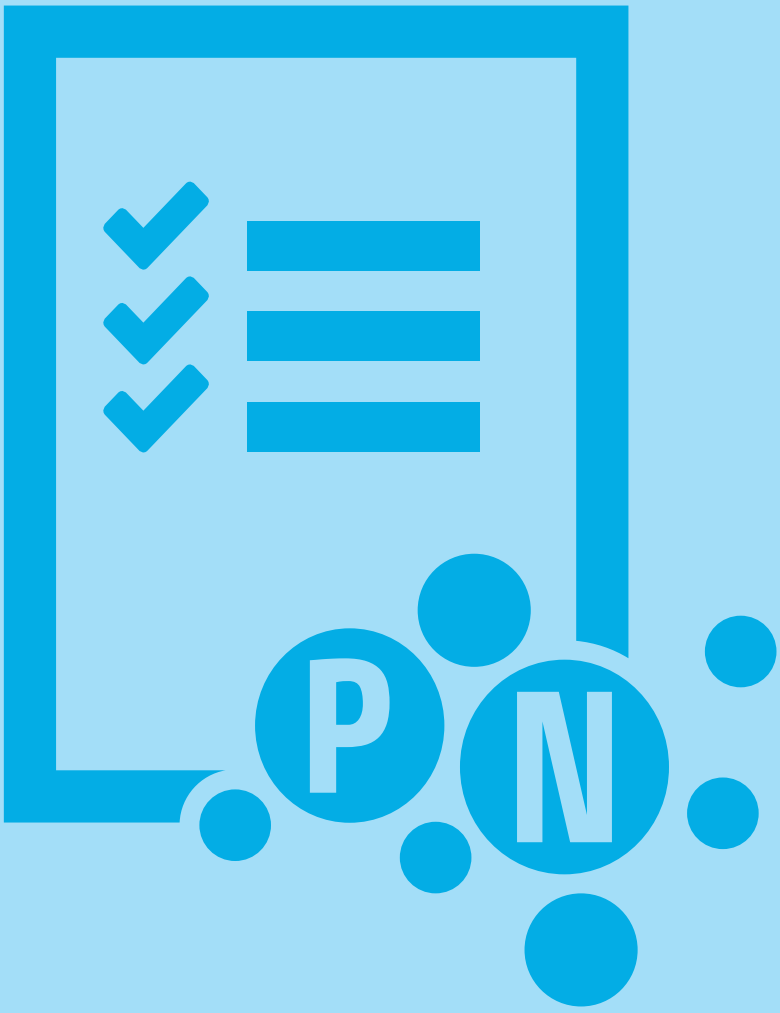
Guidelines for Sea-Based Measures to Manage Internal Nutrient Reserves in the Baltic Sea Region

Baltic Marine Environment Protection Commission

Nutrients

October 2021



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1 Aim of the Guidelines

The aim of these guidelines is to provide guidance for researchers planning to undertake research projects and for operators and environmental managers planning to implement activities designed to reduce the negative impacts caused by the internal nutrient reserves in the Baltic Sea. The guidelines also provide decision support for relevant authorities when administering consultations and environmental permitting related to sea-based measures. In this context, the guidelines are intended to provide additional information to national and international decision making. They should also encourage the exchange of information and the development of a shared knowledge pool describing sea-based measures to manage internal nutrient reserves for the benefit of HELCOM Contracting Parties and beyond.

1.1 Policy context

Despite continuing efforts of the Contracting Parties to the Helsinki Convention to reduce the nutrient load to the Baltic Sea from external sources and despite jointly achieved progress towards maximum allowable inputs of nutrients identified by the Baltic Sea Action Plan, the highly eutrophic state of the Baltic Sea continues.

Reduction of the nutrient input from external, predominantly land-based sources is of highest priority as the maximum allowable (sustainable) input[1] of nutrients has not yet been achieved for all Baltic Sea sub-basins and the net nutrient inputs have not yet been reduced to the level of national ceilings for net nutrient inputs[2].

Large amounts of nutrients have accumulated in the Baltic Sea during the past decades due to anthropogenic activities causing anoxia and preventing the sediments from acting as an effective nutrient sink, which results in an enhanced internal flux of nutrients between sediments and sea water, exacerbating eutrophication and delaying recovery.

