11.2.1 OSPAR request on possible way forward with the handling of data and/or statistics, under OSPAR monitoring programmes and for the benefit of OSPAR assessment procedures, from monitoring devices generating large amounts of data

Summary

In relation to handling of data and statistics stemming from monitoring devices generating large amounts of data, OSPAR may make use of already existing catalogues and mechanisms for discovery, access, and assessing data confidence related to eutrophication (CMEMS, EMODnet Physics, and SAHFOS) and ocean acidification (CDIAC). ICES considers these existing coordinated services and programmes to be well structured, robust, and well managed. There is little benefit to OSPAR in replicating these metadata in ICES.

Despite the already extensive data sources (existing and novel monitoring methods) being compiled, there remain many gaps when combining complementary parameters for assessment purposes in, for example, spatial resolution, frequency of sampling, and standardization of sampling methods and/or models. In order to best exploit existing data in the OSPAR common procedure it is essential that a desired end product is identified by the assessment experts (i.e. an indicator and associated target). Once in place, appropriate parameters with specifications on the temporal and spatial resolution can be identified. These technical specifications with a specific assessment end product in mind can then be turned into data products that can be prepared and delivered according to the methodologies recommended by OSPAR experts. In this process novel monitoring method data sources (models, satellite and *in situ* observations) can be exploited directly or used to complement existing monitoring, thus bringing added value to OSPAR assessments. In particular, a coordinated approach to using novel monitoring methods to complement existing monitoring should be a priority at an operational level to address MSFD descriptors D5 (human-induced eutrophication), D7 (hydrographic conditions), and D8 (contaminants). A targeted pilot project could be used develop an initial OSPAR area wide indicator and establish guiding principles for OSPAR on how to best capitalize on data generated from novel monitoring methods, while ensuring interoperability, traceability, and quality assurance that follow common international standards.

Request

ICES is requested to advise whether, 1) There would be benefits and possibilities for Contracting Parties to report summary statistics and key metadata on such datasets to ICES for OSPAR purposes; 2) Whether there are any international mechanisms already in place to discover such datasets and metadata that can inform about the relative confidence Contracting Parties can have in using such data from international data sources; and 3) How OSPAR could address best the traceability of the use of such data under the OSPAR Common Procedure, taking account of the intention of several Contracting Parties to make such datasets part of the data used in the 3rd COMP application.

Elaboration on the response

There are three components to the request which can be summarized as 1) understanding what mechanisms already exist, 2) determining whether any additional mechanisms specific for OSPAR purposes are needed, and 3) advising on how OSPAR can exploit these data in an operational and traceable manner. The primary technical response to the requests relates to the workshop report of the Process service for OSPAR request on handling large amounts of data (Barciela *et al.*, 2015).

1. Existing catalogues and mechanisms for discovery, access, and assessing data confidence

Information on datasets and data model products relevant to the OSPAR Coordinated Environmental Monitoring Programme (CEMP) and pre-CEMP exist in a number of national, European, and international coordinated programmes.

- For eutrophication (CEMP) and related to the Marine Strategy Framework Directive (MSFD) criteria (5.1, 5.2, 5.3), the Copernicus Marine Environmental Monitoring Service (CMEMS) provides core physical and biogeochemical products encompassing the OSPAR areas.

- The European Marine Observation and Data Network – Physics (EMODnet Physics) provides *in situ* data, including chlorophyll *a*, oxygen, temperature, and salinity.

- For the biological indicators of eutrophication (MSFD criterion 5.2), the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) hosts a long time-series of quality assured plankton data covering the North Atlantic.

- For ocean acidification (pre-CEMP), the Carbon Dioxide Analysis Centre (CDIAC) is the global data centre for carbon and pH data.

All of these programmes work within international standards for metadata and interoperability. Qualitative information on the quality assurance and data confidence are readily provided against the datasets, or against the data products derived from these datasets. It should be noted that while in all cases data products are freely licensed and distributable, there are in some cases restrictions on access to the underlying datasets.

2. Benefits in additional mechanisms for OSPAR purposes

ICES considers the existing coordinated services and programmes to be well structured, robust, and well managed. Therefore there is little benefit to OSPAR in replicating these metadata in ICES. For datasets not included in the identified programmes, but considered relevant to CEMP and pre-CEMP by Contracting Parties, ICES already hosts a number of metadata catalogues for describing datasets and data products and services; these could be readily adapted and made available to include such information sources.

3. How these data can be best exploited in the OSPAR common procedure

In all cases the starting point is a description of the desired end product from the assessment experts, for example, chlorophyll concentration trends at a specific spatial (i.e. coastal areas within OSPAR sub-region) and temporal (i.e. MSFD 6-year policy cycle) scales. ICES would therefore recommend an approach that has been developed through experience with the HELCOM eutrophication programme Making HELCOM Eutrophication Assessments Operational (EUTRO-OPER) and also through the exploitation of large-scale operational oceanographic products (Operational Oceanographic Products and Services; OOPS). The description of the end product is then turned into a technical specification for data products that can be prepared and delivered according to the methodologies recommended by the OSPAR experts. The data provider mechanisms offer a technical service and a number of possibilities on how to work with their datasets/data products, which includes existing and novel monitoring methods (models, satellite and *in situ* observations). In order to work effectively with these services a technical and thematic expertise is also needed at the receiving end (i.e. resolving how different data sources can/should be combined to achieve the required assessment product). The ICES Data Centre could provide the conduit between the technical provider of the data product and the OSPAR assessment experts. The final data products would be made available in an operational way, for an agreed assessment process and including all metadata, and could be readily hosted at ICES, or at the Online Data Information and Management System (ODIMS). Such a case is currently being setup for plankton time-series (ratio of large/small copepods) using SAHFOS time-series data within the EMODnet Biology setting to produce products for the North Atlantic for ICES integrated ecosystem assessments.

