EMODnet MedSea Checkpoint
Data Adequacy Report

http://www.emodnet-mediterranean.eu/
GROWTH AND INNOVATION IN OCEAN ECONOMY – GAPS AND PRIORITIES IN SEA BASIN OBSERVATION AND DATA

First Data Adequacy Report
EMODNET MedSea CheckPoint

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<table>
<thead>
<tr>
<th>Workpackage</th>
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<th>11.2 Final version of the First Data Adequacy Report</th>
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Table of Contents

EXECUTIVE SUMMARY ......................................................................................................................... 6

1 INTRODUCTION .................................................................................................................................. 8
  1.1 STRUCTURE OF THE DOCUMENT ................................................................................................. 10

2 CHECKPOINT ASSESSMENT METHODOLOGY ................................................................................... 11

3 THE CHECKPOINT METADATABASE ................................................................................................. 12
  3.1 VOCABULARIES ............................................................................................................................. 15

4 THE UPDATED LITERATURE SURVEY RESULTS .............................................................................. 16

5 CHECKPOINT INDICATOR DEFINITIONS ......................................................................................... 18
  5.1 THE SMART METHODOLOGY ........................................................................................................ 18

6 AVAILABILITY INDICATORS ............................................................................................................... 20
  6.1 VISIBILITY INDICATORS ................................................................................................................ 20
  6.2 ACCESSIBILITY INDICATORS ....................................................................................................... 22
  6.3 PERFORMANCE INDICATORS ....................................................................................................... 25
  6.4 SUMMARY OF INDICATORS ........................................................................................................ 26

7 INDICATOR RESULTS FOR ALL CHALLENGES .................................................................................. 27

8 THE INDICATORS RESULTS: OIL PLATFORM LEAK CHALLENGE ..................................................... 32
  8.1 AVAILABILITY – VISIBILITY INDICATORS .................................................................................... 34
  8.2 AVAILABILITY – ACCESSIBILITY INDICATORS .......................................................................... 36
  8.3 AVAILABILITY – PERFORMANCE INDICATOR AND SYNTHESIS ............................................. 37

9 SUMMARY OF THE LESSONS LEARNED BY EACH CHALLENGE .................................................... 38

10 DISCUSSION AND CONCLUSIONS ................................................................................................. 41

11 ANNEX 1 METADATA FORMAT AND MODEL .................................................................................. 44

12 ANNEX 2 LIST OF CHARACTERISTICS AS A FUNCTION OF CHALLENGE AND NUMBER OF DATA SOURCES ......................................................................................................................... 46

13 ANNEX 3 DATA SOURCES FOR THE 298 UPSTREAM DATA IDENTIFIED BY THE CHALLENGES .......... 49

14 ANNEX 4 NOMENCLATURE .............................................................................................................. 52
Growth and innovation in ocean economy
Gaps and priorities in sea basin observation and data

Glossary

BODC: British Oceanographic Data Centre
CFP: Common Fisheries Policy
Chl: Chlorophyll
CLS: Collecte Localisation Satellites (FR)
CLU: CLU s.r.l. (IT)
CMCC: Euro-Mediterranean Centre for Climate Change (IT)
CNR: National Research Council (IT)
Copernicus: European Programme for the establishment of a European capacity for Earth Observation
CSW: Catalogue Service for the Web
CYCOFOS: Cyprus Coastal Ocean Forecasting and Observing System
DAC: Data Assembly Center
DAR: Data Adequacy Report
DCR: Data Collection Regulation
DCF: Data Collection Framework
DG-MARE: Directorate-General for Maritime Affairs and Fisheries
EC: European Commission
ECMWF: European Centre for Medium-Range Weather Forecasts
ECV: Essential Climate Variables
EDF-EN: EDF Energies Nouvelles (FR)
EDMED: European Directory of Marine Environmental Data
EEA: European Environmental Agency
EEC: European Economic Community
EEZs: Exclusive Economic Zones
EIONet: European Environment Information and Observation Network
EMODnet: European Marine Observation and Data Network
EMSA: European Maritime Safety Agency
ESA: European Space Agency
EU: European Union
EUMETNET: European National Meteorological Services
EUNIS: European Nature Information System
EUROGOOS: European Global Ocean Observing System
FAO: Food and Agriculture Organization
FP7: Seventh Framework Programme
Growth and innovation in ocean economy

Gaps and priorities in sea basin observation and data

GBECO: General Bathymetric Chart of the Oceans
GES: Good Environmental Status
GEO: Group on Earth Observation
Geoportal: type of web portal used to find and access geographical information
GEOSS: Global Earth Observation System of Systems
GIS: Geographic information system
GMES: Global Monitoring for Environment and Security
GNOO: National Group for Operational Oceanography
GOOS: Global Ocean Observing System
HCMR: Hellenic Centre for Marine Research (GR)
HO: Hydrostatic Office
ICES: International Council for the Exploration of the Sea
ICCAT: International Commission for the Conservation of Atlantic Tunas
ICZM: Integrated Coastal Zone Management
IEO: Instituto Español de Oceanografía
IFREMER: Institut Français de Recherche pour l'Exploitation de la Mer (FR)
IH-Cantabria: Fundación Instituto de Hidráulica Ambiental de Cantabria (ES)
IHO: International Hydrographic Organization
IMEDEA: Mediterranean Advanced Studies Institute
IMO: International Maritime Organization
INGV: National Institute of Geophysics and Volcanology (IT)
INSPIRE: Infrastructure for Spatial Information in the European Community
IOC: Intergovernmental Oceanographic Commission
IPCC: Intergovernmental Panel on Climate Change
ISAC: Institute of Atmospheric Sciences and Climate
ISCOMAR: Isleña Marítima de Contenedores
ISO: International Organization for Standardization
ISPRA: Italian National Protection Agency
JCOMM: Joint WMO-IOC Commission on Marine Meteorology
JRC: Joint Research Centre
MAP: Mediterranean Action Plan
MS: Member States
MSP: Maritime Spatial Planning
MSSD: Mediterranean Strategy for Sustainable Development
NRT: Near Real Time
Growth and innovation in ocean economy
Gaps and priorities in sea basin observation and data

NKUA: National and Kapodistrian University of Athens
OSSE: Observing System Simulation Experiments
OSE: Observing System Experiment
P01: BODC Parameter Usage Vocabulary
P02: SeaDataNet Parameter Discovery Vocabulary
P03: SeaDataNet Agreed Parameter Groups
SHOM: Service hydrographique et océanographique de la marine
SOCIB: Balearic Islands Coastal Observing and Forecasting System (ES)
UCY: University of Cyprus (CY)
UN: United Nations
UNEP: United Nations Environment Programme
UNESCO: United Nations Educational, Scientific and Cultural Organization
VLIZ: Flanders Marine Institute
WISE: Water Information System for Europe
WFD: Water Framework Directive
WMO: World Meteorological Organisation
WMOP: SOCIB Western Mediterranean Sea Operational forecasting system
WWF: World Wildlife Fund
Executive Summary

EMODnet MedSea CheckPoint aims to document the quality assessment of the existing monitoring system at the sea basin level, by developing fitness-for-use indicators to show the appropriateness and availability of monitoring data for the production of Challenge targeted products. There are seven Challenges: Wind Farm Siting (CH1), Marine Protected Areas (CH2), Oil spill Platform Leaks (CH3), Climate and Coastal Protection (CH4), Fisheries (CH5), Marine Environment (CH6) and Rivers (CH7). The assessment will help identify gaps and prioritize the needs in order to optimize the system throughout the value chain (i.e. data collection, in situ and satellite data assembling, data management and networking, modelling and forecasting, geo-infrastructure) and release recommendations for future developments to better meet the application requirements.

This first Data Adequacy Report reviews the methodology used in the MedSea CheckPoint to construct the metadatabase, and develop the indicators for a selected number of assessment criteria. The indicators were defined on the basis of existing ISO standards and they are constructed directly on the metadatabase containing information on the upstream data sources (monitoring datasets). For each Challenge, CheckPoint Information on What, Why, Where, When, How data will be used to develop targeted products. The information is organised into a metadatabase which currently contains 298 data source descriptors.

On the basis of this metadatabase, the Literature Survey results were reviewed. It was confirmed that 45 Characteristics (variables derived from observations or models and/or the geographical representation of an object) are needed for the seven Challenges and 126 data providers would be required by the Challenges in order to develop the targeted products. This already highlights the importance of the MedSea CheckPoint portal for collecting and organizing the information on complex and distributed data source networks that are required to derive the Challenge products. GIS technology is used to organize all this information into a metadatabase and make it available to DGMARE and the public.

The assessment criteria are subdivided into two territories: appropriateness and availability. Only availability is described in the first DAR since most of the Challenge products have not yet been developed and thus appropriateness cannot be defined properly. The availability investigates “how the input data sets are made available to the Challenge use” and 8 indicators have been developed from the metadatabase. From this first analysis and without differentiating between the Challenges, only four indicators were assessed from which the following emerged: 1) the majority of the data
sets are accessible through an online delivery service (not always fully Inspire compliant), 2) the data policy is partially restricted; 3) most of the data are free of charge, and 4) the responsiveness in terms of data delivery time is generally high. These results will be modified when a thematic or single Challenge analysis is carried out. For example, CH1 (Wind farming) data are available but have to be purchased, and CH5 (Fisheries) data responsiveness is low (more than a week to access the data).

