



GROWTH AND INNOVATION IN OCEAN ECONOMY – GAPS AND PRIORITIES IN SEA BASIN OBSERVATION AND DATA

Annex 1 Methodology for classifying the existing upstream data according to Literature Survey

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Glossary

CF : Climate and Forecast
CMCC - Centro Euro-Mediterraneo per i Cambiamenti Climatici S.c.a r.l. (IT)
CLS - Collecte Localisation Satellites (FR)
CLU - CLU s.r.l. (IT)
CSW : Catalogue Service for the Web
DQ : Data Quality
DTM : Digital Terrain Model
EDF EN (FR)
EMODNET : European Marine Observation and Data Network
EU FP7 : 7 th Framework Programme for Research and Technological Development
GIS : Geographical Information System
GMES : Global Monitoring for Environment and Security
HCMR - Hellenic Centre for Marine Research (GR)
IFREMER - Institut Français de Recherche pour l'Exploitation de la Mer (FR)
INGV - Istituto Nazionale di Geofisica e Vulcanologia (IT)
IHO : International Hydrographic Organisation
ISO : International Organization for Standardization
NetCDF : Network Common Data Form
NKUA - Institut Français de Recherche pour l'Exploitation de la Mer (FR)
OCEANS-CAT - OCEANS Catalonia International SL (ES)
ODV : Ocean Data View (software and format)
OGC : Open Geospatial Consortium
SOCIB - Balearic Islands Coastal Observing and Forecasting System (ES)
UCY - University of Cyprus (CY)
FEM - Association de Préfiguration de l'IEED France Energies Marines (FR)
IH Cantabria - Fundación Instituto de Hidráulica Ambiental de Cantabria (ES)
WMS : Web Map Service
WFS : Web Feature Service
WCS : Web Coverage Service
WP : Work Package

Executive Summary

This document review the literature and describes the elements used for the classification of the upstream data needed by the challenges and the template 2 to be used by the challenge partners to collect them.

1 Terminology

1.1 Definition of characteristics

In this document, a “characteristic” refers :

- either to a variable (resulting from an observation or from a data processing)
- or a layer of a GIS dataset representing a feature (ie a representation of a real-world object on a map such as a protected area, a coastline or wrecks) defined by a set of vectors (polygon, curve, point) or by a raster (a spatial data model that defines space as an array of equally sized cells such as a grid or an image).

1.2 Environmental matrices

The environment matrix is the environment to which a characteristic is related : Air, Water (Marine or Fresh), Biota/Biology, Seabed, Human activities.

This concept is introduced to avoid ambiguities when using a characteristic name such as “temperature”.

1.3 Dataset

A “dataset” is a collection of data sharing the same specifications of production.

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 data base or a table of values in a publication. A data set can be constituted of several files (eg the set of seismic data files recorded along the same line).

A collection of datasets sharing the same specifications of production is a “series” of datasets (see the Inspire Geoportal).

2 Identification of datasets

The partners have to set out a methodology to classify relevant data sets and to analyze their fitness for the purposes seven applications or challenges.

The seven challenges are:

- 1) Windfarm siting
- 2) Marine Protected areas
- 3) Oil Platforms leak
- 4) Climate and Coastal protection
- 5) Fisheries management
- 6) Marine Environment
- 7) River inputs

Relevant data sets will be identified and listed according to the environmental matrix and characteristics needed by the challenge partners and grouped by characteristic category using the Seadatanet list of Discovery parameter groups of the Seadatanet Common vocabularies (www.seadatanet.org) and the Inspire categories (<http://inspire.ec.europa.eu/>) more appropriate for layer of GIS datasets , by level of processing and mode of production (RT or delayed).

From existing catalogues and data sources and from initial work of WP2-WP8 for data identification, lists of data sets will be extracted with a series of information (metadata) relevant for an evaluation of the fitness of the datasets for the purposes of the challenges.

2.1 Preliminary identification of input characteristics and datasets (Template 1)

2.1.1 Purpose

The purpose of this survey is multiple and is designed to get a preliminary list of characteristics needed by the challenge in order to search the datasets of potential interest for each challenge and to get a preliminary list of dataset sources.

2.1.2 Template 1

A very simple form has been used for this first step. The table below gives a description of its content.

