Chapter 5.2.4: Marine Biogeochemistry (B. Schneider, IOW)

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Events:

June 9/10, 2011: group meeting in Gothenburg;

September, 26/27, 2011: group meeting in Warnemünde;

January 25/26, 2012, further discussions in Gothenburg and Stockholm;

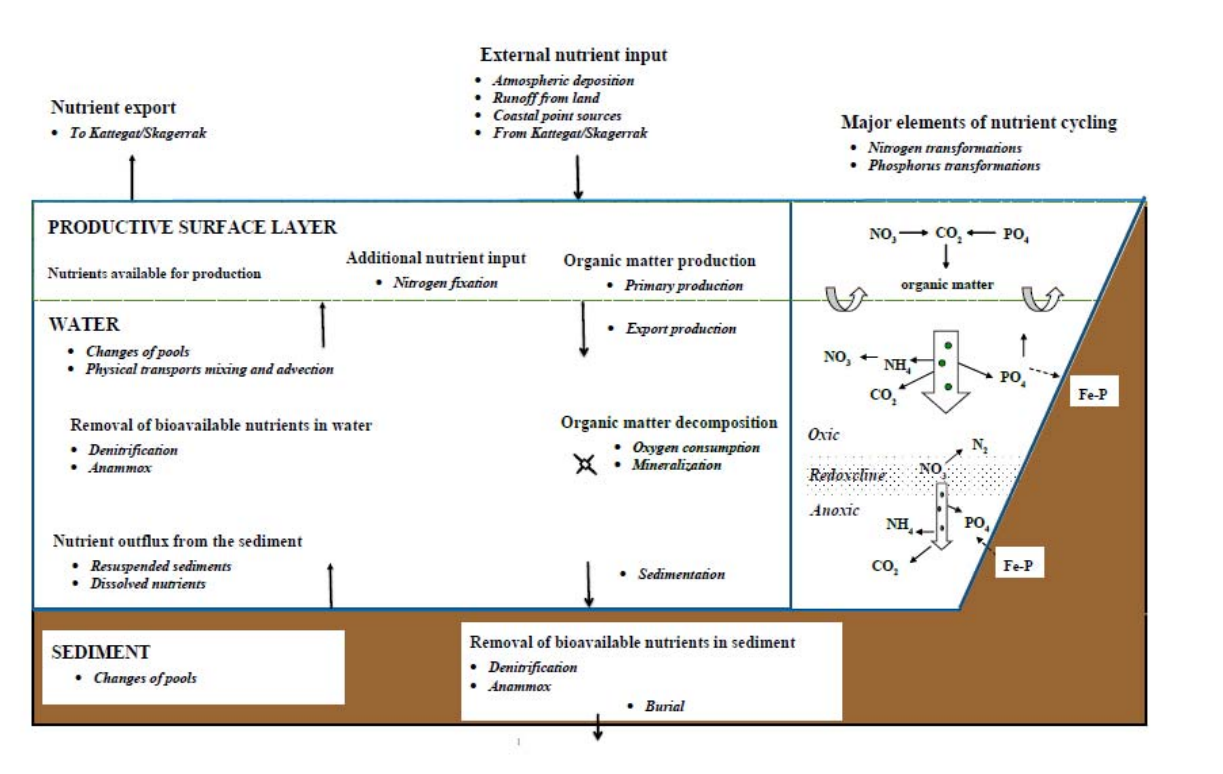
March 20/21, 2012, planned group meeting in Gothenburg;

Structure of Chapter 5.2.4, "Marine Biogeochemistry"

