A new FerryBox line in the Baltic Sea and the Kattegat for climate change and algal monitoring

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Co-operation between Sweden and Finland

Partners

- Swedish Meteorological and Hydrological Institute
- Finnish Environment Institute
- University of Gothenburg (project on ocean acidification)
  - Department of Chemistry
  - Department of Earth Sciences
  - Department of Marine ecology

Funding from

- SMHI – Swedish Ministry of the Environment
- SYKE – Finnish Ministry of the Environment
- Swedish Environmental Protection Agency
  - Contribution to equipment
  - Phytoplankton analyses
  - Project on ocean acidification

General context

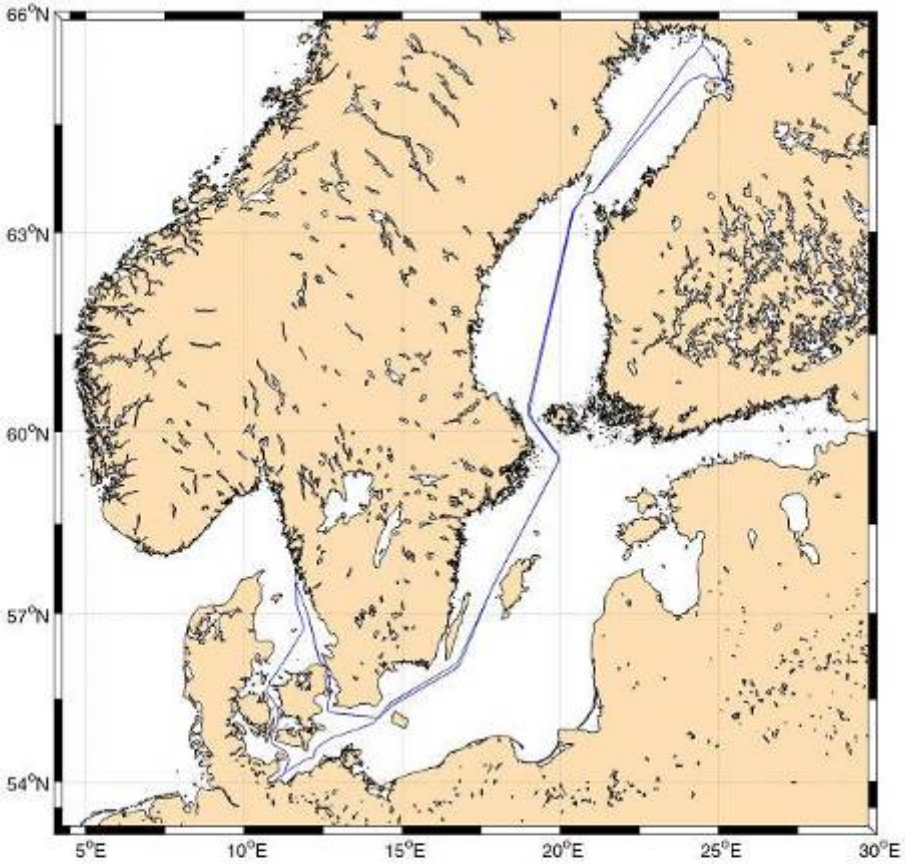
- FerryBox systems are tools to help resolve the natural variability in time and space
- Long Term Ecological Research
- Monitoring global and regional climate change
- Harmful Algal Bloom warnings and monitoring
- EU Marine Strategic Framework Directive
- Data assimilation into physical and biogeochemical models

View from R/V Argos in Southern Baltic 12 July 2006

View from space 16 July 2006 ENVISAT/MERIS/SMHI

TransPaper route

Gothenburg-Kemi-Oulu-Lübeck-Gothenburg
Gothenburg is visited once a week



TRANSATLANTIC

TransPaper

- Length over all 190.8 m
- Delivered in 2006
- Shipping company TransAtlantic AB
- 15-year contract with StoraEnso for shipping paper etc. on the route

FerryBox system on TransPaper

Real time data

Flow through system

- Temperature near water inlet
- Conductivity
- Salinity (calculated)
- Chlorophyll fluorescence – phytoplankton biomass
- Phycocyanine fluorescence – cyanobacteria biomass
- Turbidity
- Oxygen (optode)

