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Support to the Common Implementation Strategy

WG ECOSTAT Nutrient targets : Questionnaire Responses

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Report for

ECOSTAT co-chairs

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1. Introduction

ECOSTAT has a mandate to compare methods used by Member States to set management objectives for nutrients that are compatible with good ecological status and good environmental status. This report compiles the responses of countries to a questionnaire on setting and implementing management objectives for nutrients.

The aim of the questionnaire was to understand national approaches for setting and implementing management objectives for nutrients and to help Member States and collaborating countries to improve their approaches and, thereby, achieve the objectives of the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD). The work builds on the previous ECOSTAT task to compare nutrient good/moderate boundaries and intends to investigate whether and how these nutrient boundaries have been used to derive management objectives for nutrients and what approaches exist in water management to define quantitative objectives in terms of loads.

The questionnaire comprised three parts:

- Part A addressed the methods used to derive management objectives for nutrients and was answered separately for rivers, lakes, transitional, coastal and marine waters.
- Part B addressed the methods used to calculate current nutrient loads, including catchment modelling.
- Part C addressed methods/approaches used for achieving the management objectives for nutrients.

This report presents the responses of the countries to the questionnaire.

2. Responses – Part A: Methods used to derive management objectives for nutrients

2.1 Part A1: Methods used to derive management objectives for nutrients in Lakes

1.1 Have you set management objectives for nutrients for lakes that are exposed to nutrient pollution?

Summary of responses

21 countries responded that they have set management objectives for nutrients for all nutrient polluted water bodies.

4 countries responded that they have set management objectives for nutrients for some nutrient polluted water bodies.

1 country responded that they have not set management objectives for nutrients for water bodies.

Responses in detail

1.1.1 Yes, for all nutrient polluted water bodies

Respondents:

- BG
- CZ
- DE
- EE
- IE
- EL
- FR (for 1 water agency)
- IT
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI
- SE
- IS
- NO
- TR

1.1.2 Yes, for some nutrient polluted water bodies

Respondents:

- DK
- ES
- FR (for 2 water agencies)
- CY

1.1.3 No

Respondents:

- FR (for 5 water agencies)

1.2 When setting management objectives for nutrients, is there a focus on reduction of phosphorus, nitrogen, or both or on the limiting nutrient? Please explain why.

Summary of responses

9 countries responded that they focus on reduction of phosphorus when setting management objectives for nutrients.

1 country responded that they focus on reduction of nitrogen when setting management objectives for nutrients.

16 countries responded that they focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients.

4 countries responded that they focus on reduction of the limiting nutrient when setting management objectives for nutrients.

Responses in detail

1.2.1 Phosphorus

Respondents:

- CZ
- DK
- IE
- ES
- FR (for 2 water agencies)
- NL
- AT
- FI
- SE

Explanation

Country	Explanation
CZ	In terms of the primary purpose for assessing the causes of eutrophication, the methodology for assessing the ecological potential of Czech reservoirs uses the indicator total phosphorus, which is a robust indicator of productivity and eutrophication of the aquatic ecosystem in temperate reservoirs and lakes. Total phosphorus best documents the degree of eutrophication and is associated with crucial anthropogenic pressures, such as discharges of wastewater from settlements and some industrial plants, and to a lesser extent loads from agriculture or fisheries.

Country	Explanation
DK	Phosphorous and nitrogen targets are used as supporting elements in lakes. The targets help to define good ecological status. Management objectives focus on reducing phosphorus in lakes with outlets, because phosphorus has been identified as the most important stress factor in Danish lakes.
IE	The concentration of total phosphorus (mg/l) in lakes is a key indicator of lake water quality. The concentration of total phosphorus has been set in Irish legislation as an environmental quality standard to support the ecological status of Irish Lakes (S.I. No. 77 of 2019 European Union Environmental Objectives (Surface Waters (Amendment) Regulations 2019).
ES	The Royal Decree 817/2015, 11th September, defines criteria to monitor and assess the status of surface water bodies and environmental quality standards, including the good/moderate boundary for total phosphorus (and High/good boundary).
FR (for 2 water agencies)	1. For lakes, the "industrial and urban nutrients" pressures are based on total phosphorus (point pollution by nutrients). The "nutrients from agriculture" pressure is based on phosphorus (the phosphorus in sediment were not considered). The phosphorus has been considered as a tracer of the impact of « nutrients » pressure because is the most decisive for eutrophication. The diagnosis of the "impact of nutrients pressure" was updated for the 2019 'assessment'. The methods were quite similar to those used in 2013. 2. Phosphorus is the controlling factor of phytoplanktonic production in freshwater. In order to avoid the bloom of cyanobacteria, we have to prevent the reduction of N/P ratio.
NL	Both have standards. But in practice there is focus on P as this is most limiting factor. Focus on N reduction may be in favour of cyanobacteria.
AT	Phosphorus is the key nutrient that triggers eutrophication in Austrian lakes, hence only targets (= G/M boundaries) for total phosphorus were defined. There are no targets or boundaries for nitrogen in lakes. H/G and G/M boundaries were defined only for natural lakes >50 ha (with the exception of three naturally eutrophic soda pans in Eastern AT, which dry out regularly). The targets (= G/M boundaries) are met in almost all natural lakes (and only slightly exceeded in 3 lakes in some years). No G/M boundaries were defined for artificial lakes (15 storage reservoirs, 2 fish ponds, 1 mining lake and 1 Danube flood retention lake)
FI	Generally, phosphorus, but can also be set to the other limiting factor. Management objectives aims at achieving GES in a water body.
SE	Main focus is on P in fresh waters since they are regarded P-limited. However, the need for measures in coastal waters can require management objectives for both nitrogen and phosphorus in rivers.

1.2.2 Nitrogen

Respondents:

- NL

Explanation

Country	Explanation
NL	See explanation in Part A, Section 1.2.1.

1.2.3 Phosphorus & Nitrogen

Respondents:

- BG
- DE
- EE
- EL
- FR (for 2 water agencies)
- IT
- CY
- LV
- LT
- HU
- PL
- PT
- RO
- IS
- NO
- TR

Explanation

Country	Explanation
EE	Reducing both main nutrient income from point sources as most effective mitigation measure. Rarely information about internal load (phosphorus) are available.
EL	Management measures for elimination of nutrients load from agriculture and point pollution sources.
FR (for 2 water agencies)	When the downgrading is caused by the phytoplanktonic indicator, nutrients reduction is required.
IT	For lake water bodies which are included in sensitive areas or in catchment basin of sensitive areas, UWWT Directive emission thresholds for nitrogen and phosphorous applies to UWWT Plants discharges. For lake water bodies which are included in nitrate vulnerable zones or catchment basin of nitrate vulnerable zones, nitrogen limit loading of 170 Kg per hectare/year from livestock manure applies without prejudices to exception agreed with EC according to Nitrate Directive. In addition, in vulnerable areas, maximum standard nitrogen inputs (MAS) are also established for each crop per year, calculated from livestock manure and chemical fertilizers. Furthermore, in non-vulnerable zones there is a maximum nitrogen limit loading of 340 kg per hectare per year of nitrogen from livestock manure. Additional specific measures are planned for urban waste water re-use for agriculture in order to reduce direct nutrient discharges in water bodies.
CY	The focus is set on the reduction of the specific nutrient that exceeds its concentration target, in reservoirs. No management objectives have been set yet for natural lakes due to the fact that they are all temporary lakes and either brackish or salt lakes. In addition, they are very few but belong to several types. This creates several problems for their monitoring and for the assessment of their status. So far, only tentative reference conditions have been defined while no complete assessment system exists.
LV	Because nitrogen is more related to diffuse loads from agriculture, but phosphorus to diffuse loads from meliorated forests or from WWTP.
LT	An option for both phosphorus and nitrogen has been chosen, since boundaries of good status for those nutrients have been set on the basis of their concentrations link with the values of certain biological quality elements. Therefore, achievement of good status for those nutrients is believed to ensure that good status values for biological quality elements are to be achieved if no other significant pressures are present. Furthermore, an assessment of significant pressures revealed that point and non-point (diffuse) pollution with nutrients makes is dominant types of impacts on water bodies, resulting in a significant number of water bodies affected by eutrophication. As a result, it is obvious that nutrient pollution reduction measures are the main tools for achieving environmental objectives, including good status values for biological quality elements.
HU	We have boundaries for nutrients including : NH4-N, NO2-N, NO3-N, Total N , PO4-P and Total P for lakes.

Country	Explanation
PL	Concentration target has been set for lakes on the basis of the good/moderate boundary for nutrients used for status classification.
PT	Although in reservoirs phosphorus tends to be the limiting nutrient, we have defined quality objectives for both components. The main sources of nutrients are identified as point and diffuse pressures and, when nutrient values result in good ecological potential failure or risk of failure, specific measures are defined and implemented.
RO	The management objectives have been defined in the Danube River Basin District Management Plan developed at the International Commission for the Protection of the Danube River (ICPDR) level and have been addressed to both EU Member States and non-EU Member states. The ICPDR is a transnational body established to implement the Danube River Protection Convention, as a platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). RO has not established the management objectives at water body level but at national level, following the approach on the Danube basin-wide level (international level). These management objectives have been considered in the National Management Plan and River Basin Management Plan as a component part of the water management process within the Danube district. Information on management objectives at the Danube River Basin District level can be found on website www.icpdr.org (Danube River Basin District Management Plan 2009 and 2015 update).
IS	IS has implemented regulations on European directives (Urban wastewater treatment directive 91/271/EEC, Nitrates directive 91/676/EEC), and Water Framework Directive. Regulations on UWWTD in IS state that concentration targets of percentage target should be used to determine the maximum critical load.
NO	Phosphorus is regarded as the limiting factor in freshwaters, and is focused on primarily.
TR	As the percentage target is applied, both N and P parameters are targeted.

1.2.4 Limiting Nutrient

Respondents:

- DE
- ES
- IT
- FI

Explanation

Country	Explanation
ES	See explanation in Part A, Section 1.2.1.
IT	See explanation in Part A, Section 1.2.3.
FI	See explanation in Part A, Section 1.2.1.

1.3 If you have set management objectives for nutrients, please indicate which methodology has been used and provide a short description of the methodology including links to background reports or publications. In the description, please indicate whether and how you have considered pressure-response relationships.

Summary of responses

16 countries responded that they use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients.

8 countries responded that they use historical information to set management objectives for nutrients.

11 countries responded that they use expert judgement to set management objectives for nutrients.

9 countries responded that they use other methods to set management objectives for nutrients.

Responses in detail

1.3.1 Modelling based on nutrients vs BQE-response relationships

Respondents:

- DK
- DE
- EE
- IE
- ES
- FR (for 3 water agencies)
- IT
- CY
- HU
- NL
- AT
- PL
- PT
- FI
- NO
- TR

Explanation

Country	Explanation
DK	Mitigation measures are calculated as the difference between: 1. Critical loads that support good ecological status for biological quality elements (chlorophyll, phytoplankton and macrophytes) in different lake types. The method is described in the following report (in Danish): http://dce2.au.dk/pub/SR376.pdf 2. Load of phosphorous based on partly measured and partly modelled data. A baseline, based on planned mitigation measures, is accounted for when defining load. For further description see Part B.
DE	Pressure-response relationships (Modelling), Historical information and Expert judgment were used to derive Orientation- values and Background – values (Reference conditions) for Total-Phosphorus. See: Riedmüller, U., Hoehn, E., Mischke, U., Deneke, R. (2013a): Ökologische Bewertung von natürlichen, künstlichen und erheblich veränderten Seen mit der Biokomponente Phytoplankton nach den Anforderungen der EU-Wasserrahmenrichtlinie. Abschlussbericht für das LAWA-Projekt-Nr. O 4.10. Im Rahmen des Länderfinanzierungsprogramms „Wasser, Boden und Abfall" 2010. 154 S. zzgl. Anhänge. Riedmüller, U., Mischke, U., Hoehn, E. (2013b): Bewertung von Seen mit Hilfe allgemeiner physikalisch-chemischer Parameter. Seetypspezifische Hintergrund- und Orientierungswerte für die Parameter Gesamtphosphor und Sichttiefe. Im Auftrag

Country	Explanation
	und unter fachlicher Begleitung der Länderarbeitsgemeinschaft Wasser – Expertenkreis Seen. Stand 6. März 2013. 10 S.
EE	Objectives have set by the expert, combining the historical information (paleorecord) and modelling. Pressure-response relationship considered in intercalibration exercises or on reports from experts. Also reference conditions are considered. Guidance No 13, Vighi & Chiaudani 1985; Ellis & Adriaenssens, 2006; Hering et al., 2010.
IE	Initial work in defining ecological status and nutrient standards was carried out by two research projects commissioned by the EPA (Irvine et al., 2001; Free et al. 2006). The broad approach to defining the high/good and good/moderate boundary for total phosphorus (TP) in IE was based on the response of macrophytes (in terms of diversity and colonization) phytoplankton, phytobenthos and fish to total phosphorus. Later work by Free et al., 2016 carried out further analysis which included a larger dataset to look at the relationships of the BQE's with both phosphorus and typology parameters and strong correlations were identified. There is a clear separation of status classes based on the TP concentration with an obvious decline in status with increasing TP concentration. Mean values for the high/good boundary (≤ 0.010 mg l-1 TP) and good/moderate boundary (0.025 mg l-1 TP are set in legislation (S.I. No 77 of 2019). Refs: Irvine, K., Allott, N., deEyto, E., Free, G., White, J., Caroni, R., Kennelly, C., Keaney, J., Lennon, C., Kemp, A., Barry, E., Day, S., Mills, P., O' Riain, G., Quirke, B., Twomey, H., Sweeney, P., 2001: Ecological assessment of Irish lakes. Environmental Protection Agency, Wexford, 503pp. Free, G., Little, R., Tierney, D., Donnelly, K., Caroni, R., 2006. A reference based typology and ecological assessment system for Irish lakes. Preliminary investigations. 266pp. EPA, Wexford, Ireland. ISBN:1-84095-215-6. Free, G., Tierney, D.T., Little, R., Kelly, F., Kennedy, B., Plant, P., Trodd, W., Wynne, C., Caroni, R. and Byrne, C. (2016) Lake ecological assessment metrics in Ireland: relationships with phosphorus and typology parameters and the implications for setting nutrient Biology and Environment: Proceedings of the Royal Irish Academy , Vol. 116B, No. 3 (2016), pp. 191-204 Published by: Royal Irish Academy S.I. No. 77 of 2019 European Union Environmental Objectives (Surface Waters)(Amendment) Regulations 2019.
ES	When there was data available, it was applied a modelling based methodology; in other cases, expert judgement was the selected methodology.
FR (for 3 water agencies)	Application of the Vollenweider model and a deterministic model The methodology is explained in a guide for the assessment of the status of continental surface waters (rivers, canals, lakes). (only available in French; https://www.eaufrance.fr/sites/default/files/2019-05/guide-reee-esc-2019-cycle3.pdf)
IT	Management objectives are based on UWWT and Nitrate Directives requirements. It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles
CY	For reservoirs, the nutrient concentrations were set against BQE ecological potential (BQE phytoplankton). Box plots comparisons were made and the management objectives where derived based on the G/M boundary. Boundaries were set for Total P and Ammonium, since no clear boundary could be derived for Total N or Nitrates.
HU	Type specific boundaries were set by using the nutrient values distribution on the categorical EQR status of the waterbodies. The analyses include empirical mismatch and boxplot methods as well as gathering historical information and in rare expert judgement if no sufficient data were available for the modelling.
NL	For lakes a large national data base is used with regression analysis between N, P and chorophyll-a.
AT	The methodology has not changed since the report of Philipps et al. (2016). Details see in: Wolfram, G., C. Argillier, J. de Bortoli, F. Buzzi, A. Dalmiglio, M. T. Dokulil, E. Hoehn, A. Marchetto, P.-J. Martinez, G. Morabito, M. Reichmann, S. Remec-Rekar, U. Riedmüller, C. Rioury, J. Schaumburg, L. Schulz & G. Urbanic, 2009. Reference conditions and WFD compliant class bounderies for phytoplankton biomass and chlorophyll-a in Alpine lakes. Hydrobiologia 633:45-58.
PL	The management objectives are the same as the good/moderate boundary for nutrients used for status classification. For lakes the good/moderate boundary has been set by using statistic correlation test between

Country	Explanation
	phytoplankton and nutrient concentration on the basis of the methodology defined in Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018).
PT	Nutrient values for reservoirs are currently under review and will be updated for the 3rd cycle of RBMP. This review includes a mix of different methodologies, considering historical data and links to BQE (when possible), resulting in a set of possible values; the final values are being established considering all the outputs, through expert judgement. The new boundaries will be included in the next RBMP.
FI	Setting of management objectives for lakes in FI is described in the guidance: Huttunen, M. 2019: Estimation/Setting of management objectives for load reductions using the VEMALA model (link, see also Part B, Section 3). The methodology is used both for WFD river basin management and for MFSD purposes, and it estimates spatial needs to reduce anthropogenic nutrient loading. The methodology aims at identifying such spatial load reduction objectives that solves simultaneously load reduction needs both for inland water bodies as well as recipient coastal and marine areas. The input data for VEMALA estimation are: i) present observed concentrations of nitrogen (N) and phosphorus (P), ii) target concentrations for reaching good ecological status (GES), and iii) modelled N and P concentrations for natural background loading and for different sectors of human impact. Regional Centers for Economic Development, Transport and the Environment, that are responsible for RBMP's and PoM's check the input data and target concentrations and, if necessary, correct them. Methodology used for the estimation utilizes optimizing where the need for load reduction for the respective water body (WB) is also split to include those water bodies whose catchment areas locate above (upstream of) the WB in question. This is to proportionate nutrient loading reduction evenly and to take into account at the same time reduction needs of the water bodies and load retention inside the water body.
TR	Modeling studies were carried out to reveal alternative scenarios in order to determine measures and achieve water quality targets in water bodies. But for modelling studies, historical information given in the previous river basin action plans in TR and expert judgement were also used.

1.3.2 Historical information

Respondents:

- DE
- EE
- ES
- FR (for 1 water agency)
- LV
- HU
- AT
- PT

Explanation

Country	Explanation
DE	See explanation in Part A, Section 1.3.1.
EE	See explanation in Part A, Section 1.3.1.

Country	Explanation
ES	See explanation in Part A, Section 1.3.1.
LV	When available, historical information is used (rarely).
HU	See explanation in Part A, Section 1.3.1.
AT	See explanation in Part A, Section 1.3.1.
PT	See explanation in Part A, Section 1.3.1.

1.3.3 Expert Judgement

Respondents:

- BG
- DE
- EE
- EL
- ES
- FR (for 1 water agency)
- LV
- HU
- AT
- PT
- IS

Explanation

Country	Explanation
DE	See explanation in Part A, Section 1.3.1.
EE	See explanation in Part A, Section 1.3.1.
EL	Management objectives have based on the ecological status, on publications, reports, on expert judgement.
ES	See explanation in Part A, Section 1.3.1.
LV	See explanation in Part A, Section 1.3.2.
HU	See explanation in Part A, Section 1.3.1.
AT	See explanation in Part A, Section 1.3.1.
PT	See explanation in Part A, Section 1.3.1.
IS	We have used nutrient data from natural water bodies to set the reference values for nutrients and the cut off between ecological status is set using expert judgement. This work is in progress.

1.3.4 Other

Respondents:

- CZ
- EL
- FR (for 2 water agencies)

- IT
- LT
- RO
- FI
- SE
- IS

Explanation

Country	Explanation
CZ	The concentration of total phosphorus in the reservoir is always related to the concentration of total phosphorus in the inflows and depends on the flow rate of the reservoir or the time of water retention. Type-specific values of Ptot concentration for maximum and good ecological potential were derived in from type-specific limit values of Ptot in running waters (see Part A Rivers). The Vollenweider P retention relationship corrected for use in reservoirs was used to calculate the Ptot concentration in individual reservoir types (Hejzlar et al. 2006). https://www.mzp.cz/C1257458002F0DC7/cz/prehled_akceptovanych_metodik_vod/$FILE/OOV-Metodika_hodnoceni_%20ekologicky%20potencial_%20kategorie_jezero-20140301.pdf (in Czech) https://www.researchgate.net/publication/226975669_Modelling_Phosphorus_Retention_in_Lakes_and_Reservoirs
EL	See explanation in Part A, Section 1.3.3.
FR (for 2 water agencies)	The masterplan for Water Development and Management (SDAGE) does not specify objectives for nutrients' reduction for all the waterbodies. The plan identifies the waterbodies vulnerable to eutrophication owing to nutrient fluxes and/or hydromorphological alterations. Management structure concerned by these waterbodies are encouraged to engage processes of critical load. Nutrients reduction targets can be defined locally in accordance with the masterplan for Water Development and Management, the program of measures and in light of the context of each water body.
IT	See explanation in Part A, Section 1.3.1.
LT	The relation between physio-chemical quality elements and biological quality elements was tested on the basis of data from monitoring sites which were not affected by hydromorphological alterations (modified hydrological and morphological parameters (regulated water level lakes, etc.)). The threshold values for physio-chemical parameters were calculated by taking the average value between the 75 percentile value of better ecological class and the 25 percentile value of lower ecological class. The correlation was established between nutrients (total nitrogen and phosphorus) and biological quality elements.
RO	This approach has been built upon the results of the pressure analysis, the water status assessment, and includes, as a consequence, measures of basin-wide importance oriented towards the agreed visions and management objectives for each significant water management issue (SWMI), nutrient pollution being one of SWMI identified at the Danube River Basin District and national level. The following management objectives have been set up in the 2015 Update of the Danube River Basin Management Plan (DRBMP 2015): - Further reduction of the total amount of nutrients entering the Danube and its tributaries and the nutrient loads transported into the Black Sea. - Further reduction of the nutrient point source emissions by the implementation of the management objectives described for organic pollution (implementing the Urban Waste Water Treatment Directive (EU MS) and by constructing a specified number of wastewater collecting systems and municipal wastewater treatment plants (Non-EU MS) and further reduction of pollution of the surface waters from the major industrial and agricultural installations by implementing the Industrial Emissions Directive (EU MS) and introducing Best Available Techniques at a specified number of industrial facilities (Non-EU MS)) as they address the nutrient pollution as well.

Country	Explanation
	- Further reduction of the nitrogen pollution of the ground and surface waters by the implementation of the EU Nitrates Directive according to the developed action programs within the designated vulnerable zones or the whole territory of the country (EU MS). - Ensuring sustainable agricultural production and soil nutrient balances and further reduction of the diffuse nutrient pollution by implementation of basic and cost-efficient supplementary agri-environmental measures linked to the EU Common Agricultural Policy (EU MS) and by implementation of best management practices in the agriculture considering cost-efficiency (Non-EU MS). - Further decrease of the phosphorus point source pollution by implementation of the EU Regulation on the phosphate-free detergents (EU MS) and by reduction of phosphates in detergent products (Non-EU MS). See page 114 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/
FI	See explanation in Part A, Section 1.3.1.
SE	Simple regression models based on physico chemical parameters https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/foreskrifter/register-vattenforvaltning/klassificering-och-miljokvalitetsnormer-avseende-ytvatten-hvmfs-201925.html https://www.smhi.se/publikationer/publikationer/revidering-av-fysikaliska-och-kemiska-bedomningsgrunder-i-kustvatten-underlag-infor-uppdatering-av-hvmfs-2013-19-1.130745
IS	See explanation in Part A, Section 1.3.3.

1.4 Do you determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs? What methodology do you use?

Summary of responses

8 countries responded that they do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

16 countries responded that they do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

Responses in detail

1.4.1 Yes

Respondents:

- DK
- DE
- EL
- LV
- NL
- PL
- FI
- SE

Methodology Used

Country	Description
DK	DK applies empirical models to calculate nutrient target concentrations/critical loads that support good ecological status for BQEs (chlorophyll, phytoplankton and macrophytes) for each lake typology. The project is described in the following report (in Danish): http://dce2.au.dk/pub/SR376.pdf.
DE	Reduction targets are derived individually for each lake. Targets are derived by comparison of actual nutrient level with the lake-type-specific Orientation-values.
EL	The approach used is described in the methodology for the identification of anthropogenic pressures and their impacts, that was developed during the 2nd planning cycle and is available in the following link: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/Methodologia_Piesewn_v3.pdf
LV	We use load reduction target that is compatible with good status for nutrient sensitive BQEs (phytoplankton, macrophytes).
NL	On national level a gap analysis is available for nutrients. Loads and sources are known and split up to low level, e.g. within agriculture (soil type, ground water level, precipitation, transport etc), and classis main sources split (industry, households, etc). In fewer cases Water Managers have detailed lake specific reduction goals based on models like PC lake. https://themasites.pbl.nl/modellen/pclake/index.php Measures are considered and planned based on this broad or detailed analysis.
PL	For lakes the good/moderate boundary has been set by using statistic correlation test between phytoplankton and nutrient concentration on the basis of the methodology defined in Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018).
FI	Yes, we determine a load reduction target using modelling as described in Part A, Section 1.3. When optimizing, we use the maximum load reduction of 75% of all anthropogenic loading. The Lake Load Response (LLR) model can be used to support estimation of critical load reduction, i.e. how external nutrient load reduction influence total nutrient concentrations and chlorophyll-a. Kotamäki N., Pätynen A., Taskinen A., Huttula T. & Malve O. 2015. Statistical dimensioning of nutrient loading reduction - LLR assessment tool for lake managers. Environmental Management 56: 480–491. DOI: 10.1007/s00267-015-0514-0.
SE	Maximum critical load is derived in relation to the pressure analyses, while a load reduction target is derived in order to dimension the need for measures. Target is set to 2 times the reference value for TotP which is in agreement with the G/M boundary. The G/M boundary is based on the relationship to the same boundary for phytoplankton in lakes.

1.4.2 No

Respondents:

- BG
- CZ
- EE
- IE
- ES
- FR (for 4 water agencies)
- IT
- CY
- LT
- HU
- AT
- PT
- RO
- IS
- NO
- TR

Methodology Used

Country	Description
BG	<u>Description of methodology:</u> A pilot **Methodology for assessment of the Ecological capacity of reservoirs for fish production in cages (ECRfish)** was developed and applied in the process of development of RBMP of East Aegean River Basin Directorate 2016-2021 (https://earbd.bg/indexdetails.php?menu_id=665). The methodology is based on the determination of a maximum critical load of total phosphorus dissociated into the water in the process of cage fish farming appears to be the basic factor influencing the water ecosystem. The method proposed is based on the models of Dillion and Rigler (1975) and Ferreira et al. (2007) for assessment of the level of loading by biogenic elements dissociated in the medium during the functioning of cage aquafarms and metrics described in the Report on Best Aquaculture Practices (DK). The purpose of this survey is to appraise the reliability of the model used and to propose methods for determining the following important indices in reservoirs with intensive fish production in cages: **1. Total ecological capacity of reservoirs (ECRT).** The ECRT parameter is determined by the hydrological and ecological characteristics of the reservoir and reflects the total (maximum admissible) capacity for phosphorus load, the impact of which is within the "**admissible ecological change**", i.e. does not give rise to a risk of negative changes in the good ecological potential. ERC is a constant indicator for the investigated reservoir (water body) under the specific environmental conditions. Its values may vary when there is a considerable change in the nutrient pressure from water bodies located upstream and therefore the monitoring program should provide for river monitoring stations at points anteceding the place where rivers flow into reservoirs with cage aquaculture, which would monitor the total phosphorus concentration. **2. Ecological capacity of reservoirs for fish production in cages (ECRfish).** The ECRfish factor reflects that part of the total ecological capacity of reservoirs for phosphorus load (ECRT), which is admissible to be generated in fish production without posing any risk of negative changes in the ecological potential of the reservoir. For determining ECRfish, phosphorus loads from other point and diffuse sources of pressure on reservoirs are also taken into account and are expressed as a correction factor (K). To ensure comparability between the values of defined parameters when doing the calculations for ECRT, ECRfish and K the ascertained loads of phosphorus are expressed in the form of fish production per year ($t.y^{-1}$). $\mathbf{ECR_{fish} = ECRT - K\ (t.y^{-1})}$ $K = P_e / P_{loss} (t.y^{-1})$ Where: K – correction coefficient. Reflects the quantity of fish produce which will generate a phosphorus load equivalent to the load from additional diffuse and point sources of pressure on the water body (agriculture, settlements, industry, etc.) P_e – diffuse and point phosphorus load from external sources ($kg.y^{-1}$) P_{loss} – loss of phosphorus in the environment in the process of breeding hydrobionts ($kg.t^{-1}$) The methodology for assessment of ECR_{fish} is in the process of implementation in the large deep reservoirs in BG with intensive cage fishfarming.
CZ	This method is primarily suitable for true natural lakes. For reservoirs that are HMWB, we consider more appropriate and consistent the principle that the reservoir achieves good ecological potential if it lies on a watercourse in good ecological status.
FR (for 4 water agencies)	The maximum critical load or a load reduction target can be defined locally (if needed) with good status for nutrient sensitive BQEs.
PT	Nutrient loads are assessed as part of the RBMP and inform the PoM. Nutrient values compatible with BQE good quality and overall good status/potential are defined as concentration values. In the licensing process the setting of emission limit values is based on a combined approach, considering the other existing pressures and defining the maximum load that the water body can receive so that the good status is not altered or that it can be reached.
TR	A percentage target is used for the reduction of nutrient loads.

1.5 Is there a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status?

Summary of responses

18 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary.

2 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements.

6 countries responded that there is not a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.

Responses in detail

1.5.1 Yes, the management objective is to reach the nutrient concentration at good/moderate boundary

Respondents:

- BG
- CZ
- DK
- EE
- IE
- ES
- FR (for 4 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- FI
- SE
- NO

Methodology Used

Country	Description
CY	For reservoirs, the management objective is to maintain or reduce nutrient levels below the target concentration defined, which has been set based on the G/M boundary of BQEs ecological potential.
LV	In some cases the objective is reduced based on expert judgement.
NL	Yes in principle management is focused on achieving both nutrient and nutrient sensitive biology. Focus is on the G/M boundary.
NO	Both biological quality elements and nutrient concentration (physico-chemical quality element) is addressed in classification of ecological status.

1.5.2 Yes, the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements

Respondents:

- PT
- IS

Methodology Used

Country	Description
PT	From the options above, the second one suits our reality better, as the management objective is to reach good status but nutrient concentrations should ideally be lower than the good/moderate boundary (and not at the good/moderate boundary).
IS	The high/good boundary is based on nutrient concentration in natural, unpolluted rivers/lakes/coastal waters. The management objective is based on Icelandic regulations which is in concert with European directives.

1.5.3 No, another approach is used to set the management objective

Respondents:

- DE
- EL
- FR (for 1 water agency, which also responded yes)
- IT
- RO
- TR

Methodology Used

Country	Description
DE	Yes, there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, the management objective is to reach the nutrient concentration at good/moderate boundary or better and to reach good ecological status (or potential) of the biological quality elements.
EL	The setting of nutrient boundaries at good/moderate status is an ongoing project, for methodology aspects - see explanation in Part A, Section 1.3.3.
FR (for 1 water agency, which also responded yes)	The assessment of the nutrients pressure impact allow the definition of actions independently of the good status (target of non –degradation) or less than good status observed. The action ambition and the nutrients reduction target are defined locally in consultation framework (Water Development and Management Plan (SAGE), river contract…) which gather the water stakeholders.

Country	Description
IT	Management objectives consist of full implementation of UWWT and Nitrate Directives with additional specific measures on urban waste water re-use for agriculture. It is expected that such objectives will allow to reach thresholds established for nutrients as physical-chemical parameters supporting BQE. It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles.
RO	See explanation in Part A, Section 1.3.4.
TR	Although biological quality elements were also used for identification of nutrient sensitive areas, as the reference water bodies for all typologies has not been determined yet in TR, ecological status of the water bodies couldn't be identified.

1.6 If you have set management objectives for nutrients, please specify which policy the management objectives are meant to address.

Summary of responses

24 countries responded that policy the management objectives are meant to address the WFD.

15 countries responded that policy the management objectives are meant to address the NiD.

13 countries responded that policy the management objectives are meant to address the UWWTD.

3 countries responded that policy the management objectives are meant to address other policy.

Responses in detail

1.6.1 WFD

Respondents:

- BG
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 4 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI
- SE
- IS
- NO
- TR

Explanation

Country	Explanation
IE	The management objectives are set to address the Water Framework Directive and other water-related Community legislation as appropriate.

Country	Explanation
CY	The management objectives have been set according to the provisions of WFD in order to achieve Good physicochemical status and furthermore Good ecological status/potential in all water bodies. There is one reservoir that falls within a Nitrate Vulnerable Zone (NVZ), but the management objectives are set based on WFD targets.
HU	Nutrient thresholds are part of the Government Decree 1155/2016. (III. 31.) on the revised 2015 River Basin Management Plan of HU.
NL	Objectives are primarily set and based on WFD definition. Synergy is there of course with NiD and Natura2000 species/habitats.
AT	Eutrophication was the main pressure for large Alpine lakes, measures were taken during the 1970s and 1980s to improve the situation and pave the way for reaching good ecological status today. Nowadays the maintaining of the good ecological status with fulfilling the targets for total phosphorus are important to fulfil the requirements of the WFD. Based on WFD the directives NiD and UWWTD are integral part of the programme of measures. The Nitrate Action Programme requires measures to reduce nutrient emission by diffuse sources, the UWWTD for reducing emissions by point sources.
PL	WFD: reaching at least the good / moderate boundaries.
PT	The approach used to define management objectives for nutrients takes into account the requirements of these directives. However UWWTD and NiD directives were approved before the WFD and need to be harmonize with the WFD objectives, due to the important role of agriculture and urban waste waters as nutrients sources. A revision of the UWWTD is ongoing but we don´t understand why the NiD was not considered to be reviewed.
SE	National environmental quality objectives (zero eutrophication) https://www.sverigesmiljomal.se/environmental-objectives/.
NO	For WFD: good/moderate boundary.

1.6.2 NiD

Respondents:

- CZ
- DE
- IE
- EL
- ES
- FR (for 1 water agency)
- IT
- AT
- PL
- PT
- RO
- FI
- IS
- NO
- TR

Explanation

Country	Explanation
IE	See explanation in Part A, Section 1.6.1.
AT	See explanation in Part A, Section 1.6.1.
PL	NiD: reducing water pollution by nitrates from agricultural sources and preventing further pollution.
PT	See explanation in Part A, Section 1.6.1.

Country	Explanation
NO	For NiD: limitation on application of fertiliser.

1.6.3 UWWTD

Respondents:

- CZ
- DE
- IE
- EL
- ES
- IT
- AT
- PL
- PT
- RO
- IS
- NO
- TR

Explanation

Country	Explanation
IE	See explanation in Part A, Section 1.6.1.
AT	See explanation in Part A, Section 1.6.1.
PL	UWWT: in some way implementation the UWWTD may be interpreted as load management objectives at the measure level.
PT	See explanation in Part A, Section 1.6.1.
NO	for the UWWTD: level of treatment for phosphorus.

1.6.4 Other

Respondents:

- FR
- RO
- SE

Explanation

Country	Explanation
RO	- Industrial Emissions Directive and Best Available Techniques. - EU Common Agricultural Policy and best agricultural practices. - EU Regulation on the phosphate-free detergents.
SE	See explanation in Part A, Section 1.6.1.

1.7 If you have not set management objectives for nutrients, please explain the reasons. In addition, please provide information on how you achieve the WFD objectives instead (for water bodies exposed to nutrient pollution).

Summary of responses

5 countries responded that they have not set management objectives for nutrients and provided some explanation of the reasons.

Responses in detail

Respondents:

- FR (for 2 water agencies)
- CY
- AT

- RO
- IS

Country	Explanation
FR (for 2 water agencies)	1. Water bodies with no objective are in less strict objectives. The obstacles are identified and the approach to reach the good status beyond 2027 will be deploy in the program of measures. 2. The water local actors, in consultation framework (Water Development and Management Plan (SAGE), river contract…), build local diagnosis on the assessment of nutrients pressure impact behind the risk of the non -achievement of good status and the designation of aquatic systems vulnerable to eutrophication. Those local diagnosis are used to develop a precise action plan (sewage treatment plant, agricultural sector) in order to reduce phosphorus and/or nitrogen input to reach the good status of waterbodies.
CY	For reservoirs - Although Total N was checked both for the purposes of the 2nd and 3rd RBMPs, there was no clear distinction for N levels on the G/M boundary. The reason could probably be attributed to a possible P limitation in CY reservoirs.
AT	No targets were defined for artificial lakes for the following reasons: - (high) Alpine storage lakes: no eutrophication pressure, since above human settlements - Fish ponds (carps): eutrophic due to the purpose of the lake - Mining lake: the only mining lake >50 ha is oligotrophic and considered to easily meet the environmental objectives (= good ecological potential in terms of the general physical-chemical parameters). - Danube flood retention lake: regular flood events cause short-term eutrophication phases, while the lake is oligo-mesotrophic in the remaining time. By expert judgment, it is considered to easily meet the environmental objectives (= good ecological potential in terms of the general physical-chemical parameters). Therefore, no targets for nutrients were defined until now.
RO	At the national level, the same approach as the Danube basin wide level has been applied; by implementing the EU Directives and regulations, the measures under implementation at the national level have been contributing to the reduction of nutrients inputs into surface waters.
IS	Pressure due to nutrient pollution is in general not of big concern in Icelandic wb. The main objectives remain in high/good status.

