SOM Platform 2-2019, Document 2-2, Attachment 1

The attachment is based on the approach for analysing sufficiency of measures that was approved by HOD 56-2019 (Outcome, para 2.16). Draft proposals for steps 4 and 6 have been included in the approved approach to facilitate the understanding of how the new proposal fits to the framework. A section on the pros and cons of the SOM model has also been added (section 3). These proposed additions are also included as extracts in the main document 2-2. The timeline has been updated and the paragraphs on geographic scale have been revised to reflect the latest agreements by Working Groups and Topic Teams. A minor revision has also been proposed for step 1. For clarification time-lags in state recovery is proposed to be reflected separately in the model framework, as step 8. Revisions and new content are indicated in red text.

Contents

1. Overall approach

The aim of the analysis of sufficiency of measures (SOM) is to assess whether existing policies are sufficient to achieve good environmental status (GES) in the Baltic Sea. It relies on estimating the status of the marine environment at some specific future point in time, given measures in existing policies, their implementation status, natural time lags, and predicted development of human activities/pressures over this time period. This is called the 'business-as-usual (BAU) status' (Figure 1). If the analysis indicates that GES is not achieved, then existing measures are not sufficient and additional measures are needed (or existing measures strengthened).

SOM analysis includes the following components:

- information on existing measures and their level of implementation, and possible time lags in their effect (Steps 1-2),
- identifying main pathways for pressures based on links between activities and pressures (Step 3),
- estimating the effect of measures on pressures and state (Step 4),
- projections of the development of human activities/pressures (Step 5),
- estimation of the changes in the state of the marine environment due to changes in pressures (Step 6),
- using the information above to assess the projected status of the marine environment (BAU status) by a specific point in time (Step 7),
- comparison of the BAU status to GES and evaluating how far we are from reaching GES, i.e. the sufficiency of measures (Step 7).
- estimation of the effect of pressure-state time-lags on state components (Step 8).

The steps are described in detail in Section 2.

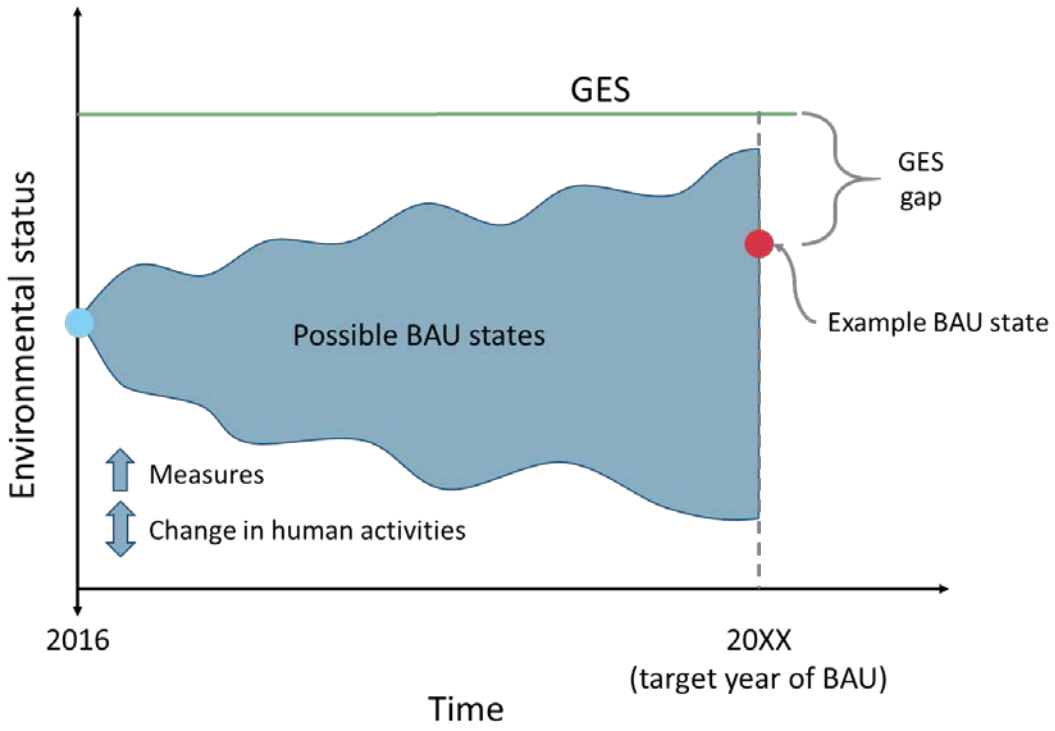


Figure 1. Illustration on the use of the BAU in the gap analysis. Source HELCOM (2018a).

Time frame

The time frame of the BAU should be consistent with the relevant target years of the HELCOM BSAP and the EU MSFD. The time frame should stretch beyond 2020/2021 to allow for more complete impact of existing

policies and measures, but it should not stretch too far into future to avoid uncertainties in changes in the climate and policies.

The kick-off meeting of the SOM Platform suggested to use either 2030 to coincide with the target year for the majority of the UN Sustainable Development Goals (SDGs) or 2033 to coincide with the EU MSFD cycle (Item 3.13 in the Notes from SOM Platform 1-2019).

Existing policies and measures

Measures that are included in the BAU status need to be clearly defined. For all existing relevant policies (e.g. current BSAP, MSFD, WFD, EU Biodiversity Strategy 2020), implemented measures with unrealized effects on base year pressure levels, on-going (or partially implemented) measures and planned measures[1] are proposed to be included in the BAU, as suggested by EN ESA 2-2018 (Item 4.3 in the Outcome of EN ESA 2-2018) and agreed by SOM Platform 1-2019. Thus, it would be assumed that all measures in existing policy frameworks are fully implemented in the time frame of the BAU, independent of their current implementation status, and their effect on reducing pressures would be realized fully in the time frame of the BAU.

An additional analysis was agreed to at SOM Platform 1-2019. It would use the same methodology and included measures at the standard BAU described above, except HELCOM measures would be analysed at their implementation status in the base year rather than under the assumption of full implementation by the target year as is standard. HELCOM measures refers to all measures organized under the HELCOM structure including BSAP and HELCOM recommendations. This analysis provides an illustration how the implementation of ongoing and planned measures affects the state of the sea and where distinction between the two BAU analyses is necessary, the second analysis will be referred to as the BAU implementation analysis (BAUi).

The SOM Platform agreed with the proposal to include in the analysis all types of measures except those related to promotion of research and some administrative measures (i.e. monitoring, coordination, developing SOM indicators, setting targets, developing information systems/tools etc.), which have no direct effect on environmental status.