1. Introduction (B. Schneider)
2. Major biogeochemical fluxes and transformations (K. Eilola)
3. Basis for current knowledge (K. Eilola)
4. Changes in external forcing (B. Schneider)
5. Current understanding in biogeochemistry and past changes
   - 5.1 Organic matter production and nutrient availability (B. Muller-Karulis)
   - 5.2 Organic matter decomposition and nutrient recycling
     - 5.2.1 Hydrographic forcing (T. Neumann)
     - 5.2.2 Oxygen depletion and H2S formation (T. Neumann)
     - 5.2.3 Nitrogen transformations (B. Schneider)
     - 5.2.4 Phosphorus transformation (K. Lukkari)
   - 5.3 The marine CO_2 (acid/base) system (B. Schneider)
   - 5.4 Carbon, nitrogen and phosphorus burial in the sediments (K. Lukkari)
6. Response to potential future changes
   - 6.1 Eutrophication (T. Neumann)
   - 6.2 Increasing atmospheric CO2 (B. Schneider)
   - 6.3 Climate change (T. Neumann)
7. Conclusions

2. Major biogeochemical fluxes and transformations (K. Eilola)

- **understanding of „biogeochemistry“ in BACC II;**
- **schematic overview of fluxes and transformations;**
- **guide through the chapter;**



3. Basis for current knowledge (K. Eilola)

- **data sources (monitoring data bases);**
- **biogeochemical modelling;**

4. Changes in external forcing (B. Schneider)

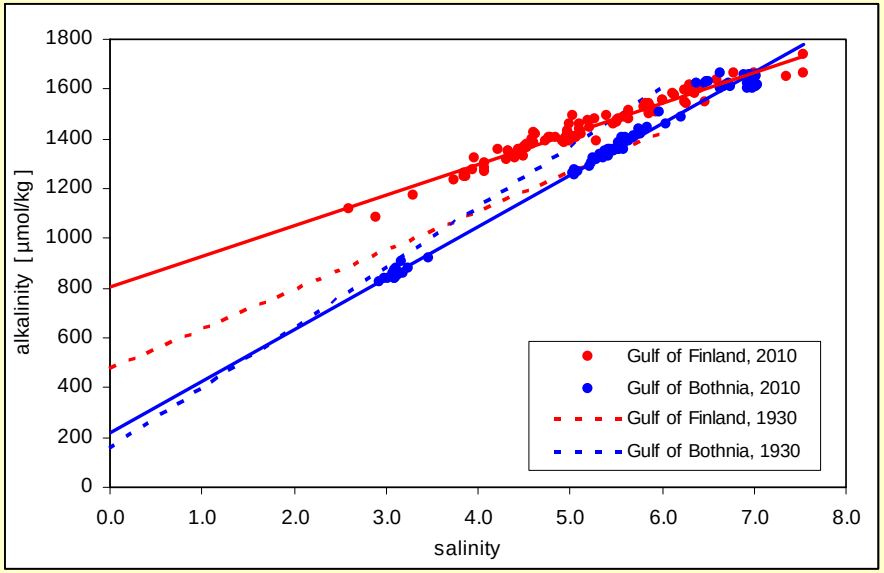
Nitrogen:

N input [t/yr]	waterborne	airborne	total
natural background	143,000	-	(143,000)
beginning 20th century	150,000	83,000	233,000
1985	641,000	322,000	963,000
2001 - 2006	641,000	198,000	839,000

Phosphorus:

N input [t/yr]	waterborne	airborne	total
natural background	143,000	-	(143,000)
beginning 20th century	150,000	83,000	233,000
1985	641,000	322,000	963,000
2001 - 2006	641,000	198,000	839,000

Alkalinity/CO_2:



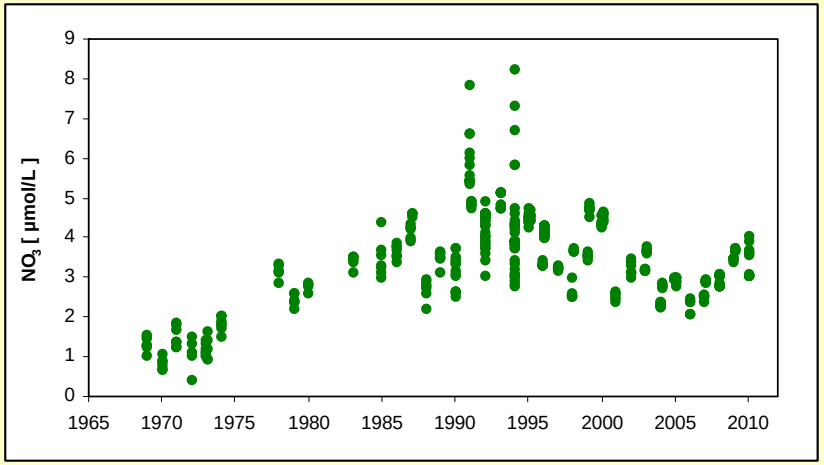
5. Current understanding in biogeochemistry and past changes

