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Survey of National Coastal and Marine geoportals: European developments

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Abstract

Rapid changes in marine and coastal areas demand implementation of processes and tools to enhance knowledge and management of these territories. To contribute to these goals, Marine and Coastal Spatial Data Infrastructures (SDIs) facilitate sharing and use of spatial data across a broad range of stakeholders by promoting data and metadata harmonization and services interoperability.

This paper describes the first results of a European Web survey undertaken to assess the developments of existing national marine and coastal geoportals for SDIs or similar Web services. The Web survey led to an inventory of 35 national operational geoportals. For each geoportal, 12 characteristics were measured in November 2014 and in March 2015, in order to monitor current developments.

Based on the preliminary survey results, four types of geoportals were distinguished: Atlas-like geoportals, (2) Hydrographic Office geoportals, (3) Oceanographic/Marine Data Centre geoportals, and (4) Hybrid geoportals.

1. Introduction

The intensity and magnitude of current changes that characterize marine and coastal areas demand the implementation of collective information processes and tools to enhance knowledge and management of these territories (Cicin-Sain *et al.*, 1998).

Since the 1990's, the role of spatial data and information in decision making in many sectors (including the marine and coastal environment) has led to the development of Spatial Data Infrastructures (SDIs) to better manage and share spatial data (Crompvoets *et al.*, 2004). The development of SDIs responds to international needs to facilitate access, exchange, and sharing of spatial data held by many stakeholders to maximize its use and re-use, while reducing the cost of management and production. Coastal and Marine SDIs have been gradually implemented in order to improve the accessibility and the availability of spatial data related to marine and coastal areas at various levels (Longhorn, 2005; Canessa *et*

al., 2007). A favourable context for increasing efficiency in spatial data production and improving availability and accessibility is being put in place to support the international concepts of Integrated Coastal Zone Management (ICZM) (Cicin-Sain *et al.*, 1998) and Maritime Spatial Planning (MSP) (Douvere, 2008). These concepts aim to deliver a sustainable approach to the management of coastal zones, oceans and seas, across sectors, between different levels of government, and across jurisdictional boundaries. These concepts and related regulations (e.g. European Commission (2008), European Commission (2013), European Commission (2014)) act as the catalyst for increasing production, access, sharing, use and integration of coastal and maritime spatial data in order to inform ICZM/MSP decision making (IHO, 2011). The needs for coastal and marine SDIs are becoming *a priori* evident.

Within this context, a European Web survey aims to assess worldwide developments of existing national marine and coastal geoportals for SDIs or similar Web services, as such inventory does not exist today. The geoportal is the central web gateway targeting the facilitation of spatial data discovery, access, and related added-value services (Crompvoets *et al.*, 2004; Maguire et Longley, 2005). The existence and status of such portals represents one of the ways to assess the processes implemented by a country to enable the access and use of coastal and marine geographic data. This paper presents the first preliminary results of the European survey undertaken.

2. <u>Scope and methodology</u>

The survey focuses on geoportals implemented by national public bodies in Europe enabling the access and the use of geographic data specifically related to marine and/or coastal zones. Within the framework of the survey, the term "data" encompasses a broad range of items such as real-time observations, time series data, GIS data layers, digital maps, etc.

2.1 Geoportal inventory

The inventory was conducted in November 2014. The list of geoportals was gathered by browsing of the Internet with the help of specific monitoring tools: Google alert, Mention and Netvibes. Based on a literature review, several keywords were used in English, Spanish and French to parameterize the tools in order to encompass the diversity of vocabulary used (e.g. coastal, marine, geoportal, SDI, data centre, etc...). The approach also included a scan of various types of information sources related to geomatics and coastal/marine domains (e.g. fromGlobal Spatial Data Infrastructure Association (GSDI), International Coastal Atlas Network(ICAN), International Hydrographic Organization (IHO), International Oceanographic Data and Information Exchange (IODE), INSPIRE conference, COASTGIS conference, etc.)

2.2 Geoportal characteristics measurements

In order to provide a general overview of the existing geoportals, the following eleven characteristics were sourced from the geoportal Web pages in November 2014 and again in March 2015 in order to monitor current developments.

