

Bio-engineering in the Baltic Sea – value of water quality improvements & risk perceptions

Dr. Marianne Zandersen¹

¹Department of Environmental Science, Aarhus University

Abstract

The Baltic Sea is heavily eutrofied and the trend has gone from bad to worse. The hypoxic zone¹ has increased about 4-times since the 1960s² and about 17% of the bottom area of the Baltic Proper was affected by anoxia (oxygen free, with toxic hydrogen sulphide present) in September-October 2010³ and has caused severe ecosystem disturbance. Despite political agreements and actual reductions in nutrient emissions to the Baltic Sea, the prevalence of oxygen depleted areas has not decreased. Two pilot projects in Sweden and Finland investigate the effects of oxygenation pumping in coastal and deepwater areas (PROPPEN⁴ and BOX⁵ projects, respectively).

Oxygenation pumping moves oxygen rich water from the higher levels of the water column to the bottom waters/deepwater. The expected effects include a slowing down of the sediment release from the bottom and improvement of the possibilities for aerobic bacterial decomposition and over time for the establishment of fauna. The projects test a bio-engineered approach to speeding up the recovery of the Baltic Sea such that the sea could be unaffected by eutrofication sooner than without oxygenation pumping⁶.

We undertake a representative primary survey of the populations in Sweden, Finland and Lithuania in order to assess the preferences of the population around the Baltic Sea towards such an engineered approach and the related potential ecological risks. The survey covers two topics:

- A contingent valuation of the willingness to pay for a speedier recovery of the Baltic Sea; and
- A risk perception survey using Likert scale questions based on two different scenarios of risk.

Using the New Environmental Paradigm (NEP) set of questions, we aim to ascertain the reasons and motivations behind people's preferences.

Preliminary results show willingness to pay ranging from 24Euro in Lithuania to 65Eur in Sweden per year per household for a faster improvement of water quality through oxygenation pumping. Also, respondents appear to respond rationally towards different levels of risks and different scales of oxygenation pumping.



Oxygenation pumping in open sea powered by windmills (conceptual stage)



Coastal site test pump (applied in practice)

¹ Defined as <2mg/l dissolved oxygen

² Jonsson, P., Carman, R., and Wulff, F.(1990) *Laminated sediments in the Baltic – a tool for evaluating nutrient mass balance*, Ambio 19, 152–158, 1990.

³ http://www.smhi.se/polopoly_fs/1.13965!syre_kartering_38-43eng_2010_ver2.pdf

⁴ <http://www.ymparisto.fi/default.asp?contentid=325150&lan=FI&clan=sv#a1>

⁵ <http://www.marsys.se/lang/se/about-us/research/baltic-deepwater-oxygenation-box/>

⁶ Helcom (2007). *Outcomes from the Expert Meetings of the HELCOM Baltic Sea Action Plan*, 2.1 Eutrophication Segment. 22nd meeting, 17-19 September 2007. HELCOM HOD 22/2007