For CH3 (Oil Spill Leak Platform) all the eight availability indicators have been estimated. The results show that the indicators have mostly positive and very positive values except for data policy visibility and the data policy itself which is limited by moratorium and/or specific agreements.

In conclusion, this first DAR highlights that it is possible to develop objective indicators of fitness for use for the input data sets to the Challenges. The next step will be to discuss thematic indicators together with Challenge indicators and enlarge the indicator set to the appropriateness territory.
1 Introduction

The EMODnet CheckPoints, a concept first conceived in the EC Marine Knowledge 2020 Communication, were set up to assess the quality and fitness for use of basin-scale monitoring systems in support of targeted applications, also called 'Challenges', i.e.: CH1- Windfarm Siting, CH2- Marine Protected Areas, CH3- Oil Platform Leak, CH4- Climate and Coastal Protection, CH5- Fisheries Management, CH6- Marine Environment, CH7- River Inputs.

The primary aims of CheckPoints are to:
1) document the appropriateness and availability of the existing monitoring system at the sea basin level;
2) develop fitness-for-use indicators to show the performance, accessibility and usability of monitoring data for the production of Challenge targeted products;
3) identify gaps and prioritize the needs in order to optimize the system throughout the value chain (i.e. data collection, in situ and satellite data assembling, data management and networking, modelling and forecasting, geo-infrastructure) and release recommendations for future developments to better meet the application requirements.

Two Data Adequacy Reports (DARs) need to be produced by the MedSea CheckPoint project, containing the major assessment findings. This report documents the first DAR, building on the definitions and the methodology described in the literature survey [Ref1].

In this report 'data' is defined as a 'reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing’ (ISO 19115). The ISO 19157 standards and additional criteria were used to define the metadata specification for the CheckPoint data inventory.

Data adequacy can be defined as the fitness for use of the data for a particular user or for a variety of users. Since different applications require different properties associated with the data itself, 'adequacy' should be defined objectively using standardized nomenclature and methods.

1 Ref1: Literature Survey available at https://webgate.ec.europa.eu/maritimeforum/node/3646
In an EC Report [Ref2] adequacy was intended as an assessment of reported information to meet the objectives of the Marine Strategy Framework Directive (MSFD) and its technical requirements listed in MSFD Articles 8, 9 and 10 [Ref3].

Adequacy can be defined as ‘sufficient to satisfy a requirement or meet a need’ [Ref4]. From this definition, ‘adequacy’ relates to meeting both requirements as well as needs and is normally applied within the framework of an ISO 9001 based Quality Management System.

ISO/TC 211 (International Organisation for Standardisation / Technical Committee No. 211) provides a series of standards that deal with various aspects of geographical information / geomatics, which include ISO 19157 Data Quality and ISO 19115:2003 Metadata. ISO 19157 standards introduce a new element for assessing ‘how’ and ‘how much’ data meets requirements in order to enhance user satisfaction.

In this report, both the data and literature are components of the ‘Universe of Discourse’ defined as a ‘view of the real or hypothetical world that includes everything of interest’ (ISO 19101). The concept behind the universe of discourse is shown in Figure 1.1.

The quality standard principles not only provide the concept of data quality, but also standardize the names and schemes under which all dataset differences and the corresponding universe of discourse can be categorized. The elements and sub-elements, as described in ISO 19113, are discussed in the Literature Survey, and will not be presented again here.

---


3 Ref3: Adequacy does not necessarily mean, for instance, that if the defined data is adequate, this automatically means that the quality of the marine waters is acceptable

1.1 Structure of the document

The report is subdivided in three parts:

1) the first (§ 2 - 4) reviews the CheckPoint methodology and metadata definitions and presents the updated Literature Survey results.

2) the second part describes the indicator definitions (§5-6);

3) the third part shows the fitness for use assessment using only the availability assessment indicators (§7-8-9).

Discussion and conclusions (§10) conclude the document.

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2 CheckPoint assessment methodology

The overall aim of EMODnet CheckPoints is to assess the fitness for use or adequacy of the existing monitoring system at the sea basin level in terms of the Challenge targeted products. This involves the development of CheckPoint Information on upstream data and a CheckPoint Service to perform the assessment and make it available. In the Literature Survey, the basic assessment methodology was specified as the:

- Establishment of a framework for collection of information related to input data sets required by the Challenges. The end product of this framework is the production of a metadatabase or CheckPoint information database;
- Definition of objective assessment criteria for the production of ‘adequacy’ indicators;
- Analysis of the fitness for use of the input datasets with respect to specific Challenge targeted products.

The assessment criteria are subdivided into two ‘Territories’ that need to be evaluated in terms of Challenge requirements. They are:

<table>
<thead>
<tr>
<th>Territory 1: Appropriateness</th>
<th>Territory 2: Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What</strong> is made available to the Challenges and what the inherent properties of such data sets are</td>
<td><strong>How</strong> the input data sets are made available to users</td>
</tr>
</tbody>
</table>

The ‘fitness for use’ or ‘adequacy’ is established with indicators based on these two assessment criteria. Territory criteria provide the degree of conformity of data to the Challenge requirements and needs. Table 2.1 lists the assessment elements of the two Territories.
Table 2.1 Appropriateness and Availability assessment criteria

Data Adequacy in EMODnet MedSea CheckPoint will be assessed in two tiers. The first DAR will analyze the 'Availability' territory for each Challenge input data sets. Here each of the Challenges is considered as an 'autonomous universe of discourse', with its own specific input data. Adequacy assessments will be based on the transformation of the input metadata into an ordered set of indicators.

The second report will consider the links between the different Challenges and use indicators for the 'appropriateness' territory.

3 The CheckPoint metadatabase

As part of the Literature Survey, metadata were collected and analyzed for upstream data classification, an iterative process that was consolidated for the first DAR.

The Literature Survey introduced the classification of upstream data for the Challenges in terms of “characteristics” and “environmental matrices”. A “characteristic” is a distinguishing feature which refers:
- either to a variable derived from the observation, the measurement or the
numerical model output of a phenomenon or of an object property in the environment

- or to the geographical representation of an object on a map (i.e. a layer such as a protected area, a coastline or wreck) by a set of vectors (polygon, curve, point) or a raster (a spatial data model that defines space as an array of equally sized cells such as a grid or an image).

The concept of environmental matrices is introduced to avoid ambiguities when using a characteristic name such as "temperature". The environment matrix is the environment to which a characteristic is defined and its elements are:

1. Air
2. Marine Waters
3. Fresh Waters
4. Biotas/Biology
5. Seabed
6. Human activities

The CheckPoint database contains the metadata that link the different sources of upstream data to the characteristics required by the Challenges. The Metadata format and model is explained in Annex 1.

The Consortium decided to use the GIS technology called ‘Sextant’[Ref 6]⁶ to store the information on the upstream data sets and the targeted products for the Challenges, when they are available. Sextant provides access to various geographical data via web services using standards defined by the Open Geospatial Consortium (OGC) and the ISO Technical Committee ISO/TC 211, Geographic information/Geomatics. Sextant uses Geonetwork to set up the Catalogue Services for the Web and is used by several EU projects such as EMODnet, MyOcean, SeaDataNet.

For the purpose of the EMODnet Medsea CheckPoint, Sextant is used to describe the upstream data and to handle the information needed for the establishment of the fitness for use indicators. In order to classify the data sources and providers, the Sextant monitoring data catalogue will use the SeaDataNet Common Vocabularies

⁶ Ref6: http://www.ifremer.fr/sextant
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Gaps and priorities in sea basin observation and data

(http://www.seadatanet.org/), the European Directory of Marine Organisations (EDMO), the European Directory of Marine Environmental Research Projects (EDMERP).

The CheckPoint metadatabase contains information describing input data to the Challenges that are uniquely identified as a combination of characteristics, dataset and use, i.e.:

1. Characteristics (= What)
2. Data sources (= From)
3. Overview (= Why for)
4. Spatial coverage (= Where)
5. Time coverage (= When)
6. Accessibility (= How)

These descriptors make up the elements of the territory assessment criteria previously described in Section 2.

The metadatabase is enabled by a dedicated CSW technology based on an ISO XML schema embedding:

- ISO 19115/139 for contextual metadata – classical reference, for catalogue
- ISO 19157 for CheckPoint indicators – such as fitness for purpose and “used by” any application (use cases).

In the Literature Survey the following ISO standards were analyzed to construct the metadata base which helps in constructing ‘adequacy’ indicators:

1. ISO/NP (New Proposal) 19157 Geographic information -- Data quality
2. ISO/NP TS (Technical Specification) 19158 Geographic information - Quality assurance of data supply

The metadatabase is built with a well-defined process to edit, validate and consolidate its content. The metadatabase will be visible and accessible through three interfaces:

- **CheckPoint Browser** –
  A public access function to search and explore the input datasets and the Challenge products;
- **CheckPoint GIS** –
A function under public and restricted access to visualize and manage CheckPoint input datasets and the Challenge products;

- **CheckPoint Dashboard** –
  A function under restricted access to compute and visualise indicators, directly built from metadatabase descriptors.

### 3.1 Vocabularies

Data curation and interoperability is possible only if common vocabularies are used. The same variable sometimes has different names depending on the repositories or the applications. Common vocabularies have been developed in many international initiatives, such as GEMET (promoted by INSPIRE as a multilingual thesaurus), UNIDATA, SeaDataNet, and the Marine Metadata Initiative (MMI).

When a vocabulary is formally managed, it becomes a controlled vocabulary. In this case, "managed" means the terms are stored and maintained using agreed-upon procedures. Procedures should exist for adding terms, modifying terms and, more rarely, rejecting terms from a controlled vocabulary.

The SeaDataNet is a controlled vocabulary containing terms that are:

1. **Accepted**: Each term adheres to community practices.
2. **Defined**: The terms are characterized precisely. Typically, this means the terms have rigorous definitions.
3. **Managed**: There is a body of experts that create and maintain the controlled vocabulary. The controlled vocabulary maintenance involves periodic review, addition of new terms, modification of terms, and occasionally the deprecation of terms.

MedSea CheckPoint decided to use the SeaDataNet Vocabulary that adopts a hierarchical approach for the classification of terms, from disciplines (P03), to parameter discovery (P02), to parameter usage (P01). This hierarchy goes from a coarser to a finer classification of a given dataset.
4 The updated literature survey results

Here we present some of the statistics obtained from the consolidated metadatabase, validated after the Literature Survey. The latter has already presented results related to input data sources for the Challenges, however the metadatabase had not been built at the time, and several iterations took place afterwards to consolidate the content and find mistakes, a process that is still ongoing and will continue until the second DAR.

At present, there are 298 data sets in the MedSea CheckPoint metadatabase. Figure 4.1 shows the number of data sets required by each Challenge.

![Figure 4.1 Number of data sets for each Challenge (total is 298)](image)

The Challenge characteristics consider three kinds of upstream data:

- variables that result from the observation of a property of an object or of a phenomenon at a given place and time;
- gridded outputs from numerical models in given areas and times;
- map layers representing the geographical features (position and geometry) of natural or man-made objects such as extent of land use, protected areas, coastline or locations of wrecks defined by a set of vectors (polygon, curve, point) or by a raster.

To date there are 45 characteristics considered for all CheckPoint Challenges.
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Figure 4.2 shows the number of characteristics required by each challenge as a function of the environmental matrix.

The list of the **298** input data sets, associated with the **45** characteristics is provided in Annex 2.

Figure 4.2 Number of characteristics by challenge and matrix

The **298** data sets are associated with **126** data providers or sources that were selected by the project experts to be the desirable upstream data inputs to the Challenges. The term data provider is used here both as a single data “producer” and a “project consortium” producer (i.e. MyOcean, Medess4MS). This creates some confusion or at least entails checking whether the accessibility evaluation is related to the producer of data or to the project providing data. The next release of Sextant will offer the possibility of adding the producer to avoid confusion.

It should be noted that the same characteristic is required by the different Challenges from different data providers. The list of **126** potential data sources is provided in Annex 3. Table 4.1 shows the categories of potential data sources, subdivided into six, broad categories.

<table>
<thead>
<tr>
<th>EU project, initiatives, ..</th>
<th>Environ. Bodies</th>
<th>National Data Centres</th>
<th>Academia, Research Centres</th>
<th>Space and Meteo Agencies</th>
<th>UN bodies and MAP RACs</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>38</td>
<td>7</td>
<td>42</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 4.1. Number of data sources (total 126) for broad categories (details are in Annex 3)
5 CheckPoint indicator definitions

We define ‘fitness for use’ criteria as the weighted sum of Territory 1 and Territory 2 assessment elements which are considered the most relevant for the use by the Challenge. The degree of fitness for use of a dataset is represented by a series of indicators which are the result of the comparison of the value of the selected criteria with the user requirements (e.g., the horizontal accuracy of the data set either described in the producer metadata or measured by the user himself).

The present DAR concentrates only on the ‘availability’ indicators since as yet we do not have the Challenge products and thus it is impossible to extract the ‘appropriateness’ indicators. In the second DAR, Challenge targeted products will be available and final fitness for use indicators will be developed.

In order to provide an objective evaluation method, a ranking system needs to be developed for each assessment criteria. The indicator methodology is illustrated in Figure 5.1.

WHAT ARE CHECKPOINT INDICATORS?

Two basic assessment Criteria or “territories”

Fitness for use
- or - Adequacy

CHECKPOINT INDICATORS
Scale to be adopted

inadequate
partially adequate
totally adequate
not relevant

METADATA AND ANALYSIS TOOLS

Figure 5.1 The two territory assessment criteria and the indicators

5.1 The SMART methodology

In the DAR, the availability indicators will be built using the ISO19157 methodology and according to the principles of ‘SMART’ methodology outlined in table 5.1.
### SMART method for indicators definition

<table>
<thead>
<tr>
<th>Letter</th>
<th>Value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Significant – Specific</td>
<td>The indicator should be significant but specific. Details for a quick understanding of the indicator should be provided so that there is no ambiguity as to what exactly the indicator stresses.</td>
</tr>
<tr>
<td>M</td>
<td>Measurable – Meaningful</td>
<td>Indicators should be measurable and quantifiable. Indicators should also measure progress, so the change can be seen as it occurs. A measurable goal for an indicator is that it can be assessed either on a sliding scale (1-10), or as a success or failure.</td>
</tr>
<tr>
<td>A</td>
<td>Achievable – Attainable</td>
<td>An achievable goal for an indicator means that it is valid given the current social, economic, or cultural resources and time available. It is action-oriented, easily attributed for the purpose of the assessment of marine data at the scale and perimeter of the MedSea CheckPoint project.</td>
</tr>
</tbody>
</table>
| R      | Realistic – Reliable | All indicators should be realistic and reliable, that is:  
- Feasible:  
- Explained (i.e. the reason for)  
- Reproducible: Because monitoring characteristics are changing and improving every day, it is important to envisage as much automatic computing as possible. Some CheckPoint indicator computations will be integrated or connected with the Web-GIS tools in order to dynamically update the CheckPoint information. |
| T      | Time-Bound – Temporal aspects defined | Setting a timeframe for the indicator goals enables assessments to be tracked and adjusted over time. Temporal aspects will cover:  
- First date of value  
- Update frequency  
- Action list: working methods and how to improve the indicator value |

Table 5.1: The principles of ‘SMART’ methodology

Indicators provide both an overview of the situation at a high level of aggregation as well as detailed information about trends and links. The challenge (in the indicator definition) is to find an appropriate balance between simplification and completeness. Indicators offer a unique and objective way to assess a problem.
without accessing directly all the metadata.

The indicators are built from descriptors in several stages. In this DAR we build the indicators from the raw descriptors without prior aggregation of the information by the Challenges, releasing a neutral and basic status of indicators. The indicators of the first DAR will be time-bound and will be updated every six months up to the second DAR. In the next section we describe the indicators for the availability criteria.

6 Availability indicators

In MedSea CheckPoint ‘availability’ measures the degree to which datasets are ready for use and obtainable. To obtain datasets, information is needed on the sources (visibility), how to access them (accessibility), and how fast the process is to take possession of them (performance).

The availability indicators (AV) provide an understanding of the readiness and service performance of the infrastructure providing access to data. The availability indicators are divided into three parts:

1) Visibility (VI), i.e. the possibility of identifying and quickly accessing the appropriate site for the required data sets;
2) Accessibility (AC) i.e. the possibility, for non expert users, to understand the retrieval model status;
3) Performance (PE) i.e. the ability of a system to keep operating over time and to meet real time operational conditions. This is related to service performance.

6.1 Visibility indicators

“Visibility” is the ability to identify and quickly access the appropriate site delivering the desired data sets. In other words it is the ability for all users, including non-experts, to perform data sourcing through an EU Inspire catalogue.
Two indicators have been defined for the visibility element, i.e.:

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Meaning (INSPIRE)</th>
<th>Meaningful (Symbol)</th>
<th>Achievable &amp; Realistic (Choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-VI-1</td>
<td>Easily found</td>
<td></td>
<td>Choice 1: Red</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Cited in peer reviewed paper or grey literature but no info on how to access&quot;</td>
</tr>
<tr>
<td>AV-VI-2</td>
<td>EU Inspire catalogue service</td>
<td></td>
<td>Choice 2 : Red</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Information retrieved upon specific request to the data source &quot;</td>
</tr>
</tbody>
</table>

The methodology used to compute the visibility indicators for the first DAR is explained in Table 6.1.

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Meaning (INSPIRE)</th>
<th>Meaningful (Symbol)</th>
<th>Achievable &amp; Realistic (Choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-VI-1</td>
<td>Easily found</td>
<td></td>
<td>Choice 1: Red</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Cited in peer reviewed paper or grey literature but no info on how to access&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 2 : Red</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Information retrieved upon specific request to the data source &quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 3: Yellow</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Use of social network, community of practices sharing information, portals of organization where no search is organized by an engine&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 4: Green</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Use of open search engines, searching by name either the data source or the characteristics&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 5: Green</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&quot;Search via reference catalogue (e.g. MyOcean, GEOSS Geoportal...)&quot;</td>
</tr>
</tbody>
</table>

Note1: advanced services, but not following the guidelines defined in INSPIRE and its technical annexes.
Table 6.1 Definitions of Visibility Indicator Values

6.2 Accessibility indicators

Accessibility is the ability for all users, including non-experts, to understand the retrieval model status and its appropriateness.