1. Name of national geoportal
2. Year of first implementation
3. Language(s) used
4. Data themes
5. Number of datasets
6. Level of openness for data access
7. Licensing
8. Data searching mechanisms
9. Data access services
10. Monthly number of users
11. Number of data suppliers
12. Standard metadata

The choice of the characteristics is based on similar geoportal assessments (Crompvoets *et al.*, 2004; EUROGI/eSDI-Net+, 2011) and on specificities recognized useful for ICZM and MSP processes (O'Dea *et al.*, 2011; Wright *et al.*, 2011).

3. **Results**

Thirty-fivesurveyed geoportals are implemented by national public organizations providing access to coastal and/or marine spatial data. Mostof the surveyed geoportals were implemented around mid 2000's[1]. It appears that most (94 %) of the geoportals of the non-English countries provide information in two (88 %) or more languages (12 %).

3.1 Typology

Given the diversity of the geoportals inventoried, the first step of the survey was to establish a typology to guide the ongoing analysis of the different characteristics of the geoportals.

The comparison of characteristics 4, 6, 8 and 9 (see above) suggests a typology resulting into the following four types of geoportal: Atlas-like geoportals, (2) Hydrographic Office geoportals, (3) Oceanographic/Marine Data Centre geoportals, and (4) Hybrid geoportals.

3.1.1. Atlas-like geoportals

Within the framework of the IOC IODE International Coastal Atlas Network (ICAN) Project,a coastal web atlas (CWA) is defined as "a collection of digital maps and datasets with supplementary tables, illustrations and information that systematically illustrate the coast, often with cartographic and decision support tools, all of which are accessible via the Internet" (O'Dea *et al.*, 2007). This type gathers the 3 geoportals of national atlases of the ICAN network together with 6 other Atlas-like geoportals (26 % of the total number of surveyed geoportals).

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[1] This information is not available from the geoportal Web pages for 77 % of the surveyed geoportals.

3.1.2. Hydrographic Office geoportals

The second type includes 9 geoportals (26 % of the total number of surveyed geoportals) that are mainly implemented by national Hydrographic Offices, organizations which are historically devoted to surveying and charting seas, oceans and navigable waters for purposes of maintaining safety of life at sea. International cooperation between these Hydrographic Offices led to the creation of the International Hydrographic Organization (IHO) in 1921.

3.1.3.Oceanographic/Marine Data Centre geoportals

In the third category,13 geoportals were identified (37 % of the total number of surveyed geoportals). They correspond mainly to National Oceanographic Data Centres(NODC)and other Marine Data Centres. The NODCs have been progressively implemented by the IOC's International Oceanographic Data and Information Exchange (IODE) since the 1960's. At the European level, the NODC and other Marine Data Centreshave been gathered in theSeaDataNet network, a Pan-European network providing on-line integrated databases since the end of the 2000's.

3.1.4. Hybrid geoportals

In addition to the 31 geoportals classified into these three first types, 4 geoportals (11 % of the total number of surveyed geoportals) were identified as Hybrid geoportals sharing the characteristics of the types 1 and 3.

3.2 Characteristics

In the sections below, the results of the measurements of the 11 characteristics are providedaccordingly to the five components proposed by Rajabifard et al. (2002).In addition for the general portrayal of the 35analyzed geoportals,thesecharacteristics allowa detailed description of the four types of geoportal. The characteristicswere measured two times (November 2014 and March 2015). Except for the number of datasets which are only slightly increasing, the other characteristics are very stable over time.

3.2.1 Data

The component Data is described by the data theme(4) and the number ofgeographicaldatasets (5).

The analyzed geoportals provide variousdigital data within diverse domains including administration (63 %), physical (77 %), biological (54 %) and human (46 %) aspects (Figure 1).They combine reference data as well as business data. Atlas-like geoportals provide a large diversity of data themes describing administrative (100 %) and biophysical (100 % and 67 %) aspects (e.g. marine biology, biodiversity, etc.) of the coastal and marine zones along with human uses (89 %) (e.g. pollution related topics, tourism, etc.).The main data accessible on the Hydrographic Office geoportals are related to administrative (100 %) (e.g. Electronic Nautical Charts, lists of lights, sailing directions) and a few to physical aspects (11 %)(e.g. tidal stream data, etc).This data is also often made available via distribution agents. Oceanographic/Marine Data Centre geoportals enable access to data mainly related

