“Comparison of European nutrient boundaries for rivers, lakes, transitional, coastal and marine waters”

Issue paper in preparation of the Ecostat workshop of 18th to 19th of November 2015

1 Introduction

The central aim of the EU Water Framework Directive (WFD) is to achieve “good ecological status” (Art. 4 WFD) for all European surface and ground waters. Nutrient concentrations are only used as supportive physicochemical quality elements in the assessment of the ecological status. The role of the general physicochemical quality elements in the ecological classification of good and moderate status is set out in the EU CIS Guidance Document No. 13 Chapter 4, while the role of nutrients as supporting elements for the assessment of eutrophication is set out in the CIS Guidance Document No. 23.

Under the Marine Strategy Framework Directive (MSFD), nutrient concentrations are not just supportive parameters but indicators that are of equal importance as the biological indicators. Nutrient boundaries set for the WFD and MSFD should ideally match, since the rivers represent a primary pathway of nutrients into the sea and nutrients entering via rivers are diluted along the salinity gradients. Setting consistent nutrient boundaries for the WFD and MSFD is therefore important for a consistent management approach of transitional, coastal and marine waters.

Based on basic data on nutrients that MS reported to WISE in 2010, major differences have been identified. The Working Group on Ecological Status (ECOSTAT), as part of the Common Implementation Strategy for the WFD and MSFD, agreed to address the topic of wide variations in the nutrient concentration boundaries set by the MS. In February 2013, a workshop in Birmingham was held to further explore these variations. At the working group meeting in Madrid, DE and the UK agreed to take the issue forward. To this end, in March 2014 two questionnaires, one for freshwater and one for saline waters, were developed and sent to the Member States focusing on nutrient boundaries for reference conditions and good/moderate status and methods used to derive these boundaries.

At the spring 2014 ECOSTAT meeting it was agreed to proceed with the further work on Member states nutrient classifications (accepted at SCG meeting May 2014). This work is needed for the following reasons:

- Previous work had demonstrated a large degree of discrepancy between the nutrient boundary values set in the MS;
- There are also too large differences in the approaches used to determine the standards and in the way the values were used by MS;
- Correspondence between nutrient boundaries and good ecological status boundaries in related biological methods are missing / unclear.

So far, the following work has been carried out within ECOSTAT nutrient activity:

- Information collected from MS on nutrient boundaries and methods how these boundaries are set and used in ecological assessment;
- Reports on comparison of nutrient boundaries drafted – for inland waters and for saline waters;
- Pressure-response report drafted with proposals of approaches how to set nutrient boundaries using pressure-response relationships and how to check the correspondence of the MS boundaries to established “good” status boundaries.

This work is also included as one of the priorities of the CIS Work Programme 2016-2018 for WG ECOSTAT (SCG meeting November 2015):

- the overall aim is “continuation of the work on nutrients, establishment of consistent and comparable boundaries”;
- deliverables include “Technical report on the harmonisation of nutrients standards” and “Best practice on the use of supporting elements for the assessment of ecological status (hydromorphology and physico-chemical parameters)”

2 Aims of the workshop

This workshop aims to discuss with the MS experts the work done so far and set the way forward to reach the objectives of the nutrient work in the context of the CIS Work programme 2016-2018.

1. To discuss **the comparison of the nutrient boundaries** and **the methods to derive and apply nutrient boundaries** and to understand the reasons for the current range of nutrient boundary values that are used by different countries to support “good ecological status”;

2. To discuss / agree on approaches **how to set nutrient boundaries using pressure-response relationships.** These approaches can be used also **to check** whether MS nutrient boundaries support “good” biology according to the pressure-response relationships. The work on pressure – response relationship has provided first results (proposal of approaches to boundary setting and their correspondence checking) which will be discussed during the workshop.

3. To draw conclusion and to decide on the way forward how to reach the objectives stated in the work programme (see above).

