



MSFD Monitoring Programme

VERSION 04.02.2014

Summary

Introduction

General

Following approval from the European Parliament, the European Commission issued the European Marine Strategy Framework Directive in 2008 (MSFD, 2008). The Directive obliges Member States to establish and implement the required measures to achieve and/or maintain good environmental status in their marine waters.

The European Commission requires member states to embed the directive in their national laws. The Netherlands did so in 2010 by incorporating the Directive into the Water Decree under the Water Act.

The member states are obliged to formulate a Marine Strategy, on which they have to report to the European Commission for each individual section.

Part 1 of this strategy should contain an initial assessment of the status of the marine environment, including a socioeconomic analysis. The Commission also requires that this section include a description of: a) what is considered to be a satisfactory environmental status by 2020; b) the environmental targets that are being pursued for that year; and c) the indicators for achieving the respective environmental targets.

The MSFD also prescribes that a monitoring programme be drawn up to be able to measure indicators associated with environmental targets. This is part 2 of the Marine Strategy. This will enable member states to continue assessing their Marine Strategy and to update it periodically (adaptive management).

Member states are asked to include a programme of measures in part 3 and to put it into effect to achieve and/or preserve a good environmental status.

On 5 October 2012 the Netherlands adopted its Marine Strategy for the Dutch part of the North Sea 2012-2020, Part I, and reported on it to the European Commission. The document outlines the initial assessment of the marine environment for 2012, the good environmental status for 2020 and the associated environmental targets and indicators (32 in total) for our part of the North Sea and ranks them according to the eleven environmental descriptors of the Directive.

This document, the Marine Strategy for the Dutch part of the North Sea 2012-2020, Part 2, describes the monitoring programme required by the European Commission for practical measurement of the indicators associated with the Dutch environmental targets for the various environmental descriptors in accordance with the Directive.

The third part of the Dutch Marine Strategy, the programme of measures, will be included in the new National Water Plan in 2014-2015 and put into effect from 2016.

National Approach

The Cabinet's ambition is to establish and safeguard a good environmental status in and the biodiversity of the North Sea as a key resource for the economy and the food supply for current and future generations.

The Cabinet has opted for a down-to-earth and pragmatic approach to implementing the entire (i.e. all parts of) Marine Strategy (the MSFD). The existing and planned new policy forms the basis for implementation. The current policy will be supplemented in those places where it falls short of achieving the good environmental status. The ambition should be: effectiveness and efficiency at a reasonable cost.

Marine Strategy for the Dutch part of the North Sea 2012-2020, Part 2, the MSFD Monitoring Programme

General

The Cabinet views this Draft MSFD Monitoring Programme as a guiding component of the approach to ensure a good status of the marine environment in the Dutch part of the North Sea. The MSFD Monitoring Programme has been drawn up in accordance with Article 11 of the Directive. It details the actual monitoring of the 32 indicators outlined in the Marine Strategy Part 1. Based on the measurement data, the Monitoring Programme provides insight into:

1. the status of the indicators, thereby indicating the extent to which an environmental target is achieved (MSFD, Art. 10), in order to facilitate the ongoing assessment and periodic updating of the environmental targets (MSFD, Art. 5)
2. the effectiveness of the programme of measures to be implemented under the MSFD.

Although the Monitoring Programme focuses primarily on the 32 indicators from the Marine Strategy Part 1, it also uses, for the purpose of interpreting the results, a number of supporting parameters that are included as standard during sampling (such as temperature, acidity, conductivity, salinity and dissolved oxygen). For the purpose of revising the entire Marine Strategy in 2020 and the next assessment of the environmental status in 2017-2018, use will also be made of the information resulting from monitoring for research or from other statutory frameworks and policy areas. This includes information from national monitoring under the Bathing Water Directive in the area of microbial pathogens, shipping intensity monitoring for the purpose of shipping traffic safety and bathymetric information obtained from hydrographic measurements. Economic data is collected by Statistics Netherlands (abbreviated as CBS in Dutch). CBS supplies the required data following receipt of a specified request for information. Thus, the requirements of MSFD Art. 8 are met and the indicative list of elements included in MSFD Appendix III is incorporated.

In this way, the MSFD Monitoring Programme provides a solid basis for updating the Marine Strategy during the second implementation cycle of the MSFD. This begins by updating the initial assessment (MSFD Art. 8) and describing the good environmental status (MSFD Art. 9), environmental targets and indicators (MSFD Art. 10) in 2018, and continues through to the adjustment of the existing programme of measures (Art. 13) in 2024.

Approach

The Cabinet's 'down-to-earth and pragmatic' approach to implementing the Marine Strategy means that the monitoring that is already operational in various policy areas will be used for this MSFD Monitoring Programme wherever possible. The aim is to collect the data once and then to make it available for multiple use to ensure that the MSFD Monitoring Programme does not cause an increase in the administrative or financial burden on companies or citizens. Innovative methods and techniques help optimise data collection, access and processing, which has a positive effect on the cost aspect.

The Cabinet seeks to implement the MSFD by means of international cooperation wherever possible. This is focused on collaboration with other EU member states bordering the North Sea, and, within OSPAR and ICES, on the development of joint indicators, coordinated monitoring programming and collaboration on implementation.

Status

This Draft MSFD Monitoring Programme was adopted by the Cabinet on 21 February 2014. The summary is available for public inspection from 7 March to 17 April 2014. The entire document can be accessed online as background information to this summary. The Cabinet will respond to the results of the public inspection in a Report of Answers. The Cabinet will adopt the final MSFD Monitoring Programme, including the Report of Answers, by 15 July 2014, and report on it to the European Commission by 15 October 2014.

Contents

In addition to this introduction and the general explanation, this Draft MSFD Monitoring Programme consists of two parts: A) Organisation of the MSFD monitoring (Marine Strategy, Part 2A) and B) the MSFD Monitoring Plan (Marine Strategy, Part 2B).

The MSFD Monitoring Plan will be updated annually in a digitally amended supplement based on the latest developments and insights in the area of indicator definitions and measurement methods. The first complete revision of the MSFD Monitoring Programme will be part of the second MSFD cycle in 2020.

Part A: Organisation of MSFD monitoring

The MSFD monitoring cycle

The MSFD Monitoring Programme is implemented in accordance with the MSFD monitoring cycle, which is described in detail in Marine Strategy, part 2A (Organisation of MSFD monitoring) and shown in the diagram. The cycle comprises six steps:

- A) Adopting current policy and management for the Marine Strategy with regard to the environmental targets and associated indicators (2012).
- B) Gathering the information required for the Marine Strategy (2012).
- C) Drafting a Monitoring Plan (this document, 2014)
- D) The actual collection of data (2014-2017)
- E) Accessing the measurement data and translating the data into information (2017)
- F) The report for updating the initial assessment, environmental targets and good environmental status (2017-2018).

