

Using Secchi Depth as water quality indicator of coastal waters

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Why using Secchi Depth?

- standardized, cheap & easy method
- used for a century with a high spatial resolution in the Baltic Sea
- Water transparency is a proper proxy for water quality:
 - Indicator for eutrophication
 - Crucial for the transition to a macrophytes-dominated ecosystem
 - Improved water transparency creates strong benefits for many aspects of ecosystem diversity and function
 - Related to bathing water quality (potentially pathogenic bacteria are sensitive to UV-light)
 - Impact on socio-economic aspects like tourism and aesthetic perception

Calculation of Secchi Depth from ecosystem model

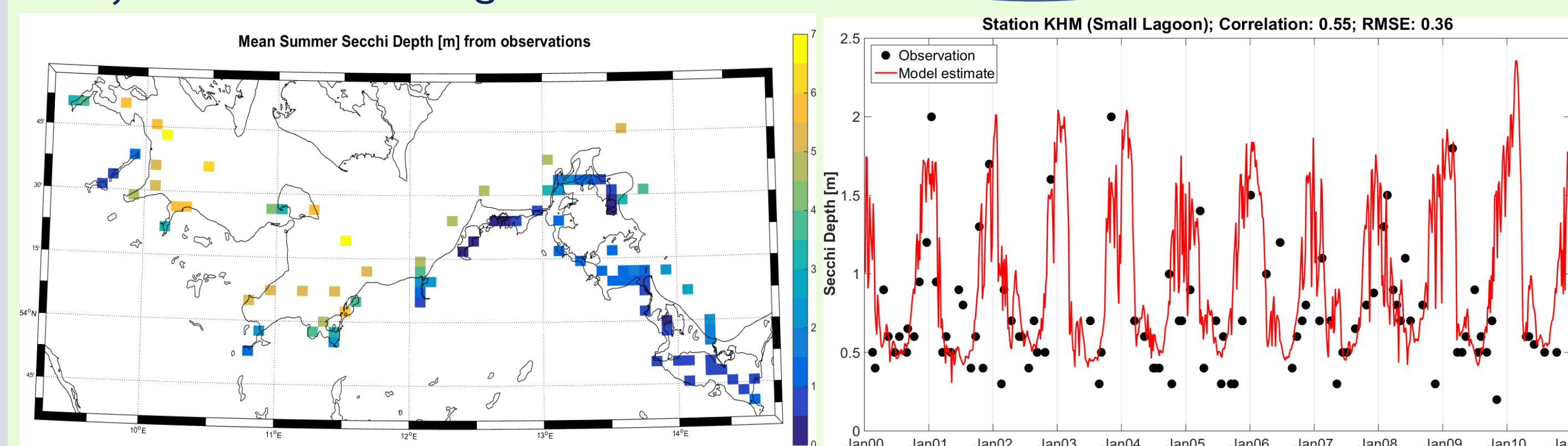
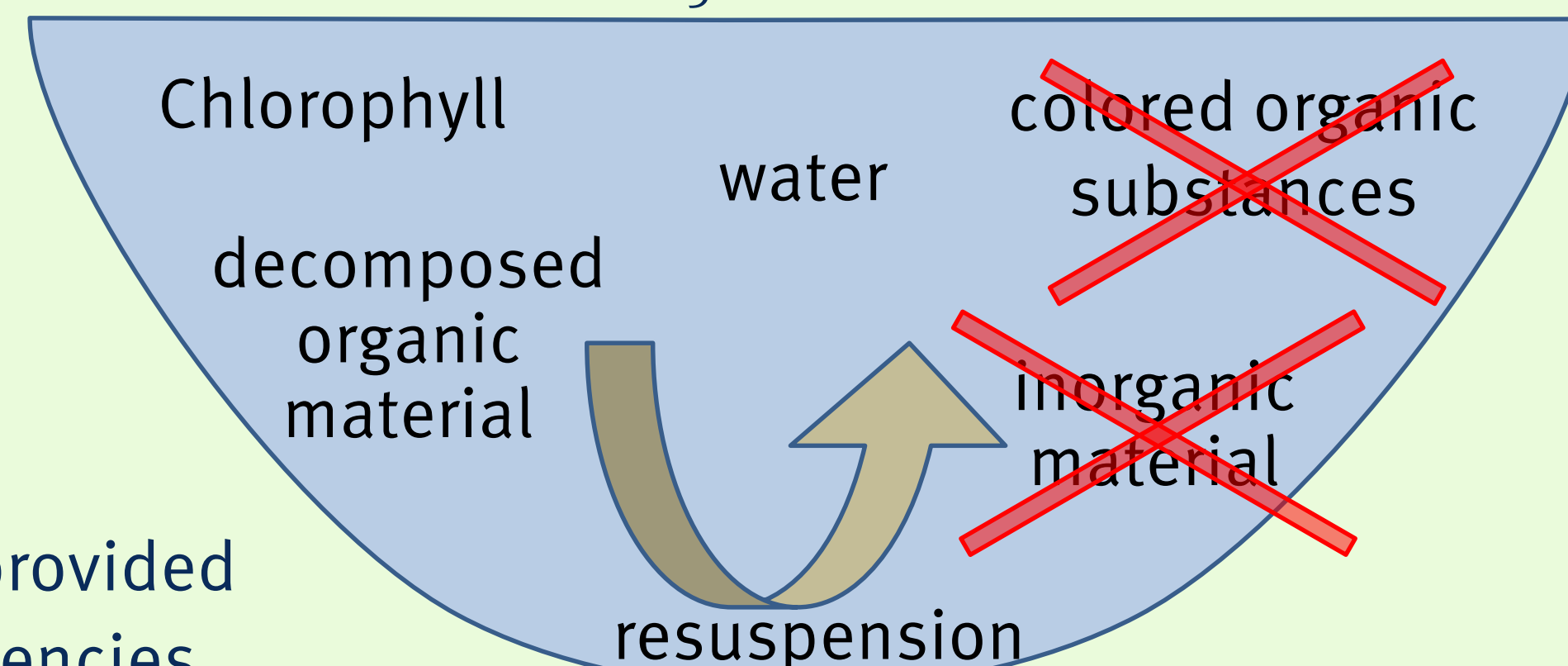
Attenuation:

$$K_{PAR} = \beta_0 + \beta_1 \cdot \text{Chlorophyll} + \beta_2 \cdot \text{Detritus} + \beta_3 \cdot \exp(-\text{Depth})$$

Secchi Depth:

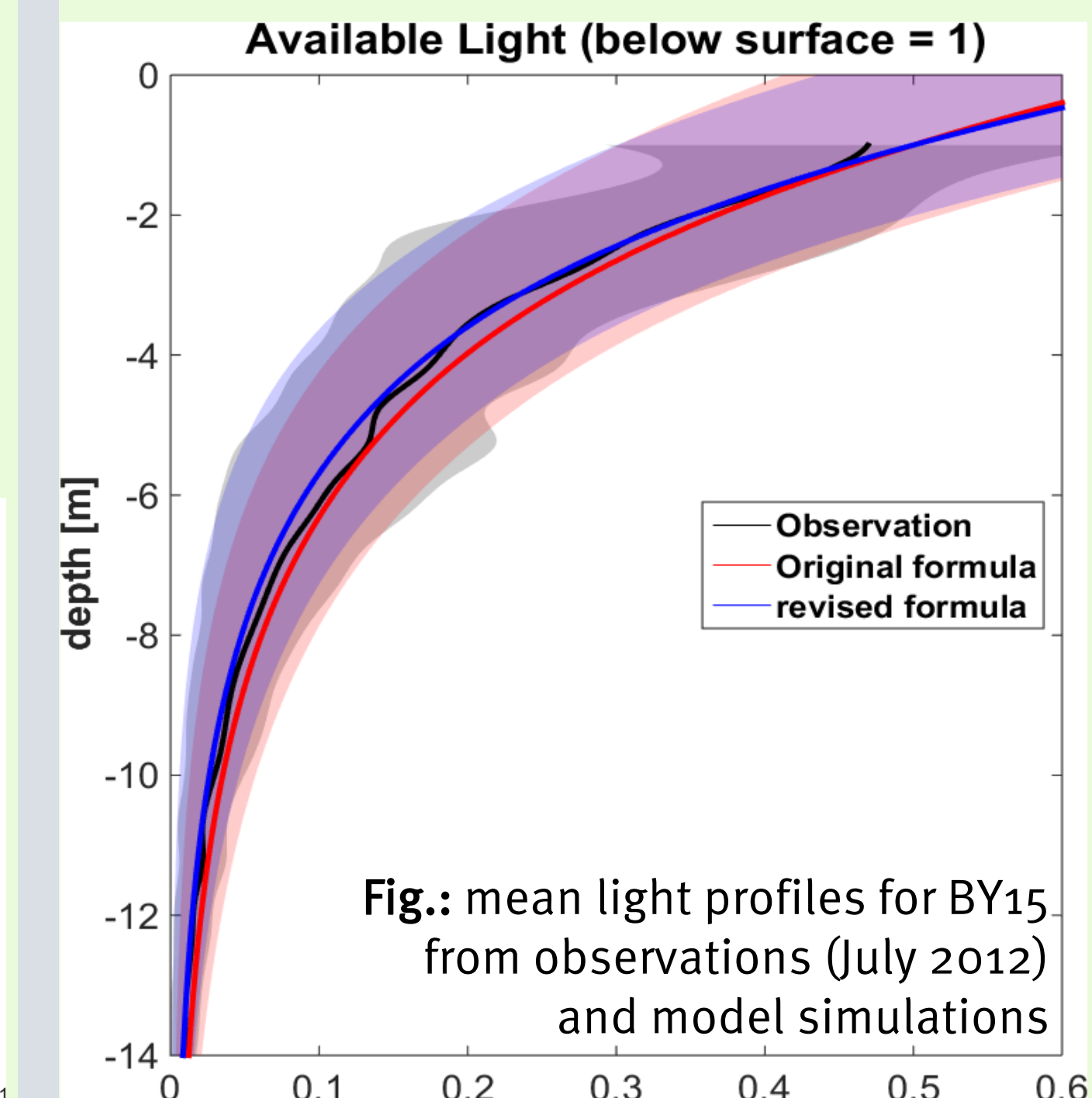
$$SD = -\ln(0.15)/K_{PAR}$$

- Estimation of β_i 's using Secchi Depth observations from Western Baltic Sea provided by environmental agencies