3 General remarks

This issue note is based on three separate reports prepared for the ECOSTAT working group, one on freshwater (rivers and lakes), one on saline waters (transitional, coastal and marine) and one on pressure-response relationships (for lakes and rivers).

For freshwaters, 28 MS submitted questionnaires, while MT reported that their nutrient boundaries were still in development. For lakes all except BE (W), LU and SL (which have no lakes) provided information on nutrient boundary values. For rivers DK and SI were unable to provide values for their nutrient boundaries. In most cases a link could be made between national types and broad types, but this was not possible for ES (lakes and rivers) and GR (rivers).

As of October 2015, for saline waters 22 MS submitted questionnaires (excluding ES and MT) and 21 MS submitted Excel spreadsheets (excluding DK, NL and MT) detailing information on nutrient boundaries for transitional, coastal and marine waters to define good/moderate and reference conditions. Not all MS have designated transitional waters: DE DK, EE, FI in the Baltic and CY and SI in the Mediterranean. Furthermore, not all MS submitted data for all three saline water categories or only submitted information regarding good/moderate status. Finally, not all MS have reported common types, but often only national types. These gaps in data have made it difficult to discern meaningful conclusions and also highlight the need for a more coherent approach.

4 Comparison of European freshwater and saline water nutrient boundaries and their application (Session 1)

4.1 Key findings of the report on freshwater

To compare boundary values it is important to compare similar lake and river types, so the reported national typologies were matched to the recently developed broad typology. For lakes 73% of records were matched, for rivers 78%.

Comparisons were reported for the nutrient parameters where sufficient numbers of boundary values were reported: total phosphorus and total nitrogen for lakes, and total phosphorus, total nitrogen and nitrate nitrogen for rivers. Comparisons were not made for ammonium or nitrite nitrogen, as they were not considered to be substances which contribute significantly to eutrophication, their mode of action being via toxicity to fish and invertebrates.

There are a number of factors that make direct comparison of nutrient boundaries between Member States difficult – these include the distribution of different river and lake types, the use of different summary statistics, different laboratory analytical techniques and determinants, and different methodological approaches to establishing boundary values. In addition, some MS have set site-specific boundaries, some type-specific, and in some cases some have used generic boundary values for all types.

It is very difficult to reliably allow for type-specific differences when comparing nutrient boundary values. However, the overall impression gained from the information provided for both nitrogen and phosphorus in rivers and lakes is that the boundary values in use for lakes are more comparable than for rivers, and the values for phosphorus are more comparable than those for nitrogen.

For lakes there is a strong scientific literature relating phosphorus concentrations to the eutrophication response, and it is not surprising that boundary values for phosphorus are less variable than for rivers. The understanding of the eutrophication response in rivers is less well developed, and it is suggested that this is reflected in the wider variation between Member States in the boundary values used.

The least comparable boundaries were for nitrogen, particularly in rivers. Several Member States reported values for nitrate nitrogen that appear to be linked to guideline values from the repealed Drinking Water Directive (80/778/EC) and Surface Water Abstraction Directive (75/440/EC). These are unlikely to be linked to supporting ecological status. Other Member States reported lower values for nitrate, or values for total nitrogen, although these still covered a relatively large range of concentrations.

In general, for both rivers and lakes, lower values were reported where modelling or regression methods were used to establish boundary values. The highest values were reported when statistical distributions of the nutrient concentrations from all water bodies were used to set the boundary values, or they were set by expert judgement.

For lakes, the majority of Member States use a mean or median as a summary metric, but for rivers and particularly for nitrogen, upper percentile values are used. In most cases there is no clear explanation, although France report that a maximum is used to detect the most unfavourable situation. For soluble nutrients such as nitrate an upper percentile may reflect winter concentration when applied to annual data, and thus be a better indication of annual available nitrogen load. However, upper percentiles have much higher uncertainty and are thus likely to be less appropriate as a metric to support ecological status.