to physical, chemical, geology, oceanography (100 %) or marine biology (69 %) collected from marine cruises, buoys, tide gauge stations, and satellites. The data provided by Hybrid geoportals are variable with a majority of data related to the physical (100 %) and biological (100%) themes (Figure 1).
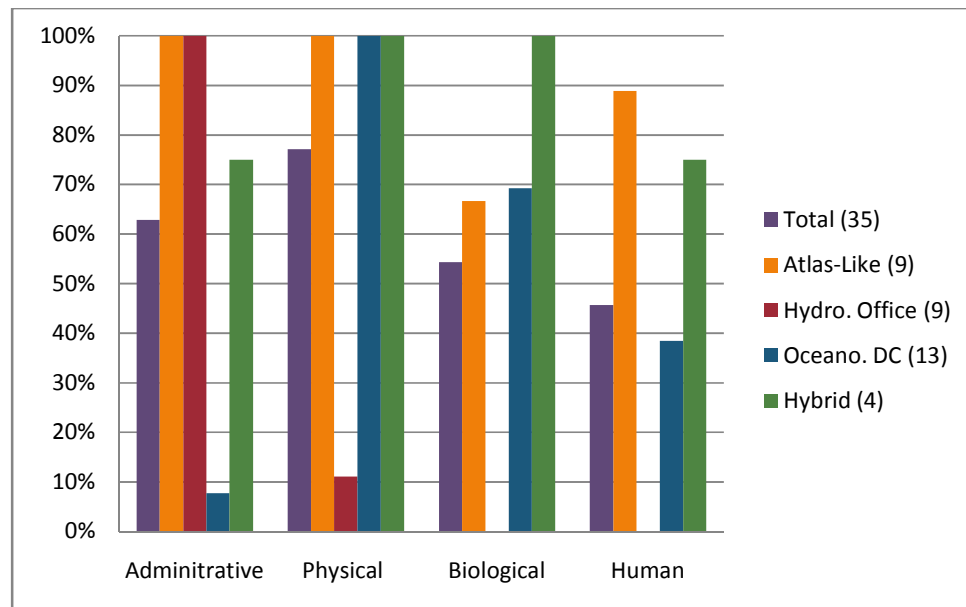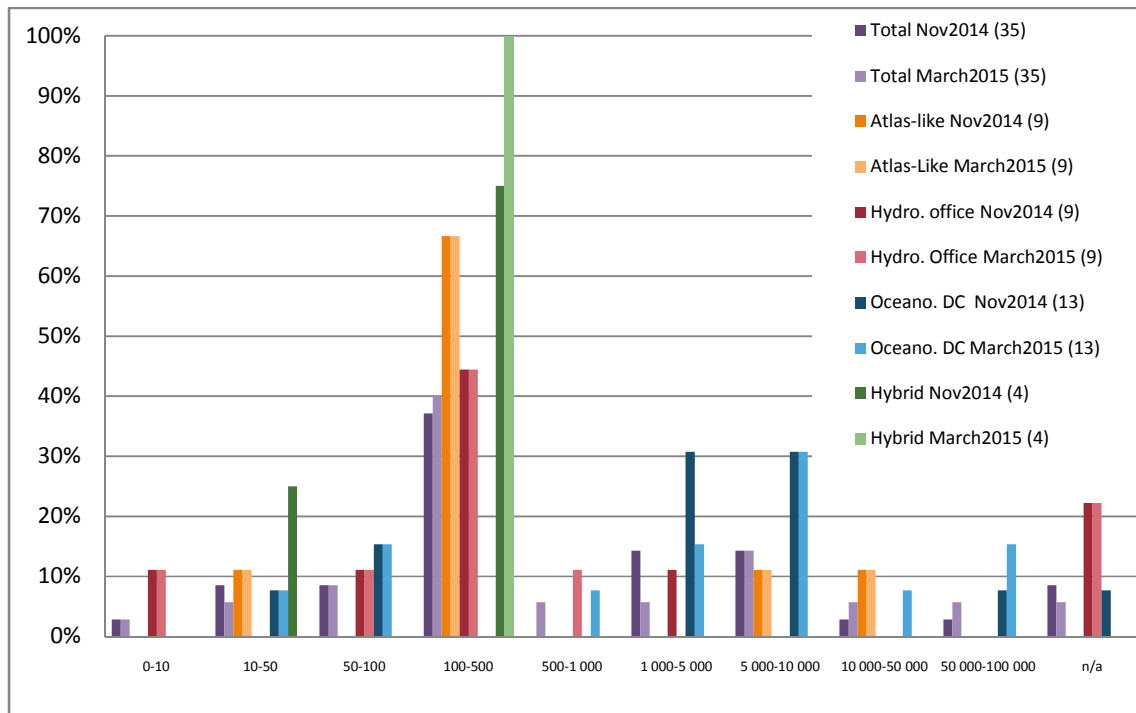