Substantial technological progress in the development of measures to manage nutrient reserves in the Baltic Sea has been achieved in recent years. Nevertheless, the scarcity of scientific evidence regarding the sustainability of the effects of such measures and the potentially harmful consequences for the marine environment, including possible transboundary effects in case of large-scale application of such measures, raises concern and there is a need for guidelines for measures to manage internal nutrient reserves.

The provisions of these guidelines are developed recognizing the following global and regional policy context:

- Paragraphs 1 and 2 of Article 3 and 1b of the Article 20 of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992, (Helsinki Convention), obliging Contracting Parties to take, individually or jointly, all appropriate legislative, administrative or other relevant measures to prevent

[1] Maximum Allowable Inputs (MAI) of nutrients are a part of the HELCOM nutrient reduction scheme, indicating the maximal level of total (water- and airborne) input of nitrogen and phosphorus to the Baltic Sea sub-basins that is allowed to fulfil the targets for the sea unaffected by eutrophication.

[2] The net nutrient input ceilings are an integral part of the HELCOM nutrient reduction scheme. They indicate maximum allowable inputs of nutrients integrating waterborne (direct coastal point sources and discharges from rivers), airborne (atmospheric deposition from a country or a group of countries) and transboundary (input via rivers through another country) inputs for each country to each sub-basin.

and eliminate pollution in order to promote the ecological restoration of the Baltic Sea Area and the preservation of its ecological balance including applying the precautionary principle as well as making related recommendations; and Paragraphs 1 and 2 of Article 7 on notification and consultation in relation to activities which are likely to have a transboundary impact.

- United Nations Convention on the Law of the Sea and its obligations for States to protect and preserve the marine environment (Art 192) including to take measures to prevent, reduce and control pollution (Art 194) and not to transfer damage or hazards or transform one type of pollution into another (Art 195);
- Resolution LP.4(8) on the Amendment to the London Protocol to Regulate the Placement of Matter for Ocean Fertilization and Other Marine Geoengineering Activities that provides an assessment framework for scientific research involving ocean fertilization and a general assessment framework for marine geoengineering activities;
- The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) obliging the signatories to the Convention to assess the environmental impact of certain activities at an early stage of planning and notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries and recalling similar obligations under the EU Environmental Impact Assessment Directive 2011/92/EC.
- The HELCOM Brussels Ministerial Declaration 2018 that foresees a stepwise approach to the management of internal nutrient reserves, encouraging Contracting Parties to the Helsinki Convention as a first step to improve the knowledge base regarding the nature and dynamics of internal nutrient reserves and, as a second step, to undertake research on the potential of measures to manage internal nutrient reserves as well as to develop and apply a risk assessment framework in HELCOM to meet the necessary environmental requirements and elaborate commonly agreed regional principles as guidance for internal nutrient reserves management;
- The statement of the HELCOM Brussels Ministerial Declaration 2018 that the risks to ecosystem and human health stemming from measures to manage internal nutrient reserves, as well as the long-term sustainability of their effects, need to be considered and thoroughly evaluated;
- The requirements of the EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora 92/43/EEC, the EU Water Framework Directive 2000/60/EG and the EU Marine Strategy Framework Directive 2008/56/EC, and related national legal acts of the EU member states, Federal Laws on Environmental Impact Assessment and on Internal Sea Waters, Territorial Sea and Contiguous Zone of the Russian Federation which aim to achieve or maintain good ecological status/good environmental status and prevent environmental degradation;
- The European Union Court of Justice ruling that Member States may not authorize projects that lead to deterioration of the status of a water body, even on a temporary basis, and that such projects shall be prohibited unless a derogation is granted (the Weser case).

The provisions of these guidelines will not prejudice stricter provisions concerning the application of measures to manage internal nutrient reserves contained in other, existing or future, national, regional or international instruments.

1.2 Definitions

In the context of these guidelines measures to manage internal nutrient reserves are hereafter called sea-based measures or sea-based activities and include both field trials for research purposes as well as operational applications of such measures. Such sea-based measures typically include but are not limited to the following:

- chemical measures, such as application of chemicals to bind phosphorus in sediments;
- physical measures such as removal of nutrient rich sediments or changing hydrography;
- biological measures such as the removal of organisms or extractive aquaculture;
- combinations of these measures.

1.3 Application of the Guidelines

These Guidelines are intended to prevent potential adverse effects of sea-based measures on the Baltic Sea marine environment, to mitigate their risks and to ensure the sustainability of desired effects through thorough planning and comprehensive and transparent national permitting procedures.

