Baltic Marine Environment Protection Commission

HELCOM Platform for sufficiency of measures — SOM Platform 2-2019

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Background

The HELCOM ACTION Project is an EU co-funded project for which HELCOM is the coordinator. The project works closely with the HELCOM *ad hoc* Platform on Sufficiency of Measures (SOM Platform) focussing on four major topics: by-catch (WP1), impacts on the seafloor (WP2), Marine Protected Areas, MPAs (WP3) and input of nutrients (WP4). Work Package 6 (WP6) of the ACTION project is developing proposals on the methodology to analyse sufficiency of measures. In addition to developing information that can support the analysis of the sufficiency of measures these WPs will further assemble important data and deliver results that can support the BSAP update and long-term HELCOM work.

The progress made and technical developments carried out so far within each of these WPs (WP 1-4) are briefly introduced in the document below. WP5 (Conditions that influence achievement of GES) will provide a separate document that will consider options on how an approach can be integrated with the finalized methodology for the SOM analyses. The inception report, the outcome of the project partner kick-off meeting, in which methods and plans for the work for each WP is available at this link and the outcome and meeting documents for the first HELCOM workshop carried out within the project, HELCOM ACTION Workshop 2.1 - Impacts on the seabed: Activity- Pressure-Measures, are available at this link. Ongoing developments, such as workshops and reports, will be added to the HELCOM ACTION website as the project progresses.

Progress within the ACTION Project has also been discussed at several relevant HELCOM Working Group Meetings. This includes WP1 and 2 being presented at HELCOM FISH 10-2019 (see presentations 5 and 6, and Outcomes paragraphs 3.11-3.20), State and Conservation 10-2019 (see presentations 12 and 20, and Outcomes paragraphs 3N.16, 3N.63-69 and 87), and PRESSURE 10-2019 (see presentation DS-4, and Outcomes paragraphs 3.16-3.31 and DS3-8). There is also interaction underway with a number of other relevant groups via recent meetings, such as PLC, RedCore, ESA Network, and GEAR 20-2019 (see Outcomes paragraph 3.27). Progress within the project is planned to be reported to a large number of relevant HELCOM Expert and Working Groups in the coming autumn and spring meeting cycles (e.g. EN BENTHIC, OSPAR-HELCOM By-catch workshop, and all relevant Working Groups).

Action requested

The Meeting is invited to:

- take note of the information provided;
- provide suggestions or guidance to the project that may be of value for further work.

The HELCOM ACTION Project – progress update on technical work packages

The information provided below aims to briefly summarise progress made to date within the four of the five technical WPs within the ACTION project. Much of the work is ongoing and the WPs are at different stages of developing project products (e.g. data analyses, reports, summaries), and work with WP6 related to the sufficiency of measures (SOM) is ongoing to ensure that information provided by these WPs is suitable for supporting the planned SOM analysis.

WP1 By-catch

By-catch of marine mammals (and birds) has been documented in many gillnet fisheries and is regarded as a major anthropogenic impact on marine mammals. This work package (WP1) will identify high-risk areas for by-catch of marine mammals and birds, focusing on the south-western Baltic Sea, though other co-operations to expand this region of study are being explored. By identifying these high-risk areas, and by-catch estimates, it will be possible to evaluate the level of pressure on non-target populations from the fisheries industry and/or identify areas where monitoring of bycatch needs to be intensified. To facilitate this approach density data of harbour porpoises combined with gillnet fishing effort data will serve as input to model high-risk areas. To further verify the model CCTV footage will be used to confirm actual porpoise by-catches from commercial gillnet vessels. In other areas where the data depth or possibility to validate the models are not available (e.g. limited monitoring or no CCTV footage) then the possibility to predict high risk areas by combining fishing effort data and harbour porpoise distribution data will be explored. Overall, the work will aim to provide estimates of total by-catch of harbour porpoises.

A similar approach will be applied to explore the by-catch of certain bird species and other mammals. Although Baltic Sea scale density maps of sea birds (eider ducks, cormorants, and scoters) and seals (grey seal and harbour seal) are incomplete, the by-catches of these species are available from video footage. For these species by-catch estimates will be made as well as a gap analysis on the additional needs for data to identify high-risk by-catch areas.

The work on the above items is ongoing, with further details and the approach to be taken (e.g. data collection from logbooks and AIS databases) set out in the inception report (see page 8). The data collection phase is ongoing into autumn 2019, with data analyses planned to be complete by the end of 2019. The partners in WP1 will be heavily involved in the OSPAR-HELCOM workshop on by-catch (3-5 September) and initial findings will be briefly presented at that workshop.

In order to enhance the understanding of potential mitigation measures an evaluation of measures to reduce by-catch of harbour porpoises will be carried out. Existing approaches are generally quite limited, principally fisheries closures, alternative fishing gears and acoustic deterrents. For example, with the harbour porpoise the main method to reduce by-catch is the use of acoustic deterrent devices, so called pingers. Gaining a greater understanding of the effectiveness of these and their cost effectiveness will be furthered, considering the cost in terms of possible catch/landings losses and implementation (e.g. via the DISPLACE model analysis).

The data collection and rationalization phase of this work is ongoing and progressing well. A number of technical issues are currently being addressed such as the handling of seasonal data, appropriate gridding

of data, how to handle gaps (e.g. for offshore bird data) during the further assessment work, and how to most suitably combine variable data sets (e.g. species density, fishing effort, CCTV, AIS and logbook data) in the final evaluation. A new software is being tested in the coming weeks to overcome certain issues related to some data collection/recording differences that occur within the region. In combination with this work a gap analysis is also being carried out.

WP2 impacts on the seafloor

WP2 has a number of ongoing activities that are somewhat separate in their development and approach, which will be integrated at the later stages of the project, and within the final report, to provide an overview of issued related to impacts on the seafloor and measures that can contribute to mitigating these pressures or impacts. WP2 held the first planned workshop of the project, HELCOM ACTION Workshop 2.1 - Impacts on the seabed: Activity- Pressure-Measures, on 22-23 May 2019. The notes, documents and presentations from the workshop are now openly available at the meeting site and via the ACTION project website.

