Four principles

- inclusion of both marine and coastal aspects
- inputs to the Baltic Sea System from the catchment
- involvement and integration of stakeholders
- dynamic approach; SRA updated each two years

Two phases

- Strategic phase 2010-2011
- Implementation phase 2012-2016

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Challenges of the new RTD governance

- Operate both at the national and regional levels
  - BONUS Advocates in each Baltic Sea country
- Create Strategic Research Agenda
  - Policy driven
  - Support high quality research
  - Dynamic approach
- Involvement of the Stakeholders
  - stakeholder analysis
  - breaking the borders between sectors