5.1 Organic matter production and nutrient availability (B. Muller-Karulis)

- **main driver for past changes are the increasing nutrient concentrations (eutrophication);**

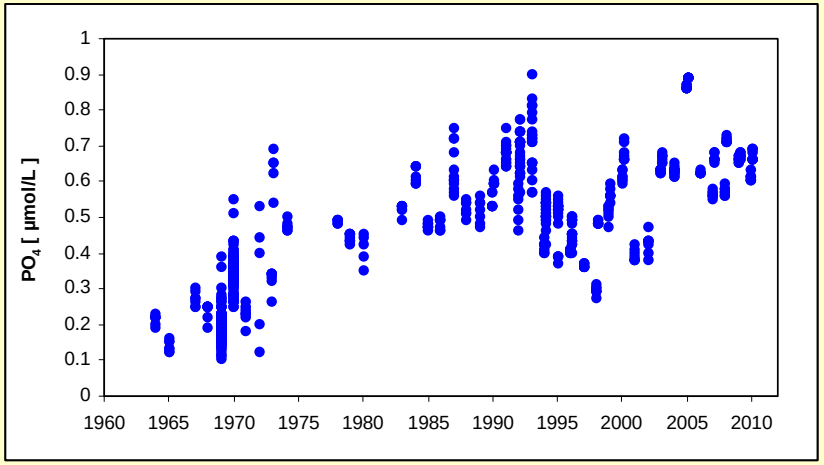
Winter nitrate concentrations:

(Monitoring, SMHI)



Winter phosphate concentrations:

(Monitoring, SMHI)