Step F concludes the monitoring cycle.

Within the MSFD monitoring cycle, there are specific parts that are completed in shorter cycles, as in the case of the annual adjustment of the measurement networks for the MWTL (Dutch acronym for a programme that is monitoring hydrological conditions nationwide) of Rijkswaterstaat or for the WOT (which stands for statutory research tasks) of the Ministry of Economic Affairs.

Informatiehuis Marien will play a central role in implementing the MSFD monitoring cycle, particularly in monitoring quality, transparency, availability and cost efficiency. This supporting body operates on a joint commission from the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs.

International collaboration is pursued in all steps of implementing the monitoring cycle.

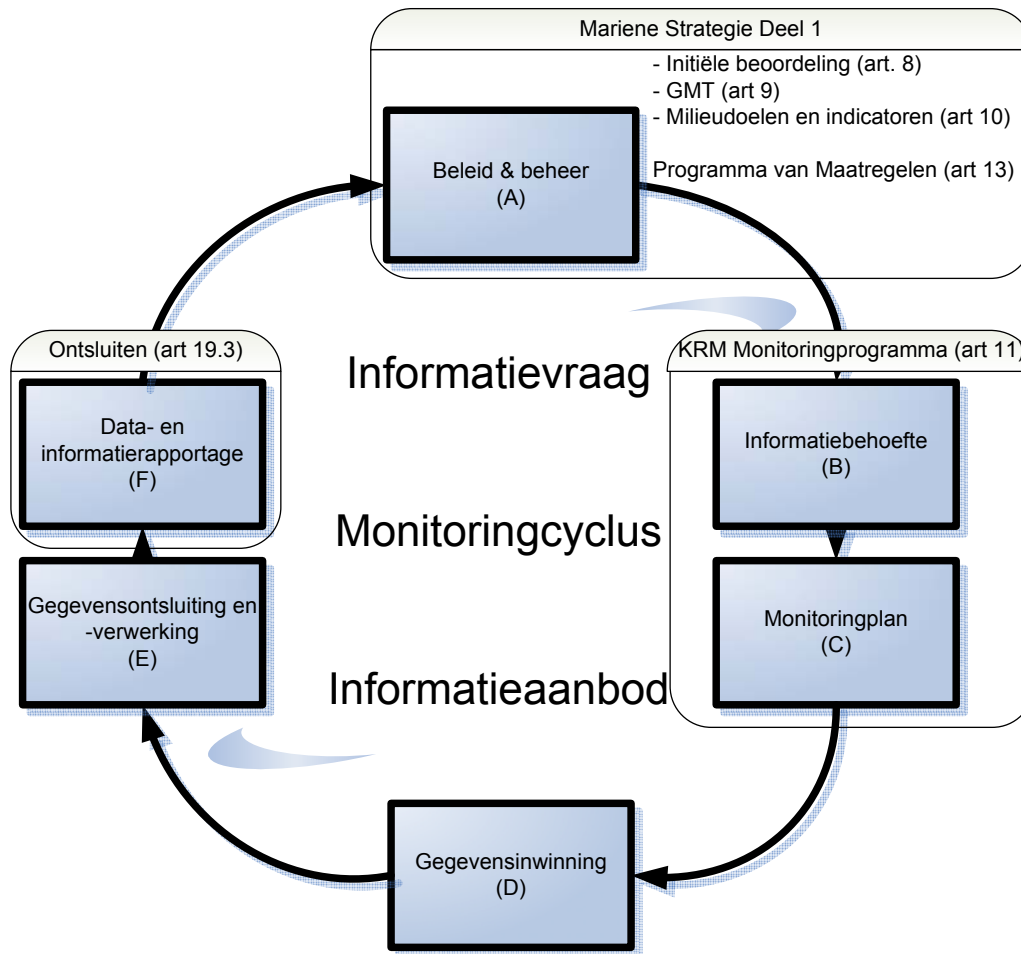


Diagram of MSFD monitoring cycle

Part B: MSFD monitoring plan

Introduction

The MSFD Monitoring Plan 2014 (Marine Strategy Part 2B) follows the structure of the MSFD based on the eleven descriptors (MSFD, Appendix I). For each descriptor, the plan describes: the environmental target, the associated indicators, the information requirement for each indicator, the information strategy, the functional measurement requirements, the monitoring strategy and the measurement plan. The functional requirements are considered a technical, substantiating step towards formulating the monitoring strategy, and have therefore been left out of this summary. For the measurement plan, reference is made to, for example, the map image presentation in the MSFD Monitoring Plan (Marine Strategy Party 2B).

In most cases, the measurement plans are taken from the existing monitoring practice for current policy (for WFD, BHD, CFP or OSPAR, for example) or - where no measurement networks were yet in place - they were created for components.

Informatiehuis Marien will update this MSFD Monitoring Plan annually in a digital supplement based on the latest developments and insights in the area of indicators and measurement methods. Proposals for adjustments may follow from international collaboration on the development of joint indicators and monitoring, for example in the contexts of OSPAR, ICES, CFP and WFD. Changing insights or innovation in measurement methods may also be cause for adjustment.

Elaboration of the MSFD Monitoring Plan by descriptor.

The elaboration of the MSFD Monitoring Programme by descriptor is given below. Descriptors 1, 3, 4 and 6 are combined under the denominator of 'marine ecosystem'.

Monitoring of the marine ecosystem (descriptors 1, 3, 4 and 6)

The goal for the structure of the marine ecosystem is to deflect the trend of deterioration of the marine ecosystem as a consequence of damage to the sea floor habitat and to biodiversity, towards recovery. This has been broken down further into sub-goals for benthos, fish, birds, marine mammals, food webs and habitats.

Marine ecosystem: biodiversity, monitoring of benthos

Environmental targets for benthos from Marine Strategy Part 1 (impacts the information requirement):

Improvement of the population size, health and distribution of populations of long-living and/or vulnerable (i.e. sensitive to physical disturbance) benthic species.

Indicator for benthos: (also impacts the information requirement):

(1) Aggregate indicators for the distribution, occurrence and condition of representatives of long-lived benthic species and biogenic structures sensitive to sea-floor disturbances.

Information strategy for benthos:

Monitoring focuses on the information requirement that follows from both the Habitats Directive and the MSFD. Both Directives oversee protection of the sea-floor habitat of the North Sea. In Marine Strategy Part 1, the Netherlands decided to use benthos for the biodiversity criteria from the Commission Decision (COM 2010/477/EU) at both species and habitat level. Within the OSPAR context and in electronic reporting sheets for the EC, benthos only has meaning for criteria at habitat level (see under habitats).

