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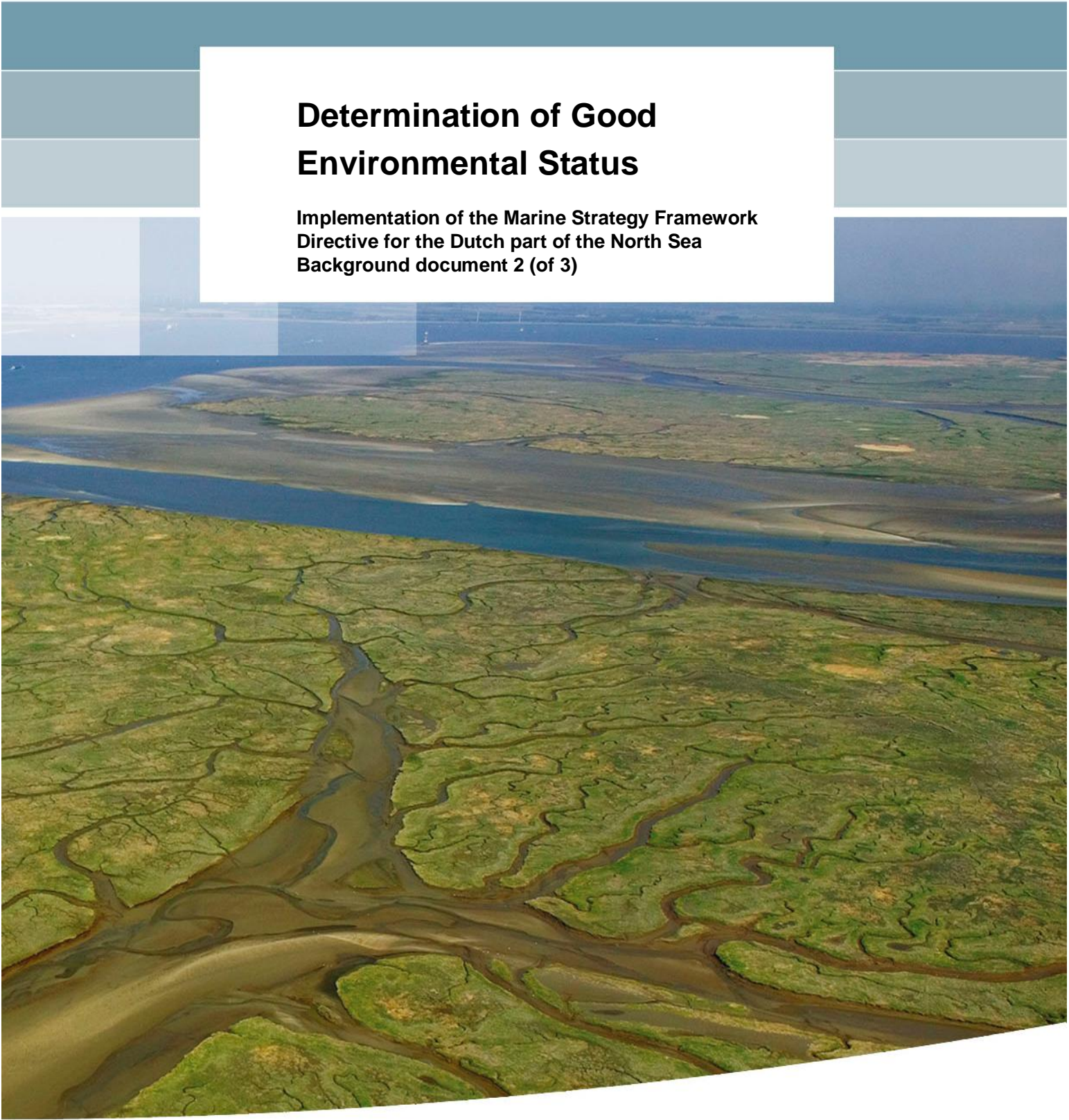
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Determination of Good Environmental Status

**Implementation of the Marine Strategy Framework
Directive for the Dutch part of the North Sea
Background document 2 (of 3)**



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**Implementation of the Marine Strategy Framework Directive
for the Dutch part of the North Sea
Background document 2 (of 3)**

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

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Summary

This report presents the characteristics of good environmental status (GES) for each descriptor, as required by Article 9 of the Marine Strategy Framework Directive (MSFD). The report provides an advice on Good Environmental Status (GES) per descriptor that is applicable to the Dutch part of the North Sea. It is the second in a series of three documents, each providing the scientific background for the implementation of the MSFD in the Netherlands.

Versie	Datum	Auteur	Paraaf	Review	Paraaf	Goedkeuring	Paraaf
	2 May 2011	Dr. T.C. Prins		Prof. Dr. R.W.P.M. Laane		Ir. T. Schilperoort	
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State
final

Justification and status of report

These advice report should be regarded as scientific background report, that serve as advisory document in the preparation for the Marine Strategy, to be written by the Ministry of Infrastructure and Environment. The reports is based on currently available knowledge, laid down in reports, scientific literature, and unpublished material and on expert judgment.

Deltares and IMARES have been working on the three background documents between January 2010 en April 2011. March 15th 2011 is taken as set date. Documents and proceedings of meetings available later than March 2011 could not be taken into account for scientific background report. Between April and September 2011 review process by the Ministry of Infrastructure and Environment and the Ministry of Economic Affairs, Agriculture and Innovation took place, after which we finalised these documents in September 2011.

The implementation of the Marine Strategy Framework Directive entails an on-going process of workshops meetings, guidance documents, and (draft) working documents provided by the EC, OSPAR, ICES, JRC and others in order to facilitate national implementation and regional coherence. The editors and the ministry are aware of the fact that after March 2011 additional information became available through documents and workshops, and this information might deviate from content in these reports.

Contents

Executive summary	1
1 Introduction	5
1.1 Background	5
1.2 The Marine Strategy Framework Directive	6
1.3 Requirements for the determination of characteristics of GES	6
1.4 Outline of this report	8
2 Approach used for the determination of GES	9
2.1 Introduction	9
2.2 Ecosystem based approach	9
2.3 Existing policy and legislative obligations	10
2.4 Ambition of current Dutch policy regarding the North Sea	11
2.5 Relations between GES descriptors	11
2.6 GES definition and target setting for 2020	13
2.7 What is “good” environmental status?	13
2.8 Steps taken towards a proposal for Good Environmental Status	15
3 Background information on GES per descriptor	17
3.1 Descriptor 1: Biological diversity	17
3.1.1 Current (inter)national policies and treaties	17
3.1.2 Risk assessment	20
3.1.3 Proposal for GES	21
3.2 Descriptor 2: Non- indigenous species	23
3.2.1 Current (inter)national policies and treaties	23
3.2.2 Risk assessment	25
3.2.3 Proposal for GES	25
3.3 Descriptor 3: Commercially exploited fish and shellfish	27
3.3.1 Current (inter)national policies and treaties	27
3.3.2 Risk assessment	28
3.3.3 Proposal for GES	29
3.4 Descriptor 4: Food webs	31
3.4.1 Current (inter)national policies and treaties	31
3.4.2 Risk assessment	32
3.4.3 Proposal for GES	33
3.5 Descriptor 5: Human-induced eutrophication	35
3.5.1 Current (inter)national policies and treaties	35
3.5.2 Risk assessment	36
3.5.3 Proposal for GES	36
3.6 Descriptor 6: Sea-floor integrity	38
3.6.1 Current (inter)national policies and treaties	38
3.6.2 Risk assessment	39
3.6.3 Proposal for GES	40
3.7 Descriptor 7: Hydrographical conditions	41
3.7.1 Current (inter)national policies and treaties	41
3.7.2 Risk assessment	42
3.7.3 Proposal for GES	42

3.8	Descriptor 8: Contaminants	43
3.8.1	Current (inter)national policies and treaties	43
3.8.2	Risk assessment	44
3.8.3	Proposal for GES	45
3.9	Descriptor 9: Contaminants in fish and other seafood	46
3.9.1	Current (inter)national policies and treaties	46
3.9.2	Risk assessment	47
3.9.3	Proposal for GES	47
3.10	Descriptor 10: Litter	48
3.10.1	Current (inter)national policies and treaties	48
3.10.2	Risk assessment	49
3.10.3	Proposal for GES	50
3.11	Descriptor 11: Energy and underwater noise	51
3.11.1	Current (inter)national policies and treaties	51
3.11.2	Risk assessment	52
3.11.3	Proposal for GES	53
4	References	55
 Appendices		
A	Acknowledgments	A-1

Executive summary

Introduction

This report presents the characteristics of good environmental status (GES) for each descriptor, as required by Article 9 of the Marine Strategy Framework Directive (MSFD). The report provides an advice on Good Environmental Status (GES) per descriptor that is applicable to the Dutch part of the North Sea. It is the second in a series of three documents, each providing the scientific background for the implementation of the MSFD in the Netherlands.

The first report of the series, by Prins et al. (2011), provides information that is pertinent to the Initial Assessment, required by Article 8 of the MSFD. The report describes the environmental conditions in the Dutch part of the North Sea, the current human activities and predominant associated pressures on the ecosystem, and the present environmental status per descriptor. The 3rd report, by Boon et al. (2011), discusses the establishment of indicators and environmental targets as specified by Article 10 of the MSFD. The interrelationships between the 3 reports is presented in Boon et al. (2011).

Ecosystem based approach

The ecosystem based approach to the management of human activities is fundamental to the MSFD. More specifically, the MSFD defines that:

- the potential for uses and activities by current and future generations is safeguarded
- ecosystems can function fully and maintain their resilience to human-induced environmental change
- the precautionary principle should prevail when consequences of human activities are uncertain.

The ecosystem based approach has been a guiding principle for the management of the North Sea within several other policies and treaties, e.g. common fisheries policy and OSPAR.

The determination of GES requires a good understanding of the current status of the marine environment, and the relations between natural and anthropogenic pressures on the one hand and environmental status on the other hand. In practice, there is only limited and often only qualitative understanding of the cause-effect relationships between human activities (pressures) and environmental effects (state) in the marine environment. Hence, the GES for 2020 should be viewed as an intermediate step, and needs to be reviewed in the next reporting cycle.

Determination of GES and target setting

The concept of sustainable use is fundamental to the MSFD. This implies that the MSFD does not aim at banning all human activities from the sea, but aims at allowing use, as long as it is at a level and in a manner that is sustainable. This means that the potential for uses and activities by current and future generations is safeguarded and ecosystems can function fully and maintain their resilience to human-induced environmental change. At the same time, the MSFD uses phrases that in some cases seem more applicable to a pristine or only slightly disturbed environment or appear at odds with one another, even within the same descriptor. Definition of what is to be considered “good” environmental status is not an easy and straightforward task. The MSFD does not give guidance on how the eleven descriptors are

related, and how achieving GES for each of the descriptors should contribute to the overall objective of the Directive.

The determination of GES has been interpreted as the description of the desired state of the marine environment in qualitative terms (cf. art. 3.5 of the MSFD). This report gives thus a qualitative description for each of the 11 GES descriptors, expressing an overall ambition for each descriptor. Quantitative targets are assigned to the set of criteria and indicators as defined by EC (2010). These are further specified in the report on environmental targets and indicators by Boon et al. (2011).

In order to achieve a proposal for GES, the following steps are taken:

- 1: an interpretation of the objectives of the MSFD, as laid out in the MSFD (EC, 2008),
- 2: review of existing legislation, both international and national, as well as their objectives, and the environmental targets following from these objectives. Most steering factors from these legislations in relation to pressures and state are interpreted. The national ambition with respect to the marine environment forms cornerstone for the determination of GES,
- 3, review of facts as documented in Prins et al. (2011) (report on Initial assessment) in order to provide a baseline. This forms the departure point for the determination of Good environmental status to be achieved by 2020,
- 4: proposal for GES with considerations based on step 1-3.