2.2 Part A2: Methods used to derive management objectives for nutrients in Rivers

2.1 Have you set management objectives for nutrients for rivers that are exposed to nutrient pollution?

Summary of responses

25 countries responded that they have set management objectives for nutrients for all nutrient polluted water bodies.

1 country responded that they have set management objectives for nutrients for some nutrient polluted water bodies.

2 countries responded that they have not set management objectives for nutrients for water bodies.

Responses in detail

2.1.1 Yes, for all nutrient polluted water bodies

Respondents:

- BE-Wa
- BG
- CZ
- DE
- EE
- IE
- EL
- ES
- FR (for 2 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- IS
- NO
- TR

2.1.2 Yes, for some nutrient polluted water bodies

Respondents:

- FR (for 3 water agencies)

2.1.3 No

Respondents:

- DK
- FR (for 3 water agencies)

2.2 When setting management objectives for nutrients, is there a focus on reduction of phosphorus, nitrogen, or both or on the limiting nutrient? Please explain why.

Summary of responses

4 countries responded that they focus on reduction of phosphorus when setting management objectives for nutrients.

1 country responded that they focus on reduction of nitrogen when setting management objectives for nutrients.

21 countries responded that they focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients.

4 countries responded that they focus on reduction of the limiting nutrient when setting management objectives for nutrients.

Responses in detail

2.2.1 Phosphorus

Respondents:

- IE
- FR (for 2 water agencies)
- FI
- SE

Explanation

Country	Explanation
IE	In Irish rivers phosphorus is usually the limiting nutrient (measured as molybdate reactive phosphorus (MRP)). In some rivers, total ammonia (TA), may also need to be considered. The concentration of total MRP and total ammonia have been set in Irish legislation as environmental quality standards to support the ecological status of Irish rivers (S.I. No. 77 of 2019 European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019).
FI	Generally, phosphorus, but can also be set to the other limiting factor. Management objectives aims at achieving GES in a water body.
SE	Main focus is on P in fresh waters since they are regarded P-limited. However, the need for measures in coastal waters can require management objectives for both nitrogen and phosphorus in rivers.

2.2.2 Nitrogen

Respondents:

- FR (for 1 water agency)

2.2.3 Phosphorus & Nitrogen

Respondents:

- BG
- CZ
- DE
- EE
- EL
- ES
- FR (for 3 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- IS
- NO
- TR

Explanation

Country	Explanation
CZ	For point sources of pollution, the main emphasis is on the elimination of phosphorus compounds, the main limiting nutrients for inland and partly also for brackish and marine ecosystems. The increased content of nitrogen compounds is addressed not only due to inland waters, where its impact is secondary, but also with regard to marine ecosystems. It is addressed primarily by measures in the catchment area.
DE	Phosphorus & Nitrogen are both important factors that are capable of contributing to eutrophication in freshwaters and that need to be managed.
EE	Reducing both main nutrient income from point sources as most effective mitigation measure.
EL	Phosphorus and Nitrogen show different pollution sources (detergents, WWTP), also phosphorus and nitrogen are the primarily responsible for eutrophication of freshwaters; hence, the best approach would be to define criteria for both elements.
ES	The Royal Decree 817/2015, 11th September, defines criteria to monitor and assess the status of surface water bodies and environmental quality standards in rivers, including the good/moderate boundary for total phosphorus, phosphate, ammonia, and nitrates (and High/good boundary).
FR (for 3 water agencies)	1. The reduction of nutrients is based on the resorption of the pressures at their origin. 2. « Urban and industrial nutrients » pressures have been estimated by organic carbon pollution (BDO5) and reduce nitrogen (point pollution by oxydizable organic matter and nutrients) Nutrients pressures from agriculture have been estimated by nitrates concentrations measured or modeled. Phosphorus pollution has been estimated by expert judgement. This pollution only concerns few water bodies (for this agency). These parameters are considered as tracer impact of « urban and industrial nutrients » pressure and nutrients pressure from agriculture limiting the achievement of good status.
IT	For river water bodies which are included in sensitive areas or in catchment basin of sensitive areas, UWWT Directive emission thresholds for nitrogen and phosphorous applies to UWWT Plants discharges. River water bodies which are included in nitrate vulnerable zones or catchment basin of nitrate vulnerable zones, nitrogen limit loading of 170 Kg per hectare/year from livestock manure applies without prejudices to exception agreed with EC according to Nitrate Directive. In addition, in vulnerable areas, maximum standard nitrogen inputs (MAS) are also established for each crop per year, calculated from livestock manure and chemical fertilizers. Furthermore, in non-vulnerable zones there is a maximum nitrogen limit loading of 340 kg per hectare per year of nitrogen from livestock manure. Additional specific measures are planned for urban waste water re-use for agriculture in order to reduce direct nutrient discharges in water bodies.
CY	The focus is set on reducing the levels of the specific nutrient that exceeds its concentration target.
LT	An option for both phosphorus and nitrogen has been chosen, since boundaries of good status for those nutrients have been set on the basis of their concentrations link with the values of certain biological quality elements. Therefore, achievement of good status for those nutrients is believed to ensure that good status values for biological quality elements are to be achieved if no other significant pressures are present. Furthermore, an assessment of significant pressures revealed that point and non-point (diffuse) pollution with nutrients makes is dominant types of impacts on water bodies, resulting in a significant number of water bodies affected by eutrophication. As a result, it is obvious that nutrient pollution reduction measures are the main tools for achieving environmental objectives, including good status values for biological quality elements.
HU	We have boundaries for nutrient including : Total Nitrogen, Total Phosphorus, PO4-P and Total Organic Nitrogen for rivers for all typology.
NL	Both have standards with one in all in principle.
PL	As the management objective is to reach the nutrient concentration at good/moderate boundaries, both N and P were taken into account.

Country	Explanation
PT	We have defined quality objectives for both components. The main sources of nutrients are identified as point and diffuse pressures and, when nutrient values result in good ecological status/potential failure or risk of failure, specific measures are defined and implemented.
RO	The management objectives have been defined in the Danube River Basin District Management Plan developed at the International Commission for the Protection of the Danube River (ICPDR) level and have been addressed to both EU Member States and non-EU Member states. The ICPDR is a transnational body established to implement the Danube River Protection Convention, as a platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). RO has not established the management objectives at water body level but at national level, following the approach on the Danube basin-wide level (international level). These management objectives have been considered in the National Management Plan and River Basin Management Plan as a component part of the water management process within the Danube district. Information on management objectives at the Danube River Basin District level can be found on website www.icpdr.org (Danube River Basin District Management Plan 2009 and 2015 update)
SK	Management objectives were set for Total P, P-PO4, Total N, N-NH4, N-NO3 for surface river water bodies in SK.
IS	IS has implemented regulations on European directives (Urban wastewater treatment directive 91/271/EEC, Nitrates directive 91/676/EEC), and Water Framework Directive. Regulations on UWWTD in IS state that concentration targets of percentage target should be used to determine the maximum critical load.
NO	Phosphorus is regarded as the limiting factor in freshwaters, and is focused on primarily.
TR	As the percentage target is applied both N and P parameters are targeted.

2.2.4 Limiting Nutrient

Respondents:

- BE-Wa
- FR (for 3 water agencies)
- IT
- FI

Explanation

Country	Explanation
BE-Wa	Standards have been put in place with respect to the NiD. In fact, farmers have to respect maximum loads for nitrogen of organic origin. This means that farms cannot exceed a certain amount of nitrogen produced and imported in comparison to the agricultural land available to them. In addition, each year, about 5% of Walloon farms in the "vulnerable zone" are inspected for specific indicator : "potentially leachable nitrogen" (nitrate residues). Three different parcels in the farm are measured in this respect to measure the nitrate residues in the soil which indicate if farmers respect standards or not. Grasslands adjacent to watercourses must be fenced to limit the impact of livestock on stream hydromorphology and to limit the input of faeces directly into the water. Since 1991, farmers must observe a 6-metre wide buffer strip along waterways. Fertilizer inputs are prohibited on this buffer strip. Currently, we are putting in place a framework that will force farmers to cover this buffer strip with a distinct crop cover. Permits for industrial wastewater must take into account the status of the water body impacted and adjusted standards. Some previous permits are currently being revised to adjust standards to the current status of water bodies.

Country	Explanation
	Treatment plants can be equipped with a tertiary treatment system that reduces nutrient discharges into water bodies.
FR (for 3 water agencies)	1. The program of measures aims the enhancement and the preservation of the aquatic environment. All nutrients at risk of downgrading are considered in the implementation of the measure. 2. All the factors downgrading the ecological status of waterbodies are considered in the definition of measures of input reduction. The phosphorus is mainly the limiting factor.
IT	See explanation in Part A, Section 2.2.3.
FI	See explanation in Part A, Section 2.2.1.

2.3 If you have set management objectives for nutrients, please indicate which methodology has been used and provide a short description of the methodology including links to background reports or publications. In the description, please indicate whether and how you have considered pressure-response relationships.

Summary of responses

16 countries responded that they use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients.

9 countries responded that they use historical information to set management objectives for nutrients.

10 countries responded that they use expert judgement to set management objectives for nutrients.

12 countries responded that they use other methods to set management objectives for nutrients.

Responses in detail

2.3.1 Modelling based on nutrients vs BQE-response relationships

Respondents:

- BE-Wa
- DE
- EE
- IE
- ES
- FR (for 3 water agencies)
- IT
- CY
- HU
- NL
- AT
- PL
- PT
- FI
- NO
- TR

Explanation

Country	Explanation
BE-Wa	Under development: we determine the maximum critical load (standards x water flows) and the real load per surface water body (results of chemical analysis x water flows). The result of this analysis is a potential "gap" between the target and the reality. Doing so, we estimate a load reduction target per parameter and per surface water body. For the agricultural sector, we use modelisation (EPIC GRID) to estimate loads par water body.

Country	Explanation
DE	Pressure-response relationships (modelling), historical information and expert judgment were used to derive orientation values and background values (reference conditions). There has been no change of methodology / boundaries since the publication of Phillips et al. (2018): Best practice for establishing nutrient concentrations to support good ecological status. JRC Science for Policy report. EUR 29329 EN, Publications Office of the European Union, Luxembourg, 142 pp. See: Halle, M. & A. Müller (2014): LAWA ACP-Projekt O 3.12: Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern. Anlagen zum Endbericht im Rahmen des Länderfinanzierungsprogramms „Wasser, Boden und Abfall" (LFP O 3.12) Halle, M. & A. Müller (2015): LAWA-ACP-Projekt O 6.14: Fließgewässertypspezifische Ableitung von Orientierungswerten und taxaspezifischen Präferenzspektren des Makrozoobenthos für den Parameter Eisen. Endbericht. Müller, A., Halle, M. and Bellack, E. (2017). Schwellenwerte und biologische Indikatoren für physikalisch-chemische Parameter in Fließgewässern. (Threshold values and biological indicators for physicochemical parameters in running waters) Wasser und Abfall 06/2017: 25-30. Halle, M. & A. Müller (2017): Ergänzende Arbeiten zur Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern in Fließgewässern. – Abschlussbericht inkl. Anhang zum LAWA-Projekt Projekt O 3.15.
EE	Objectives have set by the expert, combining the historical information and modelling. Pressure-response relationship considered in intercalibration exercises or on reports from experts. Also reference conditions are considered.
IE	The description of the methodology for the establishment of the relevant boundary values was reported to ECOSTAT in 2014 and is not repeated to avoid duplication.
ES	When there was data available, it was applied a modelling based methodology; in other cases, expert judgement was the selected methodology.
FR (for 3 water agencies)	1. A deterministic modelling is used in order to model the phytoplantonic growth (POLUPA model French acronym for —Politic of the act against phosphorus and nitrogen). (reference only available in French: https://www.shf-lhb.org/articles/lhb/pdf/1990/03/lhb1990011.pdf) 2. PEGASE model (French acronym for —Planning and management of water purification) is used with non-stationary scenarios to characterize the water quality. The model requires as input, at least data like digital terrain models, water flow, water level and other hydrodynamic measurements in some geo-localized points, diffuse loads properties, ecological model data (to characterize bacteria, phytoplankton, zooplankton, macrophytes, shells, etc…), chemical discharges (from industry and cities) and treatment plant effect. If possible, the calibration is done with measured data (from monitoring network) to reach a good correlation between modeled and measured data. The model is also used as a prospective tool to identify the potential impact of measures and to select measures to retain for the program of measures. Information: http://www.pegase.ulg.ac.be/?pg=4
IT	Management objectives are based on UWWT and Nitrate Directives requirements with addition on specific measures on riparian zones. It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles.
CY	For the 1st RBMP, target nutrient concentrations had been set based on Skoulikides et al. (2006)*. For the 2nd and 3rd RBMP, with data having become available , nutrient concentrations were set against BQE status (Box plots comparisons) and the initial concentrations from Skoulikides et al. (2006) were evaluated and adjusted where appropriate. For the 3rd RBMP specifically, nitrates concentrations were adjusted based on the BQE G/M boundary. In the absence of clear differentiation of concentrations between biological classes, Total P, phosphates, Total N, nitrites and ammonium boundaries were kept as suggested by Skoulikides et al. (2006)*. * Skoulikidis, N.Th., Amaxidis, Y., Bertahas, I., Laschou, S. and Gritzalis, K. 2006. Analysis of factors driving stream water composition and synthesis of management tools-A case study on small/medium Greek catchments. Science of the Total Environment, 362, 205-241

Country	Explanation
HU	Type specific boundaries were set by using the nutrient values distribution on the categorical EQR status of the waterbodies. The analyses include empirical mismatch and boxplot methods as well as gathering historical information and in rare expert judgement if no sufficient data were available for the modelling.
NL	Regression analysis with phytobenthos and with macro-invertebrates. Phytobenthos appears best relationship and caused more stringent standards in the second RBMP as compared to the first.
AT	The methodology has not changed since the report of Philipps et al. (2016).
PL	The management objectives are the same as the good/moderate boundary for nutrients used for status classification. For rivers the good/moderate boundary has been set by using statistic tool developed with the methodology Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018) on the basis of phytobenthos, macrophytes and benthic macroinvertebrate).
PT	Nutrient values for rivers are currently under review and will be updated for the 3rd cycle of RBMP. This review includes a mix of different methodologies, considering historical data and links to BQE (when possible), resulting in a set of possible values; the final values are being established considering all the outputs, through expert judgement. The new boundaries will be included in the next RBMP.
FI	Setting of management objectives for rivers in FI is described in the guidance: Huttunen, M. 2019: Estimation/Setting of management objectives for load reductions using the VEMALA model (link, see also Part B, Section 3.1). The methodology is used both for WFD river basin management and for MFSD purposes, and it estimates spatial needs to reduce anthropogenic nutrient loading. The methodology aims at identifying such spatial load reduction objectives that solves simultaneously load reduction needs both for inland water bodies as well as recipient coastal and marine areas. The input data for VEMALA estimation are: i) present observed concentrations of nitrogen (N) and phosphorus (P), ii) target concentrations for reaching good ecological status (GES), and iii) modelled N and P concentrations for natural background loading and for different sectors of human impact. Regional Centers for Economic Development, Transport and the Environment, that are responsible for RBMP's and PoM's check the input data and target concentrations and if necessary, correct them. Methodology used for the estimation utilizes optimizing where the need for load reduction for the respective water body (WB) is also split to include those water bodies whose catchment areas locate above (upward) the WB in question. The is to proportionate nutrient loading reduction evenly and taking into account at the same time reduction needs of the water bodies and load retention inside the water body.
TR	Modeling studies were carried out to reveal alternative scenarios in order to determine measures and achieve water quality targets in water bodies. But for modelling studies, historical information given in the previous river basin action plans in TR and expert judgement were also used.

2.3.2 Historical information

Respondents:

- DE
- EE
- ES
- FR (for 1 water agency)
- LV
- HU
- AT
- PT

- SK

Explanation

Country	Explanation
DE	See explanation in Part A, Section 2.3.1.
EE	See explanation in Part A, Section 2.3.1.
ES	See explanation in Part A, Section 2.3.1.
LV	When available, historical information is used (rarely).
HU	See explanation in Part A, Section 2.3.1.
AT	See explanation in Part A, Section 2.3.1.
PT	See explanation in Part A, Section 2.3.1.
SK	Methodology on setting nutrient boundaries has been developed in 2007 using historical data from national water quality monitoring (1990-2005), using data from investigation (2002-2006) of reference sites (for some of types) according to the Guidance Document No. 10. Inter-element harmonization (BQE/nutrients) was done later on but based on expert judgement. (*http://www.vuvh.sk/rsv2/?lang=SK* (Metodika pre odvodenie referenčných podmienok a klasifikačných schém pre hodnotenie ekologického stavu vôd))

2.3.3 Expert Judgement

Respondents:

- BG
- DE
- EE
- ES
- FR (for 2 water agencies)
- LV
- HU
- AT
- PT
- IS

Explanation

Country	Explanation
DE	See explanation in Part A, Section 2.3.1.
EE	See explanation in Part A, Section 2.3.1.
ES	See explanation in Part A, Section 2.3.1.
LV	See explanation in Part A, Section 2.3.2.
HU	See explanation in Part A, Section 2.3.1.
AT	See explanation in Part A, Section 2.3.1.

Country	Explanation
PT	See explanation in Part A, Section 2.3.1.
IS	We have used nutrient data from natural wb to set the reference values for nutrients and the cutoff between ecological status is set using expert judgement. This work is in progress.

2.3.4 Other

Respondents:

- BE-Wa
- CZ
- EL
- FR (for 4 water agencies)
- IT
- CY
- LT
- RO
- SK
- FI
- SE
- IS

Explanation

Country	Explanation
BE-Wa	See explanation in Part A, Section 2.3.1.
CZ	Type-specific values for very good and good conditions were determined as the mean values of the data set from the reference sites and from the sites representing good conditions. The boundary for very good and good conditions was derived as the 90th percentile (or 10th percentile) of the data set of reference sites for selected indicators and similarly was followed for the boundary between good and intermediate condition, where processed data from a set of sites representing good conditions were used. Only those profiles in which no significant anthropogenic pressures in the river basin were selected as reference localities (representing a very good conditions). The selection of reference sites to some extent also took into account the results of the selection of reference sites for BQE of ecological status assessment (benthic invertebrates, phytobenthos macrophytes and fish communities). A similar procedure was also used to examine other suitable localities, which could be used to derive criteria for good status and, in particular, to set the boundary between good and moderate status for individual types of water bodies. In this case, such strict criteria were not applied as in the selection of reference sites. In some cases, localities that in one of the components did not meet the definition of slight anthropogenic influence were also included in the selection. These were mainly localities at lower altitudes, where the main anthropogenic pressure is agricultural management, or municipal pollution from smaller settlements, which manifested itself mainly in higher concentrations of nitrate nitrogen. https://www.mzp.cz/C1257458002F0DC7/cz/prehled_akceptovanych_metodik_tekoucich_vod/$FILE/OOV-Metodika_FYZ-CHEM-20130129.pdf (in Czech)
EL	The physicochemical quality of water in five (5) quality classes is assessed using measured DO and nutrient concentrations from each stream site using a DO and a nutrient classification systems. For multiple samplings at a site (various seasons), the median value for each parameter is calculated and used in the classification system. All sites should classified at least in good physicochemical quality. Methodology is described in below site: http://wfdver.ypeka.gr/en/management-plans-en/methodologies-en/ Skoulikidis N., Amaxidis Y., Bertahas I., Laschou S. & Gritzalis K. (2006). Analysis of factors driving stream water composition and synthesis of management tools – A case study on small/medium Greek catchments. The Science of the Total Environment 362: 205-241.
FR (for 4 water agencies)	1. An assessment of Status Pressure/response is established for each waterbody. This assessment is then discussed among the water actors and stakeholders.

Country	Explanation
	2. The masterplan for Water Development and Management (SDAGE) does not specify objectives for nutrients' reduction for all the waterbodies. The plan identifies the waterbodies vulnerable to eutrophication owing to nutrient fluxes and/or hydromorphological alterations. Management structure concerned by these waterbodies are encouraged to engage processes of critical load. Nutrients reduction targets can be defined locally in accordance with the masterplan for Water Development and Management, the program of measures and in light of the context of each water body.
IT	See explanation in Part A, Section 2.3.1.
CY	See explanation in Part A, Section 2.3.1.
LT	The relation between physio-chemical quality elements and biological quality elements was tested on the basis of data from monitoring sites which were not affected by hydromorphological alterations (straightened, flooded or otherwise modified river). The threshold values for physio-chemical parameters were calculated by taking the average value between the 75 percentile value of better ecological class and the 25 percentile value of lower ecological class. The correlation was established between nutrients (total nitrogen and phosphorus) and biological quality elements.
RO	The same methodology as described In Part A, Section 2.2.3. Also, the MOdelling Nutrient Emissions into RIver Systems (MONERIS) was developed to determine nutrient emissions for entire Danube river basin districts and to analyse their retention and transport (pathways) in the river system (See pages 25-29 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/). Also, future development scenarios have been applied and analysed (See pages 118-121 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/).
SK	See explanation in Part A, Section 2.3.2.
FI	See explanation in Part A, Section 2.3.1.
SE	Simple regression models based on physico chemical parameters for non-agricultural rivers. For rivers with more than 10% agriculture in the catchment we used modeled back ground leaching for each water body from the PLC reporting to HELCOM and OSPAR. We used process based models run by data on soil, land use , topography and more. https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/foreskrifter/register-vattenforvaltning/klassificering-och-miljokvalitetsnormer-avseende-ytvatten-hvmfs-201925.html https://www.smhi.se/publikationer/publikationer/revidering-av-fysikaliska-och-kemiska-bedomningsgrunder-i-kustvatten-underlag-infor-uppdatering-av-hvmfs-2013-19-1.130745
IS	See explanation in Part A, Section 2.3.3.

2.4 Do you determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs? What methodology do you use?

Summary of responses

9 countries responded that they do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

18 countries responded that they do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

Responses in detail

2.4.1 Yes

Respondents:

- BE-Wa
- DE
- EL
- FR (for 1 water agency)
- LV
- LT
- PL
- FI
- SE

Methodology Used

Country	Description
BE-Wa	We determine a maximum critical load. Standards set for nitrogen and phosphorus are allow good status for BQEs.
DE	Orientation values compatible with good status for nutrient sensitive BQEs are set in the Ordinance for the Protection of Surface Waters (called Oberflächengewässerverordnung, OGewV 2016). The methods used are described here: There has been no change of methodology / boundaries since the publication of Phillips et al. (2018): Best practice for establishing nutrient concentrations to support good ecological status. JRC Science for Policy report. EUR 29329 EN, Publications Office of the European Union, Luxembourg, 142 pp. See: Halle, M. & A. Müller (2014): LAWA ACP-Projekt O 3.12: Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern. Anlagen zum Endbericht im Rahmen des Länderfinanzierungsprogramms „Wasser, Boden und Abfall" (LFP O 3.12) Halle, M. & A. Müller (2015): LAWA-ACP-Projekt O 6.14: Fließgewässertypspezifische Ableitung von Orientierungswerten und taxaspezifischen Präferenzspektren des Makrozoobenthos für den Parameter Eisen. Endbericht. Müller, A., Halle, M. and Bellack, E. (2017). Schwellenwerte und biologische Indikatoren für physikalisch-chemische Parameter in Fließgewässern. (Threshold values and biological indicators for physicochemical parameters in running waters) Wasser und Abfall 06/2017: 25-30. Additionally, "Bewirtschaftungsziele" (management targets) for total nitrogen were set to protect coastal and marine waters from river nutrient inputs : 1. North Sea 2.8 mg l-1 TN 2. Baltic Sea 2.6 mg l-1 TN These target values are measured at the freshwater-marine boundaries. For the River Rhine, which inter alia flows through DE and enters the sea in NL, the management target applies at the border between DE and NL.
EL	The approach used is described in the methodology for the identification of anthropogenic pressures and their impacts, that was developed during the 2nd planning cycle and is available in the following link: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/Methodologia_Piesewn_v3.pdf
FR (for 1 water agency)	1. According to available data, the expert judgement is based on the capacities to reduce nutrients fluxes.

Country	Description
	2. To reach the objective different actions are used : Phosphorus/chlorophyll model , the determination of phosphorus threshold to reach a concentration of chlorophyll (for instance 0.1 mg/l for 60 µg/l of chlorophyll a for the medium part of a large river), the definition of phosphorus emission norms of urban and industrial input and the removal of phosphorus from washing powder and liquid. A dephosphating policy was implemented in the catchment (sensitive areas to eutrophication, Directive 91/271/EEC). The current BQEs (diatoms macrophytes, fishes) are not as directly linked to nutrients pressure as the phytoplankton can be. 3. The chosen approach consists to confirm that the actions of the program of measures will enable the achievement of the environmental objectives. According to the approach, the critical load is not a discriminating criterion. The ability of the receiving environment to assimilate the pollutant load is assessed by modelling the status after the implementation of measures. Targeted measures are not necessarily those that cause the greatest reductions in annual flows, but they are those that best target flow reductions at the time when rivers are the most sensitive (to low water levels, particularly for parameters related to eutrophication). 4. A maximum critical load or load reduction target in accordance with the EQB for nutrient sensitive EQBs may be determined locally (if necessary).
LV	We use load reduction target that is compatible with good status for nutrient sensitive BQEs (phytoplankton, macrophytes).
LT	We use SWAT modelling system in order to evaluate the load reduction target that is needed to reach good status for nutrients in the river water bodies. Each water body has management objectives of good status according to physio-chemical elements and we calculated reduction targets for each water body with SWAT modelling systems.
PL	"Virtual" loads were estimated at the end point of each WB on the basis of the monitoring data and the load from pressures. This virtual load was cooperated to the GES / GEP borders for these nutrients. From 2019 the GES / GEP borders for nutrients was set on the basis of the sensitivity of BQE.
FI	Yes, we determine a load reduction target using modeling as described in Part A, Section 2.3.1. When optimizing, we use the maximum load reduction of 75% of all anthropogenic loading.
SE	Maximum critical load is derived in relation to the pressure analyses, while a load reduction target is derived in order to dimension the need for measures. Target is set to 2 times the reference value for TotP which is in agreement with the G/M boundary. The G/M boundary is based on the relationship to the same boundary for phytoplankton in lakes.

2.4.2 No

Respondents:

- BG
- CZ
- DK
- EE
- IE
- ES
- FR (for 8 water agencies)
- IT
- CY
- HU
- NL
- AT
- PT
- RO
- SK
- IS
- NO
- TR

Methodology Used

Country	Description
CZ	Within the framework of the International Commission for the Protection of the Danube River, supra-regional targets for nutrients and the need to reduce nutrient inputs for key profiles on the Elbe have been set. Target values of 3.2 mg/l for total nitrogen and 0.1 mg/l for total phosphorus were derived for the Hřensko/Schmilka border profile. The need to reduce inputs in the CZ in the Hřensko/Schmilka profile is 15 011 t/year (33%) of total nitrogen and 579 t/year of total phosphorus (38%). https://www.ikse-mkol.org/fileadmin/media/user_upload/CZ/06_Publikace/01_Ramcova%20smernice%20o%20vodach/2019_MKOL_Informacni_list_Strategie_NP.pdf Only concentration limits were set for the good ecological status of individual water bodies. The permissible substance runoff was solved in the identification of significant pressures and was determined from the values for the limit concentration of the given substance in a specific type of water body and the average annual runoff from the water body.
DK	DK does not calculate nutrient loads specifically for rivers. However, data collected from rivers are used to calculate critical loads for lakes and coastal waters to ensure good ecological status in these waterbodies.
FR (for 8 water agencies)	See explanation in Part A, Section 2.4.1.
NL	It is not specifically calculated, on the other hand we do use this information to calculate the effect of measures on local and national scale using the same models as described for lakes.
PT	Nutrient loads are assessed as part of the RBMP and inform the PoM. Nutrient values compatible with BQE good quality and overall good status/potential are defined as concentration values. In the licensing process the setting of emission limit values is based on a combined approach, considering the other existing pressures and defining the maximum load that the water body can receive so that the good status is not altered or that it can be reached.
TR	A percentage target is used for the reduction of nutrient loads.

2.5 Is there a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status?

Summary of responses

20 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary.

4 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements.

5 countries responded that there is not a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.

Responses in detail

2.5.1 Yes, the management objective is to reach the nutrient concentration at good/moderate boundary

Respondents:

- BE-Wa
- BG
- CZ

- EE
- IE
- EL
- ES
- FR (for 6 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- SK
- FI
- SE
- NO

Methodology Used

Country	Description
CY	The management objective is to maintain or reduce nutrient levels below the management objective defined, which has been set based on the G/M boundary of BQEs status.
NL	Yes both have standards, background is in NL. https://www.pbl.nl/publicaties/nationale-analyse-waterkwaliteit-0
PL	For rivers the good/moderate boundary has been set by using statistic tool developed with the methodology Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018) on the basis of phytobenthos, macrophytes and benthic macroinvertebrate).
NO	Both biological quality elements and nutrient concentration (physico-chemical quality element) is addressed in classification of ecological status.

2.5.2 Yes, the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements

Respondents:

- FR (for 1 water agency)
- NL
- PT
- IS

Methodology Used

Country	Description
NL	See explanation in Part A, Section 2.5.1.
PT	From the options above, the second one suits our reality better, as the management objective is to reach good status but nutrient concentrations should ideally be lower than the good/moderate boundary (and not at the good/moderate boundary).

2.5.3 No, another approach is used to set the management objective

Respondents:

- DE

- FR (for 3 water agencies)
- IT
- RO
- TR

Methodology Used

Country	Description
DE	Yes, there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status , the management objective is to reach the nutrient concentration at good or better /moderate boundary and to reach good ecological status (or potential) of the biological quality elements.
FR (for 3 water agencies)	1. The good status is the aim with sufficient latitude to ensure it if possible (the uncertainty in measurement effectiveness is often greater than half a class). 2. A link with the status of the marine environment (SDAGE). 3. The assessment of the impact of nutrient pressures makes it possible to define the need for action, regardless of the good (>obj of non-degradation) or less than good status observed. The ambition for action and the objective of nutrient reduction are defined locally within the framework of consultation bodies (SAGE, river contracts, etc.) that associate all the stakeholders "water stakeholders". 4. The methodology is based on the information given by biological indicators.
IT	Management objectives consist of full implementation of UWWT and Nitrate Directives with additional specific measures on urban waste water re-use for agriculture. It is expected that such objectives will allow to reach thresholds established for nutrients as physical-chemical parameters supporting BQE. It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles.
RO	This approach has been built upon the results of the pressure analysis, the water status assessment, and includes, as a consequence, measures of basin-wide importance oriented towards the agreed visions and management objectives for each significant water management issue (SWMI), nutrient pollution being one of SWMI identified at the Danube River Basin District and national level. The following management objectives have been set up in the 2015 Update of the Danube River Basin Management Plan (DRBMP 2015): - Further reduction of the total amount of nutrients entering the Danube and its tributaries and the nutrient loads transported into the Black Sea. - Further reduction of the nutrient point source emissions by the implementation of the management objectives described for organic pollution (implementing the Urban Waste Water Treatment Directive (EU MS) and by constructing a specified number of wastewater collecting systems and municipal wastewater treatment plants (Non-EU MS) and further reduction of pollution of the surface waters from the major industrial and agricultural installations by implementing the Industrial Emissions Directive (EU MS) and introducing Best Available Techniques at a specified number of industrial facilities (Non-EU MS)) as they address the nutrient pollution as well. - Further reduction of the nitrogen pollution of the ground and surface waters by the implementation of the EU Nitrates Directive according to the developed action programs within the designated vulnerable zones or the whole territory of the country (EU MS). - Ensuring sustainable agricultural production and soil nutrient balances and further reduction of the diffuse nutrient pollution by implementation of basic and cost-efficient supplementary agri-environmental measures linked to the EU Common Agricultural Policy (EU MS) and by implementation of best management practices in the agriculture considering cost-efficiency (Non-EU MS). - Further decrease of the phosphorus point source pollution by implementation of the EU Regulation on the phosphate-free detergents (EU MS) and by reduction of phosphates in detergent products (Non-EU MS). See page 114 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/
TR	Although biological quality elements were also used for identification of nutrient sensitive areas, as the reference water bodies for all typologies has not been determined yet in TR, ecological status of the water bodies couldn't be identified.

2.6 If you have set management objectives for nutrients, please specify which policy the management objectives are meant to address.

Summary of responses

25 countries responded that policy the management objectives are meant to address the WFD.

17 countries responded that policy the management objectives are meant to address the NiD.

16 countries responded that policy the management objectives are meant to address the UWWTD.

4 countries responded that policy the management objectives are meant to address other policy.

Responses in detail

2.6.1 WFD

Respondents:

- BE-Wa
- BG
- CZ
- DE
- EE
- IE
- EL
- ES
- FR (for 5 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- IS
- NO
- TR

Explanation

Country	Explanation
IE	The management objectives are set to address the Water Framework Directive and other water-related Community legislation as appropriate.
FR (for 5 water agencies)	1. WFD: Eutrophication of continental waters and/or toxicity on aquatic fauna (Phosphorus, NH4, NO2). Nitrates directive (NO3): public health (drinking water)) + risk of transfer to marine waters (establishment of a threshold of 18 mg/l to limit the flow to marine waters). TRAC: Specific P and N objectives are developed for tributaries of eutrophic-sensitive Mediterranean lagoons (cf. 20151221-RAP-SdageOF5B.pdf). For ex. 0.1 mg/l of phosphate (corresponding to the high limit of good class) for these rivers. 2. No reduction targets set in SDAGE 2022-2027 or earlier. The identification of vulnerable zones in application of the Nitrates Directive and the implementation of nitrate action plans are the basic measures of the program of measures not detailed in the SDAGE. MSFD: The Mediterranean Sea is not concerned by the objective of nutrient reduction because it is oligotrophic. The objective included in the Mediterranean Façade Strategic Document is D05-OE3 "Not to increase nutrient inputs in areas with little or no impact from eutrophication". It is considered

Country	Explanation
	that the dispositions and measures of the SDAGE RMed and Corsica projects concerning the reduction of agricultural and urban pollution and the fight against eutrophication of "terrestrial" environments contribute to the achievement of the objectives of the MSFD without having to do more.
CY	The management objectives have been set according to the provisions of WFD in order to achieve Good physicochemical status and furthermore Good ecological status/potential in all water bodies. There is a river waterbody that falls within a Nitrate Vulnerable Zone (NVZ), but the management objectives set are set based on WFD.
HU	Nutrient thresholds are part of the Government Decree 1155/2016. (III. 31.) on the revised 2015 River Basin Management Plan of HU.
NL	Objectives are primarily set and based on WFD definition. Synergy is there of course with NiD and Natura2000 species/habitats.
AT	Based on WFD the directives NiD and UWWTD are integral part of the programme of measures. The Nitrate Action Programme requires measures to reduce nutrient emission by diffuse sources, the UWWTD for reducing emissions by point sources. The combined approach according to Art. 10 WFD is implemented.
PL	WFD: reaching at least the good / moderate boundaries.
PT	The approach used to define management objectives for nutrients takes into account the requirements of these directives. However UWWTD and NiD directives were approved before the WFD and need to be harmonize with the WFD objectives, due to the important role of agriculture and urban waste waters as nutrients sources. A revision of the UWWTD is ongoing but we don´t understand why the NiD was not considered to be reviewed.
FI	Aim is to protect both surface waters and groundwater from eutrophication by nitrate.
SE	National environmental quality objectives (zero eutrophication) https://www.sverigesmiljomal.se/environmental-objectives/
NO	For WFD: good/moderate boundary.
TR	Management objectives for nutrients sensitive areas are presented in "By-Law on Determination of Sensitive Water Bodies and Areas Effecting these Water Bodies and Improvement of Water Quality" formed in line with the WFD requirements.

