

Mussel cultivation as a nutrient reduction measure and linkages to water quality and socio-economic aspects

Nardine Stybel¹ & Gerald Schernewski²

¹EUCC-The Coastal Union Germany

²Leibniz-Institute for Baltic Sea Research Warnemuende

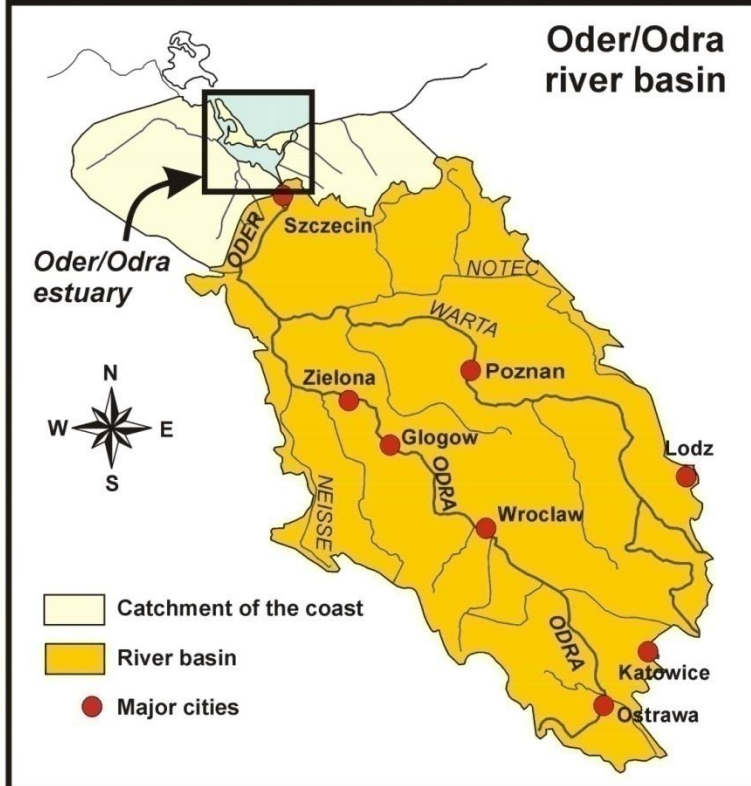
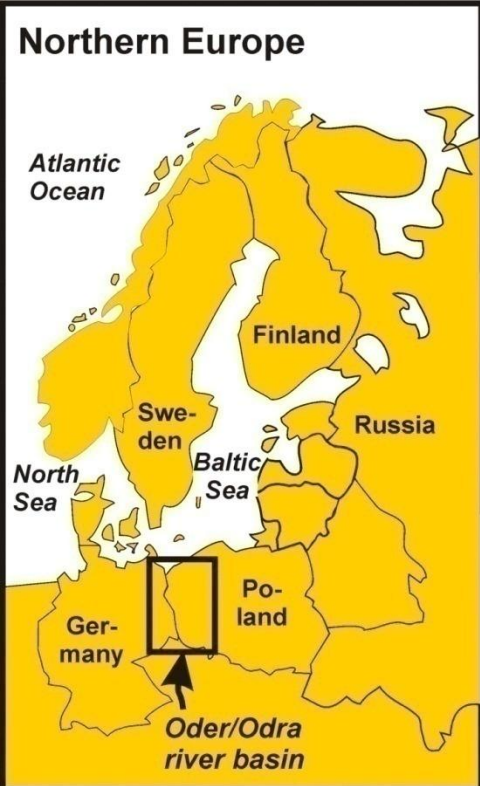
Gdansk, 06.09.2013



Part-financed by the European Union
(European Regional Development Fund)



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The Oder/Odra river basin – coast – sea system

Oder/Odra river basin	
Length (km):	854
Catchment (km ²):	118,000
Discharge (m ³ /s):	530 (average)
Population (Mio):	15.4
Oder/Odra estuary	
Catchment (km ²):	8000
Lagoon area (km ²):	687
Lagoon depth (m):	3.7 (average)
Coastal climate:	
Temperature (°C):	8.7 (average)
Precipitation (mm):	550



Nutrient loads (P and N) in river determine water quality and eutrophication in estuary

