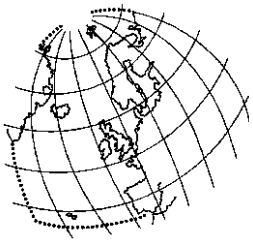
OSPAR CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE NORTH-EAST ATLANTIC



Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area

(Reference number: 2005-3)[1]

Preface

This document updates the guidance for the future application of the Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area ("the Common Procedure"), namely its "Comprehensive Procedure" (reference number: 1997-11). It compiles and develops all relevant existing arrangements with a view to the second application of, and the assessment report on, the Comprehensive Procedure in 2007/2008, and with a view to its use to other (maritime) areas and forums. The guidance includes experience gained by the Contracting Parties from the first application of the Comprehensive Procedure in 2002, considerations of synergies with the eutrophication assessment activity in the European Union, proposals on further developed harmonised assessment criteria and their assessment levels, elements of OSPAR agreement 2002-20, and arrangements to prepare for the second application of the Comprehensive Procedure and the related OSPAR 2008 integrated report, including proposals of future reporting years. This document supersedes OSPAR agreements, reference numbers 1997-11 and 2002-20.

This document defines a common procedure for the identification of the eutrophication status of the OSPAR maritime area (the "Common Procedure"). The Common Procedure is an integral part of the OSPAR Eutrophication Strategy. Action with respect to measures required following the identification of the eutrophication status of the maritime area are specified within the OSPAR Eutrophication Strategy.

The procedures specified in this document are without prejudice to existing and future legal requirements, including European Community legislation where appropriate.

[1] Supersedes agreements 1997-11 and 2002-20. Source: EUC 2005 Summary Record – EUC 05/13/1, Annex 5 as amended and endorsed by OSPAR 2005 Summary Record – OSPAR 05/21/1, §§ 6.2-6.5 and Annex 6.

Contents

1. Introduction and background

1.1 The objective of the OSPAR Eutrophication Strategy is to combat eutrophication in order to achieve and maintain a healthy marine environment where eutrophication does not occur. This should be achieved progressively by 2010, *inter alia*, by targeted measures and programmes adopted by OSPAR and other forums. The need for measures, the assessment of their effectiveness and, accordingly, the need of any further targeted OSPAR activities (measures, programmes, monitoring etc.) to achieve the goal set for 2010 require assessment and monitoring of the eutrophication status of OSPAR Convention waters. To this end, in 1997, OSPAR adopted the Common Procedure as a common framework for Contracting Parties to assess and to classify, in two phases, the eutrophication status of the OSPAR maritime area (reference number: 1997-11).

1.2 Contracting Parties have completed the first phase, the "Screening Procedure". Based on the screening results, OSPAR agreed in 2001 on those parts of the OSPAR maritime area to which the second phase, the "Comprehensive Procedure", was to be applied in 2002 (reference number: 2001-5).

1.3 To guide the Contracting Parties in the application of the Comprehensive Procedure, common harmonised assessment criteria, their assessment levels and the area classification were formally agreed by OSPAR 2002 (reference number: 2002-20*)* and refined by EUC 2002.

1.4 In 2003, following the first application of the Comprehensive Procedure by the Contracting Parties, OSPAR 2003 adopted the first integrated report on the eutrophication status of the OSPAR maritime area covering data from the years 1990-2001 (OSPAR 2003).

1.5 Based on this report, OSPAR agreed on work to update and improve the Common Procedure, in particular its Comprehensive Procedure, thereby taking account of the experiences gained by the Contracting Parties in the first application of the full cycle of the Common Procedure and the developments and agreements made since 1995 within the OSPAR framework and in other forums.

1.6 This guidance integrates existing arrangements for the Common Procedure (reference number: 1997-11) with those for the Comprehensive Procedure (reference number: 2002-20) and with the conclusions of the OSPAR 2003 integrated report (OSPAR 2003) in one document, thereby updating them for the future application of the Comprehensive Procedure to the OSPAR maritime area. This document is proposed to supersede OSPAR agreements, reference number 2002-20 and 1997-11. It is drafted with a view to its use to other (maritime) areas and in other forums and focuses on guidance for the application of the Comprehensive Procedure.

1.7 This guidance takes account of synergies and harmonisation with the EC Water Framework Directive (WFD)[2] which introduced a comprehensive ecological quality assessment of Community surface waters, including transitional and coastal waters up to one nautical mile from the baseline (chapter 8).

1.8 There might be a need for OSPAR to review the present guidance in the future, in the light of further mutual exchange of experience between OSPAR and the European Union on ongoing developments under the Water Framework Directive and emerging European Marine Strategy[3]. This includes

a. the WFD-typology which is considered to some degree in the overall classification in the Comprehensive Procedure;
b. the extension of parameters (e.g. composition and abundance of phytoplankton, and macrophyto- and macrozoobenthos) for the assessment procedure (step 1);
c. the scoring leading to an initial area classification (step 2);
d. the classification procedure, considering the level of confidence and precision; and,
e. the synchronizing of reporting.

2. Outline of the Common Procedure

2.1 It is the purpose of the Common Procedure to provide a means of establishing eutrophication status on a common basis. It aims at characterising maritime areas with regard to their eutrophication status as:

[2] Directive 2000/60/EC of the European Parliament and the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (hereinafter: the "Water Framework Directive" or "WFD").

[3] Cf. Communication from the Commission to the Council and the European Parliament COM(2002) 539 final of 2 October 2002 "Towards a Strategy to Protect and Preserve the Marine Environment".

a. problem areas if there is evidence of an undesirable disturbance to the marine ecosystem due to anthropogenic enrichment by nutrients;

b. potential problem areas if there are reasonable grounds for concern that the anthropogenic contribution of nutrients may be causing or may lead in time to an undesirable disturbance to the marine ecosystem due to elevated levels, trends and/or fluxes in such nutrients;

c. non-problem areas if there are no grounds for concern that anthropogenic enrichment by nutrients has disturbed or may in the future disturb the marine ecosystem.

2.2 It comprises two phases: an initial "broad brush" screening of selected maritime areas and an iterative comprehensive eutrophication assessment of those maritime areas which, by screening, have not been identified as obvious non-problem areas with regard to eutrophication.

2.3 The assessment and classification is supplemented by common monitoring and reporting arrangements to attain harmonised information on the eutrophication status of maritime areas.

a. The Screening Procedure

2.4 The Screening Procedure is a one-off process of screening selected maritime waters in order to identify those areas which are likely to be obvious non-problem areas with regard to eutrophication.

2.5 It was for the Contracting Parties to select areas for screening and to decide on their size. Yet, the size of the selected area was critical for the assessment result. Features which should be taken into account for the selection were the area's hydrodynamic characteristics and proximity to nutrient sources.

2.6 In the screening procedure, Contracting Parties were invited to obtain information to the extent possible for the following types of information, *inter alia*:

a. demographic/hydrodynamic/physical information
- demographic data: population and waste water treatment;
- agriculture and industry;
- hydrodynamic/physical features (for example fronts, upwelling, turbidity, flushing rates, residence times, water transport and currents);

b. optical observations
- relevant optical observations made by ship, aircraft or satellite (for example the presence of, or evidence to the contrary of, algal blooms or fish kills);

c. nutrient-related information
- voluntary data held by ICES, such as nutrient concentrations from international research cruises. ICES data are useful for screening large areas, but in coastal areas, fjords and small estuaries other data may be more appropriate (although such data may not be easily available);
- input data (for example, atmospheric inputs, riverine inputs or direct discharges);
- nutrient budgets (including the total nutrient component and the anthropogenic nutrient component);
- information from monitoring carried out under European Community Directives (where applicable).

b. The Comprehensive Procedure

2.7 The Comprehensive Procedure is to be applied to those areas not identified as non-problem areas in the Screening Procedure, including local areas located in wider non-problem areas, for their refined assessment and subsequent classification as non-problem, potential problem or problem areas with regard to eutrophication. It follows that the Comprehensive Procedure should be applied to any areas, including local areas, to which the Screening Procedure was not applied because they were not obvious non-problem areas.

2.8 The Comprehensive Procedure should be applied as soon as possible following the Screening Procedure in order to allow for immediate arrangements for appropriate monitoring activities and action programmes, namely with regard to potential problem and problem areas. The assessment may be applied as many times as necessary. Its repetition is of particular importance for areas classified as potential problem or problem areas in order to identify any changes in their eutrophication status (cf. § 3.2 of the Eutrophication Strategy (reference number: 2003-21)).

2.9 The Comprehensive Procedure consists of a set of qualitative assessment criteria which are linked to form a holistic assessment and area classification with respect to the eutrophication status of a given maritime area. The holistic approach is reflected in the selection and application of such common assessment parameters which reflect, once inter-linked, the main cause/effect relationships in the eutrophication process. These cause/effect linkages form the essence of the classification process as illustrated by a generic conceptual framework for all categories of surface waters (Figure 1).

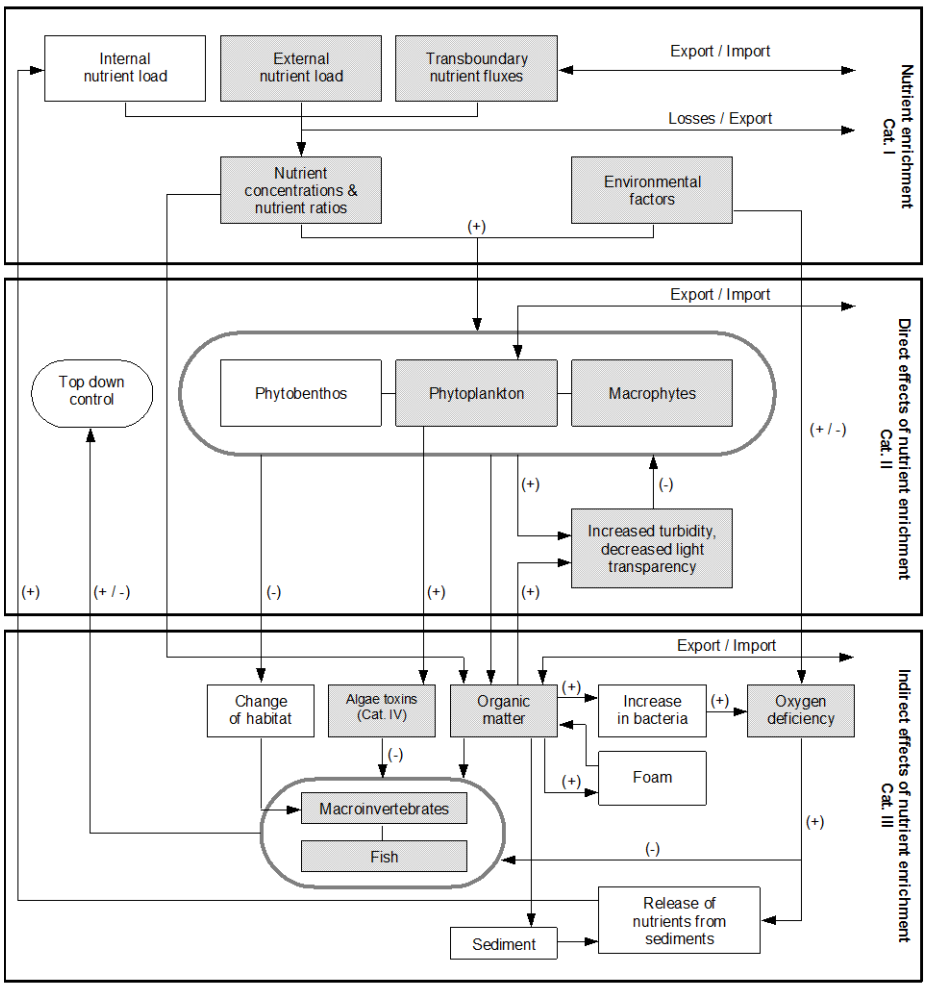


Figure 1. Generic conceptual framework to assess eutrophication in all categories of surface waters

Note: Shaded boxes indicate components relevant for the Comprehensive Procedure.
'+' indicate enhancement; '-' indicate reduction;

Cat. I = Category I. Degree of nutrient enrichment (causative factors);
Cat. II = Category II. Direct effects of nutrient enrichment;
Cat. III = Category III. Indirect effects of nutrient enrichment;
Cat. IV = Category IV. Other possible effects of nutrient enrichment.