Challenge number	Matrix	Characteristics	Data sources

3 Relevant metadata for classification

The metadata to be extracted from the data sources include :

- processing level, availability and terms of access, quality,
- spatial and temporal coverage.
- existing statements made as to fitness for purpose.

Extracting these information from ISO 19115 metadata [1] attached to the datasets made available by the data providers appears an “a priori” solution as this standard is designed “to allow a

producer to describe a dataset fully so that users can understand the assumptions and limitations and evaluate the dataset’s applicability for their intended use”.

This standard is widely used for describing digital geographic information and services by the data networks developed in the framework of EU initiatives such as EMODNET, GMES, FP6 and FP7 EU projects and a large number of EU and international organizations which constitutes the main data sources to be considered by the challenges.

However, the ISO 19115 metadata are used most of the time for catalogue purposes (“discovery” metadata) answering the following questions :

- Does a dataset on a specific topic exist (“what”) ?
- For a specific place (“where”) ?
- For a specific date or period (“when”)?
- Which is the point of contact to learn more about or order the dataset (“who”) ?

Processing level, spatial and temporal coverage, availability and terms of access are usually available in catalogues using ISO 19115 profiles.

But quality elements and additional statements related to fitness for purposes need most frequently to be collected from other sources such as the product specifications of the producer, or from the standard adopted by the producer (eg IHO 44 for bathymetry[12]) or from literature.

3.1 Quality metadata

The ISO 19113 standard [2] established “the principles for describing the quality of geographic data and specifies components for reporting quality information”.

“Quality” is the totality of characteristics of a product that bear on its ability to satisfy stated and implied needs “ (ISO 19101) [3]

The quality of a geographic dataset is described using two components:

- ✓ data quality elements;
- ✓ data quality overview elements.

The use of these components depends on the hierarchical level and on the homogeneity of the information which is to be considered and on the purpose of the description.

Upper level	Series
	Dataset
Lower level	Subset
	Feature

Figure 1: hierarchical level of information

3.1.1 Data quality overview elements

Showing how a dataset is suitable for a given usage (statements made as to fitness for purpose) or fit a product specification is the result of an evaluation of all its relevant quality elements. The quantity and the complexity of the quality information to extract and to report for establishing the fitness of each data set for each usage is just impossible in the framework of the survey. Only an overview of the quality of the various data source can be envisioned.

For the purpose of the project, it is proposed to adopt the non-quantitative elements defined by ISO 19113 for the overview of the data source quality :

1. “purpose” describes the rationale for creating a dataset and contain information about its intended use.
2. usage describes the application(s) for which a dataset has been used by the data producer or by other, distinct, data users.
3. lineage describes the history of a dataset and, in as much as is known, recount the life cycle of a dataset from collection and acquisition through compilation and derivation to its current form. Lineage may contain two unique components:
 - source information shall describe the parentage of a dataset;
 - process step or history information shall describe a record of events or transformations in the life of a dataset, including the process used to maintain the dataset whether continuous or periodic, and the lead time.

However, some of the quality elements usefull for establishing the fitness for purpose such as the accuracy of a spatial data product are sometimes made available with discovery metadata and will be extracted as far as possible.

3.1.2 Data quality elements

5 quality elements and 15 sub-elements are defined by ISO 19113. These elements are quantitative metadata including :

1. “completeness;
 - commission: excess data present in a dataset,
 - omission: data absent from a dataset.
2. logical consistency;
 - conceptual consistency: adherence to rules of the conceptual schema,
 - domain consistency: adherence of values to the value domains,
 - format consistency: degree to which data is stored in accordance with the physical structure of the dataset,
 - topological consistency: correctness of the explicitly encoded topological characteristics of a dataset.
3. positional accuracy;
 - absolute or external accuracy: closeness of reported coordinate values to values accepted as or being true,

- relative or internal accuracy: closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true,
 - gridded data position accuracy: closeness of gridded data position values to values accepted as or being true.
4. temporal accuracy;
- accuracy of a time measurement: correctness of the temporal references of an item (reporting of error in time measurement),
 - temporal consistency: correctness of ordered events or sequences, if reported,
 - temporal validity: validity of data with respect to time.
5. thematic accuracy;
- classification correctness: comparison of the classes assigned to features or their attributes to a universe of discourse (e.g. ground truth or reference dataset),
 - non-quantitative attribute correctness: correctness of non-quantitative attributes,
 - quantitative attribute accuracy: accuracy of quantitative attributes. »

These quality elements are at present included in the ISO 19157 standard which replaces the ISO 19113:2002[2], ISO 19114:2003 [4] and ISO/TS 19138:2006 standards.