Water quality: Eutrophication



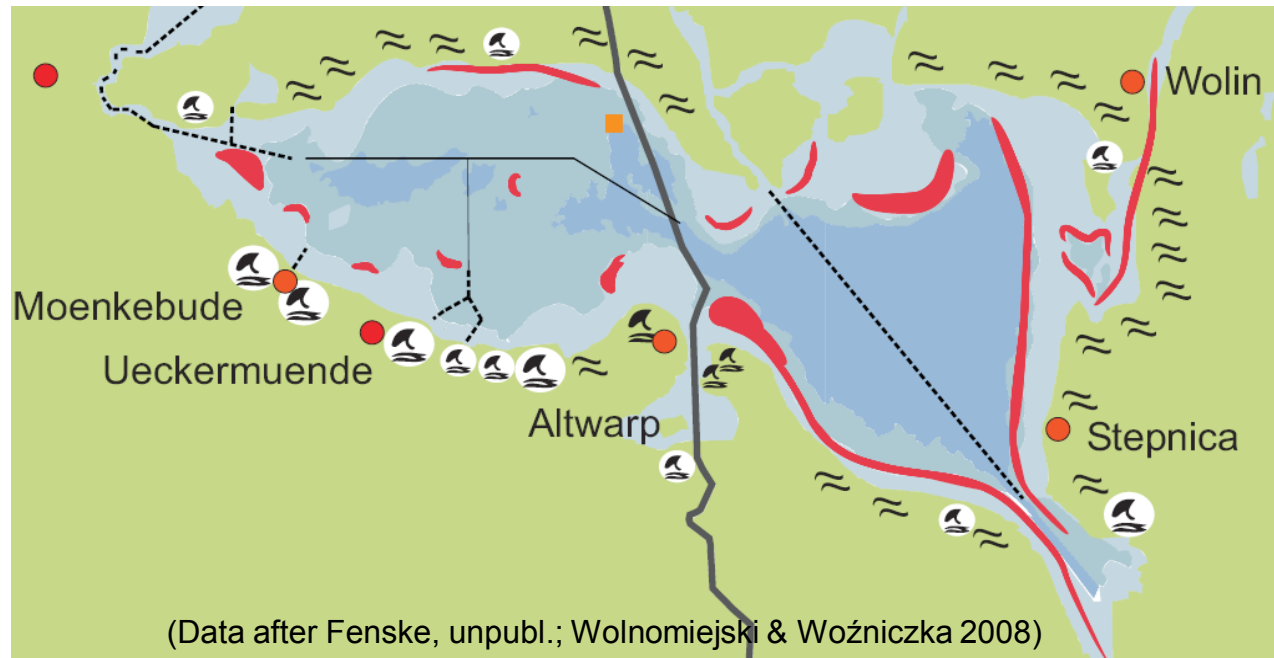
Chlorophyll a
Good status: $<12,7 \mu\text{g/l}$
2007: $68,6 \mu\text{g/l}$



Algae blooms of *Anabaena* spec. (2008) and *Microcystis* spec. (2010)

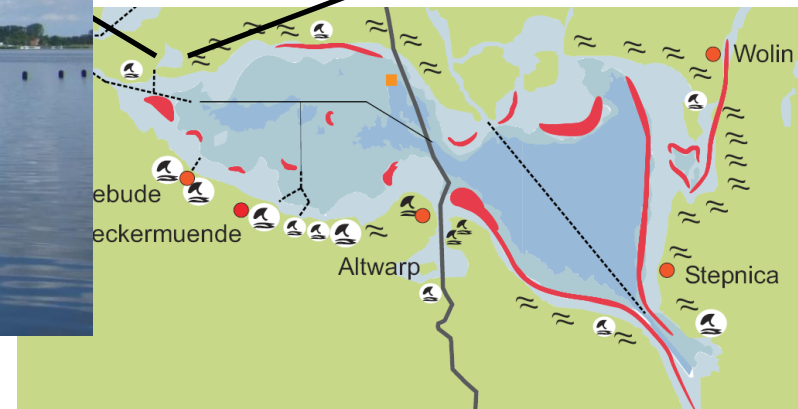
Zebra mussels in the Szczecin Lagoon

- Biomass: ca. **68.000 t**, thereof 8.000 t in the German part (Radziejewska et al. (2009))
- Coverage in the German part: 6,56 km² or 2,4 %
- Main problem for natural settlement:
 - missing hard substrate
 - risk of anoxia



Zebra mussel cultivation in the Szczecin Lagoon

- Pilot station of University of Greifswald in Usedomer See since May 2012
 - space of 100 m x 100 m with 6 net collectors of 240 m²
 - settlement by regular spat fall



