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<b>Document title</b>	Subdivision of Danish Straits
<b>Code</b>	5-1
<b>Category</b>	INF
<b>Agenda Item</b>	5– Further work on Indicators and assessments
<b>Submission date</b>	16.1.2020
Submitted by	FEAP
<b>Reference</b>	Outcome of HOD 56-2019, paragraph 3.40-3.42

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## Background

A possible subdivision of Danish Straits has been discussed latest at HOD 56 in June 2019. Clipping from the outcome:

3.40 “The Meeting took note of document 3-22 by FEAP concerning the subdivision of the Baltic Sea. The Meeting took note that Germany in general agrees that the finer resolution serves for better management and of the relevant research project in Germany. The Meeting also pointed out the need to harmonize the models used for the assessment of eutrophication and nutrient load.

3.41 The Meeting also took note that in regard with the update of the Baltic Sea nutrient load model Denmark refers to their previous statement at HELCOM 40-2019.

3.42 The Meeting recognized that this task is challenging and resource demanding and for this reason proposed to be included into the HELCOM science needs.”

FEAP understands that other subdivisions, ref point 5.5. will be discussed during this meeting. There fore we invite you to also consider this.

For information FEAP encloses document 3.22 from HOD 56, which includes a report of 07.06.19 from the consultant company, DHI.

## Action requested

The meeting is invited to comment and take note of the document.



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<b>Document title</b>	Subdivision of the 7 HELCOM Seas
<b>Code</b>	3-22
<b>Category</b>	INF
<b>Agenda Item</b>	3 - Matters arising from the HELCOM Groups
<b>Submission date</b>	07.06.2019
<b>Submitted by</b>	FEAP
<b>Reference</b>	

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## Background

FEAP proposed at the PRESSURE 10 meeting in April 2019 to subdivide Danish Straits in four separate seas. The reason was that GES varies a lot in the four sub seas in Danish Straits. GES in the Sound is not satisfactory, while GES is better in the three other seas (Great Belt, Bay of Mecklenburg and Kiel Bay), especially in the Great Belt. A reduction of the input to e.g. Kiel Bay will have very limited – or rather no – effect on GES in the Sound. Below quotes of the outcome of PRESSURE 10:

“6.39 FEAP introduced document 6-7 on a suggestion to revise sub-basins used for assessment of nutrient inputs. The Meeting took note of the information and thanked FEAP for the work done.

6.40 The Meeting discussed the proposed subdivision and was of the opinion that the proposal can hardly be implemented, as it does not cater for the current management plans, and that the proposed subdivision would require enormous resources to update the regional model and, consequently, the nutrient reduction scheme.”

As a consequence FEAP has asked the Danish consultant company DHI to elaborate a paper that describes FEAP’s proposal in technical terms. It includes an estimate of the resources involved. The paper is enclosed.

It shows that the resources at stake are not “astronomical”! FEAP furthermore finds that it should be possible to change “the current management plans” when you achieve a much more targeted MAI, than is the case today.

FEAP will continue the process in the relevant HELCOM groups, like PRESSURE and GEAR. However FEAP finds that HOD should be informed of the status of FEAP’s work in the area.

## Action requested

The Meeting is invited to comment and take note of the document.

Att: FEAP

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## Division of HELCOM sub basins – Methodology and expected time consumption

### Introduction

On request from FEAP, DHI has described the methodology and expected time consumption related to the geographical and administrative division of the HELCOM sub-basin “Danish Straits” and re-estimation of specific Maximum Allowable Input (MAI) and Good Ecological Status (GES) for the sub basins The Sound, Great Belt, Bay of Mecklenburg and Kiel Bay (or more sub-basins if relevant).

### Background

The Baltic Sea is by HELCOM divided in 7 sub-basins. For each of the seven sub-basins, MAI for nitrogen (N) and phosphorus (P) is defined. A potential need for reductions – and corresponding MAIs – are calculated based on the difference between environmental targets (like summer chlorophyll-a) and the present status of loadings. If the MAIs are fulfilled, the sub-basin should (over time) reach GES. For the assessment of GES, the 7 sub-basins in the Baltic Sea is further divided into 17 assessment sub basins (Figure 1).

The sub-basin “Danish Straits” consists of The Sound, Great Belt (including Little Belt), Bay of Mecklenburg and Kiel Bay. GES is defined specifically for each of the four sub-basins and the ecological status of these sub-basins differs considerably, while MAI is merged for all four. The methodology applied by HELCOM represents a decoupling between the actual basin-specific reference input, actual input, MAI and GES and hence, potentially leads to inefficient and incorrect sub basin management. Secondly, the methodologies applied by the Danish EPA and HELCOM introduce a decoupling between MAI and GES as specified by HELCOM under MSFD at one side, and MAI and GES as specified by the Danish EPA under WFD at the other side.

In order to establish a scientifically sound coupling between actual basin-specific reference input, actual input, MAI and GES and MSFD and WFD, a more detailed approach, including the following steps is suggested:

1. Division of sub basin “Danish Straits” based on typology analyses of sub basin (potentially The Sound, Great Belt, Bay of Mecklenburg and Kiel Bay, but other subdivisions could be relevant)
2. Definition of reference inputs for sub basins, based on models developed by the Danish EPA under WFD
3. Definition of GES for core indicators, based on models developed by the Danish EPA under WFD and/or as defined by HELCOM under MSFD
4. Definition of MAI for nitrogen (N) and Phosphorus (P) at sub basin level, based on specified GES as defined by the Danish EPA under WFD and/or as defined by HELCOM under MSFD.