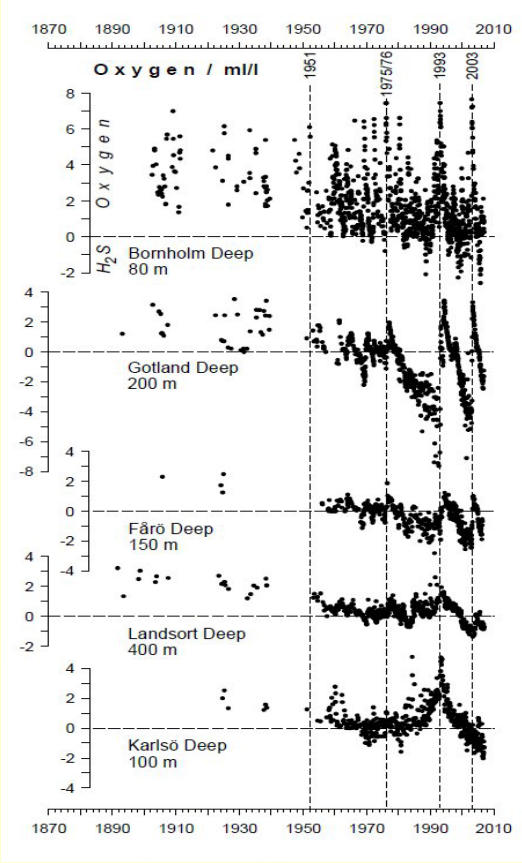


5.2 Organic matter decomposition and nutrient recycling

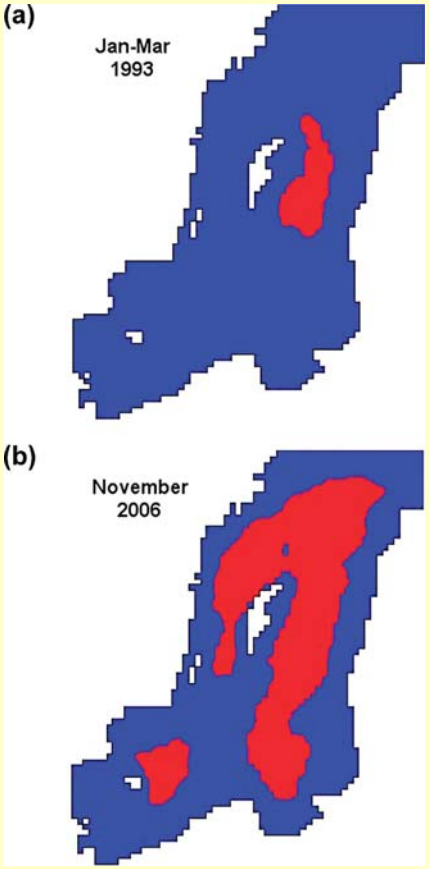
5.2.1 Hydrographic forcing (T. Neumann)

5.2.2 Oxygen depletion and H_2S formation (T. Neumann)

Oxygen/hydrogen sulphide abundance in the bottom water of different basins:



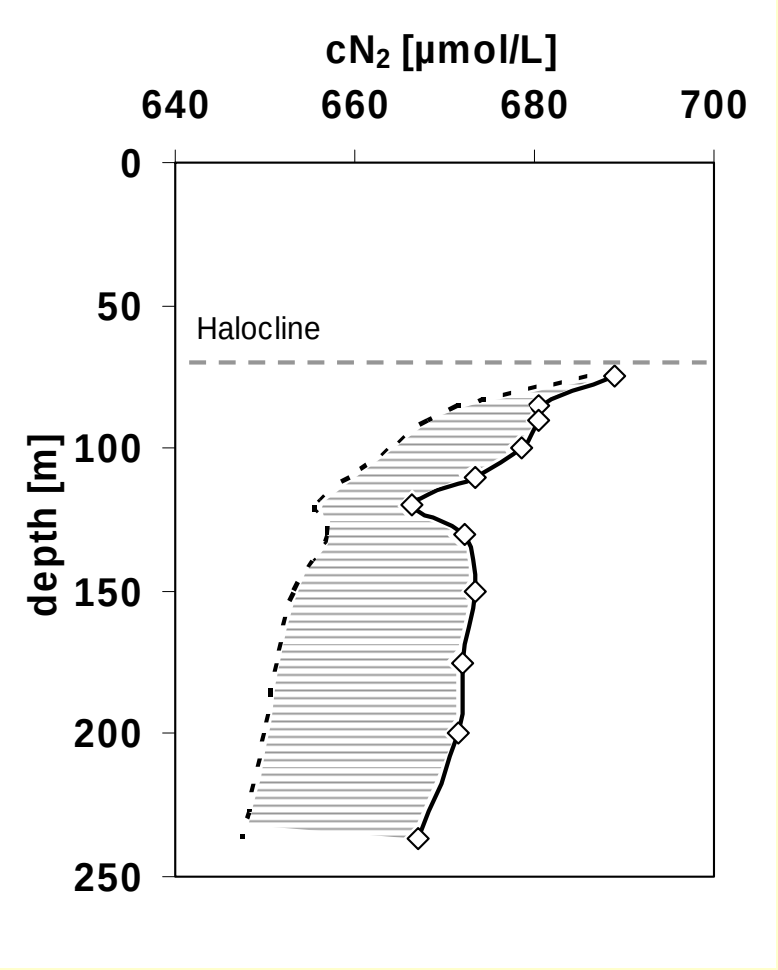
Areas with H_2S in the bottom water:



5.2.3 Nitrogen transformations (B. Schneider)

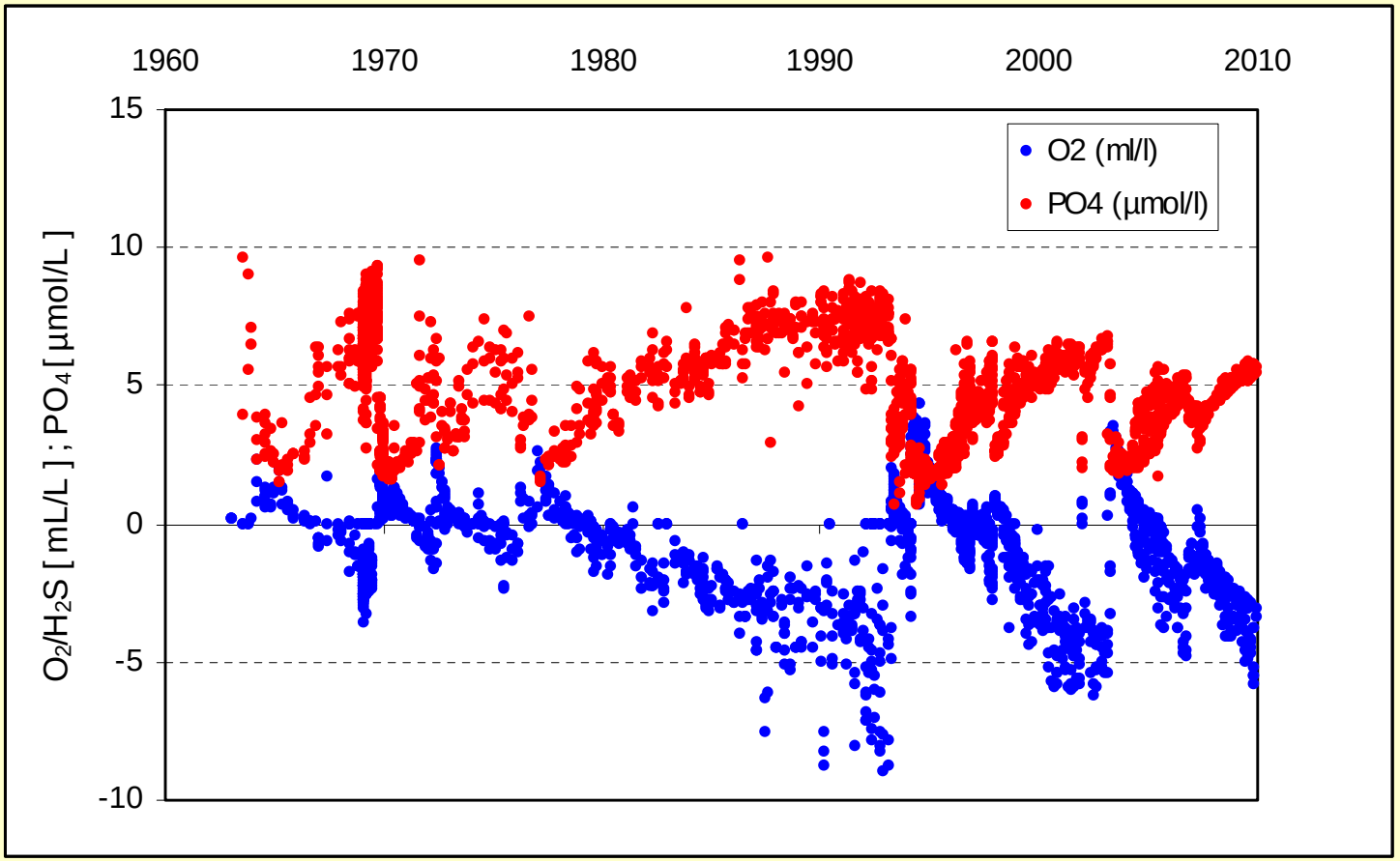
Excess of elemental nitrogen caused by denitrification (Loeffler et al.):

(data for past changes are not available)



5.2.4 Phosphorus transformation (K. Lukkari)

PO_4 concentrations in the deep water of the central Gotland Sea and its control by the redox conditions (Monitoring, SMHI):

