



Identification of ecological monitoring parameters
to assess Good Environmental Status of marine
waters

An inventory in all OSPAR Contracting Parties
that implement the MSFD



OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l'Espagne.

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Disclaimer

Biodiversity monitoring under the MSFD is currently under development, which may mean the conclusions of the inventory are rapidly out-dated.

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Executive Summary

In the European Marine Strategy Framework Directive (MSFD) eleven qualitative descriptors of Good Environmental Status (GES) have been identified. To provide guidance to these descriptors the European Commission prepared criteria and methodological standards for each descriptor to assess progress towards the GES, as well as indicators related to them¹. Member States need to consider these criteria and indicators in order to identify those, which are to be used in their marine region or sub-region. Subsequently, Member States need to identify monitoring parameters to assess these indicators. The MSFD requires cooperation and coordination between Member States sharing a marine region or sub-region.

The OSPAR Intersessional Correspondence Group – Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) coordinates the development of MSFD products related to biodiversity. This includes the definition of GES and related indicators and targets, primarily for GES descriptors 1, 2, 4 and 6. The Netherlands, on behalf of ICG-COBAM, commissioned Bureau Waardenburg bv. to carry out an inventory in all OSPAR Contracting Parties that implement the MSFD to collect information about the organisation of national marine monitoring and implementation of MSFD, existing monitoring programmes. The inventory also included questions on progress regarding identification of potential programmes and/or parameters that could support indicators for GES descriptors 1, 2, 4 and 6.

The aim of this inventory is to facilitate exchange of information between Member States on current biological monitoring and relevant databases, thereby contributing to coordinated development of indicators under the MSFD.

The inventory was carried out between August 2010 and March 2011. A first version of this report was presented in January at the ICG-COBAM meeting in London. At that stage input was received from Belgium, Denmark, Germany, Norway, Azores (Portugal), Sweden, The Netherlands and the United Kingdom. In the beginning of 2011, additional input was received from the three remaining countries France, Ireland and Spain. This information is included in this final report.

In most countries the structure and responsibilities for the implementation of the MSFD is clear, but Germany and Norway are still discussing how the MSFD should be implemented and in Ireland the responsibility of implementing monitoring programmes has not formally been assigned yet to any agency or agencies. In Denmark and Sweden the responsibility for the implementation of the MSFD will shift to new national agencies by the end of January 2011 and mid 2011 respectively.

All countries have elaborated an overview of existing monitoring programmes, but the presentation and accessibility of these overviews varies between countries. Belgium, Germany and The United Kingdom developed dedicated marine meta-databases searchable in English on the Internet (MUMM-database, Marine Monitoring Manual and UK DMOS). Details included in these databases vary between countries. Denmark, France, Ireland, Norway, Portugal, Spain, Sweden and The Netherlands do not have such specific databases and their marine data are less easily accessible for other countries. A draft of the national monitoring and assessment programme in Denmark for the period 2011–2015 is only available in Danish. In France, a national database with marine environmental data is available on the Internet (Quadrige), but only in French. In Ireland data are stored in databases of different organisations, but mainly the databases of the Marine Institute and EPA. In Norway, two overview reports are written (in Norwegian) about existing programmes in coastal waters and the open ocean and these are embedded in Integrated Management Plans for different regions. Norway has

¹ Commission Decision on criteria and methodological standards on good environmental status of marine waters (2010/477/EU).

several online databases searchable in English. In the Azores, (Portugal) the information is scattered between research institutions and other partners collecting monitoring data, but some of the databases have recently been collated and loaded into web-accessible databases. Spain has several databases managed by several research institutes and organisations, some only available in Spanish. In Sweden, data on existing programmes are included in several national and regional coastal programmes, which are integrated and harmonised through a National Monitoring Handbook. Metadata are accessible on the Internet, but only available in Swedish. In the Netherlands, a report was written (in Dutch) providing an overview of metadata on all ecological marine monitoring covered by national monitoring programmes. Only part of this information is accessible via Internet.

All countries will use their overviews of existing programmes as a starting point for the identification of potential programmes and/or parameters for identified EU indicators for GES descriptors 1, 2, 4 and 6. Belgium, Denmark, France, Germany, Ireland, Norway, the Azores (Portugal), Spain and Sweden are still working on a process for the actual identification. Challenges mentioned by these countries are the uncertainty about the way the MSFD will be implemented in their country (Germany, Ireland, Norway), (potential) lack of funding (Belgium, Portugal), and lack of guidance offered by the EU indicators (Belgium, Germany, Ireland, Spain, Sweden). A potential challenge may also be that some countries will have to deal with different marine regions and/or sub-regions (e.g. France, Spain, Portugal).

In the Netherlands and the United Kingdom a first step has been undertaken to identify programmes and/or parameters using a systematic process. The processes in both countries are based on screening of existing programmes for their potential to contribute to the identified EU indicators for MSFD descriptors. The Netherlands carried out a feasibility test resulting in a table showing per indicator potential programmes that could deliver to that indicator, including what still needs to be done to make it operational and interpretable. The UK mapped monitoring parameters from programmes included in their marine meta-database to the EU indicators using the Seadatanet² Parameter Discovery Vocabulary (P021).

Several international databases have already been developed in the past to share information in the field of marine monitoring and assessment. These databases contain many physical and chemical data, but inclusion of biological data in these databases is still very limited. Most of the biological data are stored in national databases (not linked to EU databases) and is not always accessible for other countries. An overview of the accessibility of ecological monitoring metadata based on the present inventory is given in Table 2 in chapter 3.

Récapitulatif

La Directive cadre « stratégie pour le milieu marin » (MSFD) détermine onze descripteurs qualitatifs du bon état écologique (GES). La Commission européenne a préparé des critères et des normes méthodologiques permettant d'évaluer les progrès réalisés dans le sens du GES, ainsi que des indicateurs correspondants² afin de donner des orientations pour ces descripteurs. Les Etats membres doivent étudier ces critères et indicateurs afin de déterminer ceux à utiliser dans leur région ou sous-région marine. Les Etats membres devront donc déterminer des paramètres de surveillance pour l'évaluation de ces indicateurs. La MSFD exige la coopération et la coordination entre les Etats membres partageant une région ou une sous-région marine.

² Décision de la Commission sur les critères et normes méthodologiques concernant le bon état écologique des eaux marines (2010/477/UE).

Le Groupe intersessionnel par correspondance OSPAR–Coordination de l'évaluation et de la surveillance de la biodiversité (ICG-COBAM) assure la coordination du développement de produits de la MSFD portant sur la biodiversité. Il s'agit notamment de la définition du GES et des indicateurs et cibles correspondants, essentiellement pour les descripteurs 1, 2, 4 et 6 du GES. Les Pays-Bas, au nom de l'ICG-COBAM, ont chargé le Bureau Waardenburg bv. de réaliser un inventaire, dans toutes les Parties contractantes OSPAR qui mettent en œuvre la MSFD afin de recueillir des informations sur l'organisation de la surveillance marine et de la mise en œuvre nationales de la MSFD, des programmes de surveillance existants. Cet inventaire comporte également des questions sur les progrès réalisés dans le sens de la détermination de programmes et/ou de paramètres potentiels pouvant étayer les indicateurs des descripteurs 1, 2, 4 et 6 du GES.

Cet inventaire a pour objectif de faciliter l'échange d'informations, entre les Etats membres, sur la surveillance biologique actuelle et les bases de données pertinentes, contribuant ainsi au développement coordonné d'indicateurs dans le cadre de la MSFD.

Cet inventaire a été réalisé d'août 2010 à mars 2011. Une version préliminaire du rapport a été présentée à la réunion de l'ICG-COBAM, qui s'est tenue à Londres en janvier. A ce stade des contributions ont été reçues des Açores (Portugal), de l'Allemagne, de la Belgique, du Danemark, de la Norvège, des Pays-Bas, du Royaume-Uni et de la Suède. Début 2011, des contributions complémentaires ont été communiquées par l'Espagne, la France et l'Irlande. Ces informations figurent dans le présent rapport définitif.

Dans la plupart des pays la structure et l'attribution des responsabilités relatives à la mise en œuvre de la MSFD sont claires, mais en Allemagne et en Norvège des entretiens sont encore en cours sur la manière dont la MSFD doit être mise en œuvre et en Irlande, la responsabilité de la mise en œuvre des programmes de surveillance n'a pas encore été attribuée officiellement à une ou plusieurs agences particulières. Au Danemark et en Suède la responsabilité de la mise en œuvre de la MSFD passera à de nouvelles agences nationales fin janvier 2011 et mi 2011 respectivement.

Tous les pays ont réalisé un récapitulatif des programmes de surveillance existants mais la présentation et l'accessibilité de ces récapitulatifs varient d'un pays à l'autre. L'Allemagne, la Belgique et le Royaume-Uni ont développé des bases de métadonnées marines interrogeables en anglais sur l'internet (base de données MUMM, Manuel de surveillance marine et UKDMOS). Les détails figurant dans ces bases de données varient d'un pays à l'autre. Le Danemark, l'Espagne, la France, l'Irlande, la Norvège, les Pays-Bas, le Portugal et la Suède ne possèdent pas de telles bases de données spécifiques et leurs données marines sont d'accès plus difficile pour les autres pays. Un projet de programme national de surveillance et d'évaluation au Danemark de 2011 à 2015 n'est disponible qu'en danois. En France, une base de données nationale comportant les données marines environnementales est disponible sur l'internet (Quadrige), mais en français seulement. En Irlande, les données sont stockées dans les bases de données de diverses organisations, mais principalement dans celles de l'Institut marin et de l'EPA. La Norvège a réalisé deux rapports récapitulatifs (en norvégien) sur les programmes existants pour les eaux côtières et la haute mer et ils sont imbriqués dans les plans de gestion intégrée pour diverses régions. La Norvège possède plusieurs bases de données en ligne interrogeables en anglais. Aux Açores (Portugal), les informations sont réparties dans des instituts de recherche et d'autres partenaires recueillant des données de surveillance mais certaines bases de données ont récemment été rassemblées et téléchargées dans des bases de données web. L'Espagne possède plusieurs bases de données gérées par plusieurs instituts et organisations de recherche, certaines n'étant disponibles qu'en espagnol. En Suède, les données sur les programmes existants figurent dans plusieurs programmes côtiers nationaux et régionaux qui sont intégrés et harmonisés grâce à un Manuel de surveillance nationale. Les métadonnées sont disponibles sur l'internet mais en suédois seulement. Les Pays-Bas ont rédigé un rapport (en

néerlandais) comportant un récapitulatif des métadonnées sur toute la surveillance écologique marine couverte par les programmes de surveillance nationaux. Seule une partie de ces informations est disponible sur l'internet.

Les récapitulatifs des programmes existants de tous les pays leur serviront de base pour la détermination des programmes et/ou paramètres potentiels des indicateurs UE identifiés pour les descripteurs 1, 2, 4 et 6 du GES. Les Açores (Portugal), l'Allemagne, la Belgique, le Danemark, l'Espagne, la France, l'Irlande, la Norvège, et la Suède s'efforcent encore d'identifier un processus de détermination proprement dite. Ces pays relèvent certaines difficultés, à savoir les incertitudes que présente la méthode de mise en œuvre de la MSFD dans leur pays (Allemagne, Irlande, Norvège), le manque de financement (potentiel) (Belgique, Portugal) et le manque d'orientations qu'offrent les indicateurs UE (Allemagne, Belgique, Espagne, Irlande, Suède). Le fait que certains pays doivent considérer diverses régions et/ou sous-régions marines (par exemple l'Espagne, la France, le Portugal) constitue une difficulté potentielle.

Le Royaume-Uni et les Pays-Bas ont pris des mesures préliminaires pour déterminer des programmes et/ou des paramètres en utilisant des processus systématiques. Ceux-ci se fondent sur le filtrage de programmes existants afin de déterminer leur potentiel s'agissant de contribuer aux indicateurs UE déterminés pour les descripteurs de la MSFD. Les Pays-Bas ont réalisé un test de faisabilité permettant de rédiger un tableau montrant, pour chaque indicateur, les programmes potentiels pouvant y contribuer. Il comporte notamment les mesures à prendre afin de les rendre opérationnels et interprétables. Le Royaume-Uni indique les paramètres de surveillance des programmes figurant dans sa base de métadonnées marines aux indicateurs UE en utilisant le « SeadataNet' Parameter Discovery Vocabulary (P021) ».

Plusieurs bases de données internationales ont déjà été développées dans le domaine de la surveillance et de l'évaluation marine. Ces bases de données comportent de nombreuses données physiques et chimiques mais l'inclusion de données biologiques est encore très limitée. La plupart des données biologiques sont stockées dans des bases de données nationales (non reliées aux bases de données de l'UE) et ne sont pas toujours accessibles aux autres pays. Le tableau 2 du chapitre 3 comporte un récapitulatif de l'accessibilité des métadonnées de la surveillance écologique se fondant sur le présent inventaire.