2.10 Contracting Parties should divide their OSPAR waters into suitable assessment units based on the relevant physical features. This process of characterisation could be undertaken in accordance with the Annex II to the Water Framework Directive. Guidance on this typology is given in chapter 3.

2.11 Assessment and area classification in the Comprehensive Procedure is a three-step approach based on common methodologies, guidance on which is given in this document.

2.12 In a first step, assessment criteria and their corresponding area-specific assessment levels are set and applied for a given area based on a common methodology. The scores resulting from this application are reported in an agreed format.

2.13 In a second step, the scores attained in the first step are integrated to give an initial classification for the given area.

2.14 In the third step, an overall assessment of all relevant information relating to harmonised assessment criteria, their corresponding assessment levels and supporting environmental factors is made to give the final area classification.

2.15 The Contracting Parties are required to report on the assessment and classification process, including the requirements set out in chapter 6, for the parts of the OSPAR maritime areas under their jurisdiction in a harmonised way. This allows an integrated eutrophication assessment of the entire Convention area as basis for the development of targeted measures and programmes.

2.16 It follows that marine areas shall be monitored with regard to eutrophication in compliance with common minimum monitoring requirements as agreed, for the OSPAR Convention area, in the Eutrophication Monitoring Programme[4]. The risk of misinterpretation of the causes of direct and indirect effects should be reduced when all categories (nutrient enrichment, direct effect and indirect effects) as well as supporting environmental factors are monitored and assessed together (see further chapter 7).

3. Characterisation of the OSPAR Convention area

3.1 In order to enable area-specific reference conditions to be established, there might be a need for Contracting Parties to carry out an analysis of the relevant characteristics ("typology") for their parts of the OSPAR maritime area. Relating thereto, further relevant information can be found in the Quality Status Reports for the North Sea and the whole OSPAR maritime area (QSR 1993 and QSR 2000).

3.2 For transitional (e.g. estuarine) and coastal waters falling under the regime of the Water Framework Directive, the respective typology could be used also for the application of the Comprehensive Procedure. When carrying out the characterisation, Contracting Parties should focus on the overall purpose of the Comprehensive Procedure to identify the eutrophication status of various parts of the OSPAR maritime area.

3.3 If Contracting Parties see a need to (further) divide their waters outside the area of jurisdiction of the Water Framework Directive, the following factors could assist in the characterisation (see also Figure 1 and Annex 1):

a. salinity gradients and regimes;
b. depth;
c. mixing characteristics (such as fronts, stratification);
d. transboundary fluxes;
e. upwelling;
f. sedimentation;
g. residence time/retention time;
h. mean water temperature (water temperature range);
i. turbidity (expressed in terms of suspended matter);
j. mean substrate composition (in terms of sediment types);
k. typology of offshore waters (cf. Annex 4).

4. Assessment procedure (step 1)

4.1 To allow for a harmonised assessment of the eutrophication status of maritime waters throughout the Convention area, the Comprehensive Procedure developed a conceptual framework consisting of harmonised assessment criteria/parameters which are linked to form a holistic assessment.

4.2 The aim of step 1 is to select and apply parameters which are relevant for the area concerned because they reflect the cause/effect relationships of the eutrophication process (Table 1). These linkages are illustrated in Figure 1.

[4] The Eutrophication Monitoring Programme (reference number: 2005-4) updates and supersedes the Nutrient Monitoring Programme adopted by OSPAR 1995 (reference number: 1995-5).

4.3 The results of the assessment of each of the parameters in Table 1 are reported in a harmonised way in the score table of the reporting format (section 3 in Annex 5).

a. Setting and selecting of area-specific assessment parameters

4.4 The basic assessment parameters for the assessment of eutrophication of maritime waters are laid down for the OSPAR Convention area in the Eutrophication Monitoring Programme.[5] They are to be applied throughout the whole maritime area.

4.5 Building on this, the following four categories of qualitative assessment criteria for application in the Comprehensive Procedure are agreed:

Category I	Causative factors: nutrient enrichment, taking into account environmental supporting factors;
Category II	Direct effects of nutrient enrichment;
Category III	Indirect effects of nutrient enrichment;
Category IV	Other possible effects of nutrient enrichment.

4.6 For each category, specified assessment criteria and associated biological and chemical parameters are agreed. They are reproduced in the checklist in Annex 1.

4.7 Areas have been differentiated according to their salinity into offshore, coastal and estuarine waters. Further ecosystem characteristics, including environmental supporting factors are mainly taken into account in steps 2 and 3 of the Comprehensive Procedure when integrating the assessment results and classifying maritime areas with regard to their eutrophication status.

4.8 Area differences with respect e.g. to demographic and hydrodynamic conditions and differences in data availability are likely to influence the selection of assessment parameters and their assessment levels for the use in the eutrophication assessment. The levels against which assessment is made may be area-specific. When setting assessment levels, supporting environmental factors as listed under the causative factors (Category I assessment parameters), and the characteristics distinguishing various types of areas (cf. chapter 3), should be taken into account.

4.9 Using synergies with the Water Framework Directive, maritime areas may need further characterisation under the Comprehensive Procedure according to the WFD-typology. The similarities and synergies of OSPAR Comprehensive Procedure assessment levels, the related integrated set of ecological quality objectives (EcoQOs) for eutrophication and the Water Framework Directive are set out in Figure 2 (cf. chapter 8).

4.10 While allowing for area specifications, the methodology used for applying assessment parameters is to be based on the common approach.

4.11 This requires that for a number of *qualitative* assessment criteria/parameters corresponding *quantitative* assessment levels are set on the basis of common methodologies.

4.12 For the OSPAR Convention area, parameters were selected for this purpose on the basis of common denominators found in wide-ranged qualitative and quantitative information provided by the Contracting Parties (Annex 1). This information is derived from the previous use of those qualitative assessment parameters which are set out in the initial Common Procedure guidance (reference number: 1997-11).

4.13 Based on this experience, a set of assessment parameters was selected for the development of assessment levels relating to nutrient enrichment, direct/indirect and other effects of nutrient enrichment. These parameters form the basis for the later classification of maritime areas with regard to eutrophication. These assessment parameters and related elevated levels are outlined in Table 1.

4.14 Additional parameters (e.g. from the checklist in Annex 1) may be applied where necessary to support the assessment process, to harmonise the Comprehensive Procedure with the Water Framework Directive, and to increase our current understanding. Where used, the Contracting Parties should describe, in their national reports on the application of the Comprehensive Procedure, their use with a view to their future

[5] These are for nutrient enrichment: NH_4-N, NO_2-N, NO_3-N, PO_4-P, SiO_4-Si, salinity and temperature; for direct and indirect effects: phytoplankton chlorophyll *a*, phytoplankton indicator species and species composition, macrophytes, O_2 concentration (including % saturation) and benthic communities and groups of indicator species.

harmonisation. Assessments can take account of information supplied from monitoring, research and modelling.

Table 1. Harmonised assessment parameters and related elevated levels.

Note: Parameters found at levels above the assessment level are considered as "elevated levels" and entail scoring of the relevant parameter category as (+) (cf. 'score' table at Annex 5). For concentrations, the "assessment level" is defined as a justified area-specific % deviation from background not exceeding 50%.

Assessment parameters	
Category I	**Degree of nutrient enrichment**
	1 Riverine inputs and direct discharges[6] (area-specific) Elevated inputs and/or increased trends of total N and total P (compared with previous years)
	2 Nutrient concentrations (area-specific) Elevated level(s) of winter DIN and/or DIP
	3 N/P ratio (area-specific) Elevated winter N/P ratio (Redfield N/P = 16)
Category II	**Direct effects of nutrient enrichment (during growing season)**
	1 Chlorophyll *a* concentration (area-specific) Elevated maximum and mean level
	2 Phytoplankton indicator species (area-specific) Elevated levels of nuisance/toxic phytoplankton indicator species (and increased duration of blooms)
	3 Macrophytes including macroalgae (area-specific) Shift from long-lived to short-lived nuisance species (e.g. *Ulva*). Elevated levels (biomass or area covered) especially of opportunistic green macroalgae).
Category III	**Indirect effects of nutrient enrichment (during growing season)**
	1 Oxygen deficiency Decreased levels (< 2 mg/l: acute toxicity; 2 - 6 mg/l: deficiency) and lowered % oxygen saturation
	2 Zoobenthos and fish Kills (in relation to oxygen deficiency and/or toxic algae) Long-term area-specific changes in zoobenthos biomass and species composition
	3 Organic carbon/organic matter (area-specific) Elevated levels (in relation to III.1) (relevant in sedimentation areas)
Category IV	**Other possible effects of nutrient enrichment (during growing season)**
	1 Algal toxins Incidence of DSP/PSP mussel infection events (related to II.2)

b. Defining and applying the area-specific assessment parameters and their assessment levels

4.15 For each parameter listed in Table 1 an assessment level has been developed, based on levels of increased concentrations and trends as well as on shifts, changes or occurrence. For nutrient inputs, for example, insight is needed into both, increased concentrations and an examination of trends. For concentrations, for example, "assessment levels" are defined, in general terms, as a certain percentage above an area-specific background concentration, reflecting natural variability and allowing a 'slight disturbance' as is also the case for assessment under the Water Framework Directive. The "background concentration" is

[6] Principles of the Comprehensive Study on Riverine Inputs and Direct Discharges (RID) (reference number: 1998-5, as amended).

defined, in general, as salinity-related and/or specific to a particular area, and which has been derived from data relating to a particular (usually offshore) area or from historic data.

4.16 In order to allow for natural variability, and in the absence of more specific information, the assessment level was defined as the concentration 50% above the salinity-related and/or area-specific background concentration in the first application of the Comprehensive Procedure (OSPAR 2003). This applied to winter DIN and DIP concentrations, winter N/P-ratio and maximum and mean chlorophyll *a* concentrations. In the light of experience, further applications of the Comprehensive Procedure should be based on assessment levels defined as a justified area-specific % deviation from background not exceeding 50%.

4.17 Parameters which are found at levels above the assessment levels are at "elevated levels" for the purpose of the Common Procedure. For the initial assessment in step 2 of the Comprehensive Procedure, elevated levels entail scoring of the relevant parameter category as (+) (cf. 'score' table at Annex 5).

(I) Category I - Degree of nutrient enrichment (causative factors)

(1) Nutrient inputs

(a) Riverine inputs and direct discharges of total N and total P

4.18 Data on riverine and direct inputs are available from 1990 onwards, using the information provided by Contracting Parties and the data from the Comprehensive Study on Riverine Inputs and Direct Discharges (RID).