Environmental themes to cover

It is proposed that the SOM analysis will be carried out for the same environmental themes as in the State of the Baltic Sea report (Figure 2). For some themes a descriptor level evaluation could be appropriate, e.g. to compare the BAU state with the integrated status. For biodiversity, the analyses could be done by ecosystem component, groups of species (e.g. coastal fish) or in some cases by species (e.g. grey seal). For a majority of topics, the status threshold values are proposed to be used as the basis for the analyses. For eutrophication and possibly other pressure-related components, the analyses could rely on pressure targets as agreed in HELCOM. A reflection on this is provided under Section 2, Step 2. Decisions on this aspect will be made in collaboration with SOM topic teams.

For some topics there are no agreed GES threshold values or quantitative pressure reduction targets (e.g. marine litter, underwater noise) in HELCOM, and thus proper gap analysis is not possible. For these topics, it is still possible to assess how much the existing measures will contribute to improving the condition of the Baltic Sea. This is further discussed in Steps 6 and 7.

[1] Note that the term *existing measures* covers implemented, partially implemented/ongoing and planned/not yet implemented measures in existing policies.

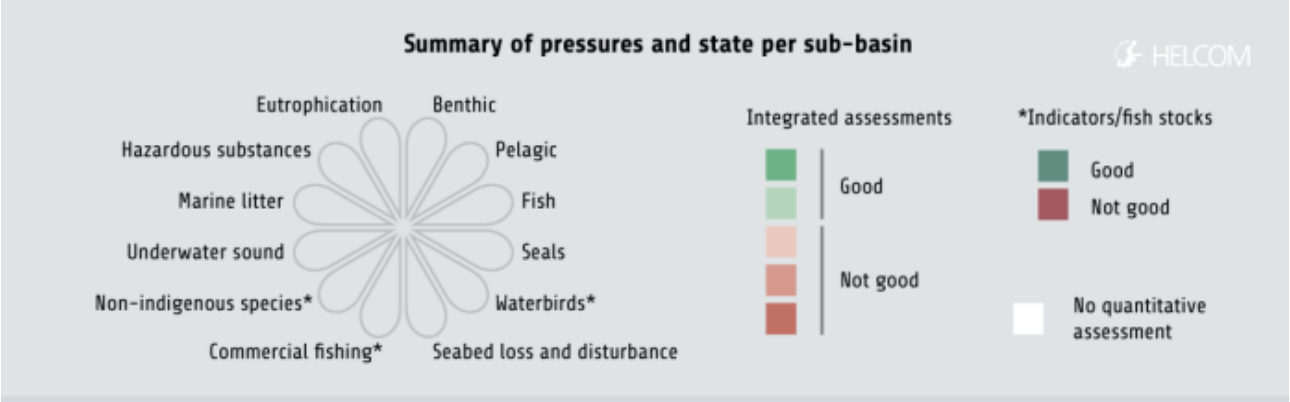


Figure 2. Proposed state components of the SOM analysis.

Geographical scale of the analysis *(revised content)*

The geographical scale of the SOM analysis is aimed at supporting decisions from a regional Baltic Sea perspective. However, the SOM analysis will be carried out at the HELCOM scale 2 level where found relevant.

Geographic scales will vary across environmental themes and reflect the fewest number of groupings required to accurately describe the activities, measures and pressures relevant to each environmental theme as identified by experts in ACTION/SOM. Different scales can be used for different stages of the analysis if requested by topic experts as long as they represent HELCOM scale 2 sub-basins or aggregations thereof. Maps consisting of more than six sub-basin aggregations will be strongly discouraged for resource management purposes. These scales will inform work in steps 1, 4, 6 and 7. The geographical scales must be decided for each of the pressures before carrying out analyses.

Data requirements

Any proposed data inputs represent places where existing data may be incorporated, they are not data requirements. Additionally, there are no requirements for the spatial or temporal coverage. Topic teams are encouraged to be as data rigorous as is possible, but data availability will vary widely between and within topics. While not the desired process, the model can function entirely on expert opinion, and as such concerns over data availability or quality are not necessary.

2. Detailed approach

The proposed approach to carry out the SOM analysis is described in seven steps and follows the overall structure presented above and in Figure 3. The main objective is to assess the sufficiency of measures to achieve GES. This is done by estimating how much existing measures will reduce anthropogenic pressures in the time frame of the BAU, the consequent change in each of the state components presented in Figure 2, and whether this will be sufficient to achieve GES for these components.

