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COUNTRY REPORT FOR GERMANY

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Country report for Germany

Delimitation

This country report focuses on the implementation of the Water Framework Directive (WFD) in the state of Schleswig-Holstein. Schleswig-Holstein manages three river basins, composed of Eider, Elbe, Schlei/Trave. The Eider and Elbe river basin units (RBU) are international river basins. The Eider RBU extends into Danish territory and the Elbe RBU originates in Austria, Czechia, and Poland.[1] The RBU Elbe extents through ten Germany states. Since the implementation of the RBMPs is a state-matter in Germany, the implementation of the RBU Elbe is coordinated by the river basin community (RBC) Elbe.

The ministry of environment of the state of Schleswig-Holstein is responsible for the state-wide control, local coordination, federal coordination (with e.g. other states within the same RBU) and reporting of the WFD.[2] The responsibility for technical and scientific aspects is divided across eight departments; these are divided into water, water protection, river ecology, hydrology and GIS, lakes, groundwaters, hydrogeology, and coastal waters.[3]

The implementation of the WFD is also coordinated at the federal level. The working group Bund-/Länderarbeitsgemeinschaft Wasser (LAWA) elaborates in this respect the methodological approaches to the indicator development and assessment. With respect to coastal waters, two working groups coordinate and plan the implementation between German states with coastal waters and matters related to the regional sea conventions (i.e. OSPAR and HELCOM), in respectively the North- and Baltic Sea (coordinated by BLANO).[4] On the local level, the RBMPs are sub-divided into 34 geographical working areas, consisting of local bodies, authorities, and interest organisations. The local soil- and water associations lead these 34 working areas as self-governing bodies and working groups.[5]

The second River Basin Management Plans (RBMP) are currently under implementation and correspond to the same geographical division as the upcoming third RBMPs. The links to these plans are provided in the table below.

[1] https://www.fgg-elbe.de/einzugsgebiet.html

[2] https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/ueberblick.html

[3] https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/grundlagen.html

[4] https://www.meeresschutz.info/blano.html

[5] https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/praktischeUmsetzung.html

Table 1: Status on Water Plan 2, Germany

Country	Status on WP2	Link to WP2	Comment
Germany – RBMP Eider	Under implementation	*2. BP Eider (schleswig-holstein.de)* *2nd RBMP website*	
Germany – RBMP Elbe	Under implementation	*2. BP Elbe (fgg-elbe.de)* *2nd RBMP website (national)*	
Germany – RBMP Schlei/Trave	Under implementation	*2. BWP Schlei/Trave (schleswig-holstein.de)* *2nd RBMP website*	

- The draft of the third RBMPs was published in December 2020, followed by a six-month public consultation that was concluded in June 2021.[6] As of August 2021, the draft RBMPs are revised in accordance with the comments received under the public consultation. The timetable foresees that the final RBMPs will be published by ultimo December 2021.

Table 2: Status on Water Plan 3, Germany

Country	Status on WP3	Link to WP3	Comment
Germany – RBMP Eider	Under preparation. Revision following public consultation.	*3. Bewirtschaftungsplan Eider (schleswig-holstein.de)* *RBMP website*	Public Consultation on 1st Draft closed 22.06.2021. Final version by 22.12.2021
Germany – RBMP Elbe	Under preparation. Revision following public consultation.	*Erläuterungen Bewirtschaftungsplan Elbe-SH (schleswig-holstein.de)* *RBMP website*	As above
Germany – RBMP Schlei/Trave	Under preparation. Revision following public consultation.	*3. Bewirtschaftungsplan Schlei/Trave (schleswig-holstein.de)* *RBMP website*	As above

As already mentioned above, this country report focuses on the RBUs located in Schleswig-Holstein, consisting of the RBMPs Eider, Elbe, and Schlei/Trave.

6 https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/bewirtschaftungszeitraum3.html

Table 3: Delimitation of the analysis, Germany

Country	River basin management plans
Germany	Eider, Elbe, Schlei/Trave

1 Country context and analysis

The figure below presents the geographical extent of the RBUs. As the figure shows, the RBUs Eider and Schlei/Trave are not characterised by a major river system, such as in the case of the Elbe. As of 2020, the majority of waterbodies is below good ecological status: only 4% of waterbodies have a good status. About three-quarter of the waterbodies have however a moderate ecological status. The two RBUs with estuaries in the North Sea (Eider and Elbe), have a comparably better status than Schlei/Trave, which has estuaries in the Baltic Sea.

Figure 1: Overview of river basin units in Schleswig-Holstein. Source: Land Schleswig-Holstein, 2010, link

All three RBUs are strongly characterised by a high level of agriculture in the form of either cropland or grassland, as the figure below on the distribution of land cover shows for each RBU. Agriculture comprises at least 75% of the land cover in the respective basins. For Eider and Elbe, cropland and grassland comprise about the same share, while cropland accounts for twice the share of grassland in the Schlei/Trave basin.

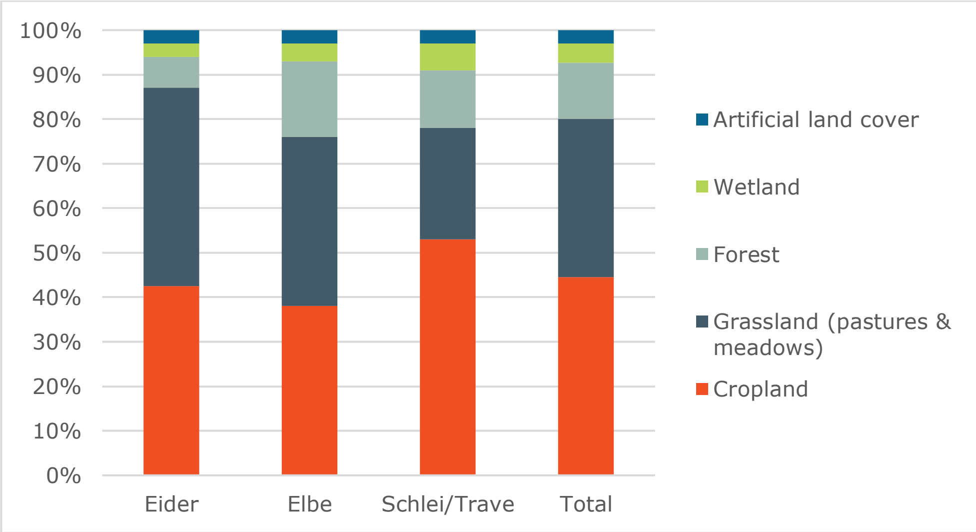

Figure 2: Land cover of the RBUs Eider, Elbe, Schlei/Trave, and Schleswig-Holstein in total (% distribution). Source: Draft, 3rd RBMPs, Chapter 1.1

2 Changes since last COWI comparative assessment

2.1 Have there been significant changes in aspects and approaches described in "Nabotjek af EU-landes fremgangsmåder ved planlægning for marine vandområdet i henhold til Vandrammedirektivet", by COWI for Miljøstyrelsen (The Danish Environmental Agency) in 2018?

For the RBU Schlei/Trave, the third RBMP entails an increase in the number of coastal waters from 25 to 27 and the definition of one territorial waterbody (as compared to zero in previous period); as shown in Table 4 below. The increase in coastal waters can be, partially, attributed to a division of the middle Schlei, Fehmarn Belt, and Fehmarn Sund, which is reasoned with biological differences in the waters as well as an adaptation to regional HELCOM agreements.
For the Elbe RBU, one coastal water was reassigned as a territorial water. The reasons provided for the reallocation of coastal waters in the RBUs Schlei/Trave and Elbe to territorial waters are to achieve increased EU-wide coherence.

Table 4: Number of surface water bodies by type in Schleswig Holstein, with changes to the second RBMP in parentheses

Type of water	Eider	Elbe	Schlei/Trave	Germany
Rivers	135 (0)	209 (0)	272 (0)	616 (0)
Lakes	16 (0)	11 (0)	51 (0)	78 (0)
Transitional waters	1 (0)	1 (0)	0 (0)	2 (0)
Coastal waters	10 (0)	3 (-1)	27 (+2)	40 (+2)
Territorial waters	1 (0)	1 (+)	1 (+1)	3 (+1)
Total waterbodies	163 (0)	225 (0)	351 (+3)	739 (+3)

Source: Draft 3rd RBMPs.

The third RBMPs entail a change to phytoplankton-related quality parameters for coastal waters: Schleswig-Holstein is no longer operating with total biovolume of phytoplankton, biovolume of green algae, and biovolume of blue algae.[7] Chlorophyll-a is thus the only phytoplankton-related element used in the Baltic Sea (as is also the case in the North Sea).

[7] Clarification by the German Environmental Agency

3 Reference for quality parameters in WFD

3.1 How is the reference condition for the quality parameters used in the country established? i.e. are historical measurements, modelling, or expert assessments used? And which point in time/year is used as reference for quality parameters in the WFD, in the case of historical measurements or modelling back to a historical point in time?

As presented above, the third RBMPs in Schleswig-Holstein only operate with chlorophyll-a as a phytoplankton-related quality parameter in coastal waters, which is presented in further detail below, for respectively the North Sea and Baltic Sea. Furthermore, the reference conditions for rivers and lakes are presented more briefly below.

The North Sea

For coastal waters in the North Sea of Schleswig-Holstein, chlorophyll-a concentrations are identified as the only nutrient related quality parameter. The reference values build on modelled correlations between observed total nitrogen (TN) and Chlorophyll-a concentrations in the time period of 1980-2005, as also further explained below.[8, 9] The reference TN concentrations in coastal waters build in turn on a modelling of the reference nutrient loads in the North Sea.[10] Reference values for TN are derived from linear correlations between the weighted means of modelled, riverine, freshwater end-members (of which most historic measurements date back to before 1880) and recent offshore end-members (2000-2005).[11,12] Total phosphorus (TP) is also calculated but is not used in setting the reference condition of coastal waters in the context of the WFD.

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[8] BLMP, 2011, Konzept zur Ableitung von Nährstoffreduzierungszielen in den Flussgebieten Ems, Weser, Elbe und Eider aufgrund von Anforderungen an den ökologischen Zustand der Küstengewässer gemäß Wasserrahmenrichtlinie

[9] Clarification by the lead author of Topcu et al. (2011)

[10] Topcu et al., 2011, Natural background concentrations of nutrients in the German Bight area (North Sea)

[11] Topcu et al., 2011, Natural background concentrations of nutrients in the German Bight area (North Sea), p. 372

[12] The "end-members" refer to the extreme ends of salinity concentrations in respectively freshwaters and offshore waters

The values of the riverine, freshwater end-members are modelled with a river flux model (MONERIS). The reference values in the freshwater end-members are determined through an assumed reference scenario: the upstream nutrient emissions into water are assumed to correspond to i) the absence of anthropogenic influences, ii) a land cover of only forests and grasslands, and iii) a reduced population. The corresponding reference nutrient concentrations are derived from recent measurements of undisturbed reference waters (in e.g. Northern Sweden) and historic measurements. There is therefore no explicit reference year. Due to highly diverse stages of development across the regions at the time, the historic measurements build on a variety of reference years, with most historic measurements dating back to before 1880.[13] Owing to the diversity of regional development mentioned above, the author of the study states that one must be cautious with referring to a single reference year.

For each German river with estuaries in the North Sea (i.e. Rhine, Elbe, Weser, Ems, and Eider), the total nutrient export at pristine conditions is thus calculated. The results are validated against comparable rivers (both domestic and international) that are either currently undisturbed, where pristine conditions are modelled, or where historic measurements are available. In terms of reference years for the rivers used for validation, the period goes as far back as 1850.[14]

The nutrient concentrations of offshore end-members are based on recent measurements in the period of 2000-2005. The decision to use recent measurements is to use regularly sampled years, covering large areas and all seasons.