2.6.2 NiD

Respondents:

- BE-Wa
- CZ
- DE
- IE
- EL
- ES
- FR (for 4 water agencies)
- IT
- AT
- PL
- PT
- RO
- SK
- FI
- IS
- NO
- TR

Explanation

Country	Explanation
IE	See explanation in Part A, Section 2.6.1.
FR (for 4 water agencies)	See explanation in Part A, Section 2.6.1.
AT	See explanation in Part A, Section 2.6.1.
PL	NiD: reducing water pollution by nitrates from agricultural sources and preventing further pollution.
PT	See explanation in Part A, Section 2.6.1.
FI	See explanation in Part A, Section 2.6.1.
NO	for NiD: limitation on application of fertiliser.
TR	See explanation in Part A, Section 2.6.1.

2.6.3 UWWTD

Respondents:

- BE-Wa
- CZ
- DE
- IE
- EL
- ES
- FR (for 2 water agencies)
- IT
- AT
- PL
- PT
- RO
- SK
- IS
- NO
- TR

Explanation

Country	Explanation
IE	See explanation in Part A, Section 2.6.1.
FR (for 2 water agencies)	See explanation in Part A, Section 2.6.1.
AT	See explanation in Part A, Section 2.6.1.
PL	UWWT: in some way implementation the UWWTD may be interpreted as load management objectives at the measure level.
PT	See explanation in Part A, Section 2.6.1.
NO	UWWTD: level of treatment for phosphorus.
TR	See explanation in Part A, Section 2.6.1.

2.6.4 Other

Respondents:

- FR (for 3 water agencies)
- PL
- RO
- SE

Explanation

Country	Explanation
FR (for 3 water agencies)	Directive 91/271/EEC) See explanation in Part A, Section 2.6.1.
PL	Other (Helcom): decreasing the load which reach the Baltic sea (from the 1997 – 2003 reference load value).
RO	- Industrial Emissions Directive and Best Available Techniques - EU Common Agricultural Policy and best agricultural practices - EU Regulation on the phosphate-free detergents
SE	See explanation in Part A, Section 2.6.1.

2.7 If you have not set management objectives for nutrients, please explain the reasons. In addition, please provide information on how you achieve the WFD objectives instead (for water bodies exposed to nutrient pollution).

Summary of responses

4 countries responded that they have not set management objectives for nutrients and provided an explanation of the reasons for this.

Responses in detail

Respondents:

- DK
- FR
- RO
- IS

Country	Explanation
DK	RBMP 2 projects showed that little data was available to set nutrient targets for rivers in DK (see project report here in Danish: https://mst.dk/media/186760/fysiske_og_kemiske_kvalitetselementer.pdf). DK argues that biological elements respond sufficiently to changes in nutrient loads and that ecological status can be determined by monitoring fauna and flora alone. In order to reach good ecological status, physical measures and measures to reduce organic load from wastewater are applied to achieve WFD objectives, as these are determined to have the most significant impacts on biological communities in Danish rivers.
FR	1. The water bodies with no target are in less strict objectives. The obstacles have been identified and the process of achieving Good Status beyond 2027 will be undertaken through the Program of Measures. 2. No nutrient reduction target sensus stricto, the approach is different but leads to a similar result. 3. The assessment of the impact of "nutrient" pressures at the origin of the risk of not achieving good status and the location of fragile aquatic environments with regard to eutrophication phenomena invites local stakeholders, within the framework of local consultation bodies (SAGE, river contracts, etc.), to establish a detailed local diagnosis. This diagnosis is used to define a precise action plan (per sanitation facility, agricultural sector) of phosphorus and/or nitrogen inputs reduction to achieve the good status of water bodies. 4. The reduction of nutrients is based on the resorption of the pressures at their origin.
RO	At the national level, the same approach as the Danube basin wide level has been applied; by implementing the EU Directives and regulations, the measures under implementation at the national level have been contributing to the reduction of nutrients inputs into surface waters.
IS	Pressure due to nutrient pollution is in general not of big concern in Icelandic water bodies. The main objectives remain in high/good status.

2.3 Part A3: Methods used to derive management objectives for nutrients in Transitional Waters

3.1 Have you set management objectives for nutrients for transitional waters that are exposed to nutrient pollution?

Summary of responses

11 countries responded that they have set management objectives for nutrients for all nutrient polluted water bodies.

2 countries responded that they have set management objectives for nutrients for some nutrient polluted water bodies.

No countries responded that they have not set management objectives for nutrients for water bodies.

Responses in detail

3.1.1 Yes, for all nutrient polluted water bodies

Respondents:

- DE
- IE
- EL
- IT
- LV
- LT
- NL
- PL
- PT
- RO
- IS

3.1.2 Yes, for some nutrient polluted water bodies

Respondents:

- ES
- FR

3.1.3 No

Respondents:

- None

3.2 When setting management objectives for nutrients, is there a focus on reduction of phosphorus, nitrogen, or both or on the limiting nutrient? Please explain why.

Summary of responses

1 country responded that they focus on reduction of phosphorus when setting management objectives for nutrients.

2 countries responded that they focus on reduction of nitrogen when setting management objectives for nutrients.

11 countries responded that they focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients.

2 countries responded that they focus on reduction of the limiting nutrient when setting management objectives for nutrients.

Responses in detail

3.2.1 Phosphorus

Respondents:

- IE

Explanation

Country	Explanation
IE	Phosphorus in transitional waters is considered to be the main driver (limiting nutrient) of eutrophication in transitional waters and so management objectives are based on meeting the environmental quality standard for molybdate reactive phosphorus (MRP) (S.I. No. 77 of 2019 European Union Environmental Objectives (Surface Waters (Amendment) Regulations 2019).

3.2.2 Nitrogen

Respondents:

- FR
- NL

Explanation

Country	Explanation
FR	Depending on the river basin district, issues and causes can be different: - Generally, there is a focus on reduction of phosphorus and nitrogen because they are both limiting factors in transitional waters and some marine waters (in relation with phytoplankton or opportunistic macroalgal blooms issues). - In Brittany, nitrogen is a limiting factor in opportunistic macroalgae issues (ex. Ulvae).
NL	N is believed most limiting for most T and C waters.

3.2.3 Phosphorus & Nitrogen

Respondents:

- DE
- EL
- ES
- FR
- IT
- LV

- LT
- PT
- IS
- PL
- RO

Explanation

Country	Explanation
DE	Phosphorus & Nitrogen are both important factors that are capable of contributing to eutrophication in transitional, coastal and marine waters and that need to be managed.
EL	Nutrients' enrichment in coastal lagoons is mostly related to agricultural runoff and riverine inputs.
ES	The Royal Decree 817/2015, 11th September, defines criteria to monitor and assess the status of surface water bodies and environmental quality standards in Transitional Waters, including the good/moderate boundary for phosphate, nitrates, nitrites and the good/moderate and High/good boundary for total phosphorus and ammonia for some types of TW.
FR	See explanation in Part A, Section 3.2.2.
IT	For transitional water bodies which are included in sensitive areas or in catchment basin of sensitive areas, UWWT Directive emission thresholds for nitrogen and phosphorous applies to UWWT Plants discharges. For transitional water bodies which are included in nitrate vulnerable zones or catchment basin of nitrate vulnerable zones, nitrogen limit loading of 170 Kg per hectare/year from livestock manure applies without prejudices to exception agreed with EC according to Nitrate Directive. In addition, in vulnerable areas, maximum standard nitrogen inputs (MAS) are also established for each crop per year, calculated from livestock manure and chemical fertilizers. Furthermore, in non-vulnerable zones there is a maximum nitrogen limit loading of 340 kg per hectare per year of nitrogen from livestock manure. Additional specific measures are planned for urban waste water re-use for agriculture in order to reduce direct nutrient discharges in water bodies.
LT	The GES values, the targets for load reduction and the measures to reduce riverine input of nutrients have been set for both nitrogen and phosphorus, therefore, yes, there is a focus on reduction of both phosphorus and nitrogen.
PL	As the management objective is to reach the nutrient concentration at good/moderate boundaries, both N and P were taken into account.
PT	Management objectives are set for nutrients failing good status (P, N or both).
RO	The management objectives have been defined in the Danube River Basin District Management Plan developed at the International Commission for the Protection of the Danube River (ICPDR) level and have been addressed to both EU Member States and non-EU Member states. The ICPDR is a transnational body established to implement the Danube River Protection Convention, as a platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). RO has not established the management objectives at water body level but at national level, following the approach on the Danube basin-wide level (international level). These management objectives have been considered in the National Management Plan and River Basin Management Plan as a component part of the water management process within the Danube district. Information on management objectives at the Danube River Basin District level can be found on website www.icpdr.org (Danube River Basin District Management Plan 2009 and 2015 update).

3.2.4 Limiting Nutrient

Respondents:

- FR
- IT

Explanation

Country	Explanation
FR	See explanation in Part A, Section 3.2.2.
IT	See explanation in Part A, Section 3.2.3.

3.3 If you have set management objectives for nutrients, please indicate which methodology has been used and provide a short description of the methodology including links to background reports or publications. In the description, please indicate whether and how you have considered pressure-response relationships.

Summary of responses

7 countries responded that they use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients.

5 countries responded that they use historical information to set management objectives for nutrients.

6 countries responded that they use expert judgement to set management objectives for nutrients.

5 countries responded that they use other methods to set management objectives for nutrients.

Responses in detail

3.3.1 Modelling based on nutrients vs BQE-response relationships

Respondents:

- DE
- FR
- IT
- LV
- LT
- NL
- PL

Explanation

Country	Explanation
DE	Pressure-response relationships (Modelling), Historical information and Expert judgment were used to derive orientation values and background values (reference conditions). see: Halle, M. & A. Müller (2014): LAWA ACP-Projekt O 3.12: Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern. Anlagen zum Endbericht im Rahmen des Länderfinanzierungsprogramms „Wasser, Boden und Abfall" (LFP O 3.12)

<table>
<tr><th>Country</th><th>Explanation</th></tr>
<tr><td></td><td>Halle, M. & A. Müller (2017): Ergänzende Arbeiten zur Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern in Fließgewässern. - Abschlussbericht inkl. Anhang zum LAWA-Projekt Projekt O 3.15.</td></tr>
<tr><td>FR</td><td>Depending on the river basin district, methodologies can be different:
- ECOMARS 3D modelling (pressures / impact deterministic model, i.e. https://www.sciencedirect.com/science/article/abs/pii/S1463500318303767 and https://www.mdpi.com/2076-3263/9/10/441): suggest reducing the intake of nutrients (nitrogen and phosphorus) especially from rivers leading to eutrophic transitional, coastal and marine areas or do not increase nutrient intakes in areas with little or no impact from eutrophication. Management objectives for nutrients will be set depending on the modelling results and the discussion between stakeholders;
- In Brittany, a new version of model to deal with marine phytoplankton issues is under development;
- GAMELAG modelling would be used to define nutrient admissible flows in Mediterranean transitional water bodies sensitive to eutrophic issues. Management objectives for nutrients will be set depending on the results and the situation.
(https://rhone-mediterranee.eaufrance.fr/sites/sierm/files/content/2019-01/20181106_Note_Flux_admissibles_0.pdf)
See also our response in Part A, Section 2.6 for rivers – tributaries of Mediterranean lagoons.
In general, experts and stakeholders debate and approve the results from modelling and propose the objectives of nutrients' reducing.</td></tr>
<tr><td>IT</td><td>Management objectives are based on UWWT and Nitrate Directives requirements.
It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles.</td></tr>
<tr><td>LT</td><td>Four types of transitional WB have been assigned: three in the Curonian Lagoon (one of them belongs to the HMWB due to port activities) and the fourth one – in the Baltic Sea area where the impact of the Curonian Lagoon (load of freshwater) is recorded. Classification system for total nitrogen and total phosphorus for transitional waters was developed following relationships with phytoplankton biomass, chl-a, based on the national monitoring data and historical data:

1. Maximum July abundance of cyanobacteria in years 1951, 1954 and 1955 in two water bodies of the Curonian lagoon was used to derive reference conditions. First of all maximum summer cyanobacteria abundance (CYAabund) was related to the mean summer abundance (using long-term monitoring data from the period 1980-2007) and the later was used to estimate reference values for chlorophyll a (chl a) and total phytoplankton biomass (PHbiom) according to empirical relationships:

PHbiom (µg/l) = 0.1719 CYAabund (□103 cells/l)

Chl a (µg/l) = 1.2655 □ PHbiom (µg/l) + 20.82 (R2= 0.62) (northern Curonian lagoon)

Chl a (µg/l) = 1.2007 □ PHbiom (µg/l) + 30.14 (R2= 0.77) (central Curonian lagoon)

2. Threshold between poor and bad water quality classes was defined using a lower limit of phytoplankton hyperbloom biomass 100 mg/l. This value was recalculated into average summer phytoplankton using empirical relationships between maximum and mean phytoplankton biomass.
3. Boundaries between good, moderate and poor water quality classes for phytoplankton biomass were estimated dividing range between reference and bad classes into equal intervals.
4. Reference for summer average concentration of total nitrogen (TN) and water quality class boundaries were estimated using empirical relationship between total nitrogen and chlorophyll a mean summer concentration

TN (µg/l) = 7.2557 □ Chl a (µg/l) + 741.51 (R2= 0.76) (northern Curonian lagoon)

TN (µg/l) = 295.03 □ Chl a (µg/l)0.3222 (R2= 0.83) (central Curonian lagoon)

5. Negligible relationships were found between phytoplankton biomass, cyanobacteria abundance and total phosphorus (TP) in the transitional waters, therefore description of reference TP concentration was based on historical data (Jurevicius, 1959) for dissolved inorganic phosphorus (DIP). Maximum DIP values for July from 1956 and 1957 in the central and northern parts of the Curonian lagoon were used (Jurevicius, 1959). TP was calculated deriving phytoplankton P from biomass values according to stoichiometric C:N:P ratio and adding obtained phytoplankton P amount to the available historical DIP concentrations.
The estimated TN and TP boundary values resulted in N:P ratio of 35 both in the central and northern parts reflecting phosphorus limitation and conditions not favorable for cyanobacteria blooms.</td></tr>
</table>

Country	Explanation
	6. Estimation of TP boundaries between water quality classes was estimated on generally assumed principle to follow an increase of N:P ratio (decrease of relative P importance) under conditions of improving water quality. Therefore, TP boundary concentrations for good, moderate and poor were set to follow a general decrease of N:P ratio from 30 to 20 and 10 respectively by expert judgment. 7. The plume of the Curonian lagoon in the Baltic Sea is extremely unstable in terms of spatial boundaries and temporal dynamics, whereas amount of data did not allow to establish empirical relationships between any of pelagic quality parameters and salinity. Therefore it was agreed among experts, that coastal waters classification system should be used in case salinity is higher than 4 psu and northern Curonian lagoon criteria should be applied in situations with water salinity lower than 2 psu. In cases of intermediate salinity values between 2 and 4 psu, mixing of equal water volumes (coastal and lagoon) should be assumed and average boundary values of the northern Curonian lagoon and coastal waters should be used for classification.
NL	Statistical relationship between phytoplankton and DIN, corrected for salinity when below 30.
PL	The management objectives are the same as the good/moderate boundary for nutrients used for status classification. For TW and CW the good/moderate boundary has been set by using statistic tool developed with the methodology Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018) on the basis of macrozoobenthos).
PT	Reference values has been established through statistical treatment of the historical data set. However, PT classification methodology for TW is not based on direct comparison between measured values and reference values. The 90th percentile of measured values on each water body is divided by the reference value (for each salinity class). It is this division that is used for classification (e.g. if 90th percentile/Reference value is between [1-2[status is good; if 90th percentile/Reference value is <1 status is excellent; if 90th percentile/Reference value is <2 status is moderate). Related paper can be found at: https://www.sciencedirect.com/science/article/pii/S0304420316300408?via%3Dihub

3.3.2 Historical information

Respondents:

- DE
- IE
- ES
- LT
- PT

Explanation

Country	Explanation
DE	See explanation in Part A, Section 3.3.1.
IE	The description of the methodology for the establishment of the relevant boundary values was reported to ECOSTAT in 2014 and is not repeated to avoid duplication.
LT	See explanation in Part A, Section 3.3.1.

Country	Explanation
PT	See explanation in Part A, Section 3.3.1.

3.3.3 Expert Judgement

Respondents:

- DE
- ES
- FR
- LT
- PT
- IS

Explanation

Country	Explanation
DE	See explanation in Part A, Section 3.3.1.
FR	See explanation in Part A, Section 3.3.1.
LT	See explanation in Part A, Section 3.3.1.
PT	See explanation in Part A, Section 3.3.1.
IS	We have used nutrient data from natural wb to set the reference values for nutrients and the cutoff between ecological status is set using expert judgement. This work is in progress.

3.3.4 Other

Respondents:

- IE
- EL
- IT
- RO
- IS

Explanation

Country	Explanation
IE	See explanation in Part A, Section 3.3.2.

Country	Explanation
EL	A multi-metric method, the PCQI index of Bald et al. (2005) is applied in order to assess the physicochemical quality of coastal lagoons in the WFD monitoring network in EL. The method consists of a factor analysis using the following physicochemical parameters: nutrients (nitrates, phosphates and ammonium), oxygen saturation, and transparency and classifying the water bodies in five ecological classes. Bald, J., Borja, A., Muxika, I., Franco, J., Valencia, V., 2005. Assessing reference conditions and physico-chemical status according to the European Water Framework Directive: a case-study from the Basque Country (Northern Spain). Mar. Pollut. Bull.50 (12), 1508–1522
IT	See explanation in Part A, Section 3.3.1.
RO	This approach has been built upon the results of the pressure analysis, the water status assessment, and includes, as a consequence, measures of basin-wide importance oriented towards the agreed visions and management objectives for each significant water management issue (SWMI), nutrient pollution being one of SWMI identified at the Danube River Basin District and national level. The following management objectives have been set up in the 2015 Update of the Danube River Basin Management Plan (DRBMP 2015): - Further reduction of the total amount of nutrients entering the Danube and its tributaries and the nutrient loads transported into the Black Sea. - Further reduction of the nutrient point source emissions by the implementation of the management objectives described for organic pollution (implementing the Urban Waste Water Treatment Directive (EU MS) and by constructing a specified number of wastewater collecting systems and municipal wastewater treatment plants (Non-EU MS) and further reduction of pollution of the surface waters from the major industrial and agricultural installations by implementing the Industrial Emissions Directive (EU MS) and introducing Best Available Techniques at a specified number of industrial facilities (Non-EU MS)) as they address the nutrient pollution as well. - Further reduction of the nitrogen pollution of the ground and surface waters by the implementation of the EU Nitrates Directive according to the developed action programs within the designated vulnerable zones or the whole territory of the country (EU MS). - Ensuring sustainable agricultural production and soil nutrient balances and further reduction of the diffuse nutrient pollution by implementation of basic and cost-efficient supplementary agri-environmental measures linked to the EU Common Agricultural Policy (EU MS) and by implementation of best management practices in the agriculture considering cost-efficiency (Non-EU MS). - Further decrease of the phosphorus point source pollution by implementation of the EU Regulation on the phosphate-free detergents (EU MS) and by reduction of phosphates in detergent products (Non-EU MS). See page 114 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/
IS	See explanation in Part A, Section 3.3.3.

3.4 Do you determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs? What methodology do you use?

Summary of responses

6 countries responded that they do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

7 countries responded that they do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

Responses in detail

3.4.1 Yes

Respondents:

- DE
- IE
- EL
- LV
- NL
- PL

Methodology Used

Country	Description
DE	Orientation values compatible with good status for nutrient sensitive BQEs are set in the Ordinance for the Protection of Surface Waters ([2] Oberflächengewässerverordnung, OGewV 2016. The methods used are described here: Halle, M. & A. Müller (2014): LAWA ACP-Projekt O 3.12: Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern. Anlagen zum Endbericht im Rahmen des Länderfinanzierungsprogramms „Wasser, Boden und Abfall" (LFP O 3.12) Halle, M. & A. Müller (2017): Ergänzende Arbeiten zur Korrelation zwischen biologischen Qualitätskomponenten und allgemeinen physikalisch-chemischen Parametern in Fließgewässern. - Abschlussbericht inkl. Anhang zum LAWA-Projekt Projekt O 3.15. Additionally "Bewirtschaftungsziele" (management targets) for total nitrogen were set to protect marine waters from river nutrient inputs : 1. North Sea: 2.8 mg l-1 TN 2. Baltic Sea: 2.6 mg l-1 TN These target values are measured at the freshwater-marine boundary. For the River Rhine, which inter alia flows through DE but enters the sea in NL, the management target applies at the border between DE and NL.
IE	A nutrient load reduction has been previously identified for specific water bodies to allow water body concentrations return to below good status and to allow the relevant nutrient sensitive biological quality elements to recover. A simple box model to determine what load reduction would be required to return the system to 'good' ecological status was used (please see Ni Longphuirt et al., 2015 for description of the model). This was a continuation of work done on coastal areas to look at a quantitative estimate of the amount of nutrient reduction required to reach non-problem area status with regard to eutrophication as defined by the OSPAR Convention (See Section A4.5). This looks at changes in nutrient concentrations, chlorophyll concentration and also macroalgal biomass relative to reduction in loads. Ní Longphuirt, S., O'Boyle, S., Wilkes, R., Dabrowski, T. and Stengel, D. (2015). Influence of Hydrological Regime in Determining the Response of Macroalgal Blooms to Nutrient Loading in Two Irish Estuaries. Estuaries and coasts: 1-17. 10.1007/s12237-015-0009-5 Mockler et al. 2017. Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework. Science of the total Environment. https://doi.org/10.1016/j.scitotenv.2017.05.186
EL	The approach used is described in the methodology for the identification of anthropogenic pressures and their impacts, that was developed during the 2nd planning cycle and is available in the following link: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/Methodologia_Piesewn_v3.pdf
LV	The management objectives have been set by Baltic Sea Action Plan adopted by HELCOM Contracting Parties in 2007 and updated later on as needed https://helcom.fi/baltic-sea-action-plan/. For more detailed description of approach see "Technical Report no 7. BALTSEM - a marine model for decision support within Baltic Sea region. Authors: Oleg P. Savchuk, Bo G. Gustafsson and Bärbel Müller-Karulis. ISBN: 978-91-86655-05-8"
NL	Because standard is standardized for salinity, automatically –at least for concentration- can be the reduction need be seen.

Country	Description
	And yes, separate calculations are made together with catchment partners to calculate the reduction need for C and T waters.
PL	For TW and CW the good/moderate boundary has been set by using statistic tool developed with the methodology Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018) on the basis of macrozoobenthos).

3.4.2 No

Respondents:

- ES
- FR
- IT
- LT
- PT
- RO
- IS

Methodology Used

Country	Description
FR	There is no critical load defined in our river basin district management plans (but modelling results on nutrients loads on Atlantic coast are used for technical work ahead of discussions with stakeholders and experts). Objectives on nutrients reduction are expressed in nitrogen and phosphorus concentrations and based on expert judgements. Nevertheless, the flow approach is under development with the coupling of bio-geochemical models of the watershed, a specific model for estuaries (C-GEM) and marine models.
PT	Nutrient loads are assessed as part of the RBMP and inform the PoM. Nutrient values compatible with BQE good quality and overall good status/potential are defined as concentration values. In the licensing process the setting of emission limit values is based on a combined approach, considering the other existing pressures and defining the maximum load that the water body can receive so that the good status is not altered or that it can be reached.

3.5 Is there a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status?

Summary of responses

7 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary.

4 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements.

4 countries responded that there is not a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.

Responses in detail

3.5.1 Yes, the management objective is to reach the nutrient concentration at good/moderate boundary

Respondents:

- IE
- ES
- IT
- LV
- LT
- NL
- PL

Methodology Used

Country	Description
NL	G/M boundary for biology.
PL	See explanation in Part A, Section 3.4.1.

3.5.2 Yes, the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements

Respondents:

- EL
- NL
- PT
- IS

Methodology Used

Country	Description
EL	The PCQI index showed a statistically significant correlation with the M-AMBI index used for the classification of benthic macroinvertebrates in coastal lagoons in EL.
NL	See explanation in Part A, Section 3.5.1.

Country	Description
PT	From the options above, the second one suits our reality better, as the management objective is to reach good status but nutrient concentrations should ideally be lower than the good/moderate boundary (and not at the good/moderate boundary).
IS	The high/good boundary is based on nutrient concentration in natural, unpolluted rivers/lakes/coastal waters. The management objective is based on Icelandic regulations which is in concert with European directives.

3.5.3 No, another approach is used to set the management objective

Respondents:

- DE
- FR
- IT
- RO

Methodology Used

Country	Description
DE	Yes, there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, the management objective is to reach the nutrient concentration at good/moderate boundary or better and to reach good ecological status (or potential) of the biological quality elements.
FR	Depending on the river basin district and issues, management objectives can be different: - Depending on sources of pressures and situations, management objectives are set for nutrients in order to prevent further deterioration in status or in order to halve the biomass production. The percentage is defined by reference of a year.
IT	Management objectives consist of full implementation of UWWT and Nitrate Directives with additional specific measures on urban waste water re-use for agriculture. It is expected that such objectives will allow to reach thresholds established for nutrients as physical-chemical parameters supporting BQE. It is understood that in IT the bqe-response relationship is generally applied on the basis of WFD principles.
RO	See explanation in Part A, Section 3.3.4

3.6 If you have set management objectives for nutrients, please specify which policy the management objectives are meant to address.

Summary of responses

13 countries responded that policy the management objectives are meant to address the WFD.

11 countries responded that policy the management objectives are meant to address the NiD.

10 countries responded that policy the management objectives are meant to address the UWWTD.

3 countries responded that policy the management objectives are meant to address other policy.

Responses in detail

3.6.1 WFD

Respondents:

- DE
- IE
- EL
- ES
- FR
- IT
- LV
- LT
- NL
- PL
- PT
- RO
- IS

Explanation

Country	Explanation
NL	Objectives are primarily set and based on WFD definition. Synergy is there of course with NiD and Natura2000 species/habitats.
PL	WFD: reaching at least the good / moderate boundaries.

3.6.2 NiD

Respondents:

- DE
- IE
- EL
- ES
- FR
- IT
- LT
- PL
- PT
- RO
- IS

Explanation

Country	Explanation
PL	NiD: reducing water pollution by nitrates from agricultural sources and preventing further pollution.

3.6.3 UWWTD

Respondents:

- DE
- IE
- EL
- FR
- IT
- LT
- PL
- PT
- RO
- IS

Explanation

Country	Explanation
PL	UWWT: in some way implementation the UWWTD may be interpreted as load management objectives at the measure level.

3.6.4 Other

Respondents:

- LV
- PL
- RO

Explanation

Country	Explanation
LV	HELCOM Convention.
PL	Other (Helcom): decreasing the load which reach the Baltic sea (from the 1997 – 2003 reference load value).
RO	Not specified, however based on responses to all other Transitional Water questions, likely to be the same as for Lakes and Rivers which was: - Industrial Emissions Directive and Best Available Techniques. - EU Common Agricultural Policy and best agricultural practices. - EU Regulation on the phosphate-free detergents.

3.7 If you have not set management objectives for nutrients, please explain the reasons. In addition, please provide information on how you achieve the WFD objectives instead (for water bodies exposed to nutrient pollution).

Summary of responses

4 countries responded that they have not set management objectives for nutrients and provided some explanation of the reasons for this.

Responses in detail

Respondents:

- FR
- PT
- RO
- IS

Country	Explanation
FR	Depending on the river basin district and issues, strategies can be different. There is no management objectives for some polluted transitional water bodies because: - Management objectives have been set for river water bodies. Indeed, to be able to achieve the good ecological status, we need to reduce the intake of nutrients from rivers leading to eutrophic transitional water bodies. - Mediterranean transitional water bodies (lagoons) are sensitive to eutrophic issues. The strategy is to define the nutrient admissible flows and depending on the result, to set management objectives for river water bodies, which might contribute to eutrophic issues in Mediterranean transitional water bodies. (https://rhone-mediterranee.eaufrance.fr/sites/sierm/files/content/2019-01/20181106_Note_Flux_admissibles_0.pdf) The method is under development because the necessary tools are just starting being available and more knowledge are required to deal with eutrophic issues in depth. - Some areas are oligotrophic and in those areas, there is no management objective for the reduction of nutrients. - When transitional water bodies are HMWB, there is no specific management objectives for nutrients.
PT	The approach used to define management objectives for nutrients takes into account the requirements of these directives. However UWWTD and NiD directives were approved before the WFD and need to be harmonize with the WFD objectives, due to the important role of agriculture and urban waste waters as nutrients sources. A revision of the UWWTD is ongoing but we don´t understand why the NiD was not considered to be reviewed.
RO	At the national level, the same approach as the Danube basin wide level has been applied; by implementing the EU Directives and regulations, the measures under implementation at the national level have been contributing to the reduction of nutrients inputs into surface waters
IS	Pressure due to nutrient pollution is in general not of big concern in Icelandic wb. The main objectives remain in high/good status.

2.4 Part A4: Methods used to derive management objectives for nutrients in Coastal Waters

4.1 Have you set management objectives for nutrients for transitional waters that are exposed to nutrient pollution?

Summary of responses

20 countries responded that they have management objectives set for nutrients for all nutrient polluted water bodies.

No countries responded that they have management objectives set for nutrients for some nutrient polluted water bodies.

No countries responded that they have no management objectives set for nutrients for water bodies.

Responses in detail

4.1.1 Yes, for all nutrient polluted water bodies

Respondents:

- DK
- DE
- EE

- IE
- EL
- ES
- FR
- IT
- CY
- LV
- LT
- NL
- PL
- PT
- RO
- FI
- SE
- IS
- NO
- TR

4.1.2 Yes, for some nutrient polluted water bodies

Respondents:

- None

4.1.3 No

Respondents:

- None

4.2 Please provide the management objectives for nutrients set for coastal waters.

Summary of responses

18 countries provided details of the management objectives for nutrients set for coastal waters. Management objectives for nutrients in coastal waters are often set by identifying the maximum allowable load input from point source inputs and river inputs. These loads are taken into account as targets in the RBMPs.

Responses in detail

Respondents:

- DK
- DE
- EE
- IE
- EL
- ES
- FR
- IT
- CY
- LV
- LT
- PT
- RO
- FI
- SE
- IS
- NO
- TR

Objectives

Country	Explanation
DK	The Maximum Allowable Input (MAI) of Danish land based nitrogen loadings in tonnes per year is determined for 90 Danish sub catchments covering all coastal water bodies by the use of a mechanistic and statistical ecosystem modelling system, covering all Danish coastal waterbodies. All relevant figures of load, maximum allowable load, reduction needed and expected effect of measures can be found in the annex I of each of the four RBMP's of DK. This pressure/impact modelling setup includes national and international nutrient loadings; airborne as well as landbased loadings. The needed reduction to support good ecological status is taking into account. Reference: Development of models and methods to support the establishment of Danish River Basin Management Plans; Scientific documentation. https://mst.dk/media/174168/dokumentationsrapport_marine-modeller-og-metoder-til-vp2_2017.pdf/ A new and more detailed model setup is in preparation to be used in the third RBMP period of 2021-2027. Coastal waters also fall under HELCOMs nutrient input ceilings. Hence, for the Danish coastal areas within the HELCOM area, HELCOM's agreed input ceilings also constitute a management objective. The current ceilings and relevant documentation can be found here: https://helcom.fi/baltic-sea-action-plan/nutrient-reduction-scheme/progress-towards-country-wise-allocated-reduction-targets/results/ .
DE	DE has set a management target for the concentration of TN in rivers at the limnic-marine boundary that allows for the achievement of good status in coastal waters (2.8 mg/l TN for rivers entering the North Sea and 2.6 mg/l TN for rivers entering the Baltic Sea). For phosphorus, we are aiming at a similar management target to be derived during the next years (this is a proposal under the programme of measures for the MSFD 2nd cycle which is under development). Meanwhile, it is assumed that the targets set for the concentration of TP in rivers allow for the achievement of good ecological status under WFD and good environmental status under MSFD in coastal waters.
EE	Mainly measures to reduce nutrients load are related with point source (regulations and control of wastewater treatment plants) or targeted to nutrient income with rivers from watershed. Measures are set in river basement management plan taken into account results of the modelling and monitoring data. In order to classify the waterbodies, a software tool was used. This tool was developed to follow the strict requirements of WFD and is based on the comparisons of reference and measured values. Nutrient concentrations as physical-chemical quality elements are used as supportive parameters. Depending on waterbody type G/M class border differ: TN 0,29–0,41 mg/l and TP 0,009–0,026 mg/l. Also ecological quality ratio (EQR) is used for coastal water bodies and EQR one takes into account different reference conditions.
IE	Nitrogen (measured as dissolved inorganic nitrogen (DIN)) is typically the limiting nutrient in coastal waters. The management objective is based on meeting the environmental quality standard for dissolved inorganic nitrogen (DIN) in coastal waters (S.I. No. 77 of 2019 European Union Environmental Objectives (Surface Waters (Amendment) Regulations 2019).
EL	The management objective is to reach the nutrient concentration at good/moderate boundary. Indicative threshold values have been set as below. These values will be updated with a wider data base. More specifically indicative G/M values are considered as: G/M for Nitrate: 1.0 μmol L^{-1} G/M for Phosphate: 0.1 μmol L^{-1}. The above thresholds derived from the use of the toolkit proposed by Phillips et al. (2018) and Teixeira et al. (2017). Moreover, nutrient thresholds derived from the four-scale classification system of Karydis (1999): G/M for Nitrate: 0.65 μmol L^{-1} G/M for Phosphate: 0.14 μmol L^{-1} G/M for Ammonium: 1.05 μmol L^{-1} In that later case, G/M has been considered the value of Lower Mesotrophic/Higher Mesotrophic status

Country	Explanation
	A combined criteria indicator has been also used, Physico-chemical Index (PCQI) (Bald et al., 2005) to assess the physico-chemical status of the coastal Greek areas. PCQI index has applied in the coastal zone of EL in order to assess their physico-chemical status. According to Simboura et al. (2016). PCQI index is recommended as a physicochemical status index since it does not downgrade the biological quality assessment and is compatible with the requirements of the WFD.
ES	The Nutrient Values for determining Good Ecological Status are established in Royal Decree 817/2015 for each of the 30 types of Coastal Waters. Apart from this, a set of environmental targets have been established by the Marine Strategies (second cycle) related to D5 in the 5 Marine Subdivisions: - Identify and address the causes (sources of diffuse nutrient contamination and / or effluent discharges) that produce the increasing trend of nutrient concentration in areas of contrasting productivity where concentrations above threshold values have been detected in the initial evaluation of D5. - Reduce the contribution of nutrients, pollutants and litter from river discharges. - Reduce the contribution of nutrients, pollutants and litter from wastewater. - Reduce the contribution of nutrients, pollutants and litter from rain episodes. - Reduce the contribution of nutrients and pollutants from agricultural activities: surpluses and returns from irrigation and livestock uses, among others.
FR	- Management objectives have been set for river water bodies but not for coastal water bodies directly. Indeed, to be able to achieve the good ecological status, we need to reduce the intake of nutrients from rivers leading to eutrophic coastal water bodies. - Reduce the intake of nutrients (nitrates and phosphates) especially from rivers leading to eutrophic marine areas. - Maintain or reduce nutrient intakes in areas with little or no impact from eutrophication. - Improve modelling to increase understanding of eutrophic issues (phytoplankton and opportunistic macroalgal blooms issues in Brittany).
IT	Explanation: management objectives are based on chlorophyll a concentration thresholds as reported in "Water Framework Directive 3rd Intercalibration Phase, Mediterranean Geographical Intercalibration Group -Coastal waters – BQE "phytoplankton", November 2014, according to water bodies typologies.
CY	There is a special Strategy for Wastewater Treatment Plants with thresholds set for upper limits of the produced recycled water. This water is used either for irrigation or, in case of excess it is discarded in sea only in winter time. Also, in the case of Nitrogen Vulnerable Zones, there is a special Strategy by the Ministry of Agriculture, Rural Development and Environment including a series of measures and monitoring for the reduction of nutrients.
LV	The management objectives have been set by Baltic Sea Action Plan adopted by HELCOM Contracting Parties in 2007 and updated later on as needed https://helcom.fi/baltic-sea-action-plan/. For more detailed description of approach see "Technical Report no 7. BALTSEM - a marine model for decision support within Baltic Sea region. Authors: Oleg P. Savchuk, Bo G. Gustafsson and Bärbel Müller-Karulis. ISBN: 978-91-86655-05-8".
LT	The objectives for coastal waters are: for TN (summer mean concentration) – G/M – 0,25 mg/l; for TP (summer mean concentration) – G/M – 0,026 mg/l.
PT	Nutrient concentration below good/moderate boundaries.
RO	The management objectives have been defined in the Danube River Basin District Management Plan developed at the International Commission for the Protection of the Danube River (ICPDR) level and have been addressed to both EU Member States and non-EU Member states. The ICPDR is a transnational body established to implement the Danube River Protection Convention, as a platform for the implementation of all transboundary aspects of the EU Water Framework Directive (WFD). RO has not established the management objectives at water body level but at national level, following the approach on the Danube basin-wide level (international level).