In air measurements

- Air temperature
- Air pressure
- Irradiation (PAR, Photosynthetic Active Radiation
- Position and time stamp (GPS)

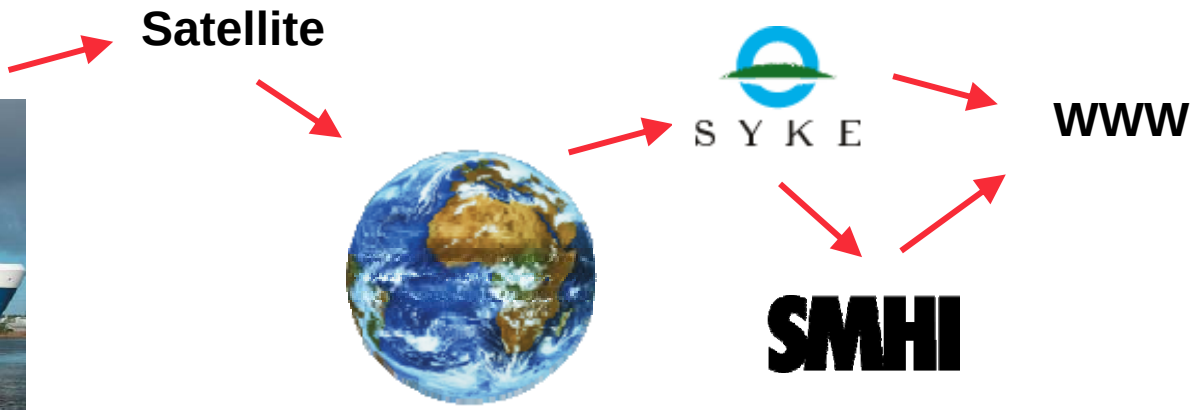
Data transfer

Sampling frequency

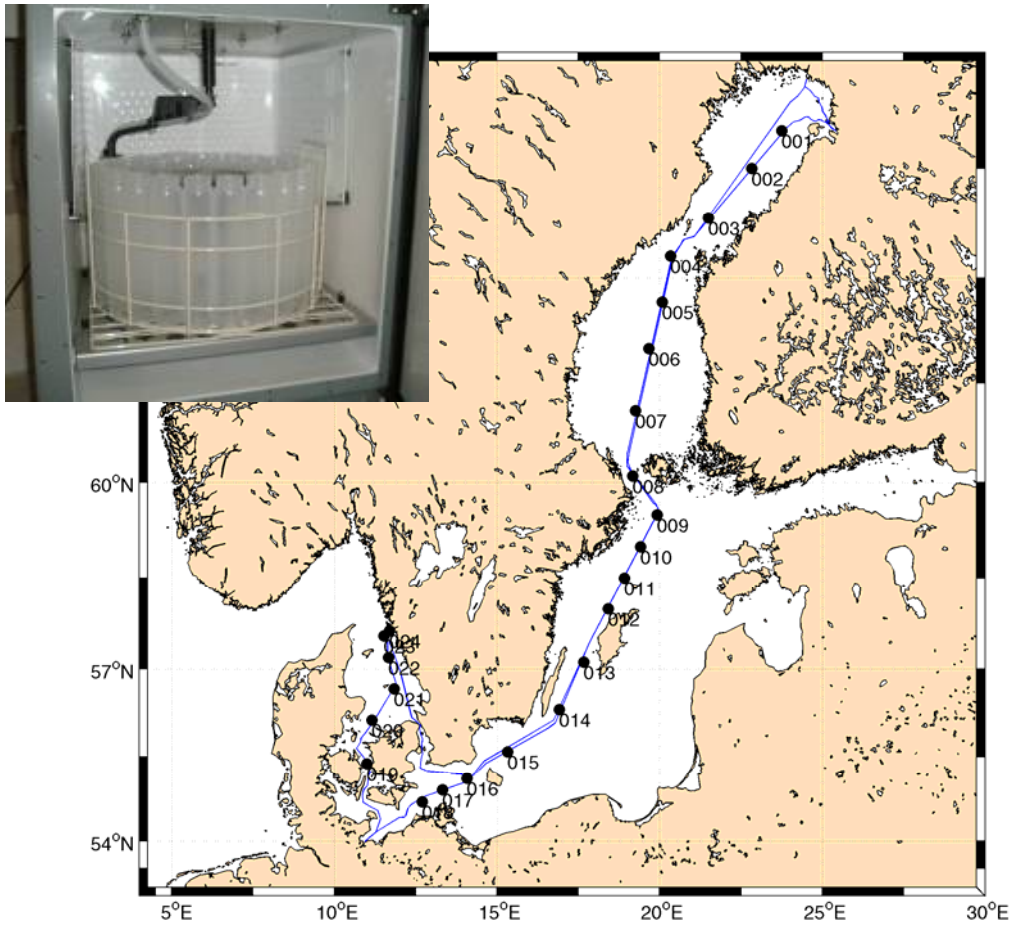
- every 20 seconds – approximately 250 meter interval