The natural background nutrient concentrations for coastal waters are subsequently determined through a mixing diagram of two components: 1) the nutrient concentrations of the freshwater end-members, and 2) the offshore end-members of the North Sea model. The offshore end-members used are limited to those that are unaffected from nutrient pollution. The mixing diagram describes natural background nutrient concentrations as a function of salinity, and is presented in Figure 3 below for TN and TP.

[13] Clarification by the lead author of Topcu et al. (2011)

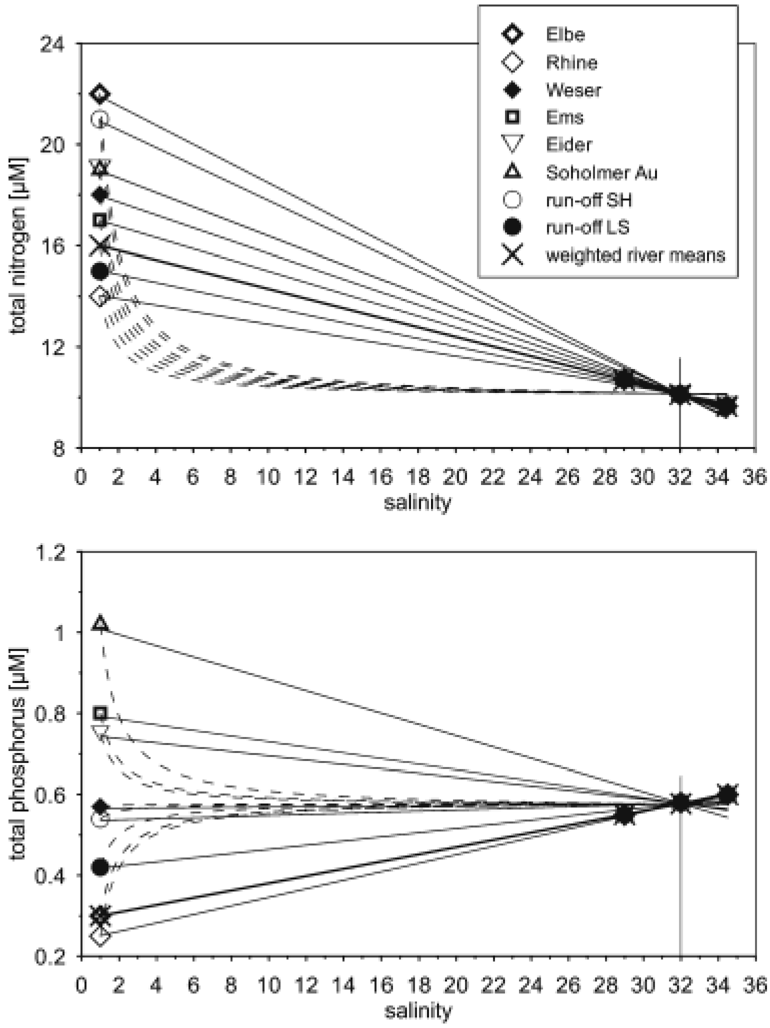

Figure 3: Linear and hyperbolic mixing diagrams of TN and TP for the German Bight, crossing at a salinity of 32. Source: Figure 4 in Topcu et al. (2011)

The calculation of the reference condition for phytoplankton assumes that marine phytoplankton growth is nitrogen-limited, as the correlation between phytoplankton and phosphorus has been shown to be less significant in other marine areas.

The reference values for Chlorophyll-a values that correspond to the modelled TN reference values are subsequently derived from correlations between Chlorophyll-a and TN measurements in the German bight in the growing seasons of 1980-2005.[15, 16] Correlations were derived for each coastal water typology. The resulting reference values for chlorophyll-a lie in the range of 3.3-6.7 µg/l, depending on the coastal water typology.

The Baltic Sea

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[15] BLMP, 2011, Konzept zur Ableitung von Nährstoffreduzierungszielen in den Flussgebieten Ems, Weser, Elbe und Eider aufgrund von Anforderungen an den ökologischen Zustand der Küstengewässer gemäß Wasserrahmenrichtlinie

[16] Clarification by the lead author of Topcu et al. (2011)

For the Baltic Sea in Schleswig Holstein, the only nutrient related quality parameter identified is chlorophyll-a concentration.[17]

The reference condition for chlorophyll-a (and nitrogen concentrations as a supportive parameter) in coastal waters are modelled through a river flux model (MONERIS) that is linked to a Baltic Sea flow and ecological model (ERGOM-MOM).[18]

The model uses historic data, with a reference year of 1880, representing a period before industrialization and agricultural intensification. Little influence of anthropogenic activities can be assumed because strong evidence exists that water transparency and macrophyte coverage even in inner coastal waters were still high at the time. The riverine nutrient inputs are calculated with MONERIS and the remaining nutrient inputs into the Baltic Sea are obtained from a study that reconstructed the historic eutrophication of the Baltic Sea in 1850-2006.[19] Due to large uncertainties in the modelling results, the model calculates the relative difference of chlorophyll-a values between the current- and reference situation. The resulting values are subsequently combined with recent chlorophyll-a measurements from 2001-2012 for each waterbody type, which results in chlorophyll-a reference values in the range of 0.87-8.1 µg/l for coastal waters in Schleswig-Holstein, depending on the coastal water typology.

Rivers

In terms of reference conditions for phytoplankton in rivers, phytoplankton reference levels have only been established for a minority of river typologies, based on current conditions of existing reference rivers, corresponding to an average chl-a concentration of 16 µg/l.[20]

Lakes

The phytoplankton indicators for lakes build on a Phytoplankton Lake Index (PhytoSee Index, PSI) with three input metrics: 1) Biomass (Biomasse), 2) Algae (Algenklasen), and 3) Phytoplankton taxa (Phytoplankton-Taxa-Seen-Index, PTSI).[21] The metric 1) Biomass consists of i) the total phytoplankton biovolume, ii) season-average chlorophyll-a concentration, and iii) chlorophyll-a maximum concentration. The 2) Algae metric is calculated through the biovolumes of algae taxa relevant for the specific lake typology. Finally, the metric of 3) Phytoplankton taxa, or PTSI, describes the trophic state per lake typology.

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[17] Clarification by the German Environmental Agency

[18] BLANO, 2014, Hintergrund- und Orientierungswerte für Nährstoffe und Chlorophyll-a in den deutschen Küstengewässern der Ostsee, https://www.blmp-online.de/PDF/WRRL/Naehrstoffreduktionsziele_Ostsee_BLANO_2014.pdf

[19] Gustafsson et al., 2012, Reconstructing the development of Baltic Sea eutrophication 1850– 2006. AMBIO 41(6): 534-548.

[20] Applicable to types 15_g and 17.

[21] http://gewaesser-bewertung.de/files/handbuch_phyto-see-index_dez2017.pdf

The reference level for the PSI has originally been elaborated by the LAWA in 1998[22] and has most recently been revised in 2014.[23] Related literature on the most recent revision is however not publicly available. It can however be said that for lakes in Northern Germany, the reference level describes an oligotrophic to eutrophic state, depending on the lake typology.

Further information on the indicators and the underlying methodologies can found on a central website.[24]

Table 5: Phytoplankton quality parameters used and their reference condition method

Quality parameter	Establishment method for reference condition	Point in time/year as reference (if historical or modelling)	Comment
Chlorophyll-a - Baltic Sea	Modelling	Ca. 1880	
Chlorophyll-a – North Sea	Modelling	Ca. before 1880	
Chlorophyll-a - Rivers	Modelling	Recent, undisturbed reference rivers	Reference values determined for a limited number
Biovolume of phytoplankton - Lakes	Unclear from available documentation	Unclear from available documentation	Unclear from available documentation
Chlorophyll-a, Seasonal average - Lakes	As above	As above	As above
Chlorophyll-a, Maximum value - Lakes	As above	As above	As above
Algae composition - Lakes	As above	As above	As above
Phytoplankton-taxa composition - Lakes	As above	As above	As above

[22] https://www.lawa.de/documents/gewaesserbewertung_stehende_gewaesser_2_4ed_copy_1552305536.pdf

[23] LAWA (2014): Trophieklassifikation von Seen. Richtlinie zur Ermittlung des Trophie-Index nach LAWA für natürliche Seen, Baggerseen, Talsperren und Speicherseen. Empfehlungen Oberirdische Gewässer. Hrsg. LAWA – Bund/Länder Arbeitsgemeinschaft Wasser. 34 S. zzgl. Access-Auswertetool.

[24] http://gewaesser-bewertung.de/

4 Status

4.1 How large part of the country's/region's water areas are in high, good, moderate, and poor condition, respectively?

The share of waterbodies with good ecological status is very low, corresponding to 4% of all waterbodies (see Table 6). Nearly three-quarter of all waterbodies have further a moderate status.
Most of the coastal waters are below good status, with only one (out of 40 coastal waterbodies) corresponding to a good status. The coastal waterbodies of the Eider are in an overall better status than those in Elbe or Schlei/Trave. In case of the latter, more than 50% of coastal waters have a status below moderate.

A comparison with the 2nd RBMPs shows that the total number of waterbodies with a good ecological status improved by 12 rivers, classified as natural waterbodies, and two lakes.[25] For each type, this corresponds to a small improvement. In terms of coastal waters, the total number of waterbodies with good ecological status deteriorated by one.

*Table 6: Ecological conditions, **number of waterbodies** and %-share, Germany*

	River	Lake	Transitional	Coastal	Total
High	-	-	-	-	-
Good	16 (3%)	14 (18%)	-	1 (3%)	31 (4%)
Moderate	494 (80%)	21 (27%)	2 (100%)	20 (50%)	537 (73%)
Poor	89 (14%)	28 (36%)	-	9 (23%)	126 (17%)
Bad	16 (3%)	15 (19%)	-	10 (25%)	41 (6%)
Total	616	78	2	40	736

Source: 3rd RBMPs, ch. 4.1.2; Note: Waterbodies where targets for 'ecological status' do not apply (e.g. territorial waters) are excluded from the % distribution

According to the RBMPs, a comparison of the ecological status with the second RBMPs has limited value owing to methodological differences in the assessments as well as natural background fluctuations.[26] Regarding the methodological differences, two key factors are mentioned.

Firstly, the quality and extent of the monitoring data has improved, as the overall number of measurements has increased. For some waterbodies, additional biological quality indicators have been investigated. Owing to the

[25] 3rd RBMP, Ch. 13.4.3
[26] 3rd RBMPs, ch. 13.4.3

WFD's 'one-out, all-out' rule, the ecological status is determined by the lowest performing indicator. The addition of new indicators may therefore lead to a lower classification of the ecological status, despite no change in the pressures. Finally, for some waterbodies, the third RBMP is the first generation where monitoring data could be used for the status assessment, as opposed to the transfer of results from comparable waterbodies or the use of expert judgement in the second RBMPs.

Secondly, the quality indicators for rivers and lakes were adjusted on the national level, which renders a comparison between the second and third RBMPs non-valid.

4.2 What is the current status for implementing Water Plan 2 in the country?

As of August 2020, measures from the 2nd management period were still under execution.[27] These relate mostly to diffuse nutrient emissions into groundwaters and morphology of rivers. All basic measures have however been completed, and the 2nd RBMPs are therefore reported to live up to the minimum criteria of the WFD.

The measures of the 2nd management period have not led to an improved ecological status of coastal waterbodies. In the RBU Schlei/Trave, the status of two coastal waterbodies has further deteriorated since 2015.

[27] 3rd RBMPs, ch. 14.1

5 Water Plan 3 contents

5.1 Are efforts planned on other pressure factors than nutrients in Water Plan 3?

Atmospheric deposits from agriculture and energy are the most significant pressure factors for surface waterbodies, affecting all waterbodies (excluding territorial waterbodies that are only subject to good chemical status). The main drivers identified are agriculture, energy production, industry, transport, and urban development. Diffuse pressures from land use are another ubiquitous pressure factor. Depending on the RBU, 80-90% of the nitrogen emissions to surface waters originate from diffuse sources, and of which predominantly from agricultural activities. This results in significant pressures for 86% (633) of waterbodies, including all transitional and coastal waterbodies.