Reasons for differences in nutrient boundary values

There are many potential reasons for differences in boundary values, but they can be split into three major groups each of which can be further sub divided:

1. True or perceived differences in relationships between ecological status and nutrients due to factors such as:-

- Different natural conditions – typology
- Responses to nutrients by different BQEs – sensitivity

2. Differences in methods used to establish values, for example two broad categories
   - Empirical relationships between nutrients and ecological status, regression pressure response models and the use of categorical relationships where data are grouped by ecological classifications. In both cases data use intercalibrated biological G/M boundary values.
   - Expert judgement, informed by ecological knowledge or the division of pressure gradients into 3 or more potentially arbitrary categories.
   - Differences in the uncertainty of relationships and the way that these are interpreted and subsequently used.

All of these need further discussion, but we suggest that the last point is particularly important.

What does the WFD and CIS Guidance say?

As a preliminary to this discussion it is useful to reflect on the purpose of the supporting element boundary values as set out in the WFD. To achieve good ecological status, the WFD specifies that "*nutrient concentrations do not exceed the levels established so as to ensure the functioning of the ecosystem and the achievement of the values specified for the biological quality elements*" (WFD Annex V, Section 1.2). The "levels" or boundary values are used during the classification of good ecological status and the Classification Guidance (European Commission 2005) makes it clear that the worst of either the supporting element class or biological class should be used to establish status, the "one out all out" principle.

The classification guidance also describes a checking procedure that can be used to "*ensure that the type-specific values established for the general physicochemical quality elements are* ***no more or no less stringent*** *than required by the WFD, and hence do not cause water bodies to be wrongly downgraded to moderate ecological status or potential*". Thus it is clear from this guidance that boundary values need to be established at levels that do not cause water bodies to be wrongly downgraded to moderate status. Given the complexity of natural systems, with many factors influencing ecological status, it is difficult to establish nutrient boundary values that are high enough to prevent water bodies to be wrongly downgraded, but that are also low enough to ensure good status is achieved in the majority.

For example if a regression analysis is used (Figure 1) boundary values can be determined from the fitted regression line or from an upper/lower line which takes into account uncertainty in the relationship. The use of the upper line minimises the risk of a water body being wrongly downgraded (Figure 1b), the lower line is more protective but will result in more water bodies being wrongly downgraded (Figure 1c). The use of the regression (Figure 1a) provides a value with the lowest mismatch.

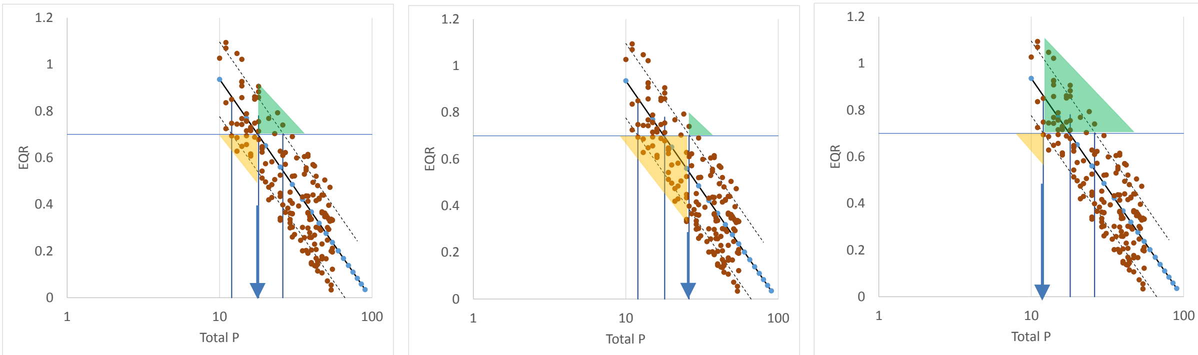

Figure 1 Hypothetical relationship between total phosphorus and biological EQR, showing regression line with confidence intervals (dotted lines). Horizontal line shows the biological good/moderate boundary, vertical lines show intersection with regression line ± confidence intervals marking potential good/moderate boundary values for total phosphorus. Triangles mark areas where classification mismatches occur, green (biology Good but phosphorus Moderate) and yellow (biology Moderate or worse but phosphorus Good) using 3 different approaches for interpretation.