WP 2.1 Identification of major pressures in Baltic Sea sub-basins

Work on drafting a report to consolidate existing results on the activities and pressures causing major impacts on the benthic sea marine environment and its habitats is underway. The format of the summary report was presented in and reviewed by a HELCOM Action WP2.1 project workshop and discussion was held on details or additional components to consider (see Workshop Notes, Agenda item 1). Further drafting of the report is ongoing, and the summary report will include the following topics:

1. Introduction

- Benthic habitats and their state are threatened and impacted by various human activities that occur at sea and/or in coastal areas, as well as land-based activities. Understanding the impacts of human activities on the seabed is highly important. The objective of the report is to consolidate existing information on pressures impacting on, and measures to reduce these on the seabed. Pressures, their effects and adverse effects on benthic habitats, and the current level of knowledge available for the assessment of habitats under the HELCOM Baltic Sea Action Plan (BSAP) and the Marine Strategy Framework Directive (MSFD), as well as best available knowledge related to restoration of benthic habitats will be included.

2. Assessment of pressures for benthic habitats

- Numerous human activities at sea cause various pressures in the marine environment. Pressures affecting the seabed and seabed habitats have been studied in several Baltic-wide projects, and at the European scale also. In this chapter, pressures affecting the seabed will be defined and described and the contribution of activities to pressures will be discussed.
- To support this section components from the ACTION project (e.g. activity-pressure linkages) will be utilised, as well as aspects related to pressure causeway and contribution of activities to an overall pressure. Other prior knowledge will also be incorporated, such as the relevant outcomes of Baltic BOOST (summarised in BSEP164), TAPAS and HOLAS II. In addition, developments taking place currently within ICES WKBEDPRES & WKBEDLOSS Workshops, ICES WKTRADE, and EU TG Seabed will also be considered.

3. Effects of pressures on habitat condition

- To assess the condition of seabed habitats we have to understand the impacts affecting their state. Here, habitat sensitivities, condition, and pressures per habitat (habitat by habitat) will be presented and discussed.
- General sensitivities of habitats (from TAPAS Sensitivity scores), as well as sensitivities of benthic biota from MARLIN, SYMPHONY and the Marine Evidence based Sensitivity Assessment for thresholds and resistance, will also be reviewed. Physical loss and damage to seabed habitats, a cross-comparison of environmental assessments and pressures, and evidence from ACTION WP2 on restoration and

displacement of activities (i.e. the highlights of the DISPLACE model) will also be integrated to the report.

4. Approaches to assess adversely affected habitats

- Adverse effects relate to the tolerance and recoverability of each habitat type, including its structure and functions. Adversely affected habitats, and thresholds to assess habitats, have been explored previously and this subject will be reviewed to build a clear definition of adversely affected habitats and gather possible threshold values that could be applied to the assessment of habitats.

5. Measures to reach GES of benthic habitats and seafloor integrity

- The review will also include the listing of current measures taking place within the ACTION project and incorporate and discussion and knowledge on costs or effectiveness. As part of the work associated with WP6 EN BENTHIC will assess and evaluate the effectiveness of the measures in November 2019. Evidence from ACTION WP2.2 for coastal restoration, and a consolidated review of the DISPLACE model findings (predominantly related to fishing), will also be included as well as touching on any gaps or new/alternative approaches of potential value.

6. Habitat integration across EUNIS levels

- For assessing impacts on the seabed, different hierarchical levels can be tackled in together. Practical guidance for integration of levels exists already and will be discussed in this chapter as this forms a critical building block in developing the link between detailed monitoring (i.e. data collection), sub-regional, and regional (as well as research and pan-European) scales when carrying out a suitable seafloor and benthic habitats assessment. Summarising broad habitat types present in the Baltic Sea, practical guidance how different hierarchical levels of habitats, and the integration of HELCOM HUB and EUNIS habitat type classifications will also be discussed.

7. A method for assessing lost, disturbed and adversely affected area of benthic habitats

- Finally, a method for the assessment of impacts on benthic habitats, based on the above input, will be included as a summary of the overall work. This will take the form of a step-wise method guideline for carrying out a technical assessment of the lost, disturbed and adversely affected area (km^2) of benthic habitat types from different activities.

Another major task of this section of the WP was the workshop, HELCOM ACTION Workshop 2.1 - Impacts on the seabed: Activity- Pressure-Measures, held on 22-23 May 2019. The notes, documents and presentations from the workshop are now openly available at the meeting site and via the ACTION project website.

A draft of the report outlined above will be sent to HELCOM EN BENTHIC, EN DREDS, STATE&CONSERVATION and PRESSURE once it is completed. Comments and input from these groups will be welcomed at that stage.

WP 2.2 Identification of effective measures to reduce impacts on the seafloor

Restoration of coastal habitats

The objective is to analyze the effectiveness and sufficiency of existing restoration measures related to impacts on the seabed. To do this, appropriate measures have been identified and collated, and the feasibility of potential measures to restore coastal habitats has been evaluated. A draft list has been prepared and is available via the HELCOM ACTION Workshop 2.1 site (see introductory document and draft list). Identifying in which coastal areas/sub-basins such restoration measures would be particularly relevant along the Baltic Sea coast, in addition to estimating the cost and cost effectiveness of such restoration measures is also part of this process. This is ongoing within the project.

Typical drivers of restoration are the biodiversity convention, MSFD, HELCOM status assessment, regional and national objectives, as well as restoration as a method for environmental compensation. The identification of cost-effective restoration measures will largely be based on the Swedish report by Kraufvelin et al. (2019, in prep.) but also on expert opinions and questionnaires that consider central restoration or similar measures, with a main focus on shallow coastal areas in the Baltic Sea region. The list

is comprehensive and provides detailed information for at least twelve restoration measures, encompassing potential measures, some of which are currently used in the Baltic Sea.

The task to identify in which coastal areas the restoration measures are of highest significance/need will be carried out together with regional experts (using e.g. questionnaires, HELCOM maps, etc.) and taking into consideration the outcome of the WP2.1 report (described above). This can also connect to Pan Baltic Scope work on pressures and impacts on Essential fish habitats, and will be an aspect considered during later stages of this process. The strategy is to make a rough description of which habitats and areas that are the most damaged and where different types of restoration could be efficient. The aim is to suggest viable and cost-effective restoration measures to these habitats/areas, and to provide recommendations for specific measures needed to restore the damaged habitats/systems.

