

Workshop: Absorbance of water samples and the Secchi depth

The Baltic Sea estuaries – optical detection of eutrophication

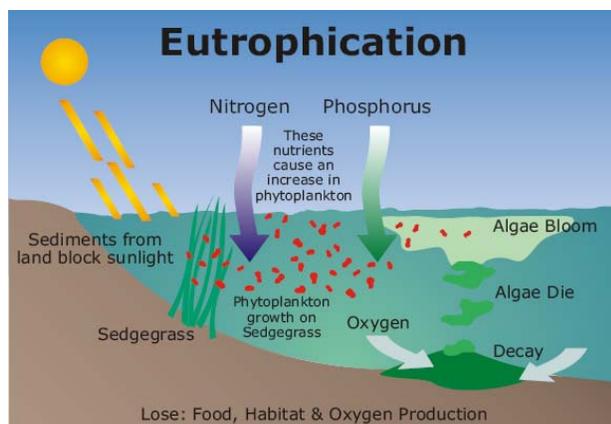
In the beginning of this workshop you will be informed about the optical properties of a few components of the Baltic Sea water. You have used an elementary oceanographical equipment to measure water transparency during boat expedition. In this part you will find how to correlate the Secchi depth with state of environment and eutrophication.

- 1) Read the theory first
- 2) Run the experiment. Read the instructions, conduct the experiment and answer all given questions.

Worksheet : How to measure the state of the ecosystem

Water molecules and other substances dissolved in sea water absorbs different colours of visible light. Pure water absorbs orange and red light, that is why “clean” waters seem blue to us. Other most important absorbents are so called yellow substances which are dissolved organic matter - they consist of small particles of decaying organic matter. They absorb violet and blue light, thus water becomes green or even yellowish. Only small part of yellow substances in water environment is natural, most of them come from human activity (water treatment plants, agriculture) and get to the marine environment by the rivers. Yellow substances are rich in nutrients. That is why estuaries are places of frequent phytoplankton blooms which is a major problem of Baltic ecology. Chlorophyll in phytoplankton cells makes the water colour to be green. Phytoplankton together with suspended inorganic material scatter the light and make water less transparent.

Transparency can be affected by the colour of the water, algae blooms, and suspended sediments. Transparency decreases as water colour, suspended sediments, or algal abundance increases,. Because phytoplankton blooms are caused by yellow substances which are mainly of human origin, transparency is therefore an indicator of the impact of human activity on the water ecosystem and **eutrophication**.



Eutrophication refers to an excessive amount of nutrients in a body of water, usually caused by river runoff from the land, which causes a dense growth of plant life, leading to a decrease in oxygen supply, which causes the death of animals.

Fig. 1 Eutrophication

Experiment 1: Estimating Trophic State From Secchi Depth

Secchi depth is a simple indicator of the trophic state of the sea. Plant chlorophyll pigments are often assumed to be a major indicator of trophic state, as they absorb and scatter light. Secchi depth, therefore, should be able to be used as an estimator of algal abundance.

Nowadays scientists use more sophisticated equipment concurrently with disk measurements. [Photometers](#) can record visible, ultraviolet and infrared parts of the light spectrum. They do measurements in a few bandwidths, which can be more comprehensively correlated with components of the sea water and thus with the state of the marine environment.

Instruments:

Secchi depth data sheets from boat cruise, sea water samples in bottles, beaker glass, additionally photometer

Instructions:

1. Take the table with Secchi depth measurements taken during boat trip – sort measurement points from the inner bay to the open sea.
2. Place the measurement points on the map of boat route.
3. Put water samples taken during cruise on the laboratory table, in the same order as depth measurements.
4. Pour water from bottles into the beaker glasses and put them against white wall, remember of the order!
5. Try to notice colour differences in the water samples.
6. Correlate observed color intensity with Secchi depth measurements for each point.
7. Additionally do the photometer test with all samples (see instruction of the photometer)

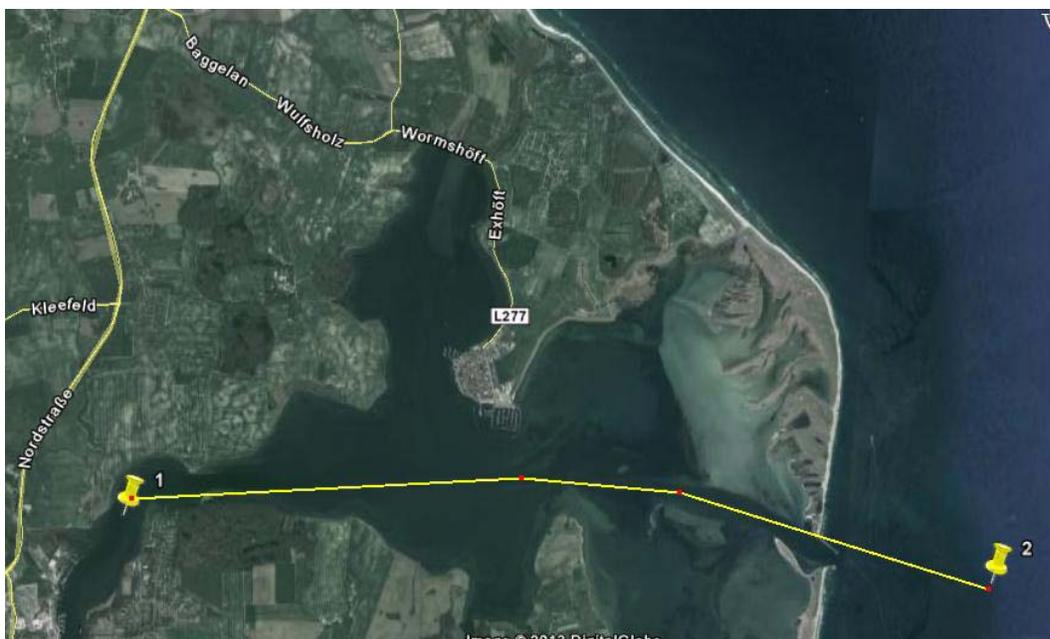


Fig. 2 Transect from inner bay (here: Schlei, Germany) to the open sea



Fig. 3 Bottles in order from inner bay to the open sea



Fig. 4: Pupil doing photometer test

Questions:

1. What is the main reason for eutrophication?
2. Do you expect open water will have different color then estuary?
3. Why do oceanographers use Secchi disks?
4. How will Secchi depth change when there is algae bloom?

Notes:

