Survey of National Coastal and Marine SDI geoportals: a first typology of the worldwide developments

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Abstract

The intensity of current changes that characterize marine and coastal areas demand the implementation of collective processes and tools to enhance knowledge and management of these territories. To contribute to these goals, Spatial Data Infrastructures (SDIs) aim to facilitate the sharing and the use of spatial data between a broad range of stakeholders by promoting data and metadata harmonization and services interoperability.

This paper describes the first results of an international Web survey undertaken to assess the developments of existing national marine and coastal geoportals of SDIs or similar Web services. A Web survey done in October 2014 led to an inventory of 81 national operational geoportals. Based on the survey results, a preliminary typology can be made. Four types of geoportals can be distinguished: (1) National Oceanographic Data Centre (NODC) geoportals, (2) Marine/Coastal Atlas geoportals and (3) Hydrographic Office geoportals, (4) Hybrid geoportals.

Introduction

Marine and coastal areas are complex and vulnerable territories, home to many diverse human activities and complex environmental oceanic and meteorological events. For the past fifty years, marine and coastal areas all over the world have been in crisis, through over-exploitation of resources and related use conflicts (UNEP, 2012). The intensity and magnitude of current changes that characterize marine and coastal areas demand the implementation of collective processes and tools to enhance knowledge and management of these territories (Cicin-Sain *et al.*, 1998).

Progress over the past three decades in the field of Geographic Information Sciences and Technologies provides an enabling framework for the monitoring and management of these territories (Bartlett et Smith, 2004; Gourmelon et Robin, 2005; Wright *et al.*, 2011). 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 SDIs to better manage and share spatial data and information (Crompvoets *et al.*, 2004). The development of SDIs responds to the international needs to facilitate access, exchange, and share of spatial data and information held by many stakeholders to maximize its use and re-use, while reducing the cost of management and production. SDIs include components such as data, policy, access networks, standards, and people (Rajabifard *et al.*, 2002) to support these goals.

Coastal and Marine SDIs have been gradually implemented in order to improve the accessibility and the availability of spatial data and information related to marine and coastal areas at various levels (Longhorn, 2005; Canessa *et al.*, 2007). While these initiatives are not always labelled "SDI" (e.g. Atlas, Information System...), they share SDI objectives and concepts. They provide the user community (decision makers, planners, scientists and citizens in general) with real time observations and multi-thematic data (biophysical, human uses, biodiversity…) collected through research, monitoring and observation (Wright *et al.*, 2011).

A favourable context for increasing efficiency in spatial data production and improving availability and accessibility is being put into 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 the 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 geo-information in order to inform IZCM/MSP decision making (IHO, 2011). The needs for coastal and marine SDIs are becoming *a priori* evident.

Within this context, an international Web survey aims to assess the worldwide developments of existing national marine and coastal geoportals of SDIs or similar Web services, as such inventory does still not exist.

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 the country to enable the access and use of coastal and marine geographic data and information. This article presents the first preliminary results of the international survey undertaken. Given the diversity of the geoportals inventoried, the first step of the survey is to establish a typology to guide the ongoing analysis of the different characteristics of the geoportals.

Scope and methodology

The survey focuses on geoportals implemented by national public bodies 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. The data can be related to different domains (physical or biological environments, human uses, topography, bathymetry, management or legislative aspects) and different scales (local, national, supranational, global).

The survey was conducted in October 2014. The required information was collected from the Web. The survey 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, the following keywords were utilized in English, Spanish and French to parameterize the tools in order to encompass the diversity of vocabulary used: "coastal", "marine", "ocean", "sea", "portal", "geoportal", "clearinghouse", "spatial data infrastructure", "atlas", "data centre" and "information system". The approach also encompassed a scan of various types of information sources related to geomatics and coastal/marine domains, including international networks and events such as GSDI, ICAN, IHO, IODE, INSPIRE, COASTGIS conference, Seadatanet, FIG.

In order to provide a general overview of the geoportals, the following characteristics were sourced from the geoportal Web pages. They allow a general description of the first elements that the user can discover online: (1) Name, (2) Geographical distribution, (3) Language used, (4) Data thematic, (5) Data access policy, (6) Search data mechanisms, (7) Access data mechanisms. The first three characteristics correspond to the general description of the geoportal. The four others characteristics provide information on the discipline and the topic of the data accessible on the geoportals (4) and on different means to discover and access these data (5-7).