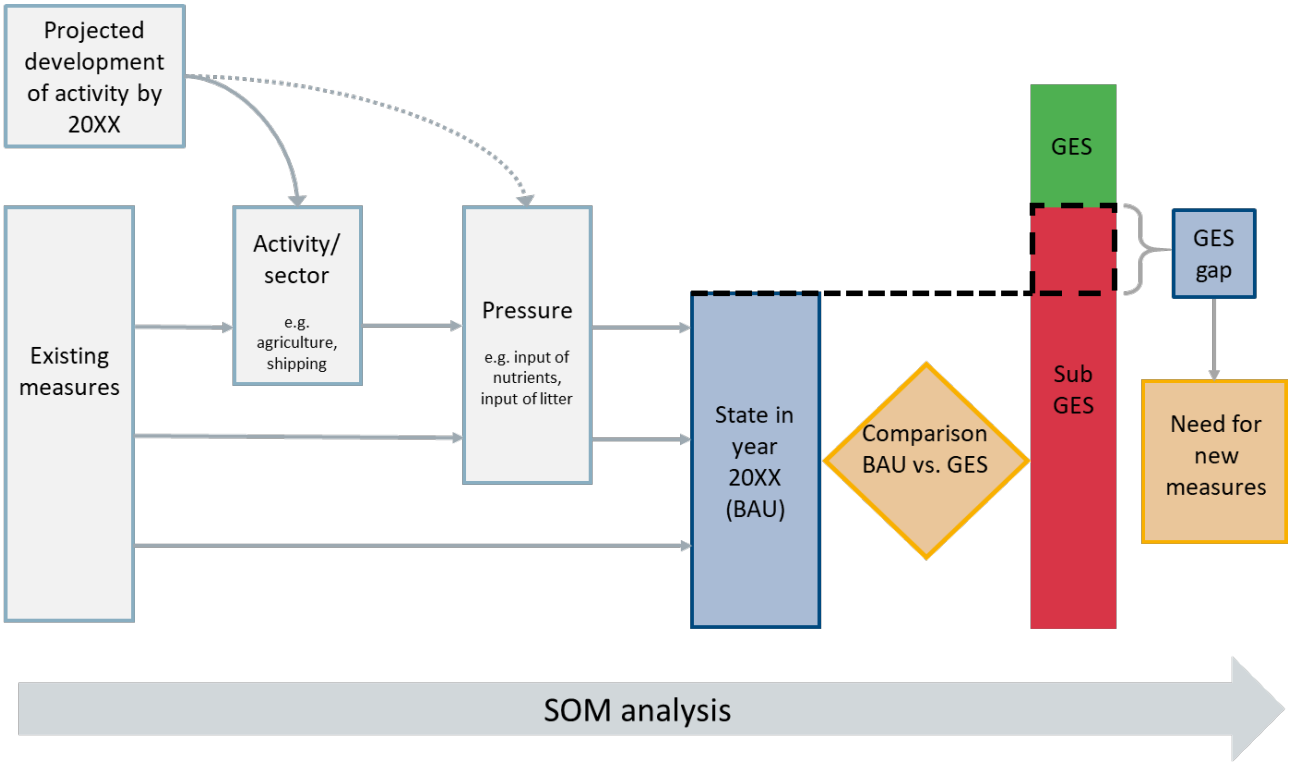


Figure 3. Structure of the SOM analysis: Linking measures with activities, pressures or state components; predicted changes in activities and pressures; comparison of the BAU state with GES; and estimation of the need for new measures.

Step 1. Existing measures (*revised content*)

This section gives detailed information on SOM components related to existing measures and their level of implementation.

1a. Identify measures under existing policies (i.e. existing measures) to assess their effect on the marine environment. This includes global conventions, EU directives and regulations, regional HELCOM actions and national measures.

1b. [New proposal] Categorize measures into common groups based on, for example, the general type of the measure (e.g. legal, technical, monitoring, knowledge and awareness), and the key type of the measure (KTM) (as in the EU MSFD and WFD). Measures are categorized into 'Measure types' which are the units used in the SOM surveys for the effectiveness of measures. The measure type is a mixture of the above-mentioned categorization (e.g. KTM) and more concrete description of the measure. An example of a measure type is 'Technical modification of fishing gears to reduce bycatch of harbour porpoise'. The categorization will allow for simplifying the analysis (i.e. by aggregating similar type of measures) and linking them with activities and/or pressures (or in case of restoration measures, to state).

A majority of measures are linked with human activities, but some may be linked to pressures (e.g. long-range transboundary pollution) and a few are directly linked to state components (e.g. restoration, restocking) (Figure 3).

- If a measure is linked to an activity, i.e. the activity is restricted or changed, then one can follow the linkage framework and estimate the consequent reduction of pressures (Steps 3-4).
- If a measure is linked to a pressure or a state component (restoration measures), then the effect in Step 4 is directly estimated.

1c. Assess the implementation status of the measure, i.e. whether the measure 1) has been implemented and has unrealized effects on base year pressure levels, 2) has been partially implemented or implementation is ongoing, or 3) is planned to be implemented. The implementation status of the measures may differ by countries, which needs to be taken into account. The BSAP implementation status has been assessed already in previous HELCOM processes, but some other measures (e.g. national MSFD measures) may require such an assessment on the basis of EU Member State reports. This step informs especially Step 2.

Information needed	**Data sources**	**Main contribution**
List of measures	HELCOM Explorer HELCOM Recommendations EU MSFD Programmes of measures EU WFD Other EU policies/directives as agreed	ACTION project/secretariat
Implementation status (implemented, partially implemented/ongoing, planned)	As above + EU reports on implementation of PoMs	ACTION project/secretariat, complemented as needed by CPs
Type of measure (e.g. technical, monitoring, knowledge and awareness…) and simplified description	As above	Initial sorting by secretariat/ACTION project, validation by SOM Platform
Whether a measure has an effect on activity, pressure or state	As above	Initial sorting by secretariat/ACTION project, validation by SOM Platform

Step 2. Estimating time-lags in measure-pressure links *(content moved to step 8)*

Even fully implemented measures do not always have an immediate effect on the state due to time lags between measures and pressures (e.g. banned substance with persistent use of legacy production) and pressures and state (e.g. benthic communities after trawling).

Consideration of measure-pressure time-lags

- If a measure was fully implemented by the BAU base year, then one needs to estimate whether there could be any time-lag carrying its effect on effected pressures beyond the base year. If no time-lag is estimated to remain, then the effects of the measure should be visible in the pressure status and the measure does not need to be included in the SOM analyses. Otherwise, the measure is included.
- If a measure is only partially implemented or planned to be implemented, then the assumption is made that full implementation, including full effect on effected pressures, will take place by the BAU end year (cf. the urge by Ministerial Declaration 2018 to implement the BSAP). This assumption is partially suspended in the BAUi scenario, where HELCOM measures are evaluated only at the base year implementation status and measure-pressure time-lags will need to be considered during Step 4.

[text on consideration of pressure-state time lags has been moved to step 8].

Information needed	Data sources	Main contribution
Data on time lags of effect of measures on state	Literature	Input from SOM Topic teams[2], ACTION project

Step 3. Identifying main pathways for pressures using activity-pressure-linkages

Assessing the effects of measures means describing how they affect pressures or state either directly or via activities. Thus, the links between activities and pressures need to be identified and quantified. Information on the linkages between activities and pressures is available, for instance, in the activity-pressure matrix of the TAPAS project, and in more detail in similar matrices of the DEVOTES project. These can be used as a starting point to identify the main pathways. A key issue is that the links should be (semi)quantitative and, hence, allow for assessing the relative contribution of the activities to the pressure. This is important for assessing the proportion of the pressure reduction attributable to each activity and for identifying potential new measures. This phase will include an expert survey which is supported by pre-filled information of significant activities for each pressure type. Experts will be asked to estimate the most likely contribution of relevant activities to specific pressures, as well as, the lower and upper bounds of contribution for each relevant activity.

Information needed	Data sources	Main contribution
Links between activities and pressures	Project results (e.g. HELCOM TAPAS linkage matrices, DEVOTES linkage matrices)	ACTION project. Anticipated that existing results can be used
Information on relative contribution to pressures from different activities	HELCOM reports, literature	Input from SOM Topic teams[2], ACTION project
	Expert-based evaluation	Survey participation by SOM Topic teams, ACTION, HELCOM ENs, EGs, WGs

Step 4. Estimation of effects of measures (*new proposal*)

When the main pathways between activities and pressures have been identified, one will estimate how much measures will jointly reduce each pressure. In the case of restoration measures, this step will entail estimating how much measures will affect the state components and be used in Steps 6 and 7. The information on effects of measures will be first reviewed from several past and on-going projects and then surveyed from experts using probability scales and given prior information of the likely effects.

Expert evaluation can also be used to survey for possible hidden/neglected pressures that were not identified in Step 3. The relative effects of measures on pressures and state are proposed to be defined as probability distributions that describe the probability of different reduction outcomes (e.g. using percentages (%)). The total effect of measures includes the effect of reduction in pressures on state and the direct effect on state.