SWOT-Analysis

Mussel cultivation in the Szczecin Lagoon

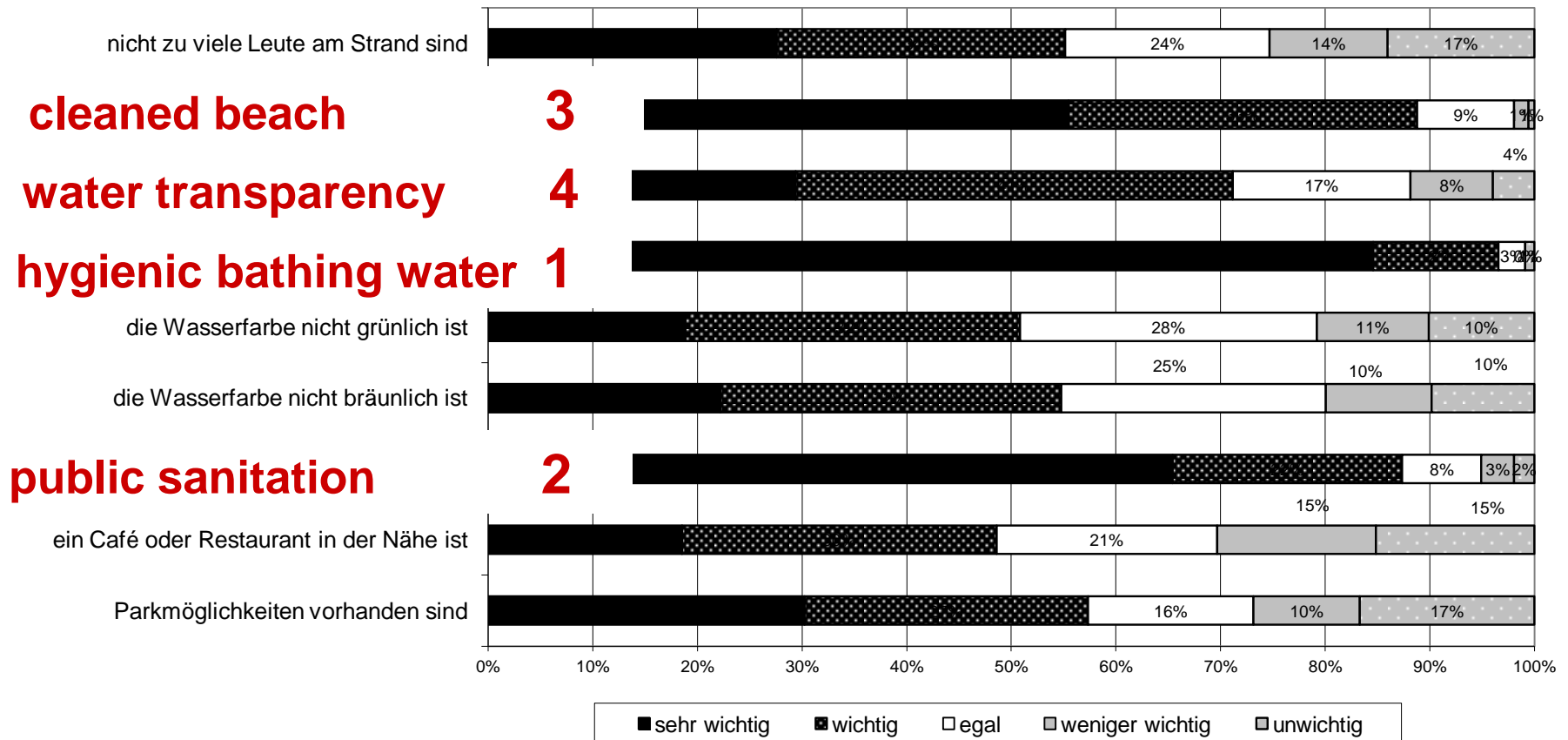
Strenghts	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> • Environmentally friendly, „native“ species • Removal of nutrients by periodic harvest • Improvement of ecosystem quality by increased biodiversity • Low limitation by spatfall in comparison with bottom cultures 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Resettlement of macrophytes by improved water transparency • Altered food web interactions, more benthic feeding fish and expanded fishery • New regional jobs in harvesting and processing of mussels • Higher number of tourists and overnight stays in summer season by improved water transparency 	<ul style="list-style-type: none"> • 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

Importance of water quality

Water transparency plays an important role for tourists.