These Guidelines are also intended to facilitate the development of the knowledge base related to sea-based measures in order to mitigate eutrophication of the Baltic Sea.

Contracting Parties should communicate these guidelines with national competent authorities and other relevant stakeholders.

Contracting Parties to the Helsinki Convention should assess and control sea-based measures in the Baltic Sea including private, commercial and research projects through national permitting procedures, always acting with caution when intervening in the marine environment.

Contracting Parties to the Helsinki Convention should take these guidelines into account in permitting procedures for measures to manage internal nutrient reserves in the Baltic Sea region in order to ensure that:

- they serve to achieve a Baltic Sea unaffected by eutrophication and with the aim that positive effects of the measures will be sustained even after the measures are completed;
- they do not cause significant adverse effects on the environment and
- environmental risks are minimized.

Contracting Parties should encourage reporting in accordance with these guidelines, ensuring also that the information is available for other Contracting Parties via consideration by relevant HELCOM working groups.

1.4 Regional Principles

The following regional principles should be applied when national authorities, international and national financial institutions, private investors, research organizations and commercial organizations plan any sea-based measures related to the management of internal nutrient reserves:

- sea-based measures should contribute to the achievement of a Baltic Sea

unaffected by eutrophication;
- sea-based measures do not substitute measures to reduce nutrient inputs to the Baltic Sea from land, air or maritime sources and cannot therefore be accounted for as national nutrient input reduction measures in the context of the nutrient input ceilings agreed in the Baltic Sea Action Plan;
- sea-based measures should not lead to deterioration of the status of the marine environment;
- the precautionary principle should be applied when assessing and controlling sea-based measures;
- measures should be based on the best available scientific knowledge;
- the environmental effects of sea-based measures should be monitored for the duration they are expected to effect on the marine environment.

The precautionary principle of the Helsinki Convention is applicable to sea-based measures and all such measures should be considered with care, in particular taking preventive measures when there is reason to assume that substances or energy introduced, directly or indirectly, into the marine environment may create hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea. At the same time, testing such measures may be necessary to learn more about their environmental effects, both positive and negative, with the ultimate aim to develop sea-based measures into effective and safe tools to help manage eutrophication. In this context these guidelines constitute a suitable instrument for managing the environmental risk that may arise when applying sea-based measures.

The knowledge base regarding the nature and dynamics of internal nutrient reserves and the potential of measures to manage these reserves should be improved through:

- research on nutrient fluxes in the marine environment, factors affecting their character and methods to manage internal nutrient reserves, including harm of these methods to the environment on short- and long-term scale, along with potential adverse transboundary effects;
- exchange of information on recent research and results of testing of all sea-based measures in the Baltic Sea region;
- enhanced international cooperation with the aim to transfer and develop the best available techniques and practices regarding sea-based measures to mitigate eutrophication;
- engaging in dialogue and enhanced cooperation with business and industry, sea users, local communities and other relevant civil society groups as well as national stakeholders focusing on application of sea-based measures to mitigate eutrophication.

As HELCOM Contracting Parties gain experience applying sea-based measures and following these guidelines, the guidelines should be reviewed at least every six years and revised as necessary.

2 Guidance for planning measures to manage internal nutrient reserves

Evaluating the benefits and impacts of identified effects on environmental indicators enables finding out the biggest risks and risk thresholds, “no-go’s”, as well as potential benefits of the planned measure.

The following matters are relevant to consider when planning sea-based measures in the Baltic Sea region. Some matters listed below may not be of significance for all activities; all relevant matters should be considered according to the characteristics of the planned activity, with focus on the assessment of environmental risks.

- Environmental impact assessment (also positive impacts)
- Local circumstances and careful selection of the sites
- Monitoring of environmental indicators before and after implementation e.g. sediment, bottom fauna, water quality data
- Duration of the targeted effect, e.g. nutrient reduction, or improvement of the oxygen condition
- Nutrient sources and loading rates into target area
- Impacts related to hazardous substances
- Scale of the activity and of the area affected by the activity
- Positive values and impacts on ecosystem services e.g. recreation, fishing
- Social and economic impacts

2.1 Environmental impact assessment of sea-based activities

The environmental impact assessment should aim at identifying potential environmental effects, benefits and risks related to the planned activity. It should lead to an understanding of e.g. the direction (positive/negative, indicators), magnitude, extent and duration of the identified effects and associated risks. Information related to the impact assessment recommended for communicating proposals on sea-based measures is given in the example project description, Appendix 1. Appendix 1 also includes the BRAUNS methodology which can be utilized for the communication purposes. This has previously been developed for assessing risk for medical interventions (P Hammond pers. comm.) to ensure that proposals consider Benefits, Risks, Alternatives, Unknowns, the Null-alternative and Safety measures.