Proposed Good Environmental Status per descriptor

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- | | |
|---|--|
| <ul style="list-style-type: none"> - Biological diversity | <ul style="list-style-type: none"> - biological diversity in general is maintained compared to the current state, - and is restored where current state does not meet existing obligations. |
| <ul style="list-style-type: none"> - Non-indigenous species | <ul style="list-style-type: none"> - the abundance and distribution of non-indigenous species does not increase and there are no further introductions of non-indigenous species, - non-indigenous species do not cause adverse effects. |
| <ul style="list-style-type: none"> - Commercially exploited fish and shellfish | <ul style="list-style-type: none"> - the population of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock. |
| <ul style="list-style-type: none"> - Food webs | <ul style="list-style-type: none"> - key food web species can use their full reproductive capacity, - all elements of the marine food web, to the extent that they are known, occur at normal abundance. |
| <ul style="list-style-type: none"> - Human-induced eutrophication | <ul style="list-style-type: none"> - human induced eutrophication is minimized. |
| <ul style="list-style-type: none"> - Sea-floor integrity | <ul style="list-style-type: none"> - a specific proportion of the total surface area of each benthic habitat is undisturbed, - recovery and presence of benthic communities in line with local physiographic, geographic and climatic conditions is ensured. |

- Hydrographical conditions
 - Contaminants
 - Contaminants in fish and other seafood
 - Litter
 - Energy and underwater noise
- Infrastructural or engineering works do not occur at such a scale that they result in permanent adverse effects on the ecosystem through significant changes in hydrographical conditions.
 - concentrations of contaminants, measured in the relevant matrix for the marine environment, are at levels not giving rise to pollution effects.
 - contaminants in fish and other seafood for human consumption do not exceed levels established by Community and national legislation.
 - the amount of litter in the water column, on the seabed and washed ashore decreases compared to the baseline reference,
 - harmful effects of litter in marine organisms do not occur.
 - the occurrence and fitness of marine fauna is not adversely affected by background noise and/or loud impulsive sounds introduced by human activities.

1 Introduction

1.1 Background

The European Marine Strategy Framework Directive 2008/56 (MSFD) (EC, 2008) has become effective on 15 July 2008. The objective of the MSFD is to achieve or maintain good environmental status (GES) in the marine environment by 2020. As one of the first steps in the implementation of the MSFD, by 15 July 2012 each member state must make an Initial Assessment (article 8), determine characteristics of GES (article 9) and establish environmental indicators and targets (article 10).

Deltares and IMARES have been commissioned by the Ministry of Infrastructure and Environment and the Ministry of Economic Affairs, Agriculture and Innovation to provide scientific advice for the implementation of the MSFD by the Netherlands. For this purpose, three separate reports for the Dutch part of the North Sea have been drafted. These reports focus on

- 1 the Initial Assessment
- 2 the determination of Good Environmental Status
- 3 the establishment of Indicators and Environmental Targets

The reports should be regarded as scientific background reports, that serve as advisory documents in the preparation for the Marine Strategy. The reports are based on currently available knowledge, laid down in reports, scientific literature, and unpublished material and on expert judgment. The reports do not reflect the opinion of the principals.

The Initial Assessment (IA) report gives a description of the current state of the Dutch part of the North Sea. This report provides information on the physical characteristics of the southern North Sea. It describes the human activities in the Dutch part of the North Sea, the associated environmental pressures, and the current environmental state.

The GES report on the determination of GES (this report) advises on the characteristics of good environmental status. Those characteristics were defined on the basis of the MSFD requirements, the current conditions in the Dutch part of the North Sea (as described in the Initial Assessment) and the commitments laid down in legislation and (inter)national policy.

The third report on the establishment of Indicators and environmental targets presents a proposal for environmental indicators and targets. The proposal is based on an elaboration of the criteria and indicators in the Commission decision on criteria and methodological standards on GES of marine waters (EC, 2010), GES and on a consideration of potential indicators in terms of suitability, quality and practicability. The indicators and targets form the translation of GES into more specific, qualitative or quantitative environmental requirements that must be met to achieve GES.

Summarizing, the first report for the Initial Assessment describes the current state of the Dutch coastal zone. The second report on the determination of GES proposes the overall ambition of the environmental state to be achieved. This ambition is subsequently translated into environmental targets for indicators in the third report, describing indicators for each GES-descriptor which can either be qualitatively described or quantitatively assessed.

Together, the three reports provide the scientific background for the Dutch Ministry of Infrastructure and Environment (as leading ministry) to develop a marine strategy. A social and economic analysis (required as part of the Initial Assessment) will be reported separately by Rijkswaterstaat/Centre for water management.

1.2 The Marine Strategy Framework Directive

The objective of the Directive is to achieve or maintain good environmental status (GES) in the marine environment by 2020. GES means that the seas are clean, healthy and productive and that use of the marine environment is at a level that is sustainable. For this purpose, each member state needs to develop and implement a Marine Strategy in order to:

- a) protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected,
- b) prevent and reduce inputs in the marine environment and phase out pollution, to ensure that there are no significant impacts on or risks to marine biodiversity, marine ecosystems, human health or legitimate use of the sea.

The leading philosophy behind the MSFD is the ecosystem approach. This implies that management of human activities is required. The collective pressures from human activities acting on the marine environment should be kept within levels compatible with the achievement of GES, whilst enabling the sustainable use of marine goods and services by present and future generations (article 1.3 MSFD).

The MSFD prescribes that member states sharing a marine (sub-)region should cooperate during the whole process to ensure that their marine strategies are coherent and coordinated and should endeavour to follow a common approach. The approach consists of the following elements:

- making an Initial Assessment of the marine waters, by 15 July 2012,
- determination of a set of characteristics of Good Environmental Status, by 15 July 2012,
- establishment of a set of Environmental Targets and associated indicators, by 15 July 2012,
- establishment and implementation of a Monitoring Programme for assessment and updating of the targets, by 15 July 2014,
- development of a programme of measures to achieve or maintain good environmental status, by 2015 at the latest,
- entry into operation of the programme of measures, by 2016 at the latest,
- every six years after the initial establishment, the above mentioned elements must be reviewed,
- achievement or maintenance of good environmental status by 2020.

1.3 Requirements for the determination of characteristics of GES

In Article 9, the Marine Strategy Framework Directive (MSFD) describes the requirements for the determination of good environmental status:

- member states have to describe a set of characteristics for good environmental status, on the basis of the 11 qualitative descriptors listed in Annex I of the MSFD.
- the indicative list of elements in Table 1 of Annex III (describing physical, chemical and biological features, habitat types, and hydromorphology) has to be taken into account. Also, pressures and impacts must be taken into account. An indicative list of pressures and impacts related to human activities is provided in Table 2 of Annex III.

- in a Commission Decision on criteria and methodological standards (EC, 2010), the European Commission describes the criteria and applicable methodological standards that must be used to assess whether good environmental status is being achieved.

Good environmental status is described in Article 3.5 as *“the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations, i.e.:*

- a) the structure, functions and processes of the constituent marine ecosystems, together with the associated physiographic, geographic, geological and climatic factors, allow those ecosystems to function fully and to maintain their resilience to human-induced environmental change. Marine species and habitats are protected, human-induced decline of biodiversity is prevented and diverse biological components function in balance;*
- b) hydro-morphological, physical and chemical properties of the ecosystems, including those properties which result from human activities in the area concerned, support the ecosystems as described above. Anthropogenic inputs of substances and energy, including noise, into the marine environment do not cause pollution effects”*

Programmes of measures to achieve or maintain good environmental status of the marine environment by the year 2020, must be based on the ecosystem approach and, in particular, the precautionary principle (both discussed in chapter 2.2).

The European Commission recognizes that, in view of the dynamic nature of marine ecosystems and their natural variability, and changes in pressures and impacts with the evolvement of human activities, determination of good environmental status may have to be adapted over time. Programmes of measures must be flexible, adaptive and take account of scientific and technological developments, i.e. adaptive management should be applied (EC, 2010).

The marine strategy will be updated on a regular basis. According to Article 17 of the MSFD, an update of the determination of good environmental status, together with an update of the initial assessment and the environmental targets must be done every six years. This means that a first update is foreseen by 2018.

In this report, the determination of GES has been interpreted as the description of the desired state of the marine environment in qualitative terms (cf. Art. 3.5). A qualitative description for each of the 11 GES descriptors, expressing an overall ambition for each descriptor is presented here.

1.4 Outline of this report

Chapter 2 gives a description of the 'building blocks' that were used to come to a determination of GES. Those building blocks are the general MSFD approach of ecosystem based management, the already existing (inter)national commitments, and the current national policy for the North Sea.

Chapter 3 gives a more extensive background to the determination of GES for each descriptor. Per descriptor, background information is provided on Annex I of the MSFD. Furthermore, an overview is given of current commitments as laid down in the most relevant legislation and policy documents, and/or (inter)national policies already addressing each descriptor. For each descriptor, the most important issues concerning present environmental state and pressures are discussed. On the basis of current commitments and the MSFD requirements, a proposal for GES is given. Finally, consideration is given to the feasibility of achieving GES, given the current environmental issues and the nature of the most important pressures.

2 Approach used for the determination of GES

2.1 Introduction

The determination of good environmental status is a step in the policy development towards protection and restoration of the marine environment. Where possible, the determination should be based on well-established principles. One of those principles also mentioned in the MSFD is the ecosystem approach (definition see 2.2). The determination of GES should also take into account existing (inter)national policy and legislative commitments.

Many of the concepts behind the MSFD still need further elaboration. As part of this process, the European Commission has asked Joint Research Centre (JRC) and International Council for the exploration of the sea (ICES) to provide scientific support and put forward a comparable and consistent interpretation of the concept of GES. This has eventually resulted in reports from 10 Task Groups, published in April 2010, for each of the qualitative descriptors from Annex I of the MSFD, with exception of descriptor 7 (hydrographic conditions). A Commission Decision on criteria and indicators for assessing GES was published on 1 September 2010 (EC, 2010).

Within OSPAR, several working groups are active to prepare advice on the implementation of the MSFD in the OSPAR area through a harmonized approach. Possible approaches are still in development. It can be anticipated that it will not be possible by 2012 to have a complete, refined picture of what constitutes GES, what it means and how progress towards GES can be measured. There is still a need for further elaboration of the concepts behind the MSFD. Therefore, the initial assessment, the set of GES characteristics, the environmental targets and associated indicators, to be completed by 2012 will only be a first stage. Much of the required information is not yet available, and a pragmatic approach is advisable. Further development and refinement will be necessary in the subsequent six-year reporting period, resulting in adaptive management.

2.2 Ecosystem based approach

The MSFD describes the requirements for the determination of good environmental status (EC, 2008). The European Commission further elaborates on the approach to be taken (EC, 2010). It is recognized that there is a need to develop additional scientific understanding for assessing good environmental status, in order to support the ecosystem-based approach to management.

The MSFD states that marine strategies shall apply an ecosystem-based approach to the management of human activities. This must ensure that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status, and that the capacity of marine ecosystems to respond to human induced changes is not compromised, while enabling the sustainable use of marine goods and services by present and future generations.

The ecosystem approach was adopted as the primary framework for action under the UN Convention on Biological Diversity. It is generally described as: “*a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way*”. More specifications are provided in CBD-COP 6 reports¹.

The ecosystem based approach has been a guiding principle for the management of the North Sea within OSPAR since 2003. The ecosystem approach is described by OSPAR as:

¹ Convention on Biological Diversity (CBD), COP6 = Conference of the parties, 6th meeting

“The comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity”.

The application of the precautionary principle is equally a central part of the ecosystem approach (OSPAR, 2010).

In VenW (2009) the following elements are mentioned as part of the ecosystem approach for the North Sea:

- monitoring, analysis of measurement data, scientific research of ecological processes and evaluation as basis for management and policy,
- developing ecological quality objectives (EcoQOs) and economic and social quality objectives,
- Involving potential ecological consequences of intended activities in decision-making about marine activities,
- protecting the marine environment with a view to sustainable development and application of the precautionary principle,
- assignation of Marine Protected Areas,
- adaptive management, enabling responses to economic developments and knowledge accumulation,
- involving stakeholders in marine management.

The application of the ecosystem approach involves a solid scientific substantiation of measures, although it is recognised that cause and effect relationships are not always unequivocal and understood.

The precautionary principle, as it has been implemented in international and national policy, is a crucial starting point for planning and designing intended activities at sea. It implies that precautionary measures must be taken if there is reasonable concern that an activity may damage the marine environment, human health and/or other legitimate use, even if no conclusive evidence is available that there is a causal link between an activity and its effects. The reason behind this precautionary principle is that anything that enters the ocean system can never or only with extreme difficulty be removed and can therefore accumulate in the system (VenW, 2009).

The precautionary principle entails taking measures in advance to prevent potentially long-term, irreversible and adverse effects of activities and, if the activity appears permissible, to reduce such effects. Tools used are drafting and evaluating environmental impact assessments, conducting risk analyses and risk assessment, using cleaner technologies, control systems, monitoring and management of (waste) substance flows (VenW, 2009).