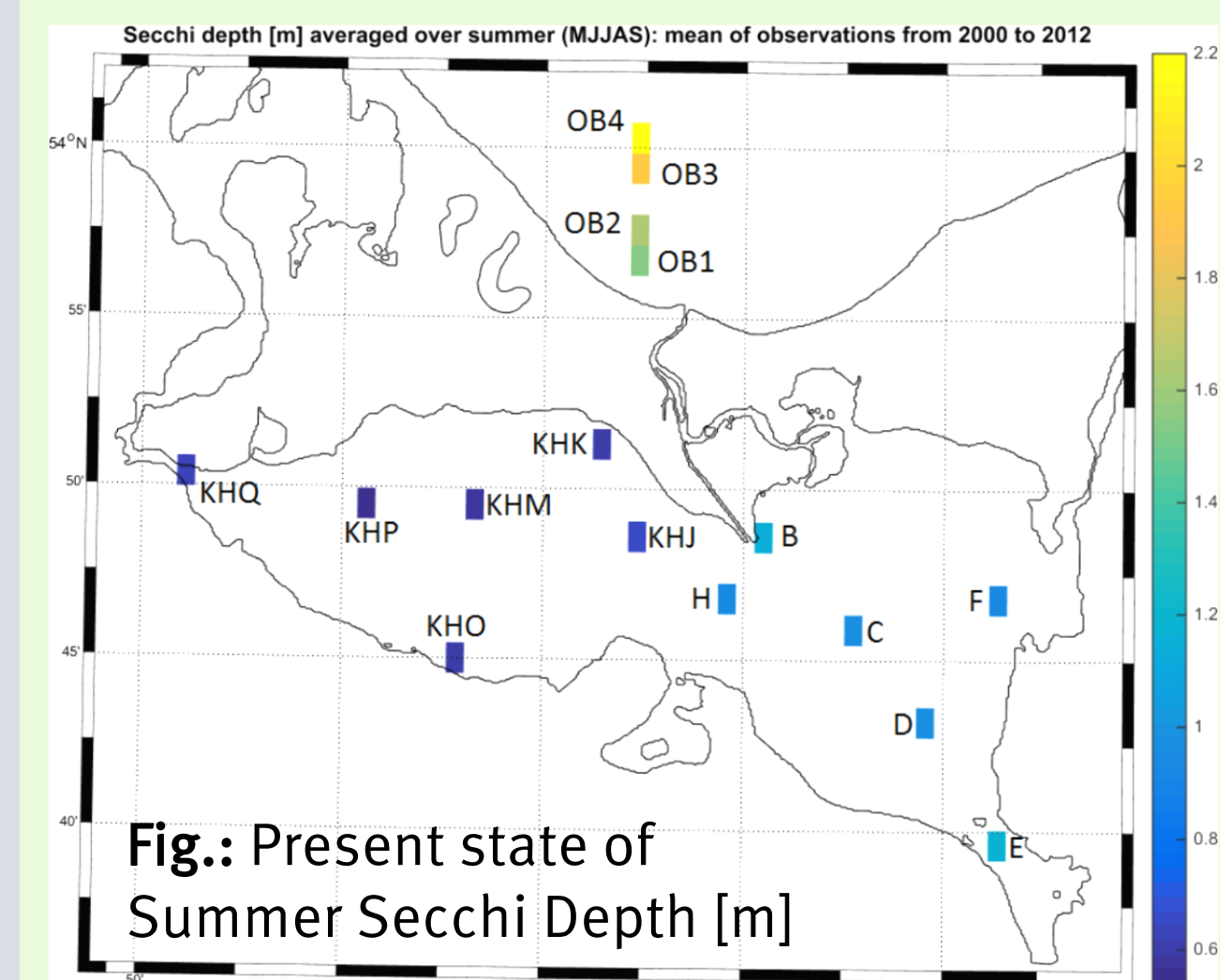
Next steps

- Include missing attenuation by CDOM & SPM in calculation of underwater light in the model
- Adjustments still necessary

