Task 4.1.2 A practical guidance how different hierarchical levels of habitats (e.g. broader and more-detailed HELCOM underwater biotopes) can be tackled within the same assessment.

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1. Development of methodology

This document has been prepared by the SPICE project under Theme 4 (Cumulative impacts and maximum allowable pressures on habitats), Task 4.1.2 A practical guidance how different hierarchical levels of habitats (e.g. broader and more-detailed HELCOM underwater biotopes) can be tackled within the same assessment. The draft was developed by Georg Martin (EMI Estonia), Kaire Torn (Estonia), Antonia Nystrom Sandman (Aquabiota, Sweden) and Henrik Nygård (SYKE, Finland). The draft proposal was discussed and developed further on the HELCOM SPICE Workshop on Theme 4: Cumulative Impacts and Maximum Allowable Pressures on Habitats in September 2017.

1.1 Introduction.

Currently different marine habitat classification systems are used under different directives and conventions which have different levels of detail. While broad habitat types are defined mainly by physical and geomorphological features the assessment of condition/status/quality of habitats has to include information on biological component (species or communities/assemblages). No common guidelines exist how to incorporate detailed quantitative biological information in quantitative status assessment of broader habitat types. Current activity aims to develop guidelines how to tackle the information on status of biological component of marine habitats in status assessment of habitats on different hierarchical levels of habitat classification systems. The work was organized in three steps:

1. Development of translation matrix between different habitat classification systems used by different directives and conventions (Baltic Sea case),
2. Development of guidelines of status assessment aggregation principles between hierarchical units,
3. Testing different approaches of status assessment for habitats in test areas.

1.2 Translation between different habitat classification systems used by legal instruments (EU Directives) and conventions (Baltic Sea case)

Currently three different habitat classification systems are used in the Baltic Sea area for describing and assessing status of marine habitats. Each of those is used and developed under technically different system with slightly different purpose. At the same time coordination and harmonization of assessment results is required by e.g. the Marine Strategy Framework Directive (MSFD) and national authorities as the underlying data collection and monitoring procedures are often serving assessment procedures of different instruments as well as measures applied on the basis of these assessments are often also targeting same directives. We identified three major habitat classification systems that need a translation guide to be able to transfer the information as status classification from one system to another. Existing guidance on the translation between different environmental directives is currently not very specific in taking into account Baltic Sea conditions (e.g. Evans et al 2012 and 2016).

1.2.1 Habitat Directive (HD)

Habitat classification system for Habitat Directive (list of marine habitat types) is based on mixture of broadscale hydromorphological, landscape level properties and some selected physical or biological features of marine benthic habitats. The list is not all inclusive, but reflects the natural features in most need of protection on European scale. Definition of each habitat type includes description of physical features of marine environment in some cases with description of characteristic biological communities or species. Differences exist in national interpretations of the definitions of habitats. Guidelines exist on assessment of the status of the habitat types and regular reporting system is in place.

1.2.2 Marine Strategy Framework Directive (MSFD)

Habitat classification system used for MSFD reporting consists of all inclusive list of very broadscale habitat features. It covers full range of possible habitats on the tidal shelf and open sea. Classification system includes both 'predominant seabed and water column types', often referred to as 'Predominant Habitat Types', and 'Special habitat types', which refer especially to those recognized or identified under Community legislation (the Habitats Directive) or international conventions as being of special scientific or biodiversity interest (Cochrane et al 2010). System is compatible with EUNIS. Definitions of classification units do not include information on biological features and system does not include hierarchical divisions. General guidance on how to assess status exist and this requires information on both distribution pattern and structure of biological communities (New Commission Decision).

1.2.3 HELCOM Underwater Biotope and Habitat classification system (HUB)

HUB system was developed on the basis of EUNIS classification system with the aim to include also biological features of the marine habitats (HELCOM 2013). HUB is hierarchical, all inclusive system covering all possible habitats occurring in the Baltic Sea. It is built in a way to be comparable with EUNIS system. Higher hierarchical levels of this system reflect the physical properties of the habitat while lower levels (5-6) represent the biological features of the habitats. Clear classification scheme and guidelines exist for identification of the particular habitat (HELCOM 2013).

1.2.4 Development of translation matrix between the three habitat classification systems.

1.2.4.1 MSFD-HD

Development of translation matrix is necessary for harmonization of the assessment effort between the three different systems since currently no detailed guidelines exist on how to do that. This is especially the case for the Baltic Sea where traditional EUNIS system can not be applied (absence of tides). For development of translation matrix between MSFD and HD classification systems the following documents were used document "Links between the Marine Strategy Framework Directive (MSFD 2008/56/EC) and the Nature Directives (Birds Directive 2009/147/EEC (BD) and Habitats Directive 92/43/EEC (HD)) - Interactions, overlaps and potential areas for closer coordination", 27 July 2012. Modifications of the recommended translation matrix were done taking into account Baltic Sea conditions and also recommendations from e.g. Evans et al 2014 (Table 1.)

Modification of already existing translation matrix to Baltic Sea case included removing the classification units associated with tidal system from the MSFD part. As the water level fluctuation in the Baltic Sea still creates the characteristic habitats as (HD 1140) these were attributed to "Infralittoral" part of the MSFD system.

The resulting matrix demonstrates that there is no 1:1 compatibility between these two systems and this goes in both directions; one classification unit of one system can include several classification units of other system. This means that for practical translation of the e.g. status classification results between those two systems more detailed, quantitative information is needed (e.g. area of different substrate types within the assessment unit) and each case should be dealt separately. Automated status translation can be done only when quantitative information is available.

Table 1. Translation matrix between MSFD and HD classification systems of marine habitat types in the Baltic Sea.

Modified from "Links between the Marine Strategy Framework Directive (MSFD 2008/56/EC) and the Nature Directives (Birds Directive 2009/147/EEC (BD) and Habitats Directive 92/43/EEC (HD)) - Interactions, overlaps and potential areas for closer coordination", 27 July 2012. Shaded units are not occurring in the Baltic Sea.

	1110 Sandbanks wgich are slightly covered by sea water all the time	1130 Estuaries	1140 Mudflats and sandflats not covered by seawater at low tide	1150 Coastal lagoons	1160 Large shallow inlets and bays	1170 Reefs	1180 Submarine structures made by leaking gases	1650 Boreal Baltic narrow inlets	8330 submerged or partially submerged sea caves
Littoral rock and biogenic reef									
Littoral sediment									
Infralittoral rock and biogenic reef									
Infralittoral coarse sediment									
Infralittoral mixed sediment									
Infralittoral sand			*						
Infralittoral mud			*						
Circalittoral rock and biogenic reef									
Circalittoral coarse sediment									
Circalittoral mixed sediment									
Circalittoral sand									
Circalittoral mud									
Offshore circalittoral rock and biogenic reef									
Offshore circalittoral coarse sediment									
Offshore circalittoral mixed sediment									
Offshore circalittoral sand									
Offshore circalittoral mud									
Upper bathyal rock and biogenic reef									
Upper bathyal sediment									
Lower bathyal rock and biogenic reef									
Lower bathyal sediment									
Abyssal									

*** In the tideless Baltic littoral is not defined as separate habitat. In tidal environments, habitat type 1140 belongs to Littoral sediment.**

1.2.4.2 MSFD-HUB

For developing a proposal for translation matrix between MSFD and HELCOM HUB system available guidance documents were used (e.g. translation between MSFD and EUNIS systems provided in the new draft Commission Decision laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardized methods for monitoring and assessment, and repealing Decision 2010/477/EU) and modified them according to Baltic Sea conditions. As HUB is hierarchical system and MSFD system covers only the very broad scale features of marine environment only one HUB level (level 3) was included in the translation matrix (Table 2).