1. Introduction

1.1 Background

The main goal of the Marine Strategy Framework Directive (MSFD) is to achieve Good Environmental Status (GES) of the EU's marine waters by 2020. For each marine region or sub-region this GES has to be determined and an Initial Assessment (IA) of the current ecological state has to be carried out. In the MSFD eleven qualitative descriptors of good environmental status have been identified. To provide guidance to these descriptors the European Commission prepared criteria and methodological standards for each descriptor to assess progress towards the GES, as well as indicators related to them (Commission Decision of 1 September 2010). Member States need to consider these criteria and indicators in order to identify those, which are to be used in their marine region or sub-region. Subsequently Member States need to identify monitoring parameters to assess these indicators. While the responsibility to choose appropriate indicators and monitoring parameters lies with Member States, they are obliged to coordinate this work within regions or sub-regions.

The OSPAR Intersessional Correspondence Group - Biodiversity Assessment and Monitoring (ICG-COBAM) provides a coordinating role in the development of MSFD products related to biodiversity. This includes the definition of GES and related indicators and targets, primarily for GES descriptors 1, 2, 4 and 6 (for definitions see Box 1).

Box 1 Definitions of descriptors 1, 2, 4 and 6

Descriptor 1. 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 climate conditions.

Descriptor 2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Descriptor 4. 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.

Descriptor 6. Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

As a basis for this work the Netherlands, on behalf of ICG-COBAM, commissioned Bureau Waardenburg bv. to carry out an inventory in all OSPAR Contracting Parties consisting of:

- An overview of organisations and/or institutes responsible for national marine monitoring including monitoring and assessment carried out under the MSFD;
- Information on existing ecological monitoring programmes in different Member States;
- A description of the processes in different Member States to identify ecological programmes and/or parameters that potentially could be used for the assessment of the identified EU indicators for GES descriptors 1, 2, 4 and 6. When programmes and/or parameters have already been identified then these will also be presented.

The inventory was carried out between August 2010 and March 2011. A first version of this report was presented in January at the ICG-COBAM meeting in London. At that stage input was received from

Belgium, Denmark, Germany, Norway, Azores (Portugal), Sweden, The Netherlands and the United Kingdom. In the beginning of 2011 additional input was received from the three remaining countries France, Ireland and Spain. This information is included in this final report version 2.

1.2 Methods

Several initiatives have already been undertaken in the past to share information between OSPAR Contracting Parties in the field of marine biodiversity monitoring and assessment. Examples include:

- An inventory of activities in all OSPAR Contracting Parties to improve synergies between different European Directives and International Conventions was carried out in 2008 by the OSPAR Intersessional Correspondence Group - Synergies in Assessment and Monitoring (ICG-SIAM) (OSPAR, 2008). This report describes the responsibilities (organisations and/or institutes involved) and organisational structures (how monitoring and assessment programmes are organised and where data are stored) of marine biodiversity monitoring and assessment in all OSPAR Contracting Parties and provides insight in national and international activities to harmonise activities and improve synergies between EU Directives and International Conventions;
- The EDIOS database: EDIOS is an internet-based searchable directory of the ocean-observing, measuring, and monitoring systems operating in Europe and is an initiative of EuroGOOS (European Global Ocean-observing System). The directory includes metadata, *i.e.* information on: location, measured parameters, frequency, data availability, technical information on instruments, responsible institutes and links to data-holding agencies;
- The EMODNET database: EMODNET is the name for a European Marine Observation and Data Network currently developed and set up by the European Commission. EMODNET will include data from various marine monitoring programmes. Currently a pilot project is carried out by Belgium to set up an online database for EMODNET with information on biological data. Countries who have contributed data to this pilot project include Belgium, Germany, Denmark, Netherlands and France. The biological portal includes data on benthos, zooplankton, phytoplankton, fish, birds, mammals, reptiles, algae and pigments;
- Several national databases dedicated to marine monitoring and available on the Internet (*i.e.* MUMM database (Belgium), UKDMOS (United Kingdom) and the Marine Monitoring Manual (Germany)).

Bureau Waardenburg bv. used the results of the 2008 report as a basis to describe the organisation of national monitoring and implementation of the MSFD. The information about responsibilities collated in the 2008 report was summarised and sent to contact persons in the different countries to check whether this information is still up to date and add to it where feasible.

The 2008 report provided limited information on existing monitoring programmes (*i.e.* which ecological groups are monitored, what parameters are being used, frequency, number of locations *etc.*). Therefore, Bureau Waardenburg consulted existing national and international databases and websites on the Internet to find more specific information on existing ecological monitoring programmes in different OSPAR countries. This information was summarised and subsequently contact persons were asked to review this information.

Information about the processes followed in different countries to identify ecological programmes and/or parameters that potentially could be used for the assessment of the identified EU indicators for GES descriptors 1, 2, 4 and 6 is hardly available on the Internet. To collect this information, specific questions were sent by e-mail to the contact persons in different countries and telephone interviews

were conducted. Based on this information a draft summary was prepared for each country, which was reviewed by the contact persons before finalisation.

1.3 Guidance to the reader

Chapter 2 contains information for each country about:

- 1) the organisation of national monitoring and implementation of MSFD;
- 2) existing monitoring programmes; and
- 3) potential programmes used for identified EU indicators for GES descriptors 1, 2, 4 and 6.

In chapter 3 a comparison is made between the processes followed in the different countries to identify potential programmes and/or parameters. When results of these processes were available, then these were also compared. In Annex 1 a list of contact persons is provided.

2 Results inventory per country

2.1 Belgium

2.1.1 Organisation of national marine monitoring and implementation of MSFD

The Belgian Federal government and the three regions (Flanders, Wallonia and Brussels Capital region) are responsible for the management of the marine area under Belgian jurisdiction and the protection and management of its marine biodiversity. Since 2004, the 'Marine Environment Unit' of the Federal Public Service "Health, Food Chain Safety and Environment" is the marine policy branch of the federal government. Its role includes amongst others the follow-up of national and international legislation concerning the marine environment including the implementation of the MSFD. The three regions are each responsible for the environmental policy (including water management) within their regions and hence implement European directives and international conventions in their regions.

Only the federal government transposed the MSFD in the federal legislation. It is the 'Marine Environment Unit' of the Federal Public Service "Health, Food Chain Safety and Environment" which coordinates the implementation of the MSFD and acts as the hub to involve the various regional and federal competent authorities. The "Marine Environment Unit" and the other competent authorities are represented in the working group 'North Sea and Oceans' of the inter-governmental consultative forum (Coordination Committee International Environmental Policy or CCIEP). One of the tasks of the CCIEP is to supervise the collection of data required for responding to requests for information from international bodies. The Belgian position on marine environmental issues is prepared by the working group 'North Sea and Oceans' of the CCIEP.

The Management Unit of the North Sea Mathematical Models (MUMM) is in charge of many of the marine monitoring programmes and advises the competent authorities in relation to marine matters. MUMM is a department of the Royal Belgian Institute of Natural Sciences (RBINS), a federal scientific establishment that comes under the Federal Science Policy.

Other institutes and organisations involved in the monitoring of marine biodiversity include the Institute for Agriculture and Fisheries Research of the Flemish Region (ILVO) (fisheries data and macro-benthos), the Institute for Nature and Forest Research (INBO) (marine birds), the Université Libre de Bruxelles (micro-algae), the University of Antwerp (organic pollution) and Ghent University (macro-benthos).

2.1.2 Existing monitoring programmes

Besides the monitoring in the framework of OSPAR, Belgium also ensures the monitoring of three sectoral activities:

- the immersion of dredging spoil;
- the exploitation of sand and gravel;
- the installation of offshore wind farms.

In these three cases, the reference zones not affected by human activities are also the object of comparison monitoring. The results achieved for these reference zones are good indicators for the good environmental status for the un-impacted Belgian marine waters.

This results in three published reports:

- every 2 years for the dredging;
- every 3 years for sand and gravel exploitation;
- every year for the offshore wind farms.

For these monitoring activities, Belgium uses the “methodological standards” which were agreed on international level, where they exist.

Similarly, for other European Marine Strategies, it will be extremely difficult to apply the GES ‘sensu stricto’, based on reference values, to distinguish the good from the bad status. Expert judgments will have to be used, although these are often not very conclusive because of the presence of natural variability in the marine ecosystem.

The MUMM's monitoring and modelling currently deals with physical parameters (water levels, currents, waves, temperature, salinity), chemical substances and biological elements (confined to the first links in the food chain, but also marine mammals). National monitoring data collected by the MUMM are gathered by the Belgian Marine Data Centre (BMDC), a group within the MUMM whose expertise is the management and the analysis of marine environmental data.

The MUMM database (www.mumm.ac.be/datacentre) includes mainly data on physical and chemical parameters (e.g. data for up to 200 physical and chemical parameters collected through the real-time data acquisition system 'ODAS' (Oceanographic Data Acquisition System) and data on concentrations of numerous substances in the air, water, sediment and biota collected through measurements in situ and analyses carried out in laboratories (Integrated Dynamical Oceanographic Data Management (IDOD) database). The MUMM database contains limited ecological data (mainly birds and marine mammals).

Both parameter-based inventories and project-based inventories are included in the MUMM database. For biodiversity parameter-based inventories information is provided about phylum, classis, reported taxon, parameter (e.g. abundance, density, biomass, species productivity *etc.*), first and last year of monitoring, sampling events and number of values. For project-based inventories various information is provided including the title and abstract of the project, the start and end date and the name of the responsible organisation.

VLIZ (Vlaams Instituut voor de Zee) is working on the so-called EMODNET pilot project (<http://bio.emodnet.eu>) for biological data. This biological portal includes data on benthos (201 datasets), zooplankton (47 datasets), phytoplankton (44 datasets), fish (49 datasets), birds (14 datasets), mammals (27 datasets), reptiles (7 datasets), algae (41 datasets) and pigments (18 datasets). Several countries including Belgium, Germany, Denmark, Netherlands and France provide

data, but the dataset is not searchable on datasets for a specific country. The goal of this project is to collect existing biological datasets and show that these datasets can be used for various purposes. As VLIZ is not tasked with national monitoring requirements and data included in this database overlap with data in the MUMM database, this portal will not be used for the MSFD reporting purposes.

RELEVANT DATABASES

National data collected by other institutes and organisations are stored in the MUMM database and/or VLIZ (Flanders Marine Institute)-database.

2.1.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

Belgium did not yet identify programmes and/or parameters for identified EU indicators for descriptors 1, 2, 4 and 6. The intention is – at least as a starting point – to recycle the existing information and to produce a version (V.1) of the criteria and indicators available for the implementation of the MSFD. This version will be updated as soon as the definition and technical description of these criteria and indicators are better described, and as long as the practical application of these indicators remains feasible (regarding costs *etc.*).

Results achieved from reference zones from the monitoring of three sectoral activities are good indicators for the good environmental status for the un-impacted Belgian marine waters. Reference values for GES in combination with expert judgement will be used to assess the status of marine waters.

2.2 Denmark

2.2.1 Organisation of national marine monitoring and implementation of MSFD

NOVANA is the Nationwide Monitoring and Assessment Programme for the Aquatic and Terrestrial Environment in Denmark and is used to fulfil many of the Denmark's national and international monitoring and reporting obligations resulting from different European Directives.

As of January 2011 the organisation of NOVANA has been changed. The Danish Forest and Nature Agency and the Agency for Spatial and Environmental Planning were merged, to form the "Nature Agency". This agency will be responsible for a new period of NOVANA in 2011–2015. The operation of the Programme will be performed in cooperation with the Danish Environment Protection Agency (EPA) and the National Survey and Cadastre. There will also be a contractually based cooperation with the National Environmental Research Institute (NERI) and the Geological Survey of Denmark and Greenland (GEUS) through their role as topic centres and scientific institutions.

The Danish Parliament implemented the MSFD by adopting "Lov om Havstrategi" in 2010. The law demands that a suitable monitoring programme has to be established by 2014. It will probably take form by adjusting the NOVANA programme.

The future "Nature Agency" will be responsible for the identification of monitoring programmes and/or parameters for identified EU indicators for descriptors. The Topic Centre for Marine Data and the Topic Centre for Biodiversity and Terrestrial Nature will, as scientific institutions, contribute to the identification.

2.2.2 Existing monitoring programmes

NOVANA is subdivided into eight sub-programmes, including two sub-programmes relevant for monitoring and assessing marine ecosystems with regard to biodiversity aspects: 'Marine Waters' and 'Species and Terrestrial Natural Habitats'.

The sub-programme 'Marine Waters' encompasses monitoring activities to provide information on:

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- Phytoplankton (species composition, abundance and biomass);
- Zooplankton (micro- and mesozooplankton – species composition, abundance and biomass);
- Submerged aquatic vegetation (macroalgae on hard substrate and rooted angiosperms (eelgrass) – species composition and coverage);
- Fauna on soft bottom (species composition, abundance and biomass);
- Fauna on hard substrate (semi-quantitative studies of species composition and abundance);
- Seals and porpoises (abundance)

Monitoring of seabirds is included in the sub-programme 'Species and Terrestrial Habitats':

- Birds and effects of birds in Tønder Marsh;
- Birds in the Wadden Sea;
- Breeding populations of cormorants;
- Selected species on the Danish Red List;
- Status and trend for selected Danish plant and animal species on Annex II and IV of the Habitats Directive;
- Birds pursuant to the Birds Directive.

