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<b>Document title</b>	Calculation of MPA coverage
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### Background

STATE & CONSERVATION 8-2018 invited the Secretariat to make the presentation of the progress and status of the MPA network (as presented in the HELCOM MPA database) a reoccurring agenda point at the meetings, as well as to include sub-basin, including division by EEZ, results in the calculations.

STATE & CONSERVATION 9-2018 meeting noted that the current distribution and coverage of the MPA network is still below 10 % for part of the sub-basins (outcome para 3N.32, document 3N-17). In order to provide supporting information for the Recommendation, the meeting invited the Secretariat to provide subbasin-wide calculations for the total protected area, including both HELCOM MPAs and Natura 2000 areas (N2000s) and compile a list of those sub-basins with a less than 10% total coverage of protected areas, as well as to identify the countries bordering the respective sub-basins. The information was agreed to be shared with State and Conservation Working Group.

STATE & CONSERVATION 9-2018 agreed that in the future information on the coverage of MPAs and the management plans of MPAs will be presented in one document including relevant maps.

STATE & CONSERVATION 11-2019 took note of the current status of MPA management plans and MPA coverage contained in the HELCOM MPA database and noted that the lack of a coherent and topologically complete data set to be used in the analysis has presented a challenge. The meeting considered that a data call for the Contracting Parties to submit data layers with national borders and coastlines should be a first step. The meeting also invited the Secretariat to submit a document outlining all encountered issues in more detail, including example maps, for further discussion.

This document presents the calculation methodology for the MPA coverage, including encountered issues in the exercise.

### Action requested

The Meeting is invited to:

- take note of the information on encountered issues with MPA coverage analysis
- comment on the solution suggestions and recommend a way forward.

## Methodology for calculating the MPA coverage

For calculating the coverage of MPAs per sub-basin, country and EEZ/TW, including marine fraction, the following data sets are needed:

*Table 1 Data sets used for the MPA analysis*

Data set	Metadata	Original data source
HELCOM MPAs	<a href="#">Link</a>	HELCOM Contracting Parties (compiled by Secretariat gradually during long time period)
EEA Coastline	<a href="#">Link</a>	EEA (Satellite images, GSHHG coastline and manual digitation work)
Sub-basin (HELCOM assessment unit level 2)	<a href="#">Link</a>	HELCOM and Contracting Parties
EEZ	<a href="#">Link</a>	Contracting Parties and UN
Territorial water	<a href="#">Link</a>	EEA, OpenStreetMap and CPs

Areas for the analyses of marine fraction of HELCOM MPAs were delineated as follows: All land areas (as in EEA Coastline) were removed from the HELCOM MPA dataset. Removed areas included all areas on islands and mainland, regardless whether the islands were included in the original MPA delineation or cut out of it. Some MPAs have areas falling landward of the coastline and these were also removed.

If the N2000 areas are included in the analysis, the same method was applied to remove mainland and islands from N2000 areas. All overlapping MPA and N2000 areas were dissolved, and the resulting total MPA + N2000 areas were compared to the HELCOM sub-basins.

In order to get the national shares of MPAs, the EEZ data is used to “slice” the MPA’s to form country wise data sets of the coverage. Further to get Territorial Water share of the national share, the TW area is clipped out from the EEZ data.

For the MPA coverage by sub-basin, the outside borders of sub-basins are used to divide the MPAs to different sub-basins. After that, the same methodology as above was used to divide them further into EEZ and TW shares.