Survey in 2008 (12 beaches, 450 interviews)

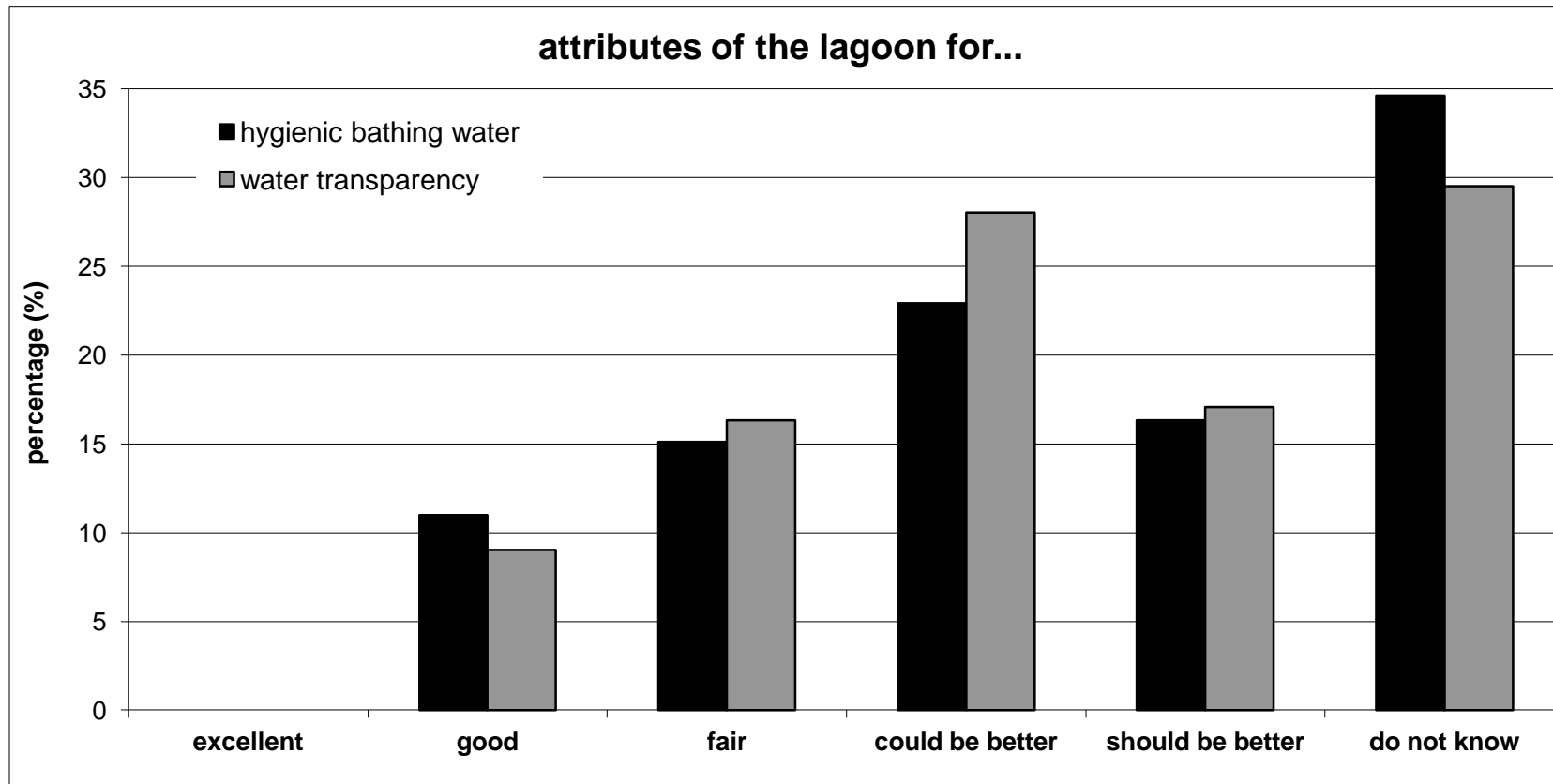
How important is it to find following characteristics at the lagoon?