Monitoring of fish (species composition and size distribution) is carried out by DTU-Aqua for the Ministry of Food, Agriculture and Fisheries in cooperation with ICES.

As written above a new five-year period of NOVANA started in January 2011. An overview of the ecological marine monitoring programme is given in table 8.1 and table 8.2 of the NOVANA programme. These tables include information on ecological groups and/or parameters monitored, the number of locations or transects, frequency and the number of monitoring years that these groups and/or parameters will be monitored between 2011 and 2015. An overview of the monitoring of birds is given in Table 2 of the NOVANA programme. The NOVANA programme is only in Danish at the moment and it might be translated into English at a later stage.

The National Environmental Research Institute (NERI) participates in the EMODNET pilot project (see chapter Belgium), but so far the biological portal doesn't include information from Denmark.

2.2.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

The Agency for Spatial and Environmental Planning has launched a project to investigate the existing monitoring programmes to find out to which extent they fulfil the demands of monitoring originating from MSFD. Denmark expects to complete this investigation during 2011.

2.3 France

2.3.1 Organisation of national marine monitoring and implementation of MSFD

The Ministry of Ecology, Sustainable development, Transport and Housing (MEDDTL in French) is primarily responsible for the implementation of the European Commission directives (WFD, Habitats Directive, Birds Directive, MSFD) and international conventions. It is supported for scientific and technical developments by research institutes such as Ifremer (French Research Institute for Exploitation of the Sea) and the National Museum of Natural History (MNHN).

France has recently introduced new national environmental legislation (Grenelle 2), part of which transposes the MSFD into French law. Two institutes are tasked with coordinating MSFD

implementation: Ifremer (who is responsible for the analysis of characteristics and current environmental status for the Initial Assessment, and of the coordination of GES definition) and the French Marine Protected Areas (MPA) Agency (in charge of the analysis of pressures and impacts, and of the economic and social analysis, for the Initial Assessment). Other organisations (e.g. the MNHN) and research agencies will also contribute to this work, as experts contributing data and analysis for the Initial Assessment, and/or as task leaders on a particular GES descriptor.

France's Initial Assessment will partly be based on data collected under WFD, Habitats Directive and the OSPAR Quality Status Report. Development work on each GES Descriptor will be directed by a specific lead within the above-mentioned organisations (for example, the MNHN is task leader for descriptor 1 and descriptor 2).

Table 1. List of lead organisations for each descriptor of good environmental status.

Descriptors		Lead organisations
1	Biodiversity	National Museum of Natural History (MNHN)
2	Non-indigenous Species	National Museum of Natural History (MNHN)
3	Fisheries	French Research Institute for Exploitation of the Sea (Ifremer)
4	Food Webs	National Center of Scientific Research (CNRS)
5	Eutrophication	French Research Institute for Exploitation of the Sea (Ifremer)
6	Seafloor Integrity	Office of Geological and Mining Research (BRGM)
7	Hydrographic Conditions	Naval Hydrographic and Oceanographic Service (SHOM)
8	Contaminants	French Research Institute for Exploitation of the Sea (Ifremer)
9	Contaminants in Seafood	French Food Safety Agency (ANSES)
10	Litter	French Research Institute for Exploitation of the Sea (Ifremer)
11	Energy and noise	Naval Hydrographic and Oceanographic Service (SHOM) French Research Institute for Exploitation of the Sea (Ifremer)

A particular challenge for France is dealing with multiple marine regions (Atlantic and Mediterranean) and sub-regions (three within the north-east Atlantic) and ensuring adequate coordination across these areas. France prefers working at a sub-regional level and intends to prepare its Initial Assessment accordingly. A 6-month public consultation period on their Initial Assessment, determination of GES and the targets and indicators will take place prior to the European Commission's July 2012 deadline.

There is currently no general organisation of national monitoring of the marine environment. The Ministry of Ecology and Sustainable Development is usually responsible for national implementation of monitoring programmes that are designed to meet requirements of different European directives. Regarding the WFD, river basin authorities are adopting their own monitoring programmes following the national regulation. Ifremer is responsible for the scientific coordination of WFD monitoring programme in coastal and transitional waters. A central database has been built, which is the reference database for coastal and transitional waters in the national WISE: Quadriges². The MNHN is responsible for the scientific coordination of the Habitats Directive and Bird Directive monitoring. No

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monitoring programme as such is in place for these directives yet, although occasional inventories are produced.

For OSPAR requirements, several research institutes contribute to OSPAR reporting. For example, Ifremer uses the data obtained through the WFD monitoring programme and their specific monitoring network, to report regarding chemicals.

In 2007, a national information system on biodiversity and landscape diversity, the National Information System on Nature and Landscapes (SINP) was launched. As a component of the French National Biodiversity Strategy, this national data discovery portal helps to structure available data on biodiversity and landscape diversity, to facilitate its use in developing policies, to provide accurate information to the general public and to prepare reporting exercises required by European and international commitments. The overall scientific coordination of the SINP has been entrusted to MNHN, but its marine component is also managed by Ifremer and the French MPA agency. The SINP is linked to a searchable metadatabase, the Inventory of data-acquisition methods on Nature and Landscapes (IDCNP) that aims to comprehensively list all marine and terrestrial monitoring and observation programmes. The IDCNP contains metadata on parameter groups measured, frequency, taxonomic and geographic references, start dates, as well as other fields intended to allow an analysis of whether existing and available French biodiversity and landscape data are geographically and temporally sufficient to provide robust assessments of the environment.

2.3.2 Existing monitoring programmes

As mentioned in the above paragraph, a comprehensive inventory is being carried out by the SINP. The following shows an overview of the main monitoring programmes or databases containing information able to contribute towards assessing GES.

Ifremer

Since the early 1970's, Ifremer has operated several observing networks, most of which can be connected to biodiversity and ecosystems. It is planned to use these networks to organise and structure the monitoring required by the implementation of the MSFD, if needed through adaptations of their parameters and/or modes of operation.

The monitoring networks relevant to MSFD whose data is managed by Quadrigé² are the following:

- ROCCH (monitoring of coastal chemical contaminants), which has replaced RNO (national monitoring network) since 2008 and was designed to comply with the reporting rules of OSPAR, the Barcelona Convention, and WFD;
- REPHY (monitoring of phytoplankton and phytotoxins);
- REMI (monitoring of microbiological quality, especially in oyster farm areas);
- REBENT (monitoring of benthic zone habitats, fauna and flora), operated by multiple partners and coordinated by Ifremer;
- REMORA (monitoring of growth and quality of oysters);
- RSL (monitoring of lagoons);
- Regional networks.

SOMLIT ("Service d'Observation en Milieu Littoral")

(<http://somlit.epoc.u-bordeaux1.fr/fr/>)

Since 1995, marine stations belonging to the RNSLM (national network of marine stations and laboratories) have been monitoring 15 physico-chemical coastal water parameters. These provide time-series data and CTD profiles at 16 different points around the French coast, selected to be situated in relatively unimpacted coastal waters.

RELEVANT DATABASES

Quadrige

Data and results from Ifremer's observing networks are stored in a central database named Quadrige. Quadrige currently includes the database itself but also services associated to it, such as GIS tools, and outputs for information to the general public. Quadrige can be accessed via the Internet at the following address: <http://envlit.ifremer.fr> (in French). Quadrige results are fully compatible with a format defined at the national level by the 'French National database on water' (Service d'Administration National des Données et Référentiels sur l'Eau (Sandre)), and therefore constitutes an element of France's 'Information System for Water' (Système d'Information sur l'Eau, SIE). Quadrige was fully revised between 2004 and 2007 and the new system, Quadrige², includes more options as regards to spatial data and allows for data exchange both between French partners and with foreign institutions, in particular at the EU level. Quadrige² is the most relevant database in the context of the MSFD, as it gathers all marine environment related data. Quadrige² is embedded into SISMER (<http://www.ifremer.fr/sismer>), the French General Information System for Marine Scientific Data. SISMER activity includes compilation, safeguarding and dissemination of conventional data collected during national and international projects. Data management also includes information on methodology and formats (meta-data), and the implementation of quality checks to insure comparability of data from various sources.

INPN

As a national reference centre for biodiversity, the MNHN manages the 'INPN' (National Inventory of Natural Heritage - <http://inpn.mnhn.fr/isb/index.jsp>), an information network that allows wildlife data to be searched by species, site or designation. Information from the MNHN and partner organisations is centralised, safeguarded and made accessible for any analysis required, for instance to allow for determining which habitats and/or species need protection.

OTHER INITIATIVES RELEVANT TO THE MSFD

For the Habitats Directive a national mapping programme and conservation status assessment of marine N2000 sites was financed by the MEDDTL and implemented by the AAMP. This programme started in summer 2010 and will end in May 2012. Results will be available at the end of 2012.

For the Birds Directive a national programme financed by the MEDDTL and implemented by the AAMP aims to fill a knowledge gap on seabird seasonal and spatial distribution up to the 200 nautical mile limit. Results will be available at the end of 2012.

A national inventory of the 28 seabird species that regularly nest in France is being carried out along the French coastline between 2009 and 2011. This census is coordinated by the GISOM (Groupement d'Interêt Scientifique Oiseaux Marins) with financial support from the MEDDTL and AAMP. Results are available and are comparable with the previous censuses carried out since 1969.

Other databases relevant to the MSFD can be mentioned as:

- databases on pelagic and benthic species managed by the national network of marine stations and laboratories (RNSLM)

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- database on marine mammals managed by the CRM M (Research Centre on marine Mammals)
- fish database managed by the CEMAGREF (Centre for environmental science and technologies), for transitional waters within the WFD.

2.3.3 Potential programmes or identified EU indicators for GES descriptors 1, 2, 4 and 6

Work is currently being undertaken by experts for the initial assessment and task leaders for GES definition in order to identify existing data that would be useful for IA and development of EU Decision indicators. Each descriptor task leader is responsible for identifying the monitoring programmes that have the potential to provide data for their descriptor, criteria or indicators. They are encouraged to utilise the details of what parameters were measured for each programme in order to do so. This work started recently (end of 2010 or beginning of 2011, depending on the descriptors) and there is therefore no clear view so far on which programmes or parameters will be used. Descriptor task leaders are requested to submit their report to the Ministry by end of November 2011, with an intermediate report to be provided by mid-June.

2.4 Germany

2.4.1 Organisation of national marine monitoring and implementation of MSFD

In 2006, a new marine monitoring concept was developed integrating monitoring requirements for the marine environment by re-structuring the 'Bund/Länder-Messprogramm (BLMP)' for the North Sea and the Baltic Sea. Until 2006, the BLMP was used in particular to give effect to the OSPAR Joint Monitoring and Assessment Programme (JAMP; OSPAR, 2005) for the North Sea and the HELCOM Cooperative Monitoring in the Baltic Marine Environment (COMBINE; HELCOM, 1992) and had a strong focus on monitoring chemical pollutants. Until then, marine ecological monitoring requirements of different directives and conventions were mainly addressed through targeted (short term) research projects and/or long term monitoring projects carried out by various institutes and included monitoring of phytoplankton, macrophytes, macro-zoobenthos, fish, birds, marine mammals, habitats and substrates, contaminants, hydrology and bathymetry.

In the new programme the existing BLMP programme and the ecological programmes are integrated, harmonising monitoring obligations of HELCOM, OSPAR, Water Framework Directive, of the Trilateral Waddensea Cooperation, of the Birds & Habitats Directives and of the Marine Strategy Framework Directive. The new programme was implemented by respective decisions of the German Water and Nature Directors in 2007.

A Steering Group gets assistance by a secretariat and three main working groups:

- Monitoring and assessment;
- Data management;
- Quality assurance.

The 'Monitoring and Assessment' working group coordinates the objectives of the monitoring programmes, up-date and further development of the monitoring specifications, scientific discussion about marine assessments and development of templates for graphs and text for reports and assessments. The working group is supported by the following ad hoc groups:

- Plankton and nutrients;
- Benthos;

- Vertebrates (fish, birds, mammals);
- Hydrology, hydrography & morphology;
- Pollutants and biological effects;
- Habitats.

The 'Data Management' working group is responsible for the configuration and structure of data interchange between the specific regional and national marine databases (for example databases of coastal state agencies and federal bodies or the TMAP Data Units (Trilateral Monitoring and Assessment Programme for the Wadden Sea)).

The 'Quality Assurance' working group is responsible for quality assurance under DIN (Deutsches Institut für Normung / German Institute for Standardization) and ISO/IEC 17025 (International Institute for Standardization) guidelines. This group is led by the QA Unit of the BLMP, which is located at the German Federal Environment Agency (Umweltbundesamt, UBA). The QA Unit is responsible for quality assurance of data collected under the existing BLMP programme.

In Germany there is no agreement yet about the structure that is going to be used to implement requirements of the MSFD. Therefore it is not clear who will be responsible for the national coordination, adaptation and harmonization of monitoring programmes and/or parameters for identified EU indicators for descriptors 1, 2, 4 and 6.