Figure 1 Map of the Baltic Sea presenting the 7 sub basins (left) with defined MAI (left (<http://maps.helcom.fi/website/mapservice/>)), and 17 sub-basins (right) with defined GES (right (<http://stateofthebalticsea.helcom.fi/in-brief/our-baltic-sea/>)).

### Division of sub basin based on typology analyses of sub basins

The division of a basin into smaller bodies must ensure that the individual water bodies are consistent both with respect to the hydromorphological, physicochemical and biological characteristics and their respective pressure factors and associated impacts (i.e., the same type, environmental objectives and state of the water).

It must also be ensured that the water bodies do not become so small that they cannot be meaningfully managed - i.e. there must be a balanced division, where water areas are as uniform as possible, but at the same time without dividing into such small water areas that the subsequent administrative burden grows too much.

In the final division, it is important to ensure that a water area can be managed so that the water area as a whole reaches Good Ecological Status (GES).

According to the Common Implementation Strategy (CIS) guide no. 5 ([http://ec.europa.eu/environment/water/water-framework/facts\\_figures/guidance\\_docs\\_en.htm](http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm)), there are a number of hydromorphological (physical and chemical parameters) parameters that must / can be included in the typological division:

- There are three mandatory parameters: Longitude / latitude, tidal variation and salinity, and
- A variety of additional (optional) parameters: Current speed, wave exposure, average water temperatures, vertical mixing, turbidity, residence time, average substrate composition, and water temperature variation.

Here we suggest that these data will be collected, evaluated and analyzed, in order to determine to what extent the water bodies included in the existing Danish Straits can be meaningfully sub-divided.

## **Definition of reference inputs, GES for core indicators and MAI for nitrogen (N) and Phosphorus (P) for sub basins**

The definition of reference inputs, GES for core indicators and MAI for nitrogen (N) and Phosphorus (P) for sub basins in “Danish Straits”, will be based on existing model simulations and results.

The use of mechanistic models ensures a model tool which enables the definition of differentiated reference inputs, GES for core indicators and MAI for nitrogen (N) and Phosphorus (P) for sub basins and hence ensuring differentiated regulation at sub basin level.

Reference input corresponds to the N- and P- input from Danish as well as inputs from other countries' catchments 100 years ago.

Reference simulations with N and P input correspond to a situation with limited anthropogenic nutrient input from Denmark and the rest of the Baltic Sea.

Definition of GES for core indicators is defined based on reference simulations with N and P input corresponding to a situation with limited anthropogenic nutrient input from Denmark and the rest of the Baltic Sea.

MAI for nitrogen (N) and Phosphorus (P) for sub basins is defined with the existing mechanistic sub basin specific models, it is possible to calculate (simulate) the effects of various combinations of measures to reduce nutrient supply to the sub basins.

A method which makes it possible to carry out a screening of the need for reductions in the nutrient supply in the individual sub basins. Briefly, the workflow is that with the mechanistic sub basin specific models, a number of model runs are carried out with different sizes of nutrient input. On the basis of the model runs, relations between quality element indicators and N and P input are established for each sub basin. Using the relationships, the effort needs are calculated by combining the scenario results with the results of current runs and reference runs as well as the GES of the indicators.

The following data is applied in the mechanistic models:

- N and P- input from Danish as well as inputs from other countries.
- Atmospheric N-deposition
- Boundary data and meteorological data
- Bathymetry data

The mechanistic models include:

- Mechanistic models for years 2002-2016
- Calibration against measurements for years 2002-2016
- Goodness of fit verification of mechanistic models
- Scientific model documentation

The use of mechanistic models includes:

- Definition of reference conditions and GES for core indicators
- Scenarios (N and or P) for definition of MAI for nitrogen (N) and Phosphorus (P) for sub basins.

## **Expected time consumption**

Division of sub basin based on typology analyses of sub basins, based on the methodology as described above. The typology analysis is optional if it is decided to keep the existing sub basins, namely, The Sound, Great Belt, Bay of Mecklenburg and Kiel Bay.

**The typology analysis is expected to require approximately 150-200 man hours.**

Definition of reference inputs, GES for core indicators and MAI for nitrogen (N) and Phosphorus (P) for sub basins, The Sound, Great Belt, Bay of Mecklenburg and Kiel Bay (or more sub basins if relevant), based on the existing model results and methodology as described above.

Notice that the described work requires acceptance of use of model simulations and results from the Danish EPA.

**The definition of reference inputs, GES for core indicators and MAI for nitrogen (N) and Phosphorus (P) for sub basins is expected to require approximately 250-300 man hours incl. reporting.**

Please notice that expected time consumption is an estimate and that the initiation of the work requires specified definition of tasks and budget.

Best regards

**DHI A/S**

A handwritten signature in black ink, appearing to read 'Mads Joakim Birkeland'.

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