Table 2. MSFD broad habitat types related with HUB habitats

The proposed translation was created based on links between MSFD broad habitat types and relevant EUNIS habitat codes on Commission Decision 2016, "ANNEX to the Commission Decision laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardized methods for monitoring and assessment, and repealing Decision 2010/477/EU" and guidelines from Evans et al. 2014 "Crosswalks between European marine habitat typologies - A contribution to the MAES marine pilot".

MSFD	HUB level 3
Infralittoral rock and biogenic reef	AA.A Baltic photic rock and boulders AA.B Baltic photic hard clay AA.C Baltic photic marl (marlstone rock) AA.D Baltic photic maerl beds AA.E Baltic photic shell gravel AA.F Baltic photic ferromanganese concretion bottoms AA.G Baltic photic peat bottoms AA.K Baltic photic hard anthropogenically created substrates
Infralittoral coarse sediment	AA.I Baltic photic coarse sediment
Infralittoral mixed sediment	AA.M Baltic photic mixed substrate
Infralittoral sand	AA.J Baltic photic sand AA.L Baltic photic soft anthrophogenically created substrates*
Infralittoral mud	AA.H Baltic photic muddy sediment AA.L Baltic photic soft anthrophogenically created substrates*
Circalittoral rock and biogenic reef	AB.A Baltic aphotic rock and boulders AB.B Baltic aphotic hard clay AB.C Baltic aphotic marl (marlstone rock) AB.D Baltic aphotic maerl beds AB.E Baltic aphotic shell gravel AB.F Baltic aphotic ferromanganese concretion bottoms AB.G Baltic aphotic peat bottoms AB.K Baltic aphotic hard anthropogenically created substrates
Circalittoral coarse sediment	AB.I Baltic aphotic coarse sediment
Circalittoral mixed sediment	AB.M Baltic aphotic mixed substrate
Circalittoral sand	AB.J Baltic aphotic sand AB.L Baltic aphotic soft anthrophogenically created substrates*
Circalittoral mud	AB.H Baltic aphotic muddy sediment AB.L Baltic aphotic soft anthrophogenically created substrates*

* To be determined in each case separately

1.2.5 Development of guidelines of status assessment aggregation principles between hierarchical units

Current proposed methodology is dealing with hierarchical habitat classification system. The aim is to transfer the status classification result from lowest hierarchical habitat classification system (level at which the classification of single stations is usually performed) to higher levels (HUB level 3) with translation to status of MSFD broad habitat types.

An important precondition of this method is that status assessment result on a particular HUB level is expressed in numerical value (e.g. assessment result can be expressed through EQR/BQR type of metric). Suitable metric to be used for this assessment is e.g. HELCOM indicator "Condition of benthic habitats" developed by the TAPAS project and HELCOM IN benthic habitat monitoring.

1.2.5.1 Selection of assessment habitats.

There might be a wish to select particular HUB level 5/6 habitats for the assessment and not deal with all existing habitats. This might be very useful approach to conserve the effort. As HUB is hierarchical system, each level 5/6 habitat is directly related to one level 3 habitat. So it is possible to select one or couple of level 5/6 habitats most representative for the particular level 3 habitat for the assessment unit in question. There is an option to create the list of "important" HUB level 5/6 habitats for larger assessment areas (national waters/HELCOM basins/Baltic Sea). This list can be agreed among experts before actual large scale assessments are performed. In this case we assume that selected "important" HUB level 5/6 habitats are representative for the total variety of habitats and represent the overall status of benthic habitats in the assessment unit.

Of course, there is an opportunity to use all existing HUB level 5/6 habitats in the assessment unit applying the aggregation rules within the each hierarchical levels.

1.2.5.2 Proposal for stepwise procedure for hierarchical aggregation of the habitat status classification.

Aggregation of status classification of lower hierarchical classification levels should be carried out using following stepwise procedure:

Step 1. Status assessment of HUB level 5/6 habitat. This is performed using a metric expressing the final result in numeric value/ratio. In case of using HELCOM indicator "Condition of benthic habitats" (recommended) the assessment procedure corresponds to principles and thresholds applied in HD taking into account important properties of the habitat – area, distribution range and quality status (status of biological communities) of habitats.

Step 2. Further procedure depends on the use of: A) selected list of "important" HUB level 5/6 habitats, or B) using status classification of all available HUB level 5/6 habitats in the assessed sea area (assessment unit).

<u>Option A).</u> Assessment is done for single HUB level 5/6 "important" habitat. Aggregation for HUB level 4 and 3 is carried out by applying averaging of assessment ratio (EQR/BQR) of previous level.

<u>Option B).</u> Assessment is done for each HUB level 5/6 habitat available in assessment unit. Aggregation for HUB level 4 is carried out using weighted averaging using HUB level 5/6

habitat area as weighting factor. Aggregation to level 3 is done through averaging the assessment ratio of level 4.

Step 3. Transfering the assessment result from HUB level 3 to MSFD broad habitat types using the translation matrix (Table 2.).