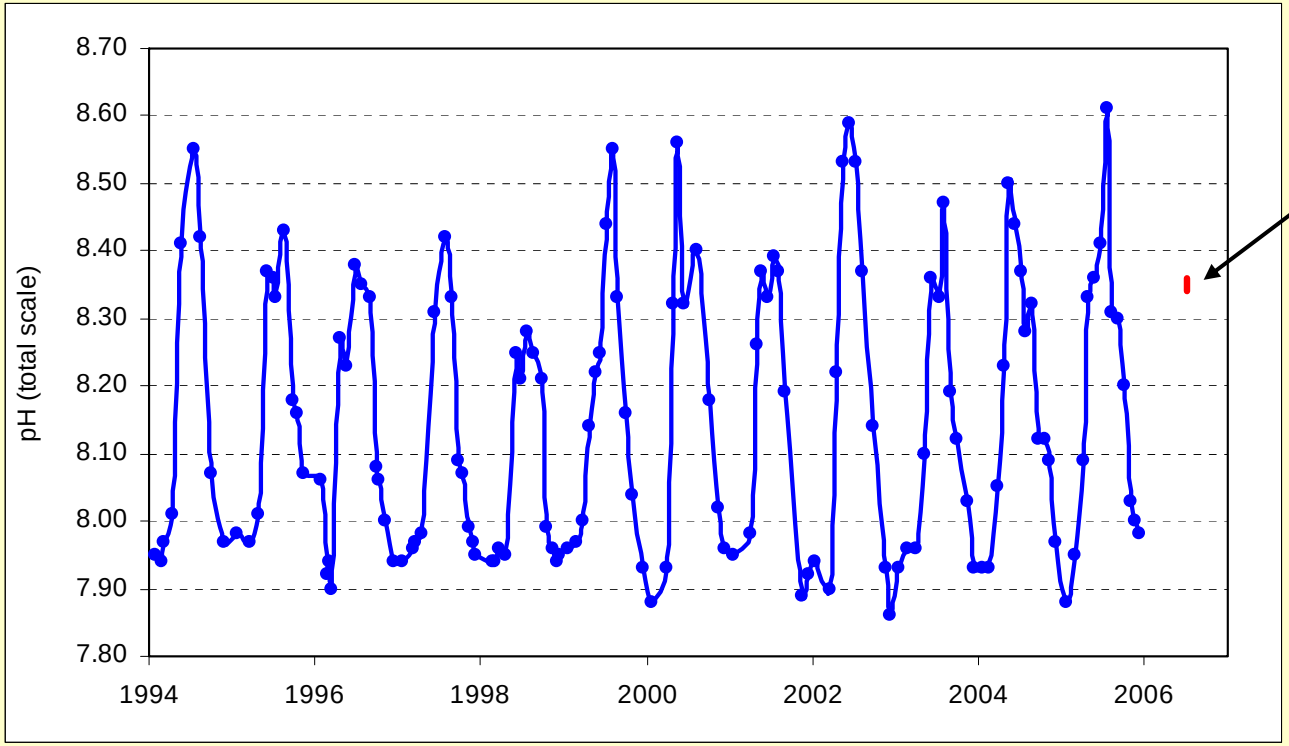


5.3 The marine CO_2 (acid/base) system (B. Schneider)

- **„ocean acidification“ by inceasing atmospheric CO_2;**
- **counteracting prosses: changes in alklinity and eutrophication;**

