Marine Regions: towards a standard for georeferenced marine names

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Geographic Information Systems have become indispensable tools in managing and displaying marine data. However, a unique georeferenced standard of marine placenames and areas is not available, hampering several marine geographic applications, such as the linking of these locations to databases for data integration. In order to improve the current situation, we developed "Marine Regions", a standard, hierarchical list of geographic names, linked to information and maps of the geographic location of these names, freely available at http://www. marineregions.org. The objectives of Marine Regions are to improve access and clarity of the different geographic marine names such as seas, sandbanks, ridges and bays and to display univocally the boundaries of marine biogeographic or managerial marine areas.

Structure & technology

All geographic objects of the Marine Regions database have a unique identifier, called the MRGID (= Marine Regions Geographic Identifier), used for locating the geographic resources on

Fig. 1 - Screenshot of the "Marine Regions", displaying the placedetails, relations, boundaries and download links of the Alaskan part of the US Exclusive Economic Zone.

the web. The different geographic objects are determined by a placetype and coordinates. While the coordinates can be represented as different vector data types (being a point, a multipoint,
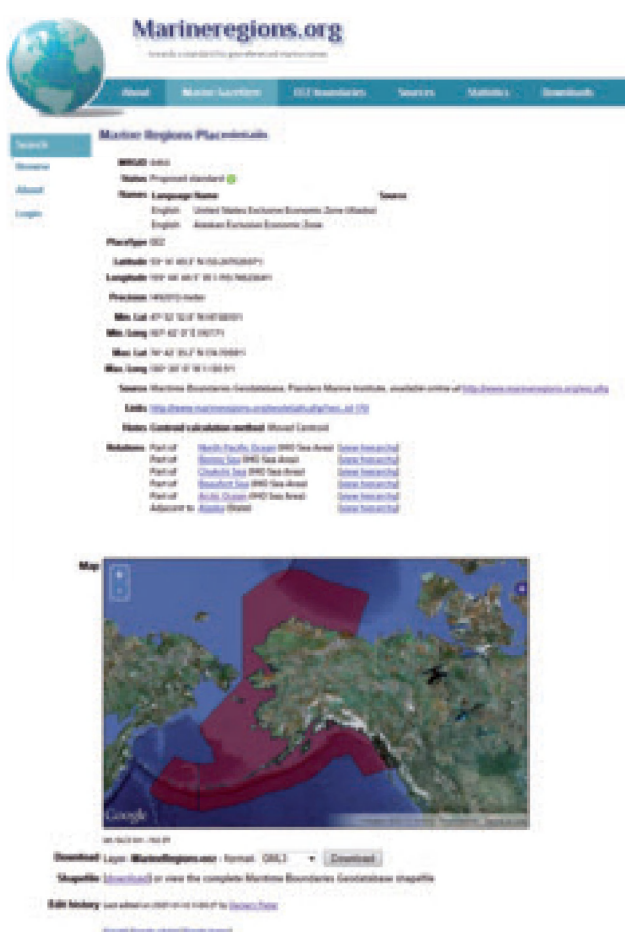
polyline or a polygon), a placetype provides contextual information to the geographic objects, for example a sea, a bay, a ridge, a sandbank or an undersea trench. Not only physical placetypes are considered, but also administrative placetypes, like countries, EEZ's, fishing zones or territorial seas can be stored in the database.

The actual name of the geographic objects is stored as a different entity, allowing thus multiple naming for one geographic object (i.e. dealing with different languages). It is also possible to define different relations between the geographic objects (part of, partly part of, adjacent to, similar to, streams through or flows out). Such a structure allows the user to group joint geographic units and to create a hierarchical classification of different places. Once logged in, geoobjects can be edited through the webinterface of Marine Regions. If a point, a line or a polygon is available for a geographic object, the geographic position of the object will be visualised on an interactive web mapping interface (Fig. 1).

The geographic webinterface is based on the OpenLayers technology. All shapefiles containing the polylines and polygons are uploaded to a local Geoserver installation, allowing to distribute the geographic objects as different Web Mapping Services (WMS) and Web Feature Services (WFS). The polygons of the different geographic classifications can be downloaded from the website as individual shapefiles.

Content of Marine Regions

At the moment Marine Regions lists and provides geographical information and relations on more than 32,604 placenames, representing 25,487 marine geographic places. The number of records is an approximate value based on the database on January 15th, 2013. We can distinguish three different categories of information: regional checklists, global checklists and global or regional spatial marine classifications.

The regional checklists include detailed information from the North Sea, the Black Sea and the Antarctic region. The main global checklists integrated in Marine Regions are the IHO-IOC GEBCO Gazetteer of undersea feature names, marine placenames from the Aquatic Sciences and Fisheries Abstracts (ASFA) thesaurus and several distribution records from the World Register of Marine Species.