A final, widely dominant pressure factor are physical modifications that impact the status of a high number of waterbodies. The RBMPs list a variety of causes behind the physical modifications, such as for agricultural purposes, flood protection and sluices. Table 7 below presents an overview of the pressures identified across the different RBUs as well as whether corresponding measures are foreseen.

As regards coastal waters, three significant pressures are identified. Diffuse nutrient pollution from agriculture and airborne deposits affects all 40 coastal waterbodies (100%). Further, hydromorphologic alterations impact 11 coastal waterbodies in the Baltic Sea (in the Schlei/Trave RBU).

Table 7: Pressure factors identified in water plans, Germany

		Eider	Elbe	Schlei/Trave	Germany	Actions planned
Point sources	Industry	Not relevant	Not relevant	Not relevant	Not relevant	Yes
	Treatment plants	Not relevant	Significant	Significant	Significant	Yes
	Aquaculture	Not relevant	Not relevant	Significant	Significant	Yes
Diffuse sources	Scattered settlements	Not relevant	Significant	Significant	Significant	not identified
	Agriculture	Significant	Significant	Significant	Significant	Yes
	Rain-related outlets	Not relevant	Significant	Not relevant	Significant	Yes
	Airborne deposits	Significant	Significant	Significant	Significant	not identified
	Other diffuse sources	Not relevant	Not relevant	Not relevant	Not relevant	Yes
Physical impacts	Water extraction	Not relevant	Not relevant	Significant	Significant	not identified
	Physical modification	Significant	Significant	Significant	Significant	Yes
Other	Invasive species	Not relevant	Significant	Significant	Significant	Yes
	Fisheries	Not relevant	Significant	Not relevant	Significant	Yes
	Acidification	Not relevant	Not relevant	Not relevant	Not relevant	No
	Other	Significant	Significant	Significant	Significant	Yes

Source: 3rd RBMPs, Ch. 2.2; Note: For Germany, a pressure was deemed as significant, if the pressure was significant in at least one RBU; Draft Programme of Measures, Annex 2

5.2 Have exemptions from the WFD been used in Water Plan 3 – which and to which extent?

The 3rd RBMPs make wide use of an extension of the deadline from achieving a good ecological status to 2027 under WFD-article 4.4. No derogations for less stringent environmental objectives (art. 4.5), a temporary deterioration of the status (art. 4.6) nor hydromorphological changes (art. 4.7) are applied. Table 8 below presents the exemptions applied under article 4.4 for coastal waters and all waterbodies. For the ecological status, exemptions are applied to nearly all waterbodies (96% of 735 waterbodies).[28] Natural conditions are provided as a reason for all exemptions. Disproportionate costs are also widely applied, however to a lesser degree. Exemptions owing to technical feasibility are only limitedly applied, and only to rivers and lakes in the RBU Schlei/Trave.[29]

Exemptions are also widely applied to the chemical status: all surface waterbodies are subject to exemptions, owing to technical feasibility and natural conditions in all waterbodies. As above, natural conditions are listed for all waterbodies.

Table 8 Exemptions applied until 2027 on coastal waters (excl. Territorial waters) and all waterbodies (incl. territorial waters), Germany

Art.	Description	Coastal waters (excl. territorial)	All waterbodies (incl. territorial)
4.4a	Technical feasibility	0 (0%)	24 (3%)
4.4b	Disproportionate costs	15 (38%)	649 (88%)
4.4c	Natural circumstances	40 (100%)	713 (96%)

Source: 3rd RBMPs, ch. 5.3

The origin behind the high number of exemptions is that despite extensive measures, not all types of pressures can be sufficiently reduced. The RBMPs moreover refer to the latency with which waterbodies reflect a consistent and measurable good ecological status.

As a result, it is expected that none of the waterbodies (including all coastal waters) with an exemption until 2027 will achieve a good status by the end of the third management period (see Table 9 below). For most coastal waters, good status is expected to be achieved between 2027 and 2039 (53%). There are however also a significant number of waterbodies where good status is only expected between 2039 and 2045 (23%) or even after 2045 (25%). The RBMPs conclude therefore that measures need to be implemented beyond 2027. Yet, the plans are not explicitly referring to the need of a fourth management cycle.

[28] 3rd RBMPs, ch. 5.3

[29] It is worth mentioning that Article 4.4.(c) limits extensions due to technical feasibility and disproportionate costs until 2027. This limitation does however not apply to natural conditions. All waterbodies with exemptions in Schleswig-Holstein, have exemptions due to natural conditions..

Table 9: Number of waterbodies expected to achieve good environmental status by 2027, 2039, 2045, or after 2045.

Year	Coastal waters	All waterbodies
By 2027	-	-
Before 2039	21 (53%)	538 (75%)
Before 2045	9 (23%)	126 (18%)
After 2045	10 (25%)	41 (6%)

Source: 3rd RBMPs, ch. 5.4.1

5.3 What are the targets for nitrogen and phosphorus in Water Plan 3? How large reductions (in tons and %) are necessary, and are there concrete targets such as concentration in river waters by estuary?

As previously elaborated, the 3rd RBMPs do not entail changes to the nitrogen and phosphorus targets in river waters by estuary. Nutrient targets are primarily defined as target concentrations in river estuaries, rather than nutrient loads. The approaches taken differ between the North Sea and Baltic Sea.