Country	Explanation
	These management objectives have been considered in the National Management Plan and River Basin Management Plan as a component part of the water management process within the Danube district. Information on management objectives at the Danube River Basin District level can be found on website www.icpdr.org (Danube River Basin District Management Plan 2009 and 2015 update).
FI	Objective is to achieve good ecological / environmental status in the coastal and open waters.
SE	Good ecological status.
IS	The management objective is that coastal waters are in high or good ecological status. The good/moderate boundaries are in line with the OSPAR objectives/criteria.
NO	Management objective is to reach the nutrient concentration at good/moderate boundary based on the national classification system for nutrients.
TR	Management objectives for nutrients set for coastal sensitive areas are presented in "By-Law on Determination of Sensitive Water Bodies and Areas Effecting these Water Bodies and Improvement of Water Quality" formed in line with the WFD requirements. Oligotrophic water quality is targeted in coastal waters.

4.3 When setting management objectives for nutrients, is there a focus on reduction of phosphorus, nitrogen, or both or on the limiting nutrient? Please explain why.

Summary of responses

No countries responded that they focus on reduction of phosphorus when setting management objectives for nutrients.

3 countries responded that they focus on reduction of nitrogen when setting management objectives for nutrients.

16 countries responded that they focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients.

1 country responded that they focus on reduction of the limiting nutrient when setting management objectives for nutrients.

Responses in detail

4.3.1 Phosphorus

Respondents:

- None

4.3.2 Nitrogen

Respondents:

- DE
- IE

- NL

Explanation

Country	Explanation
DE	We have so far focused on nitrogen, since this is the limiting nutrient in coastal waters.
IE	In coastal waters the focus is on nitrogen as this is typically considered to be the limiting nutrient in these water bodies.
NL	N is believed most limiting for most T and C waters.

4.3.3 Phosphorus & Nitrogen

Respondents:

- DK
- EE
- EL
- ES
- FR
- IT
- CY
- LV
- LT
- PL
- PT
- RO
- FI
- SE
- IS
- NO

Explanation

Country	Explanation
DK	In the model calculations related the present RBMP period of 2015-2021 further reduction of nitrogen loads was indicated as the main solution to support GES in Danish coastal waters. The baseline for this was the previous 2 decades of measures reducing the Danish loadings of Phosphorous by more than 80 % and Nitrogen by nearly 50%. In the further development and refining of the modelling system of the third period focus will still be on both nitrogen and phosphorus loadings (landbased as well as airborne (N)) in order to set targets for both nutrients if relevant. Thus Maximum Allowable Input (MAI) of Danish land based nitrogen and phosphorous loadings can be expected in the third RBMP period of 2021-2027. Similarly, HELCOM's nutrient input ceilings are for both phosphorous and nitrogen.
EE	Management plan focus on point source and limits for both nutrient have been set.
EL	Nitrogen and/or phosphorus are the nutrients related to eutrophication.
ES	The Royal Decree 817/2015, 11th September, defines criteria to monitor and assess the status of surface water bodies and environmental quality standards in Coastal Waters, including the good/moderate boundary for phosphate, nitrates, nitrites, total phosphorus and ammonia, depending on the type of water body.
FR	Depending on the river basin district, issues and causes can be different: - Generally, there is a focus on reduction of phosphorus and nitrogen because they are both limiting factors in marine phytoplankton blooms issues. - In Brittany, nitrogen is a limiting factor in green algae issues.
IT	For coastal water bodies which are included in sensitive areas, UWWT Directive emission thresholds for nitrogen and phosphorous applies to UWWT Plants discharges. For transitional water bodies which are included in nitrate vulnerable

Country	Explanation
	zones, limit loading of 170 Kg per hectare applies without prejudices to exception agreed with EC according to Nitrate Directive.
CY	The management objectives refer to both nutrients as they both contribute to eutrophication. Also, the Ground Waters of CY are already in Bad ecological status and there is an effort to contribute to their improvement.
LV	See explanation in Part A, Section 4.2.
LT	The GES values, the targets for load reduction and the measures to reduce riverine input of nutrients have been set for both nitrogen and phosphorus, therefore, yes, there is a focus on reduction of both phosphorus and nitrogen.
PL	As the management objective is to reach the nutrient concentration at good/moderate boundaries, both N and P were taken into account.
PT	Management objectives are set for nutrients failing good status (P, N or both).
RO	See explanation in Part A, Section 4.2.
FI	A large part of the coastal and open waters is limited by both nutrients, or the limitation varies in time. In addition, excess nutrients flow to adjacent areas, and thus the unlimiting nutrient is also important.
SE	Variable conditions (temporal and spatial) around the SE coast regarding what nutrient is limiting.
IS	IS has implemented regulations on European directives (Urban wastewater treatment directive 91/271/EEC, Nitrates directive 91/676/EEC), and Water Framework Directive. Regulations on UWWTD in IS state that concentration targets of percentage target should be used to determine the maximum critical load.
NO	Nitrogen regarded as the main problem in coastal waters

4.3.4 Limiting Nutrient

Respondents:

- FR

Explanation

Country	Explanation
FR	See explanation in Part A, Section 4.3.3.

4.4 If you have set management objectives for nutrients, please indicate which methodology has been used and provide a short description of the methodology including links to background reports or publications. In the description, please indicate whether and how you have considered pressure-response relationships.

Summary of responses

11 countries responded that they use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients.

10 countries responded that they use historical information to set management objectives for nutrients.

7 countries responded that they use expert judgement to set management objectives for nutrients.

5 countries responded that they use other methods to set management objectives for nutrients.

Responses in detail

4.4.1 Modelling based on nutrients vs BQE-response relationships

Respondents:

- DK
- DE
- EE
- IE
- EL
- FR
- LV
- LT
- NL
- PL
- SE

Explanation

Country	Explanation
DK	Modelling of Maximum Allowable Input (MAI) of nitrogen and phosphorous taking into account the pressures and responses of the biological quality elements. The needed reduction of nutrients to support good ecological status is calculated and included in the programmes of measures. HELCOM used the TARGREV report to derive historical nutrient concentrations and subsequent modelling to derive MAI. Detailed information on target setting can be found here: https://helcom.fi/baltic-sea-action-plan/nutrient-reduction-scheme/background-on-target-setting/
DE	Baltic Sea We have used the catchment model MONERIS to determine nutrient loads around 1880. 1880 was selected since it is known that a diverse community of macrophytes was still abundant and that therefore coastal waters were not eutrophic. The nutrient and chlorophyll-a concentrations as well as secchi depth resulting from 1880 nutrient inputs were modelled using the 3D ecosystem model ERGOM-MOM. The concentrations for nutrients and chl-a resulting from the modelling approach were set as reference conditions. Good/moderate boundaries were obtained by adding an allowable deviation of 50% taking into account natural variability. Based on average chlorophyll-a concentrations representing good status the maximum allowable nutrient inputs and associated nutrient concentrations were determined, assuming that airborne nitrogen inputs will be lowered by 20% due to the implementation of the Gothenburg Protocol. This approach resulted in an average allowable nutrient concentration for all rivers of 2.6mg/l at the limnic-marin boundary that was set as the management target for nitrogen. A pressure-response relationship has been established between nutrient inputs and chlorophyll-a concentrations/secchi depth. References: Hirt, U., Mahnkopf, J., Gadegast, M., Czudowski, L., Mischke, U., Heidecke, C., Schernewski, G. & Venohr, M. (2013): Reference conditions for rivers of the German Baltic Sea catchment: reconstructing nutrient regimes using the model MONERIS. Regional Environmental Change 14 (3): 1123-1138, doi:10.1007/s10113-013-0559-7. Schernewski, G., Friedland, R., Carstens, M., Hirt, U., Leujak, W., Nausch, G., Neumann, T., Petenati, T., Sagert, S., Wasmund, N., von Weber, W, (2015): Implementation of European marine policy: new water quality targets for German Baltic Waters., Marine Policy 51: 305-321. https://www.sciencedirect.com/science/article/pii/S0308597X14002358 North Sea Initially, pressure-response relationships between nutrient concentrations and secchi depth and chlorophyll-a were investigated. A focus was set on correlations between TN concentrations and chlorophyll-a concentrations. Based on the target value of 2.8mg/l TN at the limnic-marine boundary that was agreed for the river Rhine in the International Commission for the Protection of the River Rhine the status achievable in coastal waters with respect to chlorophyll-a concentrations was analysed by using correlations between TN concentrations and chlorophyll-a. It was shown that lowering the riverine concentrations to 2.8mg/l would be sufficient to achieve good status for chlorophyll-a. Hence this concentration was set as a management value for nitrogen. Reference:

Country	Explanation
	ARGE 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. Bund-Länder Messprogramm Meeresumwelt, 50 Seiten. https://www.meeresschutz.info/sonstige-berichte.html
EE	Objectives have set by the expert, combining the historical information and modelling.
IE	The description of the methodology for the establishment of the relevant boundary values for the freshwater endpoint for the coastal DIN EQS was reported to ECOSTAT in 2014 and is not repeated to avoid duplication. Proposed coastal standards for IE have been developed in line with the current OSPAR standards. In accordance with the OSPAR Common Procedure (table 4.3 & EUC (2) 05/2/Info.1-E, OSPAR Commission 2005-3). The background is considered to be 8□M or 0.11 mg N L-1. The high-good boundary is set at approximately 50% above the background for DIN (12µM or 0.17 mg N L-1) and the good-moderate boundary is set at 50% above the high-good boundary (18µM or 0.25 mg N L-1). The well-established general relationship between nitrogen concentration and dissolved oxygen utilisation was also taken into consideration in assessing the suitability of the good/moderate DIN boundary in coastal waters. The Potential Oxygen Demand (POD) at different DIN concentrations was estimated. The corresponding level of POD at the DIN good/moderate boundary value was considered sufficient to protect 90% of bottom-dwelling marine organisms (Vaquer-Sunyer and Duarte, 2008). For example, at the good/moderate DIN concentration of 0.25 mg/l, the potential amount of oxygen utilisation that would result would be approximately 2.0 mg/l (O'Boyle and Nolan, 2010). This would still leave a bottom oxygen concentration of 5.2 mg/l, which is above the minimum threshold of 4.6 mg/l, considered sufficient to protect the majority of marine organisms. The statistical methodologies for determining appropriate nutrient concentrations for supporting ecological status under the Water Framework Directive developed by Philips et al 2016 and applied to European Transitional and Coastal Waters (Teixeira & Salas, 2016) by the working Group on Ecological Status (ECOSTAT) were also tested. The results of this have already been reported. O'Boyle, Shane, and Glenn Nolan. 2010 "The Influence of water column stratification on dissolved oxygen levels in coastal and shelf waters around Ireland." Biology & Environment: Proceedings of the Royal Irish Academy. Vol. 110. No. 3. The Royal Irish Academy, 2010. Vaquer-Sunyer, Raquel, and Carlos M. Duarte. 2008 "Thresholds of hypoxia for marine biodiversity." Proceedings of the National Academy of Sciences 105.40 (2008): 15452-15457.
EL	1. Use of toolkit proposed by Phillips et al. (2018) and Teixeira et al. (2017) on R scripts: Intercalibrated data from the Water Framework Directive (WFD) for the biological quality element phytoplankton was used for deriving nutrient boundaries in coastal waters. The work was performed for the Working Group on Ecological Status (ECOSTAT), as part of the Common Implementation Strategy (CIS) for the WFD and MSFD. The statistical work was based on different approaches, as described in the Guidance (Phillips et al. 2018): a) univariate linear regression analysis (OLS linear regression of EQR vs. nutrients and nutrients vs. EQR, and standard major axis (SMA) regression, i.e. geometric average of slope models from previous OLS models); and b) categorical analysis; c) bivariate linear regression analysis; d) additive quantile regression analysis. 2. For Karydis (1999) eutrophication scale, a statistical analysis of inorganic nutrient data (P-PO4, N-NO3, N-NO2, N-NH3) has been made for scaling aquatic systems into oligotrophic, mesotrophic and eutrophic water types. Three data sets have been used from areas known as impacted-eutrophic (in the vicinity of Athens sewage outfall), mesotrophic (sites in a distance for the Athens sewage outfall) and oligotrophic (Rhodos Island) (Ignadiades et al., 1992). 3. The PCQI index includes nitrate, phosphate, ammonium, Secchi disk depth of disappearance (SD) and percentage of oxygen saturation, which are mainly required by the WFD for the assessment of the physico-chemical status (Bald et al., 2005; Simboura et al., 2016).
FR	Depending on the river basin district and issues, models can be different: - They can be based on historical information, nutrients vs BQE-response relationships and usually they are completed by expert judgment. - The idea is to determine the nutrient threshold in river water bodies, which would be compatible with the achievement of costal water bodies' good ecological status, by modelling. - Depending on modelling result and the threshold that we need to achieve, realistic management objectives are set to attain or maintain coastal water bodies' good ecological status over time.

Country	Explanation
	For example, description of ECOMARS 3D model: (http://marc.ifremer.fr/en/how_does_it_work/modele_eco_mars3d_manche_gascogne or cf. bibliographic references in Part A, Section 3.3): We set nutrients targets by calculating nutrient concentration threshold to reach in rivers that lead to good environmental state in coastal and marine waters. Calculation of such threshold were done using modeling and Simplex approach, it was combined with expert judgment on the final results. Relationship between pressure and response was taken into account through a linear regression between observed chlorophyll-a concentration and modelled bio-available nutrients concentrations in coastal waters.
LV	See explanation in Part A, Section 4.2.
LT	Average summer concentrations of total nitrogen (TN) and total phosphorus (TP) have been selected for characterization of water quality after analysis of their relationships with pelagic biological parameters (chl a, phytoplankton biomass). Reference values for both nitrogen and phosphorus were not possible to estimate for coastal waters neither using modeling, nor using information from non-impacted sites or historical measurements, therefore values have been recalculated from biological elements (historical or modeled reference values available) using empirical relationships. Following steps have been performed in developing classification for summer average total nitrogen and total phosphorus: 1. Modeled long-term maximum of average chlorophyll a concentrations (2.1 µg/l) for summer months in the south-eastern Baltic (Table 2 in Schernewski, Neuman, 2005) was used to define reference conditions for chlorophyll a. 2. Threshold between poor and bad water quality classes was defined using a lower limit of intensive phytoplankton bloom 10 mg/l (Reimers,1990). This value was recalculated into average summer phytoplankton concentration using empirical relationship between maximum (PHmax) and mean (PHmean) phytoplankton biomass (national monitoring data from the period 1993-2007 obtained at 5 stations) PHmean (mg/l) = 0.796 □ PHmax (mg/l) – 0.0295 ($R2= 0.93$) 3. Reference chlorophyll a (Chl a) concentration was transformed into phytoplankton biomass (PHbiom) using empirical relationship: Chl a (mg/l) = 0.3001 □ Phbiom (mg/l) + 0.188 ($R2= 0.43$) Boundaries between reference and bad classes (good, moderate and poor) for phytoplankton biomass were estimated using equal proportion principle and back calculated to chlorophyll a boundaries. 4. Total phosphorus (TP) reference concentration and water quality class boundaries were estimated using empirical relationship between total phosphorus and chlorophyll a mean summer concentration TP (mg/l) = 3.9403 □ Chl a (µg/l) + 11.1881 ($R2= 0.48$) Lower limits of 95% confidence interval of predicted TP values were used for class boundaries. 5. Reference TN concentration was fixed according to the average pristine N:P ratio of 20 for the eastern Baltic Sea (Schernewski, Neumann, 2005). Using expert judgment boundary for poor and bad water quality classes was set to 600 µg/l and overall interval was divided into classes following equal proportions.
NL	Statistical relationship between phytoplankton and DIN, corrected for salinity when below 30.
PL	The management objectives are the same as the good/moderate boundary for nutrients used for status classification. For TW and CW the good/moderate boundary has been set by using statistic tool developed with the methodology Best Practice for establishing nutrient concentrations to support good ecological status (WG ECOSTAT, 2018) on the basis of macrozoobenthos).

Country	Explanation
SE	https://www.havochvatten.se/vagledning-foreskrifter-och-lagar/foreskrifter/register-vattenforvaltning/klassificering-och-miljokvalitetsnormer-avseende-ytvatten-hvmfs-201925.html https://www.smhi.se/publikationer/publikationer/revidering-av-fysikaliska-och-kemiska-bedomningsgrunder-i-kustvatten-underlag-infor-uppdatering-av-hvmfs-2013-19-1.130745

4.4.2 Historical information

Respondents:

- DE
- EE
- IE
- ES
- FR
- CY
- LT
- PT
- SE
- NO

Explanation

Country	Explanation
DE	See explanation in Part A, Section 4.4.1.
EE	See explanation in Part A, Section 4.4.1.
IE	See explanation in Part A, Section 4.4.1.
FR	See explanation in Part A, Section 4.4.1.
LT	See explanation in Part A, Section 4.4.1.
PT	Reference values has been established through statistical treatment of the historical data set. However, PT classification methodology for CW is not based on direct comparison between measured values and reference values. The 90th percentile of measured values on each water body is divided by the reference value. It is this division that is used for classification (e.g. if 90th percentile/Reference value is between [1-2[status is good; if 90th percentile/Reference value is <1 status is excellent; if 90th percentile/Reference value is <2 status is moderate).
SE	See explanation in Part A, Section 4.4.1.
NO	Based on historical data for selected areas. The system is based on the OSPAR criteria at that time. First review in 1997, should be reviewed again as more information is available today.

4.4.3 Expert Judgement

Respondents:

- EE
- ES
- FR

- LT
- PT
- IS
- NO

Explanation

Country	Explanation
EE	See explanation in Part A, Section 4.4.1.
FR	See explanation in Part A, Section 4.4.1.
LT	See explanation in Part A, Section 4.4.1.
PT	See explanation in Part A, Section 4.4.2.
IS	We have used nutrient data from natural wb to set the reference values for nutrients and the cutoff between ecological status is set using expert judgement. This work is in progress.
NO	See explanation in Part A, Section 4.4.2.

4.4.4 Other

Respondents:

- EL
- IT
- RO
- FI
- IS

Explanation

Country	Explanation
EL	See explanation in Part A, Section 4.4.1.
IT	Management objectives are based on UWWT and Nitrate Directives requirements.
RO	This approach has been built upon the results of the pressure analysis, the water status assessment, and includes, as a consequence, measures of basin-wide importance oriented towards the agreed visions and management objectives for each significant water management issue (SWMI), nutrient pollution being one of SWMI identified at the Danube River Basin District and national level. The following management objectives have been set up in the 2015 Update of the Danube River Basin Management Plan (DRBMP 2015): - Further reduction of the total amount of nutrients entering the Danube and its tributaries and the nutrient loads transported into the Black Sea. - Further reduction of the nutrient point source emissions by the implementation of the management objectives described for organic pollution (implementing the Urban Waste Water Treatment Directive (EU MS) and by constructing a specified number of wastewater collecting systems and municipal wastewater treatment plants

Country	Explanation
	(Non-EU MS) and further reduction of pollution of the surface waters from the major industrial and agricultural installations by implementing the Industrial Emissions Directive (EU MS) and introducing Best Available Techniques at a specified number of industrial facilities (Non-EU MS)) as they address the nutrient pollution as well. - Further reduction of the nitrogen pollution of the ground and surface waters by the implementation of the EU Nitrates Directive according to the developed action programs within the designated vulnerable zones or the whole territory of the country (EU MS). - Ensuring sustainable agricultural production and soil nutrient balances and further reduction of the diffuse nutrient pollution by implementation of basic and cost-efficient supplementary agri-environmental measures linked to the EU Common Agricultural Policy (EU MS) and by implementation of best management practices in the agriculture considering cost-efficiency (Non-EU MS). - Further decrease of the phosphorus point source pollution by implementation of the EU Regulation on the phosphate-free detergents (EU MS) and by reduction of phosphates in detergent products (Non-EU MS). See page 114 of the DRBMP 2015 https://www.icpdr.org/flowpaper/app/services/view.php?doc=drbmp-update2015.pdf&format=pdf&page={page}&subfolder=default/files/nodes/documents/ Also, it is important to underline that the Danube basin-wide vision for nutrient pollution is established in relation to the Black Sea eutrophication risk. In this respect, the basin-wide vision is the balanced management of nutrient emissions via point and diffuse sources in the entire Danube River Basin District that neither the waters of the DRBD ***nor the Black Sea are threatened or impacted by eutrophication.*** The nutrient fluxes to the Black Sea transported by the Danube River are compared with those of the early 1960ies (this period being characterized by low pressures and low eutrophication risk), which has indicated a further load reduction potential that could be at least partly exploited for the benefit of the Black Sea (figures from the DRBMP 2015 - TN: 40%, TP: 20%).
FI	Modeling on needed reductions in order to reach nutrient thresholds in coastal areas. Setting of management objectives for coastal waters in FI is described in the guidance: Huttunen, M. 2019: Estimation/Setting of management objectives for load reductions using the VEMALA model (link, see also Part B, Section 3.1). The methodology is used both for WFD river basin management and for MFSD purposes, and it estimates spatial needs to reduce anthropogenic nutrient loading. The methodology aims at identifying such spatial load reduction objectives that solves simultaneously load reduction needs both for inland water bodies as well as recipient coastal and marine areas. The input data for VEMALA estimation are: i) present observed concentrations of nitrogen (N) and phosphorus (P), ii) target concentrations for reaching good ecological status (GES), and iii) modelled N and P concentrations for natural background loading and for different sectors of human impact. Regional Centers for Economic Development, Transport and the Environment, that are responsible for RBMP's and PoM's check the input data and target concentrations and if necessary, correct them. Methodology used for the estimation utilizes optimizing where the need for load reduction for the respective water body (WB) is also split to include those water bodies whose catchment areas locate above (upstream of) the WB in question. This is to proportionate nutrient loading reduction evenly and to take into account at the same time reduction needs of the water bodies and load retention inside the water body.
IS	See explanation in Part A, Section 4.4.3.

4.5 Do you determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs? What methodology do you use?

Summary of responses

8 countries responded that they do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

11 countries responded that they do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

Responses in detail

4.5.1 Yes

Respondents:

- DK
- DE
- IE
- LV
- NL
- PL
- FI
- SE

Methodology Used

Country	Description
DK	See description in Part A, Section 4.4.1
DE	The maximum critical load can easily be calculated by multiplying the management target with the discharge. Calculating the required nutrient reduction in tons is more challenging since it requires a decision about a reference period and how to deal with the high variability in discharge. Currently, DE is using the nitrogen concentration target for the management, but there is work underway to agree on a nationally harmonized methodology for calculating nutrient reduction targets in tons per year, since it is recognized that load reduction targets are more suitable for the management than concentration targets.
IE	A load reduction targets have been previously identified for specific water bodies to allow water body concentrations return to non-problem area status with regard to eutrophication as defined by the OSPAR Convention (O'Boyle et al., 2011). This was reported under the meeting of the intersessional correspondence group on eutrophication (ICG-EUT) in 2011. A simple box model was used to determine what load reduction would be required to return five coastal areas to non-problem area status (O' Boyle et al., 2011; please see Ni Longphuirt et al., 2015 for description of the model). The model looks at changes in nutrient concentrations, chlorophyll concentration and macroalgal biomass relative to reduction in loads. In order to achieve the objectives of the OSPAR Convention PARCOM Recommendations 88/2 and 89/4 relating to the reduction of nutrient inputs to the marine environment were also considered. This requests contracting parties to put in place effective national steps to achieve a substantial reduction in inputs (up to 50%) of phosphorus (P) and nitrogen (N) into areas where they are likely, directly or indirectly, to cause pollution (i.e. into areas that have been classified as 'problem areas' or as 'potential problem areas' with regard to eutrophication status under the OSPAR Common Procedure – procedure for the identification of the eutrophication status of the OSPAR maritime area). To assess progress towards this target, OSPAR established a PARCOM reporting requirement to be completed by contracting parties, this was done last in 2012 (see Section B3 below). Ní Longphuirt, S., O'Boyle, S., Wilkes, R., Dabrowski, T. and Stengel, D. (2015). Influence of Hydrological Regime in Determining the Response of Macroalgal Blooms to Nutrient Loading in Two Irish Estuaries. Estuaries and coasts: 1-17. 10.1007/s12237-015-0009-5 Mockler et al. (2017) Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework. Science of the total Environment. https://doi.org/10.1016/j.scitotenv.2017.05.186

Country	Description
	O'Boyle, S., Wilkes, R., Dabrowski, T. 2011. Ireland's report on 'distance to target'; a quantitative estimate of the amount of nutrient reduction required to reach non-problem area status with regard to eutrophication. Presented at OSPAR ICG_EUT Meeting Nov. 2011. 9pp.
LV	See explanation in Part A, Section 4.2.
NL	Because standard is standardized for salinity, automatically –at least for concentration- can be the reduction need be seen. And yes, separate calculations are made together with catchment partners to calculate the reduction need for C and T waters.
PL	See explanation in Part A, Section 4.4.1.
FI	Load – response model (CLR) was applied, using chlorophyll-a in estimating the reduction need.
SE	Maximum critical load is derived in relation to the pressure analyses, while a load reduction target is derived in order to dimension the need for measures. Original response did not mark 'Yes' or 'No', but left this description, therefore 'Yes' response assumed.

4.5.2 No

Respondents:

- EE
- EL
- ES
- FR
- IT
- CY
- LT
- PT
- RO
- IS
- NO

Further details

Country	Details
EE	EstModel is used to determine the nutrient reduction target.
FR	There is no critical load defined in our river basin district management plans. Strategies are based on nitrogen and phosphorus concentrations and expert judgements. Nevertheless, flow approach is under development.
RO	See explanation in Part A, Section 4.4.4.

4.6 Is there a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status?

Summary of responses

12 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary.

3 countries responded that there is a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements.

6 countries responded that there is not a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.

Responses in detail

4.6.1 Yes, the management objective is to reach the nutrient concentration at good/moderate boundary

Respondents:

- DE
- EE
- IE
- EL
- ES
- LV
- LT
- NL
- PL
- FI
- SE
- NO

Additional information

Country	Description
DE	The management objective mainly focusses on the chlorophyll-a concentration and therefore on the BQE phytoplankton. The goal is to achieve the good/moderate boundary for chlorophyll-a. Furthermore, the management objective also allows for achieving the good/moderate boundary for nutrient concentrations and secchi depth.
IE	The nutrient boundaries set for ecological status are used for management objectives. The objective is to be below the good-moderate boundary concentration as stated in the legislation.
LV	See explanation in Part A, Section 4.2.
NL	G/M boundary for biology.
PL	See explanation in Part A, Section 4.4.1.
FI	Modelling on needed reductions in order to reach nutrient thresholds in coastal areas.
NO	Both biological quality elements and nutrient concentration (physico-chemical quality element) is addressed in classification of ecological status.

4.6.2 Yes, the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements

Respondents:

- NL
- PT
- IS

Additional information

Country	Description
NL	See explanation in Part A, Section 4.6.1.
PT	From the options above, the second one suits our reality better, as the management objective is to reach good status but nutrient concentrations should ideally be lower than the good/moderate boundary (and not at the good/moderate boundary).
IS	The high/good boundary is based on nutrient concentration in natural, unpolluted rivers/lakes/coastal waters. The management objective is based on Icelandic regulations which is in concert with European directives.

4.6.3 No, another approach is used to set the management objective

Respondents:

- DK
- DE
- FR
- IT
- CY
- RO

Methodology Used

Country	Description
DK	Under the RBMPs, the management objectives is to reach good/moderate boundary as defined by the biological quality elements. When calculating MAI values the target value is the boundary between good and moderate status (RBMP 2015-2021).
DE	See explanation in Part A, Section 4.6.1.
FR	- To respond WFD requirements: management objectives are set to reduce phytoplankton or macroalgal blooms (main biological indicators of eutrophication). Therefore, those management objectives are set in regards to those quality elements' parameters. - To respond MSFD requirements (D5C1): reduction targets are set also in regards to nutrient concentration.

Country	Description
IT	Management objectives consist of full implementation of UWWT and Nitrate Directives with additional specific measures on urban waste water re-use for agriculture. It is expected that such objectives will allow to reach thresholds established for nutrients as physical-chemical parameters supporting BQE.
RO	See explanation in Part A, Section 4.4.4.

4.7 If you have set management objectives for nutrients, please specify which policy the management objectives are meant to address.

Summary of responses

18 countries responded that policy the management objectives are meant to address the WFD.

13 countries responded that policy the management objectives are meant to address the MSFD.

12 countries responded that policy the management objectives are meant to address the NiD.

10 countries responded that policy the management objectives are meant to address the UWWTD.

5 countries responded that policy the management objectives are meant to address other policy.

Responses in detail

4.7.1 WFD

Respondents:

- DK
- DE
- EE
- IE
- EL
- ES
- FR
- IT
- LV
- LT
- NL
- PL
- PT
- RO
- FI
- SE
- IS
- NO

Explanation

Country	Explanation
NL	Objectives are primarily set and based on WFD definition. Synergy is there of course with NiD and Natura2000 species/habitats.
PL	WFD: reaching at least the good / moderate boundaries.
SE	Baltic Sea Action Plan, https://helcom.fi/baltic-sea-action-plan/ National environmental quality objectives (zero eutrophication) https://www.sverigesmiljomal.se/environmental-objectives/

4.7.2 MSFD

Respondents:

- DK
- DE
- EE
- IE
- EL
- ES
- FR
- IT
- LV
- LT
- PT
- RO
- SE

Explanation

Country	Explanation
SE	See explanation in Part A, Section 1.6.1.

4.7.3 NiD

Respondents:

- DE
- IE
- ES
- FR
- IT
- CY
- LT
- PL
- PT
- RO
- FI
- IS

Explanation

Country	Explanation
PL	NiD: reducing water pollution by nitrates from agricultural sources and preventing further pollution.

4.7.4 UWWTD

Respondents:

- IE
- EL
- FR
- IT
- CY
- LT
- PL
- PT
- RO
- IS

Explanation

Country	Explanation
PL	UWWT: in some way implementation the UWWTD may be interpreted as load management objectives at the measure level.

4.7.5 Other

Respondents:

- EE
- LV
- PL
- RO
- SE

Explanation

Country	Explanation
EE	RSC (HELCOM) reducing anthropogenic inputs of nutrients in accordance with HELCOM Baltic Sea Action Plan targets (country allocated reduction targets - CART) for EE.
LV	HELCOM Convention
PL	Other (Helcom): decreasing the load which reach the Baltic sea (from the 1997 – 2003 reference load value).
RO	- Industrial Emissions Directive and Best Available Techniques - EU Common Agricultural Policy and best agricultural practices - EU Regulation on the phosphate-free detergents
SE	See explanation in Part A, Section 1.6.1.

4.8 If you have not set management objectives for nutrients, please explain the reasons. In addition, please provide information on how you achieve the WFD/MSFD objectives instead for water bodies exposed to nutrient pollution.

Summary of responses

2 countries responded that they have not set management objectives for nutrients and provided an explanation for the reasons for this. In both cases these countries do not experience issues with eutrophication and therefore do not set management objectives for addressing this.

Responses in detail

Respondents:

- FR
- IS

Explanation

Country	Explanation
FR	Some areas are oligotrophic and in those areas, there is no eutrophic issue and therefore no management objectives (except measures aimed at the principle of non-degradation).
IS	Pressure due to nutrient pollution is in general not of big concern in Icelandic water bodies. The main objectives is to remain high/good status.

2.5 Part A5: Methods used to derive management objectives for nutrients in Marine Waters

5.1 Have you set management objectives for nutrients for marine waters that are exposed to nutrient pollution?

Summary of responses

9 countries responded that they have set management objectives for nutrients for all nutrient polluted marine assessment units.

2 countries responded that they have set management objectives for nutrients for some nutrient polluted marine assessment units.

3 countries responded that they have not set management objectives for nutrients for marine assessment units.

Responses in detail

5.1.1 Yes, for all nutrient polluted assessment units

Respondents:

- DK
- EE
- IE
- ES
- LV
- LT
- RO
- FI
- SE

5.1.2 Yes, for some nutrient polluted assessment units

Respondents:

- DE
- NL

5.1.3 No

Respondents:

- FR
- IT
- CY

5.2 Please provide the management objectives for nutrients set for marine waters.

Summary of responses

12 countries responded to this question to provide the management objectives for nutrients set for marine waters.

Responses in detail

Respondents:

- DK
- DE
- EE
- IE
- ES
- FR
- LV
- LT
- NL
- RO
- FI
- SE

Country	Explanation
DK	With the *existing measures* in the program of measures for the Danish Marine Strategy, such as regional plans, wastewater plans, previous plans for the aquatic environment (plans for the aquatic environment I, II and III), as well as the nature restoration projects already adopted, DK has achieved large reductions in nitrogen and phosphorus inputs to the marine environment. In addition, the initiatives in the river basin management plans from 2009 to 2015 and 2015 to 2021 are expected to contribute to reductions in nitrogen and phosphorus in marine waters. In 2011, the Baltic Sea was designated by the IMO as a particularly sensitive area for sewage discharges, and stricter rules for sewage discharges from passenger ships were adopted. However, entry into force of this regulation has been postponed, but it is expected to enter into force in 2019-2021. Overall, the measures have been set with the intention of meeting the objectives of the Water Framework Directive and thereby have a derived effect on achieving the objectives in the Marine Strategy Framework Directive. As previously described, the further development and refining of the modelling system of the third period of the river basin management planning, focus will still be on both nitrogen and phosphorus loadings (land-based as well as

Country	Explanation
	airborne (N)) to set targets for both nutrients if relevant. Thus Maximum Allowable Input (MAI) of Danish land based nitrogen and phosphorous loadings can be expected in the third RBMP period of 2021-2027. Open waters are also governed by HELCOMs nutrient input ceilings. Hence, for the Danish open sea areas within the HELCOM area, HELCOM's agreed input ceilings also constitute a management objective. The current ceilings and relevant documentation can be found here: https://helcom.fi/baltic-sea-action-plan/nutrient-reduction-scheme/progress-towards-country-wise-allocated-reduction-targets/results/
DE	We have set management objectives for the Baltic Sea but not yet for the North Sea. Work on deriving nutrient reduction targets for the North Sea has started in OSPAR and final results are expected in 2022.
EE	Management objectives set for nutrients in marine waters is derived from RSC (HELCOM) and MSFD, which require boundaries for marine waters. The two policies can be addressed by the same indicators, agreed threshold values for nutrients concentrations in assessment units and eutrophication ratio (ER) are used in the open-sea basins. ER is a quantitative value for the level of eutrophication, calculated as the ratio between the threshold value and the present concentration – when ER > 1, threshold value has not been reached and status is failed (not good). Thresholds (G/M class boundaries): TN (summer concentration, µmol/l): GOF 21,3 EGB 16,5 GOR 28,0 NBP 16,2 TP (summer concentration, µmol/l): GOF 0,55 GOR 0,7 NBP 0,38 EGB 0,45 DIN (winter-time concentration, µmol/l): GOF 3,8 GOR 5,2 NBP 2,9 EGB 2,6 DIP (winter-time concentration, µmol/l): GOF 0,59 GOR 0,41 NBP 0,25 EGB 0,29
IE	The nutrient management objectives for Marine waters and reported to the OSPAR convention are: <table><tr><td>Sea Area</td><td>Salinity</td><td>DIN µmol/L</td><td>DIP µmol/L</td></tr><tr><td>Southern Irish Sea and Eastern Celtic Sea</td><td>>34.8</td><td>>12</td><td>>0.8</td></tr><tr><td>Atlantic to Irish Sea (Coast)</td><td>>34.5</td><td>>18</td><td>>1.25</td></tr><tr><td>Atlantic and Atlantic Seasonally stratified</td><td></td><td>>15</td><td>>0.8</td></tr></table> OSPAR Commission 2005, Ecological Quality Objectives for the Greater North Sea with Regard to Nutrients and Eutrophication Effects. ISBN 1-904426-71-9, Publication Number: 2005/229. 33 pp.
ES	Marine waters will be considered to reach the Good Status for D5-Eutrophication when no significant increasing trends are detected in the period 2011-2016, nor were there any concentrations above the baseline values beyond what is statistically expected. As in the first initial assessment, trends will be considered to exist positive (increase) for each nutrient in a particular productivity area when more than 10% of the records obtained in the period 2011-2016 exceed the base value (percentile 90 estimated for the entire series) or when a statistically significant positive trend has been

Country	Explanation
	found for the entire period, calculated from the annual averages. The reference values can be consulted in the documents of Marine Strategies, following link: https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/estrategias-marinas/eemm_2dociclo.aspx These are the environmental targets established by the Marine Strategies (second cycle) related to D5 in the 5 Marine Subdivisions: - Identify and address the causes (sources of diffuse nutrient contamination and / or effluent discharges) that produce the increasing trend of nutrient concentration in areas of contrasting productivity where concentrations above threshold values have been detected in the initial evaluation of D5. - Reduce the contribution of nutrients, pollutants and litter from river discharges. - Reduce the contribution of nutrients, pollutants and litter from wastewater. - Reduce the contribution of nutrients, pollutants and litter from rain episodes. - Reduce the contribution of nutrients and pollutants from agricultural activities: surpluses and returns from irrigation and livestock uses, among others.
FR	It is considered that if the targets are set for TRAC and coastal rivers it is not necessary to fix them for offshore waters.
LV	The management objectives have been set by Baltic Sea Action Plan adopted by HELCOM Contracting Parties in 2007 and updated later on as needed https://helcom.fi/baltic-sea-action-plan/. For more detailed description of approach see "Technical Report no 7. BALTSEM - a marine model for decision support within Baltic Sea region. Authors: Oleg P. Savchuk, Bo G. Gustafsson and Bärbel Müller-Karulis. ISBN: 978-91-86655-05-8".
LT	The objectives for marine waters are: for TN (annual concentration) – GES<0,225 mg/l; for TP (annual concentration) – GES<0,014 mg/l; for dissolved inorganic nitrogen (winter mean concentration) – GES <0,040mgN/l; for dissolved inorganic phosphorus (winter mean concentration) – GES <0,010mgP/l.
NL	DIN standards winter half year + management reduction objective of 2.5mg/l total N of large rivers entering coastal of transitional waters.
RO	The management objectives for nutrients in marine waters are set as percentile 75 of all nutrients concentrations lower than: DIP – 0.23 µM DIN – 10.5 µM
FI	HELCOM BSAP country-allocated nutrient reduction targets. Modelled to reach good environmental status in D5 indicators for open sea areas using the BALTSEM model.
SE	The objectives are laid down in the Agency regulation HVMFS 2012:18 (Regulation from Swedish Agency for Marine and Water Management on what characterizes good environmental status and environmental quality standards with indicators for the North Sea and the Baltic Sea) Target with indicator according to article 10 in MSFD: EQS in Swedish legislation: A.1 Input of nutrients from human activities shall decrease until it does not cause concentrations of nitrogen and phosphorus in the marine environment that prevent good environmental status to be achieved Associated indicator: A.1.1 Input of nitrogen and phosphorus Descriptor 5. Eutrophication Criterion Indicator (s) D5C1 Nutrient levels are not at levels indicating negative eutrophication effects D5C2 Chlorophyll a levels are not at levels indicating negative effects of nutrient enrichment D5C3 The number, spatial distribution and duration of harmful algal blooms are not at levels that indicate negative effects of nutrient enrichment. D5C4 The visibility depth of the water has not, due to nutrient enrichment, been reduced to levels that indicate D5C5 The content of dissolved oxygen has not, due to nutrient enrichment, been reduced to levels indicative of adverse effects on benthic habitats or other eutrophication effects. D5C7 The species composition of the macrophytic communities and relative abundance reach values that indicate that there is no negative effect due to nutrient enrichment or organic enrichment.