## Main challenge

The main challenge in making these analyses is the lack of a coherent and topologically complete reference datasets that are required for the analysis. In more detail:

1. EEZ data has gaps and it doesn’t reach all the way to the shore in all places, most so in the southern Baltic lagoons. The source of this data is different treaties and agreements which do not necessary contain precise coordinates from open sea to shoreline. The EEZ line could be supplemented by the TW dataset, but:
2. There are differences in these two datasets for the parts they should have the same delineation, which raises the question which line should be followed for those parts. The source of TW data is EEA, OpenStreetMap and Contracting Parties. Example of mismatches between EEZ and TW can be seen at Annex 1, figures 1 & 2.
3. On some occasions the MPA’s bordering the national borders are not aligned by EEZ or TW data. There are some MPAs that reaches to other countries’ territories, according to EEZ and/or TW. The scale of the problem is few hundreds of meters and could be thus related to rounding and imprecise coordinates in EEZ treaties. In some cases, the origin of the problem is that, for some reason, there has clearly been a shift of the location of the MPA. Example can be seen in Annex 1, Figure 4.

4. As some MPA's reach to land and in order to calculate the total MPA area per country, an EEZ/TW compatible border data for land areas should also be agreed upon. This would be arbitrary line and would be created only for this analysis purposes.
5. The Assessment unit data (all levels 1-4) is not equally precise for all countries regarding the coastline, introducing some uncertainty for the sub-basin calculations. Also the number of island and their detail was intentionally decreased (islands smaller than 1 km<sup>2</sup> were changed to sea areas) in order for HELCOM assessment unit data sets to not become too heavy for desktop GIS processing. The national MPA datasets might not have the same detail of islands and coastline, potentially causing small errors in how large the marine fraction of a MPA is.
6. Some MPA's reaches to land and the basic sub-basin division (as only at sea) doesn't work to split these areas between Sub-basins. A separate arbitrary sub-basin division line on land was used, the same as was used in 20km to land exercise for S&C 10. This changes the total areas and the number of MPA's in different sub-basins, but not the marine area.
7. There are some overlapping MPA polygons and the overlap has been removed. As the same area cannot be calculated twice (even they belong to different MPA's and might also have different conservation status) when calculating how big portion of a sub-basin is under conservation.
8. Sub-basin coastline is different than EEA coastline. Sub-basin coastline comes from the assessment unit data, which is submitted by Contracting Parties and EEA comes from different source. Also, the coastline used to draw the MPAs are somewhat different than EEA or sub-basin coastline. An example of this can be seen in Annex 1, figure 3.

## Conclusions

Some challenges can be sorted out with updating/correcting data sets, where issues have been manually corrected and documented, but the underlying uncertainties related to source data would still remain. On some challenges, like the varying quality of HELCOM sub-basin coastline and its mismatch to EEA coastline, are more difficult to correct. In these cases, the options are to leave something out from the analysis or to accept the generality of the analysis and document the underlying uncertainties.

### Alternatives solutions for the problem of mismatching of EEZ and TW data sets:

- A. Use a recently created, manually corrected data set for the analysis of MPA coverage per country and Territorial waters
  - A data set where the differences between EEZ and TW have been manually corrected and documented, has been used for some HELCOM work strands. A disclaimer has been used to indicate the underlying uncertainties and that some borders have been manually edited in order to get a topologically uniform data set resulting in very minor changes of country wise EEZ and TW marine areas.
- B. Leave the analysis of MPA coverage per country and Territorial waters out from the assessment
- C. In some cases, it is clearly visible that the accuracy of HELCOM EEZ data is insufficient and using another data source would yield more accurate results. Example of this can be seen in Annex 1, Figure 5, where OpenStreetMap data is very accurate compared to HELCOM EEZ.

### Alternative solutions for the varying quality of HELCOM sub-basin data set coastline and mismatch to EEA coastline:

- A. Long term solution could be, that when at some point in the future the assessment unit level 2 data set is updated, a same coastline data set would be used by all Contracting Parties. This solution would require considerable effort from both CPs and the Secretariat.

- B. Short term solution is to accept the mismatches and include a disclaimer of underlying uncertainties

Suggestion to fix the potential shifts in MPA data set

- A. Establishment of a process where Contracting Parties would go through the delineations of MPAs to check whether there are any shifts in the spatial dataset
- B. Contracting Parties would agree that the Secretariat could make corrections to the MPA delineation, according to an agreed reference data set.