How are boundaries used and how is uncertainty dealt with?

At the previous workshop in Birmingham (February 2013) we reached the tentative conclusion that some countries were selecting higher levels for the nutrient boundary to be more certain that, when the value was exceeded, the biology would not be at Good status. In these cases, when the value was exceeded, actions via a programme of measures were normally taken. In contrast countries which established precautionary (lower) boundary values would expect to check that for a particular water body a BQE was also failing prior to taking actions, or that there was other evidence that it might do so in the future (for example evidence of increasing nutrients). It was less clear from the Birmingham workshop how classification, rather than action, was reported given the clear requirement to classify using the worst quality element. We hoped to obtain more information about this using the questionnaire circulated to nutrient experts in 2014, but insufficient information was provided concerning this issue and more discussion on the topic is needed in Berlin.

The differences in boundary values become more pronounced where pressure response relationships are weaker, as for example in rivers (these relationships are explored in more detail in the separate report on pressure-response relationships). In rivers many more factors other than nutrients influence biological status and as a result relationships between nutrient concentration and biological status have much higher uncertainty. In these cases a scatter plot may show a "wedge" type relationship to which an upper quantile line can be fitted which provides an estimate of the highest level of nutrient that is consistent with good status (Figure 2). Although this is an extreme example it illustrates the difficulty of identifying an appropriate boundary value where multiple pressures exist and this is an issue we should discuss, particularly in relation to rivers.

When using upper quantiles or confidence limits to establish boundary values it is also important to consider whether they meet the requirement of paragraph 4.6 in the Classification Guidance (European Commission 2005) that they should be as ecologically current scientific knowledge permits.

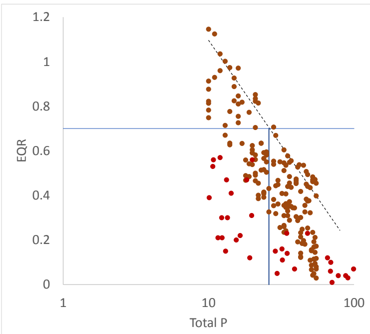

Figure 2 Hypothetical relationship between total phosphorus and biological EQR where multiple pressures occur, showing regression of upper quantile value (e.g. 95th percentile). Horizontal line shows the biological good/moderate boundary, vertical lines show intersection with line marking potential good/moderate boundary values for total phosphorus.

This link to the way that the boundary values are used cannot be ignored and may not be an issue that our workshop can resolve. However it is suggested that it is helpful to acknowledge that there are different ways of interpreting uncertainty.

It seems likely that previous guidance, for example on Eutrophication (European Commission 2009), assumed that uncertainty would be minimised if type specific boundaries were established. It was acknowledged that initially data would be limited and thus contribute to increased uncertainty. However, it may be that uncertainty will remain high due to the complexity of ecological systems. We should thus discuss the potential reasons for uncertainty and methods of reducing this. Would a common approach to analysis of national data be helpful, would combining data sets across countries reduce uncertainty and allow us to establish if country differences are the result of random differences?

Aims for the workshop

One important aim of the workshop is to clarify the relative importance of the following factors in accounting for differences in current boundary values:

1. Approach to interpretation of empirical data and use of the boundary values for management
2. Random effect of small data sets
3. Use of a Broad typology that covers too wide a range of natural conditions
4. Multiple pressures contributing to high uncertainty.

From this we should be in a position to identify further steps for this work.

