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Title

Reducing livestock densities and coupling livestock to the area of available farmland

Submitted by:

Expert contribution from DE

Note: DE encourages the HELCOM process to compile a pool of innovative ideas as a basis for HELCOM bodies to develop and agree proposed new regional measures. To aid this process, the proposal submitted is based on individual expert opinions. It does not reflect a national position and does not prejudice Germany's position on the proposal.

Description of measure

Concerning agriculture in the Baltic Sea catchment area some regions are more dominated by livestock production, while others are more focused on crop production. The crop-livestock separation is an important driving force for nutrient imbalances in agriculture (Nesme et al., 2015; Schipanski and Bennett, 2012). Areas focussing on crop production often depend on imported mineral fertilizer to a large extent. Areas focussing on livestock production import a large proportion of feed for animals (Wang et al., 2018), while the manure usually is applied on fields close to the farm, often in excess of crop needs. Therefore, in areas with high livestock densities excessive nutrient inputs to surface waters are occurring. Transporting the manure to other regions would be a possible solution, but it is costly and therefore hardly practiced. A more sustainable solution would be to reduce livestock densities and couple them more closely to the area of available farmland, so that sustainable fertilisation practices can be achieved.

The aim of the measure is that HELCOM Contracting Parties commit to a reduction of livestock densities in particular in areas with high livestock densities that are sensitive to nutrient losses.
Current livestock densities vary between HELCOM Contracting Parties Baltic Sea catchment area (0.26 to 1.17 LSU/ha according to Svanbäck et al. 2019). Therefore, an overall upper quantitative target of a certain LSU/ha is not feasible and the measure should aim for individual commitments from HELCOM Contracting Parties.

Reductions in livestock densities can be achieved by a number of instruments:

- Integration of respective limit values for livestock densities (LU/ha) as objectives in spatial plans.
- Accounting for livestock density in approval procedures: approval of new buildings for livestock only in regions where the respective limit values for livestock densities are not exceeded. Alternatively, approval could be coupled to requirements regarding own feed production. Both may require adaptations in national legislation (regulative law, planning / building law).
- Efforts (jointly by HELCOM CP's / at HELCOM-level) for a better alignment of the EU CAP with the needs of protecting the marine environment, in particular coupling direct payments to site-specific limits of fertilization (organic fertilizer and manure).

Activity:

Agriculture

Pressure:

Input of phosphorous
Input of nitrogen

State: Nutrients
Extent of impact: Baltic wide. The strongest impact can be expected from areas that currently have high livestock densities and are sensitive to nutrient losses.
Effectiveness of measure Agriculture is one of the major contributors to eutrophication of the Baltic Sea (e.g. Germany: 78 % of total nitrogen input and 51 % of total phosphorous input in 2012–2014). Organic (liquid) manure accrues in excess particularly in regions with high densities of livestock. It is commonly spread on the fields, and parts of the excess nutrients are washed or drained into the rivers and transported to the sea, or evaporated to the atmosphere and (in part) deposited onto the sea, contributing to excessive nutrient inputs. Nutrient input from excess liquid manure usually cannot be reduced sufficiently by export of manure to other regions (KLU 2019). Suitable means for the reduction of nutrient input originating from liquid manure are therefore the reduction of animal stocks particularly in regions with currently high densities and the establishment of a sustainable link between livestock production and available farmland (WBA 2015, Gutser & Matthus 2001). The farmland should take up the manure produced by the livestock and should provide fodder in order to reduce inputs of fodder and mineral fertiliser, thereby closing the nutrient loop. N and P surpluses have been shown to decrease with decreasing livestock density (Wang et al. 2018) and in the Baltic Sea catchment area a clear relationship between livestock densities and nutrient surpluses has been demonstrated (Svanbäck et al. 2019). Reduction of livestock densities are therefore expected to result in a reduction of nutrient inputs to the Baltic Sea via riverine and atmospheric pathways.
Cost, cost-effectiveness of measure: [*Free text: indicate any known or likely sources of cost and/or effectiveness data of the measure*] No estimates found in the literature.
Feasibility: Adaptations of national legislation (regulative, planning, building law) may be necessary with regard to spatial planning and approval procedures (WD 2017). Since this measure requires a re-distribution or reduction of livestock densities it is not easy to achieve. There could be synergies with the HELCOM nutrient recycling strategy that is currently in preparation and the measure also contributes to the implementation of the revised Annex III of the Helsinki Convention, in particular to the part on nutrient recycling that is currently drafted. The current CAP-reform will lead to more flexibility for the distribution of subsidies for individual EU countries, which could be used to implement this measure. The measure can be coupled with the measure on the increase of organic farming, since organic farms are characterised by reduced livestock densities.
Follow-up of measure: Possible indicators: - nutrient inputs - atmospheric emissions and deposition of ammonia -trend in nutrient surpluses - trend in livestock densities (in LU/ha) Possible monitoring programms: - MSFD monitoring of nutrients