Project partners are continuing work to finalizes the list of potential restoration methods, and their feasibility/relevance/cost efficiency, as well as work on the identification of in which coastal areas the restoration measures would be of highest significance/need. Further progress is anticipated in later autumn, with a technical update and review anticipated at HELCOM EN BENTHIC and HELCOM State and Conservation.

Spatial fishery management measures – including a brief overview of the DISPLACE model and its application

The impacts on the seafloor WP will look at pressures and activities on the seafloor and focus on aspects related to spatial regulation of offshore fisheries (utilizing the DISPLACE model) and restoration measures in coastal areas, including effects on benthic communities and the cost of measures.

DISPLACE (www.displace-project.org) is an impact evaluation platform developed to support marine spatial planning (MSP) and marine fisheries-related management issues through an underlying agent-based simulation model (Bastardie *et al.* 2014, 2015, 2017). The model primarily simulates individual fishing agents as a function of individual incentives and the spatial availability of fisheries´ resource, and further projects scenarios of alternative harvest control rules with the consequent time and space redistribution of fishing effort. It allows a detailed evaluation of the fisher´s decision-making process when confronted to particular management measures, together with evaluating the economic viability related to these policy decisions constrained by the conditions of the underlying harvested stocks. The benefit of the approach is to helping predicting the most likely displacement of the fishing pressure in reaction to measures and changes in stock distributions, within the space of possibilities that make economic sense to the fisheries, and therefore anticipate the effects on the Common Fisheries policy (CFP) and the Marine Strategy Framework Directive (MSFD) related estimates and indicators. Informing the modelling platform with existing monitoring systems is used to benchmark the effectiveness of alternative management measures and spatial plans affecting fisheries, and pressuring other ecosystem components (e.g. link to WP1 bycatch). The model is designed so that other human activities than fishing and creating pressure on the seafloor such as shipping lanes can also accumulate to the impact.

Within HELCOM ACTION WP2 (Impacts on the seabed), this benchmarking should support the identification of areas most suitable for implementing spatial fishery regulations. Analysis of where fishing effort distributes shows that the effort typically concentrate on the same areas (fishing grounds) while low but potentially highly impacting effort could apply on their margins. To reduce the impact on the Baltic seafloor, spatial management scenarios can be investigated that would limit the extent of current fishing grounds especially from their margins. Instead of just removing effort, such measures might create some concentration of fishing effort on the remaining narrowed opened areas that may or may not offset the benefit obtained from released pressure on conservation areas. Unfortunately, if the net effect is negative, it will move the system further away from Good Environmental Status (GES). Hence, the relationships between benthos state (e.g. expressed as the ratio of measured benthos abundance over a carrying

capacity) and the reduction in fishing pressure will be investigated by testing a gradient of effort cut and make sure the effort cut is followed by a reduction in impact on the sea floor.

The investigation under WP2 should further report on the cost and effect of mitigating or displacing the fishing pressure in the Baltic Sea, also including economic distributional effects, information of direct relevance to WP6. Consistent with the MSFD (Art. 13.3) we should conduct impact assessment for concerns on social and economic effect for setting/testing environmental targets, anticipate the socio-economic effects of choosing targets and alternative pathways to achieve GES, while GES being achieved might sometimes have adverse effects on some economic components. Anticipating these aspects should help informing the policy makers about the impacted stakeholders and prepare facilitation for acceptance/compliance to the identified measures most likely to close the gap towards GES. The aim is to contribute integrating to the transboundary context for consistent and coordinated measures across the Baltic subregions. By testing and analyzing the effectiveness of measures and by identifying potential new measures, the project is expected to contribute directly to the update of the HELCOM BSAP and the implementation and tentative update of MSFD Programs of Measures in the Baltic Sea for countries being EU Member States There is a need for “greater coherence with related EU legislation, in particular the Habitats and Birds Directives (92/43/EEC and 2009/147/EC) and the Water Framework Directive (2000/60/EC), and for more coherent and coordinated approaches within and between marine regions and subregions” and Article 11(1) in particular creates a direct link from the CFP to the MSFD.

Within this WP there are a number of scenarios that are being currently considered and being tested using the DISPLACE model. Utilizing the model to examine the impacts of a reduction of bottom-contact fishing pressure on marginal areas (i.e. areas on the periphery of major fishing grounds) at several different scales - including the whole Baltic Sea, per EUNIS broad habitat type, or by National Exclusive Economic Zone (EEZ) - can give an indication of the possible change in status for the marine environment. Furthermore, by running multiple related scenarios, such as reduction of fishing effort by 5 (see Figure 1), 10, 15 and 20% can provide a gradient of the impacts and thus a gradient of respective status improvements. The probability for status improvements, or the likely developments towards achieving a perceived Good Environmental Status (or based on some inferred threshold values), can thus be deduced from components of the model output that relate to major species components of the benthic habitat. In addition, the catch/landings and economic impact evaluation of such spatial restriction to the fishing, or fishing reductions, can also be predicted by the model and the model can explore maintaining these parameters (i.e. the economic aspects or maximizing the catch allocation) while displacing the fishing activities to already impacted areas.

