Action for the Reinforcement
of the Transitional Waters' Environmental Integrity

Water quality management in the Szczecin Lagoon

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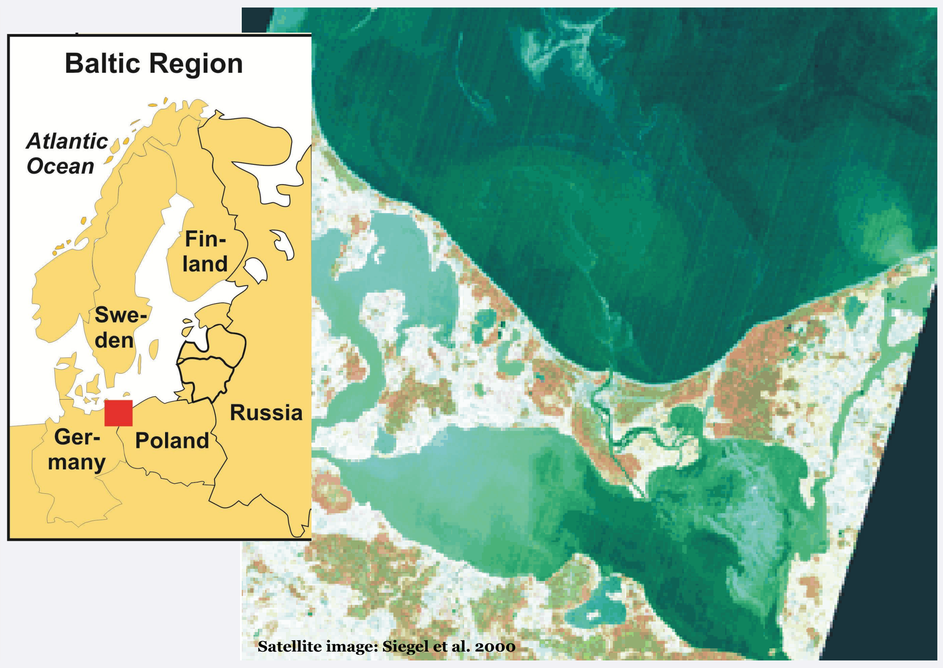
Odra river affects water quality of the lagoon

The Szczecin Lagoon, a large (687 km²) but shallow (average depth of 3.8 m) coastal system in the southern Baltic Sea, belongs to two different typologies: The German part is designated as inner coastal water whereas the Polish part as transitional water. Current values (e.g. nutrient and chl *a* concentration) are far above values for a good water quality demanded by the European Water Framework Directive (WFD). The Odra discharge contributes at least 94% to the lagoon's water budget and dominates the nutrient budgets. These riverine loads control ecosystem processes and keep the lagoon in a polytrophic to hypertrophic state. In summer, the water transparency is usually below 50 cm. Heavy blue-green algae blooms are a common feature. The poor water quality hampers regional development, especially tourism, which is a major source of income.

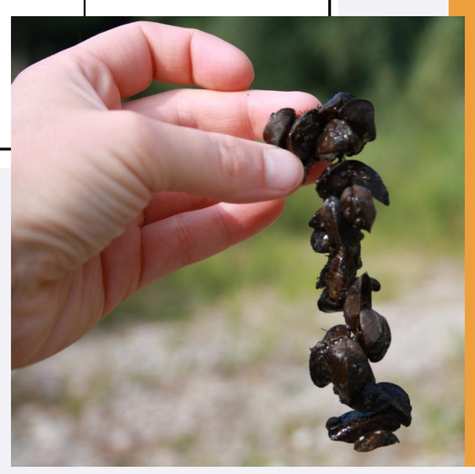
Schernewski et al. (2008) found out that with respect to nitrogen and phosphorus, nutrient load reductions in the river basin would not be sufficient to ensure good coastal water quality according to the WFD. More comprehensive management is required, which includes nutrient removal measures in the coastal waters.



Satellite image: Siegel et al. 2000

Strenghts	Weaknesses	Opportunities	Threats
•**Environmental friendly**, „native" species •**Removal of nutrients** by periodic harvest •**Improvement of ecosystem quality** by increased biodiversity •**Low limitation by spatfall** in comparison with bottom cultures	•**Uncertain commercial use** because of slow growth and small harvest size •**Increased concentration of heavy metals** affects mussel use for animal husbandry •**Reduction of mussel biomass** by predators (fish, waterfowl) or lack of food •**No tradition and experiences** in mussel cultivation • **Uncertain legal and planning situation**	•**Resettlement of macrophytes** by improved water transparency •**Altered food web interactions,** more benthic feeding fish and expanded fishery •**Higher number of tourists and overnight stays in summer season** by improved water transparency •**New regional jobs** in harvesting and processing of mussels	•**Local anoxic surface sediment** by deposited organic material •**Bothered tourists** by mussel shells washed ashore •**Material damage** by fouling of boats, gillnets etc. • **Damage of net structures** by ice cover in winter

The SWOT analysis gives an overview about pros and cons of cultivation of zebra mussels in the Szczecin Lagoon.



Management measures

In the Szczecin Lagoon, several measures are possible to combat eutrophication, to remove nutrients and to improve ecosystem quality:

- mussels farms, managed mussel beds and enlarged natural mussel beds,
- algal farms,
- increased reed belts and extended submersed macrophyte areas, and
- dredging or capping of sediment.

The enlargement of mussel beds and cultivation of mussels seem to be a promising measure. Zebra mussels form mussel beds in the lagoon with an estimated biomass of about 8,000 t in the western part (Kleines Haff) und about 60,000 t in the eastern part, the Maly Zalew (Woźniczka & Wolnomiejski 2008). In Kleines Haff, 6.56 km² (2.4 % of the area) are covered with mussel beds, the average abundancy in beds is 4,000 mussels per m², and a filtration rate of 1,083 l m^{-2} d^{-1} has been observed (Fenske 2008). Taking a volume of 1.026 km^3 (only Kleines Haff), the existing mussel beds need 144 days to filter this water volume. The total filtration rate can be increased by supporting measures up to 3,000-4,000 l $m^{-2}d^{-1}$, based on an average mussel densities of 15,000 m^{-2}.

Artificial hard substrates, such as vertical line systems and net collectors, could be used for continuous cultivation. A periodic harvest of zebra mussels would reduce the total amount of nutrients in the lagoon, and a commercial use of harvested mussels (human food, fertilizer, animal feed) can have great benefits. By filtering the water zebra mussels enhance water transparency supporting settlement and distribution of macrophytes.

Cross-border co-operation

Internal measures can help to fulfill the aims of the WFD. But it is necessary to manage the lagoon within the EU Maritime Spatial Planning framework and to prevent spatial conflicts. To implement EU policies and to ensure proper environmental integrity of the lagoon, the cross-border cooperation of local and regional interest groups, citizens and politicians is crucial.

Within ARTWEI cross-border stakeholder bodies have been implemented: regional representatives of research, authorities and NGOs worked together to discuss problems and possible solutions from two perspectives:

- cross-border cooperation,
- environmental integrity of river basins – transitional waters – open sea.

Cross-border workshops, excursions and a photo competition were conducted to raise awareness of local characteristics and demands for a sustainable development.

The development of conclusions and recommendations for the durable reinforcement of the environmental integrity of transitional waters and the political endorsement in the form of a Good Practice Code of Conduct are the main outcomes of the project ARTWEI.


Picture: Schernewski

ARTWEI

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South Baltic PROGRAMME

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