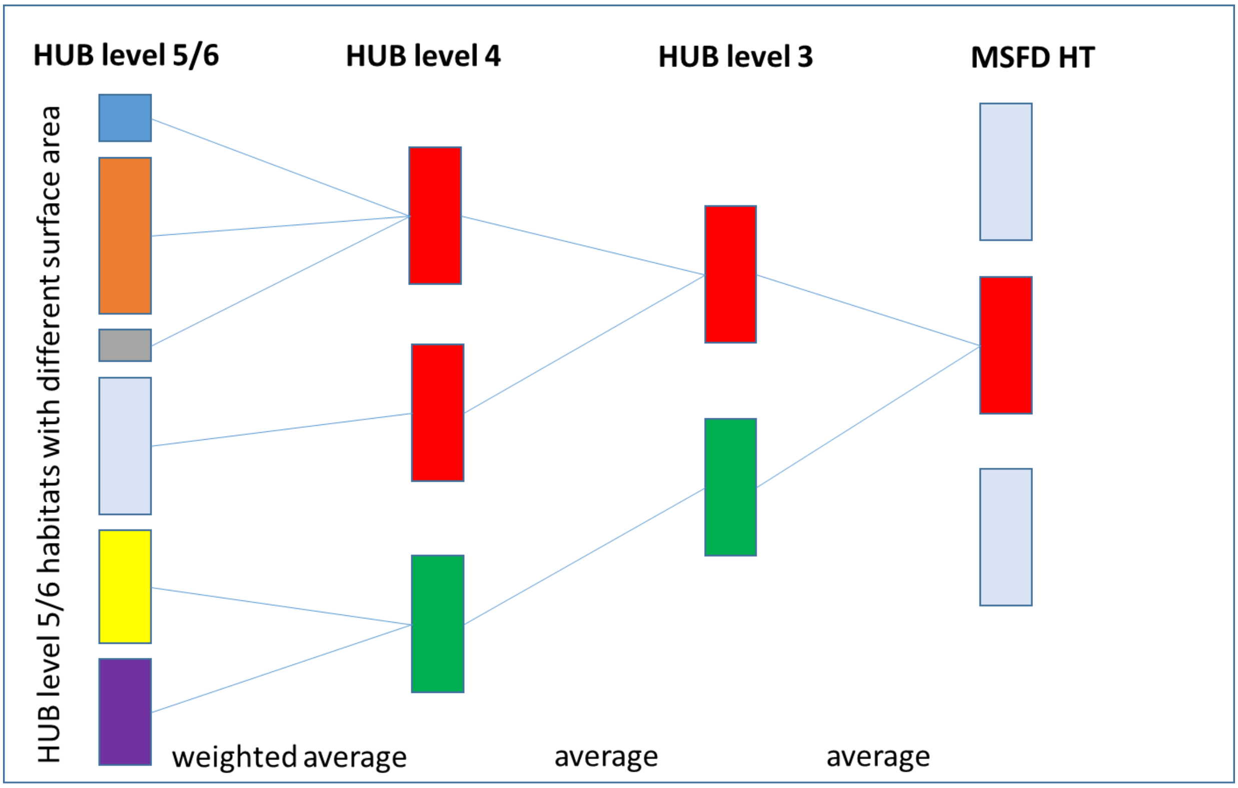

Figure 1. Aggregation principle according to option B (using all HUB level 5/6 habitats in the assessment unit).

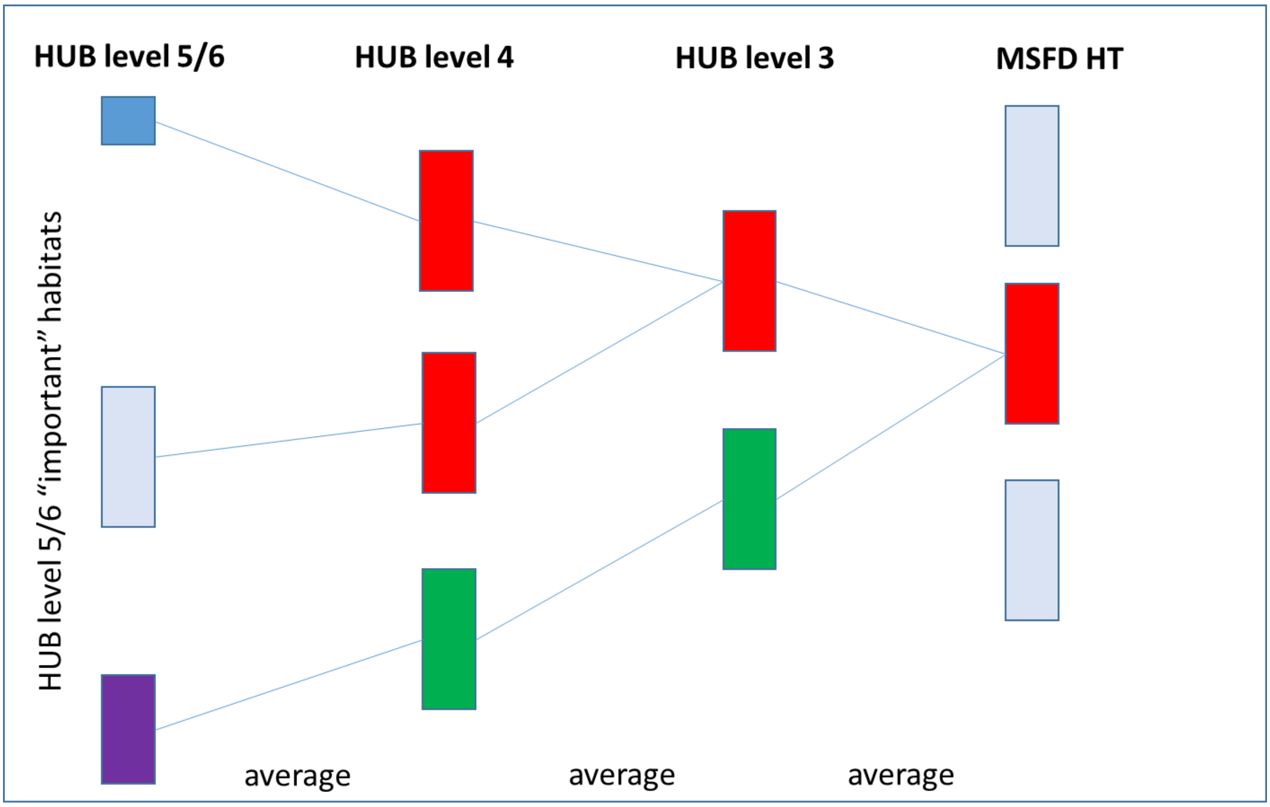

Figure 2. Aggregation principle using option A (using predefined list of „important“ HUB level 5/6 habitats).

2. Test case

2.1 Introduction

SPICE project has developed proposal for methodology how to aggregate the assessment results of habitats from lower hierarchical levels to the scale needed for e.g. MSFD reporting. The fact that most of the information on different properties of the habitats is available for the lower hierarchical levels creates the need for the good methodology and principles to be used when aggregating the information to a higher levels. Current exercise was carried out to demonstrate the applicability of the proposed methodology on the real test case.

2.2 Description of assessment method

2.2.1 Indicator description

In current exercise the indicator „Condition of benthic habitats“ was used to assess the status of HUB level 5 habitats in selected test area (Väinameri, Western Estonia). This indicator has been proposed as pre-core indicator under HELCOM TAPAS project.

A general principle of proposed assessment system is based on practices used for HD reporting (Evans & Arvela 2011) taking into account requirements of MSFD new version of methodological guidelines. Assessment procedure is composed of conditional classification of three different habitat properties: 1) area, 2) extent (range), and 3) quality. Assessment is based on comparison of current situation with baseline level.

<u>Area</u> defined as the actual area of polygons or sum of the grid squares where habitat is found at present. When high resolution data is available, then actual area and polygons should be used for the calculation. If the resolution of the data is low then the grid cell approach should be applied. Size of the grid cells should be set as small as possible, but has to be increased when the data resolution becomes lower. The sensitivity of the indicator will thus vary between assessment units for the same habitat if different resolution of data is available in different assessment unit. This difference should be expressed as level of confidence of the assessment.

Method to establish confidence of the assessment based on type of spatial data used:

1 (low) − estimate based on expert opinion or limited data

2 (intermediate) − estimate based on modelling or grid size ≥5x5 km

3 (high) − estimate based on actual data and grid size <5x5 km

<u>Extent</u> defined as area inside the shortest continuous boundary which connects the outer corners of the polygon or grids where habitat is found at present.

<u>Quality</u> includes the assessment of structure and functions of habitat to reflect the condition of the relevant habitats and biological community. For assessment any indices considering the biological component (e.g. basing on species composition or abundance of the benthic community) or/and physical properties directly reflecting the quality of the habitat should preferably be used. Assessment of status of benthic communities may be based on nationally developed method (e.g. national HD assessment) or an expert judgement. Proportion of the area or monitored stations in good status defines status class of the habitat quality.

2.2.2 GES determination and normalization of scales

For aggregation of habitat properties (area, extent, quality) all assessment results need to be harmonized by transferring them to one scale. All assessment results need to be normalized to a scale from 0 to 1, where the GES boundary is set as 0.6. Transition rules have been taken over from HELCOM HOLAS II biodiversity assessment procedure (BalticBOOST, 2016; HELCOM, 2017). Output of assessment is given in status categories expressed as EQR (Ecological Quality Ratio) as outlined in table 1.