4.19 The assessment procedures should:

(i) consider the pattern of change in inputs and flows over the maximum period possible;

(ii) where possible, consider seasonal variations;

(iii) take into account the level of the (yearly) riverine discharge ("wet" and "dry" years) related to the respective riverine N- and P-inputs;

(iv) compare, if possible, current loads of total N and P (riverine and direct inputs) with the relevant background loads or reference conditions. In the absence of background loads, compare current loads of total N and P (riverine inputs and direct discharges) with those from previous years. Furthermore, existing trends of these total N and P loads (years need to be defined) should be considered and included in the assessment. In respect of establishing whether there is a trend in inputs, any change of more than 5% over a ten-year period should be considered as a trend. In respect of the analysis of trends, flow adjustment of riverine inputs should be made.

(b) Other parameters for nutrient input not listed in Table 1

4.20 The pressures causing eutrophication may originate a long way from a region being affected. There may be the situation where the nutrient pressures on affected regions may be originating from adjacent areas (see also section 5.5). Therefore, the overall assessment of nutrient inputs also needs to consider transboundary and atmospheric inputs as listed in the following paragraphs.

(aa) Transboundary nutrient inputs

4.21 It has been acknowledged for a number of years that some marine areas (like the sedimentation areas: the Oyster Ground area in the Dutch offshore part of the North Sea, the German Bight and Skagerrak) are affected or likely to be affected not only by direct and riverine inputs, but also by nutrient fluxes from adjacent (maritime) areas. This occurs through transboundary nutrient inputs and related effects (nutrient inputs via transport of nutrient enriched water masses from one maritime area to another).

4.22 The further harmonisation of the assessment of transboundary inputs to specific sea areas should be strengthened in order to help to quantify and determine the significance of the anthropogenic and non-anthropogenic components. One way could be to divide the sea area into boxes, based on their inherent physical characteristics (temperature, salinity, flushing times) and to calculate their internal nutrient and water budgets, taking into account nutrient inputs via all significant pathways and sources and the transboundary fluxes between them. This work should include further development of scientifically accepted modelling tools directed towards spatial and temporal integration of nutrient fluxes.

(bb) Atmospheric deposition of nitrogen

4.23 Atmospheric nitrogen inputs may have a material influence on nitrogen concentrations in marine waters. From the first application of the Comprehensive Procedure it became obvious that atmospheric

nitrogen input plays a major role for some regions (in particular in those coastal regions where riverine inputs are small). In the current eutrophication assessment according to the Comprehensive Procedure atmospheric nitrogen is not adequately covered. Information (maps, tables etc.) on emissions and deposition of oxidised and reduced nitrogen in the OSPAR Convention area with a special emphasis on the North Sea (subdivided into 13 subregions) are presented in the EMEP report "Atmospheric Nitrogen in the OSPAR Convention Area in the Period 1990-2001" (EMEP 2004). This report is derived from results of the UNECE Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) under the Convention on Long-Range Transboundary Air Pollution (LRTAP). These results and/or results from a possible update should be taken into account during the next application of the Comprehensive Procedure.

(2) Winter nutrient (DIN and/or DIP, and Si) concentrations

4.24 Widely used in comparable assessments are total dissolved inorganic nitrogen compounds (NO_3 + NO_2 + NH_4 (DIN)) and ortho-P (DIP) for winter time (when algal activity is lowest). Silicate (SiO_4) is monitored, but not widely used in assessments and is therefore not incorporated in Table 1.

(a) Overall guidance for salinity gradient riverine influenced waters

4.25 The widely used uniform assessment procedure with respect to yearly trends and elevated concentrations of DIN and DIP in winter**,** and silicate in *salinity gradient (riverine influenced)* waters is as follows (see examples in Annex 2a):

a. Mixing diagrams and salinity-specific background concentrations:
In marine coastal waters with salinity gradients yearly trends in winter nutrient concentrations are assessed by plotting the winter nutrient concentrations of each year in relation to the respective measured salinity values ("mixing diagrams"). In winter, defined as period when algal activity is lowest, DIN and DIP (but also silicate) show a conservative behaviour and, therefore, a good linear relationship with salinity (decreasing concentration with increasing salinity from coast to offshore).

b. Trends and increased concentrations compared with salinity-specific background concentrations:
In order to compensate for differences in salinity at the various locations and during the various years, nutrient concentrations are normalised for salinity. This is done by calculating the winter nutrient concentration at a given salinity (e.g. 30) from the mixing diagram of a particular year. The salinity normalised nutrient concentration (with 95% confidence interval) is plotted in relation to the respective year in order to establish trends in the winter nutrient concentrations and the assessment level (compared with background concentration).

4.26 To conclude, in undertaking, and reporting on, their assessments, Contracting Parties should use and report comprehensive data on winter DIN and winter DIP concentrations, and silicate, and associated salinity (report on lowest and highest values with associated salinity from the mixing diagram: see Annex 2a). Contracting Parties should consider winter nutrient concentrations, normalised for salinity.

(b) Areas without salinity gradients

4.27 In areas where there is no relationship between salinity and winter nutrient concentrations, nutrient levels can be simply assessed by calculating mean values for the winter period and compared to area-specific background concentrations.

4.28 When reporting on winter DIN and DIP, and on silicate for the various areas under investigation, the relevant mean salinity regime shall be reported.

4.29 The following assessment procedure is used for identifying elevated levels (see Annex 2c):

a. (salinity-related and/or area-specific) background concentrations and

b. assessment levels based on a justified area-specific % deviation from background not exceeding 50%.

4.30 From the monitoring data available in the ICES database, the following proposal is made for DIN in other waters not listed in Annex 2c: 10 μmol/l as background concentration; and an assessment level of 15 μmol/l.

4.31 From the monitoring data available in the ICES database, the following proposal is made for DIP in other waters not listed in Annex 2c: 0.6 μmol/l as background concentration; and an assessment level of 0.8 μmol/l.

4.32 As an overall conclusion, winter DIN and DIP concentrations are, and can be, assessed in a harmonised way for the central North Sea and its coastal waters, the Irish Sea, the Atlantic Sea, the Channel, the Wadden Sea, the Kattegat and the Skagerrak. Salinity-related and/or area-specific background concentrations and related assessment levels are used to assess the state of DIN and DIP nutrient enrichment. The assessment level for DIN and DIP should be based on a justified area-specific % deviation from background not exceeding 50%.

(3) Winter N/P, N/Si and P/Si ratios

4.33 Increased winter nutrient ratios, and in particular, increased N/P ratios (compared to Redfield ratio = 16), when coupled with absolute excess of nitrate, may cause shifts in species composition, from diatoms to flagellates, some of which are toxic. Since such increased N/P ratios increase the risk of nuisance and toxic algal species, increased winter N/P ratios are used in the common assessment (Table 1). Assessment levels of winter N/P ratio (24; i.e. 50% above Redfield ratio) should be used. Increased ratios of N/Si and P/Si may in addition be considered, with assessment levels at 2 for N/Si and 0,125 for P/Si, because silicate is less influenced by anthropogenic activities. These assessment levels are valid for offshore waters (salinity >34.5). For other areas assessment levels have to be defined according to the respective salinity.

4.34 Naturally increased N/P ratios are observed in some coastal/estuarine areas; consequently, the use of the Redfield N/P ratios may not be appropriate in such circumstances.

(4) Total nitrogen and phosphorus

4.35 Total nitrogen (TN), total phosphorus (TP) and organic carbon/organic matter are useful assessment parameters in addition to the winter DIN and DIP since they include all phases of the elements N and P and bridge as all-season-values the time-gap between winter and algal growing season and can be used to explain long-term nutrient enrichment in certain areas, caused by transboundary transport. TN and TP can be helpful to deduce reference conditions throughout estuarine and coastal waters because for rivers TN and TP are mostly present. TN and TP are, besides of riverine inputs, presently not included in the Eutrophication Monitoring Programme, but organic matter (total organic carbon and particulate organic carbon) is included therein for problem areas.

(II) Category II - Direct effects of nutrient enrichment

(1) Maximum and mean chlorophyll *a* concentration

4.36 There is a large fluctuation in chlorophyll *a* (chl. *a*) concentrations between years and seasons as well as spatial differences (in general, higher in nutrient enriched coastal waters, at frontal systems, and in (offshore) stratified waters compared to unstratified offshore waters). The latter difference often reflects the difference in nutrient enrichment levels (higher in coastal and stratified waters compared with unstratified offshore waters). This direct effect parameter of nutrient enrichment is furthermore highly influenced by other environmental factors (such as light availability, phytoplankton species composition and their physiological state (type of growth-limitation), and the variable grazing pressure). Nevertheless, this parameter is considered to be a useful direct effect assessment parameter of nutrient enrichment, and therefore listed in Table 1. It is predicted that chl. *a* concentrations will become reduced following the implementation of the agreed measures to achieve the 50 % N and P reduction targets (OSPAR 2001).

4.37 Environmental data such as phytoplankton chl. *a* exhibits periodicity and episodic change and, as a result, tends to be asymmetrically distributed with few high values (outliers or spikes) and many low values. While the mean and maximum chl. *a* values are currently recommended as assessment tools, an alternative approach is to employ box-whisker plots and derive 90^{th} percentile values. The 90^{th} percentile value is then compared with the threshold value derived from appropriate reference conditions. Such an approach eliminates outliers, increases confidence in the assessment and also has the advantage of bringing the OSPAR assessment into alignment with the approach adopted in freshwater under the Water Framework Directive.

4.38 Maximum and mean chl. *a* concentrations during the growing season have become available over the last decade. According to the Eutrophication Monitoring Programme and the JAMP Eutrophication

Monitoring Guidelines[7], chl. *a* concentration is measured and expressed as µg chl.*a*/l, or sometimes calculated from Particulate Phytoplankton Carbon (40 µg PPC/l equals 1 µg chl.*a*/l).

4.39 In determining the maximum and mean chlorophyll *a* levels in estuaries, chlorophyll *a* concentrations should be averaged over the estuarine salinity range during the growing season.

4.40 The assessment level for chlorophyll *a* is based on a justified area-specific % deviation from background not exceeding 50%. Examples for identifying elevated levels are at Annex 2c.

4.41 Assuming that eutrophication effects have their origin mostly in the elevated nutrient discharges, for the German Bight linear correlations between TN and chlorophyll *a* were performed during the growing season. Since TN is correlated with salinity as well, based on natural background concentrations on TN, assessment levels for chlorophyll *a* can be calculated (see Annex 2b). This approach could be tested and applied for/to other areas.

4.42 For estuaries, the full expression of chl. *a* during the growing season can be restricted by light limiting factors, e.g. in high turbidity areas. Contracting Parties should, therefore, take this possibility into account when undertaking their assessment for chlorophyll *a*, and make provision for the measurement of the variation in light regimes concurrent with chl. *a* in the relevant circumstances.

(2) Phytoplankton indicator species

4.43 Two types of area-specific phytoplankton indicator species can be distinguished: nuisance species, forming dense "blooms", and toxic species, already toxic at low concentration. Nuisance species (*Phaeocystis, Noctiluca)* and potentially toxic (e.g. dinoflagellates) species (e.g. *Chrysochromulina polylepis*, *Gymnodinium mikimotoi*, *Alexandrium* spp., *Dinophysis* spp., *Prorocentrum* spp.) are direct effect assessment parameters. The nuisance species show increased "bloom" levels (cell concentrations) and increased duration of "blooms" compared with previous years. General and physiological information of the various relevant indicator/assessment species is given in Annex 3a. Examples of levels considered as elevated levels and their effects are at Annex 3b. The list of species provided in the Annexes is not exhaustive. It should be noted that there is scientific uncertainty in the use of toxic phytoplankton species as indicators of direct eutrophication effects.