Communication system

- Ships satellite internet connection
- ftp - file transfer protocol
- Data is sent to SMHI and SYKE every 60 minutes



TransPaper sampling locations



Sampling frequency

- Every two weeks

Parameters

12 locations

- Salinity
- CDOM/humic substances

6 locations in the Kattegat

- Chlorophyll a

4 locations

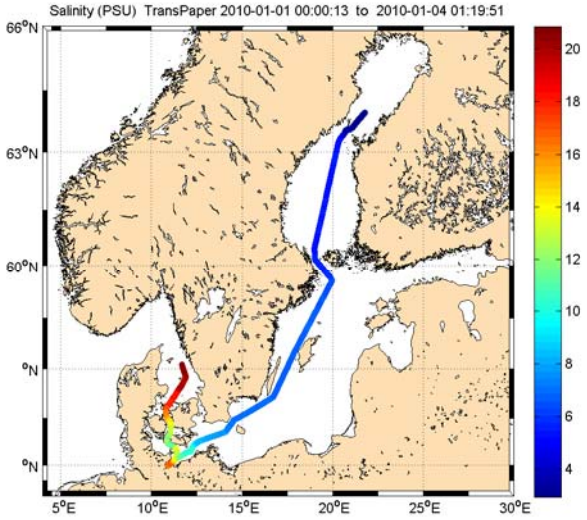
- Phytoplankton

Planned additional sampling