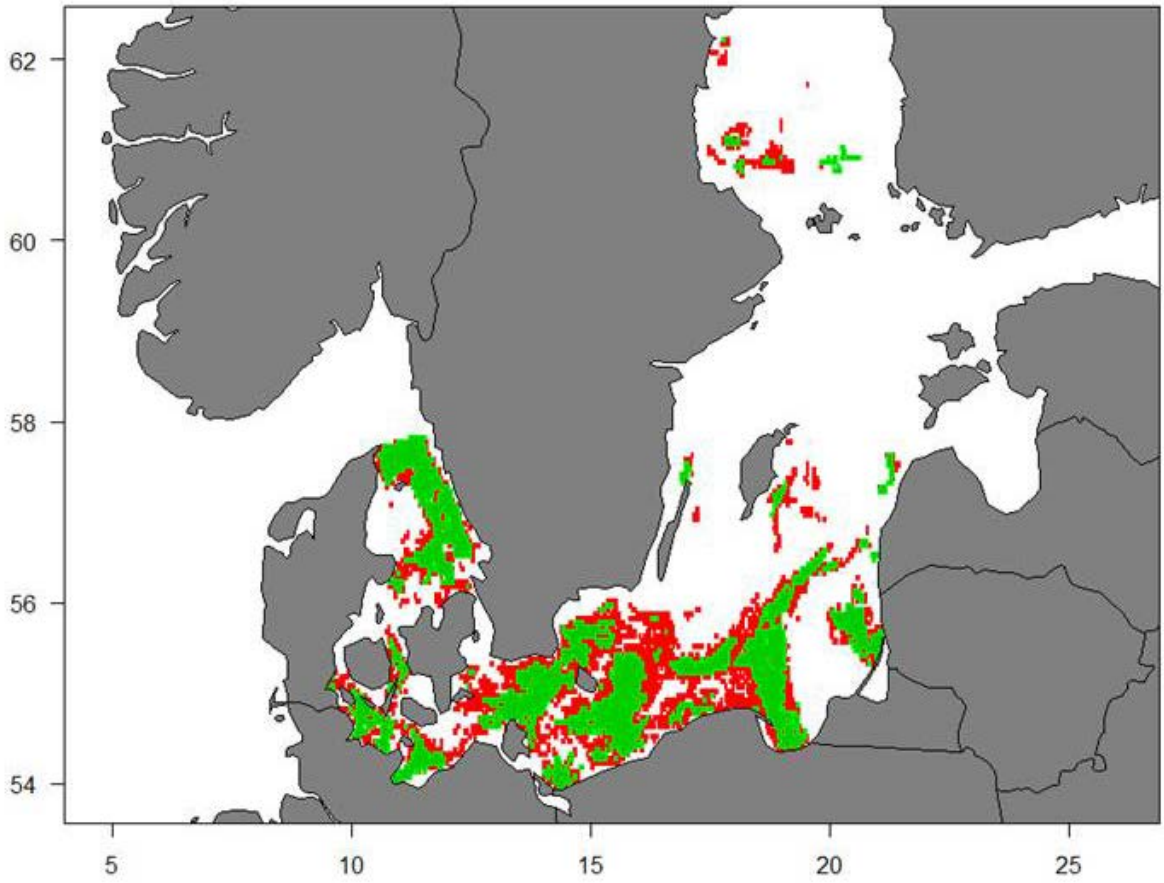

Figure 1. Example of the effects of a 5% reduction of fishing effort in marginal areas of existing fishing areas in the EEZs of Baltic Sea countries (bottom trawling data). Red = no-go areas from the reduction, and Green = fishing areas available after the imposed reduction. Note that as effort is concentrated it is likely that a 5% cut in effort will correspond to more than 5% surface area cut.

Further scenarios that are being explored in the project, and at different spatial divisions (i.e. subdivisions of the Baltic Sea), include:

- An overall reduction of the spatial extent of fishing pressure and displacement effect.
- Closure of passive gears fisheries in identified by-catch hotspots (harbour porpoise).
- Temporary closure of passive gears fisheries in areas significant for breeding birds.
- Including the effects of hypoxia on benthos recovery rates and impact of this on fisheries activities.
- Indirect impact on the seafloor, such as sediment remobilization from fishing or commercial shipping.

These scenarios are being considered to include in the standard output from the model that will inform the economic impact (e.g. catch/landings value, increased operating cost for fishing), and the relative impact evaluation of alternatives on the recovery of benthic habitats and biota, and the potential to maintain these parameters by displacing the fisheries pressure in a way that would maintain a larger area of undisturbed seabed.

WP3 Marine protected areas (MPAs)

The WP aims to carry out an assessment of effectiveness of the MPA network. The project is designed to evaluate the MSFD Programme of Measures and to contribute to the update of the HELCOM Baltic Sea Action Plan by 2021. The network of marine protected areas (MPA's, includes Natura 2000, HELCOM MPAs,

and national MPAs designated under MSFD Programmes of Measures) is one of the measures towards achieving GES in the Baltic Sea, therefore one of the project aims is to analyse the effectiveness of the existing MPA network by developing and applying the designed method at the regional scale. Since detailed information and knowledge on the management of MPA's is available at the Member state and local MPA level only, the decision to approach the needed level of details was taken to design the questionnaire and distribute it through countries representatives. The method developed within the WP was presented to State and Conservation 10-2019 with comments received and subsequently considered (see presentation 20, Outcomes paragraphs 3N.62-69).

The overall concept for the management effectiveness evaluation of the Baltic Sea MPA network is based on the management effectiveness assessment framework elaborated by the International Union for Conservation of Nature (IUCN) World Commission on Protected Areas (WCPA). The framework is based on four major criteria: i) relevance of the management measure(s) to the pressure(s); ii) implementation of the management measure (in case measure is relevant to the pressure); iii) enforcement of the measure during implementation (in case measure is relevant to the pressure and implemented); and iv) effect of the management measure on conservation feature(s).

The analysis is focused on MPAs, which have been reported and included into EEA database (893 sites) or those newly designated by countries under MSFD PoMs (6 sites). The priority in selection of MPAs for the assessment was given to NATURA 2000 sites which are also designated HELCOM MPA sites. For the purpose of the data and information gathering questionnaire, MPAs with management plans were pre-selected, taking into account the proportion of their distribution among countries, location along the Baltic latitudinal/longitudinal gradient and proportion of the marine part of the total MPA area. Division along the latitudinal gradient is based on HELCOM sub-regions for Sweden (southern part being delineated from the central part by the boundary between Arkona Sea and Bornholm Sea; central part delineated from the northern part by boundary between the Åland Sea and the Bothnian Sea). Adequate representation of Finnish sites was also ensured by proportional inclusions of MPAs from the eastern (Gulf of Finland), central (Åland Sea) and western parts (Bothnian Sea, The Quark, Bothnian Bay). Numbers of MPAs to be included into questionnaire according to country, geographic distribution and proportion of the marine part are shown in Table 1 below.

Table 1. Numbers of MPAs to be assessed via the questionnaire.