Table 1. Result categories of the assessment (HELCOM, 2017)

Assessment result	EQR score	Status category
GES, EQR score equal or above 0.6	0.8-1.0	Good – highest score
	0.6-0.8	Good – high score
SubGES, EQR score less than 0.6	0.4-0.6	Not Good – low score
	0.2-0.4	Not Good – lower score
	0-0.2	Not Good – lowest score

2.2.3 Area and extent

Assessment of area and extent of the habitats is based on comparison of current situation with baseline level. The definition of class borders follows the matrix developed for indicator "Condition of benthic habitats" which is mainly based on guidance instruction for habitat assessment for HD (table 2). Assessment results of habitat area and extent need to be classified as increased, stable, declined below 10%, or declined over 10% compared to baseline level. Transition scheme from assessment result of parameters "area" and "extent" to EQR is given in table 3.

Table 2. Assessment matrix for indicator "Condition of benthic habitats" habitat properties (modified based on Evans & Arvela, 2011).

Parameter	Status			
	GES	GES	SubGES, close to GES	SubGES, far from GES
Area	Increasing	Stable	Decline <10%	Decline >10%
Extent	Increasing	Stable	Decline <10%	Decline >10%
Quality	≥95% of area or stations in good status	≥90% of area or stations in good status	<90-75% of area or stations in good status	>25% of area or stations in bad status

Table 3. Conversion of status of parameters of “area” or “extent” to EQR values (based on BalticBOOST, 2016).

Status	Assessment result	EQR
GES	Increasing	0.875
GES	Stable	0.625
SubGES, close to GES	Decline <10%	0.375
SubGES, far from GES	Decline >10%	0.125

2.2.4 Habitat quality

Habitat quality in used methodology is expressed as percentage of area (or number of stations) currently determined to be in GES. Percentage of area (or number of stations) in GES is transferred to EQR scale following the procedure used in HELCOM HOLAS II biodiversity assessment (Figure 1). The median value of indicators decides the quality of habitat when the several indicators are used.

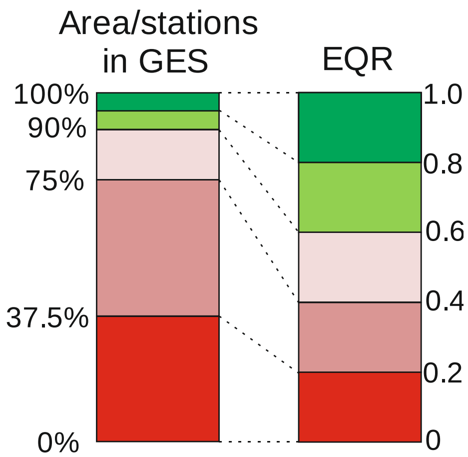

Figure 1. Transition of percentage of area or stations into EQR values.

2.3 Aggregation of assessment results

2.3.1 Habitat parameters

For each HELCOM HUB level 3 habitat property (area, extent, quality) assessment results are transferred to EQR values. Following the aggregation rules of HD assessment the parameter determined to be in worst status decides the overall status. In table 4 overall assessment example for three habitats is given.

Table 4. Overall assessment example. Habitat parameters which decides the overall assessment score is given in a blue frame.

HUB level 5 code	Area EQR	Extent EQR	Quality EQR	Overall assessment EQR
AA.A1C	0,625	0,375	0,53	0,375
AA.A1S	0,875	0,875	1,00	0,875
AA.A2W	0,625	0,625	0,60	0,600

2.3.2 Hierarchical aggregation

Hierarchical aggregation can be done using different options:

Option A: Assessment is done for single HUB level 5/6 habitats which are considered as "important" habitat. Aggregation for HUB level 4 and 3 is carried out by applying arithmetical averaging of assessment ratio (EQR) of previous level (Figure 2).

Option B: Assessment is done for each HUB level 5/6 habitat available in assessment unit. Aggregation for HUB level 4 is carried out using weighted averaging using HUB level 5/6 habitat area as weighting factor. Aggregation to level 3 is done through arithmetical averaging the assessment ratio of level 4 (Figure 3).

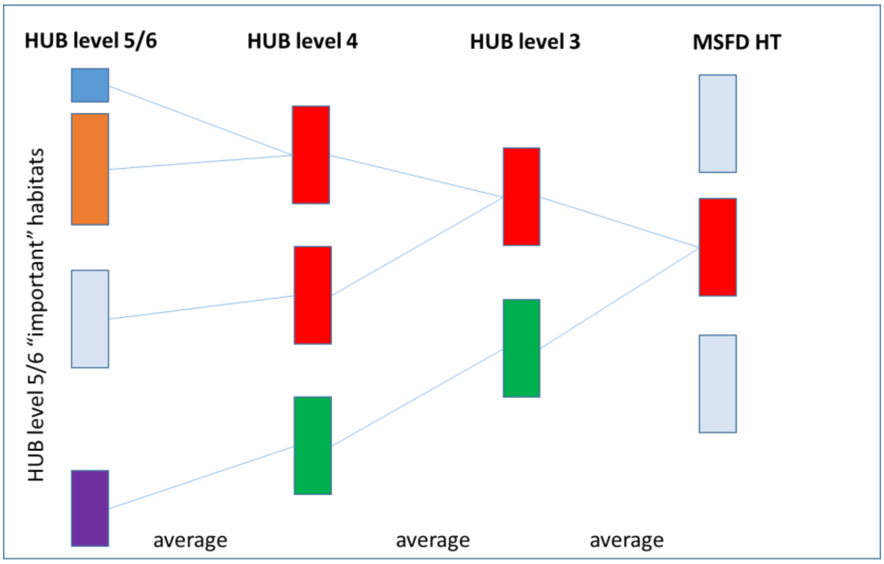

Figure 2. Schematic representation of aggregation methodology for option A.

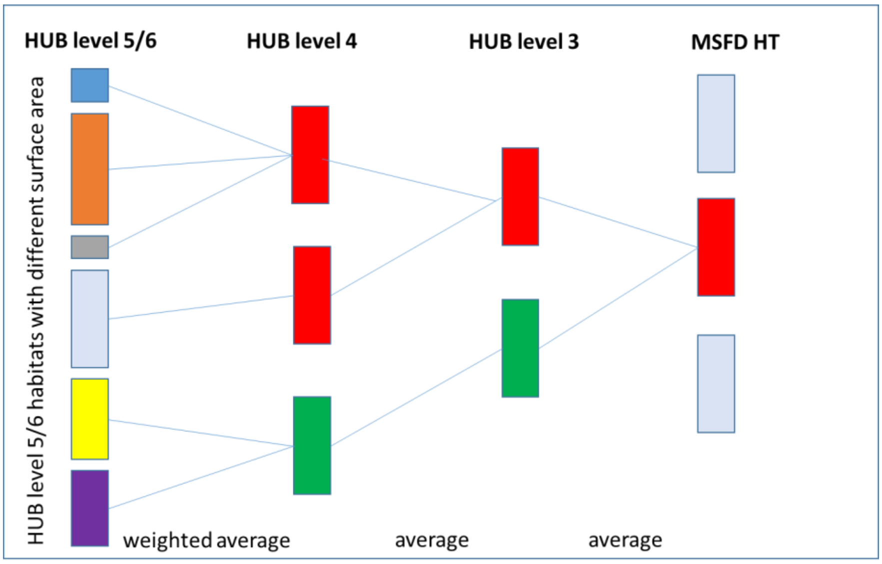

Figure 3. Schematic representation of aggregation methodology for option B.