In this report VenW, 2009 and OSPAR (2010) definitions are leading.

2.3 Existing policy and legislative obligations

The criteria for good environmental status should be built on existing obligations and European legislation, like the Water Framework Directive, Birds and Habitat Directives, Common Fisheries Policy and regional conventions (EC, 2010). Existing legislation, policies, treaties and conventions are therefore one of the starting points for the determination of GES. The list of legislation and policies that are more or less relevant to the marine environment is extensive. No attempt is made here to be comprehensive, but the most important legislation and policies are covered in chapter 3.

Relevant marine policies and legislation are found at various levels:

- national
 - National Water Plan and Policy document on the North Sea (VenW, 2009)
- EU
 - e.g. Common Fisheries Policy (CFP), Maritime Policy, Water Framework Directive (WFD), Birds and Habitats Directives (BHD), Nitrates Directive etc.
- other international agreements
 - North East Atlantic or North Sea
 - e.g. OSPAR convention, Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), Agreement on the Conservation of Small Cetaceans of the Baltic and the North Seas (Ascobans), etc.
 - Global
 - e.g. Convention on Biological Diversity (CBD), Bonn Convention on Migratory Species (Bonn Agreement), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), etc.

2.4 Ambition of current Dutch policy regarding the North Sea

In the recently published Policy document on the North Sea (VenW, 2009) three “development tasks” were identified. At the first place, achieving sustainable (economic) development in balance with the marine ecosystem. In addition, emphasis is laid on the need to allocate sand extraction sites for the purpose of coastal and flood protection, and on the need to reserve space for large-scale renewable energy.

The ambition for sustainable development has been translated into the following targets (VenW, 2009):

- *“The North Sea is a healthy, dynamic and open marine ecosystem that is used sustainably. Economic, ecological and socio-cultural values are in balance (planet, people, profit). By contributing to the formulation of an integrated policy and measures for the protection of marine biodiversity and the creation of a global network of protected marine areas, the Netherlands meets (international) goals for the marine ecosystem. The ecosystem approach and the precautionary principle are applied actively in the policy.”*
- *“The experience-related value of the North Sea for leisure pursuits and tourism is a strong international trump card. Part of this is the unobstructed views across the sea along almost the whole stretch of coastline. Archaeological values in the seabed have been well preserved.”*
- *“Sustainable fishing and marine aquaculture sustain a healthy fish population and so fishing remains the socio-economic basis for parts of the coastal region. Natural benthic life has recovered.”*
- *“The North Sea is of profound social significance for shipping. Harbours that are easy and safe to reach, and free, safe passage are guaranteed for shipping.”*
- *“Smaller oil and gas fields are dismantled where possible, and after 2020, large, freed-up gas fields have been envisaged for CO₂ storage.”*
- *“Electricity cables, telecommunications cables and pipes are bundled where possible.”*

2.5 Relations between GES descriptors

In Annex I of the MSFD mentions eleven qualitative descriptors for determining good environmental status. These eleven descriptors form a system that aims at describing marine ecosystem status. However, there is a structure in these descriptors (Borja et al., 2010). Borja et al. (2010) present a conceptual model describing the hierarchy in the eleven GES descriptors, and the links between descriptors and pressures. This hierarchy is based on their

discrimination between so-called endogenic and exogenic managed pressures and the isolated position of descriptors 1 and 4 (biological diversity and food webs, respectively). Under endogenic managed pressures the authors classify pressures within a system that can be controlled by environmental management. With exogenic managed pressures the authors relate to pressures from outside a system, like sea level rise or global warming, for which only the consequences can be managed. Borja et al. (2010) suggest that descriptors 1 and 4 should be given a greater weighting. All other descriptors relate more or less to identifiable pressures, with descriptors 2, 5, 8, 9, 10 and 11 concerning with inputs and descriptors 3 and 6 concerned with physical and biological extraction from the system.

The conceptual model of Borja et al. (2010) emphasizes that there are a number of GES descriptors that are directly related to specific pressures, while other descriptors (in particular Biological diversity and Food webs) have a more indirect relation to many different pressures. The model suggests a hierarchy at the level of descriptors, ranking from strongly pressure related to a high-level biological integration. This should be reflected in the determination of GES and the establishment of indicators and targets, where the achievement of GES for the higher-level descriptors depends in part on the achievement of GES for the more pressure-related descriptors.

Elaborating on the conceptual model of Borja et al. (2010), we propose a model where a number of GES descriptors (2, 5, 8, 9, 10, 11) are related to “input” pressures, i.e. pressures caused by the input of substances, organisms, litter or energy. These descriptors are shown on the right-hand side of Figure 2.1. A few other descriptors (3, 6, 7) are mainly related to physical or biological disturbance, by extraction of species or disturbance of habitats (shown on the left-hand side of Figure 2.1). The two descriptors Biological diversity and Food webs are, as suggested by Borja et al. (2010), more indirectly influenced by pressures and could be considered to integrate the effects of human pressures on the other descriptors.

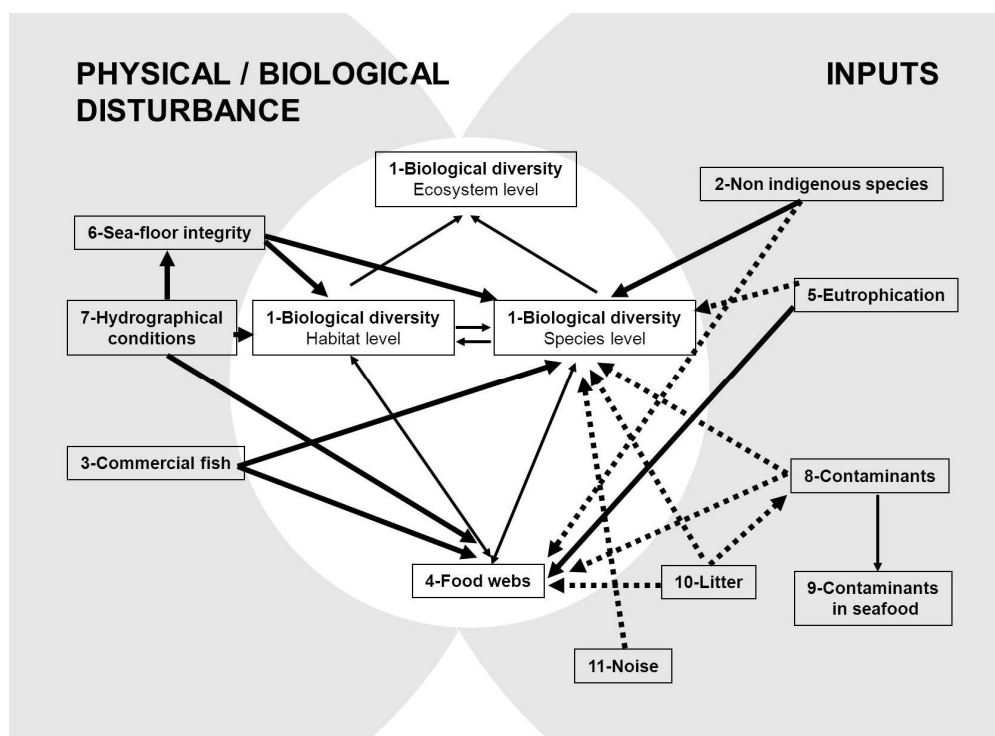


Figure 2.1 A conceptual model showing how the 11 qualitative descriptors are linked. Full lines indicate strong links, dotted lines indicate weaker links (adapted from Borja et al., 2010)

2.6 GES definition and target setting for 2020

The European Commission states, “*there is still a substantial need to develop additional scientific understanding for assessing good environmental status in a coherent and holistic manner*” (EC, 2010). Determining GES requires a good understanding of the current status of the marine environment, and the relations between natural and anthropogenic pressures on the one hand and environmental status on the other hand. GES is usually not the same as an unimpacted state, but represents a situation where human activity is at a sustainable level. In cases where the human activities exceed the acceptable level, a deviation of the current state from the desired state (GES) occurs due to the effect of anthropogenic pressures. Measures to remove or reduce those pressures should result in recovery of the ecosystem to a less impacted state. However, in many cases there is limited and often only qualitative understanding of the cause-effect relationships between human activities (pressures) and environmental effects (state) in the marine environment. This makes it difficult to identify which measures should be taken to improve the environmental status, and even more difficult to predict the efficiency and effectiveness of measures.

It is therefore to be anticipated that, while it may be possible by 2012 to have a picture of what GES should be, it will be more difficult to envisage how GES can be achieved through current and future management actions. This does not have to be an obstacle to move forward, as a further development can be considered to be part of the adaptive management approach (“learning by doing”), and fits in the six-years reporting cycle where GES can be reviewed.

Some GES descriptors, that represent more or less “classical” problems like eutrophication or contaminants, have a long history of policy development and implementation of measures. In those cases, knowledge about cause-effect relationships is often well established. The uncertainty about the achievement of targets is relatively small, even though the time lag between the implementation of measures and results in terms of improved environmental state may sometimes be many years.

For other descriptors, that are related to pressures relatively new in marine policy (e.g. litter, underwater noise) or that focus on the state of the ecosystem (biological diversity, food webs, sea-floor integrity) the uncertainty about cause-effect relationships is sometimes substantial and reference levels cannot easily be established. How GES can be achieved in 2020 may be uncertain, and this must be reflected in the way GES is defined. In such a case, defining GES as a direction in which the environmental state should develop may be more realistic. Also, in those cases GES for 2020 could be viewed as an intermediate step, to be reviewed in the next reporting cycle. Extending scientific knowledge on the relations between human activities and the state of the ecosystem is an essential part of this “learning by doing” approach, to proceed in an evidence-based management of the marine environment.

2.7 What is “good” environmental status?

The MSFD asks for a description of a set of characteristics for good environmental status, on the basis of the 11 qualitative descriptors listed in Annex I of the MSFD. This is neither a simple nor a straightforward task. There are several problematic issues related to this exercise:

The eleven qualitative descriptors of good environmental status cannot be considered equivalent. As discussed above, some of the descriptors can be related to specific pressures, while the descriptors biological diversity (1) and food webs (4) could be considered at a higher hierarchical level, integrating aspects of the other descriptors. This raises several questions. Is a good ecological status achieved if all descriptors have achieved their objectives? Is there a 'one out, all out' principle similar to the approach in the WFD? Is good ecological status for biological diversity and for food webs achieved, when GES has been achieved for all other descriptors, or are there additional requirements?

The concept of sustainable use is fundamental to the MSFD, meaning that ecosystems can function fully and maintain their resilience to human-induced environmental change. At the same time, the MSFD uses phrases that in some cases seem more applicable to a pristine or only slightly disturbed environment or appear at odds with one another, even within the same descriptor. For example, in Annex I the first sentence on descriptor 1 Biological diversity states "biological diversity is maintained" which implicitly suggests that current situation is GES and thus only needs to be maintained. Yet, the following sentence "the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions" hints at a situation where the impacts of human activities on biological diversity are negligible. Similarly, for food webs "all elements of the marine food webs" must "occur at normal abundance and diversity" and at levels where they retain "their full reproductive capacity". This phrasing seems hardly compatible with a marine environment where human use is bound to have influence on at least some components of the ecosystem.

In the Water Framework Directive, Good ecological status has been defined as a situation where "the biological quality elements ... deviate only slightly from those normally associated with the surface water body type under undisturbed conditions". In the WFD several methods have been suggested to derive such undisturbed reference conditions. The general problem with this approach has been that in the marine environment systems that could serve as a reference (i.e. comparable marine areas with no or negligible human impacts) are virtually absent, historical data to derive a reference situation are poor, and knowledge on cause-effect relationships to use for hind casting reference conditions is very limited (Mee et al., 2008). In practice, defining good ecological status for the WFD has largely been built on expert judgment. A problem associated with the establishment of reference conditions, is the implicit assumption that an ecosystem will revert to the original state by suppressing a pressure. As argued by Duarte et al. (2009), in many cases this may not be possible due to multiple changes in the ecosystem (shifting baselines) and attempting to restore historical conditions could be depicted as a "return to Neverland". The authors argue that, we "should no longer strive at delivering a planet to future generations identical to that we experienced at one point of our lives but one that maintains functional integrity and services of ecosystems conducive to a sustainable future"(Duarte et al., 2009).