4 a. **Survey**. Surveys for different topics will be carried out both online and in physical workshops. The survey will be implemented by Webropol software where effectiveness of the measure types is given for each activity-pressure combination (only main activities contributing to a pressure). The effectiveness of existing measures is first surveyed among HELCOM experts on the level of 'Measure types'. The response is on a scale (no effect –> highest effect) where the effectiveness of measure types are surveyed relative to each other

[2] 'SOM Topic teams' refer to teams of national experts that will contribute to the analyses for topics covered by the SOM Platform, see also document 5- 7 Organization of SOM work.

and level of certainty is asked for each response. Figure 4 illustrates the survey question for an activity causing a pressure. As several activities can contribute to same pressure, the survey will have several questions for a pressure and hence will be limited to the main activities linked to a pressure (based on the ACTION activity-pressure survey outcome).

Annex 1 presents a full example of the surveys covered in steps 4 and 6.

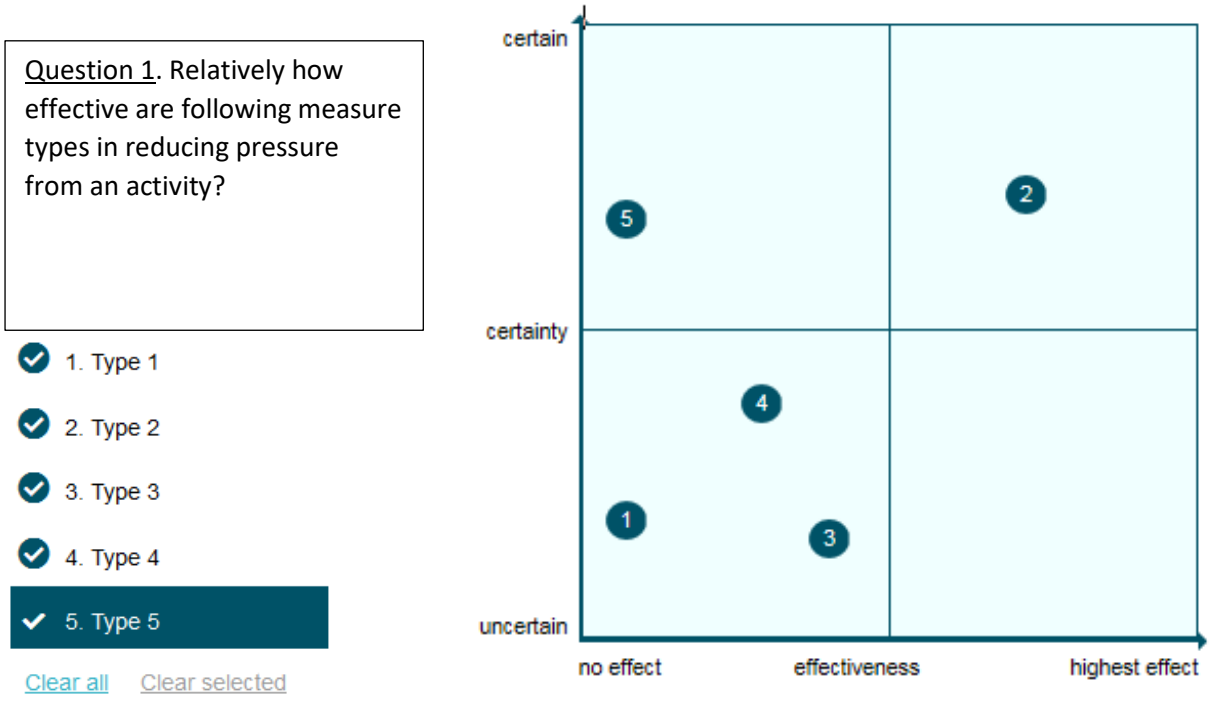


Figure 4. Schematic presentation of the effectiveness of measures survey. The survey question is limited to an activity causing a pressure. Effectiveness of measure types in reducing a pressure is estimated on the horizontal axis and the level of certainty on the vertical axis.

4b. **Reference points.** The pressure reduction in Step 4a was estimated on a relative scale and this needs to be transformed into reduction %. Therefore, the survey will also include a second question how much the most effective measure type is expected to reduce the given pressure (from the given activity). This estimate can be given in categories 0%, 1-3%, 4-6%,71-10%, 11-15%, 16-20 21-30%, 31-40%, 41-60%, 61-80%, 81-99%, 100%. One estimate is sufficient as it gives a reference point to the effectiveness scale (Step 4a), where effectiveness of other measures can be calculated from only one reference point.

4c. **External studies as reference points**. The effectiveness of measures can also be found from independent research outputs. Such data sources have been identified for all pressures and are listed in Annex 2.

These reference points are compared by the ACTION project with the ones from Step 4b.

Step 4d. **Integration**. Pressure reductions from the measure types can be summed to see the total pressure reduction but this reduction is still from one activity. Based on Step 3, one knows estimates of the activity contributions (%) in producing a pressure. By using this information, one can integrate all the pressure reductions. This is the final figure which can be used to (i) compare against pressure targets (e.g. nutrient reduction targets) or (ii) which goes to Step 6.

In addition, some deviations from the general model are planned for the following topics:

- Spatially restricted measures: some measures are not covering the entire Baltic Sea or the assessment area. These are, *inter alia*, national MSFD measures implemented in one country only,

restrictions to trawling which cover a small area of the sea, or marine protected areas. Effectiveness of these in reducing a pressure requires spatial weighting in order to not overemphasize their effectiveness. Support is asked from ACTION WP3 (MPAs).

- Marine litter: the effectiveness will depend on litter type and this may require some modifications to the survey and the analysis.
- Specific legal requirements over the EU Member States: some EU legal requirements are very specific in their pressure reductions. The litter-related directives set numeric pressure reduction targets for single-use plastics and packaging waste are require measures to meet the targets by 2025. As these are assumed to be implemented (as all the measures in BAU period), the litter inputs to sea can be assumed to decrease according to the requirement and not effectiveness survey is needed for these measures.

Information needed	Data sources	Main contribution
Data on effects of measures	National data	Reporting by countries
	Research projects (e.g. BONUS, BLUE2) Scientific literature, studies and models EU MSFD Programmes of measures Sources listed in the SPICE project deliverable on Business-as-usual scenarios EC DG ENV databases (e.g. ARCADIS 2012)	Input from SOM Topic teams[2], ACTION project on existing measures Input from SOM synopses on potential new actions and measures
	Expert evaluation/validation	Working Groups, Expert Groups, ACTION project, SOM Platform

Step 5. Projected development of human activities/pressures

The other component affecting the BAU state in addition to existing measures is the possible (external) change in activities and pressures due to changes in human behaviour in the time frame of the BAU. This may counteract the effect of existing measures if activities or pressures increase.