Country	Explanation
	D5C8 The species composition of the macrofauna communities and relative abundance reach values that indicate that there is no negative effect due to nutrient enrichment or organic enrichment. Good environmental status: When all applicable thresholds are met within the respective assessment area. For assessment of the overall status, an estimate must be made for each criterion of how large a part of the area the threshold values are followed. In coastal waters, it must be determined on the basis of the criteria used whether the area is exposed to eutrophication. In offshore water, an estimate must be made on the basis of the criteria used of how large a part of the area is not exposed to eutrophication. In addition: The supply of nutrients from human activities must be reduced until it does not cause concentrations of nitrogen and phosphorus in the marine environment that prevent good environmental status from being achieved.

5.3 When setting management objectives for nutrients, is there a focus on reduction of phosphorus, nitrogen, or both or on the limiting nutrient? Please explain why.

Summary of responses

No countries responded that they focus on reduction of phosphorus when setting management objectives for nutrients.

1 country responded that they focus on reduction of nitrogen when setting management objectives for nutrients.

10 countries responded that they focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients.

No countries responded that they focus on reduction of the limiting nutrient when setting management objectives for nutrients.

Responses in detail

5.3.1 Phosphorus

Respondents:

- None

5.3.2 Nitrogen

Respondents:

- NL

Explanation

Country	Explanation
NL	This may change in future. P reductions have been stronger than N reduction by which P is limiting nutrient most time of the year at leas [sic] near shore.

5.3.3 Phosphorus & Nitrogen

Respondents:

- DK
- DE
- EE
- IE
- ES
- FR
- LV
- LT
- RO
- FI

Explanation

Country	Explanation
DK	The measures have been set with the intention of meeting the objectives of the Water Framework Directive and thereby have a derived effect on achieving the objectives in the Marine Strategy Framework Directive. Both phosphorous and nitrogen are part of the focal areas of the Danish river basin management plans and both are part of the program of measures of the Danish Marine Strategy Directive. The program of measures will be updated in 2021. Similarly, HELCOM's nutrient input ceilings are for both phosphorous and nitrogen.
DE	The management objectives set for the Baltic Sea are based on a modelling approach. The model takes into account both nitrogen and phosphorus concentrations and determines the appropriate combination of reductions in N and P inputs that results in the lowest nutrient reduction requirements per basin (cost-optimisation function), thereby taking both nitrogen and phosphorus as well as the limiting nutrient into account.
EE	Management plan focus on reduction of both nutrients that cause eutrophication processes, measures are mostly focus on land sources.
IE	Both nutrients are considered in marine waters. Irish marine waters have not shown any impacts of eutrophication and as such a reduction of nutrients is not required. Original response selected Phosphorus and Nitrogen individually, but this was simplified to Phosphorus & Nitrogen for clarity.
ES	The nutrients monitored are - Nitrogen (NTOT) - Phosphorus (PTOT) - Dissolved inorganic nitrogen (TDIN) - Dissolved inorganic phosphorus (TDIP)
FR	An indicator for the phosphorus has been developed even if it has not be used for the MSFD assessment in 2018.
LV	See explanation in Part A, Section 5.2.
LT	The GES values, the targets for load reduction and the measures to reduce riverine input of nutrients have been set for both nitrogen and phosphorus, therefore, yes, there is a focus on reduction of both phosphorus and nitrogen.
RO	When setting management objectives for nutrients (GES boundaries concentrations) in marine waters, the focus was on historical data approach taking into consideration the correlation with salinity (as an important river or coastal source influence).

5.3.4 Limiting Nutrient

Respondents:

- None

5.4 If you have set management objectives for nutrients, please indicate which methodology has been used and provide a short description of the methodology including links to background reports or publications. In the description, please indicate whether and how you have considered pressure-response relationships.

Summary of responses

7 countries responded that they use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients.

6 countries responded that they use historical information to set management objectives for nutrients.

3 countries responded that they use expert judgement to set management objectives for nutrients.

2 countries responded that they use other methods to set management objectives for nutrients.

Responses in detail

5.4.1 Modelling based on nutrients vs BQE-response relationships

Respondents:

- DK
- DE
- EE
- LV
- NL
- FI
- SE

Explanation

Country	Explanation
DK	See explanation in Part A, Section 4.2 for the RBMP (WFD) and HELCOMs nutrient input ceilings (MSFD).
DE	Baltic Sea Long-term data series on eutrophication parameters (nutrient, chlorophyll-a, secchi depth, oxygen debt) have been investigated in the Baltic Sea looking for change points in the historic time series going back to 1900. Where such change points could be identified, they have been used for setting threshold values for the eutrophication parameters (HELCOM 2013). Then, a modelling approach was used to determine the maximum allowable nutrient inputs (MAI) that would enable the Baltic Sea to achieve good eutrophication status (iterative approach). For this work, the BALTSEM model of the Baltic Nest Institute was used. The resulting maximum allowable inputs per Baltic Sea Basin where then allocated to the HELCOM Contracting Parties using the polluter-pays principle. Other polluters (shipping, third countries) were also considered in this allocation (HELCOM Ministerial Meeting 2013). Thereby, nutrient input ceilings (NICs) have been established per HELCOM Contracting Party and Basin. DE uses these national NICs as an environmental target for eutrophication under Article 10 of the MSFD. The revised NICs for the updated Baltic Sea Action Plan for DE are 510 tons of phosphorus and 69,031 tons of nitrogen per year. References: HELCOM (2013): Approaches and methods for eutrophication target setting in the Baltic Sea region. Baltic Sea Environ. Proc. No. 133, 138 pages.

Country	Explanation
	HELCOM Ministerial Meeting (2013): Summary report on the development of revised Maximum Allowable Inputs (MAI) and updated Country Allocated Reduction Targets (CART) of the Baltic Sea Action Plan. 23 pages, https://helcom.fi/wp-content/uploads/2019/08/Summary-report-on-MAI-CART.pdf
EE	The management objectives for nutrients (targets) are based on work mainly carried out in the TARGREV project (HELCOM 2013), also taking advantage of the work done during the EUTRO PRO project while producing the HELCOM thematic assessment of eutrophication (HELCOM 2009). In the TARGREV project, the objective was to revise the scientific basis underlying the ecological targets for eutrophication, placing much emphasis on providing a strengthened data and information basis on which to set the quantitative targets. The final targets were set in the CORE EUTRO group through an expert evaluation process and accepted by the HELCOM Heads of Delegations 39/2013. (HELCOM, 2013. HELCOM core indicators: Final report of the HELCOM CORESET project. Balt. Sea Environ. Proc. No. 136).
LV	See explanation in Part A, Section 5.2.
NL	DIN concentration with probability 90% being at good status for phytoplankton on yearly data and long term gradient. For rivers: relationship between DIN coastal and River concentrations.
FI	HELCOM BSAP country-allocated nutrient reduction targets. Modelled to reach good environmental status in D5 indicators for open sea areas using the BALTSEM model.
SE	Statistical modelling with historical approach https://helcom.fi/media/documents/Eutorophication-targets_BSEP133.pdf.

5.4.2 Historical information

Respondents:

- DK
- DE
- EE
- IE
- ES
- RO

Explanation

Country	Explanation
DE	See explanation in Part A, Section 5.4.1.
EE	See explanation in Part A, Section 5.4.1.
IE	Irish Sea: Proposed standards for IE have been developed in line with the current OSPAR standards. Thresholds in the Irish Sea are considered as winter background levels of DIN and DIP (that is, dissolved inorganic nitrogen and dissolved inorganic phosphate) plus 50 %. Additional work to confirm this considered monitoring data from the Irish Sea. In the Irish Sea background concentrations were determined as 6.6 µM L-1 of TOxN data and 0.45 µM L-1 ortho-P; from waters entering St. George's Channel (McGovern et al., 2002). Values for elevated nutrients (50% above background) can be considered as ~10 µM l-1 DIN and 0.7 µM l-1 DIP for offshore waters. Although this compares TOxN with DIN, the contribution of ammonia is not expected to be significant in marine waters. These values compare well with the thresholds of DIN >12 µM and DIP >0.8 µM considered appropriate for the Irish Sea.

Country	Explanation
	Atlantic to Irish Sea Region: The agreed thresholds for eutrophication for the Atlantic region to Irish Sea are winter DIN and/or DIP defined as concentrations >50% above natural background concentrations. Proposed standards for IE have been developed in line with the current OSPAR standards. In accordance with the OSPAR Common Procedure (table 4.3 & EUC (2) 05/2/Info.1-E, OSPAR Commission 2005-3) the OSPAR background for DIN has been proposed as the background level and this value +50% (18 µM or 0.25 mg N L-1) has been proposed as the threshold value for elevated conditions. McGovern, E., Monaghan, E., Rowe, A., Duffy, C., Quinn, A., McHugh, B., McMahon, T., Smyth, M., Naughton, M., McManus, M., Nixon, E. Winter nutrient monitoring of the Western Irish Sea- 1990 to 2000. Marine Environment and Health Series, No. 4, 2002. Marine Institute, 80pp OSPAR Commission 2005, Ecological Quality Objectives for the Greater North Sea with Regard to Nutrients and Eutrophication Effects. ISBN 1-904426-71-9, Publication Number: 2005/229. 33 pp.
RO	Data (2004-2012) for marine waters DIP and DIN were analysed. Firstly, the correlation with salinity was checked. The analysis of available data on marine waters, the temporal, seasonal and spatial variability, and the significant correlation with the salinity showed the importance of the fluvial and anthropogenic input of DIP and DIN in the Romanian Black Sea waters. Next were analysed data corresponding to 40th-60th percentiles of salinities range where correlation with nutrients was not anymore significant suggesting that the anthropogenic influence was eliminated. The reference value was considered the median of the new range. The GES boundary is the reference value + accepted deviation (50%).

5.4.3 Expert Judgement

Respondents:

- EE
- ES
- RO

Explanation

Country	Explanation
EE	See explanation in Part A, Section 5.4.1.
RO	See explanation in Part A, Section 5.4.2.

5.4.4 Other

Respondents:

- FR
- LT

Explanation

Country	Explanation
FR	Cf. methodology for TRAC (WFD).
LT	Objectives and targets for open marine waters defined by the HELCOM within the working group on Eutrophication.

5.5 Do you determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs? What methodology do you use?

Summary of responses

6 countries responded that they do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

7 countries responded that they do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.

Responses in detail

5.5.1 Yes

Respondents:

- DK
- DE
- EE
- LV
- FI
- SE

Methodology Used

Country	Description
DK	See explanation in Part A, Section 4.4 for the RBMP (WFD).
DE	For the Baltic Sea the approach described above determines the "maximum allowable input" (MAI) for nitrogen and phosphorus which is equivalent to the maximum critical load. These MAIs are aiming at achievement of good eutrophication status, as determined by the indicators nutrient concentrations, chlorophyll-a, secchi depth and oxygen debt.
EE	Agreed reduction targets for nitrogen and phosphorus (in tonnes) as agreed in 2013: the nutrient reduction scheme of the HELCOM Baltic Sea Action Plan. The HELCOM Nutrient Reduction Scheme is a regional approach to sharing the burden of nutrient reductions to achieve the goal of a Baltic Sea unaffected by eutrophication. The Scheme was first introduced and agreed on in 2007, in the HELCOM Baltic Sea Action Plan and the revision has been completed in 2013. There are two main components of the nutrient reduction scheme: - Maximum Allowable Inputs (MAI) of nutrients, indicating the maximal level of inputs of water- and airborne nitrogen and phosphorus to Baltic Sea sub-basins that can be allowed to fulfill the targets for a non-eutrophied sea; - Country Allocated Reduction Targets (CART), indicating how much the HELCOM countries need to reduce nutrient inputs compared to a reference period (1997-2003 Targets – HELCOM
LV	See explanation in Part A, Section 5.2.

Country	Description
FI	HELCOM BSAP country-allocated nutrient reduction targets. Modelled to reach good environmental status in D5 indicators for open sea areas using the BALTSEM model.
SE	Both maximum critical load and nutrient (load) reduction targets have been derived in Helcom cooperation. https://helcom.fi/wp-content/uploads/2019/08/Summary-report-on-MAI-CART.pdf (not yet done for the offshore Skagerrak that has GES for eutrophication)

5.5.2 No

Respondents:

- IE
- ES
- FR
- IT
- LT
- NL
- RO

Further Details

Country	Details
IE	As marine areas are not considered eutrophic nutrient reduction targets are not considered for these areas. Nutrient reduction targets focus on transitional and coastal waterbodies under the WFD.
NL	No load but concentration. Critical load can be calculated based on concentration per water body with models. Original response did not mark 'Yes' or 'No', 'No' response assumed.

5.6 Is there a relationship between the management objectives set for nutrients and the criteria for descriptor 5 of the MSFD?

Summary of responses

12 countries responded that there is a relationship between the management objectives set for nutrients and the criteria for descriptor 5 of the MSFD.

1 country responded that there is not a relationship between the management objectives set for nutrients and the criteria for descriptor 5 of the MSFD.

Responses in detail

5.6.1 Yes

Respondents:

- DK
- DE
- EE
- IE
- ES
- FR
- LV
- LT
- NL
- RO
- FI
- SE

Respective Criteria

Country	Criteria
DK	The modelling of MAI (see description above) is aimed to support good ecological status of the biological quality element of the WFD e.g. phytoplankton biomass (chlorophyll-a), which is a part of the DC5. For MSFD, HELCOM's nutrient input ceilings have been derived so as to ensure good environmental status (GES). See description and relevant links in Part A, Sections 4.2 and 4.4.
DE	For the Baltic Sea, there is a relationship between the management objective (the maximum allowable inputs) and D5C1, D5C2, D5C4, D5C5.
EE	D5C1 nutrient concentrations, D5C2 chlorophyll-a, D5C4 transparency (and indirectly D5C5 dissolved oxygen).
IE	The OSPAR Common Procedure (OSPAR COMP) is used to assess GES under Descriptor 5 (D5C1 nutrient concentrations) on eutrophication. The OSPAR COMP is an integrated holistic approach which is based on the assessment of a number of quantitative criteria which reflect, once interlinked, the main cause effect-relationship of the eutrophication process. The criteria include levels of riverine inputs of total nitrogen and total phosphorus, winter concentrations of dissolved inorganic nitrogen and phosphorus, N/P ratio, median and 90%ile chlorophyll, levels of opportunistic macrophytes and the occurrence of oxygen deficiency. Nutrient and chlorophyll thresholds are hence harmonised between OSPAR and MSFD for Irish marine areas (and transitional and coastal areas) and are the same as described in Part A, Sections 5.2 and 5.4. Also, chlorophyll concentration thresholds are consistent between the MSFD and OSPAR for Irish waters (10 mg L^{-1}). Details of this can be found in OSPARs Intermediate Assessment 2017 and also OSPAR Commission (2005). OSPAR common Procedure report 2014 https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/eutrophication/third-comp-summary eutrophication/ OSPAR Commission 2005, Ecological Quality Objectives for the Greater North Sea with Regard to Nutrients and Eutrophication Effects. ISBN 1-904426-71-9, Publication Number: 2005/229. 33 pp
FR	D5C2 (like for TRAC).
ES	Directly related to D5C1 (nutrient concentrations, already explained above) Also D5C2 is tackled: chlorophyll-a is measured in the water column, and the limit or Threshold values for this element are set in Royal Decree 817/2015 (for coastal waters). For areas beyond coastal areas, they will be considered to reach the BEA when no significant increasing trends are detected in the period 2011-2017, or they show concentrations above baseline values beyond what is statistically expected.
LV	D5C1 nutrient concentration.
LT	D5C1 nutrient concentrations, D5C2 chlorophyll-a concentrations.
NL	More or less the same with focus on comparable meaning, biological nearly same values and for nutrients as well but corrected for salinity. Original response did not mark 'Yes' or 'No', 'Yes' response assumed.
RO	In marine waters the management objectives are criteria C1 in D5. They were not established in correlation with chlorophyll a.

Country	Criteria
FI	Nutrient concentrations, chlorophyll-a, oxygen, Secchi depth.
SE	For criteria 1, 2, 3, 4 , 5 and 8. (From Helcom cooperation).

5.6.2 No

Respondents:

- IT

5.7 If you have set management objectives for nutrients, please specify which policy the management objectives are meant to address.

Summary of responses

13 countries responded that policy the management objectives are meant to address the MSFD.

10 countries responded that policy the management objectives are meant to address the Regional Seas Conventions.

1 country responded that policy the management objectives are meant to address other policy.

Responses in detail

5.7.1 MSFD

Respondents:

- DK
- DE
- EE
- IE
- ES
- FR
- LV
- LT
- NL
- PL
- RO
- FI
- SE

5.7.2 Regional Seas Conventions

Respondents:

- DK
- DE
- EE
- IE
- ES
- LT
- NL
- PL
- FI
- SE

5.7.3 Other

Respondents:

- SE

Specification

Country	Specification
SE	National environmental quality objectives (zero eutrophication) https://www.sverigesmiljomal.se/environmental-objectives/

5.8 If you have not set management objectives for nutrients, please explain the reasons. In addition, please provide information on how you achieve the MSFD objectives for descriptor 5 "eutrophication" instead (for water bodies exposed to nutrient pollution).

Summary of responses

6 countries responded that they have not set management objectives for nutrients and provided an explanation for the reasons for this.

Responses in detail

Respondents:

- DE
- IE
- FR
- IT
- CY
- NL

Country	Explanation
DE	For the North Sea, a political nutrient reduction target has been set at the 2nd North Sea Conference in Bremen in 1984 aiming for a 50% reduction of nitrogen and phosphorus inputs between 1985 to 1995. DE has achieved these reductions around 1990 for phosphorus and around 2005 for nitrogen. OSPAR is currently in the process to derive harmonized threshold values for nutrient concentrations and chlorophyll-a based on the results of the JMP EUNOSAT project (see: https://www.informatiehuismarien.nl/uk/projects/algae-evaluated-from/information/results/). These threshold values will constitute the basis for deriving nutrient reduction targets in 2022, most likely based on a similar methodology as used by HELCOM (determining maximum allowable nutrient inputs and allocating these based on the polluter pays principle).
IE	As no eutrophication is observed in Irish Marine areas management objectives are in line with the aforementioned thresholds.

Country	Explanation
FR	The eutrophication of marine waters (outside the river basin district management plans' fields) is caused by the plumes of large rivers. Thus, there is no reduction target for offshore waters but we set reduction targets in the most contributing rivers to reduce their inputs and to be compatible with achieving the marine waters' good ecological status. The objectives defined in the river basin district management plans take into account the needs of the marine environment. The strategy is identical to the one applied for coastal waters. Work on the definition of seascapes at the regional scale is being developed in the framework of OSPAR.
IT	The reason is related to some difficulties in the full implementation of UWWTD and Nitrate Directive. A common GES definition (threshold values for primary criteria indicators and aggregation rules) have not yet been established at the regional or subregional level.
CY	To our knowledge there are no nutrient sources in marine waters of CY. For any activities in marine waters there are terms applied in the Environmental Impact Assessment procedure.
NL	Sea comprehensive procedure Ospar and recent work by Eunosat.

3. Responses – Part B: Methods used to calculate current nutrient loads

1 Do you calculate current nutrient loads in order to achieve management objectives for nutrients?

Summary of responses

21 countries responded that they do calculate current nutrient loads in order to achieve management objectives for nutrients.

6 countries responded that they do not calculate current nutrient loads in order to achieve management objectives for nutrients.

Responses in detail

1.1 Yes

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 8 water agencies for continental waters and for all water agencies for TraC and marine)
- IT
- CY
- LV
- LT
- NL
- PL
- PT
- RO
- SK
- FI
- SE
- NO

1.2 No

- BG
- FR (for 2 water agencies for continental waters)
- HU
- AT
- IS
- TR

2 If yes, what methods do you use?

Summary of responses

5 countries responded that loads are calculated from monitoring of nutrient concentrations multiplied with flow in the inflows to the water body.

8 countries responded that loads are calculated from estimates of emissions from different sources.

13 countries responded that both of these approaches are used.

6 countries responded that other approaches are used.

Responses in detail

2.1 Loads are calculated from monitoring of nutrient concentrations multiplied with flow in the inflows to the water body

Respondents:

- DK
- IT
- LV
- NL
- SK

Country	Details
DK	Monitoring of nutrient loads in watercourses cover 60 pct. of the land area. For the rest of the area is load calculated based on models for the diffuse loss from the area and data for loads from point sources.

2.2 Loads are calculated from estimates of emissions from different sources

Respondents:

- DK
- EE
- EL
- FR (for 2 water agencies for continental waters)
- CY
- LT
- NL
- SK

Sources Included

Country	Sources
DK	See explanation in Part B, Section 2.1.
EE	Agriculture, forest land, waste water, internal load.
FR (for 2 water agencies for continental waters)	Agriculture, urban waste water, industrial rejets industriels [industrial waste]. *Source data to assess urban and industrial nutrient pollution:* The source data are derived from the self-monitoring of wastewater treatment plants for the period 2013-2015. Also other data are used : data from the application Measures-Rejects, data from additional charges and local data for pollution of urban origin, as well as self-monitoring data form classified facilities and Industry charge for pollution of industrial origin . The non collective waste-water treatment plants are considered. Pollution flows are transformed into concentrations in the watercourse. Different data can be used :the values of low water flows from reconstructed natural (QMNA5 modelled by IRSTEA, as well as the results of local studies to improve the accuracy of the results. *Source data to assess pollution by agricultural nutrients:* The data used are based on: - an exploitation of the results of monitoring stations on which nitrate monitoring is carried out for the 2013-2015 period; - for water bodies without direct monitoring, an analysis of land use from the Corine Land Cover database (CLC 2012), cross-referenced with IDPR index (acronym in French for - Index of network development and persistence) is used. This index, developed by the French geological survey (BRGM), characterizes the propensity of soils to runoff or infiltrate rainwater (for more information : https://www.esrifrance.fr/iso_album/p30_brgm.pdf; http://www.geocatalogue.fr/Detail.do?id=13039). The methodological notes are only available in French. - Marine Aquaculture is also considered.
CY	Agriculture, animal husbandry, fishfarms, landfills.
LT	Background sources, agriculture, point sources and scattered dwellings with stormwater.
NL	At least on national scale, see also national analysis.

2.3 Both approaches are used

Respondents:

- BE-Wa
- CZ
- DK
- DE
- IE
- ES
- FR (for 4 water agencies for continental waters and for all water agencies for TraC and marine waters)
- PL
- PT
- RO
- FI
- SE
- NO

Further Details

Country	Details
CZ	If we perform classical balance studies, we use the first approach. When determining the significance of point sources of pollution, we calculate the load from the discharge record. The reported amount of discharged substances - BOD5, N-NO3, N-NH4 and total phosphorus is

Country	Details
	determined by the average annual concentration. For each discharge object, the total amount of discharged substance - substance ratio - was determined from this concentration and the total amount of wastewater discharged. The substance ratio was then added up for all objects in the catchment area of the relevant water body. Furthermore, for each water body, the permissible substance ratio was calculated from the values for the limit concentration of the given substance in a specific type of water body and the average annual outflow from the area of water body. Subsequently, the substance ratio was compared with the permissible substance ratio and the significance of the effect of a particular substance was determined. Loads from other sources (sewage overflows, agricultural, fish ponds) were determined only as degrees of significance. http://eagri.cz/public/web/file/611627/metodika_urceni_vyznamnosti_vlivu.pdf (in Czech) Models are being developed for the catchment area of important water reservoirs, which are used for water supply purposes or are heavily affected by eutrophication. Other types of models are then for the catchment area of reservoirs used for fisheries management.
DK	See explanation in Part B, Section 2.1.
DE	We calculate loads to the sea based on measured concentrations and discharge. In addition, we use catchment modelling approaches to quantify the loads and to assign the loads to different pathways/sources. These approaches vary from one German Federal State to another, although DE currently attempts to develop and implement a nationally consistent nutrient model (AGRUM-DE, MoRE, MONERIS). Most modelling approaches calculate loads from estimates of emissions from different sources (e.g. diffuse sources from agricultural and urban areas as well as point sources such as wastewater treatment plants) and pathways (e.g. erosion, drainage, interflow, groundwater, aerial deposition). The model is validated through long-term mean monitoring values for phosphorus and nitrogen.
IE	Nutrient loads calculated from nutrient monitoring and flow: Nutrient loads are calculated annually and reported to OSPAR under the Riverine Inputs and Direct Discharges (RID) Programme; methods and results can be found in (Ni Longphuirt et al., 2016; O'Boyle et al., 2016). Monthly water samples were collected from eighteen rivers (catchment above zero salinity, representing roughly 50% of the Irish land areas) and analysed to give nutrient concentration data (mg L^1) for total phosphorus (TP), unfiltered molybdate reactive phosphorus (MRP), total nitrogen (TN), total oxidised nitrogen (TON) and ammonium (NH4). The individual concentration of each specific nutrient was first multiplied by its corresponding flow. These were then summed annually and divided by the sum of the flows in each year. This was considered the flow weighted mean concentration (FWMC, mg m^3) and can be expressed by: $\mathrm{FWMC} = \frac{\Sigma_{i=1}^{n}(C_i Q_i)}{\Sigma_{i=1}^{n}(Q_i)}$ Annual flow normalised input $= \frac{FWMCxQ_r}{Norm_f}$. where Ci is the concentration measured in sample I (mg m^3); Qi is the corresponding flow for sample i (m^3 s^1); and n is the number of samples taken in the sampling period (year). The annual flow normalised input (t yr^1) for each parameter was then calculated by multiplying the FWMC by the annual flow (Qr, m^3 yr^1) for each river and dividing by an annual flow normalization factor (Normf) to remove the effects of oscillations in flow and hence rainfall/weather and allow comparability with the load source apportionment. The normalisation factor is calculated as the long-term average flow (QLTA) divided by the annual flow for each year. Nutrient loads downstream of the monitoring sites used above are determined through the use of a Load Apportionment model (See section B3, Mockler et al., 2017). Ní Longphuirt, S., Mockler, E. M., O'Boyle, S., Wynne, C. and Stengel, D.B. 2016 Linking changes in nutrient source load to estuarine responses: an Irish perspective. Biology and Environment: Proceedings of the Royal Irish Academy 2016. DOI: 10.3318/ BIOE.2016.21 Mockler et al. 2017. Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework. Science of the total Environment. https://doi.org/10.1016/j.scitotenv.2017.05.186

Country	Details
	O'Boyle, S., Quinn, R., Dunne, N., Mockler, E., and Nı´ Longphuirt, S. 2016 What have we learned from over two decades of monitoring riverine nutrient inputs to Ireland's marine environment? Biology and Environment: Proceedings of the Royal Irish Academy 2016. DOI: 10.3318/ BIOE.2016.23
FR (for 4 water agencies for continental waters and for all water agencies for TraC and marine waters)	The loads are evaluated using the PEGASE model and models developed at the French national level: NUTTING'N,CASSIS_N and PRESSAGRIDOM. The characterization of the agricultural nitrogen pressure comes from the exploitation of the communal nitrogen excesses of the CASSIS_N model (French acronym for - Calculation of soil simplified surplus of nitrogen) (for more information: https://geosciences.univ-tours.fr/cassis/). The pressure is expressed in kg of nitrogen excess in relation to a geographical unit (water body or watershed). The surplus is calculated as the balance between inputs (mineral fertilization - organic fertilization - symbiotic fixation - atmospheric deposition) and outputs of nitrogen from the soil (export by crops) for a given year. Results are available from 1955 to 2015. The vulnerability of the environment to transfers is assessed by adapting national methods that rely on descriptive and expert approaches to assess the risk of water contamination by nitrogen: the adaptation of the NUTTING'N model: - characteristics of watersheds: hydromorphism, forest cover, effective rainfall; - characteristic of the hydrographic network: density of the hydrographic network, water transfer time in the hydrographic network, average depth of the water mass network. Nutting N is a conceptual and statistical model linking nutrient sources (N) to physiographic features of the hillslopes and stream network of a catchment to assess the retention and the flux at the outlet. It was designed to be applied using only public databases at the regional or country level.It supplies estimates of specific mean annual loads, and are calibrated against mean loads measured over a five year period, where available. (for more information: https://www6.rennes.inrae.fr/umrsas_eng/Results/Tools/Nutting) Pressagridom is modelling tool developed by CIRAD to estimate the quantities of nitrogen leaching. References: CASSIS_N: Poisvert Cécile, Curie Florence, Gassama Nathalie, 2016. Evolution of nitrogen surpluses (1960-2015): national deployment, study of transfer times and the impact of changes in agricultural practices. Evaluation of nitrogen pressures. Technical report. Université de Tours - UFR Sciences et Techniques. Onema. Version 2. 45 pages. NUTTING'N: Dupas R., Gascuel C., 2012. Estimation of nitrogen emissions from agriculture at the scale of continental surface water bodies. INRA. 19 pages.
PT	Sources included: agriculture, livestock, urban waste water, industry, golf courses.
RO	Sources included: human agglomerations, agriculture, urban waste waters, industrial activities.
FI	Nutrient loads are calculated using the VEMALA modelling tool described in Part A. The input data for VEMALA estimation for model calculations include i) present observed concentrations of nitrogen (N) and phosphorus (P), ii) target concentrations for reaching good ecological status (GES), and iii) modelled N and P concentrations for natural background loading and for different sectors of human impact.
SE	For coastal areas outside larger catchments, modelled load is calculated by rescaling of the loads from representative rivers. For atmospheric nitrogen loads we use EMEP model products and SMHI Match Model.

2.4 Other approaches are used

Respondents:

- EE
- IT
- NL
- FI
- SE

- NO

Explanation of other approaches used

Country	Approach
EE	Nutrient load is calculated, if the waterbody status is poor or bad and is unclear the pressure resources. Wide-range nutrient load measurements are mainly used to improve knowledge of pressures.
IT	In some areas its envisaged the use of calculation systems for the nutrient load estimation in a catchment area, for example for nitrogen are considered inputs (chemical fertilizers, zootechnical effluents, biological fixation and atmospheric deposition) and output (removal crops, NHO3 volatilization and soil denitrification)
NL	Nutrient model based on high number of geo-hydrological units, with information on land use, sediment type, use of manure and crops, run off, sediment processes (STONE model) These model results are combined with a larger national hydrological model for ground and surface water in 4 seasonal steps.
FI	See explanation in Part B, Section 2.3.
SE	See explanation in Part B, Section 2.3.
NO	From the RID monitoring programme and the TEOTIL model.

3 Do you use catchment models that quantify the nutrient emissions/nutrient losses to surface waters?

Summary of responses

19 countries responded that they use catchment models that quantify the nutrient emissions/nutrient losses to surface waters. All 19 countries included a description of their models. Of these, 8 countries responded that they employ models operating at catchment level, 10 at sub-catchment level, 10 at water body level and 8 at specific spatial units.

7 countries responded that they do not use catchment models that quantify the nutrient emissions/nutrient losses to surface waters.