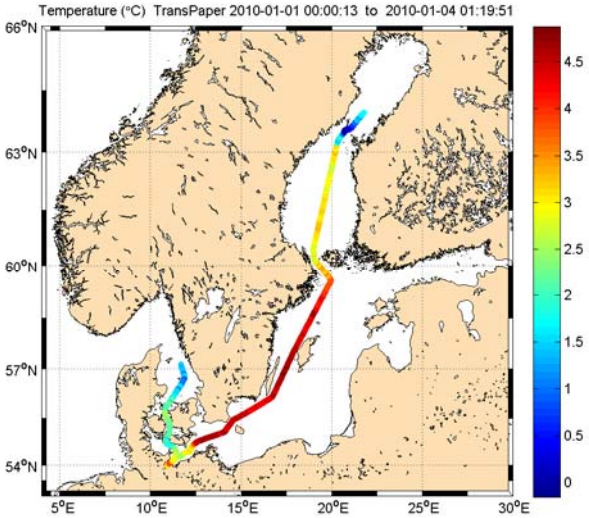
- alkalinity
- inorganic nutrients

Examples of data presentation

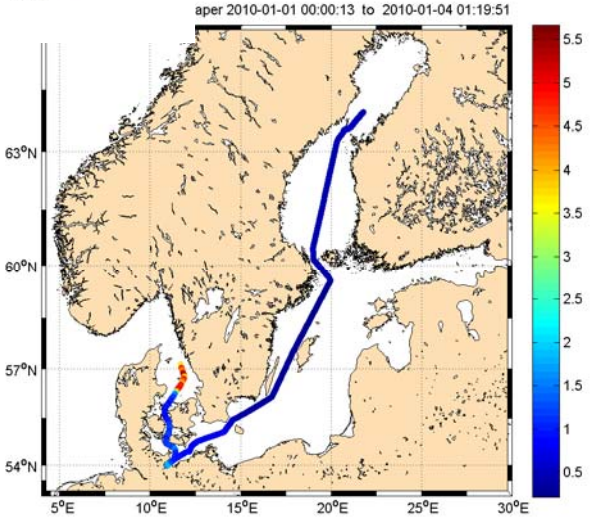
Salinity



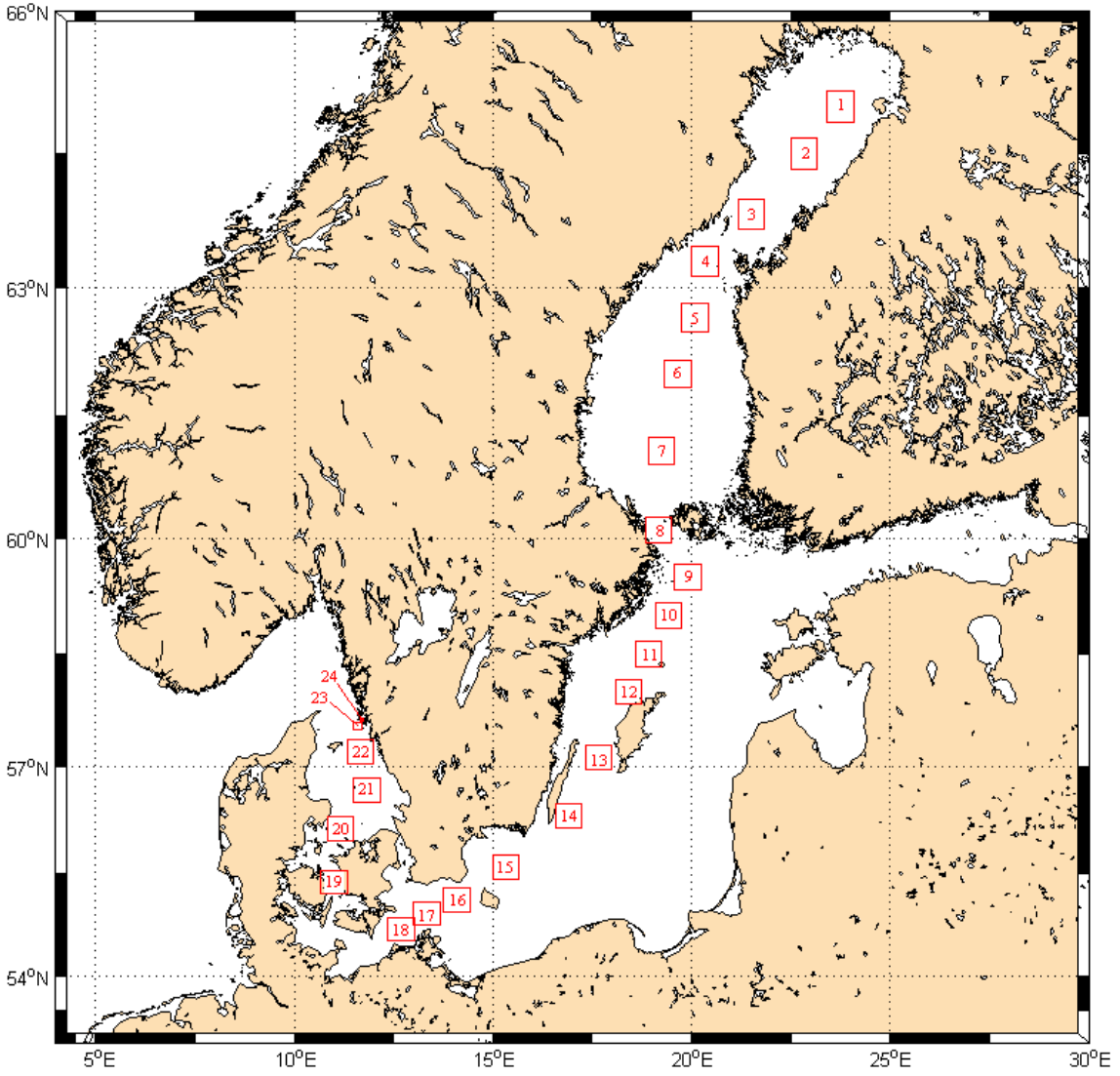
Temperature



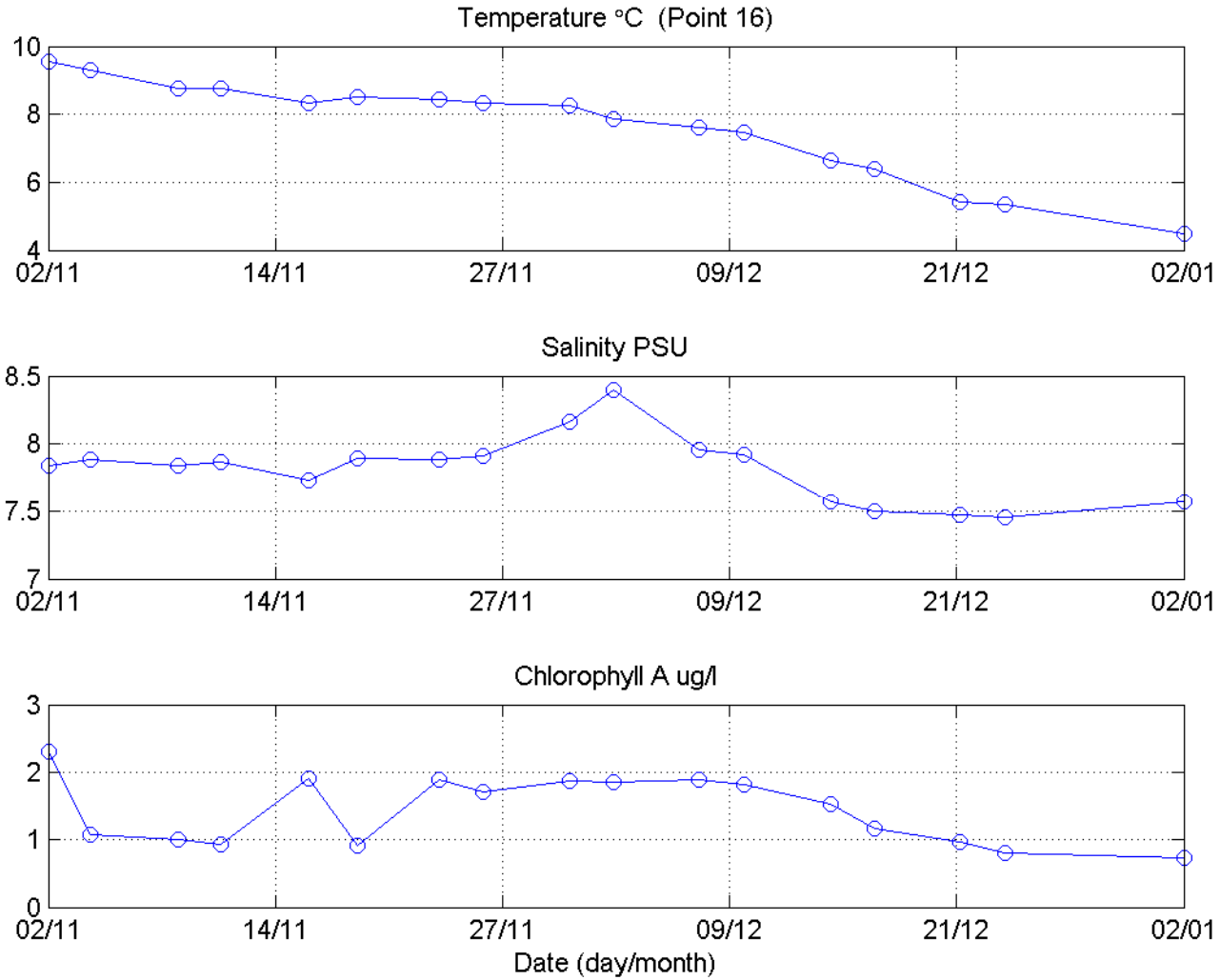
Chlorophyll fluorescence



TransPaper regions for data averaging



Averaged data for region 16 West of Bornholm winter 2009-2010



Access to data

Near real time data