Good environmental status in the MSFD could be considered as a point, somewhere between an undisturbed (reference) situation and the present situation (assuming that the current situation is not considered to be “good”). However, defining what is to be considered “good” is not a scientific exercise, but a societal decision. GES can be regarded as an ethical concept, that is highly dependent on worldview and existing national and international commitments. This point is extensively discussed by Mee et al. (2008). While scientific knowledge can be helpful to describe ecosystem changes, society has to decide to what extent these changes are acceptable. Consequently, the proposal for GES presented in this report should be regarded as starting points for a further discussion and a societal decision and not an evidence-based, scientific, fact.

2.8 Steps taken towards a proposal for Good Environmental Status

This report gives a proposal for Good Environmental Status for each descriptor (MSFD annex I). This definition is given as a qualitative statement. A quantitative outline for each of the criteria and indicators from the commission decision is part of the establishment of indicators and targets. The latter is reported separately by Boon et al. (2011).

In Figure 2.2 the steps taken towards a proposal for GES are visualised. Step 1 is an interpretation of the objectives of the MSFD, as laid out in the MSFD (EC, 2008). In step 2 existing legislation, both international and national, as well as their objectives, and the environmental targets following from these objectives are summed and most steering factors from these legislations in relation to pressures and state are interpreted. The national ambition with respect to the marine environment forms cornerstone for the determination of GES. In step 3, the facts as documented in Prins et al. (2011) (report on Initial assessment) are wrapped up in order to provide a baseline. The analysis of the present state of the marine environment and the predominant pressures for each GES descriptor forms part of the Initial assessment. This information can be used to identify to what extent the present state deviates from the desirable state, and to what extent human pressures form a bottleneck for achieving Good environmental state. This forms the departure point for the determination of Good environmental status to be achieved by 2020.

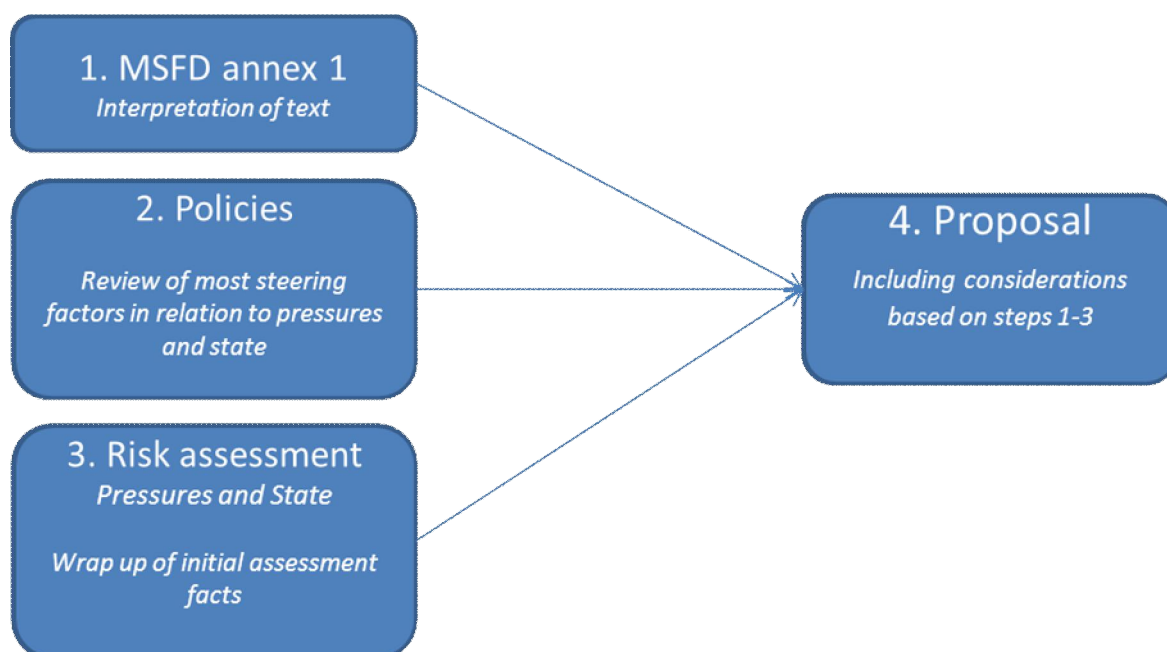


Figure 2.2 Steps taken towards the proposal for GES, done for each descriptor.

Chapter 3 gives the background information for each descriptor. This information is based on expert knowledge, and literature reviews. Furthermore, ICES/JRC task group reports are used in the overall process as advise documents.

In addition. Two stakeholder workshops have been organized by the Ministry of Infrastructure and Environment in June and September 2010. In these two workshops, options for defining GES and potential measures to achieve GES have been discussed. The results of these workshops and follow-up discussions with the Ministry of Infrastructure and Environment and the Ministry of Economic affairs, Agriculture and Innovation have provided the input for the determination of good environmental status in this report.

3 Background information on GES per descriptor

3.1 Descriptor 1: Biological diversity

Annex I MSFD
Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

Annex 1 of the MSFD asks for maintaining biological diversity. Important aspects to take into account while addressing biological diversity is that quality and occurrence of habitats and the distribution and abundance of species should be in line with prevailing physiographic, geographic and climatic conditions. This means that where this is not yet the case, biodiversity should be improved towards a level in accordance with prevailing natural conditions.

3.1.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Convention on Biological Diversity ²	Encourage actions which will lead to a sustainable future.	By 2020: <ul style="list-style-type: none"> - steps are taken to achieve or have sustainable use and to keep the impacts of use of natural resources well within safe ecological limits - rate of loss of all natural habitats, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced. - all fish and invertebrate stocks are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits. - pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity. - invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

² Summarized targets relevant for GES descriptor 1

UNEP Convention on Migratory Species, CMS (Bonn Convention)	To conserve terrestrial, marine and avian migratory species throughout their range.	More specifically in the North Sea area: <ul style="list-style-type: none"> - Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas - Seals in the Wadden Sea - African-Eurasian Migratory Water birds - Albatrosses and Petrels
World summit on sustainable development	Aim is to restore the world's depleted fisheries for 2015	Implemented by Common Fisheries Policy
ASCOBANS (special agreement under CMS)	To promote close cooperation amongst parties with a view to achieving and maintaining a favourable conservation status for small cetaceans.	<ul style="list-style-type: none"> - Adoption and enforcement of national legislation. - Assessment and management of human-cetacean interactions - Habitat protection - Research and monitoring - Capacity building, collection and dissemination of information, training and education - Responses to emergency situations
Habitats Directive	To promote the maintenance of biodiversity by requiring EU member states to take measures to maintain or restore natural habitats and wild species at a favourable conservation status	Conservation objectives for habitats and species in Natura 2000 designated sites and network
Birds Directive	To conserve all species of naturally occurring birds in the wild state in territory of the EU member states	Conservation objectives for bird species in Natura 2000 designated sites and network
Common Fisheries Policy (reform by 2012)	To ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions An ecosystem approach to marine management is being implemented through the MSFD. The future CFP must be set up to provide the right instruments to support this ecosystem approach	A move to fishing at Maximal Sustainable Yield (MSY), eliminating discards and ensuring a low ecological impact of fisheries
Water Framework Directive	To establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater	Good ecological status by 2015, where the values of biological quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'. Ecology objectives are defined up to 1 nautical mile.
OSPAR	To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been	<ul style="list-style-type: none"> - Identify those marine species, habitats or ecosystems that need to be protected, conserved or restored. - Adopt measures within the sphere of competence of OSPAR for the protection of those species and habitats, or draw the attention of other competent authorities to the

	adversely affected.	<p>need for such measures.</p> <ul style="list-style-type: none"> - Establish an ecologically coherent network of well managed marine protected areas by 2010. - EcoQO on proportion of large fish - EcoQO on seal populations - EcoQO on seabird populations (under development) - EcoQO on by-catch of harbour porpoise.
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	<ul style="list-style-type: none"> - Ecosystem approach and precautionary principle are applied actively - Recovery of natural benthic life
Dutch International Policy Program for Biodiversity	Aim: a transition to sustainable use of biodiversity and natural resources. The loss of biodiversity represents a perfect candidate for the application of the precautionary principle.	

Most of the present, worldwide and EU, policies and conventions mentioned in the table above aim at halting the decline of biodiversity and moving towards a sustainable use, in order to maintain biodiversity. In addition, more specific objectives are defined targeting some species, species groups or habitats, for example under the Birds and Habitats Directives (together Natura 2000). Several sites in the Dutch part of the North Sea have been designated or will be designated in near future as Natura 2000 sites. At present, most conservation objectives for these sites are not met yet, and management plans are under development in order to meet the objectives. Assuming that measures will be implemented, GES could be set as an increase of biological diversity within Natura 2000 designated sites, depending on the conservation status of individual species and habitats and their conservation objectives at site level. It should be mentioned that Natura 2000 policy relates not only to individual designated areas or species, but to the overall network of habitats. The common fisheries policy (CFP) moves to fishing at Maximum Sustainable Yield (MSY) by 2012, eliminating discards and ensuring a lower ecological impact of fisheries in near future. Furthermore, the development and application of new fishing methods strengthen the targets of CFP. Recent and future developments within fisheries will significantly reduce related pressures in the entire southern North Sea. Based in the ambitions and potential measures following from CFP we assume that biological diversity can, at least, be maintained at the present level for areas outside the Natura 2000 sites.

3.1.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011).

Pressures

Many activities and the associated pressures in the Dutch part of the North Sea have an impact on biological diversity, by affecting species distribution or abundance or by impacting habitat condition. The most important activities in this respect are: commercial fishing, aggregate extraction, oil and gas exploration, maritime transportation, and pollution through land-based emissions (Prins et al., 2011). High impacts upon biological diversity result from the extraction of (target and non-target) species by fisheries, and the disturbance of the sea-floor by bottom-tending gear, resulting in impacts on species composition, species abundance as well as on habitat quality and condition. Maritime transport poses a potential risk through pressures such as underwater noise, litter and the introduction of non-indigenous species, affecting some of the associated GES descriptors but also having an effect on biological diversity. The impact of sand extraction refers to physical damage and biological disturbance, but is local. The construction of offshore wind farms and the designation of Natura 2000 sites may result in substantial areas with restrictions on fishing and more specifically bottom trawling, which will positively affect biological diversity, in particular in the benthic system.

Present state

Species level

Information on species distribution, population size and population condition is only available for a selection of groups (marine mammals, birds, commercial fish species, macrozoobenthos and phytoplankton).

For marine birds coastal and offshore areas of the Dutch part of the North Sea are of great importance. Generally, bird populations increased compared to the data of first monitoring. Populations of common scoter and kittiwake show a decline that is thought to be related to a decrease in food availability.

Numbers grey seal, harbour seal and of harbour porpoise, increased or stabilized since the mid 1980s. The increase might be due to exclusion of hunting, reduction of PCB concentrations, availability of prey species and less competition with other predators.

Three different fish communities can be distinguished in the North Sea, which relate to environmental conditions such as water depth and temperature. Trends in fish stocks show that fish species not directly targeted by fisheries increased. Large sized species with low fecundity decreased in population size since 1977. These fish species may be replaced by species that are less sensitive to disturbance. Overall, fish species richness has increased, probably due to environmental effects (increasing temperatures) as well as anthropogenic influences (commercial fisheries).

Biodiversity of benthic invertebrates is higher in the northern offshore waters (north of the Frisian Front). Density and biomass is higher in the coastal waters and in the Frisian Front area. No clear trends are observed in macrobenthos communities.

Phyto- and zooplankton composition show long-term changes, primarily related natural oscillations (meteorology, transport patterns). To some extent, nutrient enrichment plays a role in the increase of dinoflagellates and diatoms.

Habitat level

Several habitat types can be distinguished in the Dutch part of the North Sea, differing in depth, grain size and silt content and biological diversity. Some of these habitats, 'shallow banks' and 'reefs', are designated as Natura 2000 sites, and labeled with an unfavourable-inadequate conservation status. Information is available about the spatial distribution of benthic habitats outside Natura 2000 sites, but information on quality aspects are generally less or not available. In Prins et al. (2011) an overview of specific Dutch Continental Shelf areas/habitats types and their specifics on biodiversity is provided.

Ecosystem level

On an ecosystem level, there is a general agreement that globally biodiversity faces unprecedented threats as a result of human activities in the marine environment, land based inputs to the sea and climate change. According to an assessment by Wortelboer the current biodiversity of the Dutch North Sea is only 40% of its natural state. Fish and mammals have relatively low nature value scores, whereas macrobenthos and birds have relatively high scores. Although the trend in the average biodiversity since 1990 is negligible, phytoplankton and mammals show an overall positive trend, whereas macrobenthos and fish show an overall negative trend. The nature value indicator for mammals is slightly improving.