Country	**Number and proportion of N2000 sites with management plans**	**Number and proportion of N2000 sites with management plans according to proportion of marine part**			**Number of MPAs selected for assessment by the questionnaire (fully marine / marine area between 50 and 100%/ marine area <50%)**
		Fully marine sites	**Marine part between 50 and 100%**	**Marine part <50%**	
Sweden	448 (64%)	15 3%	235 (53%)	198 (44%)	114 (3/61/50)
Denmark	105 (15%)	29 (28%)	57 (54%)	19 (18%)	40 (11/22/7)
Finland	59 (8%)	1 (2%)	44 (75%)	14 (23%)	18 (1/11/6)
Germany	41 (7%)	9 (22%)	21 (51%)	11 (27%)	14 (3/7/4)
Estonia	37 (5%)	28 (72%)	9 (28%)	0 (0%)	12 (9/3/0)

In total, 200 MPAs were selected based on criteria described above. Additionally, all Danish MSFD sites (6), as well as Latvian (3) and Lithuanian (1) sites that have legally approved management plans, have been included into the assessment, increasing the total number of sites for evaluation with the questionnaire up to 210.

The decision was taken to use human activities instead of pressures for assessing the relevance of management measures, since activities are of primary interest when it comes to implementing measures that may mitigate. The list of human activities generating pressure to specific conservation features was compiled based on the HELCOM SOM Platform shortlist of activities and pressures and cross-linked with the list of pressures/activities/threats used in the reporting on Habitats Directive Article 17. Pressures for human activities are given in the Questionnaire as guidance for assessment of management measures.

Conservation features considered by the Questionnaire include all Habitat Directive Annex I marine habitat types and species listed under categories of Endangered or Critically endangered in the HELCOM Red List assessment (HELCOM, 2013), which are also included into Bird or Habitat Directive Annexes, Table 2.

Table 2. Selection of conservation features for the questionnaire.

Species	**HELCOM Red List 2013**	**EU Habitats Directive**	**EU Bird Directive**
Macrophytes:			
Hippuris tetraphylla	EN	Annex II, IV	
Persicaria foliosa	EN	Annex II, IV	
Fishes:			
Thymallus thymallus	CR	Annex V	
Baltic Sea birds:			
Anser fabalis,	EN		Annex II
Clangula hyemalis,	EN		Annex II
Gavia stellata,	CR		Annex I
Gavia arctica,	CR		Annex I
Polysticta stelleri	EN		Annex I
Marine mammals:			
Phocoena phocoena	CR (Baltic Sea subpopulation)	Annex II, IV	

*Red List categories according to IUCN criteria: EN – endangered species; CR – critically endangered species.

The following criteria were formulated to request from experts when evaluating the management of human activities affecting conservation features in a given MPA, using one of four assessment categories:

- category 1: human activity not addressed by management measure in the management plan;
- category 2: human activity addressed by management measure in the management plan but not legally implemented, i.e. no administrative action was taken to transfer management measure from the MP to the implementation;
- category 3: human activity addressed by management measure in the management plan, legally implemented but not enforced legally;
- category 4: human activity addressed by management measure in the management plan, legally implemented and enforced i.e. using administrative instruments and defined control measures.

All human activities independently of their occurrence, either before or after approval of the management plans, will be considered in the evaluation. At the same time, only those human activities (pressures), that are relevant for a given conservation feature in the MPA, according to an expert judgement, scientific evidence or indirect information, will be included into the assessment.

The work package is currently considering two types of human activities: 1. management takes place through MPA management plan and is valid within MPA area; 2. management is taking place outside MPA, and is managed through other legal acts (e.g. EIA procedures, WFD etc) than using a management plan for the particular MPA. Inclusion of second type of human activities into the questionnaire extends significantly the overall effort needed to complete the evaluation, therefore different technical solutions are being tested to simplify the questionnaire form. A draft was implemented (can be visualised at: https://www.surveymonkey.com/r/KLLW5BY) and the final questionnaire is currently under final review by work package partners. The request to fill in the questionnaire will be distributed by the HELCOM Secretariat to the country representatives in early September and the outcomes are expected by the end of October.

Based on the responses received from the questionnaires, the work package will estimate the contribution of the MPAs to GES through assessing management effectiveness (listed as management categories 1-4) for 16 selected conservation features (*i.e.* Red listed species and habitat types). The following questions of management effectiveness will be answered from the questionnaire data:

- what is the share of fully, partly and not managed MPAs?
- what conservation features have the highest/lowest management effectiveness level through MPAs?
- what human activities are least/best managed in MPAs?
- do we have geographic patterns in management effectiveness?
- is the proportion of marine area relative to the total MPA area important for management effectiveness?
- do we have adequate management effectiveness for endangered/critically endangered species in MPAs? (does MPAs have adequate management effectiveness for conservation of endangered/critically endangered species?)
- what human activities generating pressures for conservation features within MPAs are managed through other legal instruments but MPA management plans?

WP4 Input of nutrients

4.1 Follow up existing measures

The CPs are annually delivering, among other parameters, nutrient inputs and river runoff for the complete Baltic Sea catchment. As a part of the quality assurance of riverine input data for the nutrient input indicator and MAI-CART follow-up assessment work within the HELCOM PLC-7 project, the Baltic Nest Institute (BNI) analyses the temporal development of these data. Nutrient inputs for each river are flow normalized in order to illustrate the changes that are not due to variations in river runoff. In addition, simple linear trends are computed. Within the ACTION project this information has been extracted, analyzed and compiled into a report with illustrations of the time-development from 1995-2017 for each river. The information collated in the report consist of over 300 pages of trend data, a single example of which is shown below (Figure 2). These data analyses and visualizations were developed to provide assistance to the relevant contact points within the HELCOM Contracting Parties to select interesting test case catchments for further analysis within the ACTION project- the idea being to select examples of areas where good and bad results had been observed (i.e. where measures were considered to have been effective, or not) , thus allowing a comparative overall assessment.