- Global Ocean Observing System
  - EuroGOOS
    - BOOS www.boos.org and BOOS ftp-box
- SMHI web site www.smhi.se
- Alg@line at Baltic Sea Portal www.itameriportaali.fi
- Baltic Algae Watch system at SMHI (password protected)

Quality controlled archive data (not yet fully operational)

- Swedish National Oceanographic Data Centre at SMHI www.smhi.se
- Finnish Environment Instiute www.ymparisto.fi

Issues and teething problems

Heavy ice cover in 2010

- Clogging of water inlet
- Harbours blocked by ice
- Ships schedule changes

Other isues

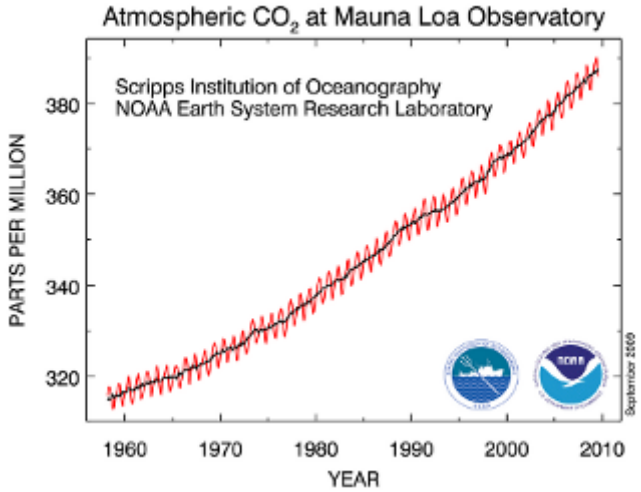
- A GPS broke down
- Snow in irradiance sensor
- Problems triggering two water sampling devices

15 March MODIS/Aqua NASA

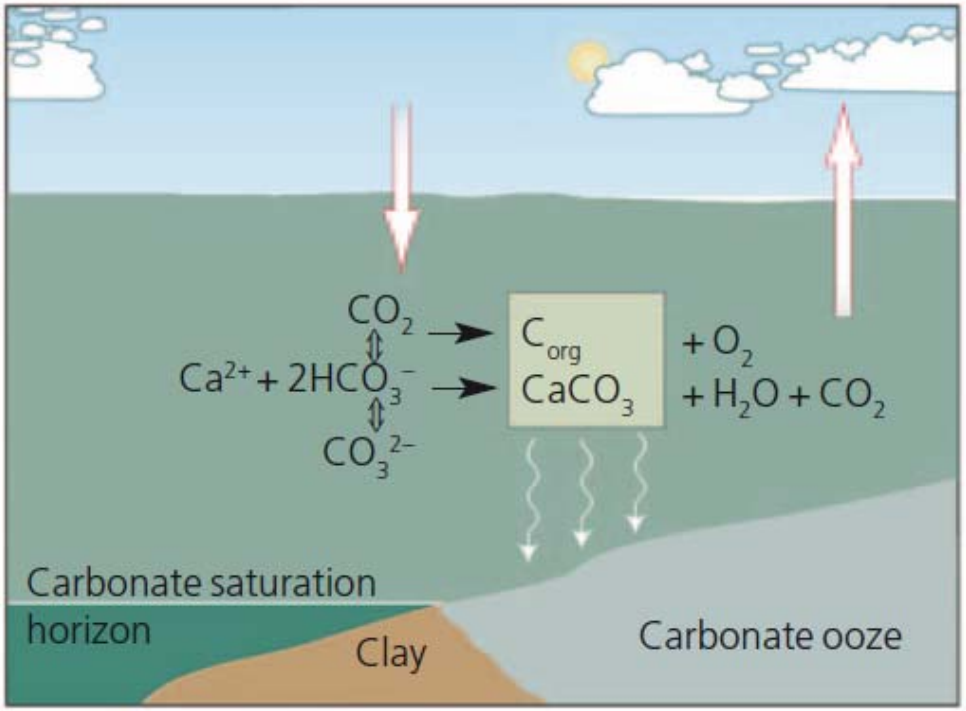
New research project funded by the Swedish EPA
- Ocean acidification - the state of the Baltic Sea and the Skagerrak-Kattegat