2.4.2 Existing monitoring programmes

During the last years, the ad hoc groups of the 'Monitoring and Assessment' working group have worked to describe (environmental) objectives, threats, monitoring requirements, existing and proposed monitoring programmes, assessment tools, quality assurance and data management concerning their monitoring issues. These specifications were then compiled into a Marine Monitoring Manual (in German: "Monitoring-Handbuch"), which has recently been transformed into a database and a web application (www.blmponline.de/Seiten/Monitoringhandbuch.htm). An English version is currently being produced and published on the same website. This manual contains information about the actual monitoring programmes regarding the following themes:

- Plankton and nutrients;
- Benthos;
- Vertebrates (fish, birds, mammals);
- Hydrology, hydrography & morphology;
- Pollutants and biological effects;
- Habitats.

For each theme the actual existing programmes are presented in several summary sheets (in German: Kennblätter) containing detailed information about the coverage of the specific summary sheet (which species and/or habitats are included), organisations involved, legislative drivers, marine areas, monitoring methods and parameters, monitoring frequency, assessment, quality assurance and activities needed to implement the specific concept. In total, this manual consists of 31 finalised summary sheets. Three summary sheets are still in progress.

All summary sheets are up to date with respect to the 'known' requirements of the MSFD. The term 'known' refers to the fact that the EU indicators for descriptors 1, 2, 4 do not provide enough guidance on which species and/or habitats should be measured at this stage. Until these indicators become

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more operational, it is unsure how the existing monitoring programmes should be adapted to meet the monitoring and assessment requirements of the MSFD. ICG-COBAM is working on a project making these indicators more operational.

2.4.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

Until now there is no agreement about the structure that is going to be used to implement requirements of the MSFD. Therefore no action has been undertaken yet to identify monitoring programmes and/or parameters that potentially can be used for identified EU indicators for GES descriptors 1, 2, 4 and 6.

The existing programmes will need to be an important criterion in the selection process to avoid overlap of activities.

The current development of regional guidance on Article 8 assessments, the determination of GES and the setting of environmental targets under the OSPAR and Helsinki conventions will be incorporated as far as possible in the German 2012 reports. However, it is foreseeable that both EU and regional guidance for these tasks can be closely considered only in future updating of these reports.

2.5 Ireland

2.5.1 Organisation of national marine monitoring and implementation of MSFD

A number of Government Departments are responsible for marine matters in Ireland. These include the Department of Agriculture, Fisheries and Food, the Department of Communications, Energy and Natural Resources, the Department of Transport and the Department of the Environment, Heritage and Local Government. The Department of the Environment, Heritage and Local Government has the overall responsibility for implementation of the Marine Strategy Framework Directive.

Monitoring and assessment of marine waters is undertaken by a number of state agencies/bodies. These include the Environmental Protection Agency, the Marine Institute and the National Parks and Wildlife Services of the Department of the Environment, Heritage and Local Government. The responsibility for the implementation of MSFD monitoring programmes has not formally been assigned yet to any agency or agencies. Work on the development of GES descriptors, targets and indicators is being progressed by a national working group comprising representatives of key Government Departments and national agencies.

2.5.2 Existing monitoring programmes

In 2003, the Environmental Protection Agency, in collaboration with other state agencies and bodies, including the Marine Institute and National Parks and Wildlife Service, developed a national environmental monitoring programme for transitional, coastal and marine waters. This programme identified 36 existing and proposed monitoring programmes to meet current and future information needs of European and national environmental legislation. The majority of these programmes are now in place. Although the MSFD was not specifically mentioned in the 2003 document, a number of these programmes collect information that can be used in the development of biodiversity-based indicators as required by the MSFD. A brief overview of several of these programmes is given below.

National Data Collection Programme for Natura 2000 sites

In 2009 and 2010 a series of one-off surveys were conducted in 40 estuarine and coastal Natura 2000 sites around the coast of Ireland. The surveys consisted of quantitative estimates of infauna biota and generation of broad-scale habitat maps for each of the sites. Given the quantitative nature of the information gathered and the broad spatial extent within the Natura 2000 sites, the data are

considered broadly representative of conditions in the area. In addition, the data collected during these surveys can be used to assess ecological status as required by the WFD.

Status of introduced non-indigenous species

Alien watch, a project joint-funded by the Department of the Environment Northern Ireland and the Department of the Environment, Heritage and Local Government includes voluntary reporting on alien species occurrence to Alien Species Ireland. This project was also used to develop codes of practice in order to mitigate risks associated with certain practices that have been implicated with the introduction of alien species, e.g. aquaculture and marina operators.

In addition, the presence of alien species is noted in the various WFD biological monitoring programmes mentioned below.

Status of commercial fish stocks

The Irish marine monitoring programme on fisheries is carried out by the Fisheries Science Services of the Marine Institute under the European data Collection Regulation (Council Regulation (EC) 199/2008, Commission Regulation (EC) 665/2008 and Commission Decision 2008/949/EC) and includes the collection of fisheries and biological data from commercial catches and independent scientific surveys. The following scientific surveys will contribute to indicators for the GES biodiversity descriptors 1, 2, 4 and 6:

The Irish Groundfish Survey (IGS) conducted annually in Irish shelf waters since 2003 (1995 in some areas) provides data on the abundance of commercial and non-commercial groundfish species, as well as fish communities indicators such as the (Large Fish Indicator (LFI) and Large Species Indicator (LSI) as stated in the MSFD. It also collects semi-quantitative data on some invertebrate species.

The Irish deepwater survey (IWS) conducted annually in Irish deep waters from 2006 to 2010 (now waiting on future DCF funding) provides data on the abundance of commercial and non-commercial deepwater species, as well as fish communities indicators such as the LFI and LSI as stated in the MSFD. It also collects semi quantitative data on some invertebrate species.

There is a series of Irish fisheries acoustic surveys which collect abundance and biological data on pelagic fish species. These include the Celtic Sea Herring Acoustic Survey (CSHAS) conducted since 1989 in the Celtic Sea and the southwest of Ireland; the Northwest Herring Acoustic Survey (NWHAS) conducted since 1999 in the west and North of Ireland; and the International blue whiting spawning stock survey (IBSSS) conducted since 2004 in the deeper offshore waters west and north of Ireland. Ireland participates in this survey, which is coordinated by ICES.

Finally, the ICES international mackerel and horse mackerel egg survey (MEGS) is a large scale international survey programme carried out triennially along the shelf edge west off Ireland collecting fish plankton data as well as fecundity data on adult mackerel and horse mackerel. Ireland participates in this survey, which is coordinated by ICES.

Data collected from these surveys are managed in house in the Marine Institute in survey databases. The data on groundfish surveys (IGS and IWS) are also housed in ICES.

Status of phytoplankton in transitional and coastal waters (WFD)

This programme commenced in 2007 and involves the annual collection of data on phytoplankton species composition, abundance and biomass from transitional (estuarine) and coastal waters around Ireland. Sampling is undertaken four times per year (once in winter and three times in summer) at a network of stations that are representative of Ireland's entire WFD area, which extends to over 12,000 km². The EPA and the Marine Institute undertake this programme and the information collected is

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archived in their data bases. In 2010, an ecological quality ratio (EQR) derived from these datasets was submitted on a trial basis to the European Environment Agency through the EIONET network.

Status of macrophytes in transitional and coastal waters (WFD)

This programme, undertaken by the EPA, commenced in 2007 and involves the annual assessment of attached opportunistic macro-algae (spatial extent, percentage cover and biomass), the assessment every three years of rocky shore macro-algae (species composition and species richness) and at least once in a six-year cycle assessment of intertidal seagrass beds (species composition, spatial extent and bed density). A monitoring and assessment programme for saltmarshes is currently under development. In 2010, Ecological Quality Ratios (EQRs) derived from these datasets have been submitted on a trial basis to the European Environment Agency through the EIONET network.

Status of macrobenthos in transitional and coastal waters (WFD)

This programme will be fully in place by 2011 and involves the assessment every three-years of soft sediment benthic invertebrate communities in transitional and coastal waters. The ecological status of these communities is based on species composition and abundance. Samples are also collected for sediment analysis and habitat identification purposes. The Marine Institute will carry out this programme. In 2010, Ecological Quality Ratios (EQRs) derived from information collected to date was submitted on a trial basis to the European Environment Agency through the EIONET network.

Status of fish in transitional and coastal waters (WFD)

This programme commenced in 2007 and involves the collection of information every three-years on the composition and abundance of fish species and the presence/absence of indicator species in transitional waters. A variety of netting techniques such as beach seining, beam trawling, and fyke netting are used, as appropriate, to sample the fish community. In addition to biometric data, information on bed type (e.g. gravel, sand or mud) and site slope is also collected together with salinity and temperature at all beach seine sampling sites. This programme is carried out by Inland Fisheries Ireland.

Other relevant programmes

A number of additional programmes listed below may also provide some useful supporting information for biodiversity assessment in terms of characterising habitat types and the physico-chemical nature of the marine environment:

- *Status of physico-chemical parameters in transitional and coastal waters (WFD).*

This programme commenced, in full, in 2007 and involves the annual collection of data on temperature, salinity, nutrients (DIN, DIP, silicate, ammonia), pH, water transparency (secchi depth, turbidity (NTU)), and oxygen conditions (dissolved oxygen and biochemical oxygen demand (BOD)). Sampling is undertaken four times per year; once in winter and three times in summer from over 600 stations. This information is stored in an EPA database and reported annually to the European Environment Agency through the EIONET network.

- *Status of winter nutrients in coastal and offshore waters (OSPAR).*

This programme commenced in 1990 and samples are collected annually in winter (January-February) and analysed for phosphate, total oxidised nitrogen, nitrite, ammonia and silicate. Temperature, salinity, dissolved oxygen and turbidity are measured using CTD instrumentation. The geographic sample area includes the estuarine, coastal and offshore waters of the Irish and Celtic Seas, and in more recent years the Atlantic waters to the west of

Ireland. This information is stored in a database of the Marine Institute and forwarded annually to ICES. Data are made available to other organisations on request.

2.5.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

Work is currently underway in Ireland to identify which existing monitoring programmes will provide data to fulfil the monitoring and assessment requirements of the MSFD. This work is still at an early stage and will be further informed by developments within OSPAR and guidance under the EU Common Implementation Strategy.

2.6 Norway

2.6.1 Organisation of national marine monitoring and implementation of MSFD

The Ministry of Environment is responsible for all political issues regarding the MSFD in Norway. The Norwegian government is currently in discussion to decide in what way Norway as an EEA country³ is going to include the MSFD in the EEA agreement.

The Climate and pollution agency coordinates the Norwegian participation connected to technical questions regarding the MSFD. It is also responsible for all issues related to pollution. The Directorate for Nature management (DN) participates in questions regarding the biological diversity of marine ecosystems. The Ministry of Fisheries and Coastal Affairs is responsible for the management of all commercial fish stocks.

The main focus areas of the DN are the conservation and sustainable use of biological diversity. DN assists the Government in its environmental protection work at the national and international level (EU; OSPAR; CBD *etc.*), is responsible for implementing environmental policies, and for identifying, preventing and dealing with environmental problems.

The Institute of Marine Research (IMR) carries out monitoring and assessment of marine areas both in the coastal area and in the offshore area. Their monitoring programmes could feed the MSFD. Monitoring of the coastal zone, as for other WFD-waterbodies, is coordinated by the DN. Different institutions like the IMR and the Institute of Water Research carry out monitoring under the WFD. MSFD and WFD overlap in the coastal zone.

SEAPOP (SEAbird POPulations) is a long-term monitoring and mapping programme for Norwegian seabirds that was established in 2005. The programme represents a new initiative for these activities in Norway, Svalbard and adjacent sea areas, and will provide and maintain base-line knowledge of seabirds for an improved management of this marine environment. The work is organised and carried out by the Norwegian Institute for Nature Research (NINA) in close cooperation with the Norwegian Polar Institute (NP) and Tromsø University Museum, and is currently financed by the Ministry of Environment, the Ministry of Petroleum and Energy and the Norwegian Oil Industry Association. The Directorate for Nature Management is leading the steering group for this programme.

Integrated Management Plans for the Barents Sea, established in 2006, and the Norwegian Sea, established in 2009, set the overall framework for all human activities (oil and gas industry, fishing, and shipping) in the area to ensure the continued health, production, and function of the ecosystems. The plans have followed international guidelines for ecosystem-based management. A Management

³ Norway is not a regular EU-member but an EEA-member (European Economic Area). It allows Norway to participate in the EU's single market without a conventional EU membership. In exchange, the country is obliged to adopt all EU legislation related to the single market, except those pieces of legislation that relate to agriculture and fisheries. Norway also agreed to enact legislation similar to that passed in the EU in the areas of social policy, consumer protection, environment, company law and statistics.

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Plan for the North Sea will be ready in 2013. These management plans are international, composed by the Border States together.