4.2 Questions for discussion for freshwater (Session 1, Working Group 1a)

- What are the most important reasons for the differences in MS boundary values?
- How should we compare type-specific with site-specific approaches?
- Are the measured parameters an important factor (i.e. soluble or total nutrients)?
- Why are rivers more variable than lakes?
- Why are nitrogen values more variable than phosphorus?

4.3 Key findings of the report on saline waters

In general there was a large heterogeneity in the nutrient parameters assessed by MS, while some assessed the dissolved nutrients (inorganic nitrogen, phosphate) others assessed total nutrients (total nitrogen, total phosphorus). In addition, the assessment time (summer, winter or all year round) varied between MS. Lastly, there were also differences in the statistic used for the assessment (mean, median or 90^{th} percentile). These described differences were observed between MS, as well as within the four marine ecoregions according the MSFD and even within MS between transitional, coastal and marine waters.

The large heterogeneity seriously hampered a comparison of the nutrient boundaries for reference conditions and good/moderate status within a marine ecoregion. Comparison was also hampered by some MS providing no or incomplete nutrient boundaries or nutrient boundaries without units. In particular for reference conditions there is a considerable lack of information. No analysis could be carried out comparing the common types within the marine ecoregions because only very few MS reported these and it was not possible to assign these types based on the sparse information provided by MS. Of the few comparisons that could be made within regions the following conclusions were drawn:

- Baltic Sea
  - Transitional waters: The G/M boundaries of TN and TP used by Lithuania in transitional waters showed a broad range (TN: 0,25 mg/l – 1,08 mg/l; TP: 26-80 µg/l) compared to the G/M boundaries used by Poland and Sweden.

  - Coastal waters: For TN and TP a comparison of the G/M boundaries could be made between five MS (EE, FI, LT, PL,SE). LT only used one boundary while the other MS have defined several boundaries for their coastal waters that showed a wide range (TN: 0,20-1,0mg/l; TP: 7-38µg/l). For TN some of the G/M boundaries Sweden has set were much higher than the boundaries of the other four MS. For TP Poland has generally set the highest G/M boundaries.

  - Marine waters: A comparison was possible for the G/M boundaries of the dissolved nutrients between five MS (DE, LV, LT, PL, SE). G/M boundaries for inorganic nitrogen varied between 0,05-0,18 mg/l and for phosphate between 20-24 µg/l. PL and LV were for both nutrients the MS that have set the highest nutrient boundaries. It was also evident that for example the G/M boundaries for inorganic nitrogen reported by MS differed from the ones used under HELCOM and these boundaries were all higher (less ambitious) than the ones agreed in HELCOM.

- Black Sea
  - Transitional waters: no comparison between BG and RO can be made in the Black Sea, as both countries use different parameters, methods and time periods for defining G/M boundaries for transitional waters.
  - Coastal waters: For defining G/M conditions, comparisons are difficult: although both BG and RO assess phosphate, they use different methods and assess during different times.
  - Marine waters: Comparisons on G/M conditions are difficult as while both MS assess phosphate, BG assesses in spring and summer (method is unknown) and RO assesses year-round. BG does not assess DIN.

- Mediterranean Sea
  - Transitional waters: Only EL and HR provided information regarding transitional waters in the Mediterranean. No comparisons are possible as despite both countries assessing phosphate, they use different methods.
  - Coastal waters: No comparison is possible. The most frequently assessed parameter is phosphate (5 out of the 6 MS reporting) but while 3 MS use mean the others used median and 90th percentile, making it difficult to draw parallels. Only HR and IT assess total phosphorus but use different methods. 3 MS (CY, EL and ES) assess nitrate year round and assess the data using mean methods.
  - Marine waters: Only 3 out of 9 MS reported data so a meaningful conclusion is not possible. All three MS assess phosphate but it is unknown at what time of year ES carries out its assessment. While HR and SI use 90th percentile as a method for assessing data, ES uses mean. All three MS assess nitrate but again, while HR and SI use maximum as the assessment method, ES uses mean.