4.44 Shifts in species composition from diatoms to flagellates (some of which are toxic) could indicate eutrophication. The composition of phytoplankton should be compared with area-specific reference conditions and could for example be expressed by the ratio of diatoms to flagellates.

(3) Macrophytes including macroalgae

4.45 Shifts in species (from long-lived species like eel-grass to nuisance short-lived species like *Ulva, Enteromorpha*) form an important area-specific indicator/assessment parameter in shallow waters, estuaries and embayments. In some of these areas, specific assessment levels (reduced depth distribution, and increased area coverage with nuisance species) are mentioned.

(III) Category III - Indirect effects of nutrient enrichment

(1) Oxygen deficiency

4.46 The degree of oxygen deficiency is widely used as an indirect assessment parameter for nutrient enrichment. Oxygen deficiency, induced by decaying algal blooms and long-term nutrients and associated organic matter enrichment, is observed in areas, especially in those that are susceptible to eutrophication effects, e.g. sedimentation areas, areas with long residence time, but also in (shallow) waters covered with surface algal "blooms" of increased nuisance algal species.

4.47 Assessment levels of the various degrees of oxygen deficiency show ranges for the various areas in the North Sea: < 2 mg/l: acute toxic (ca. 75 % deficiency); 4 - 5 mg/l (ca. 50 % deficiency) and < 5 - 6 mg/l: deficient. Oxygen concentrations above 6 mg/l are considered to cause no problems. The assessment levels that are now used are ranging from 4-6 mg/l to judge whether oxygen is scored as an undesired oxygen deficiency level for that particular area (scored as '+' in reporting format Annex 5). Attention needs to be given to scale and occurrence of oxygen deficiency by sufficient monitoring with respect to spatial and temporal aspects.

[7] JAMP Eutrophication Monitoring Guidelines, reference numbers: 1997-2 to 1997-6.

4.48 The assessment of oxygen should include also reporting of % saturation, water temperature and salinity in order to ensure comparability of assessments and presentation of results within the OSPAR maritime area. For example, dissolved oxygen criteria (% saturation) could be used in respect to both, deoxygenation and supersaturation (based on 5th percentile and 95th percentile compliance), with values established for tidal freshwaters, intermediate waters and full salinity waters.

(2) Changes/kills in zoobenthos

4.49 This parameter is indirectly related to nutrient enrichment. A distinction can be made between acute toxicity kills directly related to oxygen deficiency and/or toxic blooms, and long-term changes in zoobenthos species composition as a result of long-term increased eutrophication. However, the latter can also be caused by other factors like fisheries which may have an overriding effect compared with eutrophication effects.

4.50 The assessment guidance for "kills in zoobenthos" in relation to eutrophication is a "yes-or-no" assessment parameter (occurrence scored with '+', non-occurrence with '-') and should be based on supporting information on the occurrence of toxic phytoplankton species and oxygen levels. Assessment guidance for "long-term changes in zoobenthos species composition and biomass" might become available from Contracting Parties and ICES in the near future.

(3) Fish kills

4.51 This parameter is a "yes-or-no" assessment parameter (occurrence scored with '+', non-occurrence with '-') and should be based on supporting information on the occurrence of toxic phytoplankton species and oxygen levels.

(4) Organic carbon/organic matter

4.52 Organic carbon/organic matter is not widely used in the assessment up to now. However, this parameter can be an integrating eutrophication indicator. It can serve as a food source for heterotrophic flagellates. Especially in sedimentation areas (like e.g. German Bight, Oyster Ground and Skagerrak) particulate organic matter can be accumulated causing undesirable disturbance. Additional effects in coastal areas are the modification of the light regime and formation of particulate organic matter, a product of enhanced sedimentation through flocculation. It is recommended to include this parameter into the eutrophication assessment, where relevant.

(IV) Category IV - Other possible effects of nutrient enrichment

Algal toxins

4.53 DSP/PSP mussel infection events are a relevant assessment parameter in relation to potential toxic algal species in areas where cultivated or wild shellfish stocks are harvested for human consumption. This parameter is a "yes-or-no" assessment parameter (occurrence of DSP/PSP mussel infection events scored with '+', non-occurrence with '-') and should be based on coherent monitoring on phytoplankton eutrophication indicator species (nuisance and/or toxic) (Category II.2).

5. Integration of categorised assessment parameters for initial area classification (step 2)

5.1 The scores for each of the parameters in Table 1 which result from the assessment procedure are reported in a common format (section 3 of Annex 5). This table is the departing point for the second step in the classification process.

5.2 The scores attained from the application of the assessment parameters are integrated in a table with the criteria categories (Table 1) and the area classes for an initial area classification (cf. Table 2 for guidance).

5.3 The initial classification shall be as follows:

a. areas showing an increased degree of nutrient enrichment accompanied by direct and/or indirect/ other possible effects are regarded as **'problem areas'**;

b. areas may show direct effects and/or indirect or other possible effects, when there is no evident increased nutrient enrichment, for example, as a result of transboundary transport of (toxic) algae and/or organic matter arising from adjacent/remote areas. These areas could be classified as **'problem areas'**;

c. areas with an increased degree of nutrient enrichment where

(i) either there is firm, scientifically based evidence of the absence of (direct, indirect, or other possible) eutrophication effects – these are classified initially as '**non-problem areas'**, although the increased degree of nutrient enrichment in these areas may contribute to eutrophication problems elsewhere;

(ii) or there is not enough data to perform an assessment or where the data available is not fit for the purpose – these are classified initially as **'potential problem areas'**;

d. areas without nutrient enrichment and related (in)direct/ other possible effects are considered to be **'non-problem areas'**.

Table 2. Examples of the integration of categorised assessment parameters (see Table 1) for an initial classification.

	Category I Degree of nutrient enrichment Nutrient inputs Winter DIN and DIP Winter N/P ratio	Category II Direct effects Chlorophyll *a* Phytoplankton indicator species Macrophytes	Categories III and IV Indirect effects/other possible effects Oxygen deficiency Changes/kills in zoobenthos, fish kills Organic carbon/matter Algal toxins	Initial Classification
a	+	+	+	problem area
	+	+	-	problem area
	+	-	+	problem area
b	-	+	+	problem area[8]
	-	+	-	problem area[8]
	-	-	+	problem area[8]
c	+	-	-	non-problem area [9]
	+	?	?	Potential problem area
	+	?	-	Potential problem area
	+	-	?	Potential problem area
d	-	-	-	non-problem area

(+) = Increased trends, elevated levels, shifts or changes in the respective assessment parameters in Table 1

(-) = Neither increased trends nor elevated levels nor shifts nor changes in the respective assessment parameters in Table 1

? = Not enough data to perform an assessment or the data available is not fit for the purpose

Note: Categories I, II and/or III/IV are scored '+' in cases where one or more of its respective assessment parameters is showing an increased trend, elevated level, shift or change.

5.4 When weighing data derived from the assessment process, the quality of the underlying monitoring should be taken into account. It follows from Table 2 that it may be appropriate to initially classify an area as potential problem area if the area shows an increased degree of nutrient enrichment (Category I) but where data on direct, indirect/other possible effects are not sufficient to enable an assessment or are not fit for this purpose (as indicated by '?' in Table 2). In such a situation section 3.2(b) of the OSPAR Eutrophication Strategy applies. It requires urgent implementation of monitoring and research in order to enable a full assessment of the eutrophication status of the area concerned within five years of its classification as potential problem area with regard to eutrophication. In addition, it calls for preventive measures to be taken in accordance with the precautionary principle.

[8] For example, caused by transboundary transport of (toxic) algae and/or organic matter arising from adjacent/remote areas.

[9] The increased degree of nutrient enrichment in these areas may contribute to eutrophication problems elsewhere.

5.5 It should be pointed out that, despite large anthropogenic nutrient inputs and high nutrient concentrations, an area may exhibit few if any direct and/or indirect effects. However, Contracting Parties should take into account the risk that nutrient inputs may be transferred to adjacent areas where they can cause detrimental environmental effects and Contracting Parties should recognise that they may contribute significantly to so-called "transboundary affected" problem areas and potential problem areas with regard to eutrophication outside their national jurisdiction.

5.6 In the case of areas with an increased degree of nutrient enrichment, initially classified as "non-problem areas" (cf. § 5.3 c(i)), the status is conditional on the provision of an appraisal in Step 3, explaining why there are reasonable grounds for considering that there will continue to be an absence of (direct, indirect or other possible) eutrophication effects, in spite of the presence of enhanced levels of nutrients. This should include an assessment that they may not lead in time to undesirable disturbance to the marine environment. These areas may retain their status as non-problem areas with respect to eutrophication, but will need to be re-examined at the next assessment under the Comprehensive Procedure. For these areas the monitoring requirements for potential problem areas apply (cf. chapter 7).

6. Overall area classification (step 3)

6.1 Following the steps 1 and 2 classification, in a third step, an appraisal of all relevant information (concerning the harmonised assessment criteria, their respective assessment levels and the supporting environmental factors) should be made in order to provide a sufficiently sound and transparent account of the reasons for giving a particular status to an area (cf. also Figure 1).

6.2 This step 3 appraisal should be carried out in the light of (i) the definitions relating to the three different types of areas with regard to eutrophication (see section 2), (ii) the harmonised assessment parameters and related elevated levels (see Table 1), (iii) the scoring for each of these assessment parameters and (iv) their integration in accordance with Table 2.

6.3 Contracting Parties should present the results of the appraisal for each area to OSPAR as:

a. a statement that it does not see a need to assess additional local/regional supporting environmental factors and that the result of the application of steps 1 and 2 for an area, in accordance with the Comprehensive Procedure, is transparent and verifiable and reliable enough for giving a particular eutrophication status to that area;

or

b. a transparent and verifiable assessment of all relevant information, including additional local/regional factors not addressed in the steps 1 and 2.

6.4 OSPAR should review and assess the results of the initial classification following steps 1 and 2 and of the step 3 appraisal. Contracting Parties should take the outcome of this assessment into account when identifying the eutrophication status of their parts of the maritime area.

6.5 The Contracting Parties need to report in a harmonised transparent way on the overall classification consisting of the steps outlined above including the initial classification, the appraisal of all relevant information (that is, the harmonised assessment parameters and their respective assessment levels and the supporting environmental factors), and the subsequent final classification made by the Contracting Parties for their waters that are subject to the Comprehensive Procedure (see sections 4 and 5 of the reporting format, Annex 5).

6.6 Where, as a result of this classification process,

a. one Contracting Party thinks that it must classify part of the maritime area under its jurisdiction as a problem area with respect to eutrophication, having taken account of what it considers to be significant transboundary inputs into that area deriving, directly or indirectly, from nutrients discharged or emitted from or through the territory/marine waters of another Contracting Party (or Contracting Parties), and;

b. that other Contracting Party is not (or those other Contracting Parties are not) in a situation to accept such a classification, then the Comprehensive Procedure should not be regarded as completed in respect of that area.

The OSPAR Commission will then use its best efforts to clarify the position so that the Comprehensive Procedure can be completed.