The Norwegian management plans are relevant to much of the work that goes on in OSPAR and will also be relevant to the MSFD. The Ministry of Environment is in charge. A group with participants from different directorates is involved in the process: The Norwegian Climate and Pollution Agency, The Directorate for Nature Management, The Norwegian Polar Institute (for the Barents Sea) The Directorate of Fisheries, The Institute of Marine Research, The Norwegian Petroleum Directorate, The Norwegian Coastal Administration, The Norwegian Maritime Directorate, The Norwegian Radiation Protection Authority, and research institutions. Different documents and reports have been produced to give input to the management plans (see figure 1). Four groups are established to follow-up the different plans: An advisory group on monitoring, a management forum, a forum on environmental risk management and a reference group. Several indicators have been developed in connection with these management plans. The monitoring group coordinates the monitoring to provide data for the different indicators from existing and new monitoring programmes. Indicators of these management plans partly overlap with MSFD-descriptors, but are less detailed. Thus monitoring for MSFD-indicators will also partly correspond, but it is unclear to what extent.

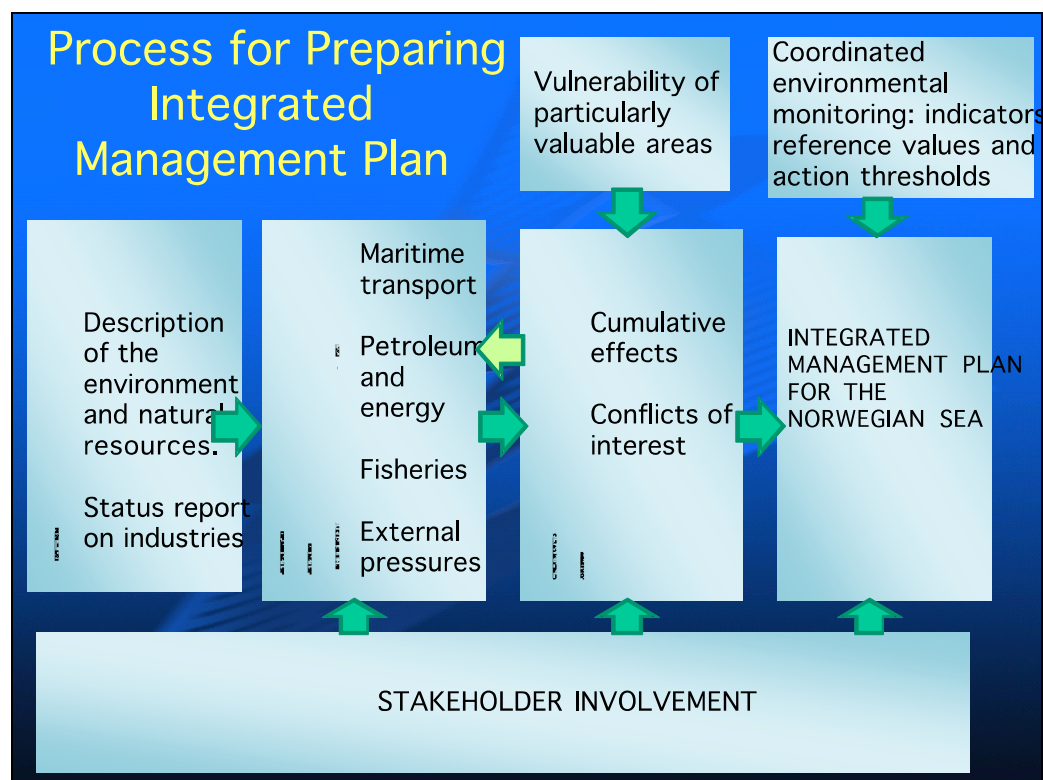


Figure 1. Process for preparing management plans

WFD

The Norwegian framework regulation on water management (the Water Regulation) incorporates the WFD into Norwegian law (approved in 2009). To catch up with the first phase of the EU implementation schedule, a selection of 29 sub-districts have been characterised, River Basin Management Plans (RBMPs) and Programmes of Measures (PoMs) have been completed and draft-monitoring programmes have been prepared. So far no specific monitoring programmes have started for the coastal water under the WFD.

2.6.2 Existing monitoring programmes

There are two reports containing an overview of existing monitoring programmes: one for coastal waters and one for the ocean. These reports are only in Norwegian. Some examples of national and international monitoring projects:

- Coastal monitoring including monitoring and classification of the state of oceanography, water chemistry, phytoplankton, hard bottom flora and fauna, soft bottom fauna;
- Mapping and surveillance of biodiversity in an interdisciplinary project with main focus on mapping natural habitats at a local scale;
- Monitoring of algae for the fish and shellfish farming industry and for The Norwegian Food Safety Authority monitoring programmes;

There is no coordinated monitoring on alien species but some research exists.

RELEVANT DATABASES

The Norwegian Marine Data Centre (NMD) at the Institute of Marine Research was established as a national data centre dedicated to the professional processing and long-term storage of marine environmental and fisheries data and production of data products. NMD maintains the largest collection of marine environmental and fisheries data in Norway. Other national databases include a national algae database (NIVA) and a database containing results from a national coastal marine natural habitat mapping project called 'Naturbasen' (DN) (www.dirnat.no/content.ap?thisId=500029694).

The data and knowledge on seabird-monitoring are being published online via www.seapop.no.

2.6.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

There has been no coupling of monitoring programmes to MSFD descriptors so far. Step one is to determine if and in what way Norway will adopt the MSFD. Step two is to determine what monitoring programmes fit the different descriptors. The monitoring group coordinates the monitoring and also gives advice for new indicators and monitoring programmes. It is likely that there are many monitoring programmes relevant for the MSFD indicators, but not everything will be covered, an analysis to identify the gaps has yet to be carried out (personal comment, Anne Britt Storeng).

An analysis of existing monitoring programmes (see links below) gives the following parameters that may be of use for descriptor 1 (biological diversity). This is based on an expert judgement-selection from reports on existing monitoring programmes and has no official status.

In coastal waters:

- For biodiversity Norway monitors in coastal waters:
- seagrass cover (monitoring under the WFD);
- plankton;
- species composition and cover of hard substrate and soft substrate (mapping of soft bottom habitat along the coast, monitoring in the southern part of Norway);
- fish species composition (both commercial and not commercial catches);
- fish distribution in coastal zone (in Skagerrak (shallow water) and Trondheimsfjorden (bottom trawling));

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- algae (in Trondheimsfjorden, the coast along the Skagerrak and some selected spots around the coast (connected to mussel contamination);
- shore birds;
- specific species: seals, porpoise, eagles, otters;

In oceans:

- physical parameters (temperature, salt, etc.);
- zooplankton;
- phytoplankton;
- fish-eggs and larvae;
- vertebrates;
- invertebrates (shrimps);
- ecology of ice;
- seabirds;
- benthic species on hard and soft sediment and corals.

Links:

- National species database: <http://www.artsdatabanken.no/>
- Overview existing biodiversity monitoring in the coastal zone:
<http://www.dirnat.no/content/752/Nasjonal-overvaking-av-marint-biologisk-mangfold-i-kystsonen> .
- Overview existing biodiversity monitoring in the ocean: Direktoratet for naturforvaltning - Nasjonal overvåking av marint biologisk mangfold i havområder og Arktis.

2.7 Portugal

Bureau Waardenburg prepared this chapter with input from the Azores, a marine sub-region, only. Bureau Waardenburg has not been able to receive input from other marine regions in Portugal.

2.7.1 Organisation of national marine monitoring and implementation of MSFD

INAG is the Environmental Ministry agency responsible for the implementation of European directives and other international agreements with relevance for coastal and marine ecosystems in Portugal.

Monitoring and assessment of Portuguese transitional and coastal waters involves a number of different institutions. The Fisheries Institute (IPIMAR) and the Hydrographic Institute (HI) are the main government laboratories, which carry out sampling programmes. Additionally, a number of universities and research centres, mainly the Institute of Marine Research (IMAR), carry out monitoring work under contract and execute research projects that inform coastal management.

In the Azores archipelago, due to the obligations inherent to the political statute, the administrative body responsible for the collection, structuring and deliverable of data is the Regional Government, and more specifically its recently established executive service, the Regional Directorate for the Sea Affairs (www.azores.gov.pt/Portal/pt/entidades/sram-dram). This Directorate is also responsible for

implementation of the MSFD in the Azores⁴, but as this Directorate does not have the operational tools or the human capacity, contract relations shall be implemented with the proper institutions. The integration of data and preparation to deliver to the Portuguese national authorities (INAG) will be done by the Regional Directorate for the Sea Affairs.

Currently the Directorate is trying to develop the contractual connections to the information owners and with the research institutions to start methodological and systematic surveys. A main constraint for the Azores is the lack of a funding programme for the MSFD implementation.

2.7.2 Existing monitoring programmes

To address national and international legislation or emerging environmental issues, a number of ongoing sampling programmes in several thematic areas and more specific programmes that study particular systems and/or environmental issues are carried out. Regular monitoring activities include:

- Hydromorphology: maritime charts and tide tables; wave climate; meteorological data; salinity, temperature and currents along the coast and sediment mapping;
- Marine geology: sediments in coastal and transitional waters;
- Water quality: nutrients, photosynthetic pigments, physical parameters, heavy metals and synthetic pollutants in the main estuaries and lagoons;
- Phytoplankton: phytoplankton community structure along the coast, phytoplankton concentration in the main transitional and sheltered coastal waters;
- Shellfish: Bivalves in coastal areas and lagoons (abundances, physiological aspects, presence of biotoxins);
- Specific pollutants: heavy metals, organics such as PCBs, dioxins and PAHs (transitional and inshore coastal waters).

Especially important for the implementation of the MSFD in the Azores are the strengthening of the following existing monitoring programmes or research tools:

1. Oceanographic characterization, including benthos analysis;
2. Habitats;
 - a. Marine shallow habitats;
 - b. Deep sea hydrothermal vents;
3. Biodiversity;
 - a. Marine Birds;
 - b. Marine mammals;
 - c. Invasive species detection programme;
 - d. Species location geographic information system.

⁴ The recently established Azores administration, the Regional Directorate for the Sea Affairs, is responsible for the maintenance or developing of monitoring programs and the developing of scientific tools for the integration of information that allows for the Good Environmental Status identification, the identification of areas, species or themes in need of recuperation and the implementation of plans to accomplish it.

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To harmonise monitoring and assessment activities in transitional and coastal waters in Portugal, the project 'Monitoring Plan for Water Quality and Ecology of Portuguese transitional and coastal waters (MONAE)' was launched in 2004 and carried out between 2004 and 2006 (www.monae.org)⁵. MONAE was primarily written to meet monitoring requirements of the WFD.

In the Azores several projects, some EU funded, are used to collect crucial information for the development of programmes and tools that will give answers needed for the implementation of the MSFD. These include:

- Oceanography and benthos: AZODC, Detra, Lamar, OPALINA, OT Network (Canada funded), MESHAtlantic (ERDF).
- Habitats

Shallow water habitats: Empafish (FP6), MareFish, Marbena (FP5), Invasoras (Regional funding), GREX (FP6), Free subnet (Marie Curie), MarBef (FP6), Marmac (Interreg), MAR-ECO.

Deep Sea Hydrothermal Vents: Exocet/D (FP6), Fisiovent, MoMAR, DEEPSETS, ESONET (NoE), MOMARnet, CAREX, Hermione (FP7), ChEss.

Deep Sea Habitats: CoralFish (FP7), Condor (EEA Grants), Oasis, CenSeam.

Deep Sea Habitats: CoralFish (FP7), Condor (EEA Grants), Oasis, CenSeam.

- Biodiversity

Marine Birds: IBAs (LIFE).

Marine mammals: Cetamarh (Regional funding), Macetus (Interreg) and Golfinicho (National funding).

- Fisheries: Aphacarbo, Cepropesca, MADE (FP7), POPA (Regional funding), Deecon.

Most of the data collected by the various agencies and academic institutions are stored locally in internal databases. The availability of historical data is thus compromised by data fragmentation which stems from the lack of coordination of monitoring activities both at a system (e.g. estuary or lagoon) and at a national level. In the last few years some of these datasets have been collated and loaded into web-accessible databases (e.g. snirh.inag.pt and www.barcaweb.com).

In the Azores the information is scattered in the research institutions and other partners that were, for several different reasons, collecting the information. This information is now collected with the support of regional, national and European authorities and can be used for MSFD purposes.

2.7.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

No potential programmes and/or parameters have been identified yet for the implementation of the MSFD in the Azores. This is still work in progress, carried out under the responsibility of the Directorate for the Sea Affairs, who is currently in the process of establishing contracts with institutions who can actually carry out these tasks. A main constraint for the Azores is the lack of a funding programme for the MSFD implementation.

⁵ MONAE did build on previous work in the Typology and Reference Conditions study (TICOR) carried out in 2002-2003 (www.ecowin.org/ticor). The TICOR study aimed to provide a framework for appropriate coastal management in Portugal following the requirements of the Water Framework Directive (WFD).

Several projects have already been initiated in the Azores to collect crucial information for the development of programmes and tools that will result in the answers needed for the implementation of the MSFD (see paragraph 2.7.2 – Existing monitoring programmes).

2.8 Spain

2.8.1 Organisation of national marine monitoring and implementation of MSFD

The national government is responsible for monitoring requirements of the Marine Strategy Framework Directive. The regional governments are responsible for monitoring requirements of the Water Framework Directive related to coastal waters.