3.1.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- biological diversity in general is maintained compared to the current state,
- and is restored where current state does not meet existing obligations.

Considerations

In general:

GES should prescribe that the occurrence of species and habitats is in line with prevailing natural conditions, according to MSFD annex I. It is however not easy to define what this should be. Indicators and corresponding targets will make this more specific, e.g. for species groups such as birds, marine mammals, fish and benthos, and for habitats. Furthermore, existing and potential future measures taken with respect to other descriptors will in general be beneficial to GES "biological diversity".

Regarding the first bullet:

This equates to the minimum ambition level for GES in general. It corresponds with the Annex I definition of GES for descriptor 1 (Biological diversity) to maintain biological diversity, and is furthermore in line with the general policy objective following from the Convention on Biological Diversity to halt the decline in biological diversity.

Regarding the second bullet:

This entails a derivation towards a higher ambition compared to the first part of the GES proposal.

Designation of (future) sites under the Birds and Habitats Directive and the Common fisheries Policy-reform are expected to contribute in a more direct way of an improvement of biological diversity. In general, the implementation of Natura 2000 will lead to the protected status of at least 20% of the Dutch part of the North Sea. Specific needed improvements do however depend on the current conservation status of individual species and habitats and their conservation objectives at site level. In Prins et al. (2011) these specific assessments on a species level are provided.

Common Fisheries Policy (CFP) and related fisheries management is assumed to contribute by a reduction of the ecological impact of fisheries. However, the actual effectiveness of measures under Natura 2000 and CFP for achieving GES cannot yet be evaluated, as management plans for Natura 2000 sites and regulation under CFP are still under discussion. In some areas a significant reduction in physical disturbance of benthic habitat due to zoning of fisheries and changes to more environmentally benign fishing techniques may result in an improvement of biological diversity of benthic habitat. Fisheries also influence the presence of birds, through discards, shellfish extraction and disturbance. Some bird species (e.g. lesser and greater black-backed gull, skuas) depend in part on (the discards) of fisheries. Their numbers will probably decrease if fishing intensity is reduced or when discarding is no longer allowed.

3.2 Descriptor 2: Non- indigenous species

Annex I MSFD
Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Annex I of the MSFD focuses on the absence of adverse effects of introduced non-indigenous species (NIS). The criteria and indicators in the Commission decision (EC, 2010) focus on the establishment of trends in occurrence of non-indigenous species, and on the occurrence of environmental impacts.

3.2.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Convention on Biological Diversity	Encourage actions which will lead to a sustainable future.	Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species
UNCLOS	To protect and preserve the marine environment from a "significant and harmful change" from the pollution by the intentional or unintentional introduction of alien species	
IMO, MARPOL, Ballast Water Convention	To prevent, minimize and ultimately eliminate the transfer of Harmful Aquatic Organisms and Pathogens through the control and management of ships' Ballast Water and Sediments, and via hull fouling guidelines	Prevention via Ballast Water management and hull fouling guidelines
Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein	Establish restrictions on the introduction of live specimens of species for which their introduction into the natural environment presents an ecological threat to wild species of fauna and flora indigenous to the Community.	
Council Regulation (EC) no 708/2007 concerning use of alien and locally absent	To optimise benefits associated with introductions and translocations of alien and locally absent species used in aquaculture while at the same time avoiding alterations in	

species in aquaculture	ecosystems and preventing negative biological interaction including genetic change with indigenous populations and restricting the spread of non-target species and detrimental impacts on natural habitats	
Birds Directive	Make sure that introduction of non-native birds do not threaten other biodiversity (Article 11)	
OSPAR	Endeavour to limit the introduction of non-indigenous species by human activities to levels that do not adversely alter the ecosystems.	No quantitative targets
Water Framework Directive	To establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater	Good ecological status by 2015, where the values of biological quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'. Ecological objectives are defined up to 1 nautical mile.
Flora Fauna wet	Prevention: Forbidden to put out alien species	
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	
Dutch policy memorandum on invasive exotic species	Prevent damage caused by invasive non-indigenous species	<ul style="list-style-type: none"> - Prevention - Elimination - Isolation and management of an established population

Particularly shipping is considered a vector for the introduction of non-indigenous species. This is strongly related to the release of ballast water. Areas with heavy shipping traffic have a high chance of introduction of non-indigenous species and, consequently, probably the highest risk of significant impacts. Prevention of introduction mainly related to ballast water by shipping is the most important step in managing NIS. The Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) aims to minimize the transfer of harmful aquatic organisms and pathogens. The BWM Convention and other relevant international policies focus on the management of the vectors of introduction by a source oriented approach. The Dutch policy concerning invasive non-indigenous species (EL&I, 2007) has a three-tier approach, prevention, isolation and elimination and management.

3.2.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

The most important activities related to the introduction of non-indigenous species in the North Sea are maritime transport and aquaculture in relation to shell fish transports. Both activities are expected to increase.

Pressures associated with maritime transport and mariculture are the discharge of ballast water originating from exotic seas, the release of non-indigenous species from ship hulls and the dispersion from mariculture activities. These activities are a continuous source of non-indigenous species, and increase the risk of introduction of invasive non-indigenous species. Measures are however being implemented.

Non-indigenous species can cause considerable and adverse and/or harmful change in the North Sea ecosystem leading potentially to disappearance of habitats, extinction of species and changes in the food web

Present state

There are no specific monitoring programmes which focus on the introduction and establishment of non-indigenous species. The American jack knife clam has successfully established itself in the Dutch coastal zone. A causal relationship could not be established, but this species might have caused the decrease of some indigenous bivalve species. The Pacific oyster has established in the South West Delta area and the Wadden Sea, possibly facilitated by climate change. This species poses a high risk to competition with other bivalves and habitat modification.

Risk of impact of non-indigenous species increases due to increased intensity of related activities, but due to the implementation of measures the actual risk might not be equivalent. Furthermore, the magnitude of actual ecological impact of invasion cannot be predicted.

3.2.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- the abundance and distribution of non-indigenous species does not increase and there are no further introductions of non-indigenous species,
- non-indigenous species do not cause adverse effects.

Considerations

In general:

The GES definition fits with the general policy objective to prevent introduction of species by targeting vectors, limit further spreading of non-indigenous species and manage the impacts.

Regarding the first bullet:

Risk of impact of non-indigenous species increases due to increased intensity of related activities, but due to the implementation of measures the increase of introductions might not be equivalent. The BWM Convention will become effective after ratification by 30 states, representing 35 per cent of world merchant shipping tonnage. In October 2010, 27

States have ratified the Convention, representing 25% of world merchant shipping tonnage. It is uncertain in what year the implementation of the Convention can be considered an effective measure to reduce the risk of new introductions of non-indigenous species. National legislation of the treaty is expected to be implemented in 2012.

Pressures associated with maritime transport are the discharge of ballast water originating from other ecoregions, and the release of non-indigenous species from ship hulls (bio fouling).

Mariculture hardly occurs in the Dutch part of the North Sea. Increase in mariculture activities in the North Sea or adjacent waters may increase the risk of introductions.

Regarding the second bullet:

This is equivalent to second part of the descriptor (“not adversely alter the environment”).

Maritime transport and aquaculture remain a continuous source of non-indigenous species, and increase the risk of introduction of invasive non-indigenous species. Although measures are taken, one introduction can result in an invasion of which the ecological impact the magnitude cannot be predicted.

As there are only ad-hoc monitoring activities, there is often a time lag between establishment of a non-indigenous species in the marine environment and its detection. Consequently, once established, measures to eradicate non-indigenous species from the marine environment are generally impractical and costly. Management of impacts may then be the only feasible option.

3.3 Descriptor 3: Commercially exploited fish and shellfish

Annex I MSFD
Population of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Annex I of the MSFD asks for exploitation of fish and shellfish within safe biological limits. Important aspects to take into account are population age and size distribution which are indicative of a healthy stock. The Commission Decision focuses on fishing pressure and stock size.

3.3.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Common Fisheries Policy (reform by 2012)	To ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions An ecosystem approach to marine management is being implemented through the MSFD. The future CFP must be set up to provide the right instruments to support this ecosystem approach	A move to fishing at MSY, eliminating discards and ensuring a low ecological impact of fisheries
ICES	The context for ICES advice is set by several international agreements and policies (UNCLOS, UNCED, UN Fish Stocks Agreement, FAO Code of Conduct for Responsible Fisheries, CBD, Johannesburg Declaration of the World Summit of Sustainable Development) that call for an ecosystem approach, application of the precautionary principle and maximum sustainable yield (MSY)	To attain full implementation of the MSY approach by 2015. ICES advice for each stock includes: <ul style="list-style-type: none"> - An estimate of historical trends in landings, spawning stock biomass, recruitment and fishing mortality rate; - A description of the 'state of the stock' in relation to historical levels; - The likely medium term development of the stock using different rates of fishing mortality; and - A short term forecast of spawning stock biomass and catch.
OSPAR	To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities,	<ul style="list-style-type: none"> - to achieve further reductions in fishing pressure and ensure that priority action is taken to address discarding practices, which remain a key issue, especially in EU waters; - to ensure that deep-water fisheries take into

	and to restore, where practicable, marine areas which have been adversely affected.	<p>account the special vulnerability of both the species exploited and their habitats;</p> <ul style="list-style-type: none"> - to keep as low as possible, and preferably eliminate, the by-catch of marine mammals, sharks, seabirds and turtles; - to encourage developments in scientific support for fisheries management - to integrate fisheries management with wider maritime management, promoting consistency and synergy between fisheries policies and the policies regulating other maritime uses. - EcoQO on large fish - EcoQo on commercial fish stocks (related to Standing Stock Biomass (SSB)and Fishing mortality (F))
Habitats Directive	To promote the maintenance of biodiversity by requiring EU member states to take measures to maintain or restore natural habitats and wild species at a favourable conservation status	Conservation objectives for habitats and species in Natura 2000 sites
Water Framework Directive	To establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater	<p>Good ecological status by 2015, where the values of biological quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'</p> <p><i>NB. Fish are not a quality element in coastal waters. Ecological objectives are defined up to 1 nautical mile.</i></p>
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	

The common fisheries policy (CFP) moves to fishing at MSY by 2012. By adopting an ecosystem based approach, the CFP should ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions

3.3.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al.(2011). In this section a summary is provided.

Pressures

The main pressure on commercial fish stocks comes from the extraction of species by fisheries, including extraction as a consequence of incidental by-catch of non-target species. The main instrument to manage fisheries is the Common Fisheries Policy.

Present state

Detailed information on fishing activity and associated pressures is given in the report on the Initial assessment (Prins et al., 2011).

Stock status based on the level of fishing pressure and the reproductive capacity of the stocks show that fishing mortality has decreased in recent years. However, spawning stock biomass SSB has hardly increased. Most commercial stocks in the North Sea cannot be considered to be sustainably exploited, in relation to the MSY approach (Maximum Sustainable Yield).

There has been a decline in the size distribution of demersal fish in the North Sea over the period 1975-2005. This probably also applies for the commercial species.

The OSPAR EcoQO on the proportion of large fish shows improvement, but has not been met yet.

For at least two commercial species (plaice, sole) the probabilistic maturation reaction norm indicator age shows that length at maturation has indeed significantly shifted towards younger age and smaller length. This is attributed to intensive exploitation which may have caused evolutionary changes in the age and length at maturation of these species.

In the 1990s, the shellfish *Spisula subtruncata* was commercially exploited. The abundance of this species has shown an unexplained decline. Nowadays, some fisheries on the American razor clam *Ensis directus* occurs in the coastal zone.

At present, there is only limited exploitation of shellfish stocks (mainly American razor clam).

3.3.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- the population of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Considerations

The definition of GES is similar to the description in Annex I of the MSFD, as this description is in line with the objective of the current fisheries policy.

Current policies aim at adopting an ecosystem approach and moving to sustainable exploitation of commercial fish stocks. The reform of the Common Fisheries Policy (CFP) in 2012 should support this development. It should be realized that recovery of highly exploited stocks may be slow, for example due to evolutionary changes in the population.

The achievement of good environmental status depends on the success of the CFP reform to achieve sustainable fisheries.