It is recognized that some of them are difficult to use by non-experts. This classification must be understood as a guideline to extract and to report the quality information needed by the user in a standard way for later comparison with the user requirements of each challenge.

The extraction of all quality elements can be time consuming but fully appropriate if limited to the description of the data sets selected for the evaluation of their fitness for the purpose of each challenge. The quality elements of the data producer can be extracted either from the ISO 19115 metadata set when available or from the product specifications and quality standard applied by the data producer when datasets belong to an homogeneous collection of data sets produced. This is detailed in the chapter describing the template to collect them.

If there is any question related to the classification of a quality information, WP1 partners will help the challenge partners to select the appropriate quality category. Nevertheless, examples can be found in the ISO standards.

3.2 Fitness for use metadata

3.2.1 ISO approach

The ISO 19157 standard [6] on data quality for geographic information “recognizes that a data producer and a data user may view data quality from different perspectives”. “Conformance quality levels may be set using the data producer’s product specification or a data user’s data quality requirements” (fig. 2).

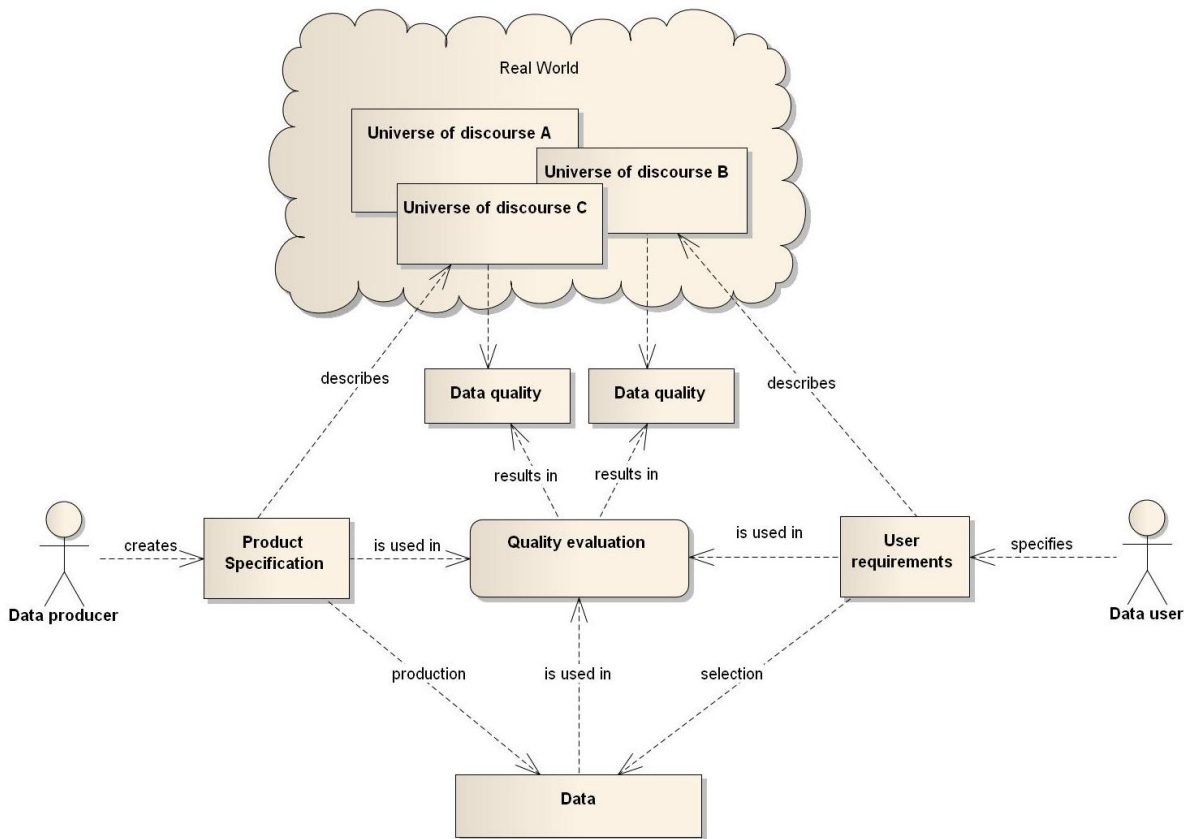


Fig 2 : Data quality versus point of view (source ISO 19157)

The ability of a data set to satisfy the producer's specifications is the internal quality.