- North East Atlantic Sea
    - Transitional waters: No comparison is possible. MS within the regional sea assess different parameters and use different methods for assessing the same parameter.
    - Coastal waters: A comparison was possible for the G/M boundaries of the dissolved nutrients among nine MS (BE, F, DE, IE, NL, NO, ES, SE, UK). G/M boundaries for DIN varied between 0,05-0,61 mg/l. Values for BE, IE, NO, ES are taken from Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area (Reference number: 2013-8). Please note that the metrics behind these values are not always clear
    - Marine waters: Only 6 MS reported data for G/M boundaries. DE, IE, SE, and the UK assess DIN in the winter and assess the data using mean methods (except IE uses median). DIN values for DE, SE and UK range from 0,049 mg /l (Sweden) to 0,24 mg/l (Germany).

Most often a mixture of approaches was used to set nutrient reference conditions and G/M boundaries, and while expert judgment played an important role, it was predominantly used in combination with other, more quantitative approaches (use of existing sites with minor disturbance, historical data and information, modelling). As a basis for deriving reference conditions MS have predominantly used historic riverine nutrient inputs or historic nutrient concentrations. These have been interpolated along salinity gradients into the open sea using mixing diagrams. The further the historic nutrient concentrations go back in time the more they were derived by modelling rather than looking at time-series of in-situ data. With respect to the historic conditions, it is interesting that even within a region and between neighbouring MS there have been very different historic years used to base reference conditions upon (e.g. 1880, 1900, 1930, 1950s, 1960s). While this might be due to data availability, it also appears that there are very different notions among MS of what constitutes water quality conditions not yet affected by eutrophication. Those MS that have not used the approach described above have mainly relied on deriving nutrient concentrations from recent sites considered to be unpolluted or have relied on pressure-response relationships between biological quality elements (predominantly chlorophyll-a) and nutrients.

G/M boundaries have often been derived by adding an "acceptable deviation" (mostly of 50%) to the reference conditions. In particular in the Baltic Sea and North-East Atlantic this approach was chosen. It shows that setting reference conditions is the main anchor point for deriving G/M boundaries.

In terms of the role of the general physicochemical quality elements in the ecological classification of good and moderate status, Member States have largely developed different approaches to dealing with the inevitable differences between classifications derived from nutrient sensitive biological quality elements and the supporting nutrient standard.

A key aspect here is how the assessment of nutrient concentrations affects the classification of the overall ecological status and how this factors into the consideration of measures if there is a mis-match of classification for biology and nutrients. Most MS apply the one out all out principle in a very strict way in that if any of the biological quality elements sensitive to nutrients are not in good status or nutrient concentrations are not good, the water body is classified as being not in good status. 6 MS (coastal waters) and 3 MS (transitional waters) allow a water body with nutrients in poor status but with good biological quality elements to be classified as good status.

4.4 Questions for discussion for saline waters (Session 1, Working Group 1b)

Questions relating to nutrient boundary values

- Why is there such a large variety of nutrient parameters used by MS? Are there ecological reasons why dissolved nutrients or total nutrients are assessed or is this mainly driven by monitoring practicalities or cost efficiency (monitoring frequency of dissolved nutrients is less than for total nutrients)?
- Is there a possibility to agree on a key set of suitable nutrient parameters at least within a region?
- Could a general agreement be reached that total nutrients are important parameters to describe eutrophication effects since they can be used for calculating nutrient budgets and they are generally more robust (more measurements are generally collected, less affected by climate change)?
- Why are some MS using different nutrient parameters (e.g. TN or inorganic nitrogen) in transitional, coastal and marine waters? Does this support nutrient management?
- What are reasons for diverging from the general pattern of monitoring total nutrients all year round and dissolved nutrients in winter?
- What are the reasons for using different statistics (mean, 90^{th} percentile etc.) when assessing nutrients?
- Why did some MS not report on reference conditions and G/M boundaries for nutrients? Were these not set or were they just not reported?
- Of the few comparisons that could be made within a region, is there an explanation for the observed outliers?
- Why do some MS – despite being Contracting Parties of HELCOM/OSPAR, not use the nutrient boundaries agreed and used in HELCOM and OSPAR?
- Why did most MS not report on the common types?