Preconditions of using proposed aggregation methodology:

- Status of HUB level 5/6 habitat is expressed in numerical continuous value (e.g. EQR/BQR or similar);
- The area of HUB level 5/6 habitat is known in the assessment unit/area;
- In case of applying assessment of limited "important habitats", those have to be defined for all assessment units.

3. Stepwise assessment procedure

Step 1. Status assessment of HUB level 5/6 habitat. This is performed using a metric expressing the final result in numeric value/ratio.

Step 2. Further procedure depends on the use of: A) selected list of "important" HUB level 5/6 habitats, or B) using status classification of all available HUB level 5/6 habitats in the assessed sea area (assessment unit).

Option A. Assessment is done for single HUB level 5/6 "important" habitat. Aggregation for HUB level 4 and 3 is carried out by applying averaging of assessment ratio (EQR) of previous level.

Option B. Assessment is done for each HUB level 5/6 habitat available in assessment unit. Aggregation for HUB level 4 is carried out using weighted averaging using HUB level 5/6 habitat area as weighting factor. Aggregation to level 3 is done through averaging the assessment ratio of level 4.

Step 3. Transferring the assessment result from HUB level 3 to MSFD broad habitat types using the translation matrix.

4. Estonian test case

4.1 Study area

Test case was carried out in West Estonian Archipelago Sea area, a relatively small region between continental Estonia and its western islands (Figure 4). Five narrow straits connect it with neighbouring marine areas. The total surface area of the study area was 1700 km$^{2.}$ The mean depth of the whole system is less than 10 m. Salinity vary from 5 to 6.5 PSU in majority of the area. Whole sea are defined as the Natura 2000 site.

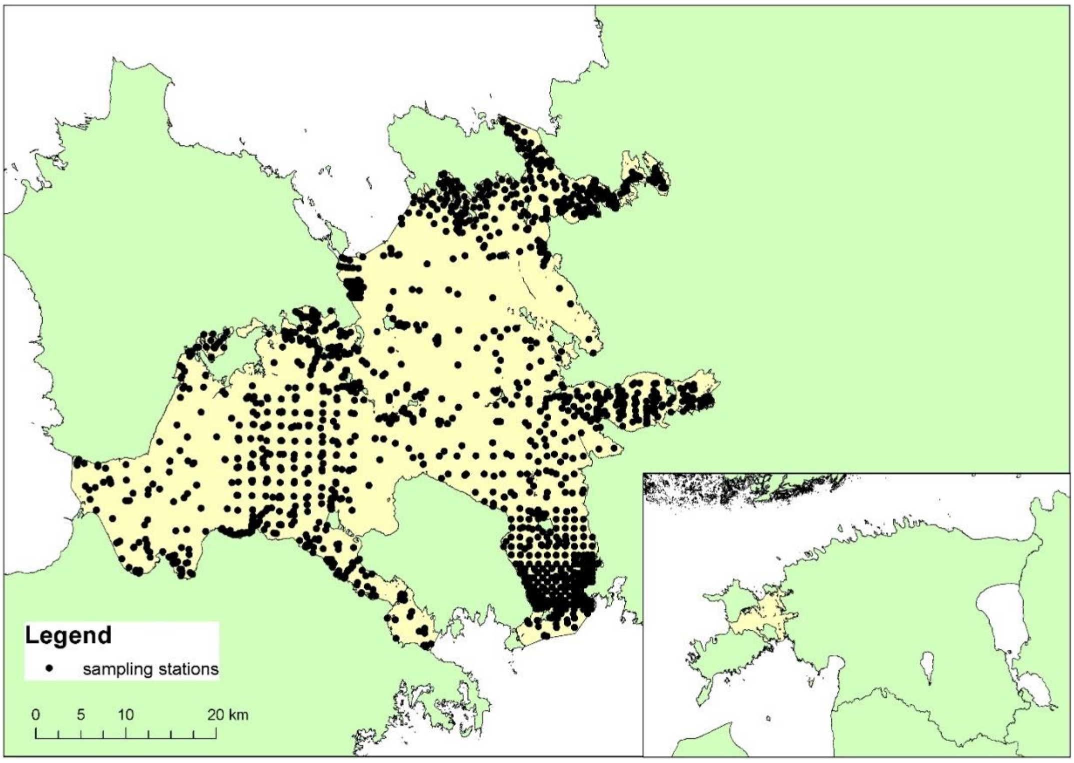

Figure 4. Location of the study area and sampling stations.

4.2 Input data

Distribution of HUB level 3 habitats has been modelled using the random forest machine learning technique (Figure 5). The predictor variables included different bathymetrical, hydrodynamic, and physico-chemical variables. All predictor variables were available as georeferenced raster layers. Input data for the dependent variable, i.e. the sampling point-wise data of substrate type, were compiled from the database of the Estonian Marine Institute, University of Tartu. Substrate data was available from 3521 sampling stations (Figure 4).

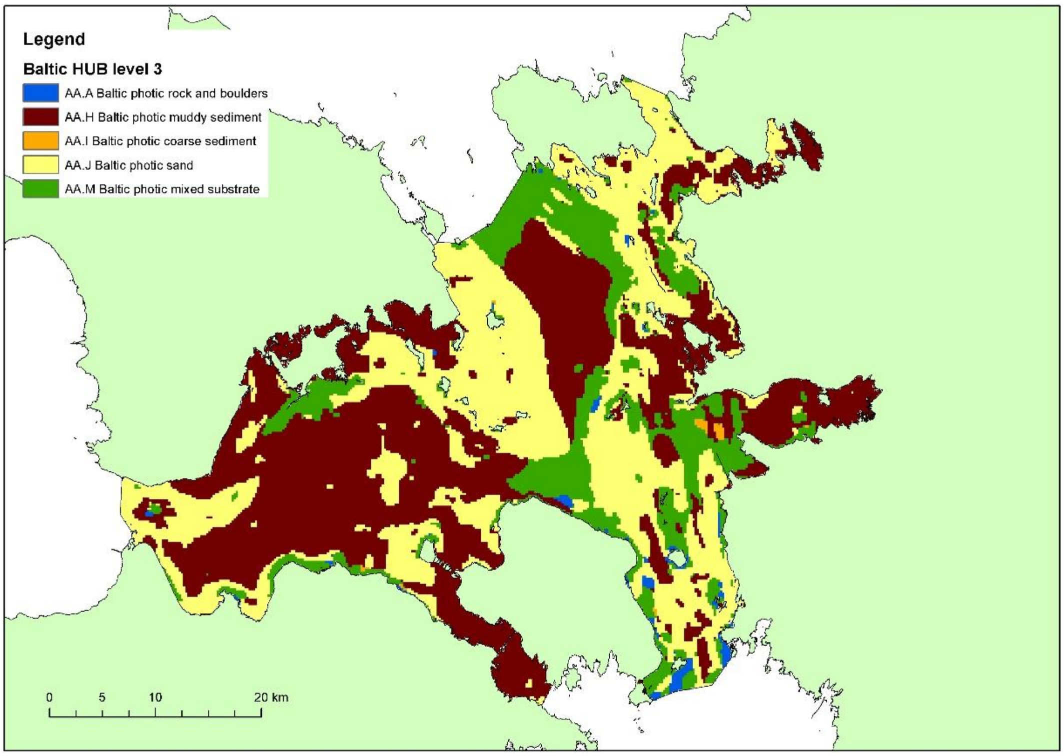

Figure 5. Distribution of modelled HUB level 3 habitats in West Estonian Archipelago Sea.