The ability of a data set to satisfy the user's requirements is the external quality.

Internal and external quality share the same ISO 19113 quality descriptors and can be described using the ISO 19115 metadata standard.

To allow this, ISO 19157 introduced an additional quality category – “usability” - which allows to aggregate evaluation results of the ISO 19113 data quality elements based on user requirements (fig 3). Usability can be used also to declare the overall data quality conformance with the data quality requirements of a given usage (a dataset shall pass all the data quality requirements in the application schema).

However, few if not none of data providers deliver such information as ISO 19115 metadata for various reasons. We will have to extract the usability component from literature.

In addition, it is recognized that the ISO 19157 which is based on the concepts developed initially for the data providers does not cover all the needs of the end user for establishing the fitness of a data set to its own purpose.

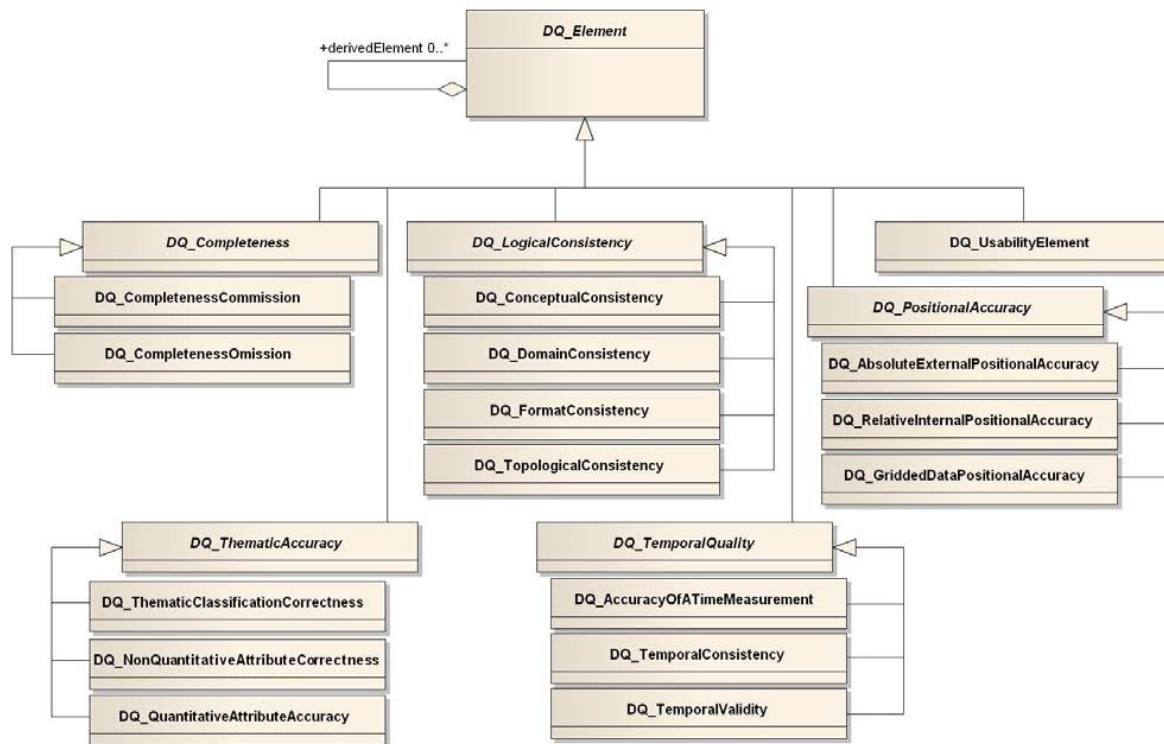


Fig 3 : overview of the quality elements (source ISO 19157)

3.2.2 Additionnal elements

Other characteristics geospatial data are needed to define the fitness for purpose of a data set according to the authors [7].

3.2.2.1 Space and time elements

The space and time coverage and the resolution are key elements of the evaluation of the fitness for purpose of the users.