6.7 In such a situation, an initial step could be to convene a meeting of experts from the Contracting Parties involved and from as many other Contracting Parties as possible, under the chairmanship of the Chairman of the Commission or a person appointed by him/her. The aim of such a meeting should be to produce a report to the OSPAR Commission reviewing and evaluating all the scientific evidence relevant to the eutrophication status of the area in question. In particular, the report should seek to establish to the extent possible:

a. the most likely origins of the various inputs of nutrients to the area;

b. the robustness of any evidence that nutrients discharged or emitted from the territory of the Contracting Party or Contracting Parties (alleged to be the source) are making a significant contribution to eutrophication in the area;

c. whether there is a need to change the classification of the area in question as a problem area;

d. the possibilities for, and the expected results of, measures to reduce inputs of nutrients to the area.

6.8 In the light of this report, the OSPAR Commission should then decide what further steps are desirable to resolve the situation. This may include the commissioning of further scientific studies to be jointly conducted and funded by the parties concerned. In the meantime, the area should be described in reports of the outcome of the Common Procedure as "problem area (transboundary affected) subject to resolution of assessment differences". This review process should be completed within two years after that classification. Any extension of that period should be agreed upon by the OSPAR Commission.

7. Monitoring and data requirements

7.1 In order to be consistent in the harmonised holistic assessment and area classification, it is also necessary to follow the requirements of the relevant parts of the OSPAR monitoring programmes. This includes

a. the OSPAR Eutrophication Monitoring Programme;

b. JAMP Eutrophication Monitoring Guidelines relating to nutrients, oxygen, chlorophyll *a*, phytoplankton indicator species, and benthos[10] and quality assurance procedures;

c. the Comprehensive Study of Riverine Inputs and Direct Discharges (RID)[11];

d. information reported to ICES.

7.2 The assessment parameters are strongly interlinked along a cause/effect scheme from nutrient enrichment (Category I), to direct effects (Category II, e.g. chlorophyll *a*, phytoplankton nuisance and toxic indicator species) and indirect effects (Category III, e.g. oxygen deficiency and changes/kills in zoobenthos). Therefore, to reduce the risk of misinterpretation of these cause/effects, all categories (nutrient enrichment, direct effects and indirect effects) should be assessed together.

7.3 Area-specific aspects and the level of confidence in the assessment parameter levels should be adequately addressed by applying sufficient monitoring in space and time. There is for some assessment parameters in some areas a need to improve the monitoring frequency and area coverage in order to meet the area-specific requirements and the required level of confidence.

7.4 However, to ensure a complete assessment, full use should also be made of information arising from sources and programmes other than those mentioned above, subject to it satisfying the relevant needs in terms of quality assurance.

7.5 The Eutrophication Monitoring Programme defines the minimum requirements for monitoring and reporting. For areas, including local areas located in wider non-problem areas, identified as problem or potential problem areas, a sufficient frequency and spatial coverage of all the parameters in the programme

[10] OSPAR reference numbers: 1997-2, 1997-3, 1997-4, 1997-5 and 1997-6 respectively.
[11] OSPAR reference number: 1998-5.

should be monitored and reported each year. For the areas identified as non-problem areas, results relating to the monitoring of the assessment parameters listed in Category I should be reported once in 3 years.

7.6 In general, attention needs to be paid to a sufficient eutrophication monitoring under consideration of scale and occurrence of eutrophication related effects (e.g. phytoplankton blooms, mass occurrence of macroalgae, oxygen deficiency, fish kills). Therefore, spatial and temporal aspects of eutrophication have to be addressed adequately. Particular attention is drawn to the need of updated guidance on the frequency and spatial coverage of monitoring in the Eutrophication Monitoring Programme.

7.7 In the light of the agreed common assessment parameters and the experiences gained by the Contracting Parties in the first application of the Comprehensive Procedure, it may be necessary for OSPAR to re-examine its co-ordinated monitoring programmes and to adjust them so that they are in line with the data requirements for future applications of the Comprehensive Procedure.

8. Synergies with Water Framework Directive

8.1 There are considerable similarities between the approach of the Water Framework Directive, the Comprehensive Procedure and the related integrated set of EcoQOs for eutrophication. The two latter, however, are only directed to the nutrients/eutrophication issue while the Water Framework Directive relates to all human pressures.

8.2 There are also differences in approaches:

a. in *geographical coverage*, namely: The Water Framework Directive covers waters up to one nautical mile seaward from the coastal base line for biological quality elements, including nutrients and oxygen. The Comprehensive Procedure has a much broader geographical coverage (North-East Atlantic) and includes estuaries as well.

b. in the number of *"classes"*: The Water Framework Directive provides for the classification of water types including estuaries and coastal waters, comprising the following five classes: high, good, moderate, poor and bad. The Comprehensive Procedure provides for a classification in problem areas, initially classified potential problem areas (showing elevated nutrient levels but no or yet unknown levels of eutrophication effects), and non-problem areas. Figure 2 below shows the relationship between the Comprehensive Procedure, the integrated set of EcoQOs for eutrophication and the classification of waters under the Water Framework Directive. It is clear that the integrated set of EcoQOs for eutrophication allows a certain level of deviation from background concentrations as is the case under the Water Framework Directive for the waters classified as "good" ("slight disturbance").

8.3 As a starting point, the assessment level for some of the assessment parameters established in the first application of the Comprehensive Procedure was defined as a maximum % deviation of 50 compared to the natural background level. For the second application of the Comprehensive Procedure the assessment level shall be determined as a justified area-specific % deviation from background not exceeding 50%. In relation to this, the OSPAR assessment for the coastal areas and the Water Framework Directive's intercalibration process complement each other. In the context of eutrophication, the boundary between a problem area and a non-problem area in the coastal region should align with the boundary between the good and the moderate ecological status in the Water Framework Directive.

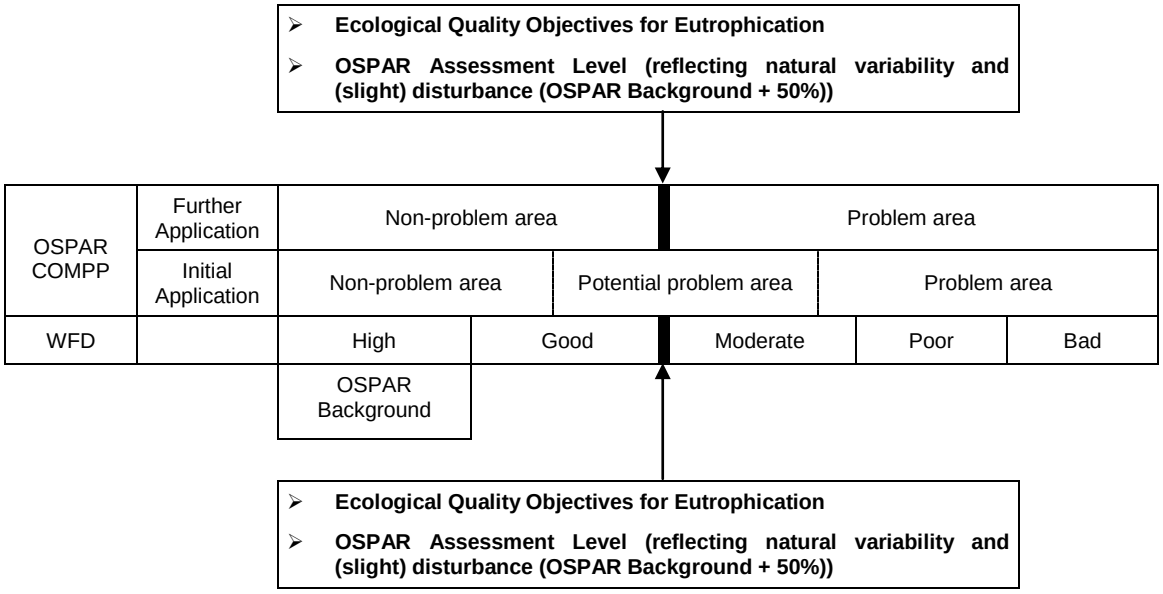


Figure 2. Relationship between the classification under the Comprehensive Procedure, the integrated set of EcoQOs for eutrophication and the Water Framework Directive.

Note: Assessment levels are based on a justified area-specific % deviation from background not exceeding 50%.
OSPAR COMPP = the Comprehensive Procedure; WFD = the Water Framework Directive.

9. Reporting and actions arising therefrom

a. Arrangements for harmonised reporting

9.1 In describing the results of the overall area classification in a harmonised way, both the assessment of each of the parameters of the Categories I, II, III and IV (Table 1), as well as the resulting initial classification (Table 2) as non-problem, potential problem and problem areas should be reported by Contracting Parties.

9.2 To ensure harmonised reporting, a reporting format has been developed which is to be used by Contracting Parties (Annex 5). The format requests Contracting Parties to provide information of the assessed area relating to its salinity regime or other environmental characteristics including physics, hydrodynamics, weather/climate conditions etc. which are needed for the characterisation of the areas falling under the Comprehensive Procedure (cf. chapter 3 and "typology" under the Water Framework Directive); a score table with the results of the application of each of the assessment parameters of Table 1; and information on the overall classification. Contracting Parties may provide more detailed information on the assessment process and the underlying data and assumptions used, including possible joint reports on adjacent areas.

9.3 Further guidance is needed on assessment periods and related reporting modes. It is suggested to use assessment periods of at least five years. As regards reporting, guidance is required whether data derived in the assessment period should be reported on a year-by-year, an average or on a whole-period basis. When deciding on future reporting years, synchronisation with the timing of similar assessments under the Water Framework Directive, the Nitrates Directive and the Urban Waste Water Treatment Directive should be sought.

9.4 The information reported by Contracting Parties is the basis for OSPAR to undertake an overall assessment of the eutrophication status of all parts of the OSPAR maritime area. On the basis of the resulting integrated report, OSPAR decides on the follow-up and its time frame: whether targeted measures need to be adopted, the Comprehensive Procedure to be applied again or the guidance thereon to be reviewed.

b. Actions arising from reporting and repetition of the Comprehensive Procedure

9.5 Following the first OSPAR integrated report, EUC 2003 set up a timetable for activities to further the update of the Comprehensive Procedure and to prepare for its second application and the related OSPAR

integrated report on the eutrophication status of the OSPAR maritime area, due for adoption by OSPAR 2008.

9.6 Further arrangements preparing for the second integrated report are set out in Annex 6.

9.7 As regards arrangements for future applications of the Comprehensive Procedure, OSPAR might need to consider linking them to and co-ordinating them with activities in other forums, namely under the relevant EC Directives referred at section 9.3.

9.8 Contracting Parties shall implement requirements of the Comprehensive Procedure of the Common Procedure in accordance with the following schedule:

a. for non-problem areas: the status of the area with regard to eutrophication will be reassessed by applying the Comprehensive Procedure if there are grounds for concern that there has been a substantial increase in the anthropogenic nutrient load;

b. for potential problem areas: monitoring and research measures should be urgently implemented in order to enable a full assessment of the eutrophication status of each area concerned within five years of its classification as a potential problem area.

c. an OSPAR integrated report on the eutrophication status of the OSPAR maritime area is due to be finalised in 2008, based on the second application of the Comprehensive Procedure to OSPAR Convention waters. Arrangements to this end are made in Annex 6.