The objective of achieving GES through the Common Fisheries Policy should address more specific issues, such as:

- stocks are exploited sustainably, consistent with high long-term yield, have full reproductive capacity, and have a healthy age and size distribution.
- fishing mortality decreases and does not exceed F_{MSY} for each fish stock ($F < F_{MSY}$)
- Spawning Stock Biomass (SSB) increases and exceeds B_{PA} for each fish stock
- the ratio catch/biomass does not show degradation

GES is achieved for a particular stock only if criteria for all attributes are fulfilled. However since there is broad scientific evidence that this cannot be achieved for all stocks simultaneously, a realistic threshold for the proportion of stocks with GES needs to be established above which the descriptor has achieved GES. This is a political rather than a scientific decision.

Regarding the proportion of large fish it should be mentioned that an indicator has only been developed (OSPAR EcoQO) for demersal fish, not for pelagic fish. There has been a decline in the length composition of demersal fish in the North Sea over the period 1975-2005. Restoring the proportion of large fish is probably not feasible by 2020.

3.4 Descriptor 4: Food webs

Annex I MSFD
All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

Annex I of the MSFD focuses on safeguarding the normal abundance and diversity of all elements of the marine food web to ensure the long-term abundance of species and the retention of their full reproductive capacity.

“All elements of the marine food webs” should occur at normal abundance and density. While the focus of the descriptor is on the functional aspects of an ecosystem, the criteria and indicators in the Commission decision mainly focus on structural aspects (proportion of selected species, abundance of key trophic groups/species) and less on functional aspects (productivity of key trophic groups/species). Furthermore, indicators and associated targets in terms of productivity are not yet applicable. Discussion is provided in the associated report on Environmental targets and Indicators.

3.4.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Convention on Biological Diversity	Encourage actions which will lead to a sustainable future.	<ul style="list-style-type: none"> - To conserve biological diversity - To use biological diversity in a sustainable manner - To share benefits from the use of genetic resources fairly and equitably
UNEP Convention on Migratory Species, CMS (Bonn Convention)	To conserve terrestrial, marine and avian migratory species throughout their range.	More specifically in the North Sea area: <ul style="list-style-type: none"> - Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas - Seals in the Wadden Sea - African-Eurasian Migratory Waterbirds - Albatrosses and Petrels
Common Fisheries Policy (reform by 2012)	To ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions An ecosystem approach to marine management is being implemented through the MSFD. The future CFP must be set up to provide the right instruments to support this ecosystem approach	A move to fishing at MSY, eliminating discards and ensuring a low ecological impact of fisheries
Habitats Directive	To promote the maintenance of biodiversity by requiring EU member states to take measures to maintain or restore natural habitats	Conservation objectives for habitats and species in Natura 2000 sites

	and wild species at a favourable conservation status	
Birds Directive	To conserve all species of naturally occurring birds in the wild state in territory of the EU member states	Conservation objectives for bird species in Natura 2000 sites
Water Framework Directive	To establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater	Good ecological status by 2015, where the values of biological quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions' . Ecological objectives are defined up to 1 nmile.
OSPAR	To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected.	<ul style="list-style-type: none"> - EcoQO on proportion of large fish - EcoQO on seal populations - EcoQO on seabird populations (under development) - EcoQO on by-catch of harbour porpoise.
ASCOBANS (special agreement under CMS)	To promote close cooperation amongst parties with a view to achieving and maintaining a favourable conservation status for small cetaceans.	<ul style="list-style-type: none"> - Adoption and enforcement of national legislation. - Assessment and management of human-cetacean interactions - Habitat protection - Research and monitoring - Capacity building, collection and dissemination of information, training and education - Responses to emergency situations
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	

There is currently no specific national or international legislation or policy directly focused on the protection of the marine food web. The actual design and implementation of this descriptor is (inter)nationally under discussion. The descriptor will benefit from all policies as described under descriptor 1 Biological diversity, in particular the implementation of Natura 2000 and the reform of the Common Fisheries Policy (CFP).

3.4.2 Risk assessment

Detailed information on pressures and present state is provided in report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

Similar to biological diversity, many activities and the associated pressures in the Dutch part of the North Sea have an impact on food webs by affecting for instance species distribution or abundance. Nearly all pressure descriptors affect food webs to a certain extent, direct or indirect. The most important activities are commercial fishing, maritime transportation, and pollution through land-based emissions, including nutrient enrichment. A more detailed description of human activities and related pressures on food webs is given in the report on the Initial assessment (Prins et al., 2011). Fisheries in particular have a high direct impact on the marine food web, due to the extraction of target species and non-target species (by-catch), and disturbance of the benthic community by bottom-trawling. This results in shifts in food web composition, expressed in e.g. a shift towards a smaller proportion of large fish in the demersal fish community. Introduction of non-indigenous species, emissions of nutrients and chemical substances, effects of litter and the production of underwater noise affect several other descriptors (2, 5, 8, 10, 11) potentially affecting food web characteristics via other pathways.

Present state

A complete overview of information under this descriptor cannot be presented for the Dutch Continental Shelf. Available information that falls within the scope of the indicators is presented below.

The OSPAR EcoQO for grey seal pup production on the Dutch Continental Shelf is met. The current conservation status for grey seals under Natura2000 is 'unfavourable–inadequate'. The OSPAR EcoQO for harbour seal population on the Dutch Continental Shelf is met. The current conservation status for harbour seals under Habitat Directive is 'favourable'. Number of sightings and strandings of harbour porpoises in Dutch waters has increased. The current conservation status for harbour porpoises under Habitat Directive is 'unfavourable-inadequate'. However, the Conservation Plan for the Harbour Porpoises in the Netherlands recommends that a conservation status of 'favourable' or 'least concern' would be more suitable for the southern North Sea. When looking at species that are indirectly affected by human activities (in particular by-catch and discards), the international indicator for by-catch of harbour porpoises is applicable. Monitoring of OSPAR EcoQO for by-catch of Harbour Porpoises in the southern North Sea is currently however inadequate to assess whether or not the target is met.

The OSPAR EcoQO for proportion of large fish (>40 cm) has declined from more than 30% before 1980 to 10% in 2007, and the target is not met. However, trends seem to be increasing again.

3.4.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- key food web species can use their full reproductive capacity,
- all elements of the marine food web, to the extent that they are known, occur at normal abundance.

Considerations

In general:

The proposal is in line with the already existing commitments. However, regarding the present state in the Dutch part of the North Sea, a slightly more narrow definition of GES than the phrase in Annex I was chosen (bullet 1).

Regarding bullet 1, the proposal focuses on the reproductive capacity of selected key groups or species rather than “all elements of the food web”, as the latter seems impractical and unmanageable. Key elements are provided in the report of environmental targets and indicators of Boon et al. (2011).

Regarding bullet 2: Like biological diversity, food webs are a complex issue. The interactions between species in a food web are complex and constantly changing, making it difficult to identify one condition that represents ‘good’ status. However, changes in species relative abundance in an ecosystem will affect interactions in several parts of a food web, and may have an adverse effect on food web status. There is a significant lack of understanding to assess the ecosystem consequences of such change. Focus on structural aspects, as abundance, of known elements (see e.g. biodiversity) contributes to the understanding as long as proper functional indicators are lacking. See report of Environmental Targets and Indicators (Boon et al., 2011) for further discussion.

3.5 Descriptor 5: Human-induced eutrophication

Annex I MSFD
Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters

Annex I of the MSFD focuses on minimizing eutrophication and in particular adverse effects. As specified in the Commission Decision, eutrophication becomes apparent through elevated levels of nutrients and the occurrence of direct effects such as phytoplankton blooms. Under adverse effects, both direct effects (species shifts) and indirect effects (hypoxia) can occur.

3.5.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	Good ecological status by 2015	Limit levels for nitrogen, chlorophyll, <i>Phaeocystis</i> in coastal waters. Ecology objectives are defined up to 1 nmile.
Nitrate Directive	Included in WFD objectives	Included in WFD targets
OSPAR	Achieve and maintain by 2010 a healthy marine environment where eutrophication does not occur	Reduction at source, in the order of 50% compared to 1985, in inputs of phosphorus and nitrogen Non-problem area in Comprehensive Procedure: - limit levels for phosphorus, nitrogen, chlorophyll, <i>Phaeocystis</i> and other indicator algal species, oxygen - no mortality of benthic fauna
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	

Current policies (WFD, OSPAR) aim at reducing nutrient levels through measures targeting point and non-point sources in the river basins discharging into the North Sea. These measures should result in nutrient levels below a region-specific level and prevention of eutrophication effects. However, to some degree there is uncertainty as to whether measures taken as part of the WFD river basin management plans will achieve the targets by 2015.

3.5.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

The predominant pressure for this GES descriptor is the discharge into the North Sea of river water rich in nutrients, particularly nitrogen. Elevated nitrogen concentrations in the freshwater systems are caused by emission from diffuse and point sources, such as runoff from agricultural land, wastewater treatment plants, emissions from industry, etc. Atmospheric deposition of nitrogen is a second, less important source. River discharges are the main anthropogenic source of nitrogen and phosphorus in Dutch marine waters. Proportional to the decrease in river loads of nitrogen (20-40%) and phosphorus (>50%), nitrogen and phosphorus concentrations in coastal waters have decreased.

Implementation of measures in the framework of the WFD river basin management plans aims at further reduction of nitrogen loads to the North Sea. The aim as formulated in the WFD river basin management plans is a reduction of 10-20% compared to the years 2000-2006. There is a chance that the coastal waters will not meet the WFD's ecological objectives (especially phytoplankton) by 2015. The main reason for this is that achieving the objectives in coastal waters depends almost entirely on measures taken upstream (including those in other countries in the river basins).

Present state

According to both the WFD assessment and the OSPAR Comprehensive Procedure, the target for nitrogen concentrations in coastal waters has not yet been met.

Over the period 1990-2009 chlorophyll concentrations in coastal waters do not show a clear trend, despite decreasing nutrient concentrations.(light limited)

Blooms of the nuisance alga *Phaeocystis globosa* are the most conspicuous symptom of eutrophication in the southern coastal North Sea. Blooms show large interannual variation, but no clear trend.

According to both the WFD assessment and the OSPAR Comprehensive Procedure, concentrations of chlorophyll-a and of blooms of the indicator species *Phaeocystis* in coastal waters are still higher than target levels.

Occasionally, low oxygen levels occur at the Oyster grounds. This is to a large extent due to (natural) physical factors.

3.5.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- human induced eutrophication is minimized.

Considerations

The definition of GES is in line with the objectives of WFD and OSPAR to prevent the occurrence of eutrophication and adverse effects like excessive algal blooms and hypoxia.

Current policies aim at reducing direct effects of eutrophication in Dutch coastal waters such as elevated chlorophyll concentrations and occurrence of *Phaeocystis* blooms. Measures to achieve this are reduction of nutrient levels through a source-oriented approach as part of the river basin management plans under the WFD. It is assumed that targets concerning those direct effects will be achieved by 2015, on the condition that nutrient levels are reduced sufficiently. It is however questioned whether the reduction of nitrogen continues.

While hypoxia sometimes occurs in bottom waters at the Oyster Grounds during summer stratification, the relation with human-induced eutrophication is uncertain (Prins et al., 2011). Occurrence of hypoxia can be considered relevant only when it occurs at a spatial scale that is large enough to result in adverse environmental effects, like mortality of benthic fauna or fish.

Other indirect effects of eutrophication, that are mentioned in EC, 2010 (decrease in water transparency, increase in opportunistic macroalgae, decrease in abundance of seaweeds and seagrasses) are not relevant in the Dutch North Sea.

3.6 Descriptor 6: Sea-floor integrity

Annex I MSFD
Sea-floor integrity is at a level that ensures that the structure and function of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

Annex I of the MSFD focuses on the safeguarding of the structure and function of the benthic community and the absence of adverse effects. The criteria and indicators in the Commission decision focus on physical damage and the impacts on the condition of the benthic community. Both safeguarding structure and function as well as the absence of adverse effects can be interpreted as ensuring the quality of the benthic community.