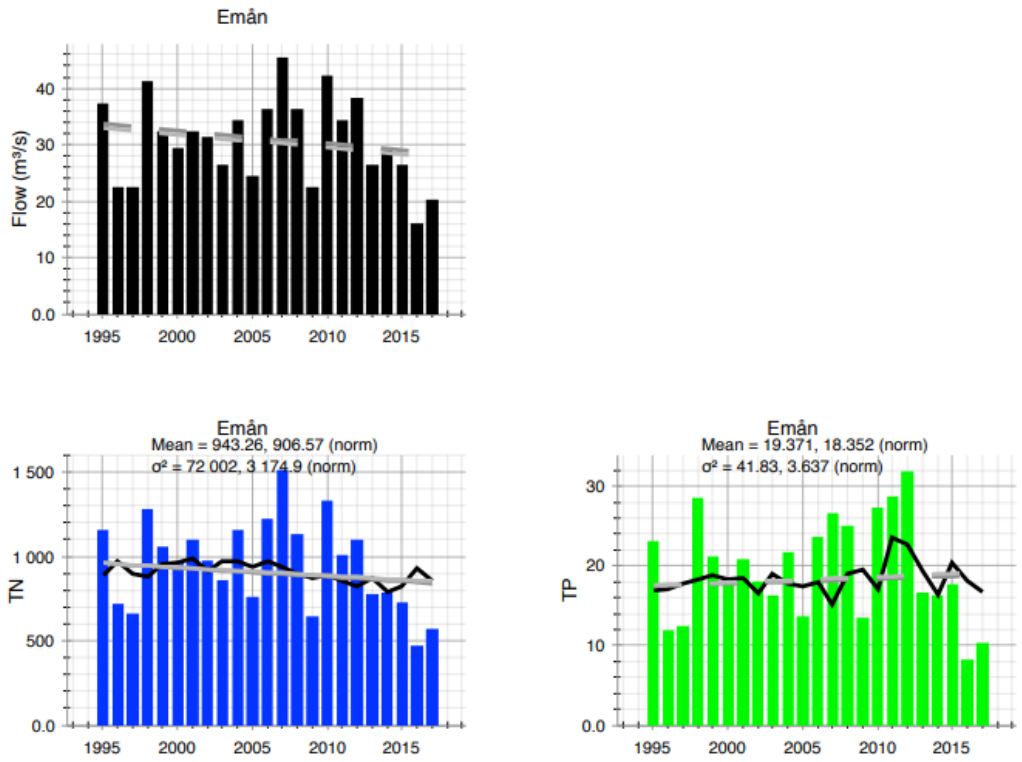

Figure 2. Example of one trend prepared for the Emån river, Baltic Proper, Sweden. Data is obtained from the PLC water database, with additions/correction made in PLC5.5, PLC6 and PLC7 for assessment purposes. Bars in graphs show actual flow/load, black lines in load graphs are flow normalized loads, dark grey lines show trends calculated using Mann-Kendall method, and light grey show trends calculated from linear regression. Solid lines are significant trends. Basic statistical measures of the time-series are indicated in the graphs. Flow rate, Total Nitrogen (TN) and Total Phosphorus (TP) are shown.

The above information, including a proposal and selection criteria on suitable rivers for further analysis has been shared with identified contact points for the HELCOM Contracting Parties (via the PLC contacts). A number of responses have been received, other aspects where discussion is needed or no response has yet been received are being followed up, and Contracting Parties represented in the ACTION project are currently making the selection following the above system within the project. Project partners are currently furthering the analyses on the identified test cases and the first version of the results will be presented at the HELCOM Workshop with River Basin Management Authorities that will take place on 18-20 September 2019 in Riga, Latvia.

One example of case studies is the well documented processes in small catchment areas in Denmark, the approach enabling successful approaches to reduce agricultural nutrient loads to be documented. Monitoring of agricultural mini-catchments has been part of the Danish national monitoring programme (NOVANA) since 1989 (Blicher-Mathiesen et al., 2019). Nitrogen (N) concentrations and loads have been monitored in soil water, tile drains, and streams within five agricultural mini-catchments. This has resulted in a national dataset on trends in flow-weighted N concentrations relative to factors such as agricultural management history, surface field balances of nitrogen and phosphorous and level of implemented mitigation measures. The analyses and trends in agricultural management, and level of the implemented mitigations measures, in the five catchments, covering the period from 1997 until circa 2017, will be compiled into a more detailed report within the project – though some initial findings are presented below (Figure 3 and Table 5). Mitigation measures implemented in the agricultural catchments involve increased manure storage capacity, better spreading technology for manure, measures that were mainly implemented in the period 1990-1998. Farmers have especially been implementing higher coverage of

catch crops and later soil tillage in agriculture after 2006 following national targets for those two mitigation measurements.