The North Sea

For the North Sea, a combination of a mass-balance approach and modelling derives corresponding nitrogen concentrations. The reference conditions for nutrients in coastal waters are determined through a modelling exercise of the North Sea catchment, as also described under question 2 above.[30] The reference conditions for chlorophyll-a are established through correlational analysis, and associated chlorophyll-a target values are derived.[31]

The target concentration for nitrogen in the limnic-marine mixing zones to achieve the nutrient targets of coastal waters, are subsequently determined with a mass-balance approach. This approach is chosen as 70-97% of the ecological status in the North Sea are assessed to be influenced from far away of the catchment, such as the river Rhine.[32] On this basis, a target for the mean annual TN concentration in the limnic-marine mixing zones of rivers draining from Germany into the North Sea is defined at 2,8 mg N/l. Based on the 2013-2018

[30] Topcu et al., 2011, Natural background concentrations of nutrients in the German Bight area (North Sea)

[31] BLMP, 2011, Konzept zur Ableitung von Nährstoffreduzierungszielen in den Flussgebieten Ems, Weser, Elbe und Eider aufgrund von Anforderungen an den ökologischen Zustand der Küstengewässer gemäß Wasserrahmenrichtlinie

[32] BLMP, 2011, Konzept zur Ableitung von Nährstoffreduzierungszielen in den Flussgebieten Ems, Weser, Elbe und Eider aufgrund von Anforderungen an den ökologischen Zustand der Küstengewässer gemäß Wasserrahmenrichtlinie

average nitrogen concentrations, it is estimated that a load reduction of 2.706 tons nitrogen is required. Of which 916 tons (or a gap of 17%) reduction are required in the Eider RBU and 1.790 tons (or a gap of 20%) reduction in the Schleswig-Holstein part of the Elbe RBU.[33]

For total phosphorus, a target concentration of 0,1-0,3 mg TP/l is defined, depending on the estuary typology. Based on the 2013-2018 average phosphorus concentration, a load reduction of 201 tons phosphorus has been determined. Of which 100 t (or a gap of 28%) in the Eider RBU and 101 t (or a gap of 32%) reduction in the Schleswig-Holstein part of the Elbe RBU.

The Baltic Sea

For the Baltic Sea, a river flux model (MONERIS) was linked to the Baltic Sea flow and ecological model ERGOM-MOM. Further, the nutrient reduction requirements agreed for the Baltic Sea Action Plan were considered when setting the boundary condition. Based on these model calculations, a mean annual total nitrogen concentration of 2,6 mg/L must be achieved in the limnic-marine mixing zones of all rivers draining from Germany into the Baltic Sea. Further nutrient targets have been identified for dissolved ammonium, nitrate and phosphate.[34] Based on the 2013-2018 average nitrogen concentrations in estuaries, a reduction of the annual nitrogen load by 2.165 t (or a gap of 35%) has been determined to achieve the nutrient target concentration by 2027.[35] The upcoming 2021 Baltic Sea Action Plan, expected for the fall 2021, will recalculate and redistribute the load reduction requirements based on the most recent scientific knowledge. The load reduction requirement may hence be subject to further changes prior to the final versions of the RBMP for Schlei/Trave.

For phosphorus concentrations, an expert judgement was made that phosphorus load reduction targets in the 2013 Baltic Sea Action Plan will be adequate for achieving the environmental objectives. Corresponding target concentrations lie in the range of 0,1-0,15 mg TP/l. Based on the 2013-2018 average phosphorus concentrations, a phosphorus load reduction of 68 t (or a gap of 35%).[36]

For the individual coastal waterbodies, specific nitrogen and phosphorus targets have been established, and are defined by national legislation. [37] For coastal waters of the North Sea, these range from 0,32-0,56 mg TN/l (year average) and 0,031-0,036 mg TP/l (year average), depending on the typology. For the

[33] https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/Downloads/Bewirtschaftungszeitraum3/e09_naehrstoffe_kuesten.pdf?__blob=publicationFile&v=1

[34] BLANO, 2014, Hintergrund- und Orientierungswerte für Nährstoffe und Chlorophyll-a in den deutschen Küstengewässern der Ostsee, https://www.blmp-online.de/PDF/WRRL/Naehrstoffreduktionsziele_Ostsee_BLANO_2014.pdf

[35] Draft Programmes of Measures for the 3rd RBMP of Schlei/Trave, ch. 4.3.1

[36] Draft Programmes of Measures for the 3rd RBMP of Schlei/Trave, ch. 4.3.1

[37] Oberflächengewässerverordnung (OGewV), 2016, https://www.gesetze-im-internet.de/ogewv_2016/OGewV.pdf

Baltic Sea in Schleswig-Holstein, these are 0,20-0,52 mg TN/l (year average) and 0,0136-0,034 mg TP/l (year average).

Table 10: Targets for nitrogen and phosphorus in Water Plan 3 and reductions necessary

Nutrient	Target	Reductions necessary to reach good ecological status
Nitrogen – Baltic Sea (estuary)	2,6 mg TN/l;	2.165 t (35% excess)
Nitrogen – North Sea (estuary)	2,8 mg TN/l	2.706 t (17-20% excess, depending on RBU)
Nitrogen – Baltic Sea (coastal waterbodies)	0,20-0,52 mg TN/l (year average)	Not available
Nitrogen – North Sea (coastal waterbodies)	0,32-0,56 mg TN/l (year average)	Not available
Phosphorus – Baltic Sea (estuary)	0,1 – 0,15 mg TP/l; 526 t TP/yr	68 t (33% excess)
Phosphorus – North Sea (estuary)	0,1 – 0,3 mg TP/l	201 t (28-32% excess, depending on RBU)
Phosphorus – Baltic Sea (coastal waterbodies)	0,0136-0,034 mg TP/l (year average)	Not available
Phosphorus – North Sea (coastal waterbodies)	0,031-0,036 mg TP/l (year average)	Not available

Source: 3rd RBMPS, Ch. 5.2.1.2; OGewV, 2016

5.4 Do the countries have efforts in Water Plan 3 that are expected to lead to achieving good ecological condition and is there an implementation plan for the efforts in Water Plan 3?

The 3rd RBMPs anticipate that the planned measures in the management period will not be sufficient to reach a good ecological status by 2027. The draft Programmes of Measures have assigned specific measures to each waterbody. When it comes to coastal waterbodies most measures focus on pollution from substances. Furthermore, a limited number of measures focus on hydromorphological and other pressures.