The environmental target requires identifying trends: monitoring should reveal whether any improvement occurs over time and, if possible, to what extent. An aggregate indicator has yet to be developed for this. The baseline measurement and subsequent monitoring focus on the typical species (in accordance with the Habitats Directive) and on a set of species that are indicative of the structure and function of the habitats, species that are sensitive to anthropogenic disturbances and species that are indicative of recovery. The results yield information that can be used for:

- an overall assessment of the status of preservation of benthic animal communities for the Habitats Directive
- an assessment for the MSFD of both the status of sensitive species and the quality of sea-floor habitats
- insight into the effectiveness of the measures taken

Monitoring Strategy and Measurement Plan for benthos:

For reasons of cost efficiency and consistency, the MSFD Monitoring Plan follows the existing HD and WFD Monitoring Programmes wherever possible. Any outstanding monitoring demands can be met using the extensive MWTL benthos measurement network, supplemented with information from the WOT (statutory research tasks) for Fisheries (shellfish surveys section) and by means of supplementary area monitoring. The measurement sites are all supplementary to the existing measurement networks in the coastal zone and the EEZ.

Before sea-floor protection measures come into effect, the baseline situation of the areas

protected under the MSFD and HD (baseline measurement¹) is determined. Sampling is focused on the designated areas protected under the HD and on the MSFD areas of search for sea floor protection. Within those, both areas under protective measures and relevant reference areas that are not under protective measures are covered. Within each of these areas, the measurement locations are randomly distributed. With the exception of the 'medium-deep mixed sand' of the Southern Bight, the 'common habitats' reported in the MSFD Initial Assessment are thus also covered at EUNIS level 3. For this reason, the Southern Bight is sampled – additionally – in the same way as the protected areas.

Research has shown that it takes a few years before the benthic community recovers after a 'sea-floor disturbance' factor has been removed. The Cabinet has therefore opted for a measurement frequency of once every three years. Based on the baseline measurement data, an evaluation will be made to check whether the spatial coverage suffices to meet the information requirement. Such an evaluation of the measurement plan will be carried out every six years (being the duration of the MSFD implementation cycles). If necessary, the measurement plan is adjusted.

Developments regarding benthos:

In 2013, the OSPAR commission established the multimetric indices for benthic habitats as a common indicator for habitats throughout the Northwest Atlantic region. This indicator is due to be adopted by the North Sea countries jointly between 2014 and 2016. This indicator makes it possible to compare the conditions of similar benthic communities at a regional level, and links up with the methods used under the WFD to assess benthos. In addition, *typical composition of species* has received the status of 'prioritised potential indicator', which means that it may be adopted as a common indicator in one to two years. This indicator comprises not only 'typical species' in accordance with the Habitats Directive, but also a selection of species that are sensitive to sea-floor disturbance.

If necessary and depending on when this OSPAR development will yield results, the Monitoring Plan will be adjusted for indicator (15) *indices for the composition of benthic communities* (see also under habitats) in 2015 or 2016. The requirements under the Habitats Directive must be observed.

Part of the benthos is monitored using an innovative sampling method developed by Dutch research institutes. The use of this 'deep dragging dredge' yields significant efficiency gains, as the sampling can be done faster and is more reliable than the current method.

Marine ecosystem: biodiversity, monitoring of fish stocks

Environmental targets for fish stocks from Marine Strategy Part 1 (also impacts the information requirement):

Improvement of the population size, health and distribution of populations of vulnerable fish species, insofar as deterioration has been caused by human activity. As regards improving the status of the Habitats Directive species, the targets are in line with the national targets of the Habitats Directive.

The targets for commercial fish and shellfish covered by this description are as follows:

- mortality caused by fishing (F) remains at the same level or below the value associated with a Maximum Sustainable Yield (MSY)
- the biomass of spawning stocks of commercially exploited fish and shellfish is above the precautionary (Bpa) level
- minimising and eventually eliminating fishery discards.

The target for depleted stocks of sharks, skates and rays fished by the EU fleet is recovery (or rebuilding) in line with the EU Shark Action Plan.

¹ As referred to in the Geurts/Slob motion (Parliamentary Document 32002-3 in the discussion of the introduction of the Nature Conservation Act 1998 in the Exclusive Economic Zone)

Indicators for fish stocks (also impacts the information requirement):

- (2) Fish mortality among commercially exploited species or, if no values are available for this, the (change in) catch per unit of effort.
- (3) The biomass of spawning stocks of commercially exploited fish.
- (4) Size distribution of both commercially exploited fish and vulnerable species.
- (5) Aggregate indicators for population size, distribution and health of sharks, skates and rays, fish species with a long-term negative trend and migratory fish.
- (6) Fishery discards.

Information strategy for fish stocks:

Specific information is needed for each indicator: Indicators 2 and 3 are existing ICES indicators. Indicator 4 requires data collected by independent research ships. This data should include length and sex per fish species.

For migratory fish, indicator 5 comprises information from landside passage monitoring (PASMOM), for sharks, skates and rays from ICES reports and also from by-catch records. Determination of the discards for indicator 6 requires data for each species on size and age distribution in discards, as well as data on the quantity of discards (number of fish and weight) for each form of fishing.

Monitoring Strategy and Measurement Plan for fish stocks:

The indicators fish mortality (2), spawning stock biomass (3) and discards of commercial fish (6) have been fully incorporated into the existing monitoring programmes relating to the Statutory Research Tasks for Fisheries (WOT) and the Data Collection Framework (DCF, coordinated by ICES). Only the size distribution of commercial fish (indicator 4) requires a closer analysis of the existing data.

A large number of the species falling under indicator 5 occur in such small numbers that the monitoring programmes now in place provide insufficient information. For this reason, use is also made of catch registration data. This data can, however, only be used to a limited extent, due to inadequate knowledge of the distinctive characteristics of species. The problem cannot be resolved at a reasonable cost by expanding fishery-independent monitoring. For this reason, existing monitoring and registration is used for this indicator, which does require some administrative operations on the existing data.

Stock monitoring is not confined to the boundaries of the Dutch part of the North Sea but covers various ICES areas. The Dutch part of the North Sea is located within areas IVb AND IVc. The Netherlands also conducts surveys outside the Dutch part of the North Sea, as other Member States conduct surveys within the boundaries of the Dutch part of the North Sea.