## Annex 1 Examples around the Baltic Sea

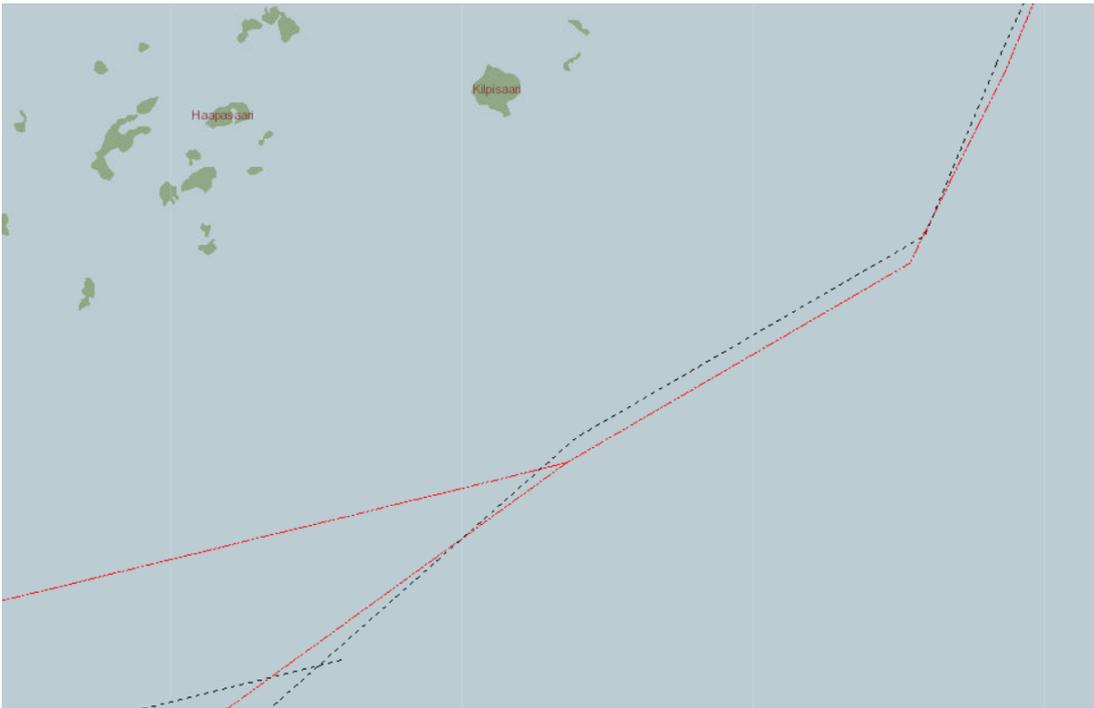


Figure 1. Example of mismatch between EEZ (black) and Territorial Waters (red) delineations at the Gulf of Finland.