This step is proposed to be run as an additional scenario on top of the effectiveness of existing measures analysis. The analysis will be limited to the predominant activities and pressures. As this component would be considered as external to the rest of the framework, the BAU status could be developed by assuming 1) no change and 2) the most likely change in predominant activities/pressures. This would enable assessing how the future change in activities/pressures affects the BAU status.

At minimum, qualitative assessment describing the trend (increasing, decreasing, no change) in the activity/pressure should be made, but quantitative information should be used when available from existing studies. For developing the BAU, the information should be converted into numerical values, e.g. 10% increase in the activity, using expert evaluation when needed. If little information is available, it would be possible to assume something about the change in activities and see how the BAU status changes.

The scenarios of projected human activities will be defined following the guidelines developed in the HELCOM SPICE project. Shared socioeconomic pathways developed in the BONUS BALTCIAPP project and alternative scenarios for blue economies created in Maritime Spatial Planning for Sustainable Blue Economies (PLAN4BLUE) project can be used in defining the scenarios of projected human activities.

Information needed	Data sources	Main contribution
Information on the future development of activities (qualitative/quantitative)	Literature, sectorial future outlook reports Project outputs (e.g. BONUS) National data (e.g. on EU MSFD Initial Assessments, and MSPD)	secretariat/ACTION/ Input from SOM Topic teams[2]
Converting the information into numerical values	Expert evaluation	Working Groups, Expert Groups, ACTION project, SOM Platform

Step 6. Linking reduced pressures with state components (*new proposal*)

Following the suggestions of the kick-off meeting of SOM platform, the SOM analysis will be structured using the same major pressure themes and biodiversity components as in the State of the Baltic Sea report (HOLAS II) and other HELCOM agreements. Additionally, the methodology for the SOM analysis will be adaptable to cover both topics with and without established GES thresholds or pressure targets.

Due to the inclusion of projected development (Step 5) in the SOM analysis and the desired ability to rerun the SOM analysis to evaluate the optimal set of additional measures to reach GES if/when a gap to GES is identified, it is necessary to be able to evaluate the effect of the full range of potential pressure changes on state condition. Optimally this would be represented in a series of pressure-state response curves, similar to Figure 4. However, data availability and the presence/absence of GES thresholds will require flexibility in this approach. Qualitative and semi-qualitative options are being considered throughout this step to adapt to topic characteristics. Additional consultation with Topic Teams is required before the approach is fully developed but in general the conceivable methods are as follows:

- When a pressure target exists (e.g. eutrophication), the state will not be evaluated in the BAU model. However, the pressure-state time-lags are included in the final considerations.
- When a GES threshold exists, contributions of pressures to state will be determined. Pressure-state response curves would then be generated through existing data and expert opinion for each identified major pressure(s), which affect the state component. These data would then allow for the calculation of a BAU status and the gap analysis.
- When a GES threshold does not exist, an approximate good status based on qualitative environmental targets set in various HELCOM documents (BSAP, topic specific action plans, ministerial declarations, etc.) is proposed. This will allow for a generalized gap analysis, which can be used in an advisory capacity to express the scale of improvement required to achieve a hypothetical GES.

Two major topics still under consideration in consultation with SOM platform and ACTION partners are (1) whether to link pressure to state improvement or to the probability of achieving GES, which will impact how GES threshold values are used in the model, and (2) how to best link states to multiple pressures. The SOM platform and appropriate HELCOM bodies will be kept informed as this work progresses.

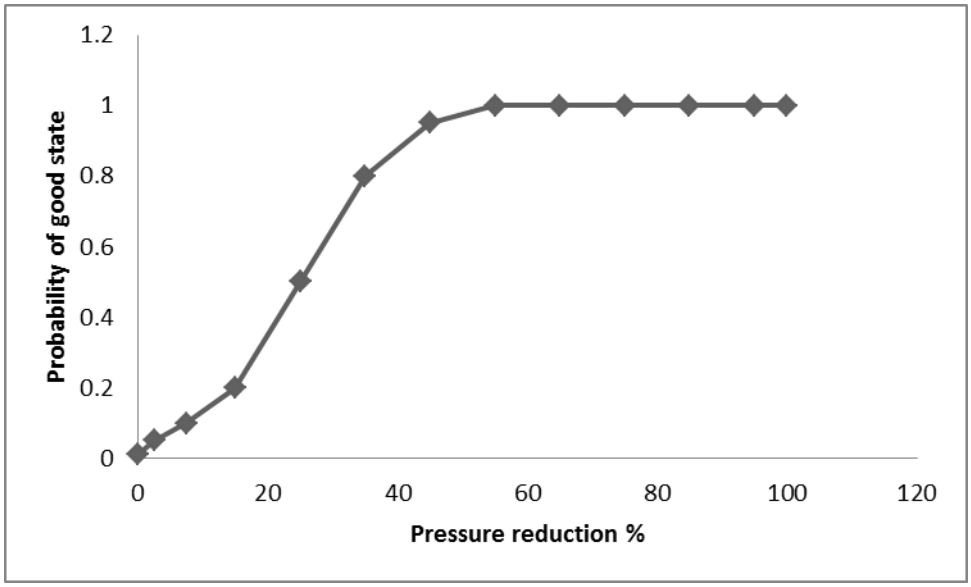


Figure 4. Conceptual pressure-state response curve. The curve illustrates the potential of pressure reduction to improve the state presented as a probability of reaching a good state. Alternative configurations might include semi-qualitative scales or be linked to state improvement.

6a. **Prioritizing pressures**. ACTION project will define the most significant pressures for each state component by using the information in HELCOM core indicators and Baltic Sea Impact Index. Using the pre-selected pressures (based on MSFD Annex III), a survey is carried out to ask the most significant pressures for each of the state components. The pressure ranking is done on a relative scale (Figure 5) which allows for estimating the contributions of the pressures for the state component. It is possible to add other pressures to the response if necessary.

6b. **Needed pressure reduction.** After the ranking, the survey asks for the most significant pressure what the needed pressure reduction % is in order to reach good state assuming that other significant pressures are decreased the same amount. This is done by asking for the minimum, most likely and maximum reduction (Figure 6). The ranking of pressures allows the scaling of the other significant pressures to the most significant one. It is also assumed that the uncertainty for all the other pressures is proportional to the most important one.

As the relations of pressures are known from this step, it is possible to assess what is the probability to reach good state given that the pressures are reduced the amount resulting from step 4. It is also possible to approximate the reduction needed on one pressure to reach good state assuming that the reductions on other pressures are known.