3.6.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Habitats Directive	To promote the maintenance of biodiversity by requiring EU member states to take measures to maintain or restore natural habitats and wild species at a favourable conservation status	Conservation objectives for habitats and species in Habitat Directive sites ³
Common Fisheries Policy (reform by 2012)	To ensure exploitation of living aquatic resources that provide sustainable economic, environmental and social conditions An ecosystem approach to marine management is being implemented through the MSFD. The future CFP must be set up to provide the right instruments to support this ecosystem approach	A move to fishing at MSY, eliminating discards and ensuring a low ecological impact of fisheries
Water Framework Directive	Good ecological status by 2015, where the values of biological quality elements (phytoplankton, macro-invertebrates) 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'	Benthic Ecological Quality Indicator (BEQI) with targets for total benthic biomass in relation to primary production surface area of ecotopes and targets for density, biomass, number of species, and species composition. Ecological objectives are defined up to 1 nmile.
OSPAR	To protect and conserve the ecosystems and the biological	- Identify those marine species, habitats or ecosystems that need to be protected,

³ Benthic species are not included in ANNEX I and II species lists to which conservation applies. However, benthic species are included as typical species being a quality element of the structure and function of specific habitat types. So, these species describe quality aspects, and a favourable conservation status implicitly applies to these typical benthic species, too.

	diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected.	<p>conserved or restored.</p> <ul style="list-style-type: none"> - Adopt measures within the sphere of competence of OSPAR for the protection of those species and habitats, or draw the attention of other competent authorities to the need for such measures. - Establish an ecologically coherent network of well managed marine protected areas by 2010. - List of threatened and declining species and habitats
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	<ul style="list-style-type: none"> - Sustainable fishing, with reduction of disturbance by bottom-trawling (no quantitative targets). - Sand extraction at greater depth to reduce impacts (no quantitative targets)

The reform of the Common Fisheries Policy may probably result in reducing the pressure caused by bottom trawling, as it has the target to reduce the ecological impact of fisheries. The designation of Natura 2000 sites under the Habitats Directive and management plans for these sites may include measures to reduce pressures on the sea-floor. For example, plans to close parts of Natura 2000 sites for bottom trawling are being formulated at present. However, until now, none of existing policies have yet resulted in targeted reduction of bottom impact.

In the Water Framework Directive, the quality of the benthic community is integrated in the assessment of macroinvertebrates. To achieve good ecological status in the coastal water bodies (1st nautical mile) the biological quality element "Benthic macroinvertebrates" must be in good status. OSPAR addresses aspects of the quality of the benthic community in its biodiversity strategy. The Habitats Directive aims at protecting benthic habitats in Natura 2000 sites (Special Areas of Conservation, SAC's).

3.6.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

The main pressures affecting the integrity of the seafloor are related to physical disturbance and extraction of species. Bottom trawling fishing gears (e.g. beam trawl, otter and shrimp trawl) are a dominant source of disturbance. In particular beam trawling is widespread and intensive in a large part of the Dutch North Sea. It is however expected that fishing methods will become more sustainable under the Common Fisheries Policy reform, potentially leading to a lower impact on benthic habitats.

Other activities with strong, but more localized, impacts on the seafloor are the extraction of sand and coastal nourishments. Those activities are expected to increase.

Present state

A large part of the seafloor in the Dutch continental shelf is physically disturbed by bottom trawling, resulting in altered benthic conditions. The impact depends on the type of bottom trawling, see report of Prins et al. (2011) for more details.

Biogenic substrate of species which are sensitive to physical disturbance, such as beds of long-lived shellfish or reefs of *Sabellaria spinulosa*, hardly occur. The tube dwelling polychaete *Lanice conchilega* can be considered a reef-building ecosystem engineer. This species is relatively resistant to physical disturbance, but the impact on the associated fauna is more pronounced. The population of long-living species, as exemplified by the ocean quahog *Arctica islandica* is declining in comparison to the 1980s.

3.6.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- a specific proportion of the total surface area of each benthic habitat is undisturbed
- recovery and presence of benthic communities in line with local physiographic, geographic and climatic conditions is ensured.

Considerations

In general, the definition of GES is in line with the general policy objective to reduce the disturbance of the benthic system (among other things by reducing fisheries impacts), and improve the quality of the benthic system.

Regarding bullet 1: A way to achieve GES, would be to limit a (to be specified) surface area of habitats disturbed by human activity. This requires a spatial management of activities that affect sea-floor integrity, matching the disturbance with the sensitivity and resilience of the habitat. For many habitats, it may be more relevant to look at the scale of the North Sea instead of the scale of the Dutch part of the North Sea.

Due to undefined quantification within pressure-effect relationships it is yet uncertain to what extent changes in future use will have. The reform of the CFP, changes in fishing practices, closure of areas related to wind farms, and other measures such as the creation of protected sites will however provide a positive base sufficient to protect significant parts of the various benthic habitats.

Regarding bullet 2: The absence of adverse effects can be interpreted as ensuring structure and function of the benthic communities. It is expected that recovery of benthic communities can take place where benthic habitats are undisturbed.

3.7 Descriptor 7: Hydrographical conditions

Annex I MSFD
Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

It is in our understanding that this GES descriptor focuses on large scale developments, which have an adverse effect on ecosystem physical functions and components.

3.7.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	Good ecological status by 2015, where the values of biological quality elements (phytoplankton, macro-invertebrates) 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions'	Benthic Ecological Quality Indicator (BEQI) with targets for total benthic biomass in relation to primary production surface area of ecotopes and targets for density, biomass, number of species, and species composition. Ecological objectives are defined up to 1 nmile.
Habitats Directive	To promote the maintenance of biodiversity by requiring EU member states to take measures to maintain or restore natural habitats and wild species at a favourable conservation status	Conservation objectives for habitats and species in Natura 2000 sites
Birds Directive	To conserve all species of naturally occurring birds in the wild state in territory of the EU member states	Conservation objectives for bird species in Natura 2000 sites
OSPAR	To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected	List of threatened and declining species and habitats
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	Sand extraction at greater depth to reduce impacts (<i>no quantitative targets</i>)

It is assumed that only large-scale activities, requiring an Environmental Impact Assessment (EIA), should be considered under this descriptor. In such an assessment, all relevant environmental effects have to be taken into account and consequently, adverse effects related to this GES descriptor will be addressed by an EIA.

Effects on Natura 2000 areas (including external effects) are already covered by the Birds and Habitat Directive, and consequently the most important ecological values should already be covered by this Directive.

3.7.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

Presently, the extension of the Rotterdam harbour in the Maasvlakte 2 project, and the pilot project Sand Engine, are two projects that are relevant examples. At present, there are no plans for the near future (until 2020) for other large scale activities.

At the longer term (after 2020), the expected increase in size of coastal nourishments, a possible extension of the coastline or large scale construction of offshore wind farms are activities that potentially may influence hydrographical conditions.

Present state

The Maasvlakte 2 project is presently the largest reclamation project in the North Sea, covering approximately 2000 ha. 2455 ha of benthic habitat (Habitat type 1110_B) is lost due to the Maasvlakte 2 project.

Foraging habitat is lost for common scoter, sandwich tern and common tern due to the Maasvlakte 2 project, and mitigation measures are taken. The Maasvlakte 2 project does not lead to permanent alteration of habitat functions on other sites than the reclamation site.

The project Sand engine will create a temporary peninsula of ca 100 ha.

3.7.3 Proposal for GES

As a determination for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- Infrastructural or engineering works do not occur at such a scale that they result in permanent adverse effects on the ecosystem through significant changes in hydrographical conditions.

Considerations

The determination of GES takes into account that the descriptor relates to permanent changes in hydrographical conditions as a consequence of large-scale projects.

While currently such projects are not foreseen, developments at the longer term (coastal defence, renewable energy) may result in effects that are large enough to be considered under this GES descriptor. Cumulative effects of several (future) smaller projects may also have to be considered in order to safeguard GES related to this descriptor.

3.8 Descriptor 8: Contaminants

Annex I MSFD
Concentrations of contaminants are at levels not giving rise to pollution effects.

Concentrations of contaminants are at levels not giving rise to pollution effects. As can be concluded from the criteria mentioned in the Commission decision, pollution effects not only means elevated concentrations of substances, but also relates to biological effects.

3.8.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	Good ecological status by 2015, where the values of biological and physical-chemical quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions' Good chemical status by 2015, where priority substances comply with environmental quality standards	National target levels for polluting substances. Target levels for priority substances established at EU level (Environmental Quality Standards Directive, 2008/105/EC). Priority substance targets are defined until 12 nmile.
OSPAR (Hazardous Substances Strategy)	Preventing pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.	Targets are defined as: <ul style="list-style-type: none"> - Background concentration (BC), defined as the concentration at a pristine or remote site based on contemporary or historical data. BC for manmade compounds is zero. - Environmental assessment criteria (EAC), concentrations of contaminants on monitoring matrices, normally sediment or biota, below which unintended or unacceptable biological responses are unlikely to occur. - EcoQO on oiled guillemot - EcoQO on imposex - EcoQO on mercury and organochlorines in seabird eggs
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	<i>Derived from OSPAR and WFD</i>

The OSPAR Hazardous Substances Strategy sets the objective of preventing pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.

The Water Framework Directive (WFD) establishes a framework for the protection of groundwater, inland surface waters, estuarine waters, and coastal waters, which sets the objective of achieving at least 'good ecological/chemical status' for all water bodies by 2015. With the ultimate aim to prevent and protect the status of water resources, sustainable water use and improvement of the aquatic environment, through specific measures for the reduction of discharges and pollution.

WFD and OSPAR differ in approach, with OSPAR striving for near background concentrations for naturally occurring substances and close to zero for man-made synthetic substances, whereas WFD has the objective of achieving good ecological/chemical status, which requires meeting quality standards that are not necessarily similar to OSPAR's quality standards.

There are also differences in assessment methods between OSPAR and WFD. According to WFD standards substances are analysed in total water, whereas OSPAR standards require analysis in the appropriate matrix, sediment, suspended matter or biota. This may result in differences in the assessments of current status.

3.8.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

Elevated concentrations of contaminants are caused by land-based emissions and emissions at sea. Major inputs come from riverine discharges with additional contributions of atmospheric deposition. Emissions or spills from other sources like shipping, offshore installations, dredged spoil also contribute contaminants to the marine environment. Decreases in riverine pollutants are expected as a consequence of the implementation of the Water Framework Directive. The number of oil spills has decreased in recent years. Changes in emissions from marine sources depend on additional measures.

Present state

Concentrations of chemical substances (excluding nutrients) in water are decreasing and seldom exceed the WFD standards in the North Sea. Only concentrations of TBT are too high in coastal areas, according to the WFD and OSPAR standards. If current efforts continue it is likely that standards on chemical substances are achieved by 2020. Doses of radioactivity in marine seafood are below the limit value.

In the OSPAR assessments of concentrations in sediments and biota, concentrations of specific metals, PCB's and PAH's have a potential for significant adverse effects. Another list of so-called 'substances of special attention' describes substances with potential adverse effects until it can be properly assessed. These priority chemicals are pesticides, short-chained chlorinated paraffins (SCCPs), nonylphenol/ethoxylates, TBT, and brominated flame retardants (BDEs). Concentrations of most contaminants are, however, decreasing.

The discharge of pharmaceuticals and personal care products to the marine environment is increasing. The ecotoxicological risks of these highly biologically active compounds are largely unknown.

Contaminants can in potential affect processes from molecular to population level by altering the reproduction and survival of organisms. The OSPAR assessment criteria as set for the EcoQO Oiled guillemots and imposex are not yet met, but if trends continue the EcoQO for oiled quillemots may be met by 2020. The TBT problem in sediments will continue to remain a problem for many years due to its persistence and the EcoQO for imposex will not be met in 2020.

3.8.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- concentrations of contaminants, measured in the relevant matrix for the marine environment, are at levels not giving rise to pollution effects.

Considerations

The determination of GES is in line with the WFD objective to achieve good status and the OSPAR objective to prevent pollution. In addition to the formulation in Annex I, the emphasis is put on measuring contaminants in the relevant matrix for the marine environment, meaning that sediment and biota should be used instead of water. Furthermore, target levels of some priority substances under WFD cannot be evaluated due the fact that detection limits are too high. Methods used in the WFD are not entirely comparable to those used in OSPAR. Harmonization between the OSPAR EAC levels and the WFD EQS levels is necessary.

According to OSPAR the phase-out of a third of the priority groups of chemicals which pose a risk to the marine environment is underway, but several substances are being replaced by other substances. Besides WFD and OSPAR substance lists, emerging substances should be considered.

The level of knowledge on impacts in the marine environment is relative high. However, in only a few cases it has been possible to directly link chemical monitoring with observations of biological effects that allow conclusions on the ecological impacts.

OSPAR has developed a number of biological effects monitoring techniques and associated assessment criteria to measure response within marine organisms. This includes both contaminant-specific techniques and techniques reflecting responses to multiple contaminants. Currently OSPAR/ICES recommendations are being developed on the level of effect that should be taken into account.

