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THE DYNAMIC ATLAS
ON THE MEDITERRANEAN MARINE
AND COASTAL PROTECTED AREAS

A Web Map Service Prototype

For reasons of economy, this document will be available
in a limited number at the meeting.
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THE DYNAMIC ATLAS ON THE MEDITERRANEAN MARINE AND COASTAL PROTECTED AREAS: A Web Map Service Prototype

FOREWORD

MedGIS is a pilot project within the framework of the Mediterranean Action Plan (MAP) launched with a kind contribution by the Regional Seas Programme. It aims at demonstrating the capabilities of a GIS and Web Map Service for the Mediterranean marine and coastal protected areas, sites of conservation interest and biodiversity.

The information is freely available on Internet by means of an interactive mapping tool. An access button to MedGIS is located in the index page of RAC/SPA web site (http://www.rac-spa.org)

MedGIS may include data on the presence, abundance and composition of coastal and marine flora and fauna, habitats, related human factors (presence and activities), as well as the impacts and risks sensitive areas are exposed to. As a prototype, MedGIS serves a representative subset of different data types. Due to the character of a pilot project, not great amounts of data are integrated at this initial phase. Some region's data may not be present at all. At this stage we focus on demonstrating and testing the functionalities which are interesting for the Regional Seas Programme, the Mediterranean Action Plan and other user communities. Priority is given to show to Parties how data of disperse origin and formats can be displayed, mapped and queried online, while data completeness and aesthetics would have to be improved during a follow up project.

We expect that MedGIS will develop into a suitable tool for decision making, conservation, prevention and quick response in emergency cases. RAC/SPA Secretariat would very much appreciate any comments and suggestions.

THE DYNAMIC ATLAS CONTENT
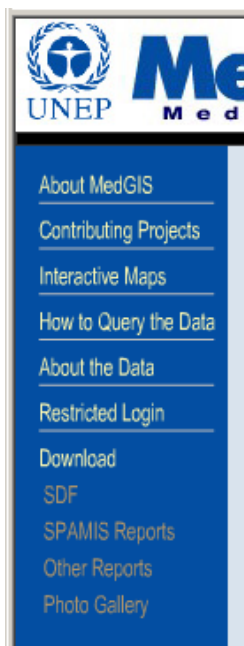
Information the user may find at the web site:

→ General information on MedGIS
→ Contributing projects, organisations, centres, universities and companies
→ The **Interactive Mapping** Tool (described here in detail)
→ Tips on how to query the data
→ Information on the data included, the type and origin of the data, etc.
→ Access for authorised personnel to sensitive data
→ Download area: Documents, such as blank Standard Data-Entry Forms, reports on SPAMIs and a photo gallery

THE INTERACTIVE MAP TOOL

Recently logged-in, the user will see a general map of the Mediterranean Region. A seabed model is intended to facilitate the orientation. Points indicate the locations of SPAMIS and sites surveyed within the MAP framework.
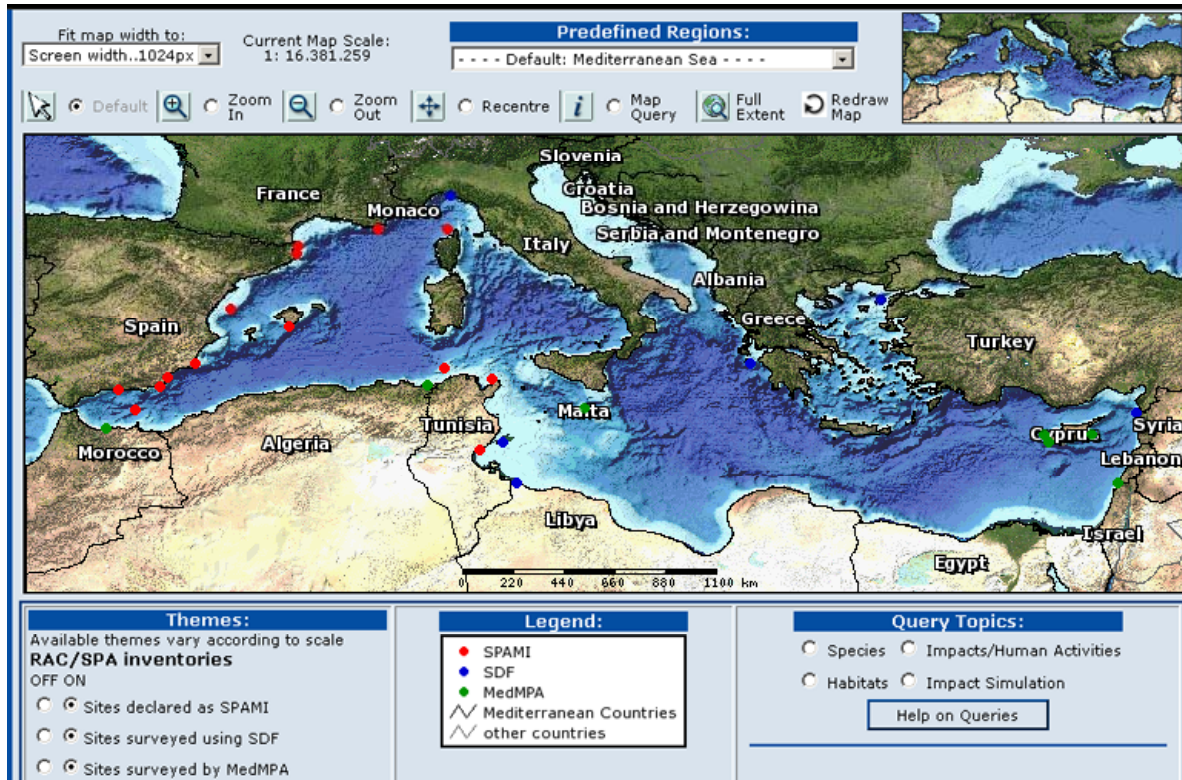
general view of the web map service application