There are five indicators devised for accessibility:

<table>
<thead>
<tr>
<th>AV-AC-1 Policy visibility</th>
<th>Visibility on data policy adopted by data providers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-AC-2 Delivery</td>
<td>Data delivery mechanisms, i.e. the services available to the user to access data</td>
</tr>
<tr>
<td>AV-AC-3 Data Policy</td>
<td>Data policy</td>
</tr>
<tr>
<td>AV-AC-4 Pricing</td>
<td>Cost basis / price policy</td>
</tr>
<tr>
<td>AV-AC-5 Readiness</td>
<td>Format for use</td>
</tr>
</tbody>
</table>

The methodology used to compute the accessibility indicators for the first DAR is explained in Table 6.2.
### Growth and innovation in ocean economy

**Gaps and priorities in sea basin observation and data**

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Meaning (INSPIRE)</th>
<th>Meaningful (Symbol)</th>
<th>Achievable &amp; Realistic (Choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AV-AC-1</strong> Policy visibility</td>
<td>The indicator comments on the information given about the data policy adopted by data providers</td>
<td>Low transparency</td>
<td>Choice 1: Red “There is no information at all on data policy adopted by data providers”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium transparency</td>
<td>Choice 2: Yellow “There is information, but details are available only on request”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High transparency</td>
<td>Choice 3: Green “There is detailed information provided to understand data policy”</td>
</tr>
<tr>
<td></td>
<td>Part B 8.1 and 8.2 of INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AV-AC-2</strong> Delivery mechanism</td>
<td>The indicator reports the type of services available to the user to access data</td>
<td>No information</td>
<td>Choice 1: Red “No information was found on data delivery mechanisms”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manual</td>
<td>Choice 2: Red “Order form/invoice is requested”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Partial Inspire function</td>
<td>Choice 3: Yellow “Online downloading services”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full Inspire function</td>
<td>Choice 4: Green “Online discovery and downloading services”</td>
</tr>
</tbody>
</table>
### AV-AC-3: Data Policy

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Policy</td>
<td>The indicator comments on the status of information given for data policy</td>
<td></td>
</tr>
</tbody>
</table>

Part B 8.2 of INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119

- **Unrestricted**: Not documented
- **Restricted**: Partially restricted
- **Not documented**: Choice 1: Red "Not or not well documented"
- **Restricted**: Choice 2: Red "Restricted"
- **Accessible under moratorium** (Ref. 8): Choice 3: Yellow "Accessible under moratorium" (Ref. 8)
- **Open and Free, No charge**: Choice 4: Green "Unrestricted"

### AV-AC-4: Pricing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing</td>
<td>The indicator comments on the provision of information related to cost basis</td>
<td></td>
</tr>
</tbody>
</table>


- **Free**: Not documented
- **Commercial cost**: Commercial cost charge
- **Distribution charge**: Choice 3: Yellow "Distribution charge"
- **Collection charge**: "Free of charge for academic institutions and uses"
- **Open and Free, No charge**: Choice 4: Green "Open and Free, No charge"

### AV-AC-5: Readiness

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readiness</td>
<td>The indicator comments on the information given for distribution format</td>
<td></td>
</tr>
</tbody>
</table>

(Optional in INSPIRE)

- **Not ready to be consumed**: Not documented
- **Proprietary and not well documented**: Choice 2: Red "Proprietary and not well documented"

---

8 Ref 8: Moratorium is defined in SeaDataNet: data are initially restricted, but the conditions relax for academic or unrestricted access once a specified period of time after an event has elapsed (such as collection, publication, completion of QC procedures or project cessation).
6.3 Performance indicators

The performance indicators indicate the ability of a system to keep operating over time and to meet real-time operational conditions. It is related to service performance. Only one indicator is defined for performance:

<table>
<thead>
<tr>
<th>AV-PE-1</th>
<th>Responsiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>How responsive is the delivery service for the available data?</td>
</tr>
</tbody>
</table>

The methodology used to compute the performance indicator for the first DAR is described in Table 6.3.
### Table 6.3 Definitions of Responsiveness Indicators

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Meaning (INSPIRE)</th>
<th>Meaningful (Symbol)</th>
<th>Achievable &amp; Realistic (Choice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-PE-1</td>
<td>The indicator comments on the information given for the timeliness or ability to process a request in a deterministic and acceptable amount of time</td>
<td>Low response</td>
<td>Choice 1: Red &quot;No information is found on response time&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 2: Red &quot;More than 1 week for release&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medium response</td>
<td>Choice 3: Yellow &quot;Less or equal to 1 week for release&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Choice 4: Green &quot;Online downloading (i.e. a few hours or less) for release&quot;</td>
</tr>
</tbody>
</table>

#### 6.4 Summary of indicators

In summary, the eight availability indicators are:

<table>
<thead>
<tr>
<th>Indicator name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-VI-1</td>
<td>Can the data sets or series of data sets be found easily?</td>
</tr>
<tr>
<td>AV-VI-2</td>
<td>Is the service catalogue EU Inspire compliant?</td>
</tr>
<tr>
<td>AV-AC-1</td>
<td>Visibility on data policy adopted by data providers.</td>
</tr>
<tr>
<td>AV-AC-2</td>
<td>Data delivery mechanisms</td>
</tr>
<tr>
<td>AV-AC-3</td>
<td>Data policy</td>
</tr>
<tr>
<td>AV-AC-4</td>
<td>Cost basis / price policy</td>
</tr>
<tr>
<td>AV-AC-5</td>
<td>Format for use</td>
</tr>
<tr>
<td>AV-PE-1</td>
<td>How responsive is the delivery service for the available data?</td>
</tr>
</tbody>
</table>
To facilitate the reproducibility of the indicator and other CheckPoint processes, an automated process was set-up to compute indicators from descriptors, which is directly accessible from the CheckPoint Dashboard (not yet available on-line). Indicators can be presented by challenge or for all challenges together (Fig. 6.1).

Fig 6.1 AV-AC-3 - Variability of Data Policy as described by Challenge 3 (upper panel) or all challenges together (lower panel) as will be available from the CheckPoint Dashboard

7 Indicator results for all Challenges

The indicators are still being built, and only the indicators that have enough information in the metadatabase at this point are presented for all Challenges, i.e. AV-AC-2, AV-AC-3, AV-AC-4 and AV-PE-1. At present, no visibility indicators can be extracted from the database because of missing information. For Oil spill platform leaks, all availability indicators can be evaluated and will be presented in
the next section.

For AV-AC-2 the results are reported in Fig. 7.1 and Table 7.1

![Bar chart](image)

Fig. 7.1 AV-AC-2 Indicator on quality of delivery mechanisms as a function of indicator values and for all Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>No information</th>
<th>Order form</th>
<th>Online downloading</th>
<th>Online discovery+ downloading</th>
<th>Online advanced sources</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch1</td>
<td>18</td>
<td>12</td>
<td>75</td>
<td>52</td>
<td>96</td>
<td>30</td>
</tr>
<tr>
<td>Ch2</td>
<td>74</td>
<td>1</td>
<td>1</td>
<td>86</td>
<td>94</td>
<td>75</td>
</tr>
<tr>
<td>Ch3</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>18</td>
<td>33</td>
<td>94</td>
</tr>
<tr>
<td>Ch4</td>
<td>25</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>26</td>
<td>33</td>
</tr>
<tr>
<td>Ch5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Ch6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Ch7</td>
<td>1</td>
<td>36</td>
<td>3</td>
<td>37</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>75</strong></td>
<td><strong>52</strong></td>
<td><strong>96</strong></td>
<td><strong>42</strong></td>
<td><strong>33</strong></td>
<td><strong>298</strong></td>
</tr>
<tr>
<td><strong>%</strong></td>
<td><strong>26</strong></td>
<td><strong>17</strong></td>
<td><strong>32</strong></td>
<td><strong>14</strong></td>
<td><strong>11</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 7.1 AV-AC-2 Indicator on quality of delivery mechanisms as a function of Challenges

Most of the datasets can be downloaded online and many are in full Inspire compliant systems (with downloading and viewing).
Wind Farming (CH1) and Fisheries (CH5) are the Challenges with the least Inspire compliant delivery mechanism most probably due to the immediate commercial value of the datasets. For the majority of Marine Protected Area-MPA (CH2) information is not given on the delivery mechanism.

For accessibility indicator AV-AC-3, related to Data Policy, the results are shown in Fig. 7.2 and Table 7.2.