Responses in detail

3.1 Yes

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- ES
- FR (for 6 water agencies for continental waters and for all water agencies for TraC and marine waters)
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI
- SE
- NO

Model Description

Country	Description
BE-Wa	2 models are used A. The EPICgrid model is a catchment hydrological model developed by the Soil-Water Systems Unit of Gembloux Agro-Bio Tech (ULg) (Sohier, 2011) on the basis of the EPIC parcel model (Williams et al., 1984). B. The Pegase* model (Planning and Management of Water Sanitation) is an integrated river basin/river model that allows the deterministic and predictive calculation of river water quality as a function of discharges and pollution inputs for non-stationary and/or permanent hydrological situations. * http://www.pegase.ulg.ac.be/?pg=4
CZ	In 2013, the methodology "Assessment of endangerment of water reservoirs by sediment and eutrophication caused by erosion of agricultural land" was created. The methodology has already been applied for the catchment area of at least 58 important reservoirs in CZ (eg Nové Mlýny, Slapy). The methodology combines balance evaluation, measured phosphorus concentrations and calculated inputs from sub-areas in detail to the level of the individual plot. http://eagri.cz/public/web/mze/zivotni-prostredi/ochrana-vody/vodni-ramcova-smernice/planovani-v-oblasti-vod/priprava-planu-povodi-pro-2-obdobi/koordinace-procesu/metodiky-a-dalsi-podpurne-dokumenty-1/vyhodnoceni-ohrozenosti-vodnich-nadrzi.html (in Czech) The application of the methodology was also carried out within the project "Measures for diminishing agricultural non-point pollution sources for river basin plans": https://atlaspvl.vumop.cz/projects/atlaspvl/oprojektu_en.php
DK	Catchment models are used for part of the area not covered by monitoring in watercourses. The catchment models are empiric models based on national monitoring data.
DE	At this point, there are various Federal approaches and types of models. These models are usually designed to display several spatial levels (grids, water body, sub-catchment, and catchment), although the respective smallest spatial level is variable. References: Fuchs, S.; Kaiser, M.; Kiemle, L.; Kittlaus, S.; Rothvoß, S.; Toshovski, S.; Wagner, A.; Wander, R.; Weber, T.; Ziegler, S. (2017): Modeling of Regionalized Emissions (MoRE) into Water Bodies: An Open-Source River Basin Management System. Water 2017, 9, 239, doi:10.3390/w9040239., see also: https://isww.iwg.kit.edu/MoRE.php Fuchs St, Weber T, Wander R, Toshovski S, Kittlaus S, Reid L (2017): Effizienz von Maßnahmen zur Reduktion von Stoffeinträgen. Umweltbundesamt (UBA), Dessau-Roßlau, UBA-Texte 05/2017. Kunkel R, Herrmann F, Kape HE, Keller L, Koch F, Tetzlaff B, Wendland F (2017): Simulation of terrestrial nitrogen fluxes in Mecklenburg-Vorpommern and scenario analyses how to reach N-quality targets for groundwater and the coastal waters. Environ Earth Sci 76, 146. More information on AGRUM: https://www.thuenen.de/de/institutsuebergreifende-projekte/agrum-deutschland/?no_cache=1 (in German) MONERIS: https://www.umweltbundesamt.de/publikationen/berechnung-von-stoffeintraegen-in-fliessgewaesser; Berechnung von Stoffeinträgen in die Fließgewässer Deutschlands mit dem Modell MONERIS, Nährstoffe, Schwermetalle und Polyzyklischearomatische Kohlenwasserstoffe; UBA Texte 45/2010.
EE	EstModel is used for the assessment of the runoff of nurtients from a catchment. https://www.keskkonnaagentuur.ee/sites/default/files/annex-1_estmodel.pdf.
IE	Historic Load Apportionment: In order to achieve the objectives of the OSPAR Convention PARCOM Recommendations 88/2 and 89/4 (reduction of nutrient inputs to the marine environment) contracting parties are requested to put in place effective national steps to achieve a substantial reduction in inputs (up to 50%) of phosphorus (P) and nitrogen (N) into areas where they are likely, directly or indirectly, to cause pollution (i.e. 'problem areas' or 'potential problem areas' with regard to eutrophication status). To assess progress towards this target, OSPAR established a PARCOM reporting requirement to be completed by contracting parties. This was last completed in 2012. Loads were determined by following, where possible, procedures outlined in OSPARS

Country	Description
	HARP_NUT guidelines and were reported nationally and by catchment (hydrometric area). These were compared with loads calculated from 1995 and 2005. <u>SLAM:</u> The Source Load Apportionment Model (SLAM) Framework (Mockler et al., 2016, 2017) incorporates multiple national spatial datasets relating to nutrient emissions to surface water, including land use and physical characteristics of the sub-catchments. Separate modules were developed for each type of nutrient source to facilitate upgrading and comparisons with new data or methods. The key input dataset for the agriculture module (i.e. the CCT) was the Land-Parcel Identification System (LPIS) which was combined with land management data from the Department of Agriculture, Food and the Marine (DAFM). This annual average export coefficient model calculated leaching rates based on methods from existing models for N and P. In addition, the model applied pathway-dependent attenuation coefficients related to the hydrogeological conditions, which were inferred from GIS maps of relevant properties including soil drainage, subsoil permeability and depth to bedrock. Mockler, E.M., Deakin, J., Archbold, M., Daly, D., Bruen, M., 2016. Nutrient load apportionment to support the identification of appropriate water framework directive measures. Biology and Environment 116B (3):245–263. http://dx.doi.org/10.3318/bioe. 2016.22 Mockler et al. 2017. Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework. Science of the total Environment. https://doi.org/10.1016/j.scitotenv.2017.05.186 Packham, I., Mockler, E., Archbold, M. *et al.* Catchment Characterisation Tool: Prioritising Critical Source Areas for managing diffuse nitrate pollution. *Environ Model Assess* **25,** 23–39 (2020). https://doi.org/10.1007/s10666-019-09683-9
ES	ES uses several models, it depends on the River Basin Authorities and Regional Authorities
FR (for 6 water agencies for continental waters and for all water agencies for TraC and marine waters)	1. PEGASE model (French acronym for —Planning and management of water purification) is used with non stationary scenarios to characterize the water quality. The model requires as input, at least data like digital terrain models, water flow, water level and other hydrodynamic measurements in some geo-localized points, diffuse loads properties, ecological model data (to characterize bacteria, phytoplankton, zooplankton, macrophytes, shells, etc…), chemical discharges (from industry and cities) and treatment plant effect. If possible, the calibration is done with measured data (from monitoring network) to reach a good correlation between modelled and measured data. The model is also used as a prospective tool to identify the potential impact of measures and to select measures to retain for the program of measures. The chosen approach consists to confirm that the actions of the program of measures will enable the achievement of the environmental objectives. According to the approach, the critical load is not a discriminating criterion. The ability of the receiving environment to assimilate the pollutant load is assessed by modelling the status after the implementation of measures. Targeted measures are not necessarily those that cause the greatest reductions in annual flows. But they are those that best target flow reductions at the time when rivers are the most sensitive (to low water levels, particularly for parameters related to eutrophication). Information: http://www.pegase.ulg.ac.be/?pg=4 2. MOSQUITEAU model for surface waters: this model allows the propagation of flows through the hydrographic network, based on the French database "carthage" (Spatial location system for superficial aquatic environments; https://geo.data.gouv.fr/en/datasets/54917fd94fb1cd2fcb6f5d3295dbf33acaf1847e). It is supplemented by the geographical reference system of discharge structures. The discharged flows are injected into the section of river in which the discharge directly arrives, then propagated towards the downstream section. A reduction is applied to consider natural self-purification process. For each hydrographic section, the sum of the discharges upstream and on the section is thus available. The calculations are made at the scale of the hydrographic section, then aggregated to the water body (smallest management unit).

Country	Description
	3. Pressagridom is modelling tool developed by CIRAD to estimate the quantities of nitrogen leaching. For TraC and marine waters: Yes Depending on the river basin district and issues, models can be different: - PEGASE model - Models based on catchment - GAMELAG model (http://rsl.cepralmar.org/doc/GuideMethodologiqueOGAMELAG.pdf) to define nutrient admissible flows in Mediterranean transitional water bodies sensitive to eutrophic issues. The goal is to generalize flow approaches in order to improve our management.
LV	We use Fyris NP. FyrisNP model calculates source apportioned gross and net transport of nitrogen and phosphorus in rivers and lakes. The main scope of the model is to assess the effects of different nutrient reduction measures on the catchment scale. The time step for the model is in the majority of applications one month and the spatial resolution is on the sub-catchment level. Retention, i.e. losses of nutrients in rivers and lakes through sedimentation, up-take by plants and denitrification, is calculated as a function of water temperature, nutrients concentrations, water flow, lake surface area and stream surface area.
LT	We use SWAT model. Short description of the model itself is on https://swat.tamu.edu/ Detailed description of your prepared SWAT model for the country is in the report, which could be accessed by following link: http://vanduo.gamta.lt/files/3%20priedas_SWAT%20modelis_20150817_SD.doc
HU	MOneris modell. All waterbody's catchment were modelled. MONERIS Venohr et al. (2009): The Model system MONERIS - Version 2.14.1vba – Manual Jolánkai et al. (2020): Modification of the MONERIS Nutrient Emission Model for a Lowland Country (Hungary) to Support River Basin Management Planning in the Danube River Basin. doi.org/10.3390/w12030859 Parameters estimated: N load from atmospheric deposition, N load transmitted through surface run-off N load from agricultural erosion, N load from natural erosion ,N load from soil drainage ,N load from groundwater , N load from urban paved surfaces Diffuse, N load From point emissions. P load from atmospheric deposition, P load transmitted through surface run-off P load from agricultural erosion, P load from natural erosion ,P load from soil drainage ,P load from groundwater , P load from urban paved surfaces Diffuse, P load From point emissions.
NL	See explanation in Part A, Section 2.4.
AT	For RBMP-risk analysis, emission model MONERIS is used – it quantified losses of the different sources to surface water and assessed the risk of failing the target – see report 2011 https://www.bmlrt.gv.at/wasser/wasserqualitaet/fluesse_seen/stobimo.html An update version was used for RBMP 3_risk analysis - a report is in preparation and will be available in autumn 2020.
PL	We have used SWAT Model for several catchments in order to estimate the different nutrients loads pathway. But at this time the result are not directly taken into account for the management of nutrient objectives.
PT	There is no widespread application of water quality modelling, but an application in the most critical areas, or in the development of land use plans. For reservoirs we use a two-dimensional model of hydrodynamic simulation and water quality CEQUAL-W2, for rivers the one-dimensional model QUAL2E. Work is currently being carried out using DHI's Mike models. https://apambiente.pt/index.php?ref=16&subref=7&sub2ref=10&sub3ref=971
RO	The MOdelling Nutrient Emissions into RIver Systems (MONERIS) was developed to determine nutrient emissions for entire Danube river basin districts and to analyse their retention and transport in the river system. The model explores the diffuse pathways of emissions, such as atmospheric deposition, erosion, surface runoff, tile drainage, groundwater, and urban systems, as well as inputs via point sources (wastewater treatment plants and industrial discharges). MONERIS also takes into account a wide range of regional characteristics, such as the water supply, soil characteristics, slope, geology, population, and sewage systems; this includes an inventory of wastewater treatment plants. Numerous digital maps as well as statistical

Country	Description
	information prepared by a geographic information system comprise the system. In addition to a description of the current state, MONERIS allows for the mapping of nutrient flows under various scenarios and can model multiple different management options. In this way, current as well as future emissions, loads and concentrations can be modelled, emission hotspots can be identified, and the potential success of management options can be determined. Users can display all central results in the form of maps and diagrams with a related open-source software program. http://www.moneris.igb-berlin.de/ http://www.moneris.igb-berlin.de/tl_files/data_moneris/data_publikationen/Moneris%20Handbuch/Handbuch_englisch12_03.2010.pdf https://ec.europa.eu/jrc/en/publication/modelling-nutrient-pollution-danube-river-basin-comparative-study-swat-moneris-and-green-models
FI	We use an operational national-scale nutrient load model VEMALA for Finnish water sheds. In VEMALA FI is divided into about 180 000 sub-basins. VEMALA simulates nutrient loading into inland waters on each sub-basin and transport and retention of nutrients in rivers and lakes. Loading from agriculture is simulated on field plot level with ICECREAM sub-model, taking into account characteristics of the field, crop, farming practices, fertilization and use of manure. Other simulated nutrient sources are natural background loading, forestry, point sources, scattered dwelling, urban runoff and deposition. https://www.syke.fi/en-US/Research__Development/Water/Models_and_tools/Models_for_river_basin_management_planning/ A_water_quality_and_nutrient_load_model_system_for_Finnish_watersheds_VEMALA Huttunen, I., Huttunen, M., Piirainen, V., Korppoo, M., Lepistö, A., Räike, A., … Vehviläinen, B. (2016). A National-Scale Nutrient Loading Model for Finnish Watersheds—VEMALA. *Environmental Modeling and Assessment*, *21*(1), 83–109. https://doi.org/10.1007/s10666-015-9470-6.
SE	Process based nutrient leaching model (ICECREAM and SOIL-NDB)) connected to hydrological models (S-HYPE).
NO	TEOTIL – calculating inputs from natural background, agriculture, urban wastewater, wastewater from scattered dwellings, industry and aqaculture. Different models calculating agricultural runoff, e.g. Agricat.

3.2 No

Respondents:

- BG
- EL
- FR (for 2 water agencies for continental waters)
- IT
- CY
- SK
- IS

If yes, at what spatial level do the models operate?

3.1.1 Catchment

Respondents:

- EE
- IE
- ES
- FR
- NL
- RO
- FI
- NO

3.1.2 Sub-catchment

Respondents:

- EE
- IE
- ES
- FR
- NL
- AT
- PT
- RO
- FI
- NO

3.1.3 Water body

Respondents:

- BE-Wa
- IE
- FR
- LV
- HU
- NL
- PL
- FI
- SE
- NO

3.1.4 Specific Spatial Unit

Respondents:

- CZ
- DK
- DE
- FR
- LT

- PL
- RO
- FI

If a specific spatial unit, please specify the size

Country	Spatial Level Size
CZ	Catchment of large water reservoirs (hundreds of km^2 and more).
DK	15 km^2 on average.
DE	The catchment models operate on different spatial levels depending on the model and questions (e.g. MoRe analytical units 130km^3).
FR	- PEGASE model, 200-metre stream section ; - For TraC and Transitional waters: model outputs are configured depending on the needs.
LT	Model operates on Hydrological Response Units scale (areas of subcatchment what have the same landuse, soil characteristics, slope), which includes not smaller than 5 ha areas.
AT	754 subcatchments - mean size 120 km^2.
PL	Not specified.
RO	Analytical unit with an average area of 500 skm.
FI	Average unit size is 2 km^2.

4 If yes, how large are the uncertainties in these models and how do you deal with these uncertainties?

Summary of responses

16 countries responded to this question to explain how uncertainties the models are addressed.

Responses in detail

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- FR
- LV
- LT
- HU
- NL
- PL
- RO
- FI
- SE
- NO

Uncertainty Management Assessment

Country	Explanation
BE-Wa	The results produced by the models are compared as much as possible with field measurements. These models are therefore subject to continuous improvement processes through the validation of the results. Uncertainties are globally reduced until they are compatible with a coherent representation of reality. Where this perspective cannot be met, the results are interpreted with the utmost caution.
CZ	There are quite a few uncertainties in modelling: - When determining the value of the specific runoff (the agreement of the results based on the calculation with the values derived on the basis of the measured data expressed by the coefficient of determination R2 is 0,73), - When calculating total phosphorus transported by erosion: o Flat-rate derivation of the total phosphorus content in soils, which in its current form does not respect the different contents of phosphorus in soils of the same type on different geological substrates, o The use of the equation for the enrichment ratio, which was derived for the territory of the USA and has not yet been verified in the conditions of CZ, o A flat-rate estimate of the share of dissolved forms of phosphorus in erosive runoff, which may vary significantly depending on the type of farming in CZ. The modelled values of sediment transport should be verified against the accumulated amounts of sediment in the reservoirs, wherever possible. In local studies, it is also recommended to physically model the transport of sediments episodically and to compare the predicted concentrations and substance ratios with the measured values in streams. When using regular monitoring data, it is necessary to pay attention to the limitations resulting from the episodic course of erosion transport processes. The creation of the models of nutrient (phosphorus) transport in the river basin is mostly part of specific projects for selected important river basins. The lack of field data is an obstacle to the routine creation of models and their verification (calibration, validation). The monitoring system currently set for the implementation of Water Framework Directive in the CZ does not lead to obtaining a sufficient amount of the necessary data.
DK	Uncertainties not known, but are taken in account by bias correction: Nutrient losses from monitored catchments is calculated by the models. Bias between monitored result and modelled result is calculated for a region. Modelled result for a catchment not monitored is bias corrected with the bias factor for the region.
DE	Uncertainties can vary between the applied model types and depend on the certainty/reliability of the data used to feed the model. E.g., there are bigger potential uncertainties related to diffuse sources than to point sources of nutrients. Consideration of fluctuation ranges helps to estimate the ranges of uncertainty for individual emission pathways. Additionally, long-term mean monitoring data is used to validate modelling results.
EE	Data not available. Improvements of the model are constantly ongoing.
IE	The models have been validated against monitoring data with reasonably good success. Nevertheless, as all models have inherent uncertainties, the modelled outputs are not used in IE for regulatory purposes. They are used to guide and direct further field scale assessments of the issues, and to target interventions. Packham, I., Mockler, E., Archbold, M. et al. Catchment Characterisation Tool: Prioritising Critical Source Areas for managing diffuse nitrate pollution. Environ Model Assess 25, 23–39 (2020). https://doi.org/10.1007/s10666-019-09683-9
FR	1. Difficult to answer this question! The uncertainties are highly variable and depend on the size of the rivers modelled, the time scales considered and the data sets available (which also have their uncertainties). At the annual scales: the uncertainties vary from year to year. The transfer processes in the soil and groundwater are not explicitly represented in the model. A comparison of the flows calculated by the model (with the estimates made by other methods based on concentration) and flow measurements is realised. At a daily scale; the uncertainties are greater: comparison with measured concentrations: calibration of soil input coefficients per hydrological zone, verification of calculated flows, verification of discharged flows. The uncertainties are greater on small rivers than on large ones. Uncertainty varies greatly depending on the quality of the input datasets. The simulated status generally differs by less than one class from the measured status. When the measured condition is much lower than the modelled condition, the objective is to set up a survey control to identify the causes of the degradation of the condition and the measures to be implemented.

Country	Explanation
	2. The uncertainties of modelling depend on the input datasets : - Low uncertainty (a few per cent) on the monitoring data of environments - Variable but low uncertainties (because validation for fiscal or inspection use) on the data from charges and premiums, self monitoring data of classified facilities, etc. Discharges not subject to declaration to the water agency (because no usable data) are not taken into account . - Uncertainty on the QMNA5 resulting from removable volume studies (up to 30% in some basins, see methods of removable volume studies,), supplemented by IRSTEA's multi-model QMNA5 ("values in an 80% range", *see the report on the Multi-model combination and consensus mapping of the low water level reference flow and the average flow on the French scale, IRSTEA 2012*) The data resulting from the MOSQUITEAU modelling allows to qualify a level of impact of each pressure (urban-industrial nutrients and nutrients of agricultural origin) according to 3 levels: 1. no or low impact (no pressure or non-measurable impact); 2. medium impact, measurable but whose effect is located at the water body scale; 3. strong impact, likely to downgrade the status of the water body. This division into 3 classes has the effect of "smoothing" the variations between the uncertainties. The risk of not achieving the nutrient-specific good status objectives is then assessed on the basis of the cumulative impacts of the 2 urban/industrial and agricultural nutrient pressures, which may be similar in nature and effect and/or cumulative. A technical consultation of local water management stakeholders is carried out to check that the diagnosis proposed by the basin corresponds to a local reality. This consultation thus enables the diagnosis to be shared with local stakeholders. Then the programme of measures to achieve good status is built locally. References : *See the reports : PEGASE Model (Aquapôle Université de Liège – rapport 2019 - Application au bassin Seine-Normandie du modèle PEGASE inclus dans le logiciel PEGOPERA) + RIVERSTRAHLER (PIREN-Seine phase VII - rapport 2018 - Modélisation des apports diffus d'azote et de phosphore aux masses d'eau de surface du bassin Seine-Normandie)*
LV	The model is calibrated against time series of measured nitrogen or phosphorus concentrations by adjusting two parameters, c0 and kvs, enabling to calibrate the model such that the computed output compares well to the measured data. The model provides the user with three different methods (manual calibration, Monte Carlo simulations, automatic calibration) for calibration and/or evaluation of sensitivity to individual parameter values.
LT	Uncertainties are very large due to the fact that very important data for the application of fertilizers in farms are not available in the country. This data is derived from other sources. Moreover, there are plenty of issues with data from other sources and complexity of the SWAT model itself that compound uncertainties on the top of each other. So far we have not quantified uncertainties for the results coming from the model. We mostly were working with trying to address data problems and update or recalibrate model to increase its compatibility with available monitoring data.
HU	The uncertainties are large, and can be handled only roughly. See the above publication (Jolánkai et al., 2020) for details.
NL	Uncertainties are large, also in hydrology. It is a process model. Therefore for management purposes these models are not suitable for one individual waterbody, but at more aggregated level, sub catchment. We can offer a presentation on this national analysis for nutrients, with specific attention on how it was done.
PL	For a part of the project we were using a SWAT model to estimate selected chemical substances outflow with surface water and groundwater. Estimations were made specifically for surface sources of area type of pollutants, coming from farming, industry and transportation. Used model estimates processes of surface, unsaturated and saturated zone retention as a circle for non-biological matters circulation with water. Uncertainties are coming from specific areas: - Quality of the monitoring data concerning pollutants, here uncertainties are quite stable - 5-7% for monitoring station, but could increase to 10-12% when re-shaped to spatial distribution; - Quality of the geographical and hydrological spatial data, here uncertainties are no higher than 5%, sources of the data are governmental institutions, quality of the primary data is granted by geodesic survey; - Modeling results uncertainties, here the results were compared with regional experimental data coming from geochemistry; data were come from scientific articles and field research results. Modelling and field research results are not very varied. Difference was between 3 to 12 %, while accepted error is 15%. That results let us accept SWAT model results as credible.

Country	Explanation
RO	Monitoring intervals are of decisive importance: the uncertainties of calculated loads increase with decreasing monitoring frequency (for nitrogen monitored at a frequency less than 14 days there is an uncertainty of minimal 20-30%) – the increasing the monitoring frequency reduce the uncertainty.
FI	Coastal: The uncertainties are considerable. The model itself does not deal with the uncertainties. However, the results are compared to river-based nutrient load observations. Rivers and lakes: The uncertainties are considerable. Also, spatial variation of uncertainties is considerable depending on availability of concentration observations and accuracy of the input data. The model itself does not deal with the uncertainties. However, we can give an expert estimate of the uncertainty on water body level.
SE	https://www.smed.se/vatten/3957
NO	Difficult to estimate the uncertainties.

4. Responses - Part C: Methods used for achieving management objectives for nutrients

1.1 When is nutrient reduction decided to be necessary for lakes?

Summary of responses

14 countries responded that nutrient reduction is decided to be necessary for lakes when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs).

15 countries responded that nutrient reduction is decided to be necessary for lakes when a water body is classified failing good status according to nutrient good/moderate boundaries.

11 countries responded that nutrient reduction is decided to be necessary for lakes when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients.

6 countries responded that nutrient reduction is decided to be necessary for lakes when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle).

5 countries responded that nutrient reduction is decided to be necessary for lakes when downstream water bodies fail to reach good status due to nutrient pollution.

7 countries responded that nutrient reduction is decided to be necessary for lakes at another point.

Responses in detail

1.1.1 When a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs)

Respondents:

- DE
- EE
- IE
- EL
- FR (for 1 water agency)
- IT
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI

1.1.2 When a water body is classified failing good status according to nutrient good/moderate boundaries (if yes, please specify if this applies to both P and N, or only to the limiting nutrient)

Respondents:

- BG
- CZ
- DE
- EE
- IE
- ES

- FR (for 2 water agencies)
- IT
- CY
- HU
- NL
- PL
- PT
- RO
- FI

Nutrient which boundaries apply to

Country	Nutrient
BG	Not specified.
CZ	In terms of the primary purpose for assessing the causes of eutrophication, the methodology for assessing the ecological potential of Czech reservoirs uses the indicator total phosphorus, which is a robust indicator of productivity and eutrophication of the aquatic ecosystem in temperate reservoirs and lakes. Total phosphorus best documents the degree of eutrophication and is associated with crucial anthropogenic pressures, such as discharges of wastewater from settlements and some industrial plants, and to a lesser extent loads from agriculture or fisheries.
DE	Not specified.
EE	If the information about limiting nutrient is available, the management objectives are more specific.
IE	Total P.
ES	Not specified.
FR (for 2 water agencies)	Not specified.
IT	Not specified.
CY	For reservoirs: The one that exceeds boundaries.
HU	OAOOA principle.
NL	Not specified.
PL	Both N and P.
PT	Not specified.
RO	Yes, it is applied for both P and N.
FI	Not specified.

1.1.3 When a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients

Respondents:

- DK
- DE
- EE
- FR (for 4 water agencies)
- IT
- LV
- LT
- RO
- FI
- SE
- NO

1.1.4 When a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle)

Respondents:

- DE
- IE
- ES
- FR (for 3 water agencies)
- RO
- FI

1.1.5 When downstream water bodies fail to reach good status due to nutrient pollution

Respondents:

- DE
- FR (for 1 water agency)
- RO
- FI
- SE

1.1.6 Other

Respondents:

- IT
- NL
- PL
- PT
- SE
- IS
- TR

Other Specification

Country	Specification
IT	Full implementation of UWWT and Nitrate Directive with additional measures on waste water re-use in agriculture.
NL	Nutrient policy is focused on achievement of nutrient standards. There is no national framework to prevent deterioration. Here the local water managers should be aware of that. Downstream reduction is getting more attention on policy level, but also there only tailor made agreements are made (so no national framework).

Country	Specification
PL	In accordance with the Regulation, the guidelines apply to the whole country, regardless of the status of a given water body (in regard to the reduction of nitrate pollution from agricultural sources).
PT	When water bodies show signs of nutrient pollution, like algae blooms.
SE	The need for nutrient reductions is based on the pressures analysis, and whether it can be verified in relation to the BQE and PhysChem supporting data.
IS	There is no lake wb in IS that has been confirmed to fail good ecological status because of nutrients contamination.
TR	As it was mentioned before although biological quality elements were also used for identification of nutrient sensitive areas, as the reference water bodies for all typologies has not been determined yet in TR, ecological status of the water bodies couldn't be identified. But on the other hand, nutrient reduction is decided to be necessary for lakes when a water body is determined as eutrophic or prone to be eutrophic in near future.

1.2 When is nutrient reduction decided to be necessary for rivers?

Summary of responses

13 countries responded that nutrient reduction is decided to be necessary for rivers when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs).

19 countries responded that nutrient reduction is decided to be necessary for rivers when a water body is classified failing good status according to nutrient good/moderate boundaries.

8 countries responded that nutrient reduction is decided to be necessary for rivers when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients.

7 countries responded that nutrient reduction is decided to be necessary for rivers when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle).

8 countries responded that nutrient reduction is decided to be necessary for rivers when downstream water bodies fail to reach good status due to nutrient pollution.

9 countries responded that nutrient reduction is decided to be necessary for rivers at another point.

Responses in detail

1.2.1 When a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs)

Respondents:

- DE
- EE
- IE
- FR (for 1 water agency)
- IT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI

1.2.2 When a water body is classified failing good status according to nutrient good/moderate boundaries (if yes, please specify if this applies to both P and N, or only to the limiting nutrient)

Respondents:

- BE-Wa
- BG
- CZ
- DE
- EE
- IE
- EL
- ES
- FR (for 3 water agencies)
- IT
- CY
- LV
- LT
- HU
- NL
- PL
- PT
- RO
- FI

Nutrient which boundaries apply to

Country	Nutrient
BE-Wa	Only to the limiting nutrient.
BG	Not specified.
CZ	For point sources of pollution, the main emphasis is on the elimination of phosphorus compounds. The increased content of nitrogen compounds is solved mainly by measures in the catchment area.
DE	Applies to both N and P
EE	If the information about limiting nutrient is available, the management objectives are more specific.
IE	P.
EL	Not specified.
ES	Not specified.
FR (for 3 water agencies)	Not specified.
IT	Not specified.
CY	The one that exceeds boundaries, which typically is N.
LV	Applies to both N and P.
LT	Applies to both N and P.
HU	OAOOA principle.
NL	Not specified.
PL	Both N and P.
PT	Not specified.
RO	Yes, it is applied for both P and N.

Country	Nutrient
FI	Not specified.

1.2.3 When a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients

Respondents:

- DE
- EE
- FR (for 3 water agencies)
- IT
- RO
- FI
- SE
- NO

1.2.4 When a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle)

Respondents:

- BE-Wa
- DE
- IE
- ES
- FR (for 2 water agencies)
- RO
- FI

1.2.5 When downstream water bodies fail to reach good status due to nutrient pollution

Respondents:

- BE-Wa
- DE
- LV
- LT
- PL
- RO

- FI
- SE

1.2.6 Other

Respondents:

- DK
- FR (for 1 water agency)
- IT
- NL
- PL
- PT
- SE
- IS
- TR

Other Specification

Country	Specification
DK	When downstream lakes and coastal waters fail to reach good status due to phosphorus pollution, phosphorus reduction measures are applied. These are not applied directly in rivers. Measures include nature-based solutions and technical/biological manipulation solutions as described later in Part C, Section 10 and 11.
FR (for 1 water agency)	When concentrations in rivers do not reach the targets set to achieve good status at sea.
IT	Full implementation of UWWT and Nitrate Directive with additional measures on waste water re-use in agriculture and maintenance and enhancing of riparian zones.
NL	Nutrient policy is focused on achievement of nutrient standards. There is no national framework to prevent deterioration. Here the local water managers should be aware of that. Downstream reduction is getting more attention on policy level, but also there only tailor made agreements are made (so no national framework).
PL	In accordance with the Regulation, the guidelines apply to the whole country, regardless of the status of a given water body (in regard to the reduction of nitrate pollution from agricultural sources).
PT	When water bodies show signs of nutrient pollution, like massive growths in vegetation cover (e.g. aquatic invasive species).
SE	The need for nutrient reductions is based on the pressures analysis, and whether it can be verified in relation to the BQE and PhysChem supporting data.
IS	There is no river wb in IS that has been confirmed to fail good ecological status because of nutrients contamination.
TR	As it was mentioned before although biological quality elements were also used for identification of nutrient sensitive areas, as the reference water bodies for all typologies has not been determined yet in TR, ecological status of the water bodies couldn't be identified. But on the other hand, nutrient reduction

Country	Specification
	is decided to be necessary for rivers when a water body class limit value is above second class where the parameters and values of second class are given below. - Oxygen saturation: 90 - 70% - BOD:4 - 8 mg/L - Ammonium-N: 0,2 - 1 mg/L - Nitrate-N: 3 - 10 mg/L - Nitrite-N: 0,01 - 0,06 mg/L - TP: 0,03 - 0,16 mg/L - Organisms* Grup B (Baetidae (Baetis, Cloeon, Procloeon, Centroptilum), Caenidae, Leptophlebidae, Siphlonuridae, Ephemerellidae, Trichoptera, Odonata, Ancylidae.) - BMWP Class II or ASPT Class II

1.3 When is nutrient reduction decided to be necessary for transitional waters?

Summary of responses

9 countries responded that nutrient reduction is decided to be necessary for transitional waters when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs).

10 countries responded that nutrient reduction is decided to be necessary for transitional waters when a water body is classified failing good status according to nutrient good/moderate boundaries.

6 countries responded that nutrient reduction is decided to be necessary for transitional waters when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients.

4 countries responded that nutrient reduction is decided to be necessary for transitional waters when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle).

5 countries responded that nutrient reduction is decided to be necessary for transitional waters when downstream water bodies fail to reach good status due to nutrient pollution.

4 countries responded that nutrient reduction is decided to be necessary for transitional waters at another point.

Responses in detail

1.3.1 When a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs)

Respondents:

- DE
- IE
- ES
- FR
- IT

- NL
- PL
- PT
- RO

Further details

Country	Details
IE	The one-out-all-out WFD principle is used.

1.3.2 When a water body is classified failing good status according to nutrient good/moderate boundaries (if yes, please specify if this applies to both P and N, or only to the limiting nutrient)

Respondents:

- DE
- IE
- EL
- ES
- IT
- LV
- NL
- PL
- PT
- RO

Nutrient which boundaries apply to

Country	Nutrient
DE	Not specified.
IE	This is usually P in transitional waters, but if N is driving the response in the sensitive BQE it can be considered.
EL	Not specified.
ES	Not specified.
IT	Not specified.
LV	Applies to both N and P.
NL	Not specified.
PL	Both N and P.
PT	It applies to both P and N.
RO	Yes, it is applied for both P and N.

1.3.3 When a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients

Respondents:

- DE
- IE
- FR
- IT
- LT
- RO

1.3.4 When a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle)

Respondents:

- DE
- IE
- FR
- RO

1.3.5 When downstream water bodies fail to reach good status due to nutrient pollution

Respondents:

- DE
- IE
- FR
- LT
- PL

Further details

Country	Details
IE	This may depend on the waterbody; the whole catchment is considered for transitional and coastal waters.

1.3.6 Other

Respondents:

- IT
- NL
- PL

- IS

Other Specification

Country	Specification
IT	Full implementation of UWWT and Nitrate Directive with additional measures on waste water re-use in agriculture.
NL	Nutrient policy is focused on achievement of nutrient standards. There is no national framework to prevent deterioration. Here the local water managers should be aware of that. Downstream reduction is getting more attention on policy level, but also there only tailor made agreements are made (so no national framework).
PL	In accordance with the Regulation, the guidelines apply to the whole country, regardless of the status of a given water body (in regard to the reduction of nitrate pollution from agricultural sources).
IS	There is no transitional wb in IS that has been confirmed to fail good ecological status because of nutrients contamination.

1.4 When is nutrient reduction decided to be necessary for coastal waters?

Summary of responses

10 countries responded that nutrient reduction is decided to be necessary for coastal waters when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs).

10 countries responded that nutrient reduction is decided to be necessary for coastal waters when a water body is classified failing good status according to nutrient good/moderate boundaries.

8 countries responded that nutrient reduction is decided to be necessary for coastal waters when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients.

3 countries responded that nutrient reduction is decided to be necessary for coastal waters when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle).

6 countries responded that nutrient reduction is decided to be necessary for coastal waters when downstream water bodies fail to reach good status due to nutrient pollution.

5 countries responded that nutrient reduction is decided to be necessary for coastal waters at another point.

Responses in detail

1.4.1 When a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs)

Respondents:

- DK
- EE
- IE
- ES
- FR
- IT
- NL
- PL
- PT
- RO

Further details

Country	Details
IE	The one-out-all-out WFD principle is used.

1.4.2 When a water body is classified failing good status according to nutrient good/moderate boundaries (if yes, please specify if this applies to both P and N, or only to the limiting nutrient)

Respondents:

- EE
- IE
- EL
- ES
- FR
- LV
- NL
- PL
- PT
- RO

Nutrient which boundaries apply to

Country	Nutrient
EE	If the information about limiting nutrient is available, the management objectives are more specific.
IE	N is considered the limiting nutrient, but if P is driving the response in the sensitive BQE it can be considered.
EL	Not specified.
ES	Not specified.
FR	Not specified.
LV	Applies to both N and P.
NL	Not specified.
PL	Both N and P.
PT	It applies to both P and N.
RO	Yes, it is applied for both P and N.

1.4.3 When a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients

Respondents:

- DE
- EE
- IE
- LT

- RO
- FI
- SE
- NO

1.4.4 When a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle)

Respondents:

- IE
- FR
- CY

1.4.5 When downstream water bodies fail to reach good status due to nutrient pollution

Respondents:

- DK
- CY
- LT
- PL
- FI
- SE

1.4.6 Other

Respondents:

- IT
- PL
- SE
- IS
- TR

Other Specification

Country	Specification
IT	Full implementation of UWWT and Nitrate Directive with additional measures on waste water re-use in agriculture.
PL	In accordance with the Regulation, the guidelines apply to the whole country, regardless of the status of a given water body (in regard to the reduction of nitrate pollution from agricultural sources).

Country	Specification
SE	The need for nutrient reductions is based on the pressures analysis, and whether it can be verified in relation to the BQE and PhysChem supporting data.
IS	There is no coastal wb in IS that has been confirmed to fail good ecological status because of nutrients contamination.
TR	Nutrient reduction is decided to be necessary for coastal waters when a water body is determined as eutrophic or prone to be eutrophic in near future.

2 When is nutrient reduction decided to be necessary for marine waters?

Summary of responses

8 countries responded that nutrient reduction is decided to be necessary for marine waters when the integrated assessment for MSFD descriptor 5 fails to achieve good status.

8 countries responded that nutrient reduction is decided to be necessary for marine waters when criterion D5C1 "nutrient concentrations" fails to achieve good status.

6 countries responded that nutrient reduction is decided to be necessary for marine waters when nutrient inputs are increasing.

5 countries responded that nutrient reduction is decided to be necessary for marine waters at another point.

Responses in detail

2.1 When the integrated assessment for MSFD descriptor 5 fails to achieve good status

Respondents:

- EE
- IE
- ES
- FR
- LT
- NL
- RO
- SE

Further details

Country	Details
IE	No eutrophication is observed in Irish marine waters.

2.2 When criterion D5C1 "nutrient concentrations" fails to achieve good status (if yes, please specify if this applies to both P and N, or only to the limiting nutrient)

Respondents:

- EE
- IE
- ES
- LV
- LT
- NL
- RO
- SE

Nutrient which this applies to

Country	Nutrient
EE	Not specified.
IE	N is considered the limiting nutrient, but if P is driving the response in the sensitive BQE it can be considered.
ES	Not specified.
LV	Applies to both N and P.
LT	Not specified.
NL	Not specified.
RO	Yes, it is applied for both P and N.
SE	In Helcom (Baltic sea management area) a failure in criteria D5C1 can cause the descriptor to fail. In OSPAR North sea area: Kattegat, Skagerakk and the Sound, in theory D5C1 can fail without causing the whole descriptor to fail.

2.3 When nutrient inputs are increasing

Respondents:

- EE
- ES
- CY
- LT
- FI
- SE

2.4 Other

Respondents:

- DK
- DE
- IT
- NL
- FI

Other Specification

Country	Specification
DK	When nutrient reduction is needed and set to meet objectives in coastal waters according to the WFD.
DE	Currently the marine waters fail to achieve good status for descriptor 5 MSFD and it is clear that further nutrient reductions are necessary. Therefore, DE is aiming at reducing nutrient inputs until the nutrient management targets are achieved. Under consideration of the time lag due to natural factors we will assess whether further measures are necessary.
IT	GES assessment for Descriptor 5 does not include nutrients concentration thresholds.
NL	According OSPAR COMP cross checking procedure. Original response did not mark ‘Other’, but left this specification, therefore ‘Other’ response assumed.
FI	Determined through HELCOM BSAP. When any of the D5 status indicators on nutrients, chl-a, oxygen, Secchi depth fail to reach good status.