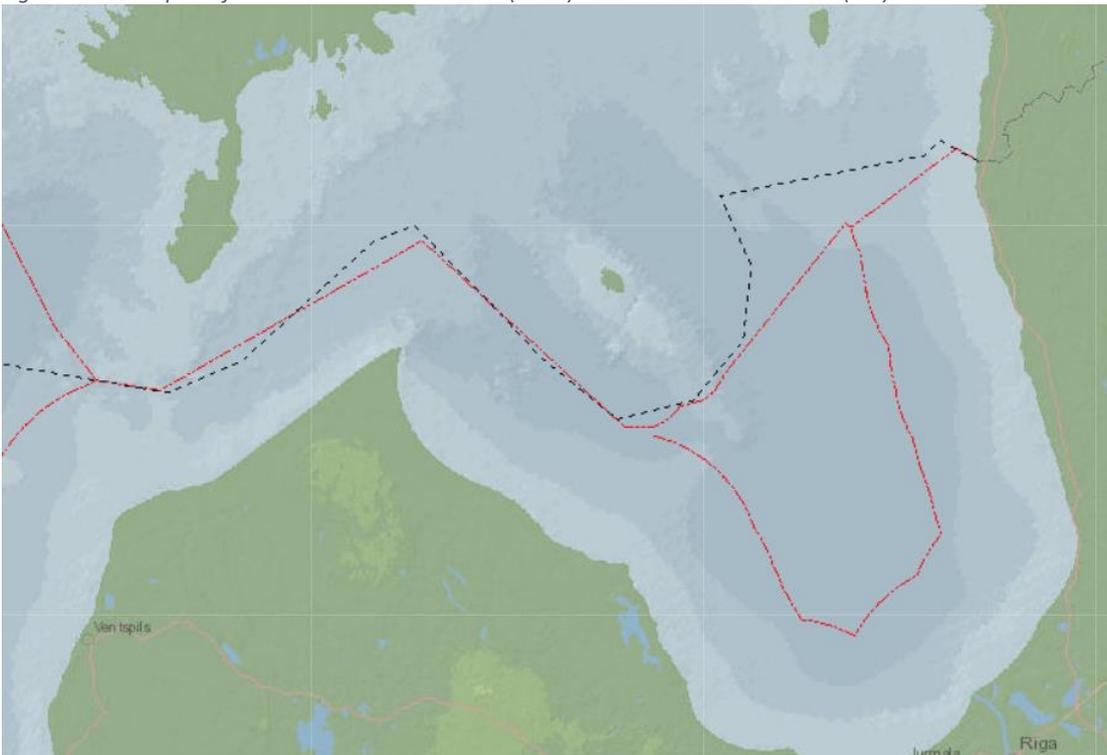


Figure 2. A second example of mismatch between EEZ (black) and Territorial Waters (red) data set in the Gulf of Riga