Annex 1

Checklist for a holistic assessment

All areas not being identified as non-problem areas with regard to eutrophication through the Screening Procedure are subject to the Comprehensive Procedure which comprises a checklist of qualitative parameters for a holistic assessment:

The qualitative assessment parameters are as follows:

a. Category I the causative factors:
   the degree of nutrient enrichment
   - with regard to inorganic/organic nitrogen
   - with regard to inorganic/organic phosphorus
   - with regard to silicate

   taking account of:
   - sources (differentiating between anthropogenic and natural sources)
   - increased/upward trends in concentration
   - elevated concentrations
   - increased N/P, N/Si, P/Si ratios
   - fluxes and nutrient cycles (including across boundary fluxes, recycling within environmental compartments and riverine, direct and atmospheric inputs)

b. the supporting environmental factors, including:
   - light availability (irradiance, turbidity, suspended load)
   - hydrodynamic conditions (stratification, flushing, retention time, upwelling, salinity, gradients, deposition)
   - climatic/weather conditions (wind, temperature)
   - zooplankton grazing (which may be influenced by other anthropogenic activities);

c. Category II. the direct effects of nutrient enrichment:
   i. phytoplankton:
      - increased biomass (e.g. chlorophyll *a*, organic carbon and cell numbers)
      - increased frequency and duration of blooms
      - increased annual primary production
      - shifts in species composition (e.g. from diatoms to flagellates, some of which are nuisance or toxic species)

   ii. macrophytes, including macroalgae:
      - increased biomass
      - shifts in species composition (from long-lived species to short-lived species, some of which are nuisance species)
      - reduced depth distribution

   iii. microphytobenthos:
      - increased biomass and primary production

d. Category III. the indirect effects of nutrient enrichment:
   i. organic carbon/organic matter:
      - increased dissolved/particulate organic carbon concentrations
      - occurrence of foam and/or slime
      - increased concentration of organic carbon in sediments (due to increased sedimentation rate)

   ii. oxygen:
      - decreased concentrations and saturation percentage
      - increased frequency of low oxygen concentrations
      - increased consumption rate
      - occurrence of anoxic zones at the sediment surface (“black spots”)

   iii. zoobenthos and fish:
      - mortalities resulting from low oxygen concentrations

   iv. benthic community structure:
      - changes in abundance
      - changes in species composition
      - changes in biomass

   v. ecosystem structure:
      - structural changes

e. Category IV. other possible effects of nutrient enrichment:
   i. algal toxins (still under investigation - the recent increase in toxic events may be linked to eutrophication).

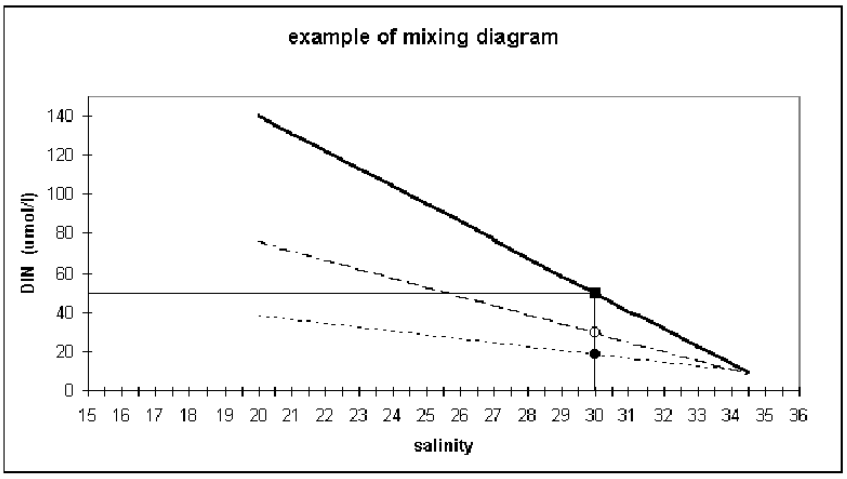
Mixing diagrams and figures of winter nutrients

This Annex contains the following example maps, figures and mixing diagrams:

1. Theoretical example of a mixing diagram
2. Examples of trends in salinity-related winter concentrations of DIP and DIN

1. Theoretical example of a mixing diagram

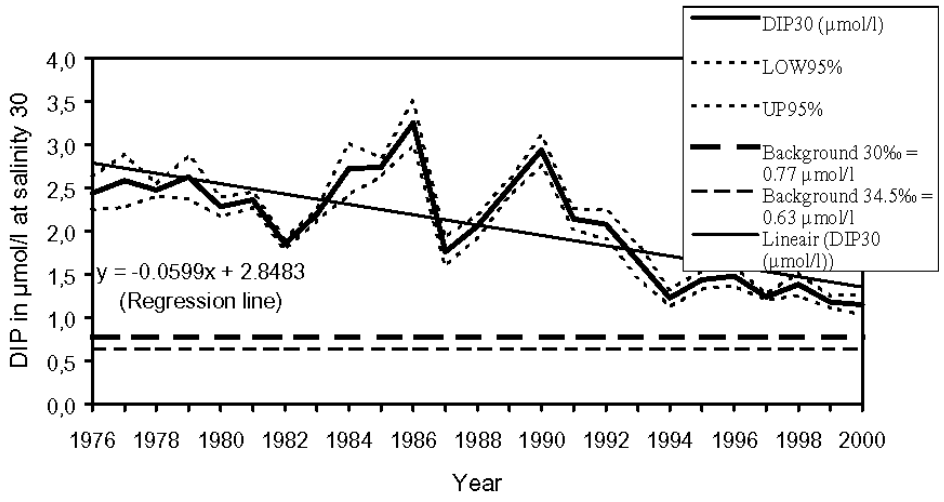
In coastal marine waters with salinity gradients, yearly trends in nutrient concentrations are assessed by plotting each year winter nutrient concentrations against the measured salinity values to produce nutrient – salinity plots. This procedure, often called mixing diagrams, was adopted by NUT in 1989. In winter, when algae activity is lowest, nutrients show more or less conservative behaviour and a clear linear relationship with salinity: i.e. decreasing concentrations with increasing salinity from coast to offshore.



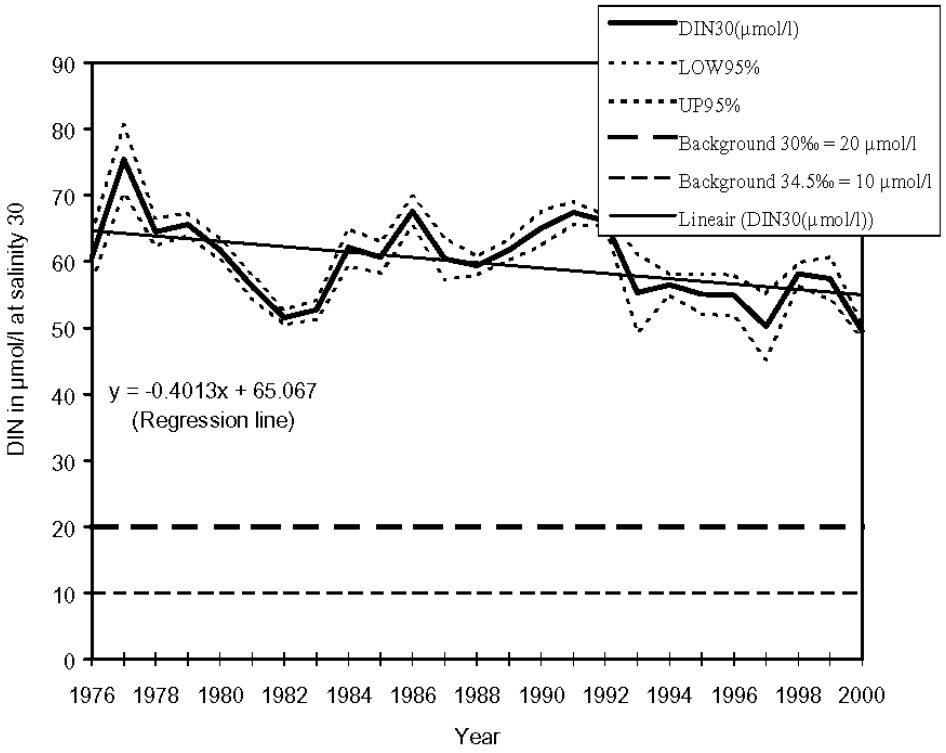
Black top line: linear relation between measured winter DIN concentrations and salinity.
Dotted middle line: 50% elevation of winter DIN contrations above background concentrations, all related to salinity
Dotted lower line: winter DIN background concentration related to salinity

Closed square: DIN concentration at a salinity of 30 psu
Open circle: 50 % elevation of DIN concentration above the background concentration at 30 psu
Closed circle: DIN background concentration at 30 psu

2. Examples of trends in salinity-related winter concentrations of DIP and DIN (Dutch coastal waters)



Trend in the year concentration of dissolved inorganic phosphate at the salinity of 30 psu at Noordwijk transect during the winter months (December till March) in the period 1976-2000 (data from all the monitoring excercises).



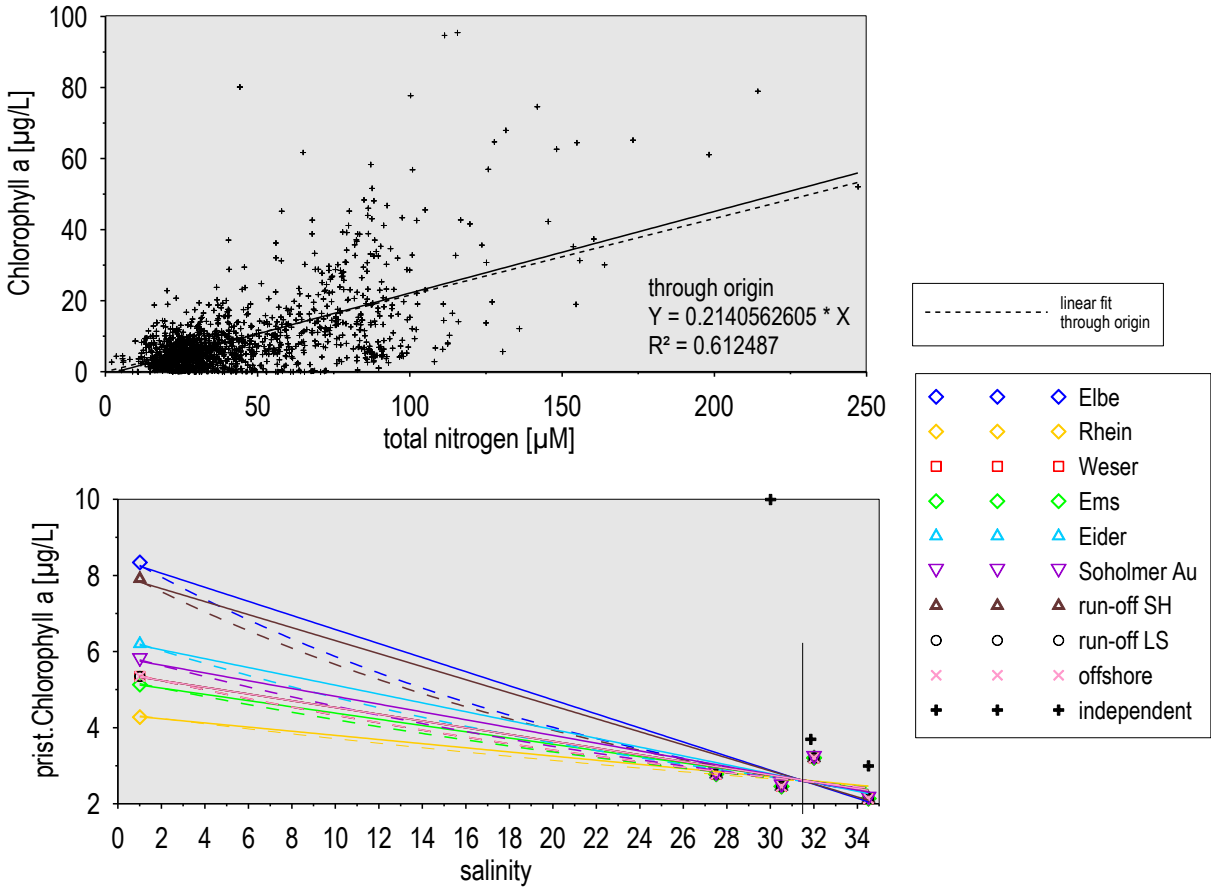
Trend in the year concentration of dissolved inorganic nitrogen compounds (nitrate, nitrite and ammonia) at the salinity of 30 psu at Noordwijk transect during the winter months (December till March) in the period 1976-2000 (data from all the monitoring excercices).