2.1.1 Description of the activity

The planned activity should be described in detail including the following information:

- the environmental problem in the targeted area that is intended to be addressed by the activity
- the mechanism of how the activity intends to manage internal nutrient reserves (chemical, biological, physical)
- the planned techniques to be applied (e.g. spreading devices, pumping devices, anchoring system, etc.)
- location, starting date and duration of the activity, including operational and monitoring periods and removal of devices

- expected results of the activity, in particular description of the target status of the area after the activity has been conducted
- possible references on the effectiveness of the activity (references of the activity from other areas when available, research results, description of the novelty)

2.1.2 Site selection, description and scale of the activity

This section concerns the provision of data necessary to evaluate the physical, chemical and biological conditions at the proposed site, and the uncertainties in the conditions in relation to the proposed activity. It also contains guidance on how to select suitable sites to minimize impacts and maximize benefits of an activity. Therefore, the section is useful when planning an activity and reporting on a planned activity.

A rationale for choosing the proposed site(s) should be provided, based on the following key goals:

- suitability for applying a specific measure to manage internal nutrient reserves – sea-based measures should target only areas that are not in good status with respect to eutrophication and are identified as potential/significant sources of internal nutrient loading, e.g. areas with severely hypoxic/anoxic bottoms;
- suitability for minimizing undesirable effects (enclosed/ semi-enclosed conditions to control, limit and monitor the effects; existing (preferably long- term) monitoring data before implementation, avoiding areas which are contaminated with hazardous substances)
- avoiding proximity to areas of special concern and value (e.g. NATURA 2000, HELCOM MPAs)
- avoiding interference with other anthropogenic activities/uses of the sea.

The site selection should include the size (in km^2 and water volume in m^3) and coordinates of the proposed site and of the region of potential impact, stating whether this also covers the waters of other HELCOM Contracting Parties other than the Contracting Party responsible for conducting the activity.

The site selection should consider the relevant characteristics of the proposed site and of the region of potential impact including the following:

- general characteristics (e.g. coastal and open waters, semi-enclosed bay)
- water column characteristics (e.g. depth, horizontal and vertical temperature and salinity distribution)
- characteristics of bottom geology
- transport and mixing characteristics (e.g. intensity of mixing, currents, exchange regime with surrounding media including the atmosphere)
- meteorology (e.g. temporal/seasonal conditions, winds, waves)
- biological and ecological characteristics (e.g. benthic and pelagic habitats, sensitive/protected/vulnerable/endemic/migratory species, vulnerable ecosystems, areas of special concern/value e.g. NATURA 2000, HELCOM MPAs)

- ecological/chemical/environmental status as assessed by HELCOM/MSFD or WFD, including the assessment of indicators and assessment themes (e.g. eutrophication, chemical status, biological status) relevant for the activity
- proximity to other uses of the sea (e.g. fishing, navigation, engineering uses etc.)

2.2.3 Assessment of the benefits

The main purpose of sea-based measures is the reduction of the internal nutrient load from nutrient reserves that have accumulated in the Baltic Sea over a long time. It should be described in detail and if possible in a quantitative way how and to what extend the planned sea-based measure will contribute to the mitigation of internal nutrient reserves and how long these effects are expected to last. Potential alternatives for achieving the same benefits should also be considered.

2.1.4 Assessment of potential negative environmental effects

The assessment of potential environmental effects should lead to a concise description of the expected consequences of the activity within the area of the activity and within the area of potential impacts, including transboundary effects and cumulative effects. The assessment should specify the potential positive and negative effects on the marine ecosystem structure and dynamics including sensitivity of species, populations, communities, habitats and processes. Effects on human health and on other legitimate uses of the sea should also be assessed.

The assessment should define the nature, temporal and spatial scales and duration of expected positive and negative effects based on reasonably conservative assumptions. If sufficient information to assess the likely negative effects is not available it is recommended to carry out an additional research that produces such information before commencing the activity.

Methodologies for assessing effects (e.g. models, pre-existing data, targeted measurements) should be described, including the sensitivity to underpinning assumptions, uncertainties and data gaps (e.g. due to limited information on baseline conditions, natural variability, longevity of the response and lack of long-term monitoring in previous activities).