3.2.2.2 Quality of Services

In addition, the evaluation of the quality of spatial data according to ISO 19113 is focused on “What” is delivered to the end-user. However, this technical dimension will not count for the total quality the end-user expects and gets. “How” he gets spatial data is also important to him [8]. The evaluation of the fitness for purposes of spatial data must include this dimension.

The attempts to define the corresponding quality components have been widely discussed not surprisingly in the field of marketing for the evaluation of the quality of services. Numerous models have been proposed [9] especially with the development of e-services [10]. However quality component definitions vary from one model to another one. In lack of standard and model convincingly appropriate for our purposes, the following components have been selected and detailed :

3.2.2.3 Visibility

This is the ability to get quickly on the appropriate site delivering the desired datasets and/or to reach the data provider when needed especially for a non expert. One of the criteria to evaluate it is to check if data sets or series of data sets are identified in the existing EU catalogues designed for this purpose :

- the INSPIRE Geoportal (<http://inspire-geoportal.ec.europa.eu/discovery/>),
- the European Directory for Marine Environmental Data maintained by SeaDataNet (<http://www.seadatanet.org/Metadata/EDMED-Datasets>)
- or thematic catalogues such as the MyOcean one (<http://www.myocean.eu/>).

As this element is attached to the identification of the dataset, these requirements are included in the identification section.

3.2.2.4 Availability conditions

These include :

- the services made available : manual ordering, on-line downloading, on-line downloading + advanced services (services or software to download for processing and viewing data)
- the data policy.: restricted, accessible under moratorium, unrestricted
- the cost basis
- the formats and semantic conventions : proprietary or standards and de facto standards (eg ODV), ISO/OGC compliant (WMS, WFS, WCS, NetCDF CF...) avoiding preliminary processing
- the interoperability of the on-line services (OGC standards...).

3.2.2.5 Performance

This category includes :

- the reliability ie the ability of a system to keep operating over time. It means the service Website giving access to the services and the service (to request data) operates correctly and either does not fail or reports any failure to the service user for compensation. This quality element would require tests through time difficult to organize in sufficient numbers for all the sites in the framework of this study. Other approaches are highly dependant on the user perception of information such as the credibility of the data provider. We propose to base this evaluation on the existence of a service contract (Service Level Agreement) or commitment or charter.
- The responsiveness :
It is related to response time (how long it takes to process a request), throughput (how many requests overall can be processed per unit of time), or timeliness (ability to meet deadlines, i.e., to process a request in a deterministic and acceptable amount of time).Based on SDN experience, distinction must be done between : immediate ie < 15mn (on-line downloading), less than 3 hours, less than 24 hours, less than 1 week, more.

Note the degree of satisfaction can vary from one application to another and from one parameter to another eg 1 week may be fully acceptable for seismic data which cannot often be transmitted on-line due to their size.

4 Collection of relevant metadata for classification (Template 2)

Based on ISO quality principles and on the literature, a template (Template 2, 0) has been designed to collect the elements identified for the classification of the upstream data potentially used by the challenge and to establish the fitness for purpose of datasets.

These elements are grouped in seven categories :

- 1/ Characteristics (variable or GIS data sets) and categories
- 2/ Data sources : provider, originating programme and dataset/dataset series
- 3/ Overview elements : production purpose, processing level, intended uses
- 4/ Spatial coverage
- 5/ Temporal coverage
- 6/ Accessibility
- 7/ ISO 19113 quality elements

The elements of categories 1,2 and 3 are required to identify datasets or dataset collections needed by the challenges as well as to identify the catalogues and documentations where to find metadata describing the data, how they can be discovered (visibility) and accessed (accessibility). Their identification by intended use is a key element for revealing the dependancies between characteristics needed. These information are mandatory and must be collected by the challenge.

The elements of categories 4 to 6 are classification elements (eg coverage, resolution ...) which can be extracted somewhat easily from catalogues or from data providers information (production specifications).

The element of category 7 are sometimes available (eg spatial accuracy) from data provider information or contained in metadata describing datasets or in the dataset itself. When a quality element is available, it is asked to report it in the template.

Relevant documents related to the fitness of the data sources for uses different of the purpose of the data provider will be cited in addition.