The implementation of the MSFD is in progress and the transposition to national legislation has been finalised by the approval in the Parliament of the Law 41/2010 of the Protection of the Sea. The law establishes five subdivisions that will be the geographical areas in which the work will be divided.

A Spanish Group of the Marine Strategy has been established to coordinate the work of the scientific experts group, the technical pressures and impact group, the socio-economic analysers and the different units from the Ministry of Environment and Rural and Marine affairs, having any competence in the sea (MSFD implementation, WFD implementation, Fisheries, Biodiversity and MPAs, Environmental Assessment, etc.). It is expected that a future broader working group will be launched, involving other competent authorities (navigation, harbours, regional governments, etc.).

The Spanish group of the Marine Strategy started the technical work for the Initial Assessment and a draft document will be available by the end of March. A workshop to identify adequate criteria and indicators for the definition of GES and target setting is anticipated to take place in June. The accurate definition of GES, targets and associated indicators will be addressed during the second half of 2011 and public consultation is expected to start by March 2012.

National and international guidance on marine monitoring and assessment

There are several manuals available providing guidelines to set up marine monitoring programmes for the Atlantic Ocean and the Mediterranean Sea for the WFD and international conventions (e.g. OSPAR, ICES), including monitoring programmes (of pressures) for coastal and transitional waters, and monitoring of discharges.

The guidances concerning RID and CEMP programmes are followed by Spain to monitor and report data related to these OSPAR requirements. A similar procedure is followed to report data to MEDPOL programme (Barcelona Convention). In a parallel way, the implementation of WFD in coastal and transitional waters has been technically supervised by the Joint Research Center of the Commission (JRC). The technical guidance that have been periodically emerging (eutrophication guidance, intercalibration guidance) are followed in the respective monitoring programmes of coastal waters carried out by regional governments.

At the national level, several guidance documents have been developed by the Ministry to advise regional governments in their respective obligations, for example:

- “Manual de diseño de los programas de control de estado de las aguas costeras y de transición” (Guidance for the design of the monitoring programmes of the status of coastal and transitional waters);
- “Manual para la elaboración de informes del Programa RID relativos a emisiones directas al mar” (Guidance for the elaboration of reports to RID programme, related to direct discharges to the sea);

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- Guidance for the establishment of monitoring programmes for species of the Habitats and Bird Directives and for species in the Spanish Catalogue of endangered species is currently under development in order to ensure consistency among the different monitoring programmes carried out by regional governments.

2.8.2 Existing monitoring programmes

The existing monitoring programmes in Spain can be summarised in the following groups:

1. Monitoring programmes emerged from the WFD (Dir 2000/60/CE)

Until now, Spain mainly focussed on monitoring marine coastal waters. Regional governments delegated most of these activities to national and regional research institutes involved in transitional and coastal monitoring programmes including⁶:

- Research institutions and Universities: Instituto de Hidráulica (Universidad de Cantabria), Indurot (Universidad de Oviedo); Universidad de Cádiz; Instituto de Ciencias Marinas de Andalucía;
- Public companies or Research Foundations: AZTI-Tecnalia; EGMASA.

The details and parameters contemplated in these monitoring programmes are explained in the River Basin Management Plans, and cover all the requirements indicated in the WFD for coastal waters: phytoplankton, macroalgae & angiosperms, benthic macroinvertebrates, physicochemical parameters (nutrients, turbidity, salinity, etc), and chemical characteristics (priority substances and certain other pollutants according to Dir 2008/105/CE).

2. Monitoring programmes emerged from Natura 2000 requirements

The Natura 2000 sites monitoring obligations are under the competence of regional governments except for the Natura 2000 sites that are 100% marine and have no ecological continuity with coastal or terrestrial habitats that are, in accordance with law 42/2007 of Natural Heritage and Biodiversity, under the competence of national government (Ministry of Environment and Rural and Marine affairs).

Nowadays, specific regional monitoring programmes have been developed to follow species and habitats under Habitats and Birds Directives but focus on coastal areas (especially for intertidal habitats or *Tursiops truncatus*).

During the process of drawing up the report on the Habitats Directive implementation in Spain (started in 2009), it was concluded that the percentage of the conservation status “Unknown” in the field of marine environment continues being high.

The above-mentioned lack of knowledge and monitoring for coastal and marine species and habitats should be reduced during the next few years, with the fulfilment of MSFD obligations. The recent project “Establecimiento de las bases ecológicas para la gestión de los tipos de hábitat de interés comunitario en España” (Establishment of ecological basis for the management of natural habitat types of community interest in Spain) has developed protocols to monitor and assess the conservation status of habitats and species of the Directive. These tools are expected to be applied in the medium term.

3. Other monitoring programmes being carried out

⁶ Only indicated those working in OSPAR coastal regions.

Several other institutes are in charge of gathering monitoring data for specific questions related to the coastal and marine waters:

- CEDEX (Centro de Estudios y Experimentación de Obras Públicas; Centre for Public Works, Studies and Experimentation). For example the Centre for Harbour and Coastal Studies of CEDEX carries out the Climate Maritime Programme for the National Port authority;
- CSIC (Consejo superior de investigaciones científicas; High Council for Scientific Research) is a national research institute and carries out marine research and monitoring activities in collaboration with regional departments and collaborators;
- IEO (Instituto Español de Oceanografía; Spanish institute for oceanography) carries out monitoring and scientific research that involves fisheries, aquaculture and Marine Protected Areas (MPAs). IEO is also specifically tasked with the implementation of monitoring requirements of international conventions (e.g. OSPAR, ICES, MEDPOL). Monitoring programmes carried out by IEO include for example:
 - Environmental assessment in marine reserves;
 - Stocks assessment;
 - Research and assessment of the biological diversity (at the habitats and species level) in selected areas;
 - Monitoring of commercial species in landing ports and fishing boats;
 - Research surveys for living resources investigation;
 - Study of temporal and spatial trends of pollutants in sediments and biota within the framework of the OSPAR and MEDPOL conventions;
 - Study of temporal and spatial trends of the biological effects of pollutants within the framework of the OSPAR and MEDPOL conventions;
 - Historical series of physico-chemical and biological variables along the Spanish marine waters (Radiales Programme).
- OAPN (Organismo Autónomo de Parques Nacionales). The National Parks network has developed its own monitoring programmes, being a part of them in coastal and marine environments (National Park of Islas Atlánticas de Galicia, in the OSPAR region).

4. Monitoring programmes from the MSFD obligations

Spain has the intention to design a complete and representative monitoring programme to fulfil monitoring and assessment requirements of MSFD Article 11, covering all the marine subdivisions in Spain, and all the descriptors of Annex I. Several institutes like IEO and CEDEX will be involved in its implementation. The biological monitoring programme in relation to the MSFD is still under development and has not yet started.

5. Monitoring programmes from the Spanish Catalogue of Endangered species

This list of endangered species (first published in 1990) was recently updated and published by Royal Decree and includes several cetaceans, birds, reptiles, fish and marine invertebrates. Spain has the intention to periodically assess the conservation status of all of these species by regularly monitoring of these species in the medium term.

The results of all of these ongoing monitoring programmes will be taken into consideration when analysing available information for MSFD requirements. Some descriptors (like D5 or D8) are well

covered by these programmes (even though they are mostly restricted to coastal environments). Others, especially biodiversity descriptors (D1, D2, D4 and D6) are only partially covered by the WFD monitoring programmes. Some of the biodiversity elements that are at least partially covered and already monitored by WFD monitoring programmes (only 1 nm far from the coast line) are:

- *Benthic-Macroinvertebrates*: since this component is considered one of the “Biological quality elements” (BQE) for the analysis of the Ecological Status of water bodies, it is monitored in coastal waters, and an index has been approved and intercalibrated for Spanish coastal waters: M-AMBI (see COM Decision 2008/915/CE). This index fits into the indicator 6.2.2. of the Decision on Criteria and Methodological Standards for GES (Decision 2010/477/EU), and probably also into criteria 1.6 (State of the habitat). Other metrics for measuring benthic macroinvertebrates are being developed in the moment for southern Spain, and, if approved, they will be introduced into monitoring programmes. These monitoring programmes only focus on soft-bottom benthic communities, with a lack of a similar assessment tool for hard-bottom communities, not only in Spain, but in the whole framework of WFD implementation;
- *Phytoplankton*: this biodiversity component is also analysed in the WFD coastal waters, but measured as Chl-a 90 percentile, and frequency of blooms, then it is assessed as an impact indicator of possible eutrophication events. Thus this biodiversity component is not for the moment adequately assessed in terms of D1, but only suitable for D5;
- *Macro-algae*: intertidal and in some cases subtidal samplings are periodically carried out to cover this BQE in coastal waters, and a multimetric assessment method, called CFR has been developed, which probably fits with indicator 1.6.1.

Relevant databases

There are several databases managed by Central Administration, that can be used for the implementation of the MSFD:

The Internet remote database on “Pressures and impacts on coastal and transitional waters” was developed to fulfil the IMPRESS process of WFD, when an impact and pressures analysis was demanded. This remote database is a live tool that can be updated by competent authorities in coastal waters (*i.e.* regional governments) and other authorities that are responsible of pressures in coastal or marine areas (*i.e.* Harbours, Fisheries administration, etc). The Ministry of Environment and Rural and Marine Affairs, with the support of CEDEX, is involved into the process of adaptation of this database to complete it with the new requirements emerging from the MSFD. This will be done in such a way that this database will be the reference where all the pressures and impact data are stored.

The Ministry’s GIS server contains several coastal habitats distribution shapes, emerged from different surveillance projects called “Ecocartography of the litoral region of ...”, carried out by the General Directorate for the Sustainability of the Coast and the Sea. A similar process is set up for storage of information of the “ESPACE” project, supported by the General Directorate of Fishing planification, that provides high quality information for the bathymetry and other variables. A selection of all these geographical data is available (or will be uploaded soon) by a GIS viewer tool (<http://imspre.mapa.mapya.es/costas/visor.html>).

The GIS servers from other different institutions, but especially those from IEO (http://mapserver.ieo.es/website/WMS_IEO/viewer.htm) and CEDEX (<http://cepyc2/PIPRM/>) also have a variable set of information and shape files related to the marine environment, including biodiversity descriptors and pressures & impacts.

The Ministry of Environment and Marine and Rural Affairs is developing an ambitious project, called “Spanish Inventory of Natural Heritage and Biodiversity”, emerged from the obligations to Law 42/2007

of the Natural Heritage and Biodiversity. This inventory will contain a “Spanish Inventory of Marine Habitats and species” and a “Spanish Catalogue of exotic invasive species” together with other information. The inventory will be available for public consultation, and included in the “Bank of data of Spanish biodiversity”, which includes a GIS viewer and several WMS servers (<http://servicios2.marm.es/WmsViewer/html/default.htm>). Similar to the inventory of marine habitats and species, this inventory has just started, so its applicability to the short-term initial assessment will be limited.

2.8.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

The development of biological monitoring programme under the MSFD is still under development following international and national guidelines. For descriptors 1, 2, 4 and 6 the following programmes are likely to be used:

- Descriptor 1. Monitoring programmes from Natura 2000 (Regional and National Governments), Monitoring programmes from WFD, Monitoring programmes for fisheries (IEO), Monitoring programmes of MPAs and Marine Reserves, Specific monitoring programmes for MSFD (to be developed);
- Descriptor 2. Specific monitoring programmes for MSFD (to be developed), Monitoring programmes of MPAs and Marine Reserves.
- Descriptor 4. Monitoring programmes from WFD (related to phytoplankton), Monitoring programmes for fisheries (IEO), Specific monitoring programmes for MSFD (to be developed).
- Descriptor 6. Monitoring programmes from Natura 2000 (Regional and National Governments), Monitoring programmes from WFD, Monitoring programmes for fisheries (IEO), Monitoring programmes of MPAs and Marine Reserves, Specific monitoring programmes for MSFD (to be developed).

2.9 Sweden

2.9.1 Organisation of national marine monitoring and implementation of MSFD

The Ministry of Environment is responsible for environmental matters at the governmental level. The Swedish Environmental Protection Agency (SEPA) is the central government agency for coordinating monitoring and implementation of MSFD. The SEPA has the overall responsibility for the management of the National Monitoring Programme and provides guidance to County Administrative Boards. The County Administrative boards are in charge of regional environmental monitoring and supervision of the air, ground and water and engaged in nature conservation. By the 1st of July 2011, SEPA will be replaced by a new Marine and Water Agency (MWA) in Gothenburg, which will take responsibility for MSFD coordination.

The national and regional marine monitoring programmes are used for assessing ecological and chemical status according to WFD requirements. For BHD a guidance manual for assessing favourable conservation status has been developed (in Swedish). Mostly for near shore habitat types (Lagoons and shallow bays), GIS modelling has also been used to show potential distribution of habitats. These models could be useful tools for identifying habitat types for the MSFD.

As for the MSFD, it is anticipated that the current offshore programme will be able to supply a considerable part of the requirements. Some new variables measuring marine acidification have been included already. When decisions have been taken regarding the definitions of GES, the monitoring programme will be modified in order to be able to assess if GES has been reached in Swedish waters. This work will be made on indicator level, and will be undertaken in close cooperation with ongoing

work within OSPAR and HELCOM. The new national monitoring programme will be ready by the 15th of July 2014 at the latest, in accordance with the Directive.