![Fig. 7.2 AV-AC-3 indicator on data policy for all Challenge data sets as a function of indicator meaning](image)

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Not documented</th>
<th>Restricted</th>
<th>Moratorium</th>
<th>Unrestricted</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch1</td>
<td>18</td>
<td>12</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch2</td>
<td>74</td>
<td>31</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch3</td>
<td>90</td>
<td>25</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch5</td>
<td>25</td>
<td>2</td>
<td>37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch6</td>
<td>5</td>
<td>32</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ch7</td>
<td>79</td>
<td>27</td>
<td>82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>27</td>
<td>110</td>
<td>82</td>
<td>298</td>
</tr>
<tr>
<td>%</td>
<td>27</td>
<td>9</td>
<td>37</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7.2 AV-AC-3 indicator on Data Policy as a function of Challenges

Again Fisheries (CH5) has almost all restricted access data sets, for MPA (CH2) information is not available for data policy, and for CH3 most of the data are
available with a moratorium. All the other Challenges have unrestricted data policy upstream data sets.

For AV-AC-4 indicator, related to Pricing Policy, the results are shown in Fig. 7.3 and Table 7.3 for all Challenges.

Fig. 7.3 AV-AC-4 indicator on pricing policy for all Challenges as a function of indicator meaning

Table 7.3 AV-AC-3 indicator on Data Pricing Policy as a function of Challenges

Most data sets required by all Challenges are free of charge, with the exception of Wind Farming (CH1) where the data have a cost. This reflects the fact that Wind farming applications have relatively large costs associated with feasibility studies.
regarding optimal sitings.

For AV-PE-1 indicator, related to time required to access the data, the results are shown in Fig. 7.4 and Table 7.4

![Figure 7.4 AV-PE-1 indicator on database responsiveness in terms of delivery for all Challenges as a function of indicator meaning](image)

<table>
<thead>
<tr>
<th>Challenge</th>
<th>No information</th>
<th>More than 1 week</th>
<th>Less than 1 week</th>
<th>Few hours or less</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch1</td>
<td>12</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Ch2</td>
<td>75</td>
<td>75</td>
<td></td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>Ch3</td>
<td>94</td>
<td>94</td>
<td></td>
<td></td>
<td>188</td>
</tr>
<tr>
<td>Ch4</td>
<td>33</td>
<td>33</td>
<td></td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>Ch5</td>
<td>25</td>
<td>1</td>
<td></td>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>Ch6</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Ch7</td>
<td>1</td>
<td>36</td>
<td>1</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>25</td>
<td>260</td>
<td>87</td>
<td>298</td>
</tr>
</tbody>
</table>

Table 7.4 AV-PE-1 Indicator on data delivery responsiveness as a function of Challenges

Most of the data delivery responsiveness is declared to be high but this will be further clarified when the data sets will be actually downloaded for the targeted
Challenge products. For Fisheries (CH5), the response time is more than a week, as part of the general problem of data availability for this Challenge.

To sum up, an overall indicator value was defined by taking the largest number of times an indicator value was chosen regardless of the challenge. This overall indicator status, for all 298 data sets, is shown in Table 7.6.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Meaning</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-AC-2</td>
<td>Delivery mechanism</td>
<td>![Partial Inspire function]</td>
</tr>
<tr>
<td>AV-AC-3</td>
<td>Data policy</td>
<td>![Partially restricted]</td>
</tr>
<tr>
<td>AV-AC-4</td>
<td>Pricing</td>
<td>![Free]</td>
</tr>
<tr>
<td>AV-PE-1</td>
<td>Responsiveness</td>
<td>![High]</td>
</tr>
</tbody>
</table>

Table 7.6 Summary of overall indicators for all Challenges

We expect this result to change slightly when the metadatabase is further checked and consolidated over the next few months and when the analysis is performed by characteristics or thematically rather than by Challenge.

8 The indicators Results: Oil Platform Leak Challenge

CH3, Oil spill Platform Leaks, has to provide an Oil Platform Leak Bulletin within 24 hours after a request from DG-MARE, containing information about transport, transformation and impacts of oil released from a source. The Bulletin has been in place since June 2014 and:

- the monitoring data are assessed here: [https://webgate.ec.europa.eu/maritimeforum/en/node/3668](https://webgate.ec.europa.eu/maritimeforum/en/node/3668)

Since the service is already in place, most of the availability information has been finalized and for this Challenge we can give all eight indicators described in Section 6. There are 94 characteristics identified in the Challenge Oil Platform Leaks. They are categorized in the environmental matrices as in Figure 8.1
Figure 8.1 Subdivision of the 94 Oil Platform Leaks datasets in the environmental matrices

Table 8.1 shows the P01 and P02 metadata for this Challenge. The table shows that the vocabularies do not provide an internationally agreed definition for some characteristics. The lack of a code in some cases creates problems in organizing and managing the MedSea CheckPoint database.
### Growth and innovation in ocean economy

**Gaps and priorities in sea basin observation and data**

#### Matrix

<table>
<thead>
<tr>
<th>Matrix</th>
<th>P02 Discovery Code</th>
<th>P01 characteristic code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>EWSB (Wind speed and direction)</td>
<td>Zonal wind component ESEWZZXX</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meridional wind component ESNSZZXX</td>
</tr>
<tr>
<td>Marine Water</td>
<td>RFVL (Horizontal velocity of the water column - currents)</td>
<td>Water zonal velocity component LCEWZZ01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water meridional velocity component LCNSZZ01</td>
</tr>
<tr>
<td></td>
<td>TEMP (Temperature of the water column)</td>
<td>Water temperature TEMPPR01</td>
</tr>
<tr>
<td></td>
<td>GWDR (Wave direction)</td>
<td>Mean wave direction GWDRZZ01</td>
</tr>
<tr>
<td></td>
<td>WVST (Wave height and period statistic)</td>
<td>Average zero crossing period of waves (T2) on the water body GTZAZZ01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Significant height of waves (Hs) on the water body GTDHZZ01</td>
</tr>
<tr>
<td>Biota</td>
<td>HBEX (Habitat extent)</td>
<td>Marine protected areas (polygon) – no P01 code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ecologically or Biologically significant areas (polygon) – no P01 code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cetacean areas (polygon) – no P01 code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coralligenous areas (polygon) – no P01 code</td>
</tr>
<tr>
<td>Sea bed</td>
<td>MBAN (Bathymetry and elevation)</td>
<td>Sea-floor depth BATHDPTH</td>
</tr>
<tr>
<td></td>
<td>COGE (Coastal geomorphology)</td>
<td>Coast type – no P01 code</td>
</tr>
<tr>
<td>Human activities</td>
<td>MLES (Marine environment leisure usage)</td>
<td>Touristic area – no P01 code</td>
</tr>
<tr>
<td></td>
<td>GP087 (Fishery characterisation)</td>
<td>Fisheries Zone (polygon) – no P01 code</td>
</tr>
<tr>
<td></td>
<td>Oil - To be better defined</td>
<td>Oil Slick Area – no P01 code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oil Slick Thickness – no P01 code</td>
</tr>
</tbody>
</table>

Table 8.1 The hierarchical organization of characteristics of Oil Platform Leaks

### 8.1 Availability – Visibility indicators

Starting with AV-VI-1 for Challenge 3, most of the data are displayed in catalogues such as EDMERP, especially for Air and Marine waters (see Fig. 8.2). For AV-VI-2, the databases are easily found using search engines or via reference catalogues.
Only three databases have no references in catalogues (Fig. 8.3).

Figure 8.2 AV-VI-1 indicator on availability: Easily found (Challenge 3)

Figure 8.3 AV-VI-2 indicator on availability: datasets referenced in catalogue services (Challenge 3)
In CH3, 60% of the databases are accessible through services provided by MonGOOS related systems (http://www.mongoos.eu/), SeaDataNet (http://www.seadatanet.org/) and by EMODnet Bathymetry and Human activities. This challenge uses mainly operational forecasting system data sources both for Air and Marine matrices.

8.2 Availability – Accessibility indicators

For the AV-AC-1 indicators on “Policy visibility” for Challenge 3, the information is visible and can be extracted from internet documents. Thus this indicator is positive but details are missing and sometimes have to be requested directly from the data provider. In the report for CH3, this indicator is 'yellow'.

Figure 8.4 shows the results for the AV-AC-2 delivery mechanism: 90% of the information is accessible via online downloading. Thus the indicator is green.

For the AV-AC-3 data Policy, the results in Fig. 8.5 show that data are accessible through a moratorium, i.e., only after agreements are put in place to access the data or after a defined period.

It is not easy for a non-expert to understand the data policy adopted by the data provider for a specific Challenge input data set. For the operational forecasting
systems in the Mediterranean Sea, the Data Exchange Agreement signed by the MonGOOS members provides the framework. In some cases the data owners also need to be contacted for information on the exact data policy adopted, as explained for the AV-VI-2 indicator.

Figure 8.5 AV-AC-3 indicator on availability: data policy.

By combining the AV-AC-2 (Fig. 8.4) and AV-AC-3 (Fig. 8.5) indicators, it is possible to infer that only a few databases are accessible through partially Inspire-compliant services.

For the indicator AV-AC-4 (not shown), there is no cost for all 94 datasets after the delivery agreements have been put in place.

For AV-AC-5, the datasets for this Challenge adopt formats that have been suggested by SeaDataNet (mainly NetCDF for 83 databases). However, the databases are better organized in the cases of ‘physical data’ (e.g. wind, wave, current). The Biota databases provide ‘shape files’ and Human Activity databases are in ‘text’ format.

### 8.3 Availability – Performance indicator and synthesis

For the AV-PE-1 indicator, all datasets can be delivered within a few hours.