At the time of the submission, 128 geoportals were assessed from 72 coastal countries (48 % of the total number of coastal countries). Out of these, 23 geoportals were not operational (18 %), 24 out of the scope of the survey (19 %) , and 81 were implemented by national public organizations providing access to coastal and/or marine spatial data (63 %). These latter were included in the survey and are the basis of the main results presented later in this paper. These geoportals are implemented by 46 countries. With the exception of major maritime countries (USA, France, Australia, Canada) that manage several geoportals (from 4 to 5), the large majority of the countries have only one or two geoportals. It appears that the geoportals of the non-English countries provide information in two or more languages.

The comparison of the characteristics 4, 5, 6 and 7 enables to suggest a preliminary typology resulting into the following four types of geoportal: (1) National Oceanographic Data Centre (NODC) geoportals, (2) Atlas-like geoportals and (3) Hydrographic Office geoportals, (4) Hybrid geoportals.

NODC geoportals

In the first category, 34 geoportals were identified (42 % of the total number of surveyed geoportals). They correspond mainly to National Oceanographic Data Centres. These data centres have been progressively implemented by the International Oceanographic Data and Information Exchange (IODE) since the 1960's. Their missions are to gather, control quality, process and disseminate oceanographic data. As of 2012, there were 80 NODCs active worldwide (IODE, 2013).

They enable access to data related to physical and chemical oceanography, marine biology or geology (e.g. data from marine cruises, buoys, tide gauge stations, satellites). The data are freely accessible or through a request form. The search page is in the form of a list of data or a catalogue interface based on criteria such as parameters, geographic extent, time period, etc. The data can be viewed, downloaded or transferred by the data centre.

Atlas-like geoportals

Within the framework of the International Coastal Atlas Network (ICAN), 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 second type gathers the 8 geoportals of national atlases of the ICAN network together with 13 other atlas-like geoportals. The main differences with NODC are the diversity of the data thematics and the type of data available. These 21 geoportals (26 % of the total number of surveyed geoportals) enable access mainly to GIS data layers and digital maps from different sources and suppliers describing biophysical aspects of the coastal and marine zones along with human uses, biodiversity, pollution related topics, etc. Although personal registration may be required for the portal, access to the data is mostly free. The registration enables the user to have access to various additional functionalities (e.g. online map saving, search request saving). To consult the data, the user has access to map search mechanisms and catalogue interface. Data access services are mainly based on viewing, downloading and other web services which allow the user to have direct access to the geographic data, maps and metadata from a GIS desktop or for online applications. Some of the geoportals provide access to decision support tools (spatial analysis, indicator, barometer tools).

Hydrographic Office geoportals

The third type includes 19 geoportals (23 % of the total number of surveyed geoportals) that are mainly implemented by national Hydrographic Offices. The main data accessible on these geoportals are related to Nautical Charts. These latter are mainly digital maps accessible *via* a list of products in hypertext. Access to the products is generally fee-paying through online payment mechanisms. The data can be then accessed in the online cart.

Hybrid geoportals

In addition to the 74 geoportals classified into these three first types, 7 geoportals (9 % of the total number of surveyed geoportals) were identified as hybrid geoportals sharing the characteristics of the types 1 and 2 (3 geoportals) or these of the types 1 and 3 (4 geoportals).

The table 1 presents the main characteristics of the four types of geoportal.

Table 1. Characteristics of the geoportal

Geoportal Class	Number	Data thematic	Data access policy	Search data mechanism	Access data mechanism
NODC	34	Oceanography	Free or request form	List or/and catalogue	View, download or transfer
Atlas	21	Biophysical and human environment	Free	Map and catalogue	View, download or Web services for GIS desktop or online application
Hydro. Dept.	19	Nautical Charts	Fee-paying	List	View and online cart
Hybrid	7	Various	Various	Various	Various

Preliminary conclusion

The preliminary results suggest that worldwide 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 81 geoportals assessed can be classified in four types: (1) National Oceanographic Data Centres or similar, (2) Atlas-like geoportals and (3) Hydrographic Office geoportals, (4) Hybrid geoportals. Each type enables access to different kinds of data through various mechanisms.

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

In the near future, the proposed typology will be complemented by the measurement of about twenty characteristics related to the five components as proposed by Rajabifard et al. (2002) to describe SDIs: data (e.g. number of dataset), access network (e.g. data search mechanism type), people (e.g. number of data suppliers), standards (e.g. metadata standard type), and policy (e.g. level of openness, pricing). The choice of these characteristics is based on similar geoportals assessment studies (Crompvoets et al., 2004; EUROGI/eSDI-Net+, 2011) and on specificities recognized as useful for IZCM and MSP processes (O'Dea et al., 2011; Wright et al., 2011). These characteristics will be measured a second time in April 2015 in order to monitor the current developments.

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