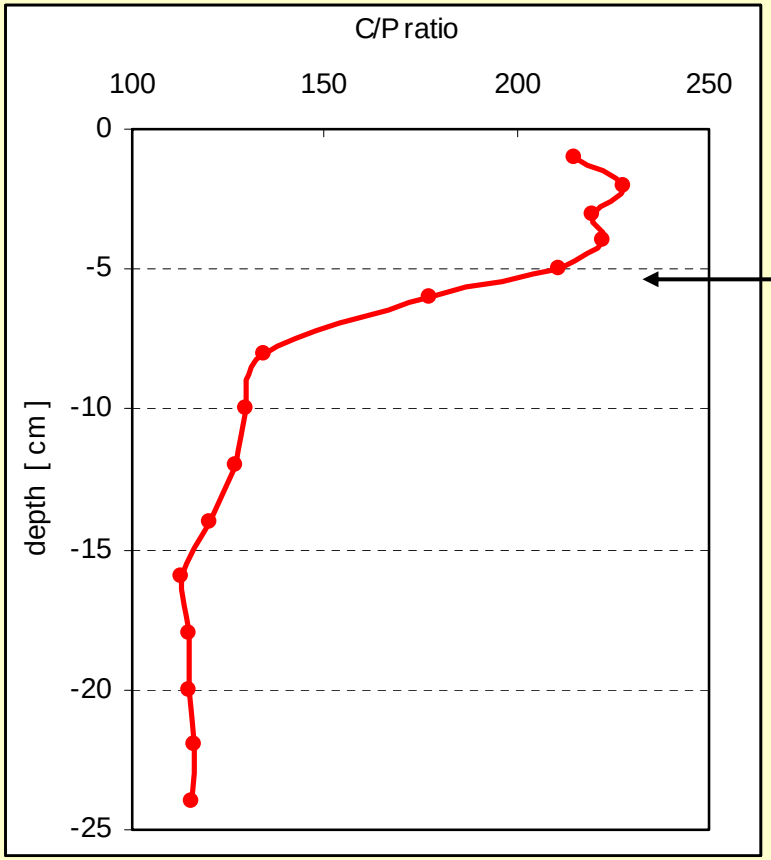
Surface water pH time series, eastern Gotland Sea

(Monitoring, SMHI)



5.4 Carbon, nitrogen and phosphorus burial in the sediments (K. Lukkari)

Mean C/P ratios in the sediment of the eastern Gotland Sea (S. Hille):



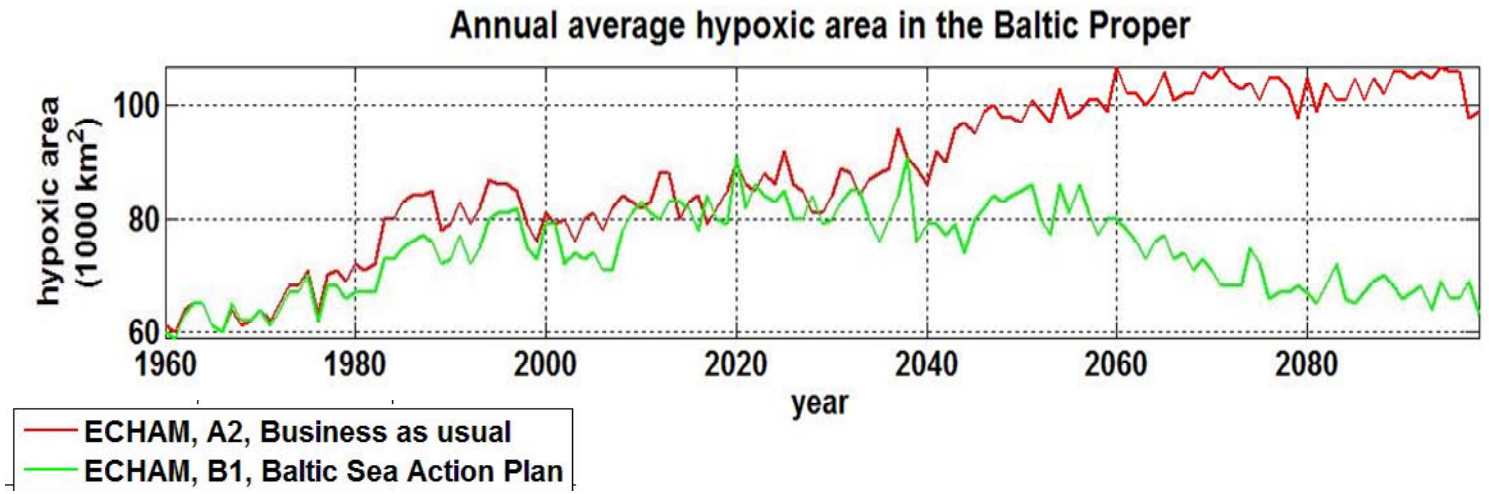
onset of increasing anoxia

(1960 – 1970)