To sum up, for Oil Platform Leaks targeted products, availability indicators are...
shown in the following table

| AV-VI-1   | Easily found | High visibility |
| AV-VI-2   | EU Inspire catalogue service | Totally adequate |
| AV-AC-1   | Policy visibility | Medium transparency |
| AV-AC-2   | Delivery mechanism | Full Inspire function |
| AV-AC-3   | Data policy | Partially restricted |
| AV-AC-4   | Pricing | Free |
| AV-AC-5   | Readiness | Ready to be consumed |
| AV-PE-1   | Responsiveness | High response |

9  Summary of the lessons learned by each Challenge

A summary of the lessons learned was explicitly requested in the Call for Tender. The ‘analysis’ for the first DAR refers here to the search for the input datasets and their cataloguing. Some specific questions were posed to Challenges on the accuracy of data sources, gaps in the input data, most useful data sources, trends in availability (improving, worsening), usefulness of secondary data sources (e.g. MyOcean, EMODnet), availability-accessibility issues, priorities in data collection or assembling.

The overall questions posed to the Challenges were:

Q1: Are your input data sources accurate enough for the Challenge products?
Q2: Where are the main gaps in the input data?
Q3: (If there are different sources for similar parameters) Which data source is the most useful?
Q4: Is the availability of data improving or worsening?
Q5: Are there more data available that could not be used for this Challenge because they were too expensive or complicated to access?
Q6: What would the main priority be for data collection or assembly in order to improve the accuracy of the results or help overcome the difficulty in producing them?

The answers were given in specific Challenges reports, which are summarized here.

Q1: Are your input data sources accurate enough for the Challenge products?
The data deriving from modeling outputs are normally considered as accurate. It has been suggested that EMODnet portals should be used as independent data sources of observations to quantify the model output accuracy and suitability. However, it has been observed that accuracy is sufficient if multi-model and multi-forcing forecast systems are used (as is the case of Oil Platform Leaks Challenge).

In general, the accuracy of in situ data is considered higher than the satellite data for the selected applications, although the temporal and spatial coverage is better assured by satellite data. The accuracy of in situ data is not yet considered suitable for some assessment criteria (e.g. connectivity) and information on priority species and habitats is also limited. The final consideration is that data accuracy can be assessed correctly if the ‘availability indicators’ are ‘green’ or in the worst case ‘yellow’.

**Q2: Where are the main gaps in the input data?**

The spatial and temporal resolution of all data is an issue for all Challenges, but the main gaps are related to biological and biodiversity data sources. The availability of VMS maps related to vessel coverage is critical and there are also gaps in the accuracy, resolution and availability of the socio-economic and environmental data. In some cases the reason for gaps is related to the lack of human and financial resources, as well as to the non availability of data sources, especially at a national level.

**Q3: Which data source is the most useful?**

The most useful data sources are for example the most available and high resolution sources for meteo-oceanographic condition datasets. The use of multiple data sources often enables gaps to be filled such as between tide gauges and sea level altimetry to meet sea level rises. Multiple data sources also enable uncertainties to be estimated in the products derived from the input datasets.

**Q4: Is the availability of data improving or worsening?**

For Challenges that need to access model data, data availability is improving due to the development of ‘Marine Services’ and ‘EMODnet Thematic portals’. The availability is also improving for Fisheries, due to the implementation of R-routines (a recruit model for stock assessment) for the analysis of VMS and AIS datasets. In general there is the idea that there is no need to access data from original
sources. Their availability in federated systems is considered to be good, since they offer the ‘best copies’ of data. The follow up of indicators every six months along with iteration with upstream providers should also help to improve the process.

Q5: Are there more data available that could not be used for this Challenge because they were too expensive or complicated to access?

All Challenges have underlined that much data can be available under specific agreements. The main issues related to data availability and access are:

- need to access bathymetric data at high resolutions
- biological data are restricted in some cases (e.g. MEDISEH project)
- AIS data are not available
- Information provided by data sources are, in many cases, not sufficient to assess their usefulness.

There is also a well-known difficulty in retrieving wildlife tracking, because proprietary issues and data tracking are centralised and metadata are managed elsewhere or not managed. This is a key issue for PMA (CH2).

Q6: What would be the main priority for data collection or assembly in order to improve the accuracy of the results or help overcome the difficulty in producing them?

In terms of numerical model data, the state-of-the-art is to use well-established modelling systems, such as the one used to derive the 10-year dataset used in Challenge 1, which also assimilates all the available measurements. In addition, a combination of model outputs with observations and statistical methods for local value-adding purposes could improve the accuracy of the results. The need to assess data assembly activities on the Mediterranean biodiversity has also been highlighted.

It is important to promote agreements with different authorities in order to be able to provide higher resolution, better accuracy, as well as environmental coastal and human activities data layers.

Bearing in mind the MedSea CheckPoint experience in the compilation of the metadatabase, incorporating descriptive metadata would be useful, following the example of MyOcean targeted products. They are easy to consult and visualize. The acquisition of information on most of the MedSea CheckPoint datasets requires a ‘document archaeology work’. The use of a metadata model, such as the one used
in MyOcean or SeaDataNet, would simplify the implementation of the MedSea CheckPoint database.

10 Discussion and conclusions

The first Data Adequacy Report contains results related to:

1. the building of the Metadatabase which began during the Literature Survey;
2. the definition of the methodology for the objective assessment of the Data Adequacy;
3. Initial results for the assessment of input datasets for the Challenges.

The adoption of well-defined standards and controlled vocabularies has guided the selection of metadata models and formats for upstream data sets. This enabled a MedSea CheckPoint Inspire compliant information system to be built with a metadatabase for developing and computing data adequacy indicators.

It soon became clear that the hierarchical organisation of the SeaDataNet vocabularies is helping the development of the information system. At the same time existing SeaDataNet controlled vocabularies were found not to contain all the terms needed for implementing and managing a metadatabase for the seven MedSea CheckPoint Challenges. This is a basic problem that should be considered in future projects.

Data originates from different providers (research centers, private companies, public agencies, etc.) and is accessed by different users (public administrations, decision-makers, citizens, etc.) for different purposes (research, government, civil protection, etc.). A total of 298 data sets are now listed as potential contributors to the Challenge targeted products. They are provided by 126 different data sources.

The 45 different characteristics selected for the Challenges are extremely heterogeneous. They originate from different sensors, with different acquisition geometries and sampling strategies, different numerical and statistical models, different spatial resolutions, etc. In addition the same characteristics originate from different data providers depending on the expert practice. In this first DAR each challenge was considered as an 'isolated universe of discourse'. This means that...
many problems on the multiple use of the same datasets for different challenges have not been considered here.

This first Data Adequacy Report defined the first set of indicators for the ‘fitness for use’ assessment. Adequacy is defined on the basis of two territories: ‘appropriateness’ and ‘availability’. For ‘availability’ eight DAR indicators were defined as follows:

<table>
<thead>
<tr>
<th>Territory</th>
<th>Indicator name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility</td>
<td>AV-VI-1</td>
<td>Easily found</td>
</tr>
<tr>
<td></td>
<td>AV-VI-2</td>
<td>EU Inspire Catalogue Service</td>
</tr>
<tr>
<td>Accessibility</td>
<td>AV-AC-1</td>
<td>Policy visibility</td>
</tr>
<tr>
<td></td>
<td>AV-AC-2</td>
<td>Delivery mechanism</td>
</tr>
<tr>
<td></td>
<td>AV-AC-3</td>
<td>Data policy</td>
</tr>
<tr>
<td></td>
<td>AV-AC-4</td>
<td>Pricing</td>
</tr>
<tr>
<td></td>
<td>AV-AC-5</td>
<td>Readiness</td>
</tr>
<tr>
<td>Performance</td>
<td>AV-PE-1</td>
<td>Responsiveness</td>
</tr>
</tbody>
</table>

The indicators were extracted from the metadatabase, however not all of them could be evaluated at this time. There are still gaps in the database that prevent this first assessment from being completed. This is true for visibility indicators and for part of the accessibility indicators.

At the level of all the Challenges, the overall results for the indicators are:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Meaning</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV-AC-2</td>
<td>Delivery mechanism</td>
<td>![Partial Inspire function]</td>
</tr>
<tr>
<td>AV-AC-3</td>
<td>Data policy</td>
<td>![Partially restricted]</td>
</tr>
<tr>
<td>AV-AC-4</td>
<td>Pricing</td>
<td>![Free]</td>
</tr>
<tr>
<td>AV-PE-1</td>
<td>Responsiveness</td>
<td>![High]</td>
</tr>
</tbody>
</table>

This initial analysis highlights that in terms of accessibility and performance, the input data sets for the Challenges are medium to high, although the situation varies greatly from Challenge to Challenge.

For the Oil spill Leaks Challenge, we were able to assess all the availability
indicators and the result is

| AV-VI-1  | Easily found | High visibility |
| AV-VI-2  | EU Inspire catalogue service | Totally adequate |
| AV-AC-1  | Policy visibility | Medium transparency |
| AV-AC-2  | Delivery mechanism | Full Inspire function |
| AV-AC-3  | Data policy | Partially restricted |
| AV-AC-4  | Pricing | Free |
| AV-AC-5  | Readiness | Ready to be consumed |
| AV-PE-1  | Responsiveness | High response |

For this Challenge, data inputs mainly come from numerical ocean, wave and atmospheric models, as well as human activities. Data are generally available but the data policy is difficult to understand and the delivery mechanism is only partially compliant with an advanced Inspire service.