Background material:

References

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Title **1. Rehabilitation of anoxic, nutrient rich or polluted sediments by removal or coverage**
Submitted by: SLU Aqua, Swedish University of Agricultural Sciences, Sweden; HELCOM ACTION
Description of measure Removal of sediment through various methods of careful dredging and/or coverage of damaged soft bottoms with a clean substrate or active carbon can lower the environmental effects from toxic compounds in polluted sediments, e.g. in harbours, marinas or in industrial recipients (Akcil et al. 2015, Rostmark et al. 2015, Eriksson et al. 2016). Similar methods could possibly be used for removal of anoxic or nutrient rich sediments for example in shallow bays in order to combat macroalgal mats (Hulth & Sundbäck 2009).
Activity: Fish and shellfish processing Aquaculture – marine, including infrastructure Transport – shipping infrastructure (harbours, ports, ship-building) Industrial uses (oil, gas, industrial plants) Waste waters (urban, industrial, and industrial animal farms) Solid waste (land-based disposal of dredged material and, e.g. land-fill) Tourism and leisure infrastructure (piers, marinas) Tourism and leisure activities (boating, beach use, water sports, etc.)
Pressure: *Changes to hydrological conditions* *Input of nitrogen* *Input of phosphorous* *Input of organic matter — diffuse sources and point sources* *Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) — diffuse sources, point sources, atmospheric deposition, acute events* *Input of litter (solid waste matter, including micro-sized litter)*
State: Dead or disturbed sediments due to hypoxia, nutrient enrichment, pollution or litter Seabed habitats Nutrients Hazardous substances Litter

Extent of impact:
The positive impacts of these restoration measures are very local and within coastal waters. Removal of some highly toxic substances may, however, be a measure having positive impact even at a Baltic Sea wide scale.

Effectiveness of measure
Recolonisation of plants (in the photic zone) and animals (in the photic and aphotic zone) are typical positive responses. If the surface sediment is removed or altered, however, a biogeochemically active layer with associated functions disappear with possible consequences for the recovery (Hulth & Sundbäck 2009). Experiments have shown that lower levels of bottom living microalgae restrict the recolonisation of macrofauna (Stocks & Grassle 2001).

Full recovery after measures such as dredging is probably restricted both by a slow or seasonal recruitment and by the availability of food (see Norkko et al. 2006 for references). The spatial scale of the disturbance seems to be the most crucial factor for the speed, succession and completeness of the recolonising macrofauna community (Lewis et al. 2002, Bolam et al. 2006, Norkko et al. 2006). The recovery of flora and fauna can possibly be boosted by leaving undisturbed refugia in the treated area that can serve as local banks for a recolonisation (Hulth & Sundbäck 2009).

Cost, cost-effectiveness of measure:
Wasserman et al. (2013) estimated costs around 22 euro per dregded m^3 of polluted sediment and 14 euro per dumped m^3 (Rio de Janeiro, Brazil).