This would fulfil the demands of the MSFD where assessment units, data confidence, indicator and data methodologies, and clear linkages to data products and underlying data sources are proposed under the common elements for assessment indicators. The OSPAR system would also clearly benefit from allow its experts to focus on defining the appropriate methodologies and criteria for using the various data sources, and letting the technical experts deal with the delivery of these products for their use.

Suggestions

Within the OSPAR region there are large variations in novel monitoring methods (models, satellite and *in situ* observations). They all generate data that can be at different resolutions and quality. These data are often fed into existing international data management programmes. In order to ensure that OSPAR is able to capitalize on these data sources for future assessments ICES recommends the following:

A case study project should be initiated to integrate data from models, satellite, and *in situ* observations with existing monitoring and assessment procedures required under the MSFD Descriptor D5. In addition to producing an operational indicator the pilot project should endeavour to establish guiding principles for the establishment of other potential indicators using novel monitoring methods, while ensuring interoperability, traceability, and quality assurance that follows common international standards. Novel monitoring methods data sources should be used to complement existing monitoring by filling in gaps and bringing added value to assessments. To avoid duplication of effort, the project should draw as much as possible on existing European coordinated programmes (such as the CMEMS and EMODnet).

The ICES Data Centre, as the CEMP data host to OSPAR, can, if requested, provide advice on possible ways to streamline multiple data sources and products, building on ICES experience with reviews of eutrophication and contaminant data flows in the HELCOM monitoring programme (via the Baltic Sea pilot project BALSAM), and with CMEMS in the ICES ecosystem overviews.

Basis of the response

Background provided by the *ad hoc* group

To address the request from OSPAR to "*advise OSPAR on handling large amounts of data from monitoring devices for monitoring and assessment programmes*" ICES organized an *ad hoc* expert group meeting in February 2015 (Barciela *et al.*, 2015).

The *ad hoc* group focused specifically on 1) how to handle large amounts of data and/or statistics, available from old and new monitoring devices; and 2) whether there are any international mechanisms to discover such datasets. One of the tasks of the group was to understand the current and future requirements of OSPAR, what the current monitoring and assessment procedures entail, and identifying perceived gaps. This understanding was based on publicly available documentation acquired via the OSPAR website. These documents were: OSPAR Eutrophication Monitoring Programme; OSPAR CEMP (Coordinated Environmental Monitoring Programme); and Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area.

OSPAR CEMP identifies basic parameters for the assessment of eutrophication of maritime waters as relating either to nutrient enrichment or relating to indirect or biological effects of eutrophication. For nutrient enrichment the basic parameters are: temperature, salinity, and dissolved inorganic nutrients [eg. NH4+ (ammonium), NO2− (nitrite), NO3− (nitrate), PO4+ (phosphate), and silicate (SiO4+)]. The parameters for direct and indirect effects are: phytoplankton chlorophyll *a*, phytoplankton indicator species and species composition, macrophytes, O_2 (oxygen concentration), and benthic communities and group of indicator species. In addition, pH was included as a parameter for ocean acidification. Much of this data can be acquired from existing international programmes (e.g. CMEMS and EMODnet) that develop models, standard metrics, and quality standards. These programmes routinely generate many of the parameters required by OSPAR, such as dissolved nutrients (nitrate or N, phosphate or P, and silicate or Si), total dissolved nutrients (N, P, and Si), riverine nutrient discharges (N, P, and Si), oxygen, temperature, salinity, and chlorophyll. Several other OSPAR parameters, such as ammonium (NH4+), pH, and phytoplankton functional types (PFTs, a proxy for species composition) are routinely calculated by the models but are currently not served as products because there is no explicit requirement for them. In addition to traditional *in situ* measurements and satellite observing networks, complementary information can also be generated by models that enable gaps to be filled in time and space, thus providing a more complete picture of the state of the marine environment. Novel *in situ* observation techniques have also been developed for platforms such as gliders, HF Radars, Argo

floats, Ferrybox, drifting buoys, and fixed moorings. These can provide complementary time-series for parameters relevant for OSPAR. ICES is well equiped to coordinate data flows from multiple sources and provide delivery mechanisms for OSPAR-tailored assessment products with regard to, for example, eutrophication and ocean acidification. Similar products are currently being operationalized together with HELCOM for eutrophication assessments, as well as for ICES ecosystem overviews that utilize Copernicus Marine Environmental Monitoring Service (CMEMS) products.

Main findings of *ad hoc* group

The group identified the basic parameters of interest to OSPAR and concluded that a large number of the parameters required by OSPAR for their monitoring and assessment procedures are routinely available from European coordinated programmes, such as the CMEMS and EMODnet. The group concluded that the momentum gathered from these internationally coordinated activities provide an unprecedented complementary resource of model data, as well as *in situ* and satellite observations. The group furthermore concluded that the OSPAR requirements are not unique as they overlap with many other statutory and European regulatory obligations (such as, for example, MSFD, WFD, among others). For this reason, the *ad hoc* group considered it highly desirable that a list of common parameters (linked to specific indicators and targets) is agreed. This would better ensure that targeted approaches can be developed to extract maximum information from integrated operational modelling and observational systems. In particular, a coordinated approach to complement existing monitoring with novel monitoring methods will be required at an operational level to address MSFD descriptors D5 (human-induced eutrophication), D7 (hydrographic conditions), and D8 (contaminants).

Sources and references

ICES. 2014. Call for Operational Oceanographic Products and Services (OOPS), 14 May 2014, Copenhagen, Denmark. http://www.ices.dk/news-and-events/news-archive/news/Pages/Call-for-Operational-Oceanographic-Products-and-Services.aspx

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