There are several map tools situated right the map which permit to **amplify, re-centre, return to the full map extent or query** the map. To amplify the map and get to the detail, click on the radio button right to the magnifying glass icon and then just click on a region on the map to zoom in.

Map size adjustment and **scale indication**: In order to match a variety of screens, we added the possibility to change the size of the map. By default the map will adapt to the most common screen size (1024 pixels = 17 inches), but the user may choose a different size from a selection list located above the map.
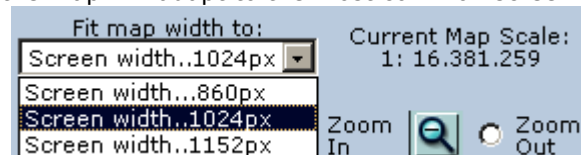
The **reference map** is a tool which is linked to the main map and thus reflects the exact location and extent of the map currently displayed. While the user zooms in and explores the area in detail, this reference map provides the necessary orientation.

Reference maps

Scale dependent feature drawing and feature labelling assure on one hand that the map composition does not get too overloaded and the map features are always displayed at an adequate scale. That means that while zooming in or out, some map features appear or disappear or get replaced by others: For example, the seabed model, which has been designed for a coarse scale map is not suitable for a closer look. It gets thus replaced by much finer scale bathymetric lines around the coastal areas.

Point features are adequate at great scales (> 1: 5.000.000) where map space matters, while polygon features provide more information but can only be properly appreciated at smaller scales (< 1: 5.000.000). Map themes which are available both as point and polygon layer (e.i. WDPA International Sites), replace each other automatically according to the current scale, maintaining the current status (on/off). Satellite imagery is indicated first by a bounding box polygon to indicate the exact location. This bounding box is replaced by the satellite image as soon as the map scale becomes adequate.

Predefined regions – selection list: There is currently a total of 27 sites which have been considered for this subsets of data. 14 sites already declared as SPAMI, 9 additional sites surveyed within MedMPA projects and 6 of the sites where the RAC/SPA Standard Data-Entry Form (SDF) has been applied. Two sites were surveyed using more than one protocol. At present, the 16 more complete ones have been integrated into MedGIS. For 7 of these sites detailed cartography was available and 6 are already included in this prototype (El Kala National Park/Algeria; Akamas, Cape Greco and Moulia/Cyprus; Rosh Haniqra Akhziv Marine Reserve/Israel; Zembra & Zembretta National Park/Tunisia). For three sites satellite imagery was available (Zakynthos Marine National Park/Greece; Oum Toyour & Ras El Bassit/ Syria; D'Al Hoceima National Park/Morocco), although finally only the SPOT image covering Zakynthos is visible to the general public. The Landsat images of Oum Toyour appears under 'restricted data' until agreeing a free view with the concerned parties (although satellite images are becoming more and more available even without the necessity of purchase) and the scene covering D'Al Hoceima was not available in it's georeferenced version.

In general, a great variety of data is represented: some sites include bathymetric lines, sampling locations, important areas or features such as rocky areas, caves or anchorage zones. Almost all of them show a detailed zoning of the Protected Area. Also included are the 7 Spanish SPAMI sites, although their 'local' datasets only consists of polygons indicating their extension.