Feasibility:
-

Follow-up of measure:
-

Background material:
-

References

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Title **2. Restoration of hard bottoms by establishment of artificial reefs**
Submitted by: SLU Aqua, Swedish University of Agricultural Sciences, Sweden; HELCOM ACTION
Description of measure Establishing artificial reefs/substrates to allow for colonisation of hard bottom macroalgal and macrofaunal assemblages and fish.
Activity: Restructuring of seabed morphology (dredging, beach replenishment, sea-based deposit of dredged material) Extraction of minerals (rock, metal ores, gravel, sand, shell)
Pressure: *Physical disturbance to seabed (temporary or reversible and recovers within 12 y)* *Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate)* *Changes to hydrological conditions*
State: The measure should only be considered for areas with historical loss of the substrate that the reef is mimicking. Seabed habitats
Extent of impact: Artificial reefs may have positive impact, but mainly locally, within coastal areas.
Effectiveness of measure Artificial reefs attract e.g. fish and shellfish and they are of interest both for commercial and recreational fisheries and for recreation (Seaman 2007, Fabi et al. 2011), although they can also affect the benthic environments negatively (Bulleri & Chapman 2010, Dafforn et al. 2015, Ruuskanen et al. 2015). The reefs may be placed out intentionally or un-intentionally as ship wrecks in connection with accidents (Ruuskanen et al. 2015, Balazy et al. 2019). Positive responses summarised: more habitat/substrates for marine organisms especially fish and shellfish, increased biodiversity, preserved ecosystem services. Negative responses summarised: altered bottom structure, impact on water circulation, effects on soft bottom organisms, the new habitat may claim space from other marine habitats. Introduced hard substrates in areas of predominating soft bottoms can also serve as stepping stones for non-indigenous invasive species. Promoting "attraction by individuals" ahead of "production" can lead to overharvesting of certain species. Negative impact on existing values should be weighed against the expected ecological improvements beforehand when planning to establish artificial reefs.
Cost, cost-effectiveness of measure: Costs are highly variable, ranging from almost nothing (zero costs) to more than 100 000 euro. Costs are mostly depending on the type of structures and measures, technique, whether monitoring is included, etc.

Feasibility:

The measure is feasible but the use of artificial reefs may be disputed ethically and environmentally. The measure is only to be considered for areas with historical loss of the substrate that the reef is mimicking. For feasibility scores for this measure, see the ranking in the introduction as well as Appendix 1 at the end of this document.

Follow-up of measure:

The effects of established artificial reefs should always be monitored and evaluated

Background material:

Artificial reefs have been for instance deployed in Kiel and in Nienhagen (northern Germany), in the Odra river estuary, in Puck Bay and in the Pomeranian Bay (Poland), in the Vistula Lagoon (Russia), in the Gulf of Riga (Estonia); in the Gulf of Finland (Russia and Finland) (Fabi et al. 2011).

References

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Title **3. Protection of habitats**
Submitted by: SLU Aqua, Swedish University of Agricultural Sciences, Sweden; HELCOM ACTION
Description of measure The measure aims to protect natural habitats, shores and also spawning and recruitment habitats for coastal fish from further deterioration due to human activities. It is applicable in the designation and management of MPAs, in shore protection as well as in spatial planning.
Activity: This refers to past activities leading to loss of functions such as natural habitats. Land claim Canalisation and other watercourse modifications (coastal dams, culverting, trenching, weirs, large-scale water deviation) Coastal defence and flood protection (seawalls, flood protection) Restructuring of seabed morphology (dredging, beach replenishment, sea-based deposit of dredged material) Fish and shellfish harvesting (bottom-touching towed gears, professional, recreational) Fish and shellfish harvesting (pelagic towed gears, stationary gears, professional, recreational) Aquaculture – marine, including infrastructure Transport – shipping (incl. anchoring, mooring) Transport – shipping infrastructure (harbours, ports, ship-building) Urban uses (land use) Tourism and leisure infrastructure (piers, marinas) Tourism and leisure activities (boating, beach use, water sports, etc.)