The template is distributed with guidelines [11] to collect these elements or to allow WP1 to collect them using the Excell template 2 made available to the challenges.

These information will be the basis of the literature review and of the specifications of the indicators and spatial layers - when pertinent- to create for the establishment of the fitness for purpose (eg geographical availability).

ANNEX A. References

- [1] ISO 19115:2003, *Geographic information — Metadata*
- [2] ISO 19113:2002, *Geographic information — Quality principles*
- [3] ISO 19101 : , *Geographic information — Reference model*
- [4] ISO 19114:2002, *Geographic information — Quality evaluation procedure*
- [5] ISO 19138:2006, *Geographic information— Data quality measures*
- [6] ISO 19157:2011, *Geographic information— Data quality*
- [7] Fundamentals of Spatial Data Quality, GIS Series, Devillers R. and Jeansoulin R. (eds), ISTE, 2006
- [8] Grönroos, C.(1984), “A service quality model and its marketing implications”, *European Journal of Marketing*, vol. 18 No 4, pp 36-44
- [9] Nitin Set, S.G. Deshmukh, Prem Vrat (2005), “Service quality models : a review”, *International Journal of Quality & Reliability Management*, vol. 22, No 9, pp.913-949
- [10] Hongxiu Li, Reima Suomi, (2009), “ A proposed scale for measuring E-service Quality”, *International Journal of u- and e-Service, Science and technology* , vol. 2n No. 1, 2009.
- [11] WP1_D1-1_Data_classification_methodology_template2_guidelines_V2, 2014, E.Moussat
- [12] IHO standards for hydrographic surveys , 5th Ed., 2008, Special publication n°44

ANNEX B. Template 2

	A	B	C	D	E	F
1		Template 2	Version 2	28/03/2014		
2						
3	CHALLENGE NAME & NUMBER (M)	Challenge contacts : name, e_mail and phone (M)			Date of last update (YYYY/MM/DD HH:MM:SS) M	
4	<p>Upstream data classification elements.</p> <p>Based on the literature and on ISO quality principles, a method has been identified to classify the upstream data potentially used by the challenges and to establish its fitness for purpose (in the Data Adequacy Report).</p> <p>Following the MSFD nomenclature, data sets are made out of 'Characteristics' (see Annex III of MSFD). The characteristics have been listed in Template-1 and they should be repeated in this Template-2. A classification methodology is needed to qualify the input data sets for each characteristics. This classification is suggested to be done now by 7 'elements':</p> <ul style="list-style-type: none"> 1/ Characteristics definition (variable or GIS data set) and category; 2/Data source specification: provider, originating programme and dataset/dataset series; 3/Overview elements : production purpose, known uses, processing level; 4/Spatial coverage; 5/Temporal coverage; 6/Accessibility; 7/ISO 19113 quality elements. <p>The classification elements are described in each folder of this Template.</p> <p>There are 7 folders, please fill all the folder elements with the list of Characteristics required by your challenge and describe the required element parameters.</p>					
5						
6						
7						
8						
<p>Introduction Characteristics Data sources Overview Sp. coverage Time coverage Accessibility ISO 19113</p>						

	A	B	C	D	E	F	G	H	I
	1/Characteristics definition and category								
1	<p>Unique identifier (integer number)</p> <p>for the combination : (variable, dataset, intended use) or (geo. feature, dataset, intended use) (M)</p>	<p>Environmental matrix where characteristics are specified :</p> <p>Air, Fresh/Marine Water, River bed/SeaBed, Biota/Biology or Human activities (M)</p>	<p>SDN Discovery group code of Parameter (P02) for variables (http://www.seadatanet.org/Standards-Software/Common-Vocabularies) (M)</p>	<p>Variable characteristic code SDN parameter list (P01) (http://www.seadatanet.org/Standards-Software/Common-Vocabularies) (C)</p>	<p>Inspire topic category for characteristics http://inspire.jrc.ec.europa.eu/reports/ImplementingRules/DataSpecifications/D2.3_Definition_of_Annex_Themes_and_scope_v3.0.pdf (C)</p>	<p>Geographic feature characteristic (GIS data sets only) - Precise the feature layer you need (eg "Caulerpa areas"). If you need a specific attribute value of the layer eg "Caulerpa taxifolia": - mention it after the layer name eg Caulerpa areas / Caulerpa taxifolia - fill the column C and D with the group and name of the variable (C)</p>	<p>Processing level of characteristics : A- Observation (raw, QC) B- high level analyzed observational product (L1,L2,L3, L4 for satellite, merged from many datasets, etc.) C- Forecast/Hindcast D- Publication O- Other (M)</p>	<p>Production mode : 1.delayed 2.real-time (M)</p>	<p>Hierarchy data level : 1- dataset 2- collection of datasets 3- data source not found (M)</p>
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Growth and innovation in ocean economy Gaps and priorities in sea basin observation and data

