

Options to consider marine eutrophication in the review of the Gothenburg Protocol

A joint report of the Ad-hoc group on Marine Protection (AMP) under the CLRTAP and the Working Group RedCore under HELCOM to the 7. Joint Meeting of EMEP SB and the WGE,

13 – 16 September 2021

For contact: Gudrun schuetze@uba.de

1. Background

Although inputs of nitrogen (N) to the North Sea and the Baltic Sea have decreased in recent years, eutrophication is still a large problem, in particular in coastal waters. 24-38 % of the overall nitrogen inputs to the Greater North Sea in the period 1990-2015 stem from atmospheric inputs¹. On average 25% of the overall nitrogen inputs to the Baltic Sea are caused by atmospheric deposition, originating mainly from combustion processes related to shipping, road transportation, energy production and agriculture^{2,3}. Both the current OSPAR North East Atlantic Environment Strategy (NEAES) and Baltic Sea Action Plan (BSAP) stipulate that marine eutrophication needs to be taken into account in setting emission targets for nitrogen under the EU NEC Directive and the Gothenburg Protocol.

2. Tasks within the Gothenburg Protocol review

In Annex 1 to the document ECE/EB.AIR/2020/3–ECE/EB.AIR/WG.5/2020/3, prepared by the Gothenburg Protocol review group, two questions deal with a possible consideration of marine eutrophication as an issue to be addressed in the review of the Gothenburg Protocol:

- 2.2: a. What are the observed and projected trends in deposition of reduced and oxidised nitrogen on land and waters (including marine ecosystems)?
- 2.8: What are the expected impacts of new scientific findings on environmental and health effects assessments, for example on: ... - inclusion of marine ecosystems protection,...? Information and knowledge for this assessment should be explored with, for example, the Baltic Marine Environment Protection Commission, as discussed at the sixth joint session of the EMEP Steering Body and the Working Group on Effects, with the aim to analyse optimized emission reduction allocations with and without taking into account effects of air pollution on marine ecosystems.

The document was discussed at the joint meeting of the Extended Bureaux of EMEP SB and WGE in March 2021 and the AMP was established to seek cooperation with experts from HELCOM in order to find answers to the questions.

¹ <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/eutrophication/nutrient-inputs/>

² Svendsen, L.M., Gustafsson, B. & Larsen, S.E. (2020). HELCOM Indicators. Input on nutrients (nitrogen and phosphorus) to the sub-basins (2018), 31pp

³ HELCOM (2018): HELCOM Thematic assessment of eutrophication 2011-2016. Baltic Sea Environment Proceedings, No. 156.

3. Cooperation and way of work

There is already a long tradition of cooperation between HELCOM and EMEP MSC-West, which delivers on request nitrogen deposition data for the Baltic Sea as well as information on source apportionment (with respect to countries).

In March /April 2021 Germany provided written information to meetings under OSPAR (Meeting of the Hazardous Substances and Eutrophication Committee (HASEC), 22 – 26 March 2021, Agenda Item 5) and HELCOM (14th Meeting of the Working Group on Reduction of Pressures from the Baltic Sea Catchment Area (PRESSURE), 13 – 16 April 2021, Agenda item 9) promoting the cooperation between the two marine conventions and AMP for the CLRTAP. HELCOM provided the opportunity for AMP to present the issue at the 14th PRESSURE meeting. The proposal for cooperation was welcomed, see outcome of the Session as cited in Annex 1 of this paper. Two working groups under PRESSURE – RedCore DG and PLC IG - were named to cooperate with the AMP and deliver information as far as possible. At the 32nd RedCore Meeting (24 June 2021) and 33th RedCore Meeting (9 September 2021) AMP and RedCore DG experts further discussed the opportunities to answer the questions (see 2.).

4. Achievements by 9th of September 2021

The contact of WGE/EMEP to HELCOM experts was established. There is large interest in further cooperation from both sides (see Annex 1). HELCOM has in its Baltic Sea Action Plan decided on Maximum Allowable Inputs (MAIs) of nutrients for the seven Baltic Sea sub-basins. MAIs indicate the maximum level of annual inputs that can be allowed to fulfil the environmental targets for a non-eutrophied Baltic Sea. MAIs can be seen as indicators for sensitivity of the Baltic Sea sub-basins and can be a meaningful basis for combining risk assessments for marine ecosystems with those for terrestrial and freshwater ecosystems.

The 32nd RedCore DG Meeting identified three options for further work, which have different complexity and need of time (further explained under 5.). Only the “Simple Approach” can be performed within the time frame of the Gothenburg Protocol review.

The 33rd RedCore DG Meeting discussed a draft of the present paper, the principles for calculating critical atmospheric inputs (CAI – see paragraph below), and scrutinized preliminary calculations of CAIs for the seven Baltic Sea Sub-basins. The CAIs are derived from the share of atmospheric N inputs of total N inputs per Baltic Sea sub-basin in a reference period. As data on atmospheric deposition, i. a. to the Baltic Sea for the years 2000 – 2019 have already been delivered by EMEP MSC-West the Meeting agreed that further elaborated CAI could be provided in the first half of October 2021 with use of two different reference periods (e.g. 2015-2019 and 2017-2019). The CAIs could, after conversion to CLRTAP-common format and units, be integrated in the common map of Critical Loads.