Different environmental indicators and considerations can be used for evaluating the effects of sea-based measures. Preferably, these should be indicators already in use by HELCOM, MSFD, WFD or other national relevant indicators. There are general indicators that should be evaluated for all activities and measure-specific indicators/considerations, that only apply to specific measures. An example list of potential indicators is in Appendix 2. The impact assessment should be planned thoroughly to ensure the selection of the most relevant indicators for different measures.

General indicators and considerations

Depending on the chosen measure, indicators should be applied according to the method of impact of the planned measure.

The indicators should cover parameters from quality and properties of water and sediment as well as vegetation and fauna. It is also relevant to consider organism responses and potential effects on the food chain (see Appendix 2 for a detailed list of potential indicators). The activity should also consider safety aspects during installation and implementation as well as use of energy and waste production.

Activity specific indicators and considerations

Depending on the chosen measure, specific indicators should be applied according to the impact mechanism of the planned measure. These indicators should be selected with assistance of a specialist of a relevant field of expertise (marine ecology, sediment geology, biogeochemistry etc.).

Activities that place substances or installations into the marine environment

If the activity to manage internal nutrient reserves involves the placement of substances or installations in the marine environment their properties and fate need to be assessed. Uncertainties associated with such an assessment also need to be identified.

The characterization and assessment of substances/installations to be placed into the marine environment should account for the method of deployment/application. The placement of substances calls for information on their origin, physical and chemical characteristics. The total amounts to be added and the rates of addition provide information on the significance of the activity for the environment. The amounts indicate the possible area initially affected by the addition and the duration of the addition process.

The substance exposure processes and pathways include physical processes moving the substance to target area, but also removing and relocating it outside the target area. The substance faces considerably varying biological and geochemical conditions in water column and bottom sediments. Possible alternatives for the proposed substances should also be considered.

For installations, the technical properties of the installation should be clarified and the mode of interaction with the marine environment should be explained. Furthermore, the fate of the installation after the termination of the activity should be taken care of.

Activities that target nutrient removal from the sediment or binding nutrients in the sediment

When removing substances from the target area special attention should be paid to hazardous substances (e.g. PAHs, TBT, dioxins, mercury) in the sediment since these could potentially be released by the activity. A sediment analysis and/or mapping of the previous uses of the planned site should be conducted to determine whether the sediment is contaminated. If the activity removes sediment by dredging, the fate of the dredged material should be described. Furthermore, it should to be demonstrated that the provisions of the HELCOM Recommendation 36/2 on the management of dredged material are followed.

Activities that aim at a biological manipulation

Activities involving a biological manipulation often aim at removing biomass containing nutrients from the marine environment. In this process, it should be considered whether non-target organisms are removed and how the removed biomass is used. If the activity involves fishing, the fishing techniques should be described and techniques that minimize environmental impacts should be used. If the activity involves aquaculture operations, it should be demonstrated that they follow the HELCOM Recommendation 37/7 on sustainable aquaculture in the Baltic Sea region. The measure should be well-planned, so that a release of nutrients back to the marine environment is avoided.

2.2. Risk assessment

If significant environmental risks and impacts are identified they should be considered and included in the risk assessment when planning the application of sea-based measures. It needs to be taken into account that risks are also measure-specific.

In general, risk is a function of the magnitude of an adverse effect (or its consequence) and its probability. For each of the negative environmental effect identified under 2.1.4. an estimation of the magnitude and probability should be provided. The integration of the magnitude of an effect and its probability will yield an estimation of risk with highest risks expected for activities that have severe consequences and high probability and lowest risk expected for activities that have negligible consequences and negligible probability (Fig.1). The estimation of the magnitude and probability is semi-quantitative at best and should represent expert judgements based on the available knowledge and experience. The magnitude of an effect should need to consider the temporal and spatial scale of the effect.