Annex 1
Version: v2
Date: 04 05 2014

2/Data sources							
Note : many datasets are missing in the existing catalogues such as the European Directory for Marine Environmental Data (http://www.seadatanet.org/Metadata) or in the catalogue of the Geoportal http://inspire-geoportal.ec.europa.eu/ . Please mention if your data set is missing in these catalogues.							
Identifier (M)	Programme/Project name (C)	SDN EDMERP Identifier http://www.seadatanet.org/Metadata/EDMERP-Projects (M)	Data provider (M)	SDN EDMO Identifier http://www.seadatanet.org/Metadata/EDMO-Organisations (M)	Data collection or data set name (M)	Catalogue name (SDN EDMED, Inspire Geoportal, SDN CDI, MyOcean, Mongoos, others...) (M) http://www.seadatanet.org/Metadata/EDMED-Datasets http://www.seadatanet.org/Data-Access/Common-Data-Index-CDI http://inspire-geoportal.ec.europa.eu/ http://www.myocean.eu/ http://www.mongoos.eu/	Identifier of the dataset in the catalogue (C)
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	A	B	C	D	F
1	3/Overview elements of dataset Please specify the intended use for each characteristics at the moment of production.				
2	Identifier (M)	Purpose of Characteristics production (provider specification) (M)	Production and quality assessment specifications reference (C)	Intended use title (M)	Intended use description (objective, process description, output data) (M)
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	A	B	C	D	E	F	G	J	K	L
1	4/Spatial coverage of characteristics									
2	Identifier (M)	Geographical area code SDN C19 list (C)	Lat S (+/-DD .DDDD) (C)	Lat N (+/-DD .DDDD) (C)	Lon W (+/-DDD.DDDD) (C)	Lon E (+/-DDD.DDDD) (C)	Hor.resolution (unit to be defined) (O)	Min depth (meters > 0 downwards) (O)	Max depth (meters > 0 downwards) (O)	Vert. Resolution (unit to be defined) (O)
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	A	B	C	D	E
1	5/Time coverage of Characteristics				
2	Identifier (M)	Start date YYYY/MM/DD HH:MM:SS (C)	End date YYYY/MM/DD HH:MM:SS (C)	Time resolution YYYY/MM/DD HH:MM:SS (O)	Update time of dataset YYYY/MM/DD HH:MM:SS (O)
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	A	B	C	D	E	F	G	H
1	6/Accessibility of characteristics							
2	Identifier (M)	<p>Data delivery mechanisms: 1- order form/envoice; 2-On-line downloading services; 3-On-line discovery+viewing + downloading services; 4-On-line discovery + viewing+ downloading + advanced services (High resolution viewing,3D viewing services, Processing/Mapping services...) (M)</p>	<p>Data policy : 1- restricted 2 - accessible under moratorium 3-unrestricted 4-unknown (M)</p>	<p>Cost basis : 1-no charge 2-distribution cost charge 3 - collection cost charge 4- commercial cost charge 5-unknown (M)</p>	Data format(s) and conventions (M)	Interoperability of on-line services (O)	<p>Responsiveness : 1. < 15mn (on-line downloading), 2.less than 3 hours, 3.less than 24 hours, 4.less than 1 week, 5.more (M)</p>	Reliability (Degree of commitment to provide the service) (O)
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22								

	A	B	C	D	E	F	G
1	7/ ISO 19113 quality elements Precise the quality requirements and tolerance threshold for each characteristics						
2	Identifier (M)	Completeness (O)	Hor. Accuracy (O)	Vert.accuracy (O)	Time accuracy (O)	Thematic accuracy (O)	Logical consistency (O)
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Growth and innovation in ocean economy
Gaps and priorities in sea basin observation and data

Annex 1
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