Distribution of HUB level 5 habitats were defined based on distribution map of modelled HUB level 3 habitat and available species information from study area (Figure 6). Altogether 20 HUB level 5 habitat types were determined in West Estonian Archipelago area.

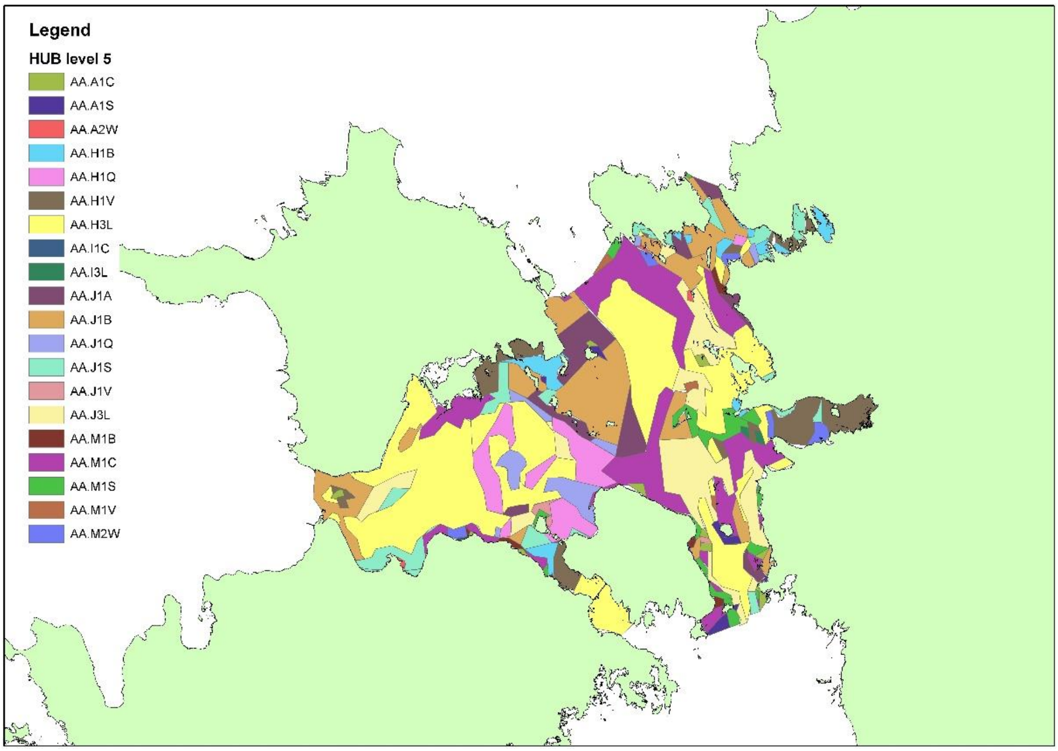

Figure 6. Distribution of modelled HUB level 5 habitats in West Estonian Archipelago Sea.

4.3 Status assessment of HUB level 5 habitat types

Altogether 20 HUB level 5 habitats were determined for West Estonian Archipelago area (area was delineated according to national WFD waterbody typology). For first step the size of the area and extent of each habitat type were measured on map. As an example the area and extent of HELCOM HUB level 5 habitat type AA.J1B **Baltic photic sand characterized by submerged rooted plant**s is given (figure 7).

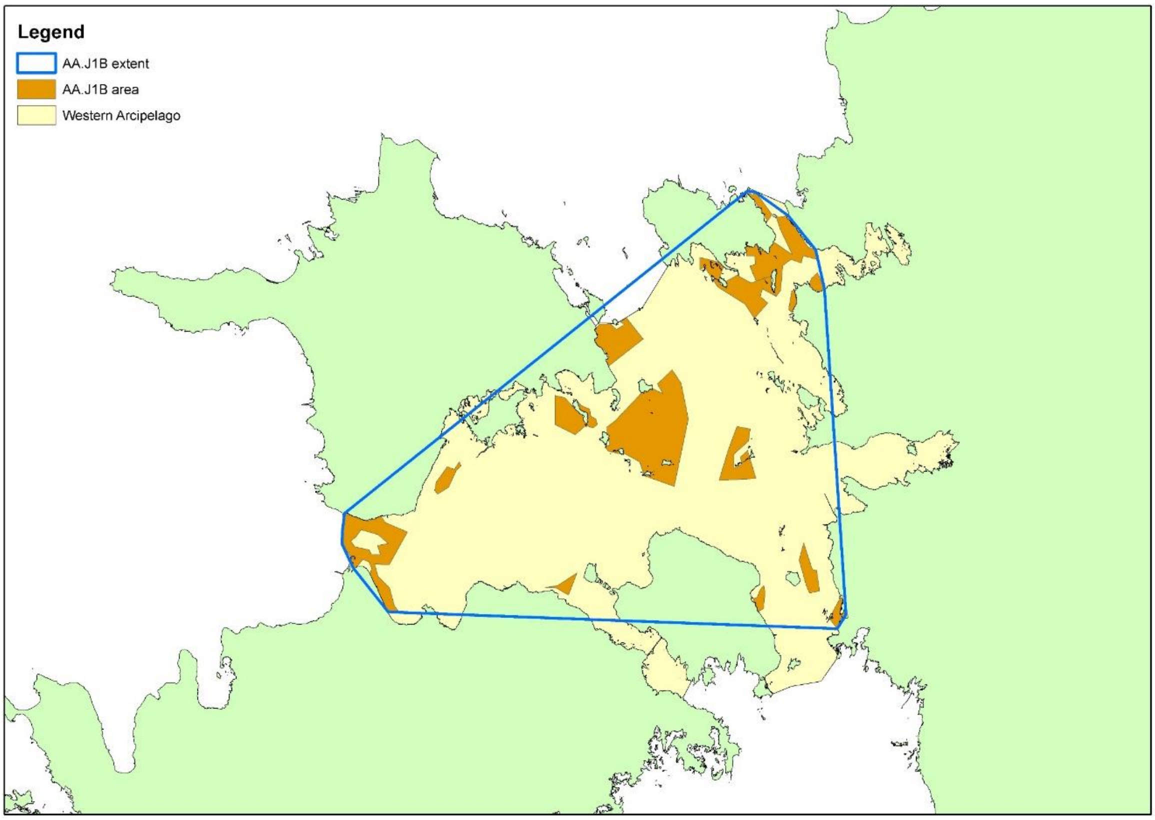

Figure 7. Area and extent of the HELCOM HUB level 5 habitat type AA.J1B Baltic photic sand characterized by submerged rooted plant.

Change in area or extent compared to baseline data was evaluated (table 5). In the cases when baseline data was not available current value were set as baseline value and status of area or extent of habitat type was considered as stable.

To assess the quality of the habitat the assessment system developed for HD assessment purposes was used when possible. Available assessment method for habitats is described by Torn et al. 2017. For the rest of habitat types evaluation exercise was completed based on expert opinion (table 6).

Table 6. Assessment results of HELCOM HUB level 5 habitats in Väinameri area (test case demonstration, not for use in official assesment procedure).