In terms of nutrients, the pressures resulting from nitrogen prevent the achievement of a good status. Accordingly, exemptions are applied to all waterbodies below good status (see also section 5.2 above).

The basic measure of a revised fertiliser ordinance (Düngeverordnung) is anticipated to lead to significant reductions in the nitrogen and phosphorus loads. Assuming the 2017 and 2020 revisions of the ordinance will be fully complied with, it is expected that the excess nitrogen loads into groundwaters will decrease by 10.080 t TN/yr.[38] The load reduction is distributed among the RBUs as follows: 40% (or 2.880 t TN/yr) in the RBU Eider, 43% (or 3.200 t TN/yr) in the RBU Elbe, and 25% (or 4.000 t TN/yr) in the RBU Schlei/Trave.[39] As regards nutrient loads entering coastal waters, a reduction of 539 t TN/yr in RBU Eider, 895 t TN/yr in RBU Elbe, and 619 t TN/yr in RBU Schlei/Trave; or 1.434 t TN/yr into the North Sea and 619 t TN/yr into the Baltic Sea from Schleswig Holstein.[40]

Despite these reductions however, it is estimated that the sum of foreseen measures until 2027 will only lead to a 10%-point reduction of the excess nitrogen loads in each RBU. After 2027, a total nitrogen excess load of 1.272 t TN/yr in estuaries of the North Sea and 1.546 t TN/yr in estuaries of the Baltic Sea are therefore expected.[41, 42]

The RBMPs acknowledge that the required measures to achieve the environmental objectives will not be completed by 2027. Nevertheless, the plans state that most of the measures will at the least be under implementation by 2027. Owing to a lack of human- and financial resources, measures need to be further stretched over time.

[38] It is not possible to derive a percentage reduction for all of Schleswig-Holstein due to the lack of necessary data

[39] Draft Programmes of Measures for the 3rd RBMP, ch. 4.3.1.1

[40] Based on subtracting the expected excess nitrogen load in 2027 from the total reductions necessary to achieve good ecological status

[41] For the respective RBUs, this corresponds to 377 t TN/yr (or a 7% exceedance) in Eider, 895 t TN/yr (or a 10% exceedance) in Elbe, and 1.546 t TN/yr (or a 25% exceedance) in Schlei/Trave.

[42] https://www.schleswig-holstein.de/DE/Fachinhalte/W/wasserrahmenrichtlinie/Downloads/Bewirtschaftungszeitraum3/e09_naehrstoffe_kuesten.pdf?__blob=publicationFile&v=1

6 Regulation of fertilizer storage and application

6.1 Which rules apply regarding fertilizer use? Specifically: Are there norms/quotas for nitrogen and phosphorus application? Which ones?

Fertilisation in Germany is regulated by the Fertiliser ordinance (Düngeverordnung), which has been substantially revised in 2017 and 2020, following infringement procedures initiated by the EU Commission.[43] For nitrogen a fertilisation norm, set to crop-specific N demand defined in the ordinance, is applied.[44] Further, a quota of 170 kg organic nitrogen/ha/yr applies.

For zones with high nitrate pollution, fertiliser application must further be 20% below crop-specific N demand (as determined by the Fertiliser ordinance).[45] For phosphorus, the fertilisation is limited to crop-specific P demand defined in the ordinance.

Table 11: Nutrient norms

Nutrient	Quota / Norm	Comment
Nitrogen	Norm: crop-specific demand + Quota: 170 kg organic N/ha/yr + Norm: 20% below crop-specific N demand in zones with high nitrate pollution	Obligatory for all nitrogen, differentiated by crop, field size, season, and soil condition.
Phosphorus	Norm: crop-specific P demand	Obligatory for all phosphorus, differentiated by crop, field size, season, and soil condition.

Source: Düngeverordnung vom 26. Mai 2017 (BGBl. I S. 1305), die durch Artikel 1 der Verordnung vom 28. April 2020 (BGBl. I S. 846) geändert worden ist

[43] Düngeverordnung vom 26. Mai 2017 (BGBl. I S. 1305), die durch Artikel 1 der Verordnung vom 28. April 2020 (BGBl. I S. 846) geändert worden ist. http://www.gesetze-im-internet.de/d_v_2017/D%C3%BCV.pdf

[44] The crop-specific demand is defined in annex (Anlage) 4 of the ordinance

[45] All of Germany's territory is designated as a Nitrate Vulnerable Zone as stipulated by the Nitrate Directive. Based on levels with high nitrate pollution, local (high nitrate pollution) zones are designated to identify areas where stricter fertilisation requirements may be needed.

6.2 Are there requirements to equipment for storing and applying livestock manure? Which ones?

Storage requirements for livestock manure are tailored to the individual needs of the farm and water protection. The storage capacity must exceed the amount of fertiliser required for a rotational period. The storage capacity for liquid manure accumulating on a farm must be sufficient for a six-month period. For solid manure, the capacity must suffice for a two-month period. The accumulating amount of manure per livestock unit is predetermined by the ordinance.

In terms of the application of manure, the use of certain types of application equipment (and indirectly the type of manure) is prohibited. Annex 8 of the ordinance specifies the prohibited equipment, consisting of the following:[46]

- Solid manure spreader without controlled manure supply to the distributor,
- Liquid manure tanker with a free outlet on the distributor,
- Central baffle distributors with upwards directed radiation,
- Liquid manure tanker with a vertically arranged open centrifugal disc,
- Rotary jet sprinkler for irrigation of liquid manure.

6.3 Are there requirements in terms of point in time for storing and applying livestock manure? Which ones?

Fertiliser application is generally limited to specific fertilisation needs, and the following requirements apply:

- No application of solid manure between 01.12. and 15.01.
- No application of fertiliser with high P content between 01.12. and 15.01.
- Application of liquid organic fertiliser on grassland and land with multi-year forage cultivation is limited to 80 kg/ha in the fall
- Application of fertiliser on flooded, water-saturated, frozen, or snow-covered soil is prohibited
- Minimum distance to waterbodies for inclined fields, ranging 3-30 meters pending on inclination.