Assessment of local water transparency

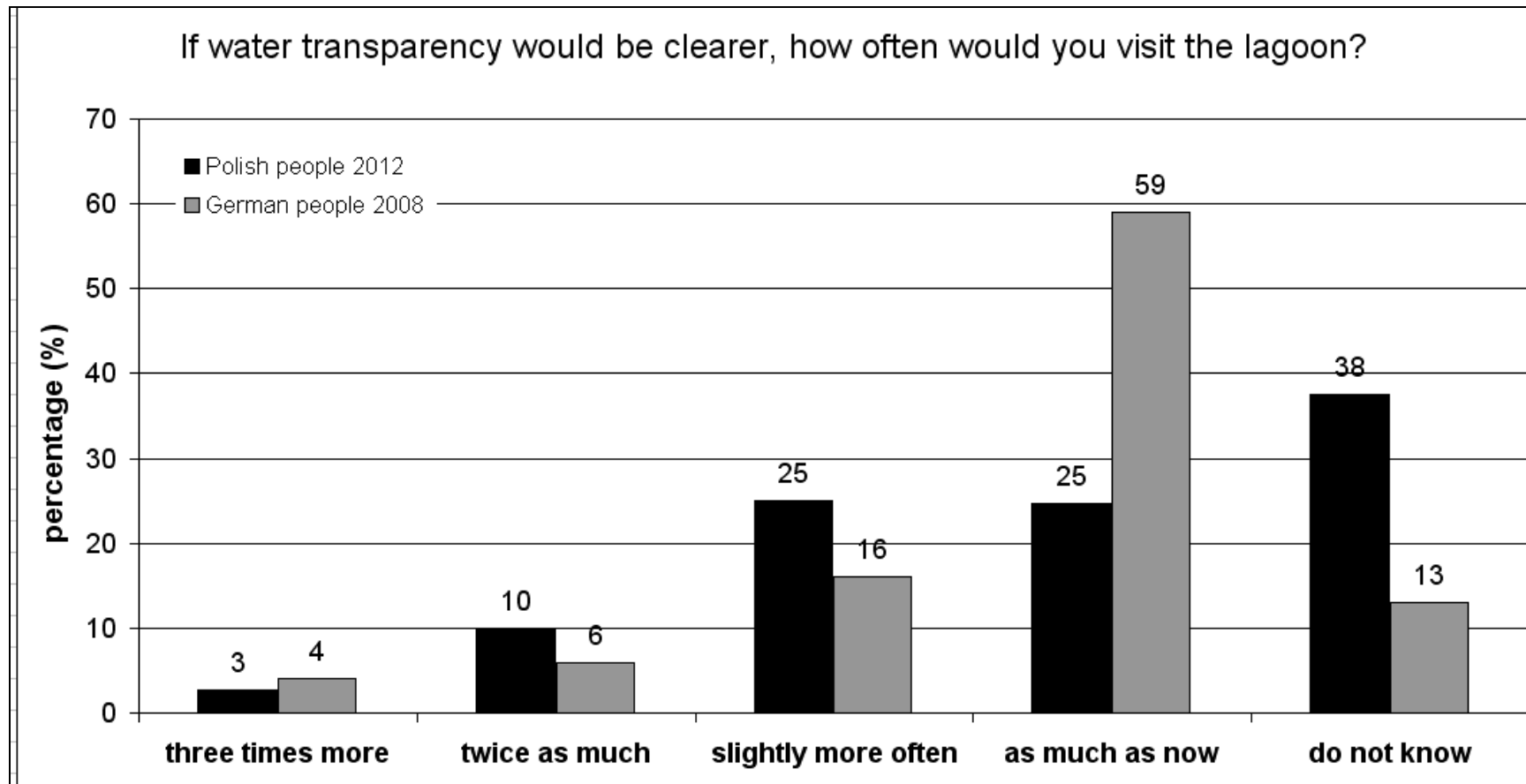
- 40% visit lagoon mainly in summer, for private day trip
- 13% use the lagoon for bathing
- 45% feel water transparency could/should be improved
- 26% are satisfied

(Survey results in 2012, 410 answers by residents of Szczecin)



Touristy potential of improved water transparency

- Improvement of water transparency implies an increase of tourist arrivals
- Ca. 30% of respondents will come more often





Acceptance of fishery related stakeholders

- 42% would accept farms in shallow areas
- 36% are against mussel cultivation
- stakeholders expect problems in:
 - spatial restrictions
 - limited economic value
 - economic competition with local fishermen
 - drifting of installation when ice conditions
- fishermen fear to lose important source of revenue: pikeperch (fish species with highest economic value; prefers turbid waters and could avoid transparent areas)



Problems in implementation

- stakeholders recognise ecological and economic value of bioremediation but expect problems in implementation and financing
- economic value of more tourists and a water quality fee would not cover high investment costs
- lack of tools and incentives, especially for fishermen to accept and test
- need for help by authorities/legislation to support bivalve farming for bioremediation



(Klamt 2011)

Dziękuję bardzo!

ARTWEI: www.balticlagoons.net/artwei/

AQUAFIMA: www.aquafima.eu

Stybel, N., Fenske, C., Schernewski, G. (2009): Mussel cultivation to improve water quality in the Szczecin Lagoon. *Journal of Coastal Research* 56, 1459-1463

Schernewski, G., N. Stybel, and T. Neumann (2012): Zebra mussel farming in the Szczecin (Oder) Lagoon: water-quality objectives and cost-effectiveness. *Ecology and Society* 17(2): 4.