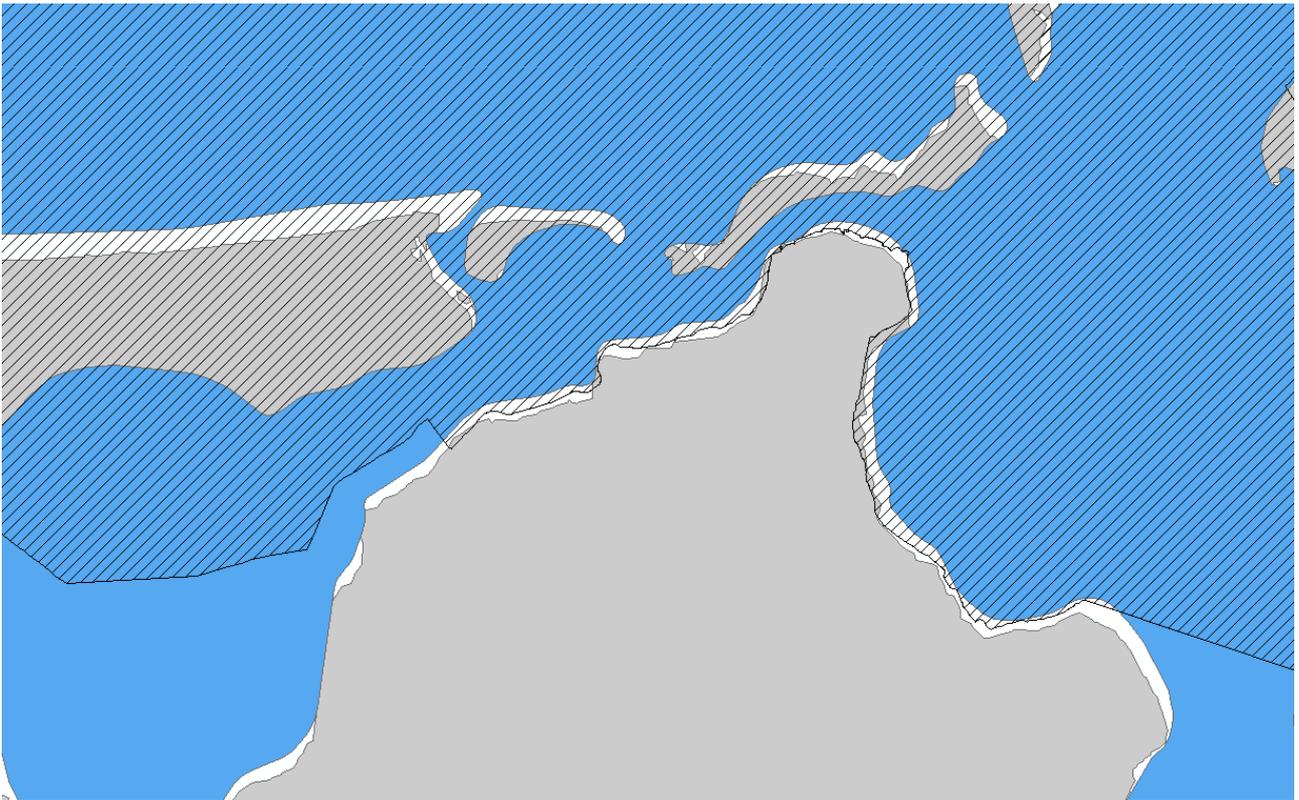


Figure 3. Example of mismatch of coastline, between assessment unit (blue), EEA coastline (grey) and the MPA (hatched polygon) data set around West-Pommeranian Lagoon National Park