Notes: For each data theme, 100 % means that all the geoportals of this type (e.g. 9 for the Atlas-like geoportals) provide data of this theme

Figure 1. Data Themes

The variety in the number of datasets between different geoportals is high: 67 %of Atlas-like geoportals give access to 100-500 datasets while 69 % of the Oceanographic/Marine Data Centre geoportalsallow the user access to more than 1000 datasets and 67 % of the Hydrographic Office geoportals to less than 500 datasets.

These differences can be explained by the specificity of the data in each type of geoportal.The Oceanographic/Marine Data Centre geoportals gather datasets corresponding mainly to vertical profiles of physical, chemical and biological data from numerous cruises and collected by different equipment. In the Atlas-like geoportals, the datasets correspond to GIS layers while in Hydrographic Office geoportals, dataset are mainly nautical chart cells with defined limitations.The total number of datasets is not available for 9 % (November 2014)and 6 % (March 2015)of the analyzed geoportals. The numbers of datasets are slightly increasing between November 2014 and March 2015 research.(Notes: for each class of number of datasets, 100 % means that all the geoportals of this type (e.g. 4 for the Hybrid geoportals) provide datasetin this class

Figure 2).

Notes: for each class of number of datasets, 100 % means that all the geoportals of this type (e.g. 4 for the Hybrid geoportals) provide datasetin this class

Figure 2. Number of datasets

3.2.2 Policy

The component Policy is described by the level of openness (6) and licensing (7).

Referring to figure 3, 43 % of the analyzed SDIs provide free access for all. The remaining geoportals provide free access only for registered users (9 %), free access by using request forms (23 %), or provide access subject to fees (26 %). Although personal registration may be required for the portal (22 %), access to the data of the Atlas-like geoportals is mostly free for all (78 %). Registration gives the user access to various additional functionalities (e.g. online map saving, search request saving). Access to the products of the Hydrographic Office geoportals is fee-paying (100 %). For the Oceanographic/Marine Data Centre geoportals, the data are freely accessible for all (38 %) or through a request form (62 %). For the Hybrid geoportals, the data are freely accessible for all (75 %) or through a request form (25 %).
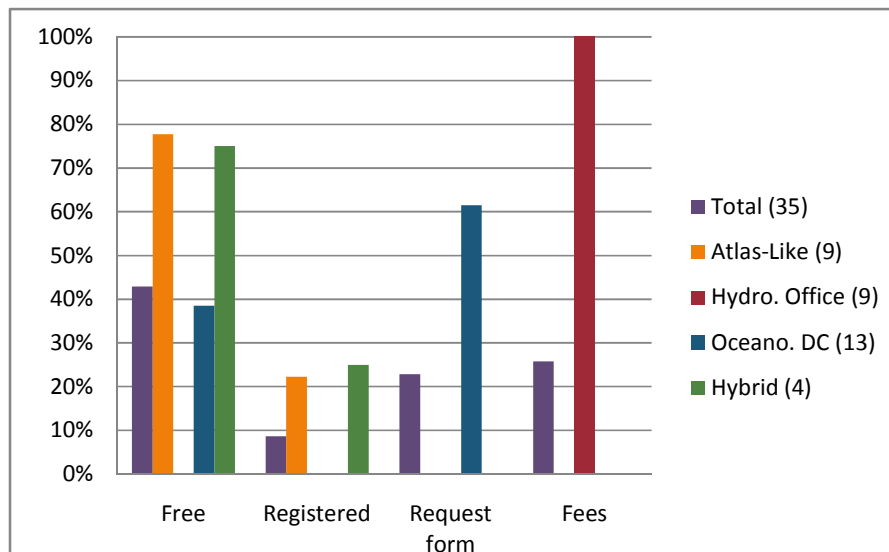
Figure 3. Level of openness

Regarding licensing, the data policy depends of the type of geoportal.The Atlas-like geoportals provide the data under Open Licenses (22 %) or Specific Data Use Agreements (78 %). The data of the Hydrographic geoportals are under the General Conditions ofSale of the distribution agents (see 3.2.1).The data policy of the Oceanographic/Marine Data Centre geoportals is compliant with IOC Oceanographic Data Exchange Policy (IOC, 2015)or the SeaDataNet Data Policy and User license(SeaDataNet, 2015).