Annex 2b

Correlations of TN with salinity and TN with chlorophyll *a*
within the German territorial waters and exclusive economic zone at the surface
during growing season

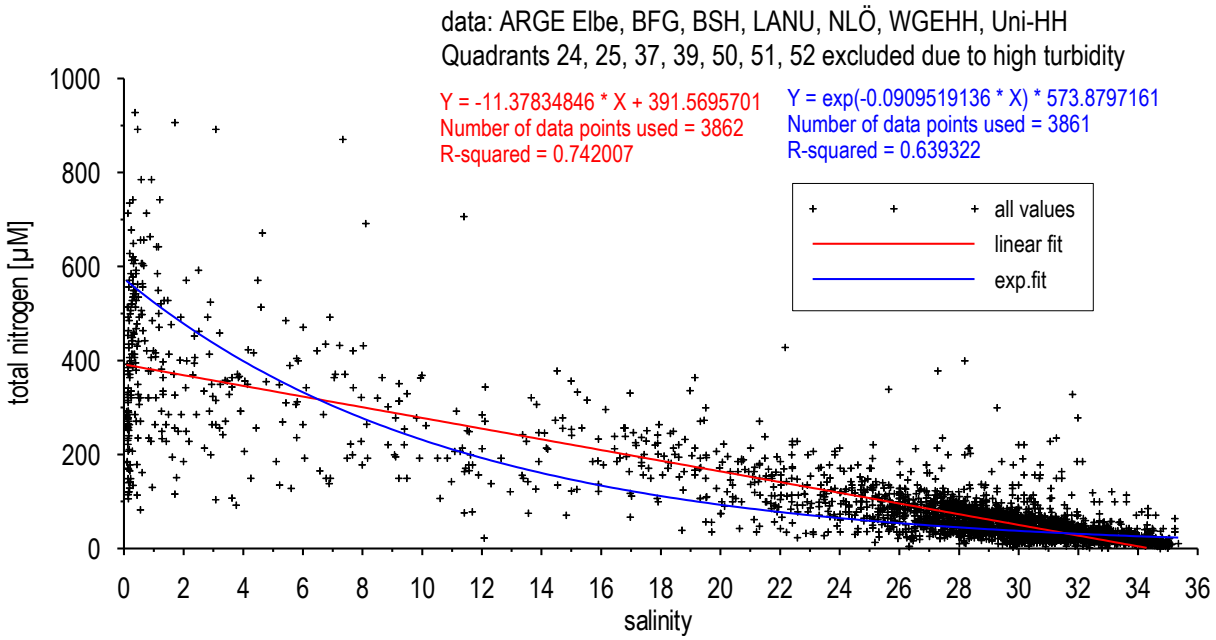
For the German Bight area linear correlations between TN and chlorophyll *a* were found during the growing season (a). Since TN is correlated with salinity as well (c), based on natural background concentrations of TN, assessment levels for chlorophyll *a* can be calculated for all salinities (b). This is in accordance with the assumption that eutrophication effects have their origin in the elevated nutrient discharges.

a) Recent data (1980 – 2000)



b) Correlations of calculated pristine chlorophyll *a* with salinity compared to independent estimations

Up to a salinity of 31.5 linear correlations are used, due to dominant mixing influences, beyond 31.5 it is suggested to use exponential fits, approaching open sea conditions.



c) Correlation of TN with salinity in the German Bight area during growing season (1980 – 2000)

Annex 2c

Area-specific background concentrations of nutrients during winter (XI-II) and chlorophyll *a* during growing season (III-X) in relation to salinity, and their related elevated levels

Sources: OSPAR agreement 2002-20, OSPAR 2003

	Area	Salinity	Background concentration DIN µmol/l	Elevated levels DIN µmol/l	Background concentration DIP µmol/l	Elevated levels DIP µmol/l	Background concentration Chlorophyll *a* µg/l, means	Background concentration Chlorophyll *a* µg/l, maxima	Elevated mean chlorophyll *a* levels µg/l, means
North Sea	Belgium Coast				0.6 0.6	>0.8 >0.8	10 10	15	 >15
	Denmark Coast	>34.5 <34.5	< 10 10 - 20	>12,5 >13 - 25	0.6-0,7 0.6	>0.8 >0.8	2-4 2-10		>4.5
	Germany Coast	>34.5 <34.5	8-9 9-16	12-14 14-24	0.6 0.5-0.6	0.9 0.75-0.9	2 2-4	10-13 13-18	3 3-6
	Netherlands Coast	>34.5 <34.5	10 14-24	>15 >21-36	0.6 0.6	>0.8 >0.8	2-4 10	 10	>4.5 >15
	Norway Coast				0.6 0.6	>0.8 >0.8	2-4 2-10		>4.5
	UK Coast	>34.5 <34.5	10 10-21	>15 >21	0.8 0.8	>1.2 >1.2	5-10 8-12	10 15	>10 >20
Channel		>34	9	>15	0.4	>0.8			
	France	>34.5	10	>15	0.8	>1.2	2	10	>4
Wadden Sea	Denmark	<30	6.5	>7	0.5	>0.7			>22-24 (needs verification)
	Germany	29-32	10-20	15-30	0.5-0.6	0.75-0.9	2-4	12-20	3-6
	Netherlands	<30	6.5	>7	0.5	>0.7		16	>22-24 (needs verification)
Skagerrak	Denmark	32-34	<10	>12.5	0.5	>0.7	<1.25		
	Norway	33	10	>15	0.5	>0.7			

	Area	Salinity	Background concentration DIN µmol/l	Elevated levels DIN µmol/l	Background concentration DIP µmol/l	Elevated levels DIP µmol/l	Background concentration Chlorophyll *a* µg/l, means	Background concentration Chlorophyll *a* µg/l, maxima	Elevated mean chlorophyll *a* levels µg/l, means
	Sweden		10	>15	0.6	0.9	1.5		>2
Kattegat	Denmark	20-32	4-5	>6-7	0.4	>0.5-0.6	1.5		>2
	Sweden		4-5	>6-7	0.4	>0.5-0.6	1.5	1.5	>2
Atlantic	France	>34.5	10	>15	0.8	>1.2	2	10	>4
	Ireland coast	>34.5					<7		>10
	Norway								
	Portugal coast	>35-35.5 <35	10 15	10-15 15-20	0.6 0.7	0.6-0.8 0.7	10		>15
	Spain coast	>34.5	10	>15				8	>12
	UK/Scotland coast	>34.5 <34.5	8 8	>12 >12	0.6 0.8	>0.9 >1.2	5 10	10 15	>10 >15
Southern Irish Sea and Eastern Celtic Sea	Ireland Offshore	>34.8	8	>12	0.5	>0.8			
Atlantic to Irish Sea	Coast	>34.5	12	>18	0.80	>1.25	<7		>10
Estuaries	Belgium								
	Denmark								
	France[12]							13	>18-20
	Germany	0-30	12-30	18-45	0.5-0.8	0.75-1.2	5-8	12-40	7.5-12
	Ireland	Referenced to 30		>42					
	Netherlands	<30	9-15	>18-30				2-6	

[12] For estuaries (salinity <30), concentrations vary too much depending on salinity and turbidity as to allow reliable assessment levels.

	Area	Salinity	Background concentration DIN µmol/l	Elevated levels DIN µmol/l	Background concentration DIP µmol/l	Elevated levels DIP µmol/l	Background concentration Chlorophyll *a* µg/l, means	Background concentration Chlorophyll *a* µg/l, maxima	Elevated mean chlorophyll *a* levels µg/l, means
	Western Scheldt Ems Dollar								>9-10 >18-20
	Norway								
	Portugal: Sado Tagus Mondego		 21 34 44	 >32 >51 >66			 6 9 6		 >9 >14 >9
	Spain								
	Sweden								
	UK								

In order to harmonise the reference values, individual elevated data were omitted. Elevated levels for nutrients are concentrations above the assessment level. Generally assessment levels for nutrients are based on a justified area-specific % deviation from background not exceeding 50% (for Denmark, a deviation from background of 25% has been used).

General and physiological information of various phytoplankton indicator species

***Phaeocystis* spp**

- foam-forming nuisance species in colonial form; occurrence during spring-summer;
- increased concentrations of more than 10^6 cells/l and increased bloom duration per year are an indication of nutrient enrichment;
- occurrence of colony-formation depends on the physiological state and is related to the excess of nitrate as N-source during N-limiting under certain conditions by light;
- *Phaeocystis* outcompetes other species under N-limitation at low N/P ratios; it has a lower P demand than diatoms and needs a minimum temperature of 7°C; T_{opt} is 15°C;
- relatively high abundance, increased frequency and duration of blooms in continental waters are strongly linked with nutrient enrichment;
- *Phaeocystis* free-living cells (but not colonies) are grazed by tintinnids, and not grazed by copepods; it therefore has a poor food value, is a bad food source for bivalves and has a negative effect on young oysters, probably due to its mucilage.

Noctiluca scintillans

- this large (0,3 mm) non-toxic heterotrophic (hence oxygen consuming) dinoflagellate forms regular tomato soup coloured surface accumulations in spring under calm weather conditions (<3-5 Bft) (nuisance species);
- its high abundance (above 10^3 cells/l) leads to low oxygen concentrations below the top layer and to high ammonium concentrations which may be harmful to fish. Oxygen deficiency induced by *Noctiluca* blooms caused a mass kill of cockles in the Dutch Wadden Sea;
- its high abundance may be due to its increased food resources as result of increased eutrophication.

Chrysochromulina polylepis

- fish and benthos killing species; toxic above 10^6 cells/l; bloom occurrence in spring;
- the exceptional bloom in May 1988 in Kattegat and Skagerrak waters is likely to be linked to eutrophication, with other factors (climate, hydrography) involved; its toxicity may be related to N/P ratios (more toxic under P-limitation);
- it seems to prefer nutrient rich water and high light intensities; the combination of a mild winter with high precipitation, followed by a warm spring with very stable water masses was probably the most important cause of its massive, toxic bloom in May 1988.

Gymnodinium mikimotoi (former name is *Gyrodinium aureolum*)

- fish-killing species when cell density exceeds 10^3 - 10^6 cells/l; in the Channel, west UK, Danish, Norwegian and Swedish waters these blooms have caused fish kills;
- bloom occurrence: late summer-autumn; first observation in 1966 along south-west Norwegian coast; optimal growth at 20 ^{0}C;
- it shows a preference for deeper water layers;

- blooms develop mainly in dynamic light environments (fronts, stratified water layers, turbid waters) where they have ecological advantage due to their ability to adapt at different light intensities, to migrate and to assimilate N at low light intensities;
- *Gymnodinium mikimotoi* is believed to be an introduced species which has spread its occurrence in the Skagerrak, Kattegat and North Sea waters since first recorded in autumn 1966 in Norwegian Skagerrak and off south west UK. Some authors have suggested that blooms occurring in recent years are linked to and a consequence of long-term increases in nutrient levels where such increases have occurred; direct links between increased nutrient levels and organic matter and toxic dinoflagellate blooms may well be obscured by other factors as meteorology and hydrography. There is a need for further research.