2.9.2 Existing monitoring programmes

A monitoring handbook of guidelines for different types of monitoring integrates the National Programmes and regional coastal programmes and harmonises monitoring activities at all levels (<http://www.naturvardsverket.se/sv/Tillstandet-i-miljon/Miljoovervakning/Handledning-for-miljoovervakning/>, in Swedish only). This handbook is based on international standards such as guidelines from HELCOM and OSPAR, and it is continuously adjusted for new requirements, such as those under the WFD and, eventually, also requirements under the MSFD. The County Administrative Boards are responsible for implementation of this handbook in their respective regions.

The National Monitoring Programme⁷ consists of ten programme areas including the programme area 'Seas and coastal areas'. In addition to the national programmes, there are regional programmes run by the Counties and private monitoring programmes run by enterprises.

The environmental monitoring programme for 'Seas and coastal areas' provides input for the description of large-scale human impacts, primarily from eutrophication and hazardous substances, and on biodiversity. The programme consists of the following continuously running sub-programmes:

- the free water column;
- soft-bottom macrofauna;
- phytobenthic communities;
- hazardous substances in marine biota;
- hazardous substances in sediments;
- top predators;
- coastal fish populations and fish health;

These sub-programmes have a frequency of once every year or up to 20-24 times a year (pelagic programmes: hydrography, chemistry, phyto- and zooplankton). Other programmes run less frequently, such as hazardous substances in sediments (performed every 6 years).

The monitoring programmes are driven by the Swedish environmental objectives, as well as European directives, international marine conventions and bilateral agreements and therefore have a strong international character. The National Marine Monitoring Programme has been modified to better meet requirements under the Water Framework Directive (WFD).

RELEVANT DATABASES

Sweden has several national marine databases. SMHI manages hydrographical, chemical and biological (except fish) data. The National Board of Fisheries manages fish data. There is also a database on hazardous substances in biota (IVL Swedish Environmental Research Institute Ltd.) and on hazardous substances in sediments (Swedish Geological Survey). All results from the national monitoring programme and a substantial part of regional programmes are reported to these

⁷ The National Monitoring Programme consists of ten programme areas: air, mountain areas, forests, agricultural land, landscapes, freshwater, seas and coastal areas, health-related environmental monitoring and toxic substances coordination.

databases, and can be retrieved over the Internet (<http://www.naturvardsverket.se/en/In-English/Menu/State-of-the-environment/Environmental-monitoring/Environmental-monitoring-data>).

2.9.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

All sub-programmes mentioned above will be used for MSFD descriptors. A detailed analysis of which variables will be used for individual descriptors has not been made, but the following ecological programmes may be used (based on judgement from Swedish experts):

- the free water column (salinity, temperature, insolation, secchi depth, oxygen/hydrogen sulphide, alkalinity, pH, total phosphorus and phosphate, total nitrogen, nitrate, nitrite, ammonium, silicon, chlorophyll a, primary production, phytoplankton density, species composition and biomass, zooplankton density, species composition and biomass, sedimentation, dissolved organic carbon, and in the Bothnian Bay also humic substances, bacteria density and growth and picocyanobacteria).
- soft-bottom macrofauna (density and biomass per species found);
- phytobenthic communities (depth distribution and coverage per species found);
- top predators (population of all three seal species, seal health and population and reproduction of sea eagles);
- integrated monitoring of coastal fish populations and fish health (population density and composition, age composition of a couple of species, visible external signs of disease, reproduction, growth, condition plus biochemical, physiological and histological biomarkers).

2.10 The Netherlands

2.10.1 Organisation of national marine monitoring and implementation of MSFD

In the Netherlands two departments are responsible for the main marine monitoring programmes, *i.e.* the Ministry Infrastructure and Environment (EenI) and the Ministry of Economic Affairs, Agriculture and Innovation (ELI). Data collection and storage is also bipartited: Marine monitoring by EenI is part of the national MWTL (Monitoring van de Waterstaatkundige Toestand des Lands) monitoring programme and stored in the national databases DONAR and (since 2004) WADI. This includes physical, chemical, morphological and biological data. ELI is responsible for monitoring under Trilateral Monitoring and Assessment Programme (TMAP) (for the Wadden Sea, *i.e.* seals, birds, shellfish and estuarine vegetation) and supplementary statutory monitoring projects (WOT) (*e.g.* fish stocks for the assessments under the EU Common Fisheries Policy). These data are collected and stored in several databases by the Institute for Marine Resources and Ecosystem Studies (IMARES).

The Dutch MSFD work programme consists of three key projects:

- i) the Initial Assessment (almost complete) based on existing evaluations of the marine environment under OSPAR, the Water Framework Directive and national programmes,
- ii) determination of GES and
- iii) development of targets and indicators. These projects are carried out by Deltares, a Dutch-based research institute and specialist consultancy for matters relating to water, soil and the subsurface. Deltares regularly consults with policy makers and has also organised an expert workshop to gather relevant information. At the end of 2010 a first draft version is expected, mid 2011 a final version. The Netherlands is also working on an assessment of pressures in the Dutch part of the North Sea to support this work. Also current monitoring programmes are

being linked in detail to MSFD indicators. This work is carried out by IMARES, a research institute that concentrates on research into strategic and applied marine ecology.

Stakeholder/public participation is considered to be an essential part of the MSFD process, and is being achieved through workshops, consultations and co-drafting of reports with stakeholders (both general public and other Government Departments in the Netherlands). MSFD will legally be implemented in the “Waterwet” through the “Waterregeling” (December 2009, updated in October 2010).

2.10.2 Existing monitoring programmes

Existing monitoring programmes of ecological parameters concern both species (vegetation (*i.e.* seagrass and salt marshes), phytoplankton, zooplankton, macro-invertebrates, fish, mammals, birds) and hydrological, physical and chemical parameters (*e.g.* wave action, heavy metals, organic micro-compounds, temperature, oxygen-content, *etc.*). A complete overview of metadata on ecological marine monitoring programmes covered by MWTL, T-MAP and WOT was prepared by Smit *et al.* (2010; respectively table 3.2, 3.3 and 3.7), which is available on the Internet (<http://edepot.wur.nl/150918>; only in Dutch language).

Monitoring programme	Legislative driver	Parameters
MWTL	KRW, JAMP (OSPAR), WFD, NEM	biotic, chemical, physical, hydrological and morphological parameters
TMAP	TMAP, JAMP (OSPAR), NEM	biotic, chemical, physical, habitat, human use and general parameters (morphology, hydrology, land-use, weather)
WOT (IMARES)	EU-legislation, JAMP (OSPAR),	biotic parameters

The National Oceanographic Data Committee (NODC) of the Netherlands facilitates the exchange of oceanographic and marine data and information. The website gives an overview of marine metadata and access to data bases (www.nodc.nl). All data of the MWTL programme are included in waterbase.nl.

2.10.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

Process followed

In the Netherlands a feasibility test of the proposed descriptors for GES for monitoring and assessment was based on the very first reports from the JRC/ICES Task Groups for GES Descriptors. This test was carried out with input (questionnaires and workshops) from technical experts from research institutes as well as policy experts from the Dutch Government.

The test was carried out to investigate (at the level of GES descriptor) whether:

- the proposed attributes and indicators are suitable and necessary;
- gaps exist in knowledge and/or monitoring programmes;
- the proposed approach is feasible for the Netherlands;
- practical application is possible.

The results of this test were reported in a so-called 'quick scan' on the feasibility of GES implementation. The report includes suggestions on how currently existing monitoring programmes could contribute to certain descriptors as well as ideas to extend these in a cost-effective way. At a later stage input from monitoring experts was added and summarized in a table containing monitoring programmes that potentially can deliver to the identified EU indicators for descriptors 1, 2, 4 and 6. The analysis includes the identification of gaps for implementation and interpretation of monitoring data.

The quick scan is a background document to support the decision-making process. It does not indicate which programmes and/or parameters will actually be used to assess the progress towards GES in the future. Decisions on how to proceed are the responsibility of policy experts and are expected in the first half of 2011.

Preliminary results

The results of the quick scan feasibility test are summarised below.

Level of descriptors

- Descriptor 1. Biological diversity: Most indicators are being appropriately measured in current monitoring schemes, except for population genetic structure, habitat volumes and relative abundance/biomass, condition of the typical species and communities and ecosystem structure (composition and relative proportions of ecosystem components (habitats and species)).
- Descriptor 2. Alien Species: Alien species are identified in regular fish- benthos and phytoplankton monitoring programmes. Stepping stones and alien species in ballast water is not monitored. Environmental impact is only monitored for *Ensis* spp., which appears to be the only relevant species at this moment. Abundance ratios are being monitored, but data analysis is still in progress and not up to date.
- Descriptor 4. Foodwebs and Species: Seals and seabirds are well monitored, productivity indices remain questionable.
- Descriptor 6. Seafloor integrity: Extent of human activities and certain sensitive benthic species are well monitored, but indices and indicator species are not defined yet. Monitoring of macro-benthos has to be extended with measurements of length/size.

Level of indicators

Table 1 gives a summary of the screening of existing monitoring programmes in relation to MSFD indicators. More than half of the indicators can be applied directly, for some indicators monitoring matches, but analysis has to be adapted. For two indicators extra monitoring is necessary. Two indicators appear not to be relevant for the Netherlands.

Table 1: Summary of the screening of existing monitoring programmes in relation to MSFD indicators. Numbers refer to the specific indicators.

Descriptor	Operational	Monitoring matches, research needed for further elaboration	New monitoring programme is needed	Non relevant for the Netherlands or no assessment possible
1	1.1.1, 1.1.2, 1.1.3 1.2.1 1.3.2	1.3.1 1.7.1	1.6.1	1.5.2

Descriptor	Operational	Monitoring matches, research needed for further elaboration	New monitoring programme is needed	Non relevant for the Netherlands or no assessment possible
	1.4.1, 1.4.2 1.5.1 1.6.2, 1.6.3			
2	2.2.2	2.2.1	2.1.1	
4	4.1.1 4.2.1 4.3.1			
6	6.1.2 6.2.1	6.2.2, 6.2.3, 6.2.4		6.1.1

2.11 United Kingdom

2.11.1 Organisation of national marine monitoring and implementation of MSFD

The United Kingdom uses the United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS) to fulfil monitoring and assessment requirements of different European Directives and international conventions. A description of the organisational structure of UKMMAS is provided in OSPAR (2008).

The MSFD has been transposed into UK regulations. The UK Department for Environment, Food and Rural Affairs (Defra) is responsible for delivery of the Directive in English coastal and offshore waters (beyond 12 nautical miles) with the Devolved Administrations of Northern Ireland, Scotland and Wales being responsible for delivery in their territorial waters. An MSFD Policy Steering Group oversees implementation across the Devolved Administrations and other Government Departments. The technical work on GES monitoring and assessment (including the Initial Assessment) will be delivered through the UK's Marine Monitoring and Assessment Strategy (UKMMAS), and in particular its 4 evidence collection groups.

2.11.2 Existing monitoring programmes

Metadata on environmental monitoring programmes carried out under the UKMMAS structure are included in United Kingdom Directory of the Marine-observing Systems (UKDMOS) (www.ukdmos.org). UKDMOS is the, a searchable meta-database of marine monitoring conducted by UK organisations.

The application builds on the existing European Directory of Ocean Observing Systems, which has undergone substantial development and refinement under the EU funded SeaDataNet project. Providing the technological solutions in collaboration with the SeaDataNet project has led to substantial cost saving to the overall UKDMOS project and ensures that UKDMOS is compatible with other ongoing national and international metadata initiatives.

At the moment 268 programmes are included in this directory, but no specific definition of a 'programme' is provided. Each programme is briefly described and details are given about the earliest start date of the programme, number of series held, legislative drivers, minimum and maximum sampling frequencies, parameters monitored, sampling protocol, platform types and depth categories. In addition contact details are provided for the person and/or organisation responsible for the specific programme.

2.11.3 Potential programmes for identified EU indicators for GES descriptors 1, 2, 4 and 6

Process followed and preliminary results

A preliminary analysis of which monitoring programmes have the potential to provide data and information for the 11 Marine Strategy Framework Directive Descriptors was completed in 2008 to provide policy makers with an improved knowledge of the potential to meet the requirements of the directive. This preliminary analysis was carried out at the level of descriptors only, and by expert judgement.

Following a better understanding of the descriptors and the Commission Decision on GES, a new approach was taken in November 2010 to identify monitoring programmes that had the potential to provide data for descriptors, criteria or indicators. This approach utilised the details of what parameters were measured for each programme, which was held in UKDMOS already. A mapping from these parameters (of which there are approximately 380 terms in a vocabulary titled 'The Parameter Discovery Vocabulary (P021)') to the indicators as specified by the Commission Decision of 2010 was completed. The strength of the mapping is variable and further information is available by going to the UKDMOS search pane and clicking the 'Please read background info first' button on the bottom right of the screen under the heading 'Additional search criteria relevant for Marine Strategy Framework Directive (MSFD)'.