In conclusion, this first DAR highlights that it is possible to develop objective indicators of fitness for use for the input data sets to the Challenges. The availability of input data sets for all Challenges seems to run between medium to high with the only exception of CH1 (Wind Farm siting) and CH5 (Fisheries). CH2 shows the least Inspire catalogues and data policy transparency.

The next step will be to discuss thematic indicators together with Challenge indicators, i.e. considering the average weighted indicator among Challenges that require the same characteristics. The addition of appropriateness indicators will also probably be combined with the availability indicators in order to change the assessment of this first DAR for the fitness for use of monitoring data sets for the Mediterranean Sea.
11 Annex 1 Metadata format and model

Metadata describe data elements or attributes (name, size, data type, etc) and data structures (length, fields, columns, etc). Metadata also document pieces of software associated with the data (platform, language, input parameters, etc). Metadata should include descriptive information on the context, quality and condition, or characteristics of the data.

The metadatabase implemented for the MedSea CheckPoint is based on the metadata formats and models presented in Table A1.
<table>
<thead>
<tr>
<th>Metadata format</th>
<th>Description</th>
</tr>
</thead>
</table>
| Dublin Core Metadata Element Set (DCMES): ANSI/NISO Z39.85 or EN ISO 15836 = Dublin Core | This standard provides a list of descriptive metadata to support resource discovery for geographical and non-geographical communities. It is used considerably by libraries for their repositories. There are two implementations with a set of associated tools:  
- HTML  
- Resource Description Framework (RDF)/XML a format for metadata, which is now used the most.  

Here is the list of associated metadata:  
-language-title-subject-description-publisher-rights-identifier-creator-contributor-date created-date modified-references-replaces. |
| EN ISO 19119 (taxonomy of services) | This is a European standard for documenting services. It belongs to the INSPIRE Recommendation. |
| Geographical information – Metadata – Implementation specification: EN ISO 19139 | This is the unique standard interpretation (implementation) of the ISO 19115 based upon the use of XML schema. It belongs to the INSPIRE Recommendation. |
| Geographical information: Metadata EN ISO 19115 | This is a GIS European standard for documenting data sets. It is the basis of INSPIRE Recommendation for the description of metadata. Three levels of resource discovery metadata:  
- discovery  
- browsing  
- exploitation  

There are different categories of metadata:  
- identification  
- spatial representation  
- quality information  
- contents description  
- presentation modalities  
- dissemination modalities  
- maintenance modalities  
- security level  
- restriction level  

with a model for the Metadata itself:  
- identifier  
- language  
- character set  
- metadatastandardname  
- metadatastandardversion  
- hierarchy level |
| ISO 19108 | This standard defines concepts for describing temporal characteristics of geographic information. It belongs to the INSPIRE Recommendation. |
| ISO 8601 | Standard for numeric representation of date and time. It belongs to the INSPIRE Recommendation. |

Table A1- MedSea CheckPoint metadata formats
Table 1: List of Characteristics as a function of Challenge and number of data sources.

<table>
<thead>
<tr>
<th>P02 Parameter list</th>
<th>Ch.1 Wind Farm</th>
<th>Ch.2 MPA</th>
<th>Ch.3 Oil leaks</th>
<th>Ch. 4 Climate &amp; coast</th>
<th>Ch. 5 Fish.</th>
<th>Ch. 6 Mar. Env.</th>
<th>Ch. 7 River input</th>
<th>Total by P02</th>
</tr>
</thead>
<tbody>
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<td>2. Air pressure</td>
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<td>3. Air temperature</td>
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<td>6. Bird behaviour</td>
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<td>7. Bird reproduction</td>
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<td>8. Bird taxonomy-related counts</td>
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<td>10. Chlorophyll pigment concentrations in the water column</td>
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<td>11. Coastal geomorphology</td>
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<td>12. Concentration of suspended particulate material in the water column</td>
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<td>15. Dissolved total and organic nitrogen concentrations in the water column</td>
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<td>16. Dissolved total or organic phosphorus concentrations in the water column</td>
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Growth and innovation in ocean economy  
Gaps and priorities in sea basin observation and data

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<td>Parameter Description</td>
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<td>Ch. 2</td>
<td>Ch. 3</td>
<td>Ch. 4</td>
<td>Ch. 5</td>
<td>Ch. 6</td>
<td>Ch. 7</td>
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<td>40. Temperature of the water column</td>
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<td>43. Wave direction</td>
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<td>44. Wave height and period statistics</td>
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<td>45. Wind speed and direction</td>
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<tr>
<td><strong>Total #</strong></td>
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</tbody>
</table>
### 13 Annex 3 Data sources for the 298 upstream data identified by the Challenges

<table>
<thead>
<tr>
<th>No.</th>
<th>Data Source</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aarhus University Department of Bioscience Marine Ecology Roskilde</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Accobams</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>Argos CLS</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>Balearic Islands Coastal Observing and Forecasting System (SOCIB)</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>Biodiversity Structure in the Romanian Coastal Zone</td>
<td>68</td>
</tr>
<tr>
<td>6</td>
<td>British Oceanographic Data Centre (BODC)</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>BSH</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>Centre d’Etudes Techniques Maritimes et Fluviales (CETMEF)</td>
<td>71</td>
</tr>
<tr>
<td>9</td>
<td>CNES</td>
<td>72</td>
</tr>
<tr>
<td>10</td>
<td>CNR Institute for the Marine and Coastal Environment (IAMC) - Oristano</td>
<td>73</td>
</tr>
<tr>
<td>11</td>
<td>CNR-ISAC</td>
<td>74</td>
</tr>
<tr>
<td>12</td>
<td>CNR-ISAC (MONGOOS)</td>
<td>75</td>
</tr>
<tr>
<td>13</td>
<td>CNRM - National Center for Meteorological Research - Toulouse</td>
<td>76</td>
</tr>
<tr>
<td>14</td>
<td>CoCoNet Towards Coast To Coast Networks of Marine Protected Areas (From The Shore To The High And Deep Sea) Coupled With Sea-Based Wind Energy Potential</td>
<td>77</td>
</tr>
<tr>
<td>15</td>
<td>Collecte Localisation Satellite</td>
<td>78</td>
</tr>
<tr>
<td>16</td>
<td>Complex Systems Research Center (CSRC) University of New Hampshire</td>
<td>79</td>
</tr>
<tr>
<td>17</td>
<td>Croatian Fisheries Control Agencies</td>
<td>80</td>
</tr>
<tr>
<td>18</td>
<td>Cyprus Oceanography Center (OC-UCY)</td>
<td>81</td>
</tr>
<tr>
<td>19</td>
<td>Data Support Section of the Computational and Information Systems Laboratory at the National Center for Atmospheric Research - Toulouse</td>
<td>82</td>
</tr>
<tr>
<td>20</td>
<td>Development of the Med Pol Phase III Data Base UNEPMAP</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>International Sediment Initiative (ISI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ISAC - Institute of Atmospheric Sciences and Climate</td>
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<td>ISAC - Institute of Atmospheric Sciences and Climate (Rome)</td>
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<td>ISPRA-Institute For Environmental Protection And Research</td>
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<td>Istituto Nazionale di Geofisica e Vulcanologia – INGV Sede Di Bologna</td>
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<td>Joint Research Center</td>
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<td>JRC - Institute for Environment and Sustainability (IES)</td>
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<td>Laboratory of Oceanography of Villefranche (Lov)</td>
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<td></td>
<td>Maltese Fisheries Control Agencies</td>
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<td></td>
<td>MarBEF - Marine Biodiversity and Ecosystem Functioning</td>
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<td>Marine Renewable Integrated Application Platform</td>
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<td>Marine Traffic</td>
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<td>Mediseh</td>
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<tr>
<td></td>
<td>Mediterranean Decision Support System for Marine Safety</td>
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<td></td>
<td>Mediterranean Sensitive Habitats</td>
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<td></td>
<td>MedPan</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>Met Office</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>DG Environment, DG Environment, 84</td>
<td>Meteo France</td>
</tr>
<tr>
<td>22</td>
<td>ELNAIS 85</td>
<td>Meteo France DpServFDP</td>
</tr>
<tr>
<td>23</td>
<td>EMODnet 86</td>
<td>MyOcean</td>
</tr>
<tr>
<td>24</td>
<td>EMODnet Bathymetry 87</td>
<td>MyOcean</td>
</tr>
<tr>
<td>25</td>
<td>EMODnet Hydrography 88</td>
<td>MyOcean (CLS)</td>
</tr>
<tr>
<td>26</td>
<td>EMODnet SeaBed Habitats 89</td>
<td>MyOcean (CNR-ISAC)</td>
</tr>
<tr>
<td>27</td>
<td>EMODnet Physics 90</td>
<td>MyOcean Med Mfc (INGV)</td>
</tr>
<tr>
<td>28</td>
<td>EMODnet Chemistry 91</td>
<td>National and Kapodistrian University of Athens</td>
</tr>
<tr>
<td>29</td>
<td>ENSTA 92</td>
<td>Department of Physics Atmospheric Modeling and Weather Forecasting Group</td>
</tr>
<tr>
<td>30</td>
<td>ENSTA Bretagne 93</td>
<td>National Council of Research - ISMAR</td>
</tr>
<tr>
<td>31</td>
<td>Ente Nazionale Idrocarburi (ENI) 94</td>
<td>National Institute for Marine Research and Development &quot;Grigore Antipa&quot;</td>
</tr>
<tr>
<td>32</td>
<td>Estuarine Quality Classes for Water Framework Directive Indicators 95</td>
<td>National Oceanic And Atmospheric Administration (Noaa)</td>
</tr>
<tr>
<td>33</td>
<td>European Centre for Medium-Range Weather Forecasts (ECMWF) 96</td>
<td>National Oceanographic Data Committee (The Netherlands?)</td>
</tr>
<tr>
<td>34</td>
<td>European Commission 97</td>
<td>Natura</td>
</tr>
<tr>
<td>35</td>
<td>European Global Ocean Observing System (EUROGOOS) 98</td>
<td>Natura2000</td>
</tr>
<tr>
<td>36</td>
<td>European Environment Agency 99</td>
<td>Netherlands Institute of Ecology Centre for Estuarine and Marine Ecology (NIOO-CEME)</td>
</tr>
<tr>
<td>37</td>
<td>European Space Agency (ESA) 100</td>
<td>Network of Marine Protected Area Managers in the Mediterranean</td>
</tr>
<tr>
<td>38</td>
<td>EuroStat 101</td>
<td>Ocean Color Tac - MyOcean</td>
</tr>
<tr>
<td>39</td>
<td>Evaluation of the Demersal Resources in the GFCM Area Using Direct Methods 102</td>
<td>Oceana</td>
</tr>
<tr>
<td>40</td>
<td>FAO - Food and Agriculture Organization of the United Nations 103</td>
<td>Oceanographic Data Center ??</td>
</tr>
<tr>
<td>41</td>
<td>Federal Institute of Hydrology (BFG) 104</td>
<td>Ogs (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale) Department of Biological Oceanography</td>
</tr>
<tr>
<td>42</td>
<td>Flanders Marine Institute (VLIZ) 105</td>
<td>Ogs (Istituto Nazionale di Oceanografia e di Geofisica Sperimentale) Division of Oceanography</td>
</tr>
<tr>
<td>43</td>
<td>Food and Agriculture Organization of the United Nations Fisheries and Aquaculture Department 106</td>
<td>Permanent Service For Mean Sea Level (PSMSL)</td>
</tr>
<tr>
<td>44</td>
<td>French Fisheries Control Agencies 107</td>
<td>Policy Oriented Marine Environmental Research in the Southern European Seas</td>
</tr>
<tr>
<td>45</td>
<td>French Marine Protected Areas Agency 108</td>
<td>Puertos del Estado</td>
</tr>
<tr>
<td>46</td>
<td>GEBCO 109</td>
<td>RAC-SPA</td>
</tr>
<tr>
<td>47</td>
<td>German Oceanographic Datacentre (DODS) 110</td>
<td>RAMSAR</td>
</tr>
</tbody>
</table>