Pressure: *Loss of, or change to, natural biological communities due to cultivation of animal or plant species* *Disturbance of species: Visual, presence, boating, recreational activities, above-water noise* *Disturbance of species: Other (e.g. barriers, collission)* *Extraction of target fish and shellfish species and incidental fish catches* *Physical disturbance to seabed (temporary or reversible and recovers within 12 y)* *Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate)* *Changes to hydrological conditions* *Input of organic matter — diffuse sources and point sources* *Input of anthropogenic sound (impulsive, continuous)* *Input of other forms of energy (including electromagnetic fields, light and heat)*
State: Coastal degradation is continuously increasing in coastal areas today, as the effect of physical modifications of seabed, tourism and boating activities, etc. lead to cumulative loss of habitat. Thus, the measure is relevant in all parts of the Baltic Sea coastline. Seabed habitats
Extent of impact: The positive impacts are mainly local, within coastal areas, but with a potential for positive basin-wide effects.
Effectiveness of measure Safeguarding important habitats for maintenance of biodiversity and provision of ecosystem services, for example the recruitment and production of fish (Sundblad et al. 2014, Kraufvelin et al. 2018), can be considerably more effective compared to restoration of deteriorated habitats, in terms of costs and since there is no time lag before the effect of the implementation can be seen. In comparison, restoration is likely to require more resources in terms of cost and time and a has a lower level of certainty in that all original functions and ecosystem services will be recovered. There is generally a lack of follow-up studies on the effect of habitat protection in the Baltic Sea. However, substantial indirect evidence is provided from studies showing how habitat deterioration reduces fish productivity (Kraufvelin et al. 2018). For example, Sundblad et al. (2014) showed that habitat limitation for early life stages of perch and pikeperch may restrict the abundance of later adult stage fish. There is evidence of long-term negative effects on fish reproduction habitats from physical development, boating and infrastructure related to boating (Sandström et al., 2005, Sundblad and Bergström 2014, Hansen et al. 2018, Sagerman et al. 2020), and studies have shown negative impacts on the habitat and the production of juvenile fish from recreational boating traffic (Sandström et al. 2005). The studies are from Swedish waters but the observed relationships can be assumed to also apply to other countries in the Baltic Sea.

Cost, cost-effectiveness of measure:
Costs for protection measures by creating marine reserves are very low. Principally they can be established more or less for free unless bought land and water areas are included or some compensation fees need to be paid to former users.

Feasibility:
High

Follow-up of measure:
-

Background material:
[*Free text: Clarify choice of background material for the synopses, e.g. does it represent a comprehensive overview of results with regard to the measure or a sub-selection*]

References

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Title
4. **Follow-up and knowledge sharing**

Submitted by:
SLU Aqua, Swedish University of Agricultural Sciences, Sweden; HELCOM ACTION

Description of measure
The measure “Follow-up and knowledge sharing” aims to enhance the evidence-base on efficiency of measures over time by mutual sharing of existing and ongoing experiences among countries. To support an adaptive management, it might also be beneficial to apply measures as test with the dual aim of improving environmental status and learning. The measure “Follow-up and knowledge sharing” is further expected to support engagement and acceptance to measures among the general public and stakeholders concerning the needs of the measures and their objectives, if supported by campaigns dedicated for specific groups.

Activity: Not applicable
Pressure: *Not applicable*
State: Even though a wide range of measures has already been implemented for coastal habitats in the Baltic Sea, there is generally a lack of scientific evaluations and evidence about the effects of many of the measures. This lack of knowledge significantly limits the work with restoring and supporting coastal habitats, through impacts on the capacity of the society to carry out measures. Seabed habitats Nutrients
Extent of impact: Even though a wide range of measures has already been implemented for habitats in the Baltic Sea, there is generally a lack of scientific evaluations and evidence on the effects of many of the measures. This lack of knowledge significantly limits the work with restoring and supporting coastal habitats through impacts on the capacity of society to carry out measures.
Effectiveness of measure Scientific evidence to follow-up on the effectiveness of measures for coastal habitats is only available for a few measures and for some areas. An effective way to support an increased evidence base would be to encourage adaptive learning and the mutual sharing of experiences among countries. To gain stronger support for these measures and for those not yet suggested in this report, it is of outmost importance that past, on-going and future measures for coastal habitats are scientifically evaluated, something that unfortunately is undertaken only rarely. Designed in a proper manner and applied for a specific coastal area, many measures to improve coastal habitats are likely to have positive effects on other parts of the food web.
Cost, cost-effectiveness of measure: -
Feasibility: -
Follow-up of measure: -
Background material: -
References -