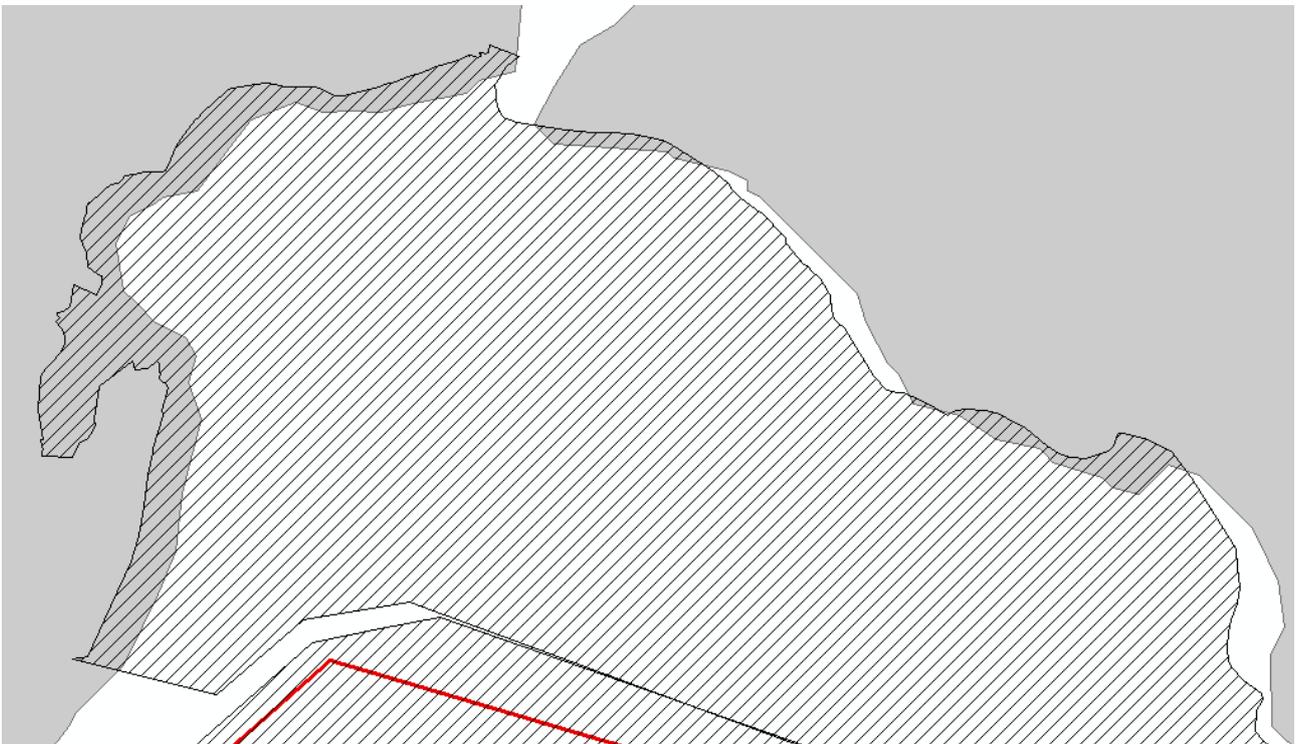


Figure 4. Example of a shift in MPA (hatched polygon), when compared to the (EEA) coastline.

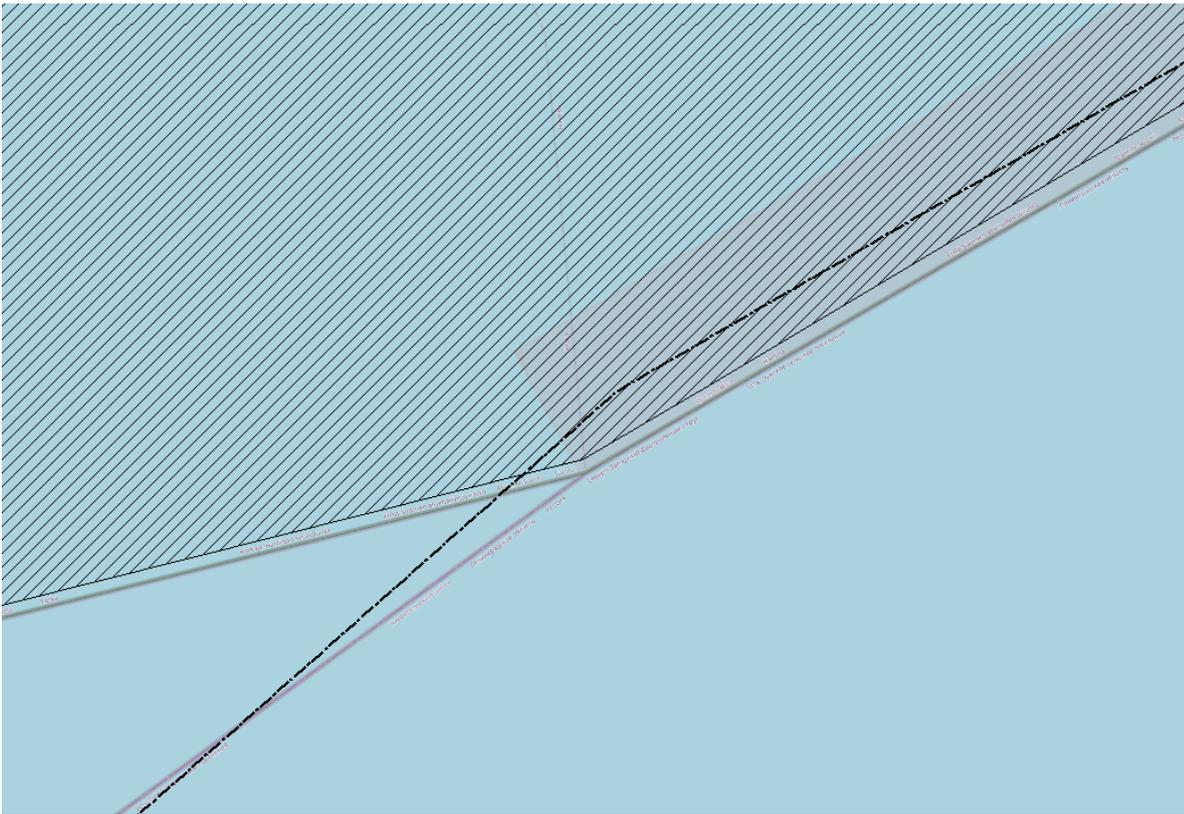


Figure 5. Example of inaccurate EEZ data (black dashed line), as compared to OpenStreetMap border data (grey line).