Developments regarding fish stocks:

In 2013, the OSPAR commission established two common indicators for the North Sea region, which will be put into practice by the North Sea countries jointly between 2014 and 2016: *population size/biomass of a set of selected species and the proportion of large fish (existing OSPAR EcoQo)*. Moreover, *average maximum length of demersal fish and elasmobranch species (fish without a swim bladder such as sharks)* has received the status of prioritised potential indicator. The final indicator is a measure of the demographic composition of the entire fish stock. The maximum length that a species can potentially reach is a measure of the demographic characteristics of the species. The indicator measures whether in the entire fish community the ratio of small fish to fish that can grow large changes. This indicator can be established as a common indicator in one to two years. Part of the preparatory work for this is being done in the context of ICES. The data required is already being collected in accordance with the multiannual programme under the DCF (COM 2010/93/EU).

If necessary and depending on when results can be expected, the MSFD Monitoring Plan will be adjusted for indicators (4) size distribution of fish stocks and (5) population size of

vulnerable and long-lived species in 2015 or 2016.

Marine ecosystem: biodiversity, monitoring of birds

Environmental targets for birds from Marine Strategy Part 1 (impacts the information requirement):

The targets for birds are in keeping with the national targets of the Birds Directive (BD). The BD aims to ensure a favourable conservation status for all species for which the Dutch part of the North Sea is vital. The target for pelagic seabirds for which the Dutch part of the North Sea is vital but for which no birds directive areas have been selected is to ensure a favourable conservation status at regional level. For those species for which this is relevant, account will be taken of the decreasing food supply as a result of decreasing eutrophication and the phased fulfilment of the obligation to bring fishery discards ashore.

Indicator for birds (also impacts the information requirement):

(7) Distribution, population, health and future prospects of populations of vulnerable (endemic) bird species in the North Sea and the quality of the habitat.

Information strategy for birds:

The indicators will be developed into parameters based on the BD reporting obligation that was tightened in 2011.

The information requirement under the Birds Directive relates to:

- numbers and trends of breeding birds and non-breeding birds.
- distribution (distribution map, range size, range trend) of breeding birds
- information on pressures and measures; not further defined.

Habitat

At the area level, the Birds Directive also requires information about the habitat. At present, there are no unambiguous definitions yet for the terms 'habitat' and 'carrying capacity of habitat'. For practical reasons, it has therefore been decided for the time being to interpret this information on the basis of the ecological requirements for the actual habitat, as established in the Natura 2000 Profiles Document (2008).

Monitoring Strategy and Measurement Plan for Birds:

The monitoring strategy is largely determined by area characteristics, resulting in a distinction between areas with a high bird density and many different species in the coastal zone, areas with a high bird density but few different species in the (planned) birds directive areas in the EEZ, and areas with a relatively low bird density and little diversity in the EEZ outside the birds directive areas.

Frequency

Annual counting of birds in the coastal zone during the winter months (November, January and February), and in the spring and summer (April, June and August). Counting in the EEZ is done in the winter (November, January, February) and the summer (August).

Spatial pattern

Counting in the EEZ requires a lower measurement density than in the coastal zone, with the exception of the Frisian Front and the Brown Ridge. If these areas are designated as BD areas, they will require greater spatial coverage.

Method

Species identification is a functional requirement, which may be hard to meet using observations at sea due to poor visibility, too large a distance between birds and the observer and the fact that a number of species are hard to tell apart. The question of how

to bypass those limitations largely determines the counting method to be used. Counts can be done from planes, from ships and from the shore. Each perspective comes with its specific options and limitations. Plane-based counts form the core of the measurement programme on account of their good quality at a relatively low cost. Flying low is best.

Developments regarding birds:

In 2013, the OSPAR commission established two common indicators for the North Sea region, which will be put into practice by the North Sea countries jointly between 2014 and 2016: *species-specific trends in relative abundance of non-breeding and breeding marine bird species* and *the distribution pattern of breeding and non-breeding marine bird species*. Moreover, the *breeding rate of marine bird species* has been designated as a prioritised potential indicator that may be established as a common indicator in one to two years. The advantage of such indicators is that they allow a comprehensive assessment of the status of the various bird species on a North Sea scale. It is expected that this information requirement will not lead to supplementary monitoring. However, a separate report with seabird information will be required for OSPAR. Depending on when this process will yield results, the Monitoring Plan will be adjusted in 2015 or 2016 for further elaboration of indicator (7) 'distribution, size, health and future prospects of populations of vulnerable (endemic) bird species and the quality of the habitat'.

The Netherlands aims for one cohesive monitoring approach for the entire North Sea area, with due observance of the requirements under the Birds Directive. As from 2014, tests will be done with new, innovative camera technologies aimed at improving species recognition and allowing the concurrent monitoring of marine mammals, which will ultimately result in greater effectiveness and efficiency.

Marine ecosystem: biodiversity, monitoring of marine mammals

Environmental targets for Marine mammals from Marine Strategy Part 1 (impacts the information requirement):

The targets for marine mammals covered by the Habitats Directive (common seal, grey seal and harbour porpoise) are the same as the national targets pursuant to the Habitats Directive.

Indicator for marine mammals (also impacts the information requirement):

(8) Distribution, size, health and future prospects of populations of marine mammals and the quality of the habitat.

Information strategy for marine mammals:

At the national level, the information requirements under the MSFD and the Habitats Directive are the same. At the area level, however, Natura 2000 does require some additional information, particularly for tracking the effects of human activities and mitigating measures.

The most important information about marine mammals concerns population size, distribution and trends. The health of seals can be determined using existing OSPAR indicators.

Monitoring Strategy and Measurement Plan for marine mammals:

Harbour porpoise

Internationally coordinated measurements, such as the Small Cetacean Abundance Survey in the North Sea and Adjacent Waters (SCANS), are the most suitable method to gain insight into the distribution of the harbour porpoise on the North Sea scale. An important aim is to make use of these international counts. Until then, national counts will be carried out. Moreover, specific harbour porpoise counts and combined counts (with birds) are being

considered. Reports on by-catches in gill nets are also included.

Common seal and grey seal

The distribution, population size and trends relating to the common seal and the grey seal are best determined using standardised sandbank counts, at low tide and preferably during the pup and shedding periods (November-December).

The HD and Natura 2000 are concerned with the status and determining the trend for seals. There is not a specific 'yardstick' (except for the common seal in the Delta and Voordelta). OSPAR, on the other hand, does have a yardstick for seals. The condition of seals can be determined on the basis of two OSPAR EcoQOs: *population trends for seals in the North Sea (no decrease of > 10% in population size over a five-year average)* and *grey seal pup production (no decrease > 10% in pup production over a five-year average)*. The Netherlands determines these EcoQOs for the Wadden Sea population by means of the current monitoring of the sandbanks.

International coordination is necessary, because the common seal and grey seal populations cross borders. This coordination is already taking shape for the OSPAR EcoQOs referred to.