3.2.3 Technology

The component Technology is described by the mechanisms for searching (8) and accessing (9).

Searching for spatial data on a geoportal can be done through different mechanisms: catalog interfaces (60 %) that allow searching by means of keywords, production time, data theme, providers, etc.; map interfaces (70 %) for locating an area of interest or by clicking on an area with predefined boundaries and a list of products in hypertext (46 %) (Figure 4).

Access of the data over the geoportals can be performed in diverseways:viewing interfaces (71 %), downloadingservices (51%),web services which allow the user to have direct access to the geographic data (20%), data transmission via e-mail (37 %) or data purchasefrom certified distribution agents (e.g. retail stores) (26 %) (Figure 5).

To consult the data, the user of the Atlas-like geoportals has mainly access to map search mechanisms (100 %) and catalogue interfaces (67 %). Data access services are mainly based on viewing (100 %), downloading (89 %) and other web services (44%).

The data of the Hydrographic geoportals are mainly accessible via a list of products in hypertext (89 %). Access to the products is generally from certified distribution agents (100 %).

For the Oceanographic/Marine Data Centre geoportals, the search page is in the form of a map (77 %) or a catalogue interface (69 %) based on criteria such as parameters, time period, cruise,etc. The data can be transferred by the data centre (100%), viewed (69 %) or downloaded (54%).

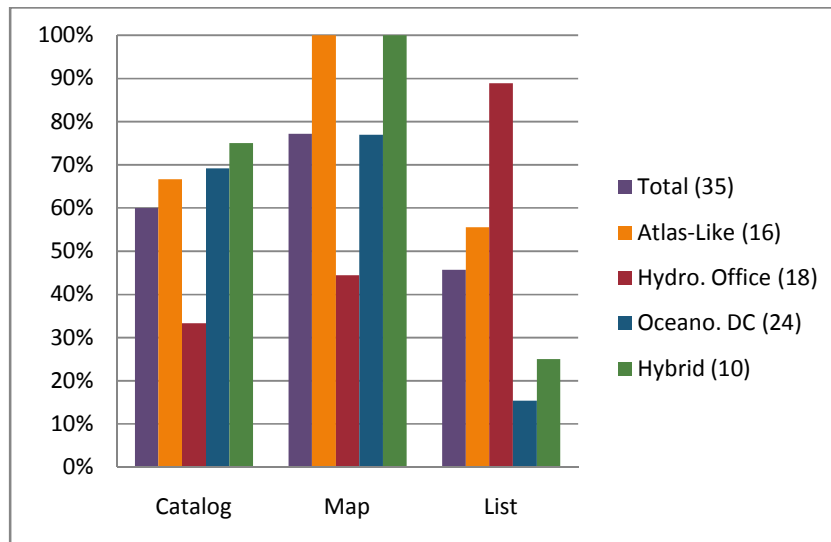The Hybrid geoportalshave mainly map search mechanisms (100 %) and view access interface (75 %) (Figure 4 and 5).
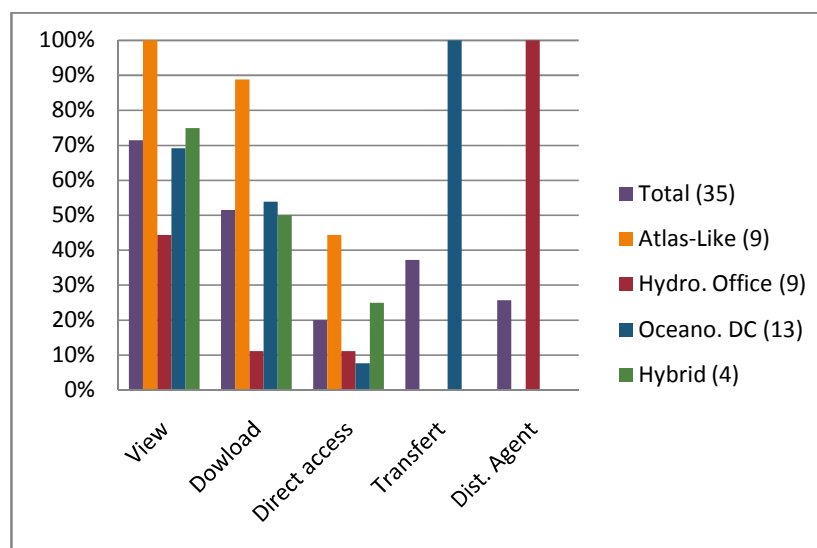

Figure 4. Search Mechanisms

Figure 5. Access Mechanisms

3.2.4 People

The People componentis characterized by the number of monthly visitors (10)and by the number of data suppliers (11).