The following impacts should be considered in the risk assessment, depending on the planned measure, which is not an exhaustive list of possible impacts:

- Disturbing the ecosystem functioning as a whole (cascading effects i.e. chains of effects due to an act affecting a system, interactions in the ecosystem that we don't yet understand)
- Biodiversity loss, e.g.
    - Impacts on specific habitats (e.g. spawning or nursery habitats for fish)
    - Impacts on species (especially key species of the ecosystem and endangered or threatened species) and species composition
- Impacts on nutrient concentrations in the productive water layer (increase of nutrient concentration in productive layer e.g. by nutrient leakages from sediment or by mixing of the water column)
- Risk of releasing of nutrients/ hazardous substances from the sediments
- Measure-specific impacts, e.g.
    - on fractions of phosphorus (e.g. mobile phosphorus) and nutrients in the sediment
    - Changes of pH in shallow areas (e.g. aluminum treatment, marl)
    - Disturbance of the bottom (e.g. dredging, spreading of aluminum to the bottom)

- Increasing the oxygen consumption in the bottom (e.g. oxygenation/dredging, if not planned right)
- Effects of changes in the environment over a longer period of time (e.g. changes in anthropogenic activities, impacts caused by land uplift, climate change etc.)

Increasing acceptability →	Consequences			
	Severe	Moderate	Mild	Negligible
Probability				
High	High	High	Medium/Low	Very low
Medium	High	Medium	Low	Very low
Low	High/Medium	Medium/Low	Low	Very low
Negligible	High/Medium/Low	Medium/Low	Low	Very low

Figure 1. Risk assessment matrix integrating the probability and consequence (magnitude) of an effect. It should be applied for each negative environmental effect.

Conclusions regarding the likelihood for effects of a given magnitude are developed from evidence regarding the strength of relevant cause-and-effect relationships, uncertainties associated with these relationships and the role of natural variation in these processes in the environment.

2.3. Uncertainties in the environmental impact assessment and risk assessment

The environmental assessment should also provide a description and summary of the uncertainties associated with its conclusions. Such a description is to include a listing of the significant/consequential assumptions, data gaps, and sources of variation in exposure and effect processes. The evaluation of uncertainties should be sufficient to inform decision-makers regarding the limitations and constraints associated with the risk conclusions, including the means for decision-makers to inform themselves about the implications for decision-making posed by those identified uncertainties. The estimation of uncertainty should also provide a source of input for identifying monitoring and research activities through which uncertainties can be reduced and risk assessments can be supported.

Because the risk management decisions are based on predictions, monitoring should seek to test these predictions, so that the environmental assessment can be improved.

2.4 Risk management procedure

Risk management procedures are necessary to ensure that environmental risks of the activity are minimized through mitigation and contingency planning and the benefits maximized and that a precautionary approach is applied.

Risks should be managed to reduce them to a low level by mitigating of risks and through contingency planning. Strategies to mitigate risks should be appropriate for the risks under consideration. They may be imposed as additional conditions by the permitting authority or included as an intrinsic part of the proposal. The restrictions can be temporal during certain oceanographic conditions or biologically important times. The restrictions can also be spatial for areas of special concern and value (e.g. NATURA 2000, HELCOM MPAs) or operational (e.g. substances or gear used, application techniques). Contingency planning should also respond to the results of monitoring in cases where unexpected negative environmental effects occur. This may include the cessation of the activity.

A well-designed monitoring regime should cover short and long-term impacts and, where possible, determine whether any unexpected negative environmental effects occur and whether the activity has achieved its purpose. The type, frequency and extent of monitoring depend on the expected local and regional environmental impacts of the activity but should include compliance monitoring to verify that permit conditions are met and impact monitoring to determine the area of impact and to verify that the assumptions made during the assessment of the proposed activity were correct.

The monitoring should start prior to the activity to establish baseline conditions and should ideally cover control sites. It should extend after the activity is terminated for a period long enough to detect those negative effects that could arise after termination of the activity. The design of the monitoring regime should be evaluated accounting relevant research and modelling information and modifications can be requested.

2.5 Reporting and dissemination of the results

For ensuring the availability of data and results for further monitoring of the effects or e.g. planning of future activities, it is recommended to compile a report on implemented activities and achieved results after the implementation of the activity. The Contracting Party should report to HELCOM PRESSURE and other relevant HELCOM groups. Collection and use of information resulting from monitoring informs future decision making and can improve future assessments.

3 Information requirements for sea-based activities in the open sea and activities in coastal waters with significant transboundary effects

Contracting Parties under whose jurisdiction sea-based measures in the open sea, or coastal measures with potentially significant transboundary effects are being planned should aim at informing other HELCOM Contracting Parties on the proposed measures in good time to enable proper communication with stakeholders across the region via relevant HELCOM WGs. The communication is advisable as early as possible, preferably at the planning stage of the sea-based measures. Such communication helps to involve broader expertise to the consideration of the project proposal and so the results of the communication process can become available for consideration by national permitting authorities.
Based on the communication HELCOM Contracting Parties can gain additional knowledge on the planned activities and associated risks and they can provide advice on possible mitigation of the associated risks.