Developments regarding marine mammals:

In 2013, the OSPAR commission established five common indicators for the North Sea region, which will be put into practice by the North Sea countries jointly between 2014 and 2016:

1. *Abundance of grey and common seals in places where they go ashore and where they have pups*
2. *Pup production of common and grey seals (existing EcoQo)*
3. *Distribution area and distribution pattern of frequently present cetaceans*
4. *Abundance on the relevant time scale of frequently present cetaceans*
5. *Mortality among seals and cetaceans due to by-catches.*

Depending on when this process will yield results, the Monitoring Plan will be adjusted in 2015 or 2016 for the further elaboration of indicator (8) '*Distribution, size, health and future prospects of populations and the quality of the habitat*'. As stated above, the Netherlands would prefer one cohesive monitoring approach for the entire North Sea area, with due observance of the requirements under the Habitats Directive.

Expectations are high for the development of high-definition camera technologies in the coming years. HD cameras are expected to improve effectiveness and efficiency in counting birds and marine mammals at sea.

Marine ecosystem: monitoring food webs

Environmental target for food webs from Marine Strategy part 1 (impacts the information requirement):

The effect of human interventions on interactions between the different trophic levels in the food web will be reduced wherever this effect is a problem.

Indicators for food webs (also impacts the information requirement):

(10) Proportion of large fish in catches of bottom species from the International Bottom Trawl Survey (IBTS): length-frequency distribution. There is a comparable OSPAR indicator available: EcoQO large fish indicator (weight percentage of fish caught having a length >40 cm).

(11) Indicators for seabirds, marine mammals, and sharks, skates and rays as top predators. Here, the indicators referred to under 'species' can be used.

(12) Food relationship of key species (indicator yet to be developed).

Information strategy for food webs:

Proportion of large fish in catches of bottom species (indicator 10)

For the indicator 'Proportion of large fish in catches of bottom species', use is made of the IBTS data: quantities per species and (in particular) the length-frequency distribution that is determined as part of the IBTS. This is the percentage of specimens over 40 centimetres in length in the catch of various species. This indicator has been developed within the OSPAR context and has been coordinated with ICES and included in the OSPAR EcoQO for proportion of large fish (LFI). Within the OSPAR context, LFI has also been designated as a common indicator for fish.

Food relationship of top predators (indicator 11)

At present, the top predators (large fish, seabirds, marine mammals, and sharks, skates and rays) are the only indicators for the assessment of the integrity of the food chain. For this reason, Marine Strategy Part 1 designates some species of top predators as indicators. For this indicator, use is made of the individual measurement networks for seabirds, marine mammals and sharks, skates and rays. The following parameters from the measurement networks in question are relevant:

- for seabirds: size of populations of vulnerable bird species
- for marine mammals: size of populations of marine mammals
- size of populations of sharks, skates and rays.

Food relationship of key species (indicator 12)

A proper understanding of how food webs function requires knowledge of the relationships between the species at various trophic levels. The relationships between species – both intratrophic and intertrophic – are, however, not yet clear enough; moreover, there are compounding substitution effects. If a certain type of prey is in scant supply, predators may prey on other species, which makes it difficult to designate indicators specifically for food relationships. In this regard, it is also impossible as yet to make the indicator 'Food relationship of key species' operational. Together with other OSPAR countries, the Netherlands has put this indicator on the knowledge agenda, and in the coming years experts will be looking at what could be the best solution for this.

Monitoring Strategy and Measurement Plan for food webs:

The information on top predators is gleaned from the monitoring of fish, marine mammals and birds. Marine Strategy Part 1 specifically mentions the common scoter, the sandwich tern and the harbour porpoise and their food for the indicator for the food relationship of key species. Signals from existing monitoring, quantities and distribution of common scoters, size of breeding colonies and the breeding success of sandwich terns, quantities of stranded harbour porpoises combined with autopsy data (thickness of blubber and stomach contents) may prompt specific research, for which use can be made of the information from fish and benthos monitoring.

Developments regarding food webs:

In 2013, the OSPAR commission established two prioritised potential indicators for food webs, which can be established as a common indicator in one to two years: *Size distribution of fish (LFI)* and *Change of function groups in plankton*. For the first indicator, use can be made of the common indicators that OSPAR and ICES are developing for fish. The Netherlands has no intention of using the plankton indicator. Depending on the further development of indicators, the Monitoring Plan will be adjusted as necessary.

Marine ecosystem: monitoring of habitats

Environmental target for Habitats from Marine Strategy part 1 (impacts the information requirement):

The distribution and size of predominant habitats remain more or less the same (i.e. within the limits of natural variation at EUNIS level 3). The special habitat types protected under the Habitats Directive are governed by the national targets of the Habitats Directive.

Additional targets:

- improvement of the quality of the deeper, silt-rich parts and deeper, non-dynamic sand beds in the Dutch part of the North Sea. The quality of the habitats is expressed in terms of the physical structure, ecological function and diversity and structure of the associated species communities.
- 10-15% of the seabed of the Dutch part of the North Sea is not appreciably disrupted by human activity.

Indicators for habitats (also impacts the information requirement):

(13) distribution and size of common habitats (EUNIS level 3) and habitats under the Habitats Directive

(14) seabed area that is not disturbed

(15) indices for the composition of benthic communities

(16) indicators for the quality of the different habitats at EUNIS level 3

Information strategy for habitats:

The Habitats Directive and MSFD are both intended to ensure protection of the sea-floor habitat. The monitoring therefore focuses on the information requirement that follows from both directives. The indicators are based on the HD and MSFD. There is no corresponding OSPAR indicator for any of the indicators. In general, the environmental targets for habitats call for status and trend determination.

Status determination for distribution and size of habitats (indicator 13)

The Cabinet has opted to not actively monitor the size and distribution of habitats. When defining the delineation of the habitats and designating the areas, size and distribution were already determined. No (significant) changes are expected here over time, which makes it an administrative indicator.

Status determination for undisturbed seabed area (indicator 14)

The Cabinet regards this indicator as an administrative indicator. The undisturbed surface of the sea floor is calculated on the basis of sand extraction data from Rijkswaterstaat's licensing database and the fishery data from the Vessel Monitoring System (VMS).

Trend determination for the quality of habitats (indicators 15 and 16)

Indicators 15 and 16 are relevant to the habitat types of the Habitats Directive and the various habitats at EUNIS level 3 (including the seabed of the Frisian Front and the Central Oyster Grounds). Within the OSPAR context, the indicators 'typical species' and 'multimetric indices' referred to under benthos are used for this.

With regard to these indicators, the Cabinet has opted for monitoring of the benthic communities. For this purpose, typical species have been selected, as well as indicator types that jointly present a good (area-wide and representative) picture of the quality of the habitat and that are also indicative of sea-floor disturbance by fishing and other pressure factors.

The quality of pelagic habitats (the water column) at EUNIS level 3 is monitored using the indicators for eutrophication, fish and food webs.