<p>| 48 | ELSNAIS 85 | Regional Activity Centre for Specially Protected Areas (RACSPA) |
| 49 | ENSTA 92 | Rempec Medslik-ii |</p>
<table>
<thead>
<tr>
<th>Page</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>GFCM Fisheries Restricted Areas</td>
</tr>
<tr>
<td>49</td>
<td>Greek Fisheries Control Agencies</td>
</tr>
<tr>
<td>50</td>
<td>Hellenic Centre for Marine Research (HCMR)</td>
</tr>
<tr>
<td>51</td>
<td>Hellenic Centre for Marine Research Hellenic National Oceanographic Data Centre (HCMR HNODC)</td>
</tr>
<tr>
<td>52</td>
<td>Hydrological Cycle in Mediterranean Experiment (HYMEX)</td>
</tr>
<tr>
<td>53</td>
<td>ICCAT</td>
</tr>
<tr>
<td>54</td>
<td>IEO Spanish Oceanographic Institute</td>
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<td>Ifremer Centre De Brest</td>
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<td>57</td>
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</tr>
<tr>
<td>58</td>
<td>Institute of Accelerating Systems and Applications (IASA-UAT)</td>
</tr>
<tr>
<td>59</td>
<td>Institute of Marine Sciences Middle East Technical University</td>
</tr>
<tr>
<td>60</td>
<td>Institute of Research for Development (IRD)</td>
</tr>
<tr>
<td>61</td>
<td>INSU</td>
</tr>
<tr>
<td>62</td>
<td>INSU (Institut National Sciences de L'univers) Serv. d'Obs. en Milieu Littoral - Somlit</td>
</tr>
<tr>
<td>63</td>
<td>International Ocean Institute - Malta Operational Centre (University Of Malta) Physical Oceanography Unit (UMTIOIPOU)</td>
</tr>
</tbody>
</table>

| 111  | Seadatanet-Pan-European Infrastructure for Marine Data 2                     |
| 112  | Service Contract Concerning Coastal Erosion Evaluation of the Needs for Action |
| 113  | SHOM                                                                         |
| 114  | Slovenian Fisheries Control Agencies                                         |
| 115  | Spanish Fisheries Control Agencies                                           |
| 116  | Systeme d'Observation du Niveau des Eaux Littorales                           |
| 117  | The Pelagos Sanctuary                                                         |
| 118  | Tulane University Department of Earth and Environmental Sciences              |
| 119  | TWReferencenet - Management And Sustainable Development Of Protected Transitional Waters |
| 120  | UNEP MAP                                                                     |
| 121  | UNESCO                                                                       |
| 122  | United Nations Environment Programme Global Environment Monitoring System (Unepgems) |
| 123  | University of Hawaii Sea Level Center                                        |
| 124  | University of New Hampshire                                                  |
| 125  | World Database on Protected Areas                                            |
| 126  | WWF                                                                          |
## Annex 4 Nomenclature

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequacy</td>
<td>Sufficient to satisfy a requirement or meet a need.</td>
</tr>
<tr>
<td>Appropriateness</td>
<td>What is made available to the challenge? What motivated/decided them to select one observation rather than another one.</td>
</tr>
<tr>
<td>Assessment criteria</td>
<td>The criteria aim to characterize/depict the inputs in terms of 3 territories capable of showing performance and gaps in the present monitoring system, appropriateness, availability and fitness for purpose.</td>
</tr>
<tr>
<td>Availability</td>
<td>How a characteristic is made available to the user.</td>
</tr>
<tr>
<td>Comparability</td>
<td>To examine things to assess how they are alike and how they are different; to judge one thing and measure it against another thing.</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Things that can exist together without problems and conflicts.</td>
</tr>
<tr>
<td>Data</td>
<td>Reinterpretable representation of information in a formalised manner suitable for communication, interpretation or processing (ISO 19115).</td>
</tr>
<tr>
<td>Dataset</td>
<td>A “dataset” is an identifiable collection of data (ISO 19115). It can be a time series, a lithological description of a marine sample, a gridded dataset such as a DTM, an hydrodynamic model output, a GIS dataset or a feature layer of a GIS dataset, a database or a table of values in a publication. A dataset can consist of several files</td>
</tr>
<tr>
<td>Dataset series</td>
<td>A dataset series is a collection of datasets sharing the same specifications of production (INSPIRE).</td>
</tr>
<tr>
<td>Environmental matrices</td>
<td>This concept is introduced to avoid ambiguities when using the name of a characteristic such as “temperature”. The environment matrix is the environment to which a characteristic is related and defined as: Air, Fresh water, Marine water, Riverbed, Seabed, Biota/Biology, Human activities.</td>
</tr>
<tr>
<td>External adequacy</td>
<td>External adequacy is defined in terms of the formal specification of question relevance, which expresses natural data dependencies among the external facts used in the ontology of the domain of expertise.</td>
</tr>
<tr>
<td>Fit for purpose</td>
<td>Defining the usefulness of data for assessment purposes. Ability to appreciate the data exploitability (Challenge feedback on efficiency &amp; reliability of marine data)</td>
</tr>
<tr>
<td>Harmonisation</td>
<td>Changes/restructuring of the reference version of the data set to make it compatible</td>
</tr>
<tr>
<td>Input dataset</td>
<td>This is the collection of existing data to be input to the Challenges. They are uniquely identified as a combination of (variable, dataset, intended use) or of (geographical feature, dataset, intended use) depending on their nature. They can be shared between challenges.</td>
</tr>
<tr>
<td>Relevance</td>
<td>Covering the extent to which data are appropriate for objectives of Challenges.</td>
</tr>
<tr>
<td>Unique identification</td>
<td>Combination of (characteristic, dataset, intended use) or of (geo. feature, dataset, intended use).</td>
</tr>
<tr>
<td>Universe of Discourse</td>
<td>View of the real or hypothetical world that includes everything of interest (ISO 19101).</td>
</tr>
<tr>
<td>Validation</td>
<td>Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.</td>
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</tbody>
</table>