***Alexandrium* spp**

- several species of *Alexandrium* (e.g. *A. tamarense*. *A. minutum/lusitanicum*, *A. ostenfeldii*) may be toxic (above 10^2 cells/l), depending on duration and cell concentration, and cause PSP;
- toxicity months: May-June;
- its appearance may be associated with a flux of water rich in nutrients, crossing fronts;
- it has been suggested that PSP-producing dinoflagellates may have spread geographically; summer blooms are recruited from resting stages which spend winter on the sea bottom.

***Dinophysis* spp.**

- *Dinophysis acuminata, D. acuta, D. norvegica, D. caudata, D. fortii, D. sacculus, D. rotundata, D. skagii and D. tripos* are considered as DSP mussel-infecting species;
- occurrence: late summer-autumn;
- more than 10^2 cells/l may give rise to DSP, depending on duration of occurrence;
- its occurrence is associated with low salinity coastal waters and calm weather (wind < 2 Bft during 1 week) rather than with temperature.

Other species

The raphidophycean species *Fibrocapsa japonica* and *Chatonella* spp. are increasingly occurring in coastal European waters. Massive toxicity has been reported for the small sized *F. japonica* when cell concentration is exceeding 4 x 10^6 cells/l. This species may also directly affect marine mammals, whereas toxicity of *Chatonnella* spp. is mainly related to fish kills.

Annex 3b

Elevated levels of area-specific nuisance and toxic phytoplankton indicator species, and the type of their effects

Phytoplankton indicator species	**Elevated levels**	**Effects**
Nuisance species		
Phaeocystis spp. (colony form)	> 10^6 cells/l (and >30 days duration)	nuisance, foam, oxygen deficiency
Noctiluca scintillans	> 10^4 cells/l (area coverage > 5 km^2)	nuisance, oxygen deficiency
Toxic (toxin producing) species		
Chrysochromulina polylepis	> 10^6 cells/l	toxic; fish and benthos kills
Gymnodinium mikimotoi	> 10^5 cells/l	toxic; fish kills, PSP mussel infection
Alexandrium spp.	> 10^2 cells/l	toxic; PSP mussel infection
Dinophysis spp.	> 10^2 cells/l	toxic; DSP mussel infection
Prorocentrum spp.	> 10^4 cells/l	toxic; DSP mussel infection

Annex 4

The significance of different factors potentially used in a typology of offshore waters in relation to the biotic parameters used in the Comprehensive Procedure

Characteristic	Optical properties	Density	Stratification	Phytoplankton	Phytobenthos
Salinity	Y*	Y	Y	Y (salinity preference)	Y
Depth	Y*	N	Y*		Y
Mean water temperature (range)	Y*	Y	Y	Y (preference, physiology)	Y (preference, physiology)
Turbidity	Y	N	N	N	Y
Mean substratum composition	Y*	N	N	Y	Y
Mixing characteristics	Y*	Y	Y	Y* (turbulence)	Y
Residence time/retention time	N	N	N	Y (biomass accumulation)	N

* signifies an indirect relationship

Note: Y = yes, N = no.

Annex 5

Reporting format on the results of the OSPAR Comprehensive Procedure

1. Area

Name and map (geographical location: longitude, latitude)

2. Description of the area

Including environmental information

3. Assessment

Category	**Assessment Parameters**	**Description of Results**	***Score*** (+ - ?)
Degree of Nutrient Enrichment (I)	Riverine inputs and direct discharges of total N and total P		
	Winter DIN and/or DIP concentrations		
	Winter N/P ratio (Redfield N/P = 16)		
Direct Effects (II)	Maximum and mean chlorophyll *a* concentration		
	Area-specific phytoplankton indicator species		
	Macrophytes including macroalgae		
Indirect Effects (III)	Oxygen deficiency		
	Changes/kills in zoobenthos and fish kills		
	Organic carbon/organic matter		
Other Possible Effects (IV)	Algal toxins (DSP/PSP mussel infection events)		

Key to the Score

\+ = Increased trends, elevated levels, shifts or changes in the respective assessment parameters

\- = Neither increased trends nor elevated levels nor shifts nor changes in the respective assessment parameters

? = Not enough data to perform an assessment or the data available is not fit for the purpose

(Reporting format continued on next page)

Reporting format on the results of the OSPAR Comprehensive Procedure (continued)

4. Overall Classification

Key to the table

NI	Riverine inputs and direct discharges of total N and total P	Mp	Macrophytes including macroalgae
DI	Winter DIN and/or DIP concentrations	O_2	Oxygen deficiency
NP	Increased winter N/P ratio	Ck	Changes/kills in zoobenthos and fish kills
Ca	Maximum and mean chlorophyll *a* concentration	Oc	Organic carbon/organic matter
Ps	Area-specific phytoplankton indicator species	At	Algal toxins (DSP/PSP mussel infection events)

\+ = Increased trends, elevated levels, shifts or changes in the respective assessment parameters

\- = Neither increased trends nor elevated levels nor shifts nor changes in the respective assessment parameters

? = Not enough data to perform an assessment or the data available is not fit for the purpose

Note: Categories I, II and/or III/IV are scored '+' in cases where one or more of its respective assessment parameters is showing an increased trend, elevated levels, shifts or changes.

Area	**Category I** Degree of nutrient enrichment		**Category II** Direct effects		**Category III and IV** Indirect effects/ other possible effects				Initial classification	Appraisal of all relevant information (concerning the harmonised assessment parameters, their respective assessment levels and the supporting environmental factors)	Final classification	Assessment period
	NI		Ca		O_2		At					
	DI		Ps		Ck							
	NP		Mp		Oc							
	NI		Ca		O_2		At					
	DI		Ps		Ck							
	NP		Mp		Oc							
	NI		Ca		O_2		At					
	DI		Ps		Ck							
	NP		Mp		Oc							

5. Discussion

Explanation of classification results

6. Other information

Provide where possible consideration of the outlook for the future and the need for further action in order to achieve by 2010 a healthy marine environment where eutrophication does not occur.

Annex 6

Timetable of activities with respect to the update and second application of the Comprehensive Procedure

	Period	Description	Lead country	Responsible body
1	2008	OSPAR Integrated Report 2008 use for 2009 reporting within WFD implementation		EC Member States
2	June 2008	OSPAR Integrated Report 2008 (reporting years to be decided, e.g. 1995-2004, both years included) taking into account WFD; content based on OSPAR 2003 report on eutrophication and updated Comprehensive Procedure guidance[13]	Germany (D) and the Netherlands (NL)	ETG/EUC to OSPAR
3	2007/ 2008	Draft integrated report based on national reports	D & NL	ETG/EUC
4	2006/ 2007	National reports including reporting formats		CPs to ETG/EUC
5	2005	Synergy of Comprehensive Procedure and the integrated set of EcoQOs for eutrophication	NL &Norway (N)	ETG/EUC
6	2005	1. Final update of Comprehensive Procedure guidance 2. Draft synergy with EC Eutrophication Guidance	D & NL EC	OSPAR
7	2004/ 2005	1. Draft update of the Comprehensive Procedure guidance 2. Synergy with WFD	D & NL	ETG/EUC
8	2004	ICES database in relation to the Comprehensive Procedure operational. Also requires the submission of sufficient data to ICES by the agreed deadlines		ICES, CPs
9	2004/ 2005	Guidelines for the eutrophication monitoring regarding frequency/spatial coverage (cf. JAMP products ET-1 as part of AT-3)		ETG/MON/ EUC
10	2004/ 2005	Guidance on the significance of any exceedence of assessment levels	UK	ETG/EUC
11	2004/ 2005	Further developed draft harmonised assessment criteria and their respective assessment levels within the Comprehensive Procedure (see also JAMP ET-5, 2006)	D & NL	ETG/EUC
12	2004/ 2005	Overview of predictive models (cf. JAMP product EA-5 based on JAMP product ET-7)		ETG/EUC
13	2004/ 2005	Information on atmospheric nitrogen emissions/depositions (cf. JAMP product EA-1)		ETG/EUC
14	2004/ 2005	Reporting years to be agreed for the OSPAR integrated report 2008		ETG/EUC

[13] Further guidance is needed on the mode for reporting data collected over the assessment period; in addition synchronisation of reporting within OSPAR and under the Water Framework Directive should be sought.

Annex 7

Reference documents

Note: Shaded documents are key documents for the Common Procedure

RECOMMENDATIONS	
88/2	PARCOM Recommendation 88/2 on the Reduction in Inputs of Nutrients to the Paris Convention Area
89/4	PARCOM Recommendation 89/4 on a Co-ordinated Programme for the Reduction of Nutrients
92/7	PARCOM Recommendation 92/7 on the Reduction of Nutrient Inputs from Agriculture into Areas where these Inputs are Likely, Directly or Indirectly, to Cause Pollution.
OTHER AGREEMENTS	
1997-2	JAMP Eutrophication Monitoring Guidelines: Nutrients
1997-3	JAMP Eutrophication Monitoring Guidelines: Oxygen
1997-4	JAMP Eutrophication Monitoring Guidelines: Chlorophyll *a* in water
1997-5	JAMP Eutrophication Monitoring Guidelines: Phytoplankton Species Composition
1997-6	JAMP Eutrophication Monitoring Guidelines: Benthos
1997-11	Common Procedure for the Identification of the Eutrophication Status of the Maritime Area, superseded
1998-5	Principles of the Comprehensive Study on Riverine Inputs and Direct Discharges (RID), as amended
2001-5	Agreement on those Parts of the OSPAR Maritime Area to which the Comprehensive Procedure will be applied
2001-7	Principles for the Comprehensive Atmospheric Monitoring Programme (CAMP)
2002-13	OSPAR Co-ordinated Environmental Monitoring Programme (CEMP)
2002-14	JAMP Guidelines for General Biological Effects Monitoring
2002-20	Common Assessment Criteria, their Assessment Levels and Area Classification within the Comprehensive Procedure of the Common Procedure, superseded
2003-21	2003 Strategies of the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic
2004-2a-2i	OSPAR HARPNUT Guideline 1: Framework and Approach of the Harmonised Quantification and Reporting Procedures for Nutrients (cf. HARPNUT Guidelines 2-9, agreements 2004-2b to 2004-2i)
2004-17	Strategy for a Joint Assessment and Monitoring Programme (JAMP)
2005-4	Eutrophication Monitoring Programme, superseding the Nutrient Monitoring Programme 1995-5
PUBLICATIONS	
QSR 1993	Quality Status Report 1993, OSPAR publication no. 14 (1993), ISBN 1-872349-06-4
QSR 2000	Quality Status Report 2000, OSPAR publication no. 111 (2000), ISBN: 0-946956-52-9.
OSPAR 2001	Evaluation of the expected situation of the eutrophication status in the Maritime

	Area following the 50% reduction target for nutrient inputs, OSPAR publication no. 140 (2001), ISBN: 0-946956-76-6.
OSPAR 2003	OSPAR integrated report 2003 on the eutrophication status of the OSPAR maritime area based upon the first application of the Comprehensive Procedure, OSPAR publication no. 189 (2003), ISBN: 1-904426-25-5.
EMEP 2004	Atmospheric Nitrogen in the OSPAR Convention Area in the period 1990 – 2001, EMEP/MSC-W Technical Report, 4/2004, also published by OSPAR, publication no. 217 (2004), ISSN 0804-2446.