Monitoring Strategy and Measurement Plan for habitats:

The monitoring strategy for habitats is provided for with the monitoring strategies for

benthic fauna, fish, eutrophication and food webs outlined in this Monitoring Plan.

Developments regarding habitats:

In 2013, the OSPAR commission designated two prioritised potential indicators, which can be established as a common indicator in one to two years: *decrease in habitat area* and *physical damage to habitats*.

Depending on whether and, if so, when this process yields any results that the Netherlands can use, the Monitoring Plan will be adjusted as necessary for indicators (13) 'Distribution and size of common habitats' and (14) 'Seabed area that is not disturbed' in 2015 or 2016. The requirements under the Habitats Directive will have to be observed for this.

Monitoring the occurrence of exotic species (descriptor 2)

Environmental target for exotic species from Marine Strategy part 1 (impacts the information requirement):

To minimise the risk of new introductions of exotic species.

A good environmental status means that the introduction of exotic species through human intervention does not occur on such a large scale that it changes the ecosystem. However, since there are practically no measures conceivable and/or feasible to reduce the number of exotic species already present, the goal formulated is limited to minimising new introductions of exotic species. Accordingly, the information requirement is focused chiefly on identifying new exotic species and any invasive increase of species already introduced.

Indicators for exotic species (also impacts the information requirement):

(17) The number of invasive exotic species

(18) The number of new invasive exotic species per annum

(19) The ratio between densities or biomass of endemic species for a selection of specific groups of species (phytoplankton, macrobenthos, fish) in Natura 2000 areas.

Information strategy for exotic species:

The monitoring of exotic species can be added to existing monitoring as an additional parameter. If, as part of current monitoring, the determination of species should reveal any new species, this will have to be registered.

Any significant increases in exotic species need to be identified. Any additional research efforts decided upon will fall outside regular monitoring.

Monitoring Strategy and Measurement Plan for exotic species:

Number of invasive exotic species present (indicator 17)

The regular fish and benthic sampling registers all species sampled. A field 'exotic (YES/NO)' will be added to the determination lists.

Number of new invasive exotic species per annum (indicator 18)

The same applies to the monitored species as in the case of indicator 17. To be able to monitor the number of new invasive exotic species, however, the catch data in the current registration of exotic species needs to be adjusted. Whether existing or new invasive exotic species are involved also needs to be registered.

Ratio of invasive exotic species to endemic species (indicator 19)

The fish and benthos sampling should not only indicate whether species are exotic or endemic, but also provide information on their respective quantities and/or biomass.

Developments regarding exotic species:

In 2013, the OSPAR commission designated *the rate of new introduction of exotic species (number of new exotic species per annum)* as a prioritised potential indicator, which may

be established as a common indicator in one to two years.
If necessary, and depending on when this process will yield results, the Monitoring Plan will be adjusted for indicator (18) *the number of new invasive exotic species per annum* in 2015 or 2016.

Monitoring of eutrophication (descriptor 5)

Environmental targets for eutrophication from Marine Strategy Part 1 (impacts the information requirement):

Reduce the concentrations of nutrients where these do not meet the WFD, in accordance with its timeframe.

Algal biomass and blooms approximately 50% above the background value.

No increased occurrence of harmful algal blooms.

No oxygen deficiency due to eutrophication.

Indicators for eutrophication (also impacts the information requirement):

(20) Area-specific average winter concentrations (December-February) of dissolved inorganic nitrogen (DIN, a sum total of nitrate, ammonium and nitrite) and dissolved inorganic phosphorus (DIP)

(21) Concentration of chlorophyll-a during the phytoplankton growth season (March-September)

(22) Local oxygen deficiency in sedimentation areas and, as a consequence, massive harmful algal blooms.

Information strategy for eutrophication:

The policy goals and the associated information requirements for the MSFD link up closely with the policy frameworks arising from EU directives and international conventions. In the zone up to 1 mile off the coast, where the WFD and OSPAR frameworks overlap, the Cabinet has therefore opted not only for the required parameters for the harmonised and internationally coordinated assessment system of the WFD but also for those of OSPAR. This system calls for the following parameters:

Supply of nutrients

The supply from land (total P and total N) via rivers and channels can be calculated by multiplying the annual discharges by the average concentrations at the estuaries. The airborne nitrogen loads (atmospheric deposits) are calculated in OSPAR using a model.

Nutrient levels

Area-specific average winter concentrations (December-February) of the nutrients dissolved inorganic nitrogen (DIN, a sum total of nitrate, ammonium and nitrite) and dissolved inorganic phosphorus (DIP).

Direct effects

Determining the 90-percentile value of the concentration of chlorophyll-a during the phytoplankton growth season (March-September) and determining phaeocystis blooms, where bloom is defined as $> 10^6$ cells/l.

Indirect effects

Oxygen concentrations are measured at various depths in the water column.

Monitoring Strategy and Measurement Plan for eutrophication:

Nutrient levels (indicator 20)

There is a linear relationship between salinity and nutrient concentrations in water. From the coast to deeper water, salinity increases and nutrient concentrations decrease. Due to

this relationship, we measure not only nitrogen and phosphorus concentrations but also salinity.

The area-specific nutrient concentrations are sampled in the winter months of December, January and February. If a measurement has to be skipped in this period due to inclement weather, it may be compensated for by an additional measurement in November.

The oxygen content of the seawater in the sedimentation areas (the Central Oyster Grounds, for example) is measured at various depths once every two months in the March-September period.

The measurements are carried out at the measurement sites along the existing lines of direction.

To calculate the loads of total nitrogen and total phosphorus, concentrations and discharges are determined at Haringvliet, Nieuwe Waterweg, Noordzeekanaal, IJsselmeer lake and the Gent-Terneuzen Channel.

Direct effects (indicator 21)

For this indicator, both chlorophyll-a (biomass) and algal blooms of *Phaeocystis* are measured in the surface water.

Along the Dutch coast, the supply of nutrients from the rivers is the largest, with a commensurate risk of algal bloom. That is why *Phaeocystis* blooms and chlorophyll-a are measured once every two weeks in the months of March-September. In the areas further off the coast, this is done once a month, and in the remote areas of the Dutch part of the North Sea once every two months. The measurements are carried out at the National Water Level Monitoring Programme measurement stations along the existing lines of direction.

Indirect effects

For the assessment of indirect effects of eutrophication, the MSFD uses the parameter of local oxygen deficiency in sedimentation areas and under layers of rapid algal bloom of *Phaeocystis*. To be able to establish the oxygen deficiency at various depths and just above the seabed, a comparison must be made with the values at which the water is saturated with oxygen. The maximum value depends on temperature and salinity, which is why these parameters are measured in addition to oxygen content.