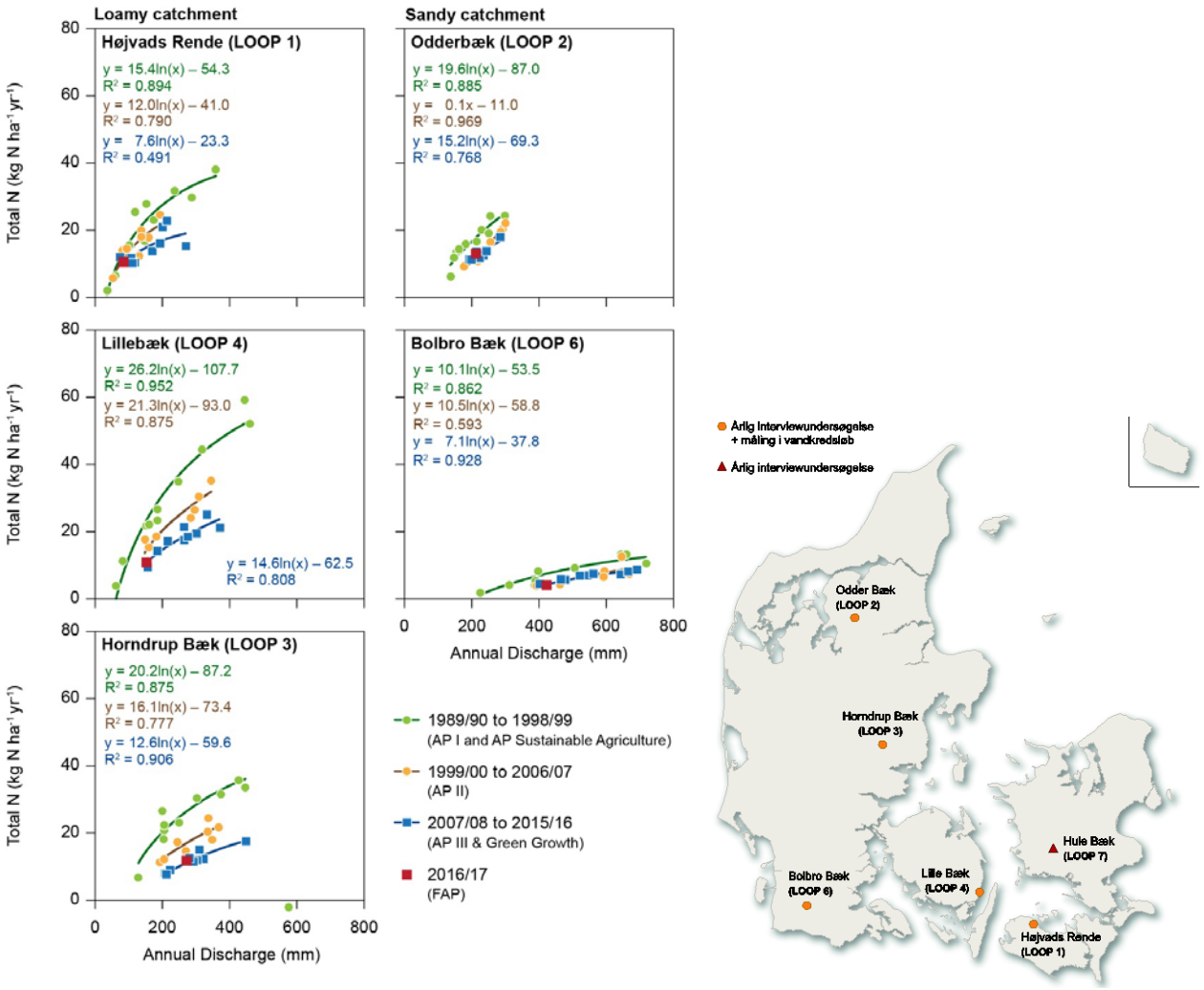

Figure 3. Left - Annual diffuse total N load in stream water in the five monitored agricultural dominated mini-catchments for three periods related to implementation of Action Plans and mitigation measures to reduce nitrogen load to aquatic waters. 1989/90-2016/17. Data is calculated for the hydrological year June 1 to May 31. Right - Location of five agricultural dominated mini-catchment in Denmark (http://dce2.au.dk/pub/SR305.pdf).

Table 5. Characteristics of soil type, proportion of agriculture, and mean of runoff, age of oxidized stream water, and Livestock Units (L.U.) for the period 1990-2015 in the monitored catchments.

	Soil type	Catchment area	Agri. area	Mean annual runoff	95% age Oxidized water	L.U.
		(km^2)	(%)	(mm)	(year)	($LU\ ha^{-1}$)
Højvads Rende	Loamy	9.8	60	156	2.33	0.15
Lillebæk	Loamy	4.4	85	240	1.02	0.77
Horndrup Bæk	Loamy	5.1	68	297	1.01	0.75
Odderbæk	Sandy	11.4	83	225	9.11	1.26
Bolbro Bæk	Sandy	7.8	85	503	2.25	1.16

Initial trials to use statistical forecasting to estimate future development of nutrient inputs to the Baltic Sea in the coming years showed that uncertainties were very large even for a relatively short forecast span (i.e. from 2017 to 2021). The preliminary data assessed so far indicate an alternative approach needs to be considered. A report will be prepared in the future, but discussion is ongoing on the specifics of a new approach that can provide a more reliable and suitable assessment. Source apportionment information and a collation of existing published effectiveness studies are being explored, and discussion on how such information, and available data, can be utilized to assess the sufficiency of existing measures is underway within the project.

Work to evaluate the contribution of point sources is also underway. A draft of the analysed data will be presented at the next meetings of HELCOM PLC (Pollution Load Compilation) and HELCOM RedCore.

4.2 Compatibility of targets under different marine policies

The aim of this section of work is to find nutrient loads per country and sub-basin which would reflect the loads if rivers would be in good ecological status (GES loads) according to Water Framework Directive (WFD, 2000/60/EC). Annex V of WFD defines that good status corresponds to nutrient concentrations not exceeding the levels to ensure the functioning of the ecosystem and the achievement of good status based on the biological quality elements. Nutrient concentrations used here are the values which mark the border between the good and moderate ecological status of rivers. The WFD does not define exact nutrient species to be assessed, but in WFD Annex VIII, the substances which contribute to eutrophication, in particular, nitrates (NO_3^-) and phosphates (PO_4^{3-}) are listed. Since we are interested in the total load of nutrients, total nitrogen and phosphorus concentrations at the good/moderate border are applied.

Identified contact points for all HELCOM countries have been contacted to gather the necessary information for estimating GES loads per country and Baltic sub-basins. Full datasets are available for Estonia, Latvia, and Lithuania while some data are still missing or not available from the other countries. Some data issues exist, and need to be overcome, for example not all countries have set ecological quality criteria for total nitrogen and phosphorus. For instance, Denmark has set total nitrogen loads (not total phosphorus concentrations) per year for sub-watersheds, which correspond the good ecological status. On one hand, these values can be used as the calculated TN loads for Denmark, but on the other hand, these load estimates could not account for the same average river flow as in the present study. Furthermore, the sub-watershed areas are mapped so that they cannot be directly divided between HELCOM sub-basins.

For Finland and Germany, all data are available except the total nitrogen boundary values for three river types in Finland and one river in Germany. Thus, the estimates are done without some rivers at this stage. Data from Poland and Sweden are expected to be received in late August – September. Russia has provided allowable concentrations in river mouths which are recalculated to TN and TP. For Narva river, data on total nutrients are available, for rivers Neva and Luga nutrient boundaries for total phosphorus were calculated using coefficients that allow the transfer from mineral or filtered nutrients to total nutrients.

Below an example based on Estonia is presented.