Predefined regions selection list

The user may go directly to these predefined regions by choosing a site in the selection list located above the map. When any of these predefined regions is selected, the cartography which belongs to this site becomes automatically available in the list of layers to be toggled on and off. The data layers are identified by a common group name and thus appear as group when the respective region has been chosen; otherwise they disappear.
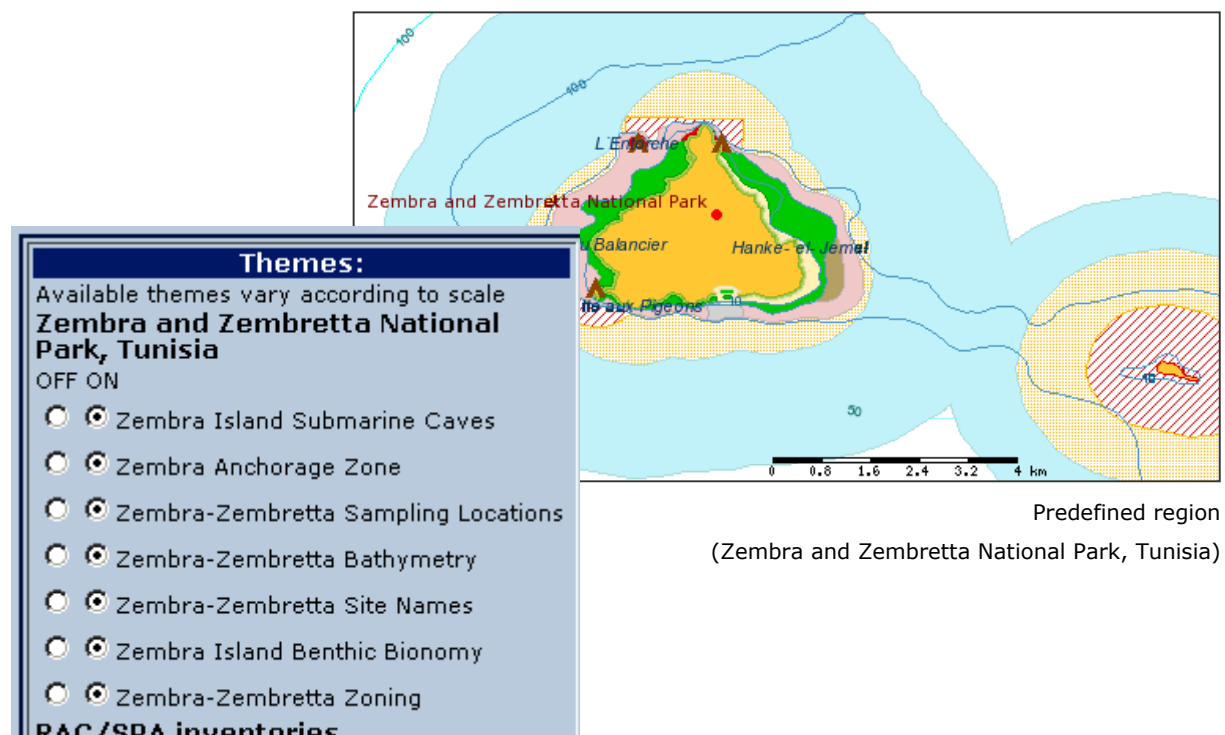
Predefined region
(Zembra and Zembretta National Park, Tunisia)

Initially we considered to keep all regional data in separate folders and make this data (map data as well as database attributes) accessible only to the respective regions. We quickly discarded this option for several reasons: First, the overall objective is to make information available to all. Second, for researches and decision makers, it is not only important to consult cartography and attribute data within the own – usually well known – region, but also to have information on what's going on in the neighbourhood and other protected areas. For now, all areas with detailed cartography are available to any user, although some point locations indicating sensitive areas (such as monk seal caves and osprey nest sites) are only visible to authorized users. Only one region is available at a time. As soon as one has been selected, all the other ones become invisible.

In order to use MedGIS as a tool for research and decision making, regional map layers may have to be available according to other criteria (for example: show all local maps which coincide with the currently visible area and scale range). This would permit to actually see all regional map layers of various SPA at once. One might wish to know where the nearest patches of a determined habitat type are, let's say, seagrass meadows, or whether if there are other locations with seal caves in the area and how far away they are.

The grouping may also be conducted differently: Layers of all regions showing habitat types might be unified in one layer and thus displayed and queried as a whole. This, of course, requires a previous agreement on habitat types definition and a general naming standardisation. That is why retrieving data in standard formats is so important to optimise synergies.