Questions relating to the methods used to set nutrient boundary values

- What are the reasons for using different approaches in deriving reference conditions (e.g. very different historic year) and G/M boundaries (e.g. sometimes >50% "acceptable deviation")? Is it possible to agree on a more harmonized approach, at least regionally?

Questions relating to the application of nutrient boundaries

- How are nutrient boundaries used in the assessment of ecological status? Purely as supporting parameters? Do they have any legal status and if so, to what extent? Do they drive measures?
- Where there is a mismatch of classification for biology and nutrients, how does the assessment of nutrient concentrations affect the classification of the overall ecological status and vice versa?
- Do the characteristics of the nutrient boundaries set affect their use in the assessment of ecological status? If yes, how?

5 Analysis of pressure-response relationships (Session 2)

5.1 Key findings of the report on pressure-response relationships

The aim of this work was to provide approaches how to set nutrient boundaries using pressure-response relationships. These approaches can be used also to check whether MS nutrient boundaries support “good” biology according to the pressure-response relationships. The work provided first results which need to be discussed and approved by the workshops. The main points are summarised below:

- The Water Framework Directive requires nutrient boundary concentrations to be established as part of the assessment of ecological status. In this report we use data and relationships developed during the intercalibration exercise for lakes and national monitoring data for rivers to determine ranges of potential nutrient (N & P) boundary concentrations at the intercalibrated boundaries for high/good and good/moderate biological status.

- Where data were available we compared the use of different regression models, including multivariate (N+P), and both type I and type II univariate (N or P) models. We suggest that the most appropriate statistical approach for univariate relationships is to use type II regression, as the slope of a conventional ordinary least squares regression is likely to be underestimated unless model uncertainty is low, resulting in incorrect predicted boundary values.

- We also used two categorical methods to determine boundary values. Firstly, we calculated the distribution of mean nutrient concentrations for water bodies categorised by biological status. Secondly, we developed a method to determine the nutrient concentration at which the mis-match between biological and nutrient status was minimised. Both methods produced boundary values that were similar to those from regression models.

- We compiled the results from all of these approaches, together with uncertainty estimates, to provide ranges for the “most likely” and “possible” ranges of boundary values for intercalibration and broad water body types.

- For many relationships, particularly in rivers, uncertainty was relatively high, with nutrient concentration typically accounting for only 35-45% of variability. As a result of this uncertainty the range of boundary values that might be predicted if a different, but similar (for example water body type) data set were used was relatively high.

- We were only able to use data or published relationships from a limited range of lake and river intercalibration types, but comparing the resulting boundary values to those currently being used by Member States, we demonstrate that in most cases the majority of national boundary values fall within the range of predicted values if uncertainty is taken into consideration.

- Given the high degree of variability in the relationships between nutrients and biological status we suggest that further discussion and guidance is needed on how they can be used to support the objectives of the WFD as it is clear that even for well-defined water body types a range of values occur in water bodies that are considered to be in good status according to the most sensitive biological quality element.

5.2. Key findings of the report on saline waters

Only a few MS have established a pressure-response relationship with biological QE. This analysis has mainly been carried out in coastal waters (17 MS), followed by transitional waters (8 MS) and marine waters (8 MS). The quality element (QE) mostly used for establishing a pressure-response relationship in transitional, coastal and marine water is phytoplankton. QE Fish is not used at all. Multiple QE have been used in analysing transitional waters in BG, IT and UK, the same for coastal waters in BG, IT, RO, UK, DK. In the case of marine waters none of the MS used more than one QE.