Pollution effects comprise oil pollution and smothering of birds as well. Although the EcoQo is probably met by 2020, the EcoQO is still a proxy. Any oil spill should be carefully monitored in relation to bird-concentrations to prevent high impact.

3.9 Descriptor 9: Contaminants in fish and other seafood

Annex I MSFD
Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.

Annex I of the MSFD focuses on levels of contaminants in fish and other seafood for human consumption. These may not exceed levels as established by Community legislation and other relevant standards, which includes national standards.

3.9.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	At good chemical status "concentrations of pollutants do not exceed the environmental quality standards established in Annex IX and under Article 16(7), and under other relevant Community legislation setting environmental quality standards at Community level."	Environmental quality standards for pollutants
EU legislation on contaminants in food are in Council Regulation 315/93/EEC	Since contamination generally has a negative impact on the quality of food and may imply a risk to human health, the EU has taken measures to minimise contaminants in food.	Maximum levels for certain contaminants in food are set in Commission Regulation (EC) No 1881/2006
OSPAR (Hazardous Substances Strategy)	Preventing pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.	Via EU legislation (contaminants in food, hazardous substance directive)
National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	

Commission Regulation EC1881/2006 sets targets for maximum levels for human consumption, of a selection of contaminants in a variety of food items, amongst them fish and other seafood for humans. Currently all regulatory levels are met. Additionally national standards for maximum levels of contaminants in food are set in the Dutch 'Warenwetregeling Verontreinigingen in levensmiddelen'. The latter entails maximum levels for e.g. PCBs.

Targets as set for EC 1881/2006 and the national 'Warenwet' form the basis of the GES definition.

3.9.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

The predominant pressures for this descriptor are emissions from point and diffuse sources (see §3.8). Observed trends show decreasing concentrations of most contaminants. Reduction of emissions through the implementation of measures in the WFD river basin management plans is expected.

Present state

The maximum allowed levels for food safety, both for mussels as for flounder do not exceed.

Fish from relatively polluted coastal areas have elevated levels of contaminants, yet all are below the allowed levels.

3.9.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- contaminants in fish and other seafood for human consumption do not exceed levels established by Community and national legislation.

Considerations

The definition of GES is in line with the description in Annex I of the MSFD, and emphasizes that both EU standards and national standards may apply.

The Commission Regulation No 1881/2006 contains maximum levels for "older", well known contaminants such as metals, PCBs and PAHs. These targets are met. However, no maximum levels for human consumption have been set yet for emerging substances.

3.10 Descriptor 10: Litter

Annex I MSFD
Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

Annex I of the MSFD focuses on properties and quantities of marine litter and aims to achieve that marine litter does not cause harm to the coastal and marine environment.

3.10.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	Good ecological status by 2015, where the values of biological and physical-chemical quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions' Good chemical status by 2015, where priority substances comply with environmental quality standards	No quantitative targets
EU Directive on port reception facilities for ship-generated waste and cargo residues (Directive 2000/59/EC, December 2002)	Focuses on ship operations in Community ports and addresses in detail the legal, financial and practical responsibilities of the different operators involved in delivery of waste and residues in ports	No quantitative targets
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) and Annex V.	To prevent and minimize pollution from ships – both accidental pollution and that from routine operations.	No discharge of plastics. No discharge of buoyant dunnage, lining or packaging material within 25 nautical miles (nm). No discharge of garbage within 12 nm. Food waste may be discharged if ground to pieces smaller than one inch. No discharge of any solid waste, including food waste, within 3 nm. "Special Areas" under MARPOL Annex V have a more restrictive set of regulations for the discharge of garbage, with the main additions being: No discharge, not only of plastics, but also of any sort of metal, rags, packing material, paper or glass. Discharge of food wastes must occur as far as practicable from land, and never closer than 12 nm.

Honolulu strategy	To promote the prevention, reduction and management of marine debris	
OSPAR	Activities on marine litter are covered by the Biodiversity Strategy and are dealt with within the EIHA Committee. In between meetings, work is undertaken in the Intersessional Correspondence Group on Marine Litter (ICG-ML).	EcoQO on abundance of plastics in stomachs of a common seabird, the Northern Fulmar
National Water Plan	"A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem."	There is no national legislation addressing marine litter.

There is currently no national legislation addressing marine litter in the European countries (Galgani et al., 2010).

Several international policies and conventions on prevention of pollution from ships are established. The Dutch Directive on port reception facilities stimulated the intake of waste from ships in ports. These will lead to a reduction of waste from ships. OSPAR has established a specific working group on Marine Litter to further address the problem.

3.10.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

The pressure is expected to increase as one of the main drivers (maritime transportation) is expected to show a significant increase in intensity. Land-based emissions and fisheries related litter are expected to decrease. The type of litter will accordingly change.

In the Netherlands, the Directive on port reception facilities was implemented in late 2004. Quantities of delivered waste in ports have increased, but without visible effects on quantities of beached litter or ingested plastics by Fulmars.

Present state

The monitoring of numbers of litter items on beaches has been standardized by OSPAR, but strong local variability and analytical problems have so far prevented appropriate statistics and the identification of target values for acceptable quality.

No clear trend can be observed in the number of litter items found on Dutch beaches since 2002.

No direct knowledge exists on the amount or composition of litter on the sea surface or in the water column in the Dutch sector. Data on litter on the seabed are fragmentary and not developed as a monitoring tool, although international trawl surveys may contain some information.

A monitoring method considering the impact of litter on marine life has been developed by OSPAR as EcoQO using the mass of plastic in the stomachs of Northern fulmars. Trends of different categories of plastic have been monitored over the past decades. OSPAR has identified a target value for acceptable ecological quality for the North Sea.

The target for the EcoQO on plastic in the stomachs of fulmar has not yet been met in the Dutch part of the North Sea.

3.10.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- the amount of litter in the water column, on the seabed and washed ashore decreases compared to the baseline reference,
- harmful effects of litter in marine organisms do not occur.

Considerations

In general, the definition of GES focuses on a reduction in the amount of litter and the harmful effects of litter, in line with the formulation in Annex I of the MSFD and the measures already implemented to reduce pollution by litter.

Regarding bullet 1:

Marine litter has different sources, coming both from ships and from land-based sources. Sources are diffuse and currently quantification is not well known.

Regarding the characteristics of litter in the marine and coastal environment no clear trend can be observed in the number of litter items found on Dutch beaches since 2002. No direct knowledge exists on the amount or composition of litter on the sea surface or in the water column in the Dutch sector. Data on litter on the seabed are fragmentary and not developed as a monitoring tool, although older Dutch datasets and international bottom trawl surveys contain information that could act as a starting point for monitoring.

Setting a GES target level for marine litter is largely an arbitrary choice. For example, in the case of the Fulmar EcoQO, the OSPAR target resembles the litter situation in a reference area where the pollution level is considered to be acceptable in terms of environmental quality, e.g. the Canadian Arctic. The EcoQO in this case is a monitoring tool, not an indicator of presence or absence of impacts. The EcoQO level is a subjective decision attempting to include all elements of the ecosystem, not just the Fulmar. See Boon et al. (2011) for more details on target setting.

Regarding bullet 2:

It is not yet clear how to monitor harmful effects of litter. The EcoQo on Fulmar can however be taken as a proxy, but is not yet met. Although lack of information on effects, we propose an absence of effects, as suggested by EC (2008). More details are provided in Boon et al. (2011).

3.11 Descriptor 11: Energy and underwater noise

Annex I MSFD
Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

Annex I of the MSFD addresses the introduction of all types of energy, including underwater noise. While the focus in the Commission decision is on underwater noise, other types of energy like thermal energy, cooling water discharges or electromagnetic energy are to be considered in future.

3.11.1 Current (inter)national policies and treaties

In the table below the most relevant existing policies, treaties and conventions are listed that support the achievement of good environmental status for this descriptor.

	General objectives	Specific targets
Water Framework Directive	Good ecological status by 2015, where the values of biological and physical-chemical quality elements 'deviate only slightly from those normally associated with the surface water body type under undisturbed conditions' Good chemical status by 2015, where priority substances comply with environmental quality standards	Limit level for cooling water discharges No quantitative targets for underwater sound
OSPAR	<u>Biodiversity strategy:</u> Objectives:- endeavour to keep the introduction of energy, including underwater noise, at levels that do not adversely affect the marine environment in the OSPAR maritime area; Implementation: consider, identify and implement appropriate measures for the reduction of the adverse effects of underwater noise on the marine environment <u>Offshore Oil and Gas Industry Strategy:</u> Implementation: further assess the impact of underwater noise from the offshore oil and gas industry in light of EU criteria and methodological standards for good environmental status and, as appropriate, develop guidance on best practice for its mitigation	No quantitative targets

National Water Plan	A sustainable, spatially efficient and safe use of the North Sea that is in balance with the marine ecosystem as laid down in the Water Framework Directive, the Marine Strategy Framework Directive and the Birds and Habitats Directives. The objective is to protect and develop the marine ecosystem	No quantitative targets regarding underwater sound
Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)	Regulation of activities with an indirect impact on small cetaceans and prevention of significant disturbances to these marine mammals especially of acoustic nature.	No quantitative targets regarding underwater sound. Resolution No. 2 of 6 th Meeting of the Parties to ASCOBANS (2009) includes recommendations and guidelines towards impact assessments and precautionary approaches for all activities related to renewable energy.
Conservation Plan for the Harbour porpoise <i>Phocoena phocoena</i> in The Netherlands	Reduce threats to harbour porpoises in the Southern North Sea by e.g. a reduction in levels of underwater noise produced by seismic surveys, controlled under water explosions, and offshore construction or demolition.	No quantitative targets regarding underwater sound, Focus on mitigation measures to reduce the production of under water noise.

With the exception of cooling water discharges, other types of energy are not considered in existing legislation or policies. Existing policies provide some background for the prevention of adverse effects on the marine environment, for example in the OSPAR strategies on biodiversity and on offshore oil and gas industry. Protection of marine fauna, e.g. under the Habitats Directive or Ascobans, also provides some background.

3.11.2 Risk assessment

Detailed information on pressures and present state is provided in the report on the Initial Assessment by Prins et al. (2011). In this section a summary is provided.

Pressures

In an inventory of all natural and anthropogenic sources of underwater noise, source levels, frequency bands, and other characteristic information were collected. The study concluded that the main contributions to anthropogenic sound energy in the Dutch part of the North Sea come from shipping, seismic surveys (airguns), underwater explosions and pile driving. It is expected that anthropogenic sound sources will increase, due to increases in shipping and construction of wind turbines.

Present state

Currently there is only very limited information available on the disturbance by underwater noise of cetaceans and other mammals, fish, fish larvae or other marine life, and the effects on species abundance or distribution in the Dutch part of the North Sea. Due to this lack of information, the current environmental status of the Dutch North Sea sector cannot be evaluated with respect to impacts of underwater noise.

Generic guidelines/procedures for the measurement and quantification of underwater sound are presently lacking.

3.11.3 Proposal for GES

As a definition for GES, the following is proposed:

The Dutch North Sea is considered to be in a good environmental status by the year 2020 when:

- the occurrence and fitness of marine fauna is not adversely affected by background noise and/or loud impulsive sounds introduced by human activities.

Considerations

The definition of GES emphasizes the various sources of energy that may be relevant to an impact on marine fauna. The definition puts focus on the species groups that are most likely to be affected by underwater noise. Occurrence could be interpreted as “number of species, abundance and distribution” as further specified in Boon et al. (2011). Fitness is related to food intake and / or reproduction. A reduction of fitness could, in the long term, decrease population viability.

Energy sources such as cooling water discharges or electromagnetic energy are not yet considered in the proposal for GES as the focus is on underwater noise (EC, 2010).

A precautionary approach is necessary for this descriptor. At present, there is considerable uncertainty about the contribution from various sources to underwater noise levels in the North Sea. In particular, the significance of anthropogenic sources in addition to ambient (background) noise is not well known. There is some knowledge on the effects of noise on marine life, but this is mainly limited to marine mammals (cetaceans, seals) and some fish species. The exact impacts of underwater noise on most species are largely unknown. This makes it difficult to decide what management actions should be taken to achieve GES.

It is to be expected that sources of underwater noise will be increasing, with a growth in intensity of maritime transportation and in offshore renewable energy like the construction and exploitation of offshore wind farms.

As sound can travel long distances, there is a potential for trans-boundary effects which should be considered.

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