Estonia has three river basin districts. Rivers are divided into seven types based on catchment size and organic matter content. Type A waters are rich in humic substances and type B waters contain little organic matter. Catchment size typology is divided into four classes: type I (10–100 km^2), type II (>100–1000 km^2), type III (>1000–10 000 km^2) and type IV (>10 000 km^2). Type IV is used only for river Narva. Boundary conditions for total nitrogen and total phosphorus are as yearly means (Table 3).

Table 3 Nutrient boundary conditions (good/moderate boundary) for Estonian river types

River type	G/M boundary for TN	G/M boundary for TP
Type I A, II A, III A	3.0 mg N l^{-1}	0.08 mg P l^{-1}
Type I B, II B, III B	3.0 mg N l^{-1}	0.08 mg P l^{-1}
Type IV (Narva river)	0.7 mg N l^{-1}	0.06 mg P l^{-1}

Flow data were available for 15 rivers for the period 1995-2017 (Table 4). Types for specific rivers were available in the appendixes of Estonian regulation. Total riverine TN and TP GES loads into Gulf of Finland based on monitored rivers are 8978 t $year^{-1}$ and 427 t $year^{-1}$, and into Gulf of Riga 7881 t $year^{-1}$ and 210 t $year^{-1}$, respectively. Additionally, the input from unmonitored coastal areas that are not covered by river monitoring should be taken into account when comparing GES loads to waterborne MAIs. There are two options to account for loads from unmonitored coastal areas – either to add the average load or to calculate the GES load by multiplying average runoff with the TN and TP boundary values. Adding the average load would result in total TN and TP loads to the Gulf of Finland as 11428 t $year^{-1}$ and 484 t $year^{-1}$, and into Gulf of Riga as 13081 t $year^{-1}$ and 306 t $year^{-1}$, respectively. The estimates based on TN and TP boundaries and average runoff would give us the TN and TP loads to the Gulf of Finland as 11740 t $year^{-1}$ and 500 t $year^{-1}$, and the Gulf of Riga as 14872 t $year^{-1}$ and 397 t $year^{-1}$, respectively.

Table 4. Average flow and nutrient GES loads for Estonian rivers.

Sub-basin	River	Average flow 1995-2017 (m^3 s^{-1})	River type	TN GES load (t $year^{-1}$)	TP GES load (t $year^{-1}$)
Baltic Proper	*BAPEELAND*	*14.50**	-	*1372 (986**)*	*37 (20**)*
	Waterborne MAI (t $year^{-1}$)			**869**	**9**
Gulf of Finland	JÄGALA	13.10	III B	1239	33
	KEILA	6.89	II B	652	17
	KUNDA	5.79	II B	548	15
	LOOBU	3.04	II B	288	8
	NARVA***	435.00	IV	3169	272
	PIRITA	7.13	II B	675	18
	PUDISOO	1.22	I A	115	3
	PURTSE	6.95	II A	658	18
	PÜHAJÕGI	1.83	II B	173	5
	VALGEJÕGI	4.01	II B	379	10
	VIHTERPALU	4.48	II A	424	11
	VÄÄNA	2.87	II B	272	7
	SELJAJÕGI	4.09	II B	387	10
	GUFEELAND	*29.20**	-	*2763 (2450**)*	*74 (58**)*
	SUM (rivers/rivers+land/rivers+GES land)			**8978/11428/11740**	**427/484/500**
	Waterborne MAI (t $year^{-1}$)			**10511**	**242**
Gulf of Riga	KASARI	30.90	III B	2923	78
	PÄRNU	52.40	III B	4957	132
	GUREELAND	*73.90**	-	*6992 (5200**)*	*186 (96**)*
	SUM (rivers/rivers+land/rivers+GES land)			**7881/13081/14872**	**210/306/397**

	Waterborne MAI (t year^{-1})	**12530**	**240**

* Runoff from unmonitored coastal areas that is not covered by river monitoring.

** Values are calculated using river type A and B boundary values (same for both types). Values in brackets are average loads for the period 1995-2017.

*** River Narva is a border river, with 33% of the loads designated to Estonia and 67% to Russia. GES loads in this table represent the 33%.

The first version of this Baltic-wide analysis will be presented at the HELCOM Workshop with River Basin Management Authorities that will take place on 18-20 September 2019 in Riga, Latvia.

4.3 Potential nutrient load reductions through existing measures

Estimations of the reduction potential of current and future measures are extremely difficult to calculate. Within HELCOM PLC a draft report summarizing the findings from an earlier questionnaire, and additional information obtained from data, has been made. After guidance from the HELCOM Pressure Working Group, indicating that Contracting Parties would not likely be able to supply the detailed data being considered within the project questionnaire it was proposed that further work between the ACTION project, PLC and RedCore should be explored.

HELCOM PLC collects information of the source apportionment of the loads to the Baltic Sea according to sectors. The data from PLC-6 is published and accessible, while the new PLC-7 data is coming soon. One possible approach that is being explored is that this data could be used to frame the ranges of possible reductions of nutrient inputs by measures in the different sectors (e.g. if agriculture contributes with X% of the total load, a reduction of agricultural emissions of Y%, will result in a nutrient input reduction of X*Y%). A major issue with the PLC source apportionment data is that the reporting is variable between the Contracting Parties, and for several Contracting Parties sector information is not available. Thus, such an approach would require some data extrapolation, and further discussion is ongoing with WP6 on how this information can be appropriately utilized within the SOM analysis.

One possible approach to carry out the questionnaire planned within the WP could be to provide the background information, such as described above, and request a series of specific responses from Contracting Parties to validate the estimates made within the ACTION project. Further planning is underway and currently, and a clear outcome is expected in the coming weeks.

As part of the activities of this WP a HELCOM workshop will be held on 18-20 September in Riga (HELCOM Workshop with River Basin Management Authorities). The information and the invitation have been shared with relevant HELCOM Working and Expert Groups and River Basin Management Authorities have also been brought into the process. Several aspects of the work carried out within ACTION will form key presentations and discussion topics at the workshop.

A summary of this section of WP4, covering all of the progress outlined briefly above, will be drafted towards the end of 2019.

4.4. HELCOM ACTION Workshop 4.2

This final aspect of the project is planned for spring 2020 and the final details and agenda will be developed within the project and taking guidance from relevant HELCOM groups. Planning will be initiated in autumn 2019.