6. Response to potential future changes

6.1 Eutrophication and climate change (T. Neumann)

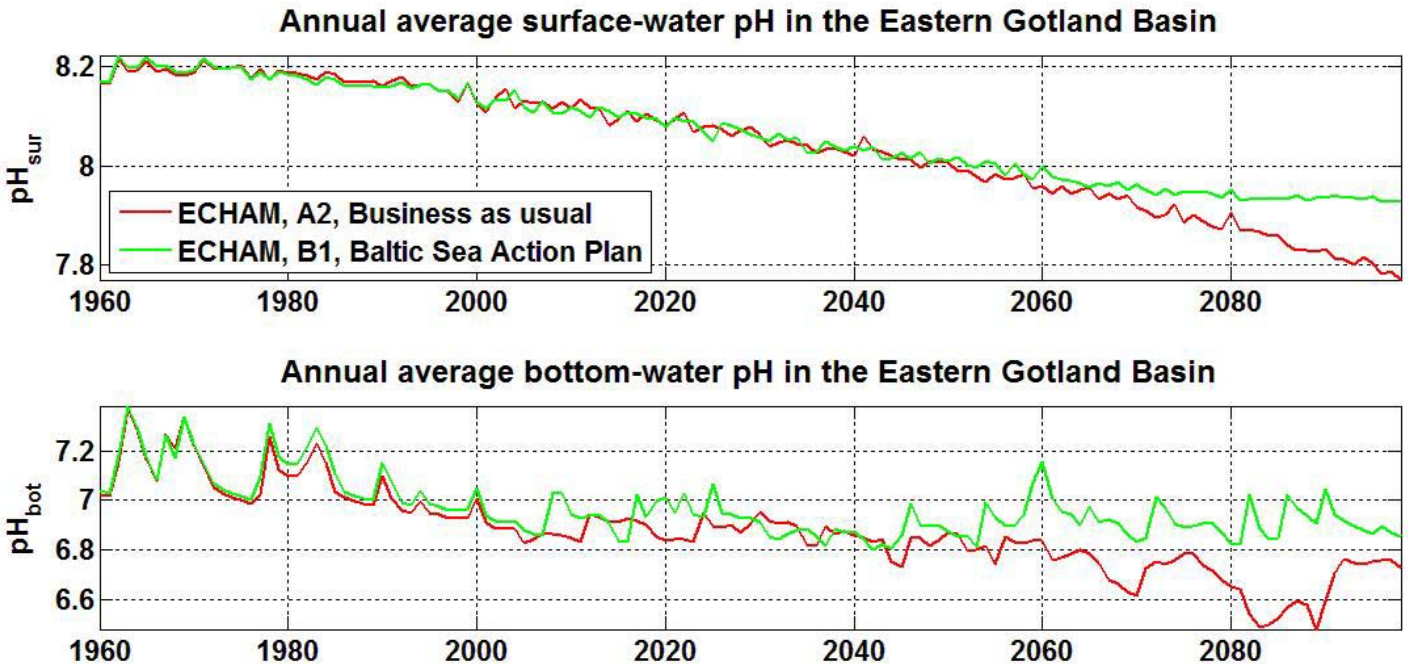
Change in hypoxic areas for different climate and nutrient inout scenarios:



Unpublished model simulations from the Baltic-C Project, others from ECOSUPPORT may follow.

6.2 Increasing atmospheric CO_2 (B. Schneider)

Combined effect of climate change, changing nutrient inputs and inceasing CO_2 on the pH:



Unpublished model simulations from the Baltic-C Project.