The monthly number of users was not available online, expect for one Atlas-like geoportal.

Number of data suppliers is not available for 54 % of the analyzed geoportals. Based on the available data, 43 % of the surveyed geoportals have less than 50 data suppliers.
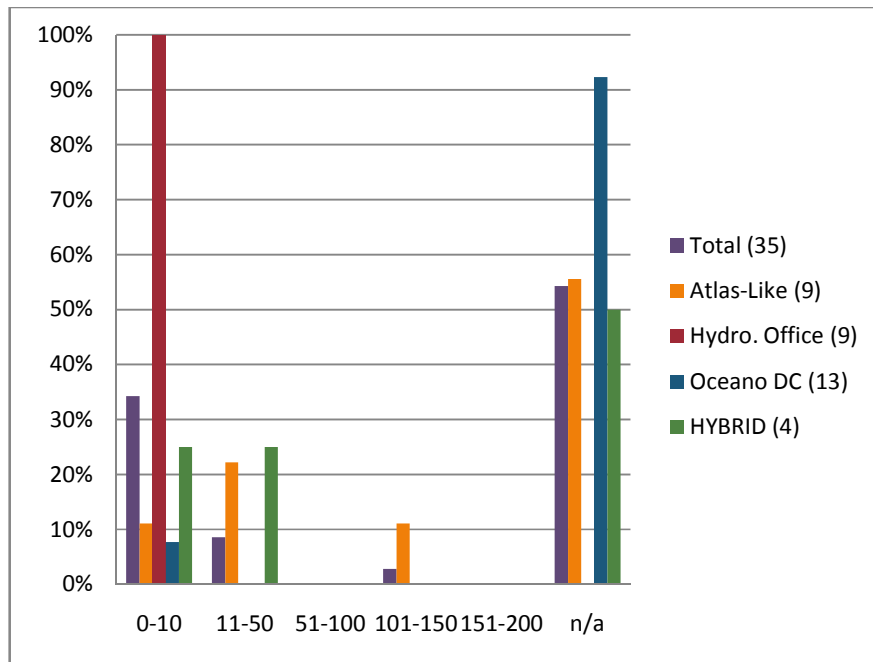

Figure 6. Number of data suppliers

3.2.5 Standards

The Standard component is represented by the application of a metadata standard (12) in the geoportal.

All the Hydrographic Office geoportals provide metadata according to theIHO transfer standard for digital hydrographic data (S-57) (IHO, 2000). The remaining geoportals provide metadata in the INSPIRE Metadata standard (European Commission, 2009).

4. Discussion and preliminary conclusion

The preliminary results suggest that European developments are underway for geoportals enabling users to have access to various data concerning coastal and marine zones. At the present stage of the study, the 35 geoportals assessed can be classified in four types: Atlas-like geoportals, Hydrographic Office geoportals,

Oceanographic/Marine Data Centre geoportals, and Hybrid geoportals. Each type enables access to different kinds of data through various mechanisms.

Thesekinds of data and mechanisms are very stable between November 2014 and March 2015or are slightly increasing (e.g. number of datasets).These characteristics are very similar to the 'terrestrial-oriented' geoportals(Crompvoets *et al.*, 2004)except the data themes and standards used.

Despite the integrated approach promoted by ICZM and MSP concepts and related regulations, the results indicate that platforms allowing access to a wide range of data related to marine, coastal and land territories are not commonly found. True data harmonisation and services interoperability, which are the underpinning principles for SDIs, need to be improved.

The main limitation of the survey concerns the fact that some information needed for assessment is not available online.In the near future, a questionnaire will be sent to the geoportal coordinators in order to assess real usage of the geoportals.

The research also provides some insights for further developments. The proposedgeoportals coordinators'survey can be extended to geoportal users in order to analyze what they do with the data in their day-to-day responsibilities and what are their needs.The combination of these approaches (geoportals, coordinators'and users' survey) should contribute to a Multi-View Framework (Crompvoets et al., 2008) in order to assess SDIs and their ability to matchthe sustainable approach to the management of the coastal zones, oceans and seas.

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