An activity is considered to significantly affect the waters of other HELCOM Contracting Parties if:

- the region where the activity takes place extends to the waters of other HELCOM Contracting Parties, or
- the region of potential impact (the area of the sea in which detectable positive or negative changes (effects) occur as a result of the activity), extends to the waters of other HELCOM Contracting Parties and if it fulfils one or more of the following criteria:
    - the scale of the activity is larger than the average size of a water body (e.g. identified by WFD);
    - negative environmental effects are likely to occur;
    - negative effects are long-lasting (> 6 years, which equals one management period of the WFD/MSFD)

When a measure is planned in the open sea or is conducted in coastal waters and has potentially significant effects on the waters of other HELCOM Contracting Parties, information in accordance with chapter 2 is recommended to be provided to the relevant HELCOM WG for communication. Once the project is finalized the relevant HELCOM WG should be informed about the results by submission of a project report.

APPENDICES

APPENDIX 1 Example project description

For a Sea-based measure project plan, the following content is recommended in order to describe important aspects of any proposal:

1. GENERAL DESCRIPTION AND OBJECTIVE OF THE ACTIVITY
   - Common summary
   - Description of the environmental problem in the targeted area
   - Description of general affecting mechanism(s) of planned activity
   - Possible references on the effectiveness of the measure (references of the activity from other areas when available, research results, description of the novelty)
   - Description of the target status of the area after activity is put into practice

2. PARTICIPANTS OF THE PROJECT
   - Information regarding the principal project team and their affiliations, including associated authorities/institutes/companies.
   - The responsible legal authority should also be provided.

3. IMPLEMENTATION
   - Description of the feasibility and suitability of the planned activity for targeted area and effect (especially in case of novel techniques)
   - Description of the planned techniques to be applied (e.g. spreading devices, pumping devices, anchoring, etc.)
   - Safety aspects (equipment related to the implementation, positions of rafts, anchoring, floating objects, and operations during activity, etc.)
   - References of the responsible parties in implementing such projects
   - Starting point and duration of the activity, including operational and monitoring periods and removal of devices.

4. DESCRIPTION OF TARGET SITE(S) AND SCALES
   - Scale of the sea area where the activity will be applied and where the effects of the activity are expected to be detectable, in square kilometers and water volumes as cubic kilometers (km^3).
   - Justifications of site selection and description of the selected site(s): water depths, surface area, volumes, quality of water, quality of sediment, water exchange etc.
     - (if target area(s) can be compared to control area, description of both)
   - Level of knowledge of the targeted area: ecological condition, available monitoring data etc.
   - Expected timescale of the targeted effects

5. IMPACT MECHANISMS AND TARGETED RESULTS
   - Description of the impact mechanism on targeted nutrients in ecosystem, e.g.
     - Physical description of the mechanism (physical forcing can be e.g. mixing of water, removal, cooling-warming, electrical)
     - Chemical: description of the change in chemistry and reactions improving the binding of nutrients e.g. in the sediment or water phase

    - Biological: description of how the planned biological measure will improve the food web and behavior of nutrients in the ecosystem
- When measure(s) create synergetic mechanism(s), they should be defined
- Description of the expected results: target for manipulation (applied measure) and potential collateral non-targeted effects

6. MONITORING
- Description of a monitoring plan, (e.g. how the status of the target area will be identified and followed prior and post to the activity)
- Spatio-temporal coverage of the monitoring plan (e.g. monitoring plan for identifying long-term effects)

7. WORK PLAN
- A general project management and implementation plan addressing the different steps/phases of the activity
- Time schedule, objectives of the project and possible constraints related to the project.

8. BUDGET AND FUNDING
- Estimated budget of the planned activities
- Funding sources of the activity (e.g. public or private funding)

9. ENVIRONMENTAL ASSESSMENT
- Evaluation of environmental impacts and risks (risk assessment framework)
- Impacts on Natura 2000 and other marine protected areas (e.g. HELCOM MPAs)
- Plan for minimizing negative effects
- Plan for risk management and monitoring
- Energy use and waste produced (if relevant)

BRAUNS Risk Management Framework[3]

Evaluation of environmental impacts and risks

B Benefits

What are the benefits of this intervention? What are the intended results? How long are they expected to last? Is this a one-time intervention or a permanent/long-term support? Please refer to a proposed monitoring programme, including post-project appraisal; are the objectives of the project quantitatively defined?