For nitrate polluted zones, further restrictions apply:

- Fertilisation in the fall is limited to winter rapeseed and catch crops for non-feed uses

[46] Düngeverordnung vom 26. Mai 2017 (BGBl. I S. 1305), die durch Artikel 1 der Verordnung vom 28. April 2020 (BGBl. I S. 846) geändert worden ist. http://www.gesetze-im-internet.de/d_v_2017/D%C3%BCV.pdf

- Application of liquid organic fertiliser on grassland and land with multi-year forage cultivation is limited to 60 kg/ha in the fall

- Application on grassland is prohibited between 01.10. and 31.01.

- Application of solid manure is prohibited between 01.11. and 31.01.

7 Pressure factors from other regions

7.1 How are pressure factors dealt with, e.g. nutrient supply and non-natural substances, from other countries/regions?

The assessment of international pressure factors and the coordination of international measures generally occurs through German federal bodies (e.g. the federal ministry of environment) that participate in international and regional forums, such as OSPAR, HELCOM, and IMO.[47] The participation of German federal bodies is coordinated through LAWA, and particularly BLANO regarding coastal waters.

As regards nutrient reduction targets in the North Sea and Baltic Sea, the reduction targets were coordinated through BLANO on a federal level, OSPAR for the North Sea, and HELCOM for the Baltic Sea.

For the coastal waters of the Baltic Sea, it is assessed that atmospheric deposition plays a central role in the nutrient loads.[48] The target setting for the estuaries of 2,6 mg TN/l assumes that the Gothenburg protocol will be fulfilled. For the RBUs as a whole however, atmospheric deposition plays only a subordinate role. The target-setting of 2,6 mg TN/l further assumes that all HELCOM members will fulfill the Baltic Sea Action Plan.[49]

For the RBU Elbe, which is an international river basin, the implementation is further coordinated through the elaboration of an international RBMP, that is coordinated by the International Commission for the protection of the Elbe (IKSE).

[47] Clarification by the Ministry of Agriculture & Environment, Schleswig-Holstein
[48] BLANO, 2014, Hintergrund- und Orientierungswerte für Nährstoffe und Chlorophyll-a in den deutschen Küstengewässern der Ostsee, https://www.blmp-online.de/PDF/WRRL/Naehrstoffreduktionsziele_Ostsee_BLANO_2014.pdf
[49] Clarification by the Ministry of Agriculture & Environment, Schleswig-Holstein

8 Other information

N/A

9 Summarized findings

Table 12: Summary table, Germany

	Subject / Question	Germany
2	***Changes since last COWI neighbor assessment***	
2.1	*Have there been significant changes in aspects and approaches described in Vandrammedirektivet.pdf (mst.dk)?*	Yes; Change in number of waters. Phytoplankton parameters were removed in the assessment of coastal waters in the Baltic Sea in Schleswig Holstein
3	***Reference for quality parameters in WFD***	
3.1	*Methodology for establishing reference condition for quality parameters?*	Chl-a – Baltic Sea: Historic/Modelling ; Chl-a – North Sea: Historic/Modelling
3.2	*Point in time*	Baltic Sea: ca. 1880; North Sea: ca. 1880
4	***Status***	
4.1	*Water areas in high, good, moderate, and poor condition*	0% high, 4% good, 73% moderate, 17% poor, 6% bad
4.2	*Status for implementing Water Plan 2 and Water plan 3*	WP2 measures are still under execution.
5	***Water Plan 3 contents***	
5.1	*Efforts planned on other pressure factors than nutrients in WP3?*	Yes
5.2	*Exemptions from the WFD used in WP3? And is there a "Plan B", e.g. preparations for a potential 4th plan period or for seeking exemptions to larger degrees?*	Yes. No indications of a 4th RBMP.
5.3	*WP3 target, nitrogen (ton, %)*	Baltic Sea: 2,6 mg TN/l North Sea: 2,8 mg TN/l
5.3	*WP3 target, phosphorus (ton, %)*	Baltic Sea: 0,1-0,15 mg TP/l (526 t/yr) North Sea: 0,1-0,3 mg TP/l
5.3	*Reductions necessary to reach targets, nitrogen? (ton, %)*	Baltic Sea: 2,165 t (35% excess) North Sea: 1,706 t (17-20% excess)
5.3	*Reductions necessary to reach targets, phosphorus? (ton, %)*	Baltic Sea: 68 t (33% excess) North Sea: 201 t (28-32% excess)

5.3	*Concrete targets, e.g. concentration in estuaries, nitrogen?*	Yes
5.3	*Concrete targets, e.g. concentration in estuaries, phosphorus?*	Yes
5.4	*Efforts in WP3 expected to lead to good ecological condition?*	No
5.5	*Implementation plan for efforts in WP3?*	Yes
6	***Regulation of fertilizer storage and application***	
6.1	*Norms/quotas for nitrogen application?* *Which ones?*	Yes, crop-specific norm; organic quota 170 kg/ha/yr. -20% norm in high nitrate polluted zones
6.1	*Norms/quotas for phosphorus application?* *Which ones?*	Yes, crop-specific norm
6.2	*Requirements to equipment for storing and applying livestock manure?* *Which ones?*	Yes. Six-month capacity, equipment restrictions
6.3	*Requirements in terms of point in time for storing and applying livestock manure?* *Which ones?*	Yes. Time- and soil-condition restrictions
7	***Pressure factors from other regions***	
7.1	*How are pressure factors dealt with, e.g. nutrient supply and non-natural substances, from other countries/regions?*	International coordination occurs, and it is assumed that international agreements will be fulfilled

Table 13: List of interviewees

Country	Name	Organisation
Germany	Not available	Ministry for Energy Transition, Agriculture, Environment, Nature and Digitization Schleswig-Holstein, Department of Water Management
Germany	Not available	German Environment Agency, Section for the Protection of the Marine Environment
Germany	Dr. Dilec Topcu	University of Hamburg, Institute for Geology