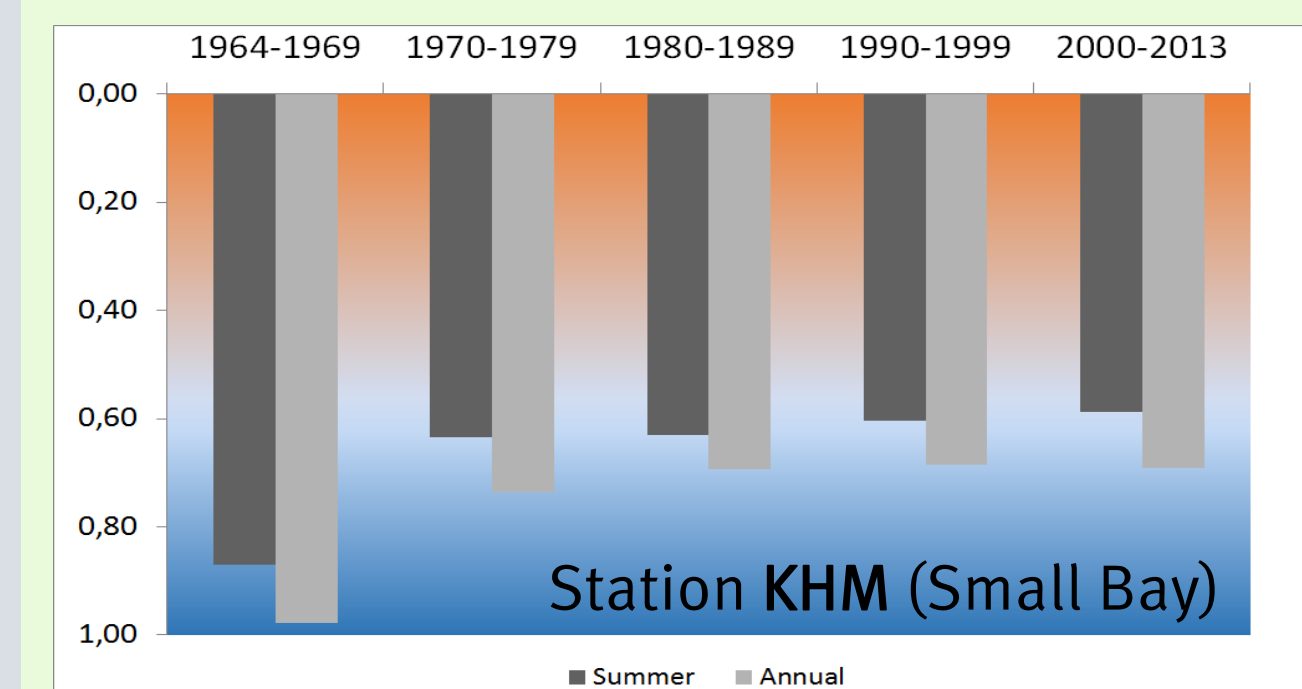


Szczecin Lagoon

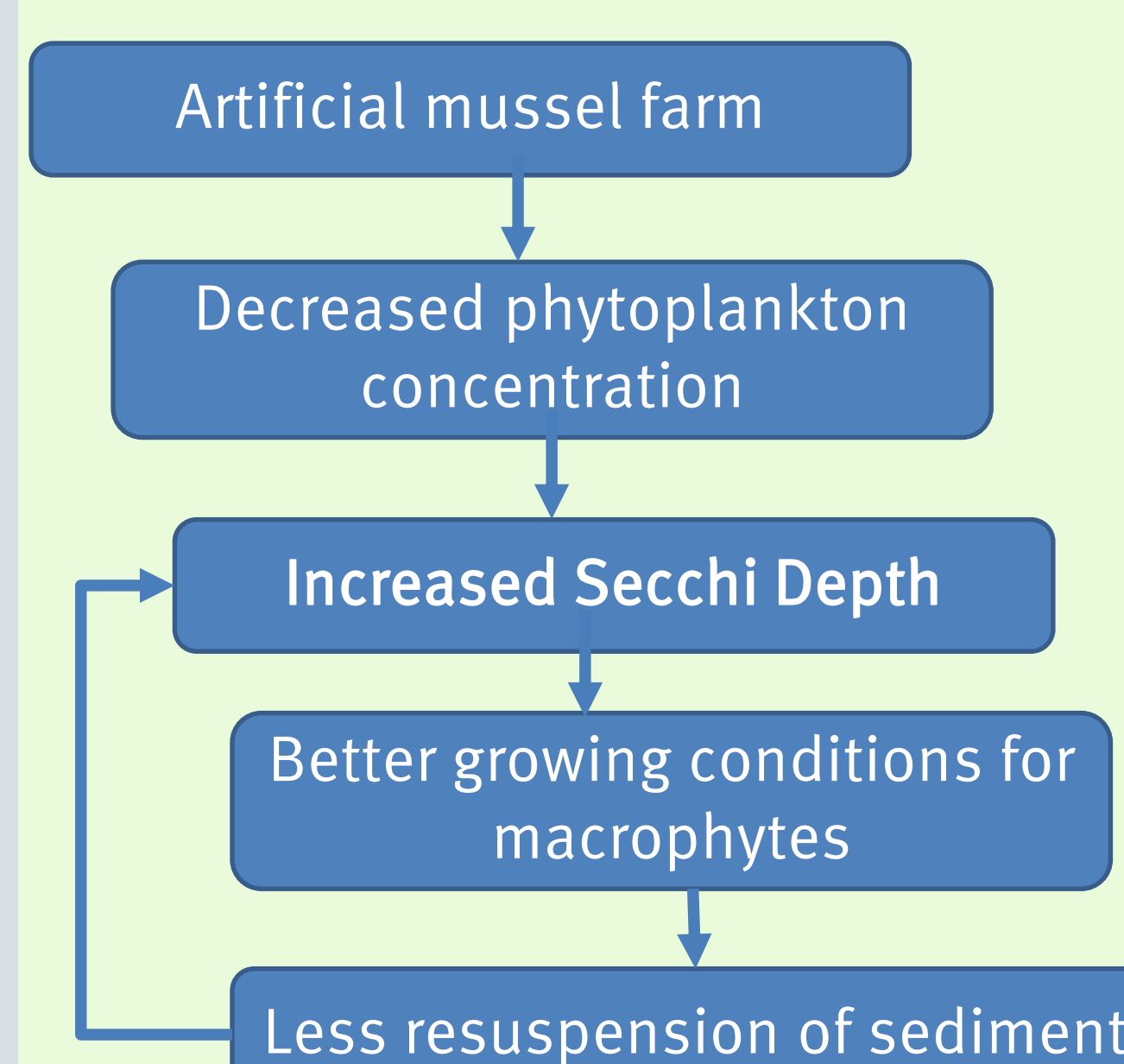
- one of the most important coastal lagoons in the Baltic Sea
- crucial supplier of ecosystem goods & services
- but heavily eutrophicated



- no recovery of Secchi Depth in Small Bay although nutrient loads have been reduced