HUB level 5 code	HUB level 5	Area	Extent	Quality (% of stations in good status)
AA.A1C	Baltic photic rock and boulders characterised by perennial algae	stable	decrease	90
AA.A1S	Baltic photic rock and boulders characterised by annual algae	increase	increase	100
AA.A2W	Baltic photic rock and boulders characterised by microphytobenthic organisms and grazing snails	stable	stable	90
AA.H1B	Baltic photic muddy sediment characterized by submerged rooted plants	stable	stable	95
AA.H1Q	Baltic photic muddy sediment characterized by stable aggregations of unnatached perennial vegetation	stable	stable	90
AA.H1V	Baltic photic muddy sediment characterized by mixed epibenthic macrocommunity	stable	stable	95
AA.H3L	Baltic photic muddy sediment characterized by infaunal bivalves	stable	stable	95
AA.I1C	Baltic photic coarse sediment characterized by perennial algae	stable	stable	90
AA.I3L	Baltic photic coarse sediment characterized by infaunal bivalves	stable	stable	90
AA.J1A	Baltic photic sand characterized by emergent vegetation	stable	stable	95
AA.J1B	Baltic photic sand characterized by submerged rooted plant	stable	stable	95
AA.J1Q	Baltic photic sand characterized by stable aggregations of unnatached perennial vegetation	stable	stable	85
AA.J1S	Baltic photic sand characterized by annual algae	increase	increase	100
AA.J1V	Baltic photic sand characterized by mixed epibenthic macrocommunity	stable	stable	
AA.J3L	Baltic photic sand characterized by infaunal bivalves	stable	stable	90
AA.M1B	Baltic photic mixed substrate characterized by submerged rooted plants	stable	stable	90
AA.M1C	Baltic photic mixed substrate characterized by perennial algae	stable	decrease	85
AA.M1S	Baltic photic mixed substrate characterized by annual algae	increase	increase	100
AA.M1V	Baltic photic mixed substrate characterized by mixed epibenthic macrocommunity	stable	stable	90
AA.M2W	Baltic photic mixed substrate characterized by microphytobenthic organisms and grazing snails	stable	stable	95

Table 6. Assessment results of HELCOM HUB level 5 habitats expressed as EQR.

HUB level 5 code	Area EQR	Extent EQR	Quality EQR	Habitat assessment EQR
AA.A1C	0.625	0.375	0.60	0.375
AA.A1S	0.875	0.875	1.00	0.875
AA.A2W	0.625	0.625	0.60	0.600
AA.H1B	0.625	0.625	0.80	0.625
AA.H1Q	0.625	0.625	0.60	0,600
AA.H1V	0.625	0.625	0.80	0.625
AA.H3L	0.625	0.625	0.60	0.600
AA.I1C	0.625	0.625	0.60	0.600
AA.I3L	0.625	0.625	0.60	0.600
AA.J1A	0.625	0.625	0.80	0.625
AA.J1B	0.625	0.625	0.80	0.625
AA.J1Q	0.625	0.625	0.53	0.530
AA.J1V	0.625	0.625	0.60	0.600
AA.J3L	0.625	0.625	0.80	0.625
AA.M1B	0.625	0.625	0.60	0.600
AA.M1C	0.625	0.375	0.60	0.375
AA.M1S	0.875	0.875	1.00	0.875
AA.M1V	0.625	0.625	0.60	0.600
AA.M2W	0.625	0.625	0.80	0.625

4.4 Aggregation of assessment results – option A

Using option A only habitats considered as important were included to assessment.

In HUB level 3 habitat types „rock and boulder (AA.A)“ and „mixed substrate (AA.M)“ were classified as subGES in West Estonian Archipelago Sea (table 7, figure 8). These habitat types are classified below GES due to the slight decrease of habitat types „Baltic photic rock and boulders characterized by perennial algae (AA.A1C)“ and „mixed substrate characterized by perennial algae (AA.M1C)“.

Table 7. Aggregation of assessment results from HUB level 5 to level 3 according to option A. Habitats considered as important are marked in bold and their EQR value is coloured.

HUB level 5 code	Level 5 EQR	HUB level 4 code	Level 4 EQR	HUB level 3 code	Level 3 EQR
AA.A1C	0.375	AA.A1	0.375	AA.A	0.375
AA.A1S	0.875				
AA.A2W	0.600	AA.A2			
AA.H1B	0.625	AA.H1	0.613	AA.H	0.606
AA.H1Q	0.600				
AA.H1V	0.600				
AA.H3L	0.600	AA.H3	0.600		
AA.I1C	0.600	AA.I1	0.600	AA.I	0.600
AA.I3L	0.600	AA.I3	0.600		
AA.J1A	0.625	AA.J1	0.593	AA.J	0.609
AA.J1B	0.625				
AA.J1Q	0.530				
AA.J1S	0.625				
AA.J1V	0.625				
AA.J3L	0.625	AA.J3	0.625		
AA.M1B	0.600	AA.M1	0.488	AA.M	0.488
AA.M1C	0.375				
AA.M1S	0.875				
AA.M1V	0.600				
AA.M2W	0.625	AA.M2			

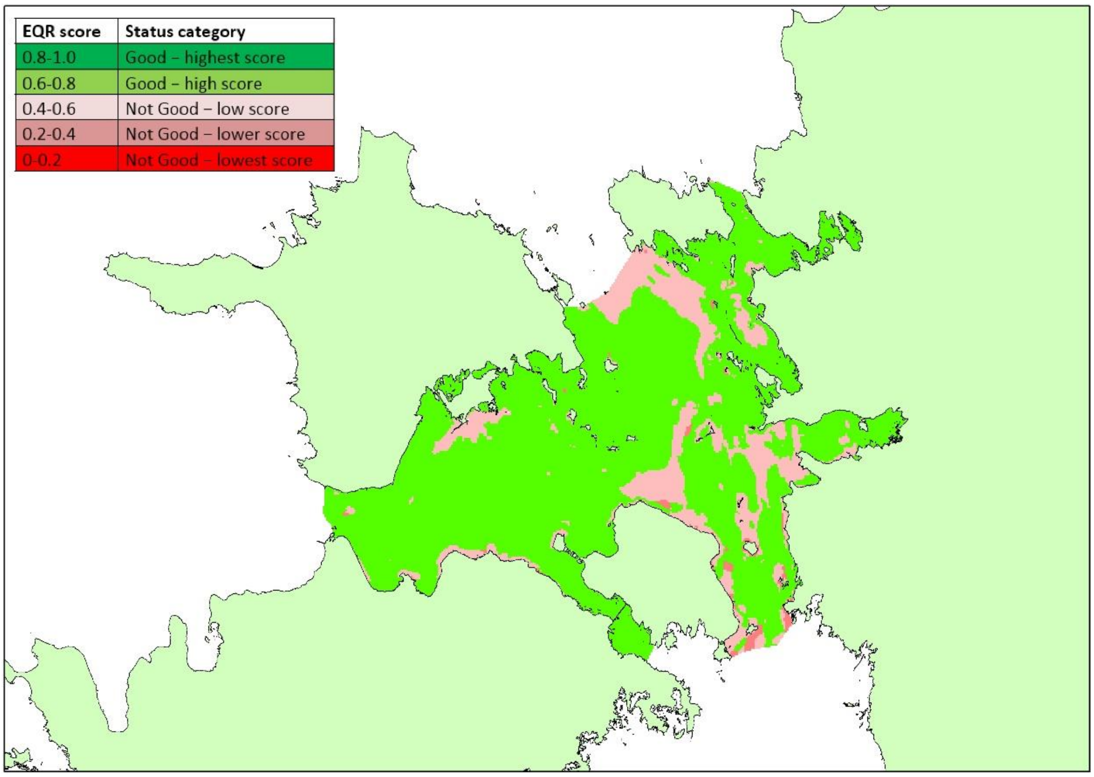

Figure 8. Aggregated assessment results of HUB level 3 according to option A.