The vertical measurements are performed three or four times in the summer (April-August), being the period when oxygen depletion can occur.

The oxygen content in the sedimentation areas (the Central Oyster Grounds, for example) is measured at the last four locations of the Terschelling line, 1 metre below the water level, at half depth or in the thermocline and 1 metre above the seabed.

Developments regarding eutrophication:

In 2013, the OSPAR commission established the following six common indicators for the North Sea region:

nutrient input via water, nutrient input via the air, nutrient concentrations in the winter, chlorophyll concentrations, changes of species composition/ indicator type Phaeocystis and oxygen.

These indicators are already operational. Where there are still differences between countries, attempts at further harmonisation will be made.

For the determination of chlorophyll concentrations, innovative methods are being developed to collect information automatically on board ferry boats, using buoys and using satellite images. Measuring from research ships can then ultimately be reduced.

The aim is to harmonise the WFD and OSPAR assessment systems.

Monitoring of hydrographical properties (descriptor 7)

Environmental targets for hydrography from Marine Strategy Part 1 (impacts the information requirement):

Human activities do not result in permanent, large-scale negative effects on the ecosystem due to changes in hydrographical conditions.

Linked to this is the operational goal that all developments must meet the requirements of the existing statutory regime and statutory assessments must be carried out in such a way that the potential (cumulative) effects of permanent changes in hydrographical conditions are taken into account at the most appropriate level (EUNIS level 3, reference year 2008). In addition, goals have been formulated under the WFD to improve the migration options of diadromous fish.

Indicators for hydrography (also impacts the information requirement):

- (23) The size of the (seabed) area impacted
- (24) The size of types of habitats that have changed permanently
- (25) Changed functions of habitats

Information strategy for hydrography:

The operational goal refers to testing against existing statutory frameworks for projects that may introduce a change in the prevalent hydrographical conditions. The information is drawn from the project monitoring that initiators are required to carry out to meet licensing regulations. The assessment scale is EUNIS level 3.

Monitoring Strategy and Measurement Plan for hydrography:

Project-dependent

Developments regarding hydrography:

None.

Monitoring of contaminants (descriptor 8)

Environmental targets for contaminants from Marine Strategy Part 1 (impacts the information requirement):

Reducing concentrations of contaminants, insofar as these do not meet the targets within the set timeframe of the WFD, as well as preventing concentrations of contaminants that do meet the WFD standards from rising above their current values, and reducing concentrations further.

Preventing the contaminating effects of tributyltin (TBT) and oil.

Indicators for contaminants (also impacts the information requirement):

- (23) Concentrations of contaminants in water
- (24) Concentrations of contaminants in biota
- (25) The incidence of imposex in sea snails
- (26) The percentage of washed up birds covered in oil

Information strategy for contaminants:

The environmental targets for contaminants call for standards-based testing (meeting the WFD targets with the set timeframe) and for trend determination (checking to see whether concentrations of contaminants rise or continue to fall).

A good standards-based test measures contaminants in the most appropriate compartment. For polar compounds, that is water and for apolar compounds, biota.

Monitoring Strategy and Measurement Plan for contaminants:

Until the WFD and OSPAR have been fully harmonised, measuring is performed as follows:

Apolar compounds in the transitional zone (up to 1 mile off the coast):

- under the WFD in total water, tested against WFD standards for priority substances and against national standards for other substances, with the exception of mercury, hexachlorobenzene and hexachlorobutadiene (which are measured in biota). Metals are measured after filtration.
- under the MSFD, in biota, tested against OSPAR assessment criteria. (Alternatively, sediment measurements may be taken in certain cases, as is already done once every three years. Passive sampling of total water samples may also be an alternative to measurements in biota, as this is more cost effective and reliable.

Polar compounds are measured in total water and tested against the WFD standards, both under the WFD and the MSFD.

Effects of TBT (indicator 25)

The effects of TBT on sea snails (imposex and intersex) are assessed using the most representative species. This is done using the methods according to the EcoQO established in OSPAR's Coordinated Environmental Monitoring Programme. In areas with a high level of TBT contamination, intersex among common periwinkles is determined; in other areas, it is imposex among species such as dog whelks, netted dog whelks and common whelks. All measurements also determine the concentration of TBT.

Effects of oil (indicator 26)

The effects of oil are reviewed by determining the percentages of dead or dying guillemots washed ashore covered in oil. This is done according to the EcoQOs that are laid down under OSPAR in the Coordinated Environmental Monitoring Programme.

The effects of oil are monitored along the entire Dutch coast.

Development regarding contaminants:

As stated above, monitoring and assessment are already coordinated within the frameworks of the WFD and OSPAR. In the coming years, the Monitoring Plan is adjusted as necessary on the basis of the results of coordinating the various measurement methods under the WFD and OSPAR in terms of indicators (23) *Concentrations of contaminants in water* and (24) *in biota*.

Monitoring of contaminants in fish and fish products (descriptor 9)

Environmental targets for contaminants in fish and fish products from Marine Strategy Part 1 (impacts the information requirement):

Contaminants in fish and other fish products for human consumption do not exceed the limits determined by Community legislation or other relevant standards.

Indicators for contaminants in fish and fish products (also impacts the information requirement):

(30-a) The frequency with which the applicable limits are exceeded

(30-b) The actual values measured

(30-c) The number of contaminants for which concurrent limit overruns have been measured

(30-d) The source of contamination (geological versus anthropogenic, local versus long distance)

Information strategy for contaminants in fish and fish products:

The information is drawn from the registrations of the new Netherlands Food and Consumer Product Safety Authority (referred to with the Dutch acronym "NVWA"). In the meantime, attempts are made to link up with the monitoring of contaminants in fish products (measurements of chemical contamination in biota); see monitoring strategy.

Monitoring Strategy and Measurement Plan for contaminants in fish and fish products:

In the Netherlands, approximately twenty fish and fishery products are systematically tested for contaminants, such as lead, cadmium and mercury, dioxins/furans and dioxin-like and other PCBs (polychlorinated biphenyls), and benzo[a]pyrene. The EU has established statutory maximum limits for these compounds. Maximum Residual Levels (MRLs) of pesticides have also been established by law. However, there is no such regulation yet for pesticides in fish. The Commodities Act contains additional MRLs for some biocides in, among others, fish.

The *Cod Liver Monitoring Programme* collects samples at three locations of the North Sea (south, central and north) as well as at locations southwest and south of Ireland. Measurements for consumer fish and other organisms (such as crabs, shellfish and shrimp) are taken in the form of random sampling at varying locations. The geographic origin (area) is known, but the exact coordinates are not. Not only the locations vary every year, so do the species. An important criterion is that the sampling is representative of human consumption patterns. Use is also made of market samples at auctions. Data on the livers of cod and European hake and from random samples of fishery products is collected every year.