3 Are you undertaking pollution accounting to identify the sources of nutrient pollution?

Summary of responses

23 countries responded that they are undertaking pollution accounting to identify the sources of nutrient pollution. Of these countries, all 23 include urban waste water as a point source, 20 countries include wastewater from scattered dwellings as a point source, 23 countries include Industrial discharges as a point source, 6 countries include manure dumps as a point source and 9 include other point sources. 22 countries include agriculture as a diffuse source, 10 include forestry as a diffuse source,14 include atmospheric deposition as a diffuse source and 11 include other diffuse sources. 22 of the 23 countries described their pollution accounting methodology.

2 countries responded that they are not undertaking pollution accounting to identify the sources of nutrient pollution.

Responses in detail

3.1 Yes

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 9 water agencies for continental waters and for TraC/marine waters)
- IT
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO
- TR

3.2 No

Respondents:

- BG
- LV

If yes, which point sources are included?

3.3 Urban Waste Water

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 9 water agencies for continental waters and for TraC/marine waters)
- IT
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO
- TR

3.4 Waste Water From Scattered Dwellings

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 4 water agencies for continental waters and for TraC/marine waters)
- IT
- LT
- HU

- NL
- AT
- PL
- RO
- SK
- FI
- NO
- TR

3.5 Industrial Discharges

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 7 water agencies for continental waters and for TraC/marine waters)
- IT
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO
- TR

3.6 Manure Dumps

- BE-Wa
- ES
- FR (for 2 water agencies for continental waters and for TraC/marine waters)
- HU
- RO
- TR

3.7 Other

- DK
- DE
- EL
- FR (for 3 water agencies for continental waters and for TraC/marine waters)
- NL
- PL
- FI
- SE
- NO

Other Specification

Country	Specification
DK	Aquaculture.
DE	Rain water management.
EL	Aquaculture.
FR (for 3 water agencies for continental waters and for TraC/marine waters)	Fish farmings, management of rainfall events.
NL	National registration of emissions, see link for water (in Dutch) http://www.emissieregistratie.nl/erpubliek/misc/documenten.aspx?ROOT=\Algemeen%20%28General%29\Exports\Exports%20Belasting%20naar%20Water%20%28Exports%20Load%20to%20Water%29.
PL	From fisheries.
FI	Aquaculture, peat production.
SE	Aquaculture.
NO	Aquaculture.

If yes, which diffuse sources are included?

3.8 Agriculture

- BE-Wa
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 9 water agencies for continental waters and for TraC/marine waters)
- IT
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO
- TR

3.9 Forestry

- BE-Wa
- EE
- IE
- EL
- FR
- AT
- FI
- SE
- NO
- TR

3.10 Atmospheric Deposition

- BE-Wa
- DK
- DE
- IE
- IT
- HU
- NL
- AT
- PL
- RO
- FI
- SE
- NO
- TR

3.11 Other

- CZ
- DK
- IE
- FR (for 3 water agencies for continental waters and for TraC/marine waters)
- NL
- PL
- PT
- RO
- FI
- SE
- TR

Other Specification

Country	Specification
CZ	Agriculture only as degrees of significance for the purpose of identification of pressures acting in water bodies, for some catchments there are modelled values available.
DK	Discharges not connected to sewerage network.
IE	Diffuse urban runoff.
FR (for 3 water agencies for continental waters and for TraC/marine waters)	- For rivers and lakes : management of rainfall events, erosion; urban emission (urban emission during rainfall events, leaks from sewage systems, Non-collective wastewater treatment). - For TraC and marine waters: erosion, rainwater input, urban wastewater, non-collective and collective sanitation, rivers, etc.
NL	Not specified.
PL	Urban runoff.
PT	Manure use in agricultural fields.
RO	Agglomerations without collecting systems.
FI	Manure (included in agriculture), scattered dwellings, storm waters.
SE	Wastewater from scattered dwellings , Stormwater.
TR	Unsanitary landfills, pasture area, urban and rural settlement drainage.

Pollution Accounting Methodology

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EE
- IE
- EL
- ES
- FR (for 3 water agencies for continental waters and for TraC/marine waters)
- IT
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- TR

Country	Explanation
BE-Wa	Urban waste water : data analysis collected from sewage treatment plants and an estimation of non-connected individual houses emission to determine a discharge load into surface water bodies Industrial discharges : we use emission data extracted from databases of emissions declared by industries to the administration for several purposes (taxes, IED reporting, etc.), joined with permit data for the locations (water bodies) and output types (direct discharge in surface water or through a WWTP). Agriculture : we use a model (EPIC GRID) to estimate the amounts of nitrogen and phosphorus that are transferred to groundwaters and surface waters from agricultural activity. This model uses data related to soils, geology, rainfall, nutrient quantity applied per crop, crop rotations, atmospheric deposition, etc. and split the quantity of nutrients lost between the groundwaters and surface waters.
CZ	See explanation in Part B, Section 2.3.
DK	Total nitrogen and phosphorus loads from rivers to coastal waters are measured. Loads from scattered dwellings are calculated. Loads from other point sources are measured. Loads from diffuse sources are estimated from these numbers.
DE	Nutrient modelling allows for differentiation between different sources and pathways of emission and enables authorities to detect potential significant emitters/polluters. Additionally, investigative monitoring is being established when WFD surveillance monitoring indicates that the environmental objectives are likely to be failed.
EE	Monitoring, modelling, expert analysis.
IE	SLAM: The Source Load Apportionment Model (SLAM) Framework (Mockler et al., 2016, 2017) incorporates multiple national spatial datasets relating to nutrient emissions to surface water, including land use and physical characteristics of the sub-catchments. Separate modules were developed for each type of nutrient source to facilitate upgrading and comparisons with new data or methods. The key input dataset for the agriculture module (i.e. the CCT) was the Land-Parcel Identification System (LPIS) which was combined with land management data from the Department of Agriculture, Food and the Marine (DAFM). This annual average export coefficient model calculated leaching rates based on methods from existing models for N and P. In addition, the model applied pathway-dependent attenuation coefficients related to the hydrogeological conditions, which were inferred from GIS maps of relevant properties including soil drainage, subsoil permeability and depth to bedrock. Mockler, E.M., Deakin, J., Archbold, M., Daly, D., Bruen, M., 2016. Nutrient load apportionment to support the identification of appropriate water framework directive measures. Biology and Environment 116B (3):245–263. http://dx.doi.org/10.3318/bioe. 2016.22. Mockler et al. 2017. Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework. Science of the total Environment. https://doi.org/10.1016/j.scitotenv.2017.05.186.

Country	Explanation
	Packham, I., Mockler, E., Archbold, M. *et al.* Catchment Characterisation Tool: Prioritising Critical Source Areas for managing diffuse nitrate pollution. *Environ Model Assess* **25,** 23–39 (2020). https://doi.org/10.1007/s10666-019-09683-9.
EL	A methodology for the identification of anthropogenic pressures and their impacts was developed during the 2nd planning cycle and is available in the following link: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/Methodologia_Piesewn_v3.pdf.
ES	ES uses several methodologies, it depends on the River Basin Authorities and Regional Authorities. It can be found in the RBMP : https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/.
FR (for 3 water agencies for continental waters and for TraC/marine waters)	For TraC and marine waters: in general, the idea is to reduce the intakes of nutrient from agricultural or rainwater sources (for example) by implementing measures. Depending on the river basin district and issues, strategies can be different to: - Estimate nutrient flows from rivers with different models; - Model rainwater flows in Mediterranean; - Etc.
IT	Nutrient loading form UWWT Plants are estimated by interpolation using emission discharges measurements of nutrients for plants which discharge in sensitive areas or catchment in sensitive areas. Nutrients loading from land diffuse sources are estimated through riverine input calculated considering flow and nutrient concentration. Atmospheric deposition on coastal and marine waters is estimated using monitoring stations for wet and dry deposition located in isles far from the coast and integrating such monitoring data into a transport and diffusion model coupled with atmospheric hindcasting modeling.
CY	All discharges from WWTP and major industries are licensed with an environmental discharge permit, in which thresholds are defined for the environmental characteristics of their emissions. This is done in order to closely monitor and estimate the discharged loads. In addition agriculture crops and animal husbandry farms are assessed in order to quantify their emissions in N and P.
LT	Percentage of arable land and percentage of "intensive" crops (summer and winter cereals and rapeseed) were calculated for the basin of each water body and interrelationships between the above mentioned percentages and total nitrogen were explored to set significant effect thresholds. Afterwards, if a threshold is exceeded and overall status is not good, water body was considered as being at risk. In addition, modelling of agricultural pollution loads was undertaken and significant thresholds estimated. Modelling was based on landuse, soil and terrain characteristics, calculated probable use of fertilizers and a range of other parameters. Modelling was done by the use of SWAT model.
NL	See explanation in Part A, Section 3.2.5.
AT	For RBMP-risk analysis, emission model MONERIS is used – it quantified losses of the different sources to surface water and assessed the risk of failing the target – see Part B, Section 3.2 for further details.
PL	A "virtual" load is calculated at the end point of each WB on the basis of the flow data extrapolation, land cover data, the monitoring data and nutrients emissions.
PT	For point sources, nutrient loads are based on users permit values and discharge monitoring. For diffuse sources, nutrient loads (related to agriculture) are determined for each drainage area, based on the concept of nutrient export rates. Land use classes in those areas are identified and the respective nitrogen (N) and phosphorus (P) characteristic exportation values (which will be transported by runoff) are defined and considered to account for the total loads generated in the draining areas for each water body or set of water bodies. A similar methodology is used for loads resulting from manure spread in agricultural fields (related to livestock). Export rates are assigned to land use classes existent in the drainage areas, including a characterization of different types of agricultural activities. The models used to estimate nutrient loads are developed in GIS.

Country	Explanation
RO	Nutrient emissions of point and diffuse sources into surface waters are evaluated in the model. Point data (e.g. waste water treatment plants), areal information (e.g. soil data), and administrative information (like statistical data for districts), are integrated. The application of geographic information systems (GIS) is essential. More detailed information can be found to http://www.moneris.igb-berlin.de/index.php/methodological-approach.html.
SK	Ration of phosphorus from agriculture land erosion to the other sources of pollution.
FI	We use an operational national-scale nutrient load model VEMALA for Finnish water sheds. In VEMALA FI is divided into about 180 000 sub-basins. VEMALA simulates nutrient loading into inland waters on each sub-basin and transport and retention of nutrients in rivers and lakes. Loading from agriculture is simulated on field plot level with ICECREAM sub-model, taking into account characteristics of the field, crop, farming practices, fertilization and use of manure. Other simulated nutrient sources are natural background loading, forestry, point sources, scattered dwelling, urban runoff and deposition. Reports and data of loading from different sectors of industry and WWTP's, are collected and available via the databases of SYKE.
SE	https://www.havochvatten.se/download/18.19a8b87f170646960b9b790a/1583507158163/rapport-2019-20-naringsbelastningen-pa-ostersjon-och-vasterhavet-2017.pdf.
TR	Historical data and land use data was considered and modeled for pollution accounting.

4. What criteria and considerations do you use to select which measures to implement in order to reduce nutrient inputs?

Summary of responses

21 countries consider the cost-efficiency of measures when selecting which measures to implement in order to reduce nutrient inputs.

17 countries consider the effectiveness of measures (e.g. % of total load reduction needed) when selecting which measures to implement in order to reduce nutrient inputs.

18 countries consider the feasibility of the implementation of measures in the different sectors when selecting which measures to implement in order to reduce nutrient inputs.

3 countries consider the costs alone when selecting which measures to implement in order to reduce nutrient inputs.

11 countries consider political priorities when selecting which measures to implement in order to reduce nutrient inputs.

6 countries have other criteria and considerations when selecting which measures to implement in order to reduce nutrient inputs.

Responses in detail

4.1 Cost-efficiency of measures

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EE
- EL

- ES
- FR (for 2 water agencies for continental waters and Trac/marine waters)
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO

3.12 Effectiveness of measures (e.g. % of total load reduction needed)

Respondents:

- BE-Wa
- BG
- CZ
- DK
- DE
- EE
- FR (for 4 water agencies for continental waters)
- CY
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI
- TR

3.13 Feasibility of implementation of measures in the different sectors

Respondents:

- BE-Wa
- DK
- DE
- EE
- IE
- ES
- FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)
- CY
- LT
- HU
- NL
- PL
- PT
- RO
- SK
- FI
- SE
- NO

3.14 Costs alone

Respondents:

- ES
- FR (for 1 water agency for continental waters)
- PL

3.15 Political priorities

Respondents:

- BE-Wa
- DK
- ES
- FR (for 1 water agency for continental waters and for all agencies for Trac/marine waters)
- LT
- NL
- PL
- RO
- SK
- SE
- TR

3.16 Other considerations

Respondents:

- CZ
- FR (for 1 water agency for continental waters)
- IT
- PL
- RO
- FI

Other Specification

Country	Specification
FR (for 1 water agency for continental waters)	None specified.
IT	Full implementation of European Union Directives.
PL	Climate change compliance, the scope of the measure (impact on other WB).
RO	Cost-benefit analysis in case of supplementary measures.
FI	A suitable implementing body needs to be found.

Further Details

Country	Details
CZ	The selection of measures took into account the fact whether one measure addresses more parameters (BOD5, N-NH4, N-NO3 and Ptot were assessed) which are not in good status. The ranking according to cost-effectiveness was further created according to the magnitude of the reduction of the substance ratio from a specific source of pollution in relation to the costs of this measure. The order of measures as needed has been established on the basis of an assessment of how much the measure will contribute to the reduction of pollution in the relevant watercourse. Furthermore, the effects are assessed in total for individual parameters from the source parts to the border of the CZ.
EL	Cost-effective analysis for any possible measures is applied for the selection and especially for prioritisation of the Programmes of Measure included in the PoMs of RBMPs.

Country	Details
ES	Consult RBMPs https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/
FR	1. The measures are defined with all the local actors (local authorities, economic actors, nature protection associations and State services) during specific meetings to draw up the programme of measures, water body by water body. 2. Financial capacity of the catchment, length of a WFD cycle, economic constraints.
NL	This is a delicate process, and the outcome is clear and transparent but the way to it remains misty for non-professionals, last part personal opinion.
PL	By taking into account political priorities we mean looking for synergies with other policy / strategic documents from the regional to the EU level.
RO	According to the WFD: Basic measures are priority and then supplementary measures, if it not enough for reaching the environmental objectives.

5. Are past policy measures such as a focus on urban waste water treatment plants as opposed to diffuse pollution from agriculture taken into account when planning new measures, e.g. trying to achieve a fair sharing of the nutrient reductions between different sectors according to a pollution account?

Summary of responses

18 countries responded that past policy measures are taken into account when planning new measures.

8 countries responded that past policy measures are not taken into account when planning new measures.

Responses in detail

5.1 Yes

Respondents:

- BE-Wa
- BG
- CZ
- DK
- DE
- EL
- ES
- FR (for 1 water agency for continental waters)
- LT
- NL
- AT
- PL
- PT
- SK
- FI
- SE
- NO
- TR

Explanation

Country	Explanation
BE-Wa	Until now, efforts are mainly based on measures for industrial sectors and urban wastewater treatment.

Country	Explanation
	Nutrient loads were calculated by sector per water body. The allocation between sectors gives us the percentage of responsibility for each sector and thus the contributions that must be requested by sector to achieve the environmental objectives.
CZ	Measures are proposed not only to address point sources of pollution, but also to address surface and subsurface sources of pollution from agricultural areas. However, measures targeting agricultural areas are very difficult to put into practice.
DK	When making The programme of measures according to the WFD cost-effectiveness analysis are made. In previous Water Management Plans it has been most cost effective to reduce the diffuse sources rather than point sources. Point sources has been reduced significantly from the late 1980ies 1990ies but are still further reduced due to centralizing and upgrading of WWTP.
DE	In urban and some countryside areas, focus often still lies on optimizing wastewater treatment plants. In agricultural regions, pollution from agriculture is frequently identified as the major contributor to nutrient pollution and is therefore taken into focus for potential reduction measures. The nutrient input reductions achieved so far in DE mainly come from reducing inputs from point sources (e.g. improving waste water treatment). The sector agriculture is responsible for a significant share of nutrient inputs. The revised fertiliser ordinance is a step into the right direction.
EL	Specific measures are proposed for each source of pollution.
ES	https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/
FR (for 1 water agency for continental waters)	See explanation in Part C, Section 5.1.
LT	Measures are proposed to tackle all relevant sources if they are significant. The outcomes of political discussions still remains to be seen.
NL	On national level both ‚ex post' as 'ex ante' are carried out.
AT	Combination of measures of WWTP and agriculture. In cases with no good ecological status and significant input of P by WWTP – reducing the effluent concentration up to 0,5 mg/l P is foreseen.
PL	Directly there is no such system of responsibility sharing. But indirectly, measures addressed to reduce diffuse pollution is likely to be favoured because point sources pollution are already compliant with environmental norms, so the cost-efficiency and feasibility of further measures for point sources will be lower than for diffuse pollution.
PT	Whenever nutrient pollution results from multiple sources, namely agriculture and urban waste water, measures are defined and implemented in the frame of the specific directives: the Nitrates Directive and the Urban Waste Water Treatment Directive. The efficiency of the implemented measures is assessed through monitoring programs, which allow the decision on the need for additional measures (taking also into account factors as the time needed for measures to produce results).
SK	We are trying to achieve a fair sharing of the nutrient reductions between different sectors via determining of dominant pollution sources.
FI	For instance, more measures are set to agricultural sector because old policy measures have not proven enough effective. Accordingly, it is not cost-efficient to set as high reduction targets for municipal sector. However, also in future all different sectors are taken into account.
SE	https://viss.lansstyrelsen.se/ReferenceLibrary.aspx?referenceLibraryID=55066.
NO	All possible measures are taken into account.

Country	Explanation
TR	Nutrient inputs to water bodies were determined according to the source. Therefore, nutrient sensitive areas were nominated as either urban sensitive areas or nitrate sensitive areas. Urban sensitive areas are defined as the drainage area of the sensitive water body and the urban wastewater drainage areas located at the upstream of this water body, which create pressure on the sensitive water body and cause the water quality targets to fail. While nitrate sensitive areas are drainage areas containing agricultural and non-agricultural lands where nitrate is formed affecting natural freshwater lakes, other fresh water sources, estuaries and coastal waters that are determined to be eutrophic or may become eutrophic in the near future if necessary measures are not taken. In that way, measures can be more source oriented and focused.

3.17 No

Respondents:

- EE
- IE
- FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)
- IT
- CY
- LV
- HU
- RO

Explanation

Country	Explanation
LV	Past measures implemented are taken into account. However, it doesn't mean that different policy sectors are set to be one-by-one. In measure selection process is taken into account pressure-impact analysis results (significant pressures), baseline scenario, risk assessment, as well as assessment on cost-efficiency of measures and most effective combination of them (if possible).
FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)	Yes: measures to limit the transfer of particulate phosphorus to watercourses from agricultural areas NO: The choice of measures is defined on the basis of different criteria: efficiency, technical feasibility and economic cost sustainability. In specific territory a non-negligible proportion of nutrients from the non –collective waste water treatments and/or loss of networks, in contrast to WWTP discharges, for which only a few WBs are degraded at the margin. For TraC and marine waters: No All nutrient-based pollutions are taken into account. The effort to reduce the pressure is proportional to this pressure's effect on the environment, independent of what has already been done.

6 Is the delay in the response of the ecosystem to reduced nutrient inputs taken into account when planning new measures?

Summary of responses

15 countries responded that the response of the ecosystem to reduced nutrient inputs are taken into account when planning new measures.

11 countries responded that the response of the ecosystem to reduced nutrient inputs are not taken into account when planning new measures.

Responses in detail

6.1 Yes

Respondents:

- BE-Wa
- CZ
- DK
- DE
- IE
- EL
- ES
- FR (for 4 water agencies for continental waters)
- LV
- AT
- PT
- RO
- FI
- SE
- NO

Explanation

Country	Explanation
BE-Wa	Indeed, some measures put in place do not achieve good status in a short period of time. In these cases, we have asked exemption for natural conditions.
CZ	In general, we propose measures for the next six-year cycle, but it is clear that the improvement will follow rather in the next planning period, however, this assumption is not supported by the established calculation methodology, because there are many difficult to quantify factors, especially the effect of sewage overflows from settlements of all sizes and the impact of the resilience of numerous ponds and dam reservoirs present on the watercourses - these factors also respond (unfavourably) to climate change.
DK	Planned mitigation measures are taken in to account (as a baseline) when calculating phosphorous loads (see Part A, Section 1.3). For instance, the effect of wetlands is taken in to account from the date at which commitment to implement a given wetland, is made. If the target load is not met when the baseline is taken in to account, new initiatives are considered,. In modelling of phosphorous loads, delay of ecosystem response is included in scenarios.
DE	Depending on the type of surface water body, the ecological response time following nutrient reduction measures can differ widely. Planners can rely on substantial knowledge on how lakes respond to restauration measures, due to long-term monitoring experience. For rivers, scientific knowledge is still fragmentary, thus, uncertainties and variability concerning the response time of the biological quality elements is high. Nonetheless, estimates of ecological response time are taken into account in concepts of measures addressing various stressors in order to implement measures effectively and to estimate the time frame to reach the WFD's environmental objectives.
IE	There are significant time delays that occur throughout the process including with policy development, uptake and implementation of measures, biophysical recovery, and reporting and consideration of monitoring results as part of development of the next programme of measures. Expert opinion and in some scenarios, modelling, have been used

Country	Explanation
	to determine the likely time it will take for improvements to take effect, which in turn is used to manage expectations of when objectives may be achieved. Time delays do prevent new measures being developed.
EL	The effectiveness of each measure is taken into account for setting the environmental objectives for the water bodies.
FR (for 4 water agencies for continental waters)	See explanation in Part C, Section 6.1.
LV	In some cases there can be time-lag in achieving the goals. In cases where the nutrient pollution is very significant, even necessary nutrient reduction till moderate/good quality boundary cannot improve immediately the status of water body. Sometimes nutrients can be in sediments/saturated water and should be reduced (used by macrophytes).
AT	After implementing measures, changes in the status of such bodies are assessed by operational monitoring sites. The temporal implementation of the monitoring programme considers the potential recreation time of the ecosystem (especially the relevant nutrient-sensitive BQEs). New measures are depending on this.
PT	The time needed for ecosystems to recover after measures being implemented is taken into account when status assessment is done and also when considering the review of PoM.
RO	For the measures addressing the reduction of nutrients discharged from urban treatment plants the response of ecosystem is estimated to be 1 year for rivers, being demonstrated by monitoring results and ecological status assessment.
FI	In the Baltic Sea the delay is considerable. In lakes and rivers, the delay depends e.g. on the pollution history, phosphorus stored in the soils, and the level of internal loading of the individual water body.
SE	Reduction effects of already conducted measures are taken into account. As an example; https://viss.lansstyrelsen.se/ReferenceLibrary/55036/Metod%20för%20påverkanstypen%20diffusa%20källor%20Jordbruk.pdf
NO	Partly, many of the agricultural measures have a delay in effectiveness.

6.2 No

Respondents:

- BG
- EE
- FR (for 4 water agencies for continental waters and for all agencies for Trac/marine waters)
- IT
- CY
- LT
- HU
- NL
- PL
- SK
- TR

Explanation

Country	Explanation
NL	We know it is there but this is very system dependent.

Country	Explanation
FR (for 4 water agencies for continental waters and for all agencies for Trac/marine waters)	Yes: 1. If it's only a problem concerning the "nutrients", the ecosystem will response rapidly. If the problem includes the biology, a delay in the response of the ecosystem will be observed (more than one cycle, WHO). 2. When there is no longer nutrient pressure (with a significant impact according to the expertise of local stakeholders (information from technical consultations)), the good status is achieved due to the inertia of the ecosystem (natural conditions): a delay is observed for all the quality elements that make up good status to be good/very good. No Feedback from the implementation of domestic and agricultural nutrient discharge reduction over the last 30 years shows very rapid results on the biological status after discharge reduction (a few months in rivers). YES and NO the geographical scope of the actions to be carried out and the potential financial, economic and social impacts are major difficulties. For TraC and marine waters : NO, however, some studies are underway on the role of sediments as a source of nutrients for transition waters.

7 Do you estimate the effect of measures on the reduction of the nutrient load or concentration in water?

Summary of responses

19 countries responded that they do estimate the effect of measures on the reduction of the nutrient load or concentration in water.

8 countries responded that they do not estimate the effect of measures on the reduction of the nutrient load or concentration in water.

Responses in detail

7.1 Yes

Respondents:

- BE-Wa
- CZ
- DK
- DE
- IE
- ES
- FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)
- IT
- LV
- LT
- NL
- AT
- PL
- PT
- RO
- FI
- SE
- NO
- TR

Explanation

Country	Explanation
BE-Wa	We use all data we have access to and estimate the effects of the measures. It is clear that the estimation of the effectiveness of measures is very complex exercise because it depends on multiple factors that may be difficult to understand due to lack of reliable data.
CZ	Assessing how much the measure will contribute to reducing pollution in the relevant watercourse is part of the selection of effective measures. The theoretical reduction of the substance input from a given source of pollution is calculated and this amount is related to the amount of pollution that is present in the water body (main watercourse) above the permissible load for good ecological status.
DK	Yes in regards to load, but not in regards to concentration.
DE	Water bodies in DE are often affected by multiple (interacting) stressors, e.g. nutrients, hydromorphological deficits, neobiota, or lacking recolonization potential. Biological effects of nutrient reduction measures can therefore sometimes be hard to predict (individually). Restoration concepts seek to pursue a holistic approach, where nutrient reduction can play an integral part to reach the biggest effects and, eventually, all environmental objectives. The challenge is that often the effect of measures is difficult to quantify (also because there are hardly any before-after studies). For rivers and lakes, the German LAWA and also some Bundesländer have started investigation programs to determine the impact of agricultural measures on nutrient reduction and BQE. HELCOM, in the process of updating the BSAP, has recently started a "sufficiency of measures" (SOM) analysis that has shown that knowledge and information is still lacking. In general, this analysis has shown that the nutrient reduction measures planned in DE are insufficient to achieve the nutrient reduction targets of the Baltic Sea Action Plan. Reference: HELCOM (2020): Results of the SOM analysis for eutrophication (not yet published).
IE	For the 2nd cycle this was only done for urban waste water measures based on estimates of the load reductions being achieved as a result of plant upgrades that are provided by the water services provider. For the third cycle, approaches for linking agricultural actions to water quality outcomes are being explored.
ES	Monitoring Programs of the water body status (RBMPs).
FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)	1. The estimation is not automatic. The monitoring can be carry out. 2. The Pegase model is used to the impact of measures on water quality 3. Explanation will be described in the next WFD inventory. 4. For the water bodies identified as being at risk of not achieving the WFD environmental objectives, a specific monitoring network is set up. Its objective is to establish the status of these water bodies and to monitor their evolution following the actions set up within the framework of the programmes of measures. Local monitoring within the framework of local consultation bodies (SAGE, river contracts, etc.) are used to follow the effect of measures at a local scale.. 5. A monitoring is carried out. For TraC and marine waters: YES The effect of the measures are evaluated thanks to the monitoring of surface water at each river basin district management plan updates. We can evaluate if we achieve our management objectives.
IT	Estimate of reduction of nutrients due to a full implementation of UWWT Directive is based on interpolation using emission discharges measurements of nutrients for plants which discharge in sensitive areas or catchment in sensitive areas and are compliant with UWWT emission threshold and typology of treatments (primary, secondary, more advanced,…) applied.
LV	Calculation of amount that can be reduced, taking into account effect of measure (amount of nutrient in water body minus reduced amount via measures).
LT	When possible (depends if a measure is possible to reliably model with current tools, mainly SWAT model). But this is done mainly for testing of effectiveness and selection of a set of cost-effective measures to be applied in risk water bodies basins on the similar scale there. Exact location and effect of measure in the basin of particular water body is not planned and addressed.
NL	See national analysis.
AT	- Biological and chemical monitoring

Country	Explanation
	- MONERIS modelling
PL	The effect will certainly not be expressed directly as a load reduction but more as a class of effectiveness (e.g.: very effective, moderately effectives, etc.) But at the present time the methodology is under development and may be subject to change.
PT	The effect is not directly assessed, but the overall efficiency of measures is assessed at WB and RB scale through monitoring programs, including nutrient-sensitive BQE and nutrient concentrations.
RO	- Scenarios developed at the Danube River Basin wide and MONERIS model application. - The national modelling tool (WaQ model) estimates the reduction of nutrient loads and concentrations in water resources after implementation of measures and estimate the water status or at risk not to achieve the environmental objectives. The pollutants modeled are nitrogenous and phosphorus. The WaQ model is applied on each sub-basin from upstream to downstream. The WaQ model applies yearly load balance equation taking into account point, not-point sources and natural background loads for each scenario. The point sources considered are: human agglomerations, industrial and agriculture enterprises. The non-point sources taking into account are: leakages from fertilizers used in agriculture, wastewater from individual wastewater collection systems, leakages from manure, etc.. The natural background is taking into consideration by loads from wetlands, forests, pasture, perennial cultures and atmospheric depositions.
FI	A combination of water-shed and coastal models and change in status classification.
SE	As an example; https://viss.lansstyrelsen.se/ReferenceLibrary/55036/Metod%20för%20påverkanstypen%20diffusa%20källor%20Jordbruk.pdf Helcom action project 4.2 shows the effect of WFD measures on achieving the BSAP goals.
NO	We try to estimate the effect of each measure on the reduction of the nutrient load, but has so far only estimated the effect of some of the measures. We have not implemented models that on a regular basis calculate the combined effect of all nutrient measures on a given water body. Original response did not mark 'Yes' or 'No', but left this description, therefore 'Yes' response assumed.
TR	Scenarios for measures were created by using models to reduce nutrient loads.

7.2 No

Respondents:

- BG
- DK
- EE
- EL
- FR (for 1 water agency for continental waters)
- CY
- HU
- SK

Country	Explanation
EL	The effect of the implemented measures are assessed mainly by the results/data of the monitoring network.
DK	Yes in regards to load, but not in regards to concentration.

8 Do you have mechanisms for managing management objectives for nutrients across political boundaries (either within or between Member States)?

Summary of responses

17 countries responded that they do have mechanisms for managing management objectives for nutrients across political boundaries.

9 countries responded that they do not have mechanisms for managing management objectives for nutrients across political boundaries.

Responses in detail

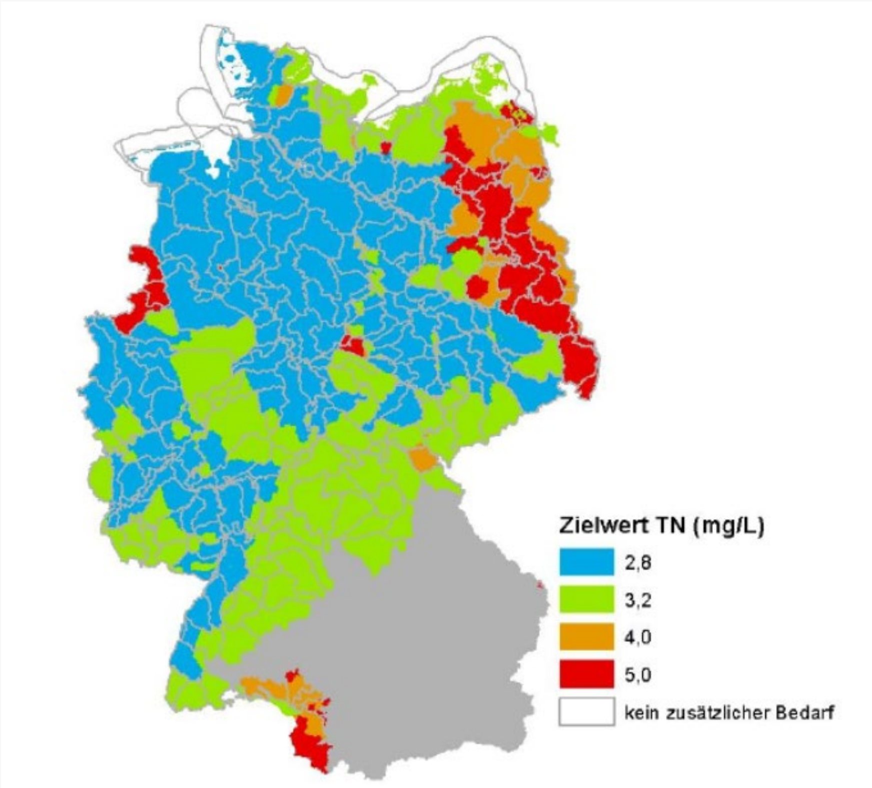
8.1 Yes

Respondents:

- CZ
- DE
- IE
- EL
- ES
- FR (for 2 water agencies for continental waters and for all agencies for Trac/marine waters)
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- SK
- FI
- SE
- NO

Explanation

Country	Explanation
CZ	The results of the assessment of the status of water bodies are harmonized at the level of the so-called cross-border working groups, and draft measures are also consulted. Likewise, the achievement of the objectives is discussed at the level of the International Commission for the Protection of the Elbe, Danube and Oder.
DE	A national working group is carrying out projects to assess nutrient concentrations from Federal monitoring programs. The projects are aiming to periodically re-evaluate management objectives across political borders within DE based on the current scientific state of knowledge. For the implementation of the WFD we use the International Riverine Commissions for transboundary rivers (Odra – IKSO, Rhine-ICPR, Donau ICPDR, Elbe IKSE). As described under Part A, Section 4 of this questionnaire DE has set management targets at the limnic-marine boundary to aim at the achievement of good ecological status in coastal waters. These targets for TN have been translated to inland waters by using the catchment model MONERIS and by considering retention (see Fig.1). Maximum allowable TN concentrations upstream have been calculated that can be considered in the River Basin Management Plans (LAWA AO 2016).