4.
Identify 1-6 most significant pressures preventing the good environmental state for the given state variable. Express their significance on a scale 1-5

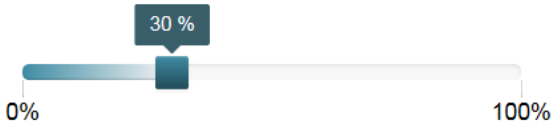
	Not significant	1	2	3	4	5
Pressure 1	○	○	◉	○	○	○
Pressure 2	○	○	○	○	○	◉
Pressure 3	○	○	○	◉	○	○
Pressure 4	○	◉	○	○	○	○
Pressure 5	○	○	◉	○	○	○
Other pressure	○	○	○	○	○	○

5. If you identified an other significant pressure, please name it here

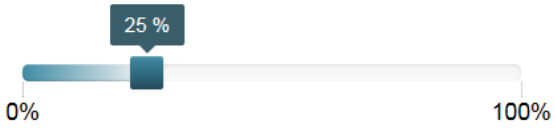
Select

Figure 5. Survey of the pressure importance. The pressures have been pre-selected (see text) but one free choice can be added if necessary

6. What is the most likely %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



7.
What is the minimum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



8.
What is the maximum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?

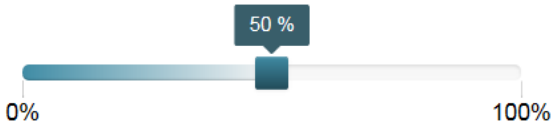


Figure 6. Needed pressure reduction to reach good state for the most important pressure (min., most likely and max.). Survey asks these three scores only for the most important pressure, while the rest can be calculated from the replies in Figure 5.

Information needed	Data sources	Main contribution

Spatial data on pressures and impacts	HELCOM map and data service	Secretariat
Spatial data on state components	HELCOM map and data service	Secretariat
Information for selecting relevant pressures	Baltic Sea Impact Index (BSII) Core indicator reports, ODEMM framework	Secretariat/ACTION project
Responses of indicators/state components to changes in pressures	Previous research projects and reports Scientific literature Existing models	Input from SOM Topic teams[2], ACTION project
	Expert evaluation/validation	Working Groups, Expert Groups, ACTION project, SOM Platform

Step 7. Comparison of BAU and GES and assessing sufficiency of measures

When the BAU status has been developed, it will be compared with GES to identify whether there is a gap and new measures are needed. The total effect of measures on state is calculated as the reduction of the GES gap resulting from reductions in pressures based on the previous steps. This reduction is proposed to be measured as an increase in the probability of reaching GES for different themes and components. The probabilistic approach further enables an extensive analysis of uncertainty and risk related to the BAU outcome. In addition, the Step 5 results (projected development in human activities/pressures) will also affect the outcome of the SOM analysis. If a pressure is predicted to increase and no measures are in place to control that pressure, the gap to GES may increase.

Step 8. Time lags in state recovery (*new proposal*)

Reductions in pressures during the BAU period do not necessarily mean that the state will become good before e.g. 2030. The lags in recovery may result from multiple reasons which are identified in the ACTION project.

In the context of SOM analysis, the issue with time lags could be resolved by focusing on pressure reductions and possible effect on state (even if the state recovery takes place much longer time).

Consideration of pressure-state time-lags *(relocated content)*

- Pressure-state time lags are not included in the BAU scenario. Instead they will be evaluated as additional information alongside GES thresholds as in Step 7. By separating pressure-state time lags from the BAU scenario, the effect of measures can be separated from unavoidable time-lags (e.g. population growth) and allow for the consideration of the sufficiency of measures in the case of avoidable time-lags (i.e. topic is projected to eventually reach GES under BAU conditions, but GES could be reached sooner if additional measures were implemented). Additionally, topics with the defining feature of very large pressure-state time lags (e.g. eutrophication) will only be evaluated to the level of pressure in the BAU analysis as it is already known that GES will not be achieved by the BAU target year.

3. Discussion of the pros and cons of the SOM model *(new content)*

3.1 Assumptions of the SOM model

The SOM approach agreed in HELCOM has made the major assumption that all the measures (i) will be implemented by the end year of BAU period, e.g. 2030 and (ii) they will have sufficiently time to influence pressure reduction.

The level of implementation of some of the BSAP measures is low and this may cause a source of error in the SOM model. Due to this, the SOM model will be run also with the current implementation status to see what the urgency for implementing the remaining BSAP measures is.

Implementation of the national measures under EU MSFD has been reported to EU Commission, but no summary reports have been planned to include to the HELCOM SOM model. The assumption for full implementation will remain.

Inherent in this assumption is that the measures are implemented strongly, e.g. using best available practices or best environmental techniques. This is an assumption of the strength of measures and it is not possible to evaluate this in the SOM model.

3.2 Simplifications of the SOM model

The SOM model will cover all human activities and pressures and all the HOLAS II state components and captures all measures agreed in the Baltic Sea. This means that the model is wider than any previous model of this field and, hence, requires some simplifications.

Standard working units. Due to the wide coverage of measures, activities, pressures and state components, no common metrics can be found for the model. Therefore, the model builds on the principle of pressure reduction (%), which can be linked to improve the state.

Measure types instead of real measures. Hundreds of existing measures in the Baltic Sea region are too much to analyse even in longer processes than HELCOM BSAP UP. To simplify the catalogue of measures, the SOM approach groups them to 'measure types' which aim to capture the main elements of the measures but still remain on relatively abstract level.

This has the limitation that the measure types and real measures are not equal (i.e. the former are abstractions and the latter are closer to reality). In a hypothetical example, a measure type 'apply pingers in gillnets to reduce bycatch of harbour porpoise' does not say how many pingers are being used in gillnets, how widely this is applied in different parts of the Baltic, is this enforced or how frequently this requirement is not followed (or how frequently a pinger prevented an animal drowning). Estimating the effectiveness of a measure type will, however, show that all measures underneath have certain effectiveness. The following steps then show whether the measures are sufficient for harbour porpoise (i.e. do we expect that no new measures are needed) or not. If the measures are estimated sufficient, there is the question whether they require strengthening even if there is no need for new measures in BSAP II.

Relative scale of effectiveness of measures. The estimation of the effectiveness of a measure type in reducing a pressure is not simple. Even working along a % scale is challenging for scientists. The SOM model simplifies the expert survey by asking the effectiveness on the scale from 'no effect' to 'very high effect' (in reducing the pressure). The survey covers all the measure types relevant for all selected combinations of activities and pressures and therefore the relative scale is not only simpler but also quicker.

To transform the survey responses to the % scale, the SOM approach uses existing studies as 'anchors'. These not only help in producing numbers (with uncertainties) to the model but also give validation data.