Development regarding contaminants in fish and fish products:

Coordinated monitoring and assessment are already taking place under the applicable European laws and regulations.

Monitoring of litter (descriptor 10)

Environmental targets for litter from Marine Strategy Part 1 (impacts the information requirement):

The policy goal for coastal litter is a reduction of the amount of visible litter. The basic reference for this is the average over the years 2002-2007. It should be noted, however, that there were still some imperfections in design and execution during the start-up phase. The target for litter in marine organisms is a decreasing trend, with the averages over the period from 2005 to 2009 as the base reference.

Indicator for litter (also impacts the information requirement):

- (31) Quantities, composition, distribution and sources of litter on beaches
- (32) Quantities of plastic in the stomachs of northern fur seals.

Information strategy for litter:

Marine Strategy Part 1 distinguished between litter, macroplastic and microplastic. Litter consists not only of plastic, but of other waste such as wood and metal. The distinction between micro- and macroplastic is well described in the literature, using the following scale: nanoplastic < 100 nm, microplastic < 5 mm, mesoplastic < 20 mm, macroplastic > 20 mm.

This distinction is relevant in that both the effects and the sampling techniques relate to the size of the plastic objects and particles. Meso- and macroplastics can be monitored on beaches. Beach litter never consists solely of plastic. Certain characteristic mesoplastics, such as industrial plastic pallets, are also sampled on the beach.

Sooner or later, waste floating on the water or suspended in the water column ends up on the beach. Only a small part of litter that sinks to the bottom is washed ashore. The litter on the beach and the microplastics in the stomachs of washed up northern fur seals form a good indicator for floating and suspended waste.

The indicator 'plastic in the stomachs of washed up dead northern fur seals' developed in the context of OSPAR is especially representative of floating meso- (< 20) and macroplastic. The smaller microplastic particles (< 5 mm) pass through a fur seal's stomach. The target level of OSPAR's EcoQO is that no more than 10% of the fur seals have more than 0.1

grams of plastic in their stomachs. Monitoring provides information on the trend over the past ten years and longer.

Monitoring Strategy and Measurement Plan for litter:

Litter on beaches

In terms of monitoring methods, the Monitoring Plan is in line with the OSPAR Beach Litter Monitoring Programme. The Netherlands has selected four reference beaches in the municipalities of Terschelling, Bergen, Noordwijk and Veere respectively. Researchers scan a 100-metre wide zone between the foot of the dunes and the waterline for 2.4-cm pieces of litter, taking a two-metre wide zigzag course. A 1,000-metre wide section is scanned for pieces of waste larger than 50 cm. All objects found are registered. The study is primarily focused on the total number of pieces of waste, although analyses are made of the most common groups of objects. These analyses reveal various trends in groups of objects, which seem to suggest leads for measures.

Plastic in stomachs of northern fumars

The plastic in the stomachs of dead fumars is divided into the categories of industrial pallets and consumer plastics. These, in turn, are subdivided into sheets, wires, foam plastics, fragments and other plastics.

The number of pieces in each category are counted and weighed. The average mass of plastic in the stomach is determined for all individual animals, so including those that have no plastic in their stomach. To reduce distortion as a result of fluctuations in the numbers of birds present in the marine area over consecutive years, the 'current' level is calculated as the average over the last five years. This period is in line with the OSPAR EcoQO. Trend analyses are made on the basis of the weight of plastic in birds' stomachs over the past decade. The long-term trend for the entire data set (from 1979 to the present) is determined in the same manner.

Developments regarding litter:

As stated above, the internationally coordinated indicators (31) *litter on beaches* and (32) *plastic in stomachs of northern fumars* are already being used in the North Sea region in the context of OSPAR. In 2013, the OSPAR commission designated *litter on the seabed* as a prioritised potential indicator. This indicator can be established as a common indicator in one to two years. The indicator IBTS (International Bottom Trawl Survey) is being developed for this. In anticipation of this, Rijkswaterstaat is already carrying out this study in combination with ICES fish monitoring. If necessary and depending on when this process will yield results, the MSFD Monitoring Plan will be adjusted in 2015 or 2016.

Monitoring of underwater noise (descriptor 11)

Environmental targets for noise from Marine Strategy Part 1 (impacts the information requirement):

For individual cases: prevent harmful effects on populations or the ecosystem, particularly to marine fauna, resulting from specific activities, such as pile-driving and seismic surveys.
Background noise and cumulative effects on populations or the ecosystem: based on knowledge gathered thus far, it is expected that goals can be set for this in 2018.

Indicators for noise (also impacts the information requirement):

- Distribution in time and space of loud impulse noises with a low or medium frequency
- Uninterrupted low-frequency noise

Information strategy for noise:

At present, licensing is used as an instrument to reduce the negative effects of specific activities (e.g. installing wind turbines at sea). However, no goals have yet been

formulated with respect to uninterrupted background noise (such as shipping) and accumulation of impulse noise (pile-driving and seismic activity). A research programme has been set up to elaborate and measure the above indicators, and to gather more knowledge about the effects that the various types of noise referred to have on the ecosystem. The results of the research will aid in updating the environmental status assessment in 2018. This will serve as the basis for formulating environmental targets in 2018. The associated, elaborated indicators will be included in the Monitoring Plan.

Monitoring Strategy and Measurement Plan for noise:

A map will be compiled which, combined with knowledge of the effects on the ecosystem, provides insight into the potential loss of habitat as a result of impulse noises. The data for this map on the distribution in time and space of loud impulse noises will be gleaned from information already available on activities that cause impulse noises. To map out the potential (cumulative effects) of uninterrupted background noise, existing data on ship movements, additional measurements and modelling will be used.

Developments regarding noise:

The elaboration of the indicators referred to, the research measurements and the assessment will be coordinated in an international context. Together with the United Kingdom, the Netherlands is heading the Technical Subgroup Noise under the EU Common Implementation Strategy. This working group has developed guidance for translating these indicators into actual monitoring. For the OSPAR region, this is being taken up by the ICG Underwater Noise, for which the Netherlands also acts as co-leader. The plan is to adopt common indicators in 2014, which can be operational for the OSPAR regions, including the North Sea, in one or two years.

Financial consequences

The MSFD Monitoring Programme uses monitoring that is already in place in the context of the CFP, the WFD and OSPAR. These are expenditures from the budgets of the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs. Additional expenditures related to implementing the MSFD Monitoring Programme amount to 750,000 euros per annum. This amount is defrayed in equal portions through the MSFD budgets at the Ministry of Infrastructure and the Environment and the Ministry of Economic Affairs. These additional expenditures will be consistently used to fund the monitoring for BHD at sea.