Country	Explanation
	 Abb. 3: Ins Binnenland übertragene meeresökologische Anforderungen an die mittlere jährliche Gesamtstickstoffkonzentration unter Berücksichtigung der akkumulativen Stickstoffretention auf der Ebene von Analysegebieten aus MONERIS (Modellversion: MONERIS 3.0; Stand: November 2013). Planungseinheiten sind umrandet. Fig. 1 Nutrient reduction requirements (as TN concentrations) for inland waters that should enable the achievement good ecological status of coastal waters considering retention and based on modelling with the catchment model MONERIS 3.0 with the respective analytical units (shown as grey lines) (LAWA-AO 2014). References: LAWA-AO (2014): Empfehlung zur Übertragung flussbürtiger meeresökologischer Reduzierungsziele ins Binnenland. Ständiger Ausschuss oberirdische Gewässer und Küstengewässer (LAWA-AO), 20 pages. Trepel, M. & Fischer, M. (2014): Übertragung meeresökologischer Reduzierungsziele ins Binnenland. Wasser und Abfall 16 (9), pages 42-45.
IE	A number of cross border catchment projects, between the Republic of Ireland and Northern Ireland, are underway that are developing a coordinated, local, evidence based, programme of measures. These include CatchmentCare (www.Catchmentcare.eu) and Source to tap (www.sourcetotap.eu).
EL	A Working Group has been established at national level, assigned to the task of supervision of the implementation of PoMs, in relation to the environmental objectives of RBMPs. The National Monitoring Network is also a mechanism for evaluating the achievement of the objectives.
ES	All the mechanisms related with the coordination to implement the WFD in the transboundary river basins in ES and PT are defined in the Albufeira Agreement.
FR (for 2 water agencies for continental waters and for all agencies for	1. Concertation with BE through the International Scheldt Commission and the International Meuse Commission. 2. Franco-Swiss governance of the waters of the Rhône catchment area is established. The International Commission for the Protection of the Waters of Lake Geneva (CIPEL), a Franco-Swiss inter-governmental body, has been contributing since 1963 to the coordination of water policy at the level of the Lake

Country	Explanation
Trac/marine waters)	Geneva catchment area, more particularly between the departments of Ain and Haute-Savoie as well as the cantons of Vaud, Valais and Geneva. The CIPEL's territory, covering an area of 10,300 square kilometres, covers the Lake Geneva catchment area as well as the downstream Rhône, from the outlet of the lake to the French-Swiss border at Chancy. For TraC and marine waters: Yes In the North, there are dialogues inside international commissions of Escaut and Meuse.
LT	National arrangements for the coordination of RBMP preparation and implementation are in place. The Lithuanian EPA is responsible for organization and coordination of the preparation of RBMP drafts, Ministry of Environment finalizes political discussions, and all duties for institutions that implement certain measures laid down in the ministerial orders (usually common orders with several ministries). Ministry of Environment oversees the implementation of RBMPs, facilitates securement of relevant financing for measures (especially from EU funds). Intergovernmental and lower level treaties in the field of water management on transboundary water bodies are in place with PL. With LV there is an inter-ministerial agreement in this respect. Periodic meetings are being held or other type of communication undertaken, especially when the process of RBMP preparation enters intermediate and final stages.
HU	ICPDR.
NL	In international river basin districts, with most clear example in Rhine where DE agreed to NL developed standard for River based on protection of Coastal waters.
AT	- Transboundary commission. - River basin commission (ICPDR, ICPER, ICPR).
PL	In the frame of the Helcom convention, or as a result of agreements about environmental objectives in the frame of bilateral cooperation in the field of the WFD implementation.
PT	The most important mechanism is the WFD. The Albufeira Convention (between PT and ES) provides tools for information exchange and the achievement of environmental objectives for WFD in transboundary water bodies. Harmonization of transboundary policies is a complex subject; there are several transboundary water bodies with high concentrations of nutrients, implying that measures have to be implemented in the upstream basin.
RO	The mechanism for managing management objectives for nutrients across political boundaries consists in implementation of the reduction pollution objectives, according to obligation of Convention on the Cooperation regarding the protection and sustainable use of Danube River, Sofia 1994 (Danube Convention). In 2000, the WFD came into force, establishing a legal framework to protect and enhance the status of aquatic ecosystems, prevent their deterioration, and ensure the long-term, sustainable use of water resources throughout the EU. In response, the Danube countries, including non-EU Member States (MS), agreed to implement the WFD throughout the entire basin. The contracting parties made the ICPDR the facilitating platform to coordinate WFD-related work. To meet these objectives, the ICPDR developed its first "Danube River Basin Management Plan" (DRBMP) in 2009, including assessments and measures towards the achievement of 'good status' by 2015. This DRBMP has been updated in 2015 with updated assessments on the main pressures impacting the Danube basin's waters, updated information on water status and progress achieved, as well as the joint further actions agreed by the Danube countries to be undertaken until 2021. The key issues requiring joint actions on the basin-wide level (Level A) are addressed, accompanied by more detailed River Basin Management Plans at the national level (Level B). The joint programme of Measures (JPM) builds upon the results of the pressure analysis, the water status assessment and includes, as a consequence, measures of basin-wide importance oriented towards the agreed nutrient vision and management objective for the next 6 years. It is based on the national programmes of measures, which shall be made operational in 3 years, and describes the expected improvements in water status by 2027, at latest. Priorities for the effective implementation of national measures on the basin-wide scale are highlighted and are the basis of further international coordination. Some additional joint initiatives and measures on the basin-wide level that show transboundary character are included. They are undertaken through the framework of the ICPDR. The ICPDR's basin-wide vision for nutrient pollution is the balanced management of nutrient emissions via point and diffuse sources in the entire Danube River Basin District that neither the waters of the DRBD nor the Black Sea are threatened or impacted by eutrophication.

Country	Explanation
SK	Mechanisms for managing of management objectives exists in the frame of International Commission for the Danube Protection (modelling of nutrients from various pathways).
FI	HELCOM and transboundary co-operation with Russia, SE and NO.
SE	Several bilateral cooperations SE-NO, SE-FI, SE-AA, SE-DK, HELCOM, OSPAR, IMO, UNECE CLRTAP (Gothenburg protocol) As an example; https://www.fsgk.se/Rajajokikomissio-painos-52s.-A4-SWE.pdf
NO	Within NO, yes. The same guidelines on measures and objectives is used in the whole country.

8.2 No

Respondents:

- BE-Wa
- BG
- DK
- EE
- FR (for 3 water agencies for continental waters)
- IT
- CY
- LV
- TR

Explanation

Country	Explanation
CY	Not necessary due to the small size of CY and because power lies with central government.
TR	Not a member state.

9 Do you consider climate change impacts on nutrient emissions and/or on biological quality elements/MSFD criterion responses to nutrients when planning the nutrient reduction measures?

Summary of responses

15 countries responded that they do consider climate change impacts on nutrient emissions and/or on biological quality elements/MSFD criterion responses to nutrients when planning the nutrient reduction measures.

12 countries responded that they do not consider climate change impacts on nutrient emissions and/or on biological quality elements/MSFD criterion responses to nutrients when planning the nutrient reduction measures.

Responses in detail

9.1 Yes

Respondents:

- BE-Wa
- CZ
- DK
- DE
- EL
- ES
- FR (for 3 water agencies for continental waters and for all agencies for Trac/marine waters)
- LT
- AT
- PL
- PT
- RO
- FI
- SE
- TR

Explanation

Country	Explanation
BE-Wa	Some measures to limit nitrogen leaching to groundwater and soil erosion also play a role in mitigating the effects of climate change. Grass strips and winter cover crop are measures to promote the maintenance of organic matter in agricultural soils and better storage of water while reducing erosion.
CZ	In connection with climate change, especially the increased frequency of torrential rains, the solution to the problem of draining large amounts of rainwater from urban agglomerations to a unified sewerage system is coming to the fore. This overloads the system and sewage overflows into watercourses occurs. It is proposed to create concepts of drainage so that the smallest possible outflow of rainwater into the sewer system occurs. Attention, so far at the level of data collection and evaluation, is also paid to changing the behaviour of ponds and reservoirs - some respond with reduced retention of phosphorus compounds and may therefore be an increased eutrophication risk for downstream ecosystems.
DK	Climate change impacts are, however, not taken in to account when planning nutrient reduction measures in lakes. For coastal waters the good/moderate limit values of the indicators chlorophyll (phytoplankton) and eelgrass dept limit (Angiosperms) sets the target values for determining MAI. The reference values behind these targets are historical data (1900) regarding eelgrass and modelled (advanced marine ecosystem models) reference values based on present input data from nearly undisturbed catchments and present climate data. The marine ecosystem models are based on timeseries of monitoring data and temperature data from the last 3 decades. Thus climate change are considered to some extent.
DE	See explanation in Part C, Section 9.1.
EL	They are considered during the development of PoMs.
ES	They are included in the RBMPs https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/ You can also find a complete list of the PoM in the next link: https://servicio.mapama.gob.es/pphh/
FR (for 3 water agencies for continental	Yes : 1. A "Climate Change" dimension is displayed in the Programme of Measures but is difficult to quantify.

Country	Explanation
waters and for all agencies for Trac/marine waters)	2. A "Climate Change" dimension is considered through the trend scenario used to establish the RNAO 2027 (for nutrients) of the inventory of the district (2019). 3. The climate change impacts are partially considered the updating of pressure data. The evolution of these pressures already includes changes in uses to adapt to the already very concrete consequences of climate change. The projections of the effects of climate change are established over a multi-decennial horizon. The risk of not achieving good status is assessed every 6 years when the SDAGEs are updated. For TraC and marine waters: YES In order to identify water bodies as being at risk of failing to meet their environmental objectives, trend-based scenarios take into account the climate change. In general, river basin district management plans take into account the climate change in their programme of measures.
LT	To some extent. Such assessments will show whether certain measures should in general be strengthened (imposed more widely), or not.
AT	When planning measures, the possible effects of climate change is taken into account, but due to the complex interrelationships, this is often a major challenge.
PL	The impact of climate change on eutrophication process will be taken into account, but at present time the methodology is under development.
PT	Climatic alterations are having an effect on rainfall, temperatures and available water resources, with effects over nutrient concentrations, mainly in arid basins. That reality is considered when performing ecological quality assessments and also on the planning for RBMP.
RO	Considering the water scarcity and drought as cross-cutting integration issues but also extreme hydrological phenomena (increasing flood risks) as consequences of global changes, there were identified interconnections addressing water quality and quantity issues, respective pollution related to nutrient pollution for surface waters. In this context, in the process of elaboration of RBMP, it is applied the DPSIR approach in relation to water quality and quantity issues, checking in each step (assessment of drivers-pressures-status-impact and response/measures) the climate change effects on achieving the environmental objectives of water bodies. These aspects (qualitative and quantitative issues and climate change) were integrated in the frame of the 1st RBMP and the 2nd RBMP (at the national and sub-unit level) in a dedicated chapter and many references to the pressures and measures chapters were linked. The results of quality monitoring of water resources showed that the water quality is negatively influenced by (summer) droughts, especially with respect to oxygen regime, nutrients concentrations and eutrophication phenomena as response to high water temperatures and rivers low flow regime and limited dilution capacity of the pollutants concentrations from point pollution sources effluents. Also, in case of intense rainfall and floods, the pollutants loads increase, as result of pollutants run-off such as nutrients (nitrates, ammonium and phosphates) and pesticides.
FI	Climate change effect included in model simulations.
SE	To a limited extent. Saraiva, S.; Markus Meier, H. E.; Andersson, H.; Höglund, A.; Dieterich, C.; Gröger, M.; Hordoir, R. & Eilola, K. Baltic Sea ecosystem response to various nutrient load scenarios in present and future climates. Climate Dynamics, 2019, 52, 3369-3387.
TR	The impact of climate change on nutrient emissions was taken into consideration during modelling studies.

9.2 No

Respondents:

- BG
- DE
- EE
- IE
- FR (for 4 water agencies for continental waters)
- IT

- CY
- LV
- HU
- NL
- SK
- NO

Comments

Country	Comments
DE	All potential measure types undergo a "climate check" to ensure that they are still efficient under changing climatic conditions. This applies to WFD measures and also to the new actions of the updated HELCOM Baltic Sea Action Plan for adoption in autumn 2021 (OSPAR is currently not yet planning concrete measures against eutrophication). However, we have not quantified whether additional nutrient input reductions are required considering future climate change since such a quantification is challenging due to a lack of information on specific regional impacts of climate change.
IE	Not at present, however a major Irish research project is about to get underway to look at this issue.
NL	We know it is there, but not considered actively.
NO	Not directly, but climate change impacts calls for even stricter measures regarding e.g. agricultural runoff and urban wastewater inputs.

10 Do you consider nature-based solutions (restoring riparian zones, wetlands, flood plains etc.) when planning the nutrient reduction measures?

Summary of responses

22 countries responded that they do consider nature-based solutions (restoring riparian zones, wetlands, flood plains etc.) when planning the nutrient reduction measures.

5 countries responded that they do not consider nature-based solutions (restoring riparian zones, wetlands, flood plains etc.) when planning the nutrient reduction measures.

Responses in detail

10.1 Yes

Respondents:

- BE-Wa
- BG
- CZ
- DK
- DE
- EE
- ES
- FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)
- IT
- CY
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- RO
- FI
- SE
- NO
- TR

Nature-Based Solutions Considered

Country	Solution
BE-Wa	We are currently working on setting up a 6-metre wide green strip along the rivers that will hopefully strengthen the ban on the use of fertilizers and pesticides in this zone. Measures like temporary flood zones and flood zones (Semois, Ourthe, Lesse) are not primarily aimed at reducing nutrient levels in rivers, may nevertheless play a role. Other measures such as planting trees along riverbank and rehabilitation of natural river shape contribute to this objective.
CZ	- Measures for surface runoff x erosion wash away (drainage ditch, protective barrier, anti-erosion sedimentation reservoir / sedimentation tank, dry reservoir, field road with anti-erosion function, anti-erosion balk, terracing, grassing of the valley, grassy belt). - Measures for drainage waters (regulation of runoff from spring reservoirs with protective grassing, local elimination of drainage (parts of drainage) - blinding, uncovering of drainage and its complete removal, reduction of drainage intensity - screens, pond doped with drainage water or pond at drainage outlet, biofilter in connection to the drainage system, seepage drain). - Combined measures (grassing of the infiltration area in connection with drainage, wetland in the lower part of the drainage system (or in connection with it) with an upstream object to slow down the outflow). - Landscaping measures (line green vegetation, vegetation support) o http://www.cbks.cz/SbornikTrebon18/KvitekKratky.pdf (in Czech) o https://api.intechopen.com/chapter/pdf-preview/47887
DK	Report on phosphorus solutions are available here (in Danish): https://dce2.au.dk/pub/SR379.pdf Report on nitrogen solutions are available here (in Danish): https://dca.au.dk/aktuelt/nyheder/vis/artikel/virkemidler-til-reduktion-af-kvaelstofbelastning-af-vandmiljoeet/
DE	For detailed information, see the River Basin Management Plans.
EE	Buffer strips and hedges; sediment and nutrient capture ponds.
ES	Restoration of riparian zones, reconnection of channels and floodplains, wetlands rehabilitation, improvement of biomorphological dynamics. Some specific examples may be found in: https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/ https://www.miteco.gob.es/es/agua/temas/delimitacion-y-restauracion-del-dominio-publico-hidraulico/estrategia-nacional-restauracion-rios/Rehabilitacion_restauracion.aspx
FR (for 6 water agencies for continental waters and for all agencies for Trac/marine waters)	1. Wetlands, area of good functioning, whole catchment area, ecological continuity, flood risks, river maintenance 2. Restoration of reedbeds at the tail of reservoirs for natural lakes (eg. http://www.smvva.fr/actions/lacs-et-zones-humides) More generally, actions on hydromorphology (major bed, ripisylve) 3. The nature-based solutions (Restoration or maintenance of the riparian zone, buffer zones, etc.) correspond to the actions implemented as part of the programme of measures to achieve good status. The type of nature-based solutions to be implemented is defined locally (within a concerted framework) in relation to each situation. The delimitation of the area of good environmental functioning is a management tool for local stakeholders that contributes to the development of nature-based solutions. For a given environment, the area of good environmental functioning corresponds to the surrounding spaces to which it is connected and which are necessary to maintain it in a good state of permanent functioning. 4. Fundamental orientation of the SDAGE 2022-2027, which deals with the safety of populations exposed to floods by taking into account the functioning of aquatic environments, contributes directly to the development of nature-based solutions s by local stakeholders in the basin. For TraC and marine waters: YES - Wetlands, intertidal zones restauration - Sodded bands - Etc. Look at OSMOSE nomenclature.

Country	Solution
IT	Maintenance and enhancing of river riparian zones.
CY	Preventing ecosystem degradation and restoring riparian zones and river corridors are considered for the reduction of nutrient loads.
LV	Artificial wetlands. Effectiveness has been tested in project NUTRINFLOW.
LT	We consider wetlands, but we shall see if it will prevail in the last version of RBMP plans.
HU	See explanation in Part C, Section 10.1. Possible error in response.
NL	See BOOT measures list.
AT	Measures for reducing nutrient concentration of Lake Ossiach include large-scale restoration of natural wetlands (Homepage https://kis.ktn.gv.at/seen/bleistaetter-moor AT joins the Interreg project IDES (Improving water quality in the Danube river and its tributaries by integrative floodplain management based on Ecosystem Services) http://www.interreg-danube.eu/approved-projects/ides.
PL	Guidance on good practice for surface water renaturisation https://we.tl/t-J28NwfTSrC.
PT	Good practice for nutrient use in agriculture, including guidelines for manure spread and promotion of traditional/extensive ways of production; connectivity restoration; control of invasive species in riparian corridors and other areas (e.g., forestry related land uses); nature-based solutions to increase water retention and control floods (e.g., renaturalization of river channels).
RO	The nature-based solutions are NWRM solutions such us restoring riparian zones and flood plains for reduction the nutrients coming mainly from agriculture.
FI	For instance restoring riparian zones and wetlands. The NBS (measures) that are considered are presented in the measures guidance: https://www.ymparisto.fi/fi-fi/vesi/vesiensuojelu/vesienhoidon_suunnittelu_ja_yhteistyo/suunnitteluopas (in Finnish).
SE	For example within agriculture, wetlands, riparian etc; https://viss.lansstyrelsen.se/ReferenceLibrary/55036/Metod%20för%20påverkanstypen%20diffusa%20källor%20Jordbruk.pdf
NO	To a certain degree. Buffer zones etc.

10.2 No

Respondents:

- IE
- EL
- FR (for 1 water agency for continental waters)
- HU
- SK

Comments

Country	Comments
IE	Nature based solutions were not considered in the 2nd cycle however they will be considered for the 3rd cycle. Approaches are currently being developed drawing heavily on the those outlined at www.nwrm.eu
HU	Restoring riparian zones. Possible error in response, this suggests 'Yes' would be appropriate.

11 Do you consider technical/biological manipulative solutions (removal of nutrient-rich sediment, oxygenation of bottom water, adding chemicals to the sediment to bind phosphorus, extractive aquaculture using mussels or seaweeds, management fisheries) when planning the nutrient reduction measures?

Summary of responses

16 countries responded that they do consider technical/biological manipulative solutions (removal of nutrient-rich sediment, oxygenation of bottom water, adding chemicals to the sediment to bind phosphorus, extractive aquaculture using mussels or seaweeds, management fisheries) when planning the nutrient reduction measures.

11 countries responded that they do not consider technical/biological manipulative solutions (removal of nutrient-rich sediment, oxygenation of bottom water, adding chemicals to the sediment to bind phosphorus, extractive aquaculture using mussels or seaweeds, management fisheries) when planning the nutrient reduction measures.

Responses in detail

11.1 Yes

Respondents:

- CZ
- DK
- DE
- EE
- ES
- FR (for 1 water agency for continental waters)
- LV
- LT
- HU
- NL
- AT
- PL
- PT
- FI
- SE
- TR

Technical/Biological Manipulative Solutions Considered

Country	Solutions
CZ	In some water reservoirs the following measures are taken: - Aeration and destratification towers (2 cases), - The precipitation of phosphorus in the tributaries of the reservoir (2 cases), - Biomanipulation with fish stock (all drinking water reservoirs).
DK	Lakes: - Addition of phosphorus binding chemical (e.g. aluminum or phoslock) to lake sediments for lakes with large internal phosphorous loads. - In lakes considered to be biological imbalance, DK removes planktivore fish from the lake ecosystem. - Oxidation of bottom waters to reduce internal phosphorous loading. Descriptions of mitigation measures are available here (in Danish): https://dce2.au.dk/pub/SR379.pdf
DE	See explanation in Part C, Section 11.1
EE	For lakes the removal of nutrient rich sediment is planned as measure.
ES	https://www.miteco.gob.es/es/agua/temas/planificacion-hidrologica/planificacion-hidrologica/planes-cuenca/.
FR (for 1 water agency for continental waters)	Lakes: If lakes are used for drinking water production: destratification or oxygenation of the bottom waters. If lakes are used for aquatic dormancy: techniques aimed at limiting cynaobacterial blooms (H2O2, ultrasound, etc.) are being developed at the local level but are not part of the solutions recommended in public policies. Sediment removal techniques are very expensive and rarely implemented.
LV	Digging of sediments, biomanipulation (fish) for lakes.
LT	We consider removal of excess nutrient by periodic removal of macrophytes vegetation, by introducing predatory fish. Removal of bottom sediments might be considered. Phosphorus binding is currently politically unacceptable, thus we are only investigating feasibility of such a measure in a pilot site.
HU	Removal of nutrient-rich sediment, oxygenation of bottom water.
NL	A national wide overview is lacking but examples are available for phoslock, iron addition, mussel substrate introduction etc.
AT	Only in special cases such as the "Old Danube (oxbow lake of Danube) - https://www.wien.gv.at/english/environment/waterbodies/old-danube/life-project/index.html
PL	At the present time the methodology and the identification of measures is under development.
PT	There is no widespread application of those types of measures, however removal of nutrient enriched sediments has been performed in some reservoirs.
FI	Several techniques are used. For instance, concerning the coastal areas of the Baltic Sea, nutrient loading reduction in the water shed: adding gypsum in agricultural areas. For lakes and rivers both catchment measures and measures directed to the water body are used. Several individual measures depending of the WB and its catchment, e.g. wetlands, riparian zones, treatment of clay soils with CaO or $Ca(OH)_2$, chemical treatments (binding of P), food web manipulation, halting of internal nutrient loading using aeration, etc.
SE	- Removal of nutrient-rich sediment, - Oxygenation of bottom water, - Adding chemicals to the sediment to bind phosphorus, - Extractive aquaculture using mussels or seaweeds,

Country	Solutions
	- Management fisheries, biomanipulation, fish stocking - Liming measures such as; Structural liming, liming dith [sic]; - https://viss.lansstyrelsen.se/ReferenceLibrary/
TR	Technical/biological manipulative solutions including removal of nutrient-rich sediment, oxygenation of bottom water, adding chemicals to the sediment to bind phosphorus, biomanipulation and floating wetlands were examined for lakes and theoretical application of floating wetland in one of a lake in TR (Manyas Lake) was studied. https://www.tarimorman.gov.tr/SYGM/Belgeler/TEZLER/Ali%20B%C3%9CT%C3%9CNO%C4%9ELU%20Tez%20Son.pdf (in Turkish) https://www.tarimorman.gov.tr/SYGM/Belgeler/TEZLER/Ceren%20AKSU%20Uzmanl%C4%B1k%20Tezi.pdf (in Turkish)

11.2 No

Respondents:

- BE-Wa
- BG
- DE
- IE
- EL
- FR (for 7 water agencies for continental waters and for all agencies for Trac/marine waters)
- IT
- CY
- RO
- SK
- NO

Comments

Country	Comments
DE	We are generally sceptical about these measures and prefer measures at source. Especially the technical measures are costly and incorporate high environmental risks and there is also the moral hazard that such measures might distract from efforts at source. In rivers these solutions are not used, but in lakes, some cases of biomanipulation or technical solutions as (partial) sediment retention or removal, hypolimnoc oxygen introduction or forced circulation have been used. https://www.nordbayern.de/region/gunzenhausen/altmuhlsee-sedimente-wurden-zu-dunger-1.5563944 https://www.nordbayern.de/region/gunzenhausen/altmuhl-und-brombachsee-kampfansage-an-algen-1.473777 Diverse publications on biomanipulation f.i. in Feldberger Haussee, Woezer See, Großer Seddiner See… TRAC: Small-scale biological measures are seen as less critical and there has been extensive research in the coastal waters of the Baltic Sea and North Sea on the use of mussel farming to mitigate eutrophication. However, there has not been any larger scale application of mussel farming in German waters to remove nutrients yet. There is currently an ongoing discussion in HELCOM to use sea-based measures to mitigate the internal nutrient leakage in the Baltic Sea. In this context, DE contributes to the development of a HELCOM recommendation and guidelines on this subject aiming at an adequate risk management for such measures. References: Schröder, T., Stanka, J., Schernewski, G. et al. (2014): The impact of a mussel farm on water transparency in the Kiel Fjord. Ocean & Coastal Management Vol. 101, Part A, Pages 42-52, https://doi.org/10.1016/j.ocecoaman.2014.04.034 Buer, A.-L., Maar, M., Nepf, M., Ritzenhofen et al. (2020): Potential and feasibility of Mytilus spp. farming along a salinity gradient. Frontiers in Marine Science 371, https://doi.org/10.3389/fmars.2020.00371
NO	To a very limited extent.

5. Summary

This report presents the compilation of the responses of countries to an ECOSTAT questionnaire on the management objectives for nutrients. The report is accompanied by an Excel workbook (Appendix B) that summarises the tick box responses in tabular format for ease of reference. The report includes the tick box responses and the full free text explanations for completeness. The questionnaire comprised three parts.

Part A of the questionnaire addressed methods used to derive management objectives for nutrients and was answered separately for rivers, lakes, transitional, coastal and marine waters. These objectives can be nutrient concentrations (e.g. the good/moderate boundaries), maximum allowable nutrient loads (e.g. the US system of total maximum daily loads, the HELCOM nutrient input ceilings) and/or a percentage reduction from the current loads. The responses to Part A indicate that:

- For Lakes:
  - Over 20 countries have set management objectives for nutrients for all nutrient polluted lake water bodies. Four countries have set management objectives for nutrients for some nutrient polluted lake water bodies. One country has not set management objectives for nutrients for lake water bodies.
  - A total of 16 countries focus on the reduction of both phosphorus and nitrogen when setting management objectives for nutrients. There are nine countries that focus only on reducing phosphorus, four that focus on reducing the limiting nutrient and only one that focusses only on reducing nitrogen.
  - In relation to the methodologies used for setting management objectives for nutrients, 16 countries use modelling based on nutrients vs BQE relationships to set management objectives for nutrients. There are 11 countries that use expert judgement, 9 countries that use other methods and 8 countries that use historical information.
  - A total of 16 countries do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs. In contrast, 8 countries do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.
  - A total of 18 countries use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at the good/moderate boundary. Two countries use this type of relationship, however the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements. Six countries do not use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.
  - A total of 24 countries responded that the policy the management objectives are meant to address is the WFD; 15 countries set management objectives to address the Nitrates Directive (NiD), 13 countries set management objectives to address the Urban Waste Water Treatment Directive (UWWTD) and 3 countries set management objectives to address other policies.
  - Five countries responded that they have not set management objectives for nutrients in lakes and provided some explanation of the reasons for this.
- For rivers:

- A total of 25 countries have set management objectives for nutrients for all nutrient polluted river water bodies. One country has set management objectives for nutrients for some nutrient polluted river water bodies. Two countries have not set management objectives for nutrients in river water bodies.
- A total of 21 countries focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients in rivers. Four countries focus on the reduction of phosphorus only; one country responded focusses on the reduction of nitrogen only and four countries focus on reduction of the limiting nutrient when setting management objectives for nutrients.
- In relation to methods used for setting management objectives, 16 countries use modelling based on nutrients vs BQE-response relationships to set management objectives for nutrients in rivers. A total of 12 countries use other methods ; 10 countries use expert judgement and nine countries use historical information.
- A total of 18 countries do not determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs in rivers. In contrast, nine countries do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs.
- A total of 20 countries use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary. Four countries use a similar relationship, however the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements. Five countries do not use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and another approach is used to set the management objectives.
- A total of 25 countries set management objectives to address the WFD; 17 countries set them to address the NiD; 16 countries set them to address the UWWTD and four countries set them to address other policies.
- Four countries have not set management objectives for nutrients in rivers and provided an explanation of the reasons for this.

- For transitional waters:
  - A total of 11 countries have set management objectives for nutrients for all nutrient polluted transitional water bodies. Two countries have set management objectives for nutrients for some nutrient polluted transitional water bodies. No countries have not set management objectives for nutrients for transitional water bodies.
  - A total of 11 countries focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients. One country focusses on reduction of phosphorus only; two countries focus on reduction of and two countries focus on reduction of the limiting nutrient when setting management objectives for nutrients.
  - In relation to the methods used for setting management objectives for nutrients, seven countries use modelling based on nutrients vs BQE-response relationships. Five countries use historical information; six countries use expert judgement and five countries use other methods to set management objectives for nutrients.
  - Six countries do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs, while seven countries do not do this.

- A total of seven countries use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary. Four countries use a similar relationship but the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements. Four countries do not use this type of relationship and another approach is used to set the management objectives.
- A total of 13 countries set management objectives to address the WFD; 11 countries set them to address the NiD, 10 countries set them to address the UWWTD and three countries set them to address other policies.
- Four countries have not set management objectives for nutrients and provided some explanation of the reasons for this.

- For coastal waters:
  - A total of 20 countries have set management objectives for nutrients for all nutrient polluted coastal water bodies. No countries have set them only for some nutrient polluted coastal water bodies and no countries have no management objectives for nutrients for water bodies.
  - A total of 18 countries provided details of the management objectives for nutrients set for coastal waters. Management objectives for nutrients in coastal waters are often set by identifying the maximum allowable load input from point source inputs and river inputs. These loads are taken into account as targets in the RBMPs.
  - A total of 16 countries focus on reduction of both phosphorus and nitrogen when setting management objectives for nutrients in coastal waters. Three countries focus only on nitrogen; no countries focus only on phosphorus and one country focusses on reduction of the limiting nutrient when setting management objectives for nutrients.
  - In relation to the methods used for setting management objectives for nutrients in coastal waters, 11 countries use modelling based on nutrients vs BQE-response relationships; 10 use historical information ; seven countries use expert judgement and five countries use other methods.
  - Eight countries do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs, whereas 11 countries do not do this.
  - A total of 12 countries use a relationship between the management objectives set for nutrients and the nutrient boundaries set for ecological status, and that the management objective is to reach the nutrient concentration at good/moderate boundary. Three countries use this type of relationship, but the management objective is to reach the mid-point of good status (between the high/good and the good/moderate boundary) as defined by the biological quality elements. Six countries do not use this type of relationship, and another approach is used to set the management objectives.
  - A total of 18 countries set management objectives to address the WFD; 13 countries set them to address the MSFD; 12 countries set them to address the NiD; 10 countries set them to address the UWWTD and five countries set them to address other policies.
  - Two countries have not set management objectives for nutrients and provided an explanation for the reasons for this. In both cases these countries do not experience issues with eutrophication in coastal waters and therefore do not set management objectives for addressing this.

- For marine waters:
  - Nine countries have set management objectives for nutrients for all nutrient polluted marine assessment units. Two countries have set management objectives for nutrients for some nutrient polluted assessment units. Three countries have not set management objectives for nutrients for assessment units.
  - A total of 12 countries provided information on their management objectives for nutrients in marine waters.
  - When setting management objectives for nutrients in marine waters, 10 countries focus on reducing both phosphorus and nitrogen, one country focuses only on nitrogen reduction, no countries focus only on phosphorus and no countries focus on reduction of the limiting nutrient.
  - In relation to the methods used for setting management objectives for nutrients in marine waters, seven countries use modelling based on nutrients vs BQE-response relationships; six countries use historical information; three countries use expert judgement and two countries use other methods.
  - Six countries do determine the maximum critical load or a load reduction target that is compatible with good status for nutrient sensitive BQEs. Seven countries do not do this.
  - A total of 12 countries use a relationship between the management objectives set for nutrients and the criteria for descriptor 5 of the MSFD. One country does not use a relationship between the management objectives set for nutrients and the criteria for descriptor 5 of the MSFD.
  - A total of 13 countries set management objectives to address the MSFD; 10 countries set them to address the Regional Seas Conventions and one country sets them to address other policies.
  - Six countries have not set management objectives for nutrients in marine waters and provided an explanation for the reasons for this.

Part B of the questionnaire addressed the methods used to calculate current nutrient loads. Nutrient loads are defined as the amount of nutrients (e.g. in kg or tons) entering into a river from the catchment or entering a lake or a transitional or coastal water body from the inlet rivers. It is normally estimated by models or by monitoring data using the product of nutrient concentrations and water discharge. The responses to Part B indicate that:

- A total of 21 countries do calculate current nutrient loads in order to achieve management objectives for nutrients. In contrast, six countries do not calculate current nutrient loads in order to achieve management objectives for nutrients.
  - Of the countries that do calculate current nutrient loads five of them calculate loads from monitoring of nutrient concentrations multiplied with flow in the inflows to the water body; eight of them calculate loads from estimates of emissions from different sources; 13 use both these approaches and six countries use other approaches.
- A total of 19 countries use catchment models that quantify the nutrient emissions/nutrient losses to surface waters. All 19 countries included a description of their models and 16 of those provided information on how uncertainty is addressed. Of these, eight countries use models operating at catchment level, 10 at sub-catchment level, 10 at water body level and eight at specific spatial units. Seven countries do not use catchment models that quantify the nutrient emissions/nutrient losses to surface waters.

Part C of the questionnaire addressed the methods used to achieve the management objectives for nutrients. The responses to Part C indicate that:

- For lakes, a total of 14 countries decide that nutrient reduction is necessary when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs). A total of 15 countries decide it is necessary when a water body is classified failing good status according to nutrient good/moderate boundaries. A total of 11 countries decide it is necessary when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients. Six countries decide it is necessary for when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle). Five countries decide it is necessary when downstream water bodies fail to reach good status due to nutrient pollution. Seven countries decide it is necessary at another point.

- For rivers, 13 countries decide nutrient reduction is necessary when a water body is classified as failing good status according to nutrient-sensitive-BQEs. A total of 19 countries decide it is necessary when a water body is classified failing good status according to nutrient good/moderate boundaries. Eight countries decide it is necessary when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients. Seven countries decide it is necessary when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle). Eight countries decide it is necessary when downstream water bodies fail to reach good status due to nutrient pollution. Nine countries decide it is necessary at another point.

- For transitional waters, nine countries decide nutrient reduction is necessary when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs). A total of 10 countries decide it is necessary when a water body is classified failing good status according to nutrient good/moderate boundaries. Six countries decide it is necessary when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients. Four countries decide it is necessary when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle). Five countries decide it is necessary when downstream water bodies fail to reach good status due to nutrient pollution. Four countries decide it is necessary at another point.

- For coastal waters, 10 countries decide nutrient reduction is necessary when a water body is classified as failing good status according to nutrient-sensitive-biological quality elements (BQEs). A total of 10 countries decide it is necessary when a water body is classified failing good status according to nutrient good/moderate boundaries. Eight countries decide it is necessary when a water body is classified as failing good status according to both nutrient-sensitive-BQEs and nutrients. Three countries decide it is necessary when a water body is classified as good status for nutrient-sensitive BQEs, but deteriorating towards moderate due to increasing pressures or impacts (precautionary principle). Six countries decide it is necessary when downstream water bodies fail to reach good status due to nutrient pollution. Five countries decide it is necessary at another point.

- For marine waters, eight countries decide nutrient reduction is necessary when the integrated assessment for MSFD descriptor 5 fails to achieve good status. Eight countries decide it is necessary when criterion D5C1 “nutrient concentrations” fails to achieve good status. Six countries decide it is necessary when nutrient inputs are increasing. Five countries decide it is necessary at another point.

- A total of 23 countries are undertaking pollution accounting to identify the sources of nutrient pollution. Of these countries, all 23 include urban waste water as a point source, 20 countries include wastewater from scattered dwellings as a point source, 23 countries include industrial discharges as a point source, six countries include manure dumps as a point source and nine include other point sources. Further, 22 countries include agriculture as a diffuse source, 10 include forestry as a diffuse source,14 include atmospheric deposition as a diffuse source and 11 include other diffuse sources. A total of 22 of the 23 countries described their pollution accounting methodology. Two countries are not undertaking pollution accounting to identify the sources of nutrient pollution.

- In relation to the criteria that countries consider when selecting which measures to implement in order to reduce nutrient inputs, 21 countries consider the cost-efficiency of measures; 17 countries consider the effectiveness of measures (e.g. % of total load reduction needed); 18 countries consider the feasibility of the implementation of measures in the different sectors; three countries consider the costs alone; 11 countries consider political priorities; and six countries have other criteria and considerations.
- Countries were asked whether past policy measures such as a focus on urban waste water treatment plants as opposed to diffuse pollution from agriculture taken into account when planning new measures, e.g. trying to achieve a fair sharing of the nutrient reductions between different sectors according to a pollution account. A total of 18 countries responded that past policy measures are taken into account when planning new measures and eight countries responded that past policy measures are not taken into account.
- A total of 15 countries take into account the response of the ecosystem to reduced nutrient inputs when planning new measures. In contrast, 11 countries do not take into account the response of the ecosystem.
- A total of 19 countries estimate the effect of measures on the reduction of the nutrient load or concentration in water. Eight countries do not do this.
- A total of 17 countries have mechanisms for managing management objectives for nutrients across political boundaries. Nine countries responded do not have such mechanisms in place.
- A total of 15 countries consider climate change impacts on nutrient emissions and/or on biological quality elements/MSFD criterion responses to nutrients when planning the nutrient reduction measures. In contrast, 12 countries do not consider this.
- A total of 22 countries responded that they do consider nature-based solutions (restoring riparian zones, wetlands, flood plains etc.) when planning the nutrient reduction measures. Five countries do not consider this.
- A total of 16 countries consider technical/biological manipulative solutions (removal of nutrient-rich sediment, oxygenation of bottom water, adding chemicals to the sediment to bind phosphorus, extractive aquaculture using mussels or seaweeds, management fisheries) when planning the nutrient reduction measures. In contrast, 11 countries do not consider this.

Appendix A
Country Acronyms

Country	Acronym
Belgium	BE
Belgium Brussels	BE-Br
Belgium Flanders	BE-Fl
Belgium Wallonia	BE-Wa
Bulgaria	BG
Czechia	CZ
Denmark	DK
Germany	DE
Estonia	EE
Ireland	IE
Greece	EL
Spain	ES
France	FR
Italy	IT
Cyprus	CY
Latvia	LV
Lithuania	LT
Hungary	HU
Netherlands	NL
Austria	AT
Poland	PL
Portugal	PT
Romania	RO
Slovakia	SK

Country	Acronym
Finland	FI
Sweden	SE
Iceland	IS
Norway	NO
Turkey	TR

Appendix B
Nutrient Questionnaire Compiled Responses

See accompanying Excel Workbook.