Pressure –state linkage. Dependency of state on pressures is the basic assumption in environmental science. In reality, many of these links have not been established in quantitative way. In the SOM model, the expert-based pressure-state link (Step 6b) is therefore essential, but it can in some cases be compared with the established pressure-state links (e.g. nutrient inputs, fisheries).

General. The SOM model will not give the final answer with a single number of the general sufficiency, but all the model outputs must be interpreted. The benefits of the model use are, however, numerous, as shown in the next section.

3.3 Benefits of the SOM approach

The sections above described assumptions and limitations which are good to keep in mind when interpreting outputs from the SOM model. The approach also has benefits (also beside the fact that the model is possible to run).

Use of effectiveness results for new measures. As the measure types are not too specific, it is possible to use them for estimating effectiveness of the new measures. This can be done two ways: (i) if a measure is considered new but still falls under the description of the measure type, its effectiveness can be taken directly from the survey outcome, or (ii) if the new measure is between two measure types, its effectiveness can be placed between effectiveness of the two related types. This will greatly simplify the BSAP UP process in 2020, when the new measures are discussed.

Use of pressure-state linkage. The pressure-state linkage is a precondition for many environmental analyses and tools and not very often shown for marine assessments. The expert-based suggestions for these linkages (with uncertainty ranges) can be later validated by specific data and (if found adequate) used for further analyses. For example, preliminary analyses of the HELCOM TAPAS sensitivity scores show relatively good agreement among experts of the sensitive features of the Baltic Sea ecosystem.

4. Time table for the SOM analyses

In terms of collecting data and information (for details see tables for each step of the approach), the ACTION project and the Secretariat will coordinate the collation of lists of measures and their implementation status for all topics and contribute to collating existing information on projections of development of human activities. The ACTION project will assess and collate other necessary information for the SOM analyses for the topics covered the project. For topics covered by the SOM Platform the collation of data and information will be done by the Topic teams that have been established to support the analyses of topics covered by the SOM Platform, in line with the proposed task list and time-line for 2019 activities below (for further information on Topic teams see document 2-2 to HOD 56-2019). SYKE, as partner in ACTION project and contributor to the SOM Platform, will carry out the BAU state and gap analysis for all topics, provided that all necessary information is available.

2019 SOM task list and timeline *(revised content)*

Task	**Outcome/contribution**	**Timeline**
Identify relevant measures frameworks	Very short information document	April
Identify presence of time-lags between measures and pressures	Very short information document	April
Propose geographic scale of analysis	Proposal	April
Expert evaluation: activity-pressure matrix	Participate in survey	August-October
Pressure-state time-lags	Data (models, project outcomes, literature)	September-November
Measure-pressure time-lag verification	Verify time-lag effected measures from list provided by Secretariat	September-October
Measure list verification	Verify no missing relevant measures from list provided by Secretariat	September-October
Effect of measures data	Data (models, project outcomes, literature, national reports)	September-November
Expert evaluation: effectiveness of measures	Participate in survey/workshop	October-November
Expert evaluation: pressure-state linkage	Participate in survey/workshop	October-November

Development of future activities	Data (models, project outcomes, literature, national reports)	Late fall
Synopses on potential new measures	Information document	End of year

The ToR for the SOM Platform outlines the preparation of syntheses on potential new actions based on e.g. recent innovation and development projects or successful measures carried out on a national level. The format for such synopses was proposed by HELCOM SOM Platform 1-2019 and HELCOM 40-2019 agreed that they can be submitted by Contracting Parties, HELCOM subsidiary bodies, international project and observers. Results from the HELCOM ACTION project will also inform the selection of new actions or strengthened actions. SOM synopses are aimed at being prepared by end of 2019 and the SOM analyses by March 2020. When the synopses and results of the SOM analyses are ready, they will be compiled and serve as input to HELCOM Working Groups in support for proposing new HELCOM actions for the updated BSAP e.g. through organizing thematic workshops or similar. The second meeting of the SOM Platform, to be held 16-17 September 2019, will discuss the organization and format for such thematic workshops.

The last step of ToR for the SOM Platform outlines analyses of cost-effectiveness to support the selection of new HELCOM actions. In the HELCOM ACTION project, analyses of cost-effectiveness will be carried out for the topics covered by the project under work package 6.2. Such analyses will take place after the preliminary proposal on new actions. An analysis will then be carried out to evaluate the joint effects of proposed new measures and the cost-effectiveness of proposed measures. Preliminary results of such analyses are anticipated to be ready in autumn 2020.

The more detailed planning of cost-effectiveness analyses will also take place at the next meeting of the SOM Platform. Additional considerations to be discussed before the selection of new actions takes place, as highlighted by Contracting Parties, are e.g. to identify which measures are relevant to implement at the regional level, the sustainability of proposed measures, and to consider the potential to analyse the costs and benefits of the updated BSAP as a whole.

Table 1 outlines some of the central steps of planned work for the SOM Platform and tentative timing of required contributions from HELCOM Working Groups and Expert Groups to support the work as an outcome of HELCOM SOM Platform 1-2019 (Annex 4). HOD will inherently be informed on the progress and tentative proposals at each upcoming meeting. Observers are invited to participate in activities according to normal procedure and workshops and a dedicated stakeholder conference is planned for in 2020 (cf Work plan for the BSAP update).

Timetable for SOM analyses as in Annex 4, meeting of HELCOM SOM Platform-1 2019

YEAR	2019				2020			
Indicative steps	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Approach	ACTION/ SOM proposal **2nd version end of March**	GEAR agreement 15-17 May 2019						
Collation of data and information input to analyses		SOM Platform/ ACTION **End of June**						
Synopses on potential new measures		Lead countries, international projects, NGOs	Lead countries, international projects, NGOs	Lead countries, international projects, NGOs				
2nd meeting SOM Platform			**Week 16-20 September 2019**					
Expert-based input to SOM analyses. review of synopses			WGs, EGs, (SOM Platform, ACTION project)	WGs, EGs (SOM Platform, ACTION project)				
Running BAU on existing measures				SOM Platform/ ACTION				
3rd SOM Platform meeting					**March 2020 (joint meeting ACTION WP6)**			
Thematic workshops, to discuss results and propose potential new actions						WGs, EGs, experts **May/June 2019**		
Assess status with potential new HELCOM actions							SOM Platform/ ACTION	
Cost-effectiveness analyses							SOM Platform/ ACTION	
4th SOM Platform meeting							**September 2020**	
Continued elaboration and endorsement of new/strengthened HELCOM actions							WGs	WGs
[Benefits of the BSAP as a whole]							SOM Platform	SOM Platform

References (additions)

Ahlvik, L., Ekholm, P., Hyytiäinen, K. & Pitkänen, H. (2014) An economiceecological model to evaluate impacts of nutrient abatement in the Baltic Sea. Environmental Modelling & Software 55: 164-175.