Links to supporting documents

R Risks

What are the remaining acceptable risks associated with this chosen intervention, after mitigation or avoidance measures are implemented? What is the effect on benthic fauna? Does it involve a permanent addition to the marine environment if so, what negative effects could this have, over both short and long terms? Are there hydrographic changes and if so, what are the implications of these? What area is likely to be impacted by these changes?

The approach here is to identify risks, then avoid/mitigate/transfer/accept and then quantify severity and likelihood of residual risk.

- Impacts on Natura 2000 and other marine protected areas (e.g. HELCOM MPAs)
- Plan for minimizing negative effects
- Energy use and waste produced (if relevant)

Links to supporting documents.

A Alternatives

What alternative approaches have been considered and why have they been discarded?

Links to supporting documents.

U Unknowns

Where are the knowledge gaps or known uncertainties in the method chosen and in the expected impacts on the ecosystem?

Links to supporting documents.

N Null-alternative

What would happen if this measure was not implemented? What result would be obtained from only controlling external nutrient sources, including the result of achieving the full BSAP reduction targets.

Links to supporting documents.

S Safety net

Who or what could be negatively impacted by this intervention?
What measures have been put in place to prevent negative impacts from this activity?
What preparations have been made to compensate stakeholders should the negative impact occur?
What restoration would be necessary to repair this negative impact?
Plan for risk management and monitoring

Links to supporting documents.

[3] pers. comm. Dr. Phil Hammond ("MD., *Private Eye*, Jan 2021").

10. SOCIO-ECONOMIC ASPECTS AND COMMUNICATION

A short description on the economic and social impact of the project should be provided. The analysis should include information and/or a cost-benefit analysis of the selected measure on the added value it would bring. In addition, a short communication strategy containing information on how local people and the general public will be informed throughout the activity should be included (relevant also in permitting the project).

- Informing the authorities responsible for the Maritime spatial planning, Land use and Building act of the planned activity area
- Informing the water area and landowners of the targeted area
- Informing the users of the targeted area (possible restrictions for recreational boating and fishing)

11. REPORTING OF THE RESULTS

For ensuring the availability of data and results for further monitoring of the effects or e.g. planning of future activities, it is recommended to compile a report on implemented activities and achieved results after the implementation of the measure.
In addition:

- Information on the observed impacts of the activity on the marine environment should be provided to relevant authorities

Responsible parties should inform relevant HELCOM working groups on the results by providing the needed information to national authorities.

APPENDIX 2 Example list of potential indicators

A. General indicators

The following are the indicators described by HELCOM/MSFD/WFD that are likely to be affected by the activity. They can be included in most cases when assessing and monitoring of the potential effects of planned activities at selected site(s) and estimating the status of the subject area. However, in individual cases not all the general indicators are monitored, or they are not relevant either, and measure specific indicators should be utilized instead (see measure-specific indicatorsbelow).

- Secchi depth
- a-chlorophyll
- Oxygen concentration and saturation in water
- Nutrient concentrations (phosphorus and nitrogen)
- Bottom vegetation and fauna (depth of submerged vegetation, vegetation cover, species composition, N.B. species composition includes marked national variations in WFD)
- PAHs, TBT, dioxins, mercury, heavy metals etc. in contaminated sediments or in biota

B. Measure-specific indicators

Depending on the chosen measure, more specific indicators should be applied according to the method of impact of the planned measure. The indicators should be selected with assistance of a specialist of relevant field of expertise (marine ecology, sediment geology, physical oceanographers etc.).

- Example indicators for the target area:
    - Bottom geology and stratification properties
    - Water movements and retention times
    - Plankton composition
    - Fish populations
    - Stoichiometric ratios for inorganic and total nutrients
    - System metabolism
- Examples for bottom sediment indicators:
    - Concentrations of phosphorus, nitrogen, iron, sulphur and organic carbon and their stoichiometric ratios
    - Sediment phosphorus fractionations (i.e. defines portions of phosphorus to loosely adsorbed, and bound to iron, aluminium, calcium and organic matter)
    - Bottom metabolism (e.g. oxygen and carbon dioxide fluxes in sediments)

In addition, special attention should be paid to hazardous substances. It is substantial to know what is in the sediment before implementing any measures, e.g. by conducting a sediment analysis and/or mapping of the previous uses of the planned site.