4.5 Aggregation of assessment results – option B

Option B gives higher importance to habitats with larger distributional area (table 8, figure 9). Therefore decline of habitats with perennial species do not influence the final result of assessment.

Table 8. Aggregated assessment results from HUB level 5 to level 3 according to option B.

HUB level 5 code	Level 5 EQR	HUB level 4 code	Level 4 EQR	HUB level 3 code	Level 3 EQR
AA.A1C	0.375	AA.A1	0.610	AA.A	0.605
AA.A1S	0.875				
AA.A2W	0.600	AA.A2	0.600		
AA.H1B	0.625	AA.H1	0.605	AA.H	0.602
AA.H1Q	0.600				
AA.H1V	0.600				
AA.H3L	0.600	AA.H3	0.600		
AA.I1C	0.600	AA.I1	0.600	AA.I	0.600
AA.I3L	0.600	AA.I3	0.600		
AA.J1A	0.625	AA.J1	0.616	AA.J	0.620
AA.J1B	0.625				
AA.J1Q	0.530				
AA.J1S	0.625				
AA.J1V	0.625				
AA.J3L	0.625	AA.J3	0.625		
AA.M1B	0.600	AA.M1	0.463	AA.M	0.544
AA.M1C	0.375				
AA.M1S	0.875				
AA.M1V	0.600				
AA.M2W	0.625	AA.M2	0.625		

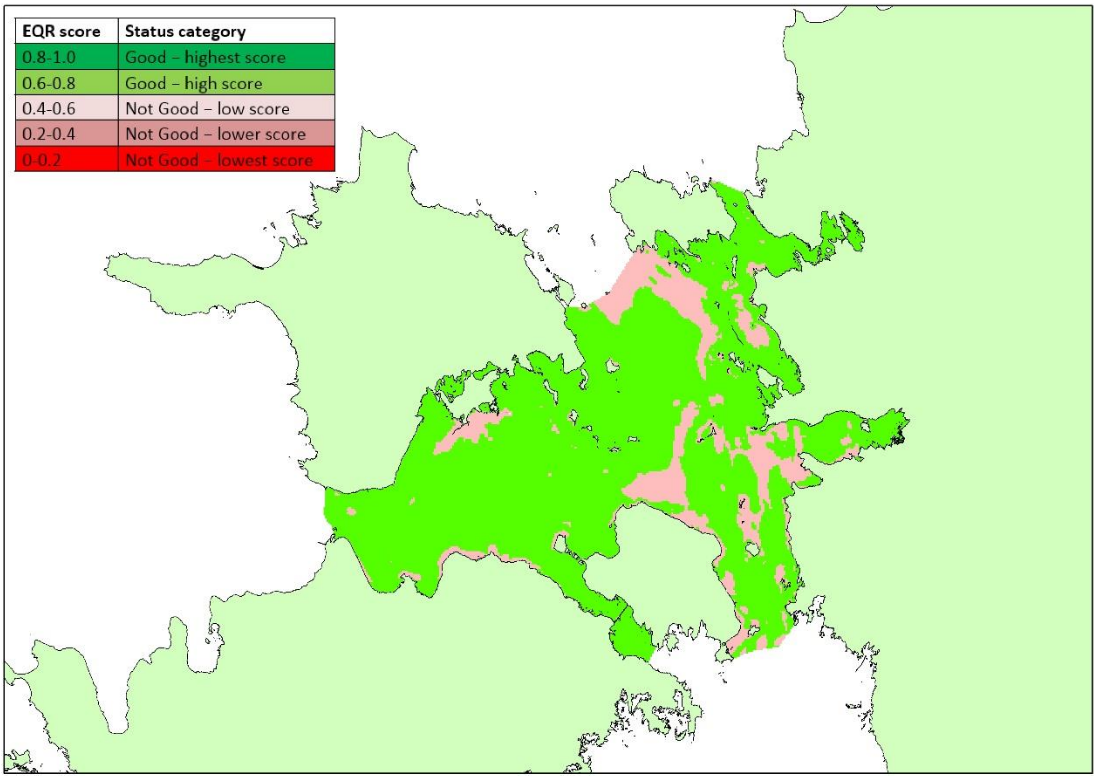

Figure 9. Aggregated assessment results of HUB level 3 according to option B.

5. Conclusions.

1. Proposed aggregation principles are working and are applicable for use in the assessment procedure.
2. There are principal differences in the assessment result depending on the application of aggregation principle A (using only predefined „important“ lower level habitats) or aggregation option B (aggregating the assessment results of all lower level habitats). In the case of using option A the final assessment result of habitat type of higher hierarchical level reflects the status of predefined „valuable“ habitats or ecosystem components. In case of option B the final result reflects/takes into account status of all ecosystem components, even those which may not be considered as „valuable“ or „important“ (e.g. habitats inhabited by opportunistic species, muddy habitats without vegetation etc.).
3. Very important prerequisite is that to perform this kind of exercise all conditions should be met: availability of data, availability of assessment method, list of „important“ or „valuable habitats“ is agreed.

References

Anon, 2012. Links between the Marine Strategy Framework Directive (MSFD 2008/56/EC) and the Nature Directives (Birds Directive 2009/147/EEC (BD) and Habitats Directive 92/43/EEC (HD))

BalticBOOST, 2016. Agreement on a biodiversity assessment tool. Available at: https://portal.helcom.fi/meetings/HOD 51-2016-400/MeetingDocuments/6-15 Agreement on a biodiversity assessment tool.pdf

COMMISSION DECISION (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU

Evans, D., Aish, A., Boon, A., Condé, S., Connor, D., Gelabert, E. Michez, N., Parry, M., Richard, D., Salvati, E. & Tunesi, L., 2016. Revising the marine section of the EUNIS Habitat classification - Report of a workshop held at the European Topic Centre on Biological Diversity, 12 & 13 May 2016. ETC/BD report to the EEA.

Evans D, Arvela M, 2011. Assessment and reporting under Article 17 of the Habitats Directive: Explanatory Notes & Guidelines for the period 2007-2012. Available at: http://bd.eionet.europa.eu/activities/Reporting/Article_17/reference_portal

Evans, D., Condé, S. & Royo Gelabert E. (2014) Crosswalks between European marine habitat typologies - A contribution to the MAES marine pilot. ETC/BD report for the EEA.

HELCOM, 2013. HELCOM HUB – Technical Report on the HELCOM Underwater Biotope and habitat classifi cation. Balt. Sea Environ. Proc. No. 139.

HELCOM, 2017. The integrated assessment of biodiversity - supplementary report to the first version of the 'State of the Baltic Sea' report 2017. Available at: http://stateofthebalticsea.helcom.fi/about-helcom-and-the-assessment/downloads-and-data/

Torn, K., Herkül, K., Martin, G., Oganjan, K. 2017. Assessment of quality of three marine benthic habitat types in northern Baltic Sea. Ecological Indicators 73, 772-783.