- Sea-based measure necessary



Calculation of water quality targets for Secchi Depth

- Using integrated modeling introduced by Schernewski et al. (2015) by computing the relative change between Secchi Depth (calculated from the model with formula above) from simulations forced with historical and present nutrient loads
- Multiplication of present observed Secchi Depth with relative change (computed from the model simulations)
- Derived targets in agreement with present HELCOM targets for open waters and historical values (known for Szczecin Lagoon and Bay of Greifswald)

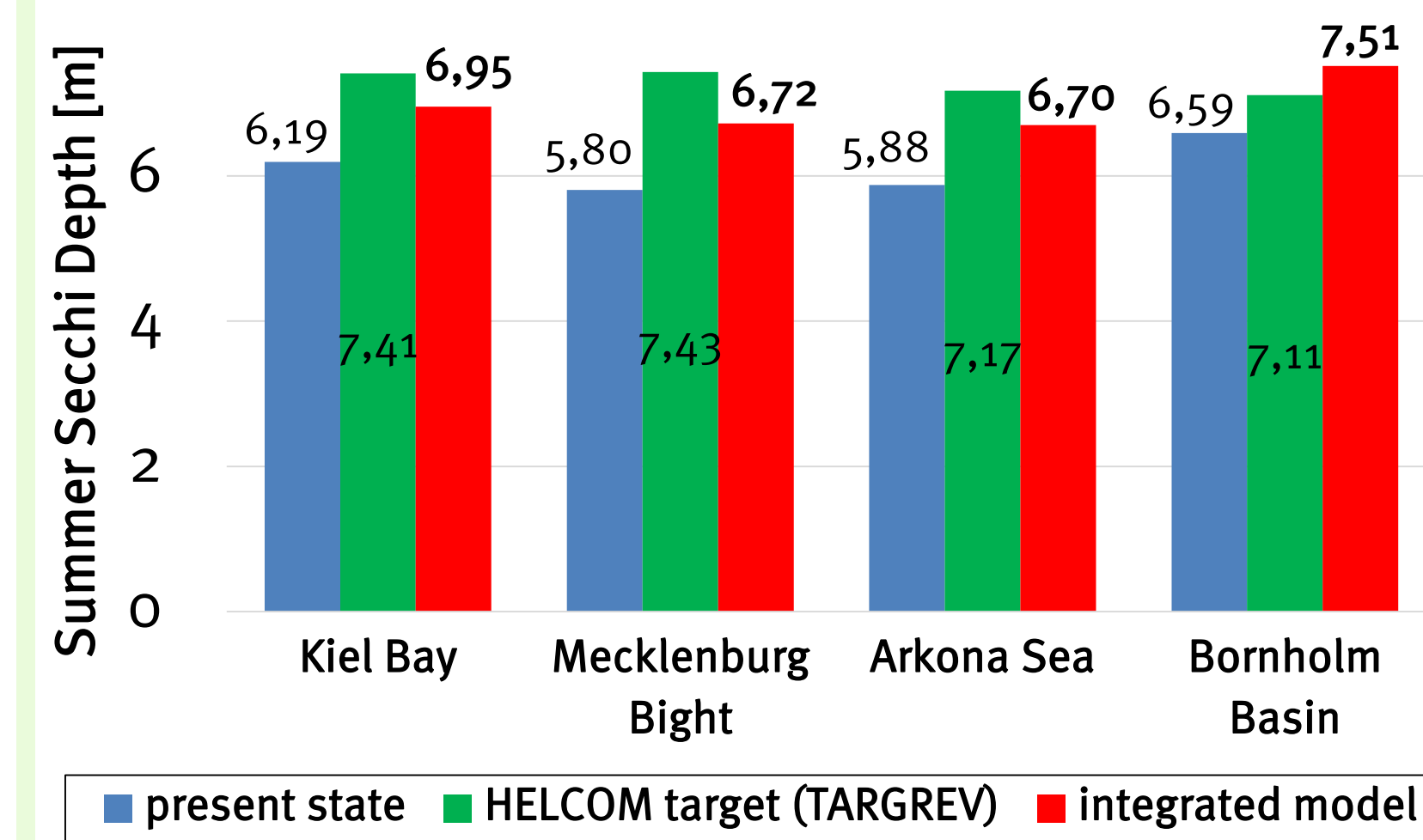
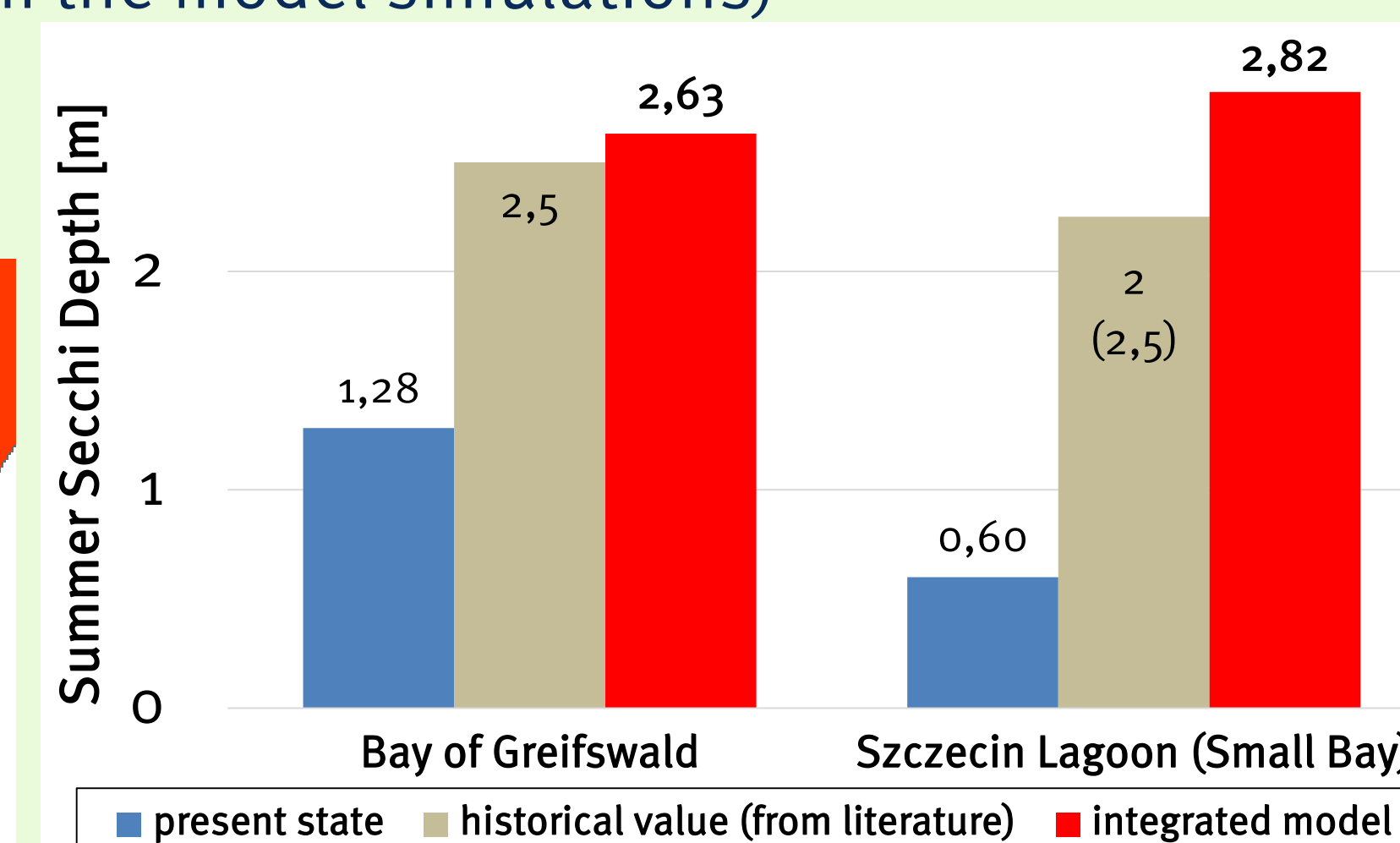
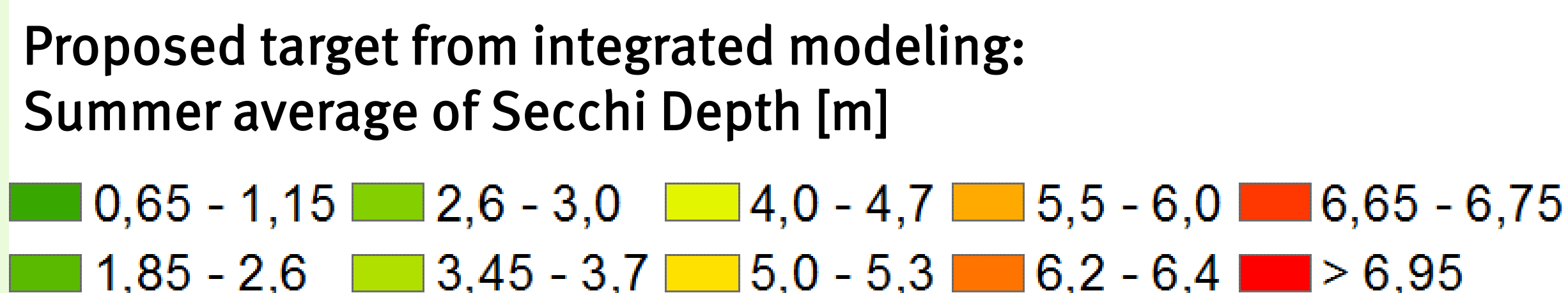