Further, the Meeting agreed that RedCore DG together with PLC IG would prepare a document for the HELCOM PRESSURE 15 meeting (to be held in early November 2021) on the issue.

5. Outlook and recommendations

Further cooperation between WGE/EMEP and HELCOM working groups could be considered at three levels of complexity and need of time. Level 3 would need an even broader cooperation than established by now, since reduction of coastal eutrophication is regulated under the EU Water Framework Directive, not under HELCOM:

- Level 1 - Simple approach (implementable within the time schedule of the GP review (for state of scientific discussion, see also item 4.): Simple sharing of N reduction burdens from air- or waterborne inputs based on a reference period, and allocating input reduction requirements applying a “polluter pays principle” to these two pathways. By doing so, CAIs can be derived for Baltic Sea sub-basins (excluding the most sensitive coastal waters; 1-nautical-mile-zone). CAIs will be calculated in N-inputs per area and per time unit, and could be divided into oxidised and reduced nitrogen CAI. This enables the inclusion of CAIs in a European receptor map, then providing critical loads for terrestrial and freshwater ecosystems and CAIs (total nitrogen input) together in one map. Such maps provide the basis for calculation of exceedance of critical loads and CAIs for eutrophication by atmospheric N-deposition for the EMEP region including or not including the Baltic Sea sub-basins. Past and recent deposition rates as well as deposition data from existing future scenarios (e.g. CLE, MFTR) could be considered in the exceedance calculations.
- Level 2 - Complex approach (not achievable within GP review, but worthwhile for subsequent future work): Full Integrated Assessment Modelling (IAM) including cost benefit analysis taking on board the consideration of the 32nd RedCore DG.
- Level 3 - Very comprehensive approach (urgently needed but possible only in the long-term perspective): Including coastal eutrophication: A project considering this important area of work would be even more complex and need inclusion of experts working for the implementation of the Water Framework Directive (possibly ECOSTAT and maybe others, and for some coastal waters much higher resolution is required for the calculation of atmospheric N deposition).

6. Open questions and uncertainties

The uncertainties of the “Simple approach” need to be further explored, and also evaluated against the complexity of level 2 and 3, and if there are the necessary data and models available to deliver more operational and robust CAIs than those derived from the Simple approach.

Further, it has to be clearly indicated in maps and reports that calculation under Level 1 and 2 do not cover the problem of coastal eutrophication. This is a big limitation, since the coasts (1 nautical mile zone) are much more sensitive to N-inputs than the Baltic sub-basins, although the shares of atmospheric N inputs of total N input in some coastal waters are minor. Beside particularly high atmospheric ammonia deposition from sources on land, the coastal waters also receive high N loads via rivers and to a smaller extend direct inputs. The coastal waters are subject to regulation by the Water Framework Directive. CLRTAP and HELCOM alone cannot solve coastal eutrophication issues.

The discussion during the 32nd RedCore showed that it will not be possible to perform an Integrated Assessment as required in question 2.8 (see. 2.) within the time frame of the Gothenburg Protocol Review. However, there is big interest from HELCOM as well as from AMP and CIAM experts to continue work on the issue beyond the year 2022 (see 5.). It needs to be clarified if and how such further cooperation could be organised and extra funding would be needed.

Furthermore, additional marine regions should also be incorporated in the future. For instance, it is expected that OSPAR will derive MAIs for the North East Atlantic in the coming years. Calculations of CAIs for the OSPAR sub-basins could be made using a similar approach as proposed for the Baltic Sea sub-basins.

Annex 1:

Outcome of the 14. PRESSURE Meeting, Agenda Item 9 “Eutrophication”

9.5 The Meeting took note of the proposal to consider marine eutrophication in the review and possible revision of the Gothenburg Protocol (document 9-3).

9.6 The Meeting discussed the potential role of HELCOM in this process.

9.7 The Meeting thanked Germany for this initiative to consider a joint effort of HELCOM countries to reduce input of nutrients to the Baltic Sea. The Meeting agreed to prioritize the task and recommended taking into consideration the following points:

- assessment and comparison of costs and benefits of measures addressing airborne reduction versus waterborne reduction;
- how the critical load analysis could consider nutrient limitations
- BALTSEM model would be a helpful tool to compute various scenarios;
- raised importance of increasing ammonia emissions which are not transported as far as NOX in the atmosphere.

9.8 The Meeting agreed to task RedCore DG and PLC IG to look into the issue at their earliest convenience, to establish communication with the Ad-hoc group on Marine Protection (AMP) under the Working Group on Effects of CLRTAP (via: Gudrun.Schuetze@uba.de) and to report to PRESSURE 15-2021 on the progress.