5.3. Questions for discussion (Working Groups 2a and 2b)

Part 1: Relating to pressure-response relationships in general and approaches used by MS

- What kind of pressure-response relationships were used?
- Does this differ between freshwater and saline waters?
- Why do the majority of MS not establish a pressure-response relationship? Is the monitoring system not set up to glean the necessary data?
- If pressure-response relationships were used, how can the results be interpreted?
- How to deal with uncertainty, particularly for rivers?

Part 2: Relating specifically to the findings of the report on pressure-response relationships

- What is the opinion of the participants on the approaches proposed in the report?
- Can these approaches be used to set nutrient boundaries to “good” biological boundaries?
- Can these approaches be used to check the correspondence of the MS boundaries to “good” biological boundaries?
- Should this work be transferred to coastal, transitional and marine waters and if yes, how?

Working groups 2a and 2b will discuss both, part 1 and part 2.

6 How to align or relate nutrient boundaries for different water categories in order to allow for a consistent management approach (Session 3)

6.1 Key findings of the report on saline waters

Ideally the boundaries set for all three types of sea waters and the ones for inland waters should be related to each other, in a way that the nutrient concentrations in rivers and lakes allow for the achievement of "good status" in coastal and marine waters. However, most often MS have not chosen to compare the same parameters or use the same methods for all three saline water categories, so a relation is quite difficult to make.

In the Baltic Sea, Sweden assesses DIN in summer and winter using mean methods in all three water types; Germany assesses total nitrogen year round using median methods for coastal and marine waters (transitional were not defined). The rest of the MS either assess different parameters or monitor the parameters at different times of the year. The situation as regards phosphorus parameters is very similar.

The N and P parameters used are consistent for 2 types of waters in LV (coastal and marine waters for N and P), LT and PL (transitional and coastal waters for P and N). For SE and DE, in a second step the ranges of G/M boundaries set from transitional to marine waters have been analysed.

In the Black Sea the situation is not clear as RO has just reported that they assess biannually but the metrics behind is unclear. BG has no common approach and the metrics for coastal waters is unclear.

In the Mediterranean Sea, while Croatia assesses DIN in transitional and coastal waters year-round using median methods, it assesses nitrate using maximum values based on multi-year data. Greece and Spain takes the same approach for nitrate in transitional and coastal waters. For P-parameters, Croatia assesses TP and phosphate the same way for transitional and coastal waters, but only assesses phosphate in marine waters and uses different methods. Greece and Spain assess phosphate the same way in transitional and coastal waters. The N and P parameters used are consistent for 2 types of waters in ES and HR (coastal and marine waters for N and P). In a second step the ranges of G/M boundaries (transitional to marine waters) set in HR and SI for phosphate have been analysed.

In the North East Atlantic, only DE provides a consistent set of parameters for N and P in all three waters. The UK has a consistent set of parameters for N for all three saline water categories. The N and P parameters used are consistent for 2 categories of waters in BE (coastal and marine waters for N and P), IE (transitional and coastal waters for P; coastal and marine waters for N) and SE and PT (transitional and for N and P).

DE has set a specific "management target value" as a nitrogen concentration at the boundary of freshwater/marine (2,8mg/l for German rivers entering the North Sea and 2,6mg/l for rivers entering the Baltic Sea). This target value will enable the achievement of "good ecological status" of transitional and coastal waters under the WFD, of "good environmental status" of marine waters under the MSFD and for the Baltic Sea of the aims of the Baltic Sea Action Plan.

6.2 Questions for discussion (in plenary)

- Why have so few MS tried to relate nutrient boundaries set for freshwater with boundaries set for saline waters?
- How is a consistent management approach ensured if nutrient boundaries do not match or if different nutrient parameters are assessed in freshwater and in saline waters?
- Can best practice approaches on aligning nutrient boundaries for different water categories be identified?
- Is more research on this issue required and if yes, what does it need to address (e.g. coupling of catchment models with marine models)?