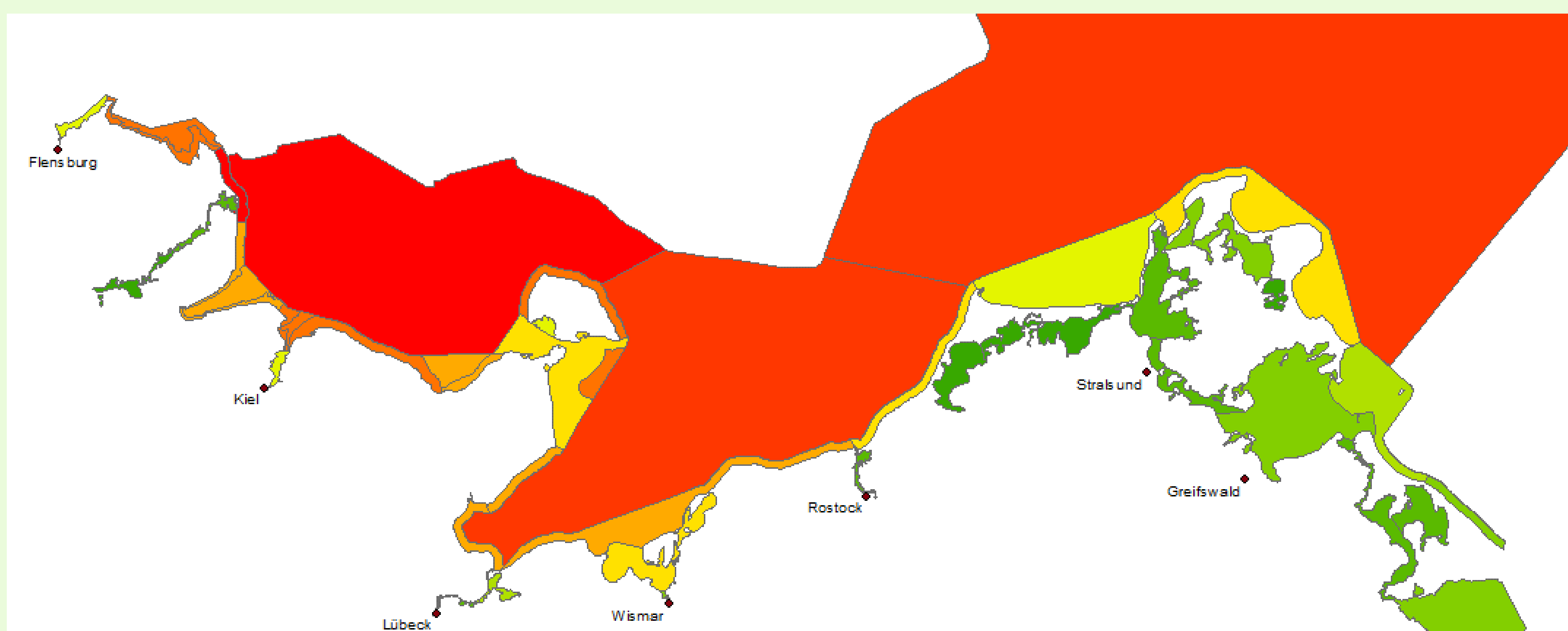


Fig.: Oder Lagoon turbid water. Copyright: IOW (coastal WG)

Observational data provided by:

- LUNG-MV: State Agency for Environment, Nature Conservation and Geology Mecklenburg-Vorpommern
- LLUR-SH: State Agency for Agriculture, Environment and Rural Areas Schleswig-Holstein
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