Marine Regions gives access to 12 marine geographic regional or global marine classifications including the boundaries of the major oceans and seas of the world, defined by the International Hydrographic Organisation (IHO), the Large Marine Ecosystems of the World, the Longhurst Biogeographical Provinces or the Marine Ecoregions of the World. The database contains also 5,597 polygons of geographic places. Marine Regions gives also access to the database of the Exclusive Economic Zones of the world making them available to the scientific community. As this information was not freely available, two global GIS covers, containing the lines of the maritime boundaries of countries and the polygons of the EEZ's have been calculated. The first step in the creation of the geodatabase was the integration of information already available. In a second phase the database of negotiated treaties from the United Nations Convention on the Law of the Sea (UNCLOS) was con-sulted and imported into a GIS. The geographic coordinates from the documents were converted to decimal degrees and imported into a database. If no treaty was available from UNCLOS, the 200 nautical miles buffer around a country was calculated. If the distance between two countries was less than 400 nautical miles, the maritime boundary was calculated as the median line between both countries.
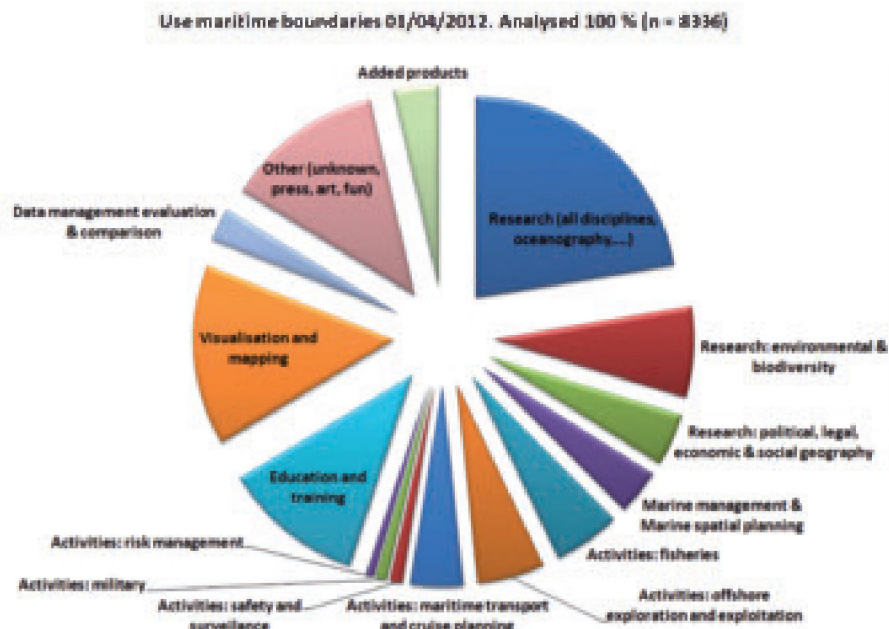
Fig. 2 - Table indicating different usages of the Marine Regions data.

Users

The web statistics and downloads of the system have been monitored since 2008. Between 2008-11-19 and 2013-01-05 18,967 shapefiles were downloaded, with 2,584 downloads in 2009, and 6,294 downloads in 2012. These statistics do not include the downloads or consultation of the geographic objects through the available WMS or WFS services, as these services are more difficult to monitor. In January 2013 the website received 90,284 hits from 3,602 unique visitors. We analysed the purpose of download of 8,336 downloads between 2008-11-19 and 2012-03-30 (Fig. 2). This represents 44% of the total recorded downloads between 2008-11-19 and 2013-01-05. The reason for download is a required but free text field when a GIS layer is downloaded from Marine Regions. We grouped the various reasons for download into different categories. Most of the downloads were performed for research purposes (33.9%) with main disciplines oceanography (22.2%), environmental and biodiversity sciences (7.3%) and political and economic geography (4.2%). In 2.7% of the cases the data was used for standardization purposes in marine data management. These two categories constitute the reasons for which Marine Regions was developed but represent less than half of total downloads. Over 21% of the geographic information was downloaded for specific purposes related to different marine and maritime activities including fisheries (5.4%), offshore exploration (5.4%), maritime transport and cruise planning (4.2%), marine management and marine spatial planning (3.7%), surveillance (1.0%), military use (0.9%) or risks assessments (0.6%). The data was also extensively used for educational or visualization purposes (26.0%). In 3.6% of cases, added products were created out of the geographic data, for example incorporation of the geographic data in an online coastal or marine atlas. Finally unknown reasons and other specific reasons like press releases or artist impressions constituted 12.7% of the downloads. The user analysis indicates that a very large user community uses the system for different applications. It is by integrating feedback from this community, that Marine Regions intends to reach his overall objective, which is evolving towards a globally accepted standard for georeferenced marine regions.