ARCADIS (2012) Economic assessment of policy measures for the implementation of the MSFD. Final report and Excel database of a study for the EC DG ENV (Project No 11601). Available at http://ec.europa.eu/environment/enveco/water/pdf/report.pdf

EC project "BLUE2" on a database of policy measures for protection of inland and marine waters in Europe (available at http://ec.europa.eu/environment/blue2_en.htm

Hasler, B., Smart, J.C.R., Fonnesbech-Wulff, A., Andersen, H.E., et al. (2014) Hydro-economic modelling of cost-effective transboundary water quality management in the Baltic Sea. Water Resources and Economics 5: 1–23

HELCOM 2018a. State of the Baltic Sea – Second HELCOM holistic assessment 2011-2016. Available in: http://stateofthebalticsea.helcom.fi/

HELCOM 2018b. SPICE project deliverable 3.3. Development of a regional "business-as-usual" scenario (BAU) to be used as a baseline in the integrated assessment of the marine environment. Available at: http://www.helcom.fi/Documents/HELCOM%20at%20work/Projects/Completed%20projects/SPICE/Theme%203_Deliverable%203.3.pdf

HELCOM 2016. TAPAS Theme 1 Deliverable: Baltic Sea pressure and impact indices (BSPI/BSII) Available at: http://www.helcom.fi/Documents/HELCOM%20at%20work/Projects/Completed%20projects/TAPAS/TAPAS%20Theme%201%20Deliverable.pdf (see Annex 6 for the TAPAS linkage framework between activities and pressures)

Hyytiäinen, K., Czajkowski, M., Ahlvik, L. & Zandersen, M. (2017) Dynamic cost-and-effect model under changing climate and socio-economic drivers. BONUS BALTICAPP, Deliverable 3.6, https://blogs.helsinki.fi/balticapp/publications/

Knights, A. M., Piet, G. J., Jongbloed, R. H., Tamis, J. E., White, L., Akoglu, E., ... & Leppanen, J. M. 2015. An exposure-effect approach for evaluating ecosystem-wide risks from human activities. ICES Journal of Marine Science, 72(3), 1105-1115.

Kontogianni, A., Tourkolias, C., Damigos, D., Skourtos, M., & Zanou, B. (2015). Modeling expert judgment to assess cost-effectiveness of EU Marine Strategy Framework Directive programs of measures. *Marine Policy*, *62*, 203-212.

Oinonen, S., Hyytiäinen, K., Ahlvik, L., Laamanen, M., Lehtoranta, V., Salojärvi, J., & Virtanen, J. (2016). Cost-effective marine protection-a pragmatic approach. *PloS one*, *11*(1), e0147085.

Owenius, S. & van der Nat, D. (2011) Measures for water protection and nutrient reduction. Baltic COMPASS report.

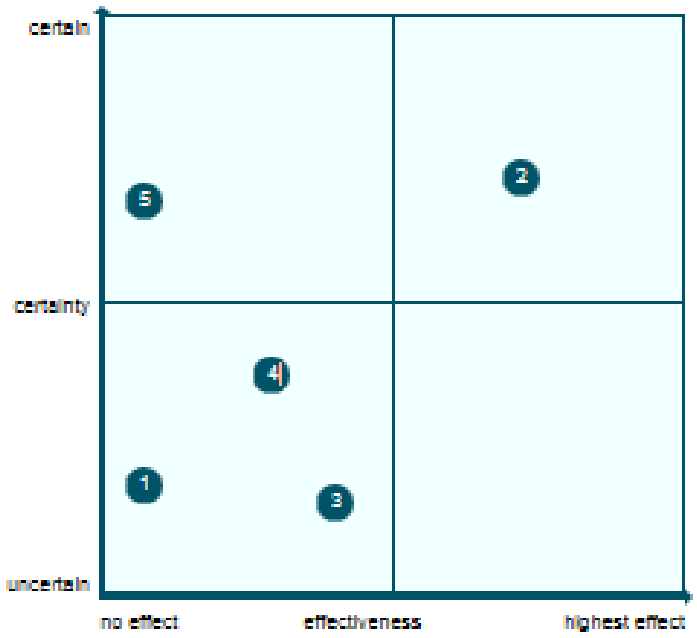
Wulff, F., Humborg, C., Andersen, H. E., Blicher-Mathiesen, G., Czajkowski, M., Elofsson, K., Fonnesbech-Wulff, A., Hasler, B., Hong, B., Jansons, V., Mörth, C.-M., Smart, J. C. R., Smedberg, E., Stålnacke, P., Swaney, D. P., Thodsen, H., Was, A., and Żylicz, T., 2014. Reduction of Baltic Sea Nutrient Inputs and Allocation of Abatement Costs Within the Baltic Sea Catchment. AMBIO: A Journal of the Human Environment, 43(1):11-25.

ANNEX 1 Example survey covering Steps 4 and 6

Measure Pressure state

1. Relatively how effective are following measure types in reducing pressure from an activity?

1. Type 1
2. Type 2
3. Type 3
4. Type 4
5. Type 5



Clear all Clear selected

2. How much will a measure of the most effective measure type (furthest on the right in previous question grid) reduce pressure from an activity?

○ 0%	○ 1-5%	○ 6-10%
○ 11-15%	○ 16-20%	○ 21-30%
○ 31-40%	◉ 41-60%	○ 61-80%
○ 81-99%	○ 100%	

Next

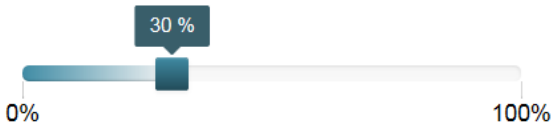
4.
Identify 1-6 most significant pressures preventing the good environmental state for the given state variable. Express their significance on a scale 1-5

	Not significant	1	2	3	4	5
Pressure 1	○	○	◉	○	○	○
Pressure 2	○	○	○	○	○	◉
Pressure 3	○	○	○	◉	○	○
Pressure 4	○	◉	○	○	○	○
Pressure 5	○	○	◉	○	○	○
Other pressure	○	○	○	○	○	○

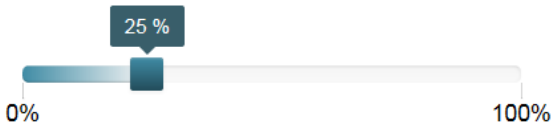
5. If you identified an other significant pressure, please name it here

Select

6. What is the most likely %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



7.
What is the minimum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?



8.
What is the maximum %-reduction of significant pressure that is required to reach the good state for the given state variable assuming that other identified significant pressures are reduced the same %-amount?