The Parameter Discovery Vocabulary and the MSFD indicators are different 'entities' so in all cases the mapping should read that 'parameter X has the potential to provide data for MSFD indicator Y'. For example, nobody actually measures 'Water transparency related to increase in suspended algae, where relevant' but they do measure suspended particulate matter (organic/inorganic), chlorophyll a and oceanographic conditions which provides data that can be combined to provide information if a decrease in water transparency is a function of a phytoplankton bloom or resuspension of sediment. Other factors should also be taken into account when using the additional functionality in UKDMOS. While a monitoring programme may provide data that could be used for an indicator, it may not be the case that the data is of a suitable quality for such an assessment or fall within the geographic scale of the assessment. Each Member State may also interpret the indicators differently, for example they may identify different key species used within an indicator. Using this mapping in UKDMOS should therefore be seen as a first step towards identifying programmes that have potential to provide data for the MSFD and should be followed up with discussion with experts. It should not be seen as the final and definitive product.

By using UKDMOS to search for programmes, which have the potential to provide data for Descriptors 1, 2, 4, and 6 the following numbers of monitoring programmes are obtained:

Table 2. Number of monitoring programmes that have potential to provide data for the descriptor

Descriptor	Number of programmes
1	232
2	178
4	182
6	102

Descriptor 1 has a potentially large number of monitoring programmes as it covers species, habitats and physical, hydrological and chemical conditions of which most monitoring programmes measure a component of. As described in the UKDMOS document, Descriptor 2 is difficult to identify monitoring

programmes for, as any monitoring programme that measures a biological entity has the potential to identify a non-indigenous species. In fact, there are few or no field monitoring programmes in the UK that are specifically designed to identify non-indigenous species, however, there are 2 programmes that collate reports of non-indigenous species. Descriptor 4 requires some further definition of exactly what the key species and functionally important groups are, as defined by the indicators.

As detailed above, it is also possible to identify monitoring programmes for individual MSFD criteria and indicators using UKDMOS however, an analysis to this level of detail has not been completed.

3 Comparison between countries

In § 3.1 a comparison is made between the processes followed in the different countries to identify programmes and/or parameters for EU indicators for descriptors 1, 2, 4 and 6. For most countries (nine from eleven) the identification of programmes and/or parameters is still work in progress.

Four countries provided preliminary results of their processes. These are compared in § 3.2.

An overview of the accessibility of ecological monitoring metadata in different countries is given in § 3.3.

3.1 Processes followed to identify programmes and/or parameters

Comparing processes in different countries shows the following similarities and differences:

- Belgium, Denmark, France, Germany, Ireland, Norway, the Azores (Portugal), Spain and Sweden are still working on a process to identify programmes and/or parameters. The progress differs for each of these countries:
 - Belgium has the intention to produce a first version of potential criteria and indicators available for implementation of the MSFD based on existing monitoring programmes. This version will be updated as soon as the definition and technical description of these criteria and indicators are better described, and as long as the practical application of these indicators remain feasible (regarding costs etc.). Existing information (parameter-based inventories and project-based inventories) is largely included in the database of the Management Unit of the North Sea Mathematical Models (MUMM). Data collected from reference zones (zones not affected by human activities) as part of the assessment of potential effects of three sectoral activities (immersion of dredging soil, exploitation of sand and gravel, and installation of offshore windfarms) can be good indicators for the good environmental status for un-impacted Belgian marine waters.
 - In Denmark, the Danish Forest and Nature Agency and the Agency for Spatial and Environmental Planning will be merged by the end of January 2011, probably into the "Nature Agency". This agency will be responsible for the Nationwide Monitoring and Assessment Programme (NOVANA) in the period between 2011 and 2015 and will also be responsible for the identification of monitoring programmes and/or parameters for identified EU indicators for descriptors. The Nature Agency will work in close cooperation with other agencies and scientific institutions.
 - In France, lead organisations have been pointed out for development work on each of the eleven GES descriptors. These organisations will receive input from other organisations and research agencies. The lead organisations are currently identifying potential data for their descriptor (if possible at the level of parameters), after which they will identify the corresponding monitoring programmes, using the national data discovery portal (SINP).

This work only started recently (end of 2010 or beginning of 2011, depending on the descriptor), therefore, results are not available at this stage. descriptor task leaders are requested to submit their report to the Ministry by the end of November 2011.

- In Germany, there is no agreement about the structure to implement the MSFD. Once there is agreement about this structure, it is likely that the Marine Monitoring Manual (an extensive overview of all existing marine monitoring activities in Germany) will be used to identify monitoring programmes and parameters that can be used for the MSFD. Germany commented that the EU indicators do not provide enough guidance on which species and/or habitats should be monitored. Until these indicators become more operational, it is unsure how Germany should adapt their existing programmes to meet the requirements of the MSFD.
- In Ireland, the responsibility for setting up and implementing monitoring programmes for the MSFD has not formally been assigned yet to any agency or agencies. A national working group consisting of representatives of key government departments and national agencies will work on the development of GES descriptors, targets and indicators in accordance to future developments within OSPAR and guidance under the EU Common Implementation Strategy.
- In Norway, the first step is to determine in what way Norway will adopt the MSFD. Step two is to determine what programmes and/or parameters fit to the EU indicators for the descriptors. Management plans for Barents Sea (established in 2006), the Norwegian Sea (established in 2009) and the North Sea (to be established in 2013) are likely to form the basis for the identification of programmes and/or parameters for the MSFD.
- In the Azores, (Portugal) the recently established Directorate for the Sea Affairs is responsible for implementation of the MSFD, but this Directorate does not have the operational tools or the human capacity to carry out the required work. Therefore they are currently in the process of establishing contracts with institutions that can carry out this work. A main constraint for the Azores is the lack of funding for implementation of the MSFD. Several projects have already been initiated in the Azores to collect crucial information for the development of programmes and tools that will result in the answers needed for the implementation of the MSFD.
- In Spain, a 'Spanish Group of the Marine Strategy' has been established to coordinate the MSFD work carried out by different organisations and expert groups. This group carried out the technical work for the Initial Assessment and are expected to coordinate the accurate definition of GES and identification of targets and associated indicators during the second half of 2011 as well following international and national guidelines.
- In Sweden, the responsibility of the implementation of the MSFD will shift from Swedish Environmental Protection Agency (SEPA) to the new Marine and Water Agency (MWA) in Gothenburg by the end of 2010. The environmental monitoring programme for 'Seas and coastal areas' consisting of several sub-programmes will be used for the MSFD descriptors. A detailed analysis of which variables will be used for individual descriptors has not been carried out so far.
- In the Netherlands and the United Kingdom, a first step has been undertaken to identify programmes and/or parameters. The processes in both countries are based on screening of existing programmes for their potential to contribute to the identified EU indicators and MSFD descriptors.

- In the Netherlands, an overview report of existing monitoring activities together with input from technical experts from research institutes and policy experts from the Dutch government (questionnaires and workshops) was used to carry out a quick scan feasibility test at the level of descriptors in the first half of 2010. At a later stage this quick scan was also carried out at the level of indicators with additional input from monitoring experts. The result of this process is a table showing per indicator potential programmes that could deliver to that indicator, including what still needs to be done to make it operational and interpretable.
- The UK used UKDMOS (a searchable meta-database of marine monitoring conducted by UK organisations) to identify programmes and parameters that could provide data and information for the EU indicators for MSFD descriptors. A preliminary analysis was carried out at the level of descriptors in 2008 by expert judgement. Following a better understanding of the descriptors and the Commission Decision on GES, a new approach was taken in November 2010. Parameters measured in the different programmes (approximately 380 terms conform the SeadataNet 'Parameter Discovery Vocabulary (P021)') were mapped to the EU indicators. The outcome of the mapping should be read as 'parameter x has the potential to provide data for indicator y'. The outcome of the mapping is not a final product, but will be followed up by discussions with experts. The strength of the mapping is variable and discussed on the UKDMOS website.

Summary

All countries will use their overviews of existing programmes as a starting point for the identification of potential programmes and/or parameters for identified EU indicators for GES descriptors 1, 2, 4 and 6. Belgium, Denmark, France, Germany, Ireland, Norway, the Azores (Portugal), Spain and Sweden are still working on a process for the actual identification. Challenges mentioned by these countries are the uncertainty about the way the MSFD will be implemented in their country (Germany, Norway, Ireland), (potential) lack of funding (Belgium, Portugal), and lack of guidance offered by the EU indicators (Belgium, Germany, Ireland, Spain, Sweden). A potential challenge may also be that some countries will have to deal with different marine regions and/or sub-regions (e.g. France, Spain, Portugal).

3.2 Identified programmes and/or parameters

The Netherlands and the United Kingdom provided preliminary outcomes of their systematic processes. They both commented that these outcomes should be seen as a first step towards identifying programmes and parameters that may provide data to fulfil monitoring and assessment requirements of the MSFD. The Netherlands presented their outcomes in a table showing which indicators are covered by existing programmes, for which indicators further research or new programmes are needed and which indicators are not relevant for The Netherlands. The UK presented their results as the number of programmes that can be applied to the different EU indicators and descriptors. For an actual description of the programmes and parameters measured under the specific programmes they refer to the UKDMOS website. These outcomes are presented in § 2.10 and 2.11.

Two other countries, Norway and Sweden, provided potential programmes and/or parameters based on national overviews of existing programmes in combination with expert-judgement. Norway indicated which of the existing programmes for coastal waters and the open ocean could be used only for descriptor 1 (see § 2.6). Sweden indicated which parameters of the sub-programmes of the environmental monitoring programme for 'Seas and coastal areas' could be applied to all MSFD descriptors (see § 2.9).

3.3 Overview of accessibility of ecological monitoring metadata

An overview of the accessibility of ecological monitoring metadata in different countries is given in table 3 and is based on the information provided in this inventory.

Table 3. Overview of the accessibility of ecological monitoring metadata

Country	National databases	Content (data)	Internet link	Remarks
Belgium ¹	MUMM database	physical, chemical, biological	http://www.mumm.ac.be/datacentre	Used for international reporting requirements.
	VLIZ database	physical, chemical, biological	Not available on the Internet?	Some overlap with MUMM-database; not used for international reporting requirements
Denmark ¹	Data of the national NOVANA programme on servers of Topic Centres	physical, chemical, biological	Not available on the Internet.	Draft of national NOVANA programme for 2011-2015 only available in Danish.
France ¹	Quadrige 2	physical, chemical, biological	http://www.ifremer.fr/envlit/resultats/surval__1 http://www.ifremer.fr/sismer	Partly accessible; limited biological data.
	Institutional databases for pelagic and benthic species (RNSLM), marine mammals (CRMM) and fish (CEMAGREF)	Biological	Will be accessible via the SINP.	
	National heritage inventory	Biological	http://inpn.mnhn.fr/isb/index.jsp	Data searchable by species, site or designation.
Germany ¹	Marine Monitoring Manual	physical, chemical, biological	http://www.blmponline.de/Seiten/Monitoringhandbuch.htm	Not all summary sheets available in English yet.
Ireland	Database of the Marine Institute	physical, chemical, biological	http://www.marinedataonline.ie	-
Norway	Database of the Norwegian Marine Data Centre	physical, chemical, biological	Not available on the Internet?	-
	Data on seabirds	Biological	http://www.seapop.no	Available in English.
	National algae database (NIVA)	Biological	Not available on the Internet?	-
	Naturbasen database (DN)	Biological	http://www.dirnat.no/content.ap?thisId=500029694	Coastal marine natural habitat mapping.

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Country	National databases	Content (data)	Internet link	Remarks
Portugal	National Information System (SNIRH)	physical, chemical	Snirh.inag.pt	Most of the data for Portugal still stored in local databases
	BarcaWin2000 (B2K)	physical, chemical, biological	http://www.barcaweb.com	Water quality and ecological data of coastal systems throughout the world; most data for Portugal still stored in local databases
Spain	National storage application?	physical, chemical, biological	?	This application should have been developed in 2008.
	Coastal habitats	Biological, physical	http://imspre.mapa.maya.es/costas/visor.html	Selection of available geographical data
	Variable sets of information and shape files related to the marine environment	Biological, chemical, physical	http://mapserver.ieo.es/website/WMS_IEO/viewer.htm http://cepy2/PIPRM	Data managed by respectively IEO and CEDEX
	Spanish inventory of Natural Heritage and Biodiversity	Biological	http://servicios2.marm.es/WmsViewer/html.default.htm	Under development.
Sweden	Database of Swedish EPA	physical, chemical, biological	http://www.naturvardsverket.se/en/In-English/Menu/State-of-the-environment/Environmental-monitoring/Environmental-monitoring-data	Includes all data from the national programme and data from several regional programmes.
The Netherlands ¹	National Oceanographic Data Committee	physical, chemical, biological	http://www.nodc.nl	Work in progress. MWTL data in waterbase.nl
United Kingdom	UKDMOS	physical, chemical, biological	http://www.ukdmos.org	-

¹ These countries participate in the so-called EMODNET pilot project (development of an international biological portal) carried out by Belgium (see <http://bio.emodnet.eu>).

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