- Bengt Karlson, SMHI, Gothenburg, project leader
- Elisabeth Sahlsten, SMHI, Gothenburg
- Henrik Lindh, SMHI, Norrköping
- Agneta Fransson, Dept. of Earth Sciences, University of Gothenburg
- Leif Anderson, Dept. of Chemistry, University of Gothenburg
- Aron Hakonen, Dept. of Chemistry, University of Gothenburg
- Stefan Hulth, Dept. of Chemistry, University of Gothenburg
- Michael Thorndyke, Dept. of Marine Ecology, University of Gothenburg (Kristineberg)
- Sam Dupont, Dept. of Marine Ecology, University of Gothenburg
- Jonathan Havenhand, Dept. of Marine Ecology, University of Gothenburg
- Elin Renborg, Dept. of Marine Ecology, University of Gothenburg
- Pia Engström,Sven Lovén Center for Marine Sciences, University of Gothenburg

Very brief background



Dr. Pieter Tans, NOAA/ESRL
(www.esrl.noaa.gov/gmd/ccgg/trends)



Ocean acidification due to increasing atmospheric carbon dioxide, Royal Academy of Science, 2005

Effects on the whole marine ecosystem expected

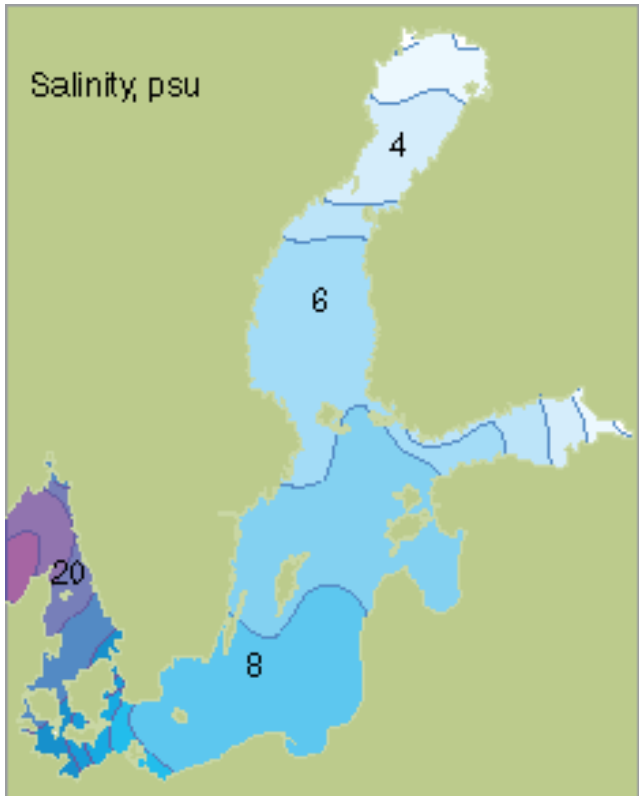
Organisms containing $CaCO_3$ extra vulnerable, e.g. mussels, corals, some plankton

Brackish waters may be extra vulnerable and are not well studied

Use of FerryBox system in th OA project

- pCO_2-measurements
- pH measurements (new methods)
- Water sampling for alkalinity measurements

Salinity range of ca 3-25 psu



pCO2 analyser, General Oceanics

Call for cooperation

- Data will be free to use through BOOS and National Oceanographic Data Centres
- Cooperation for water sample analysis
  - Nutrients
  - Photosyntheric pigments
  - Dissolved organic matter (CDOM)
  - Phytoplankton
  - Your choice
- Other cooperation