List of Map Themes: Map themes appear in a list and may be toggled on or off one by one according to the user preferences. The map layers are grouped according to their character:
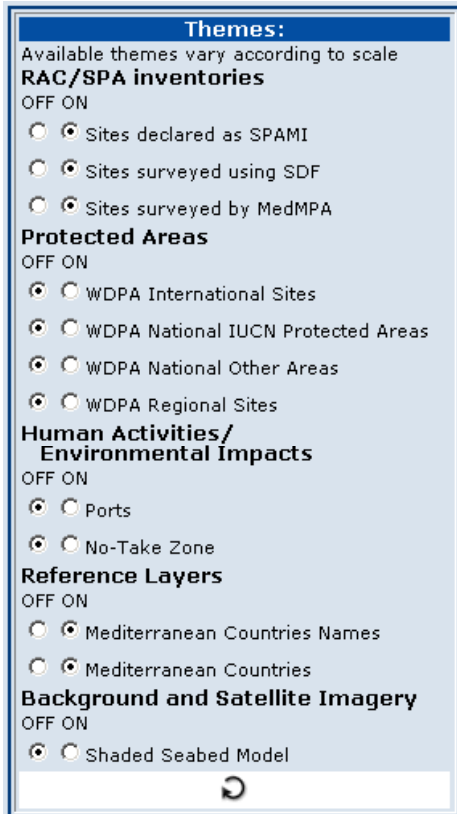
Regional cartography (if selected)

Restricted Data (if authorized login)

RAC/SPA inventories

Remote Databases (not yet available)

Protected Areas (Mediterranean)

Human Activities/Potential Impacts

Reference Layers

Background and Satellite Imagery (Mediterranean)

The themes that are listed here vary according to their availability at the current map scale.

The **legend** is generated automatically and displays the themes and classes currently visible.
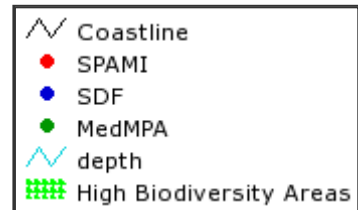
We felt that it is very important to provide some core information on the cartography and therefore included a **table of data origin** at the bottom of the web page. This table is automatically generated, reading the **metadata** of each map layer which is currently displayed: name, feature type and the responsible contributor, including a link to his web site if available.

Table of data origin

A similar table of metadata is available via the Menu-About the Data.

All available data should be registered in the future within a central database with detailed information. Apart from basic parameters such as type, description and the providing party (the institution or organisation that the user would ask permission if the user wanted a legal copy of the data) credit could also be given to the subcontracted company or university, details on department, address, contact person, methods used, purpose of the study, type of survey, date and geographic area, data format, lineage, geographic projection, scale of data capture etc. This would certainly strengthen the user's confidence in the data as well as provide public recognition to the responsible scientific and technical staff involved in the data gathering.

MAP-QUERIES

Map queries at point locations: This type of query implies interaction with the map area. The user moves the curser over the map and clicks on a determined point in order to get information about this feature.

First, the **query map tool** located right above the map must be activated. The user may then click on any feature in the map, for example on one of the points that represent *Specially Protected Areas of Mediterranean Importance* (SPAMI).

The query returns – in form of a table at the bottom of the web page – all attribute information hold in the spatial data file (a *shapefile*). In this case: name of the locality, marine, wetland and terrestrial area, year of declaration etc. Different data layers show different attribute data. All data layers, except satellite images and the seabed model can be queried using the query map tool.

For the present version, this type of query can only be conducted at point locations. We may add a drag-rectangle tool in the future. (For alternatives on 'query-by-rectangle'-queries see query on ports below).

QUERY TOPICS: Species, habitats and impacts

The following queries access a relational database where the survey data is stored. All queries show tabular output. Some of them draw additionally symbols on the map according to the corresponding coordinates returned by the database.

Just right to legend the user may choose between one of several query topics: species, habitats and impacts. The functionality of these options varies and depends on whether the user is currently looking at a predefined region or at the whole Mediterranean Sea:

Distribution Mapping

If the whole Mediterranean Sea is displayed, we assume that the user wishes to map the distribution of a particular species, habitat or impact type.

By choosing one of these options, a selection list will show up and the user may select one by clicking on its name (the selection will be highlighted in blue).

Let's try, for example, *Caretta caretta* - the Loggerhead Sea Turtle.

Image: GMIX-Designs (OBIS)

In order to see the complete list of species included in the SPA Protocol the user may click on the hyperlink **Annex2**.

If the user then executes the query by clicking on the Execute Query button, she/he gets two types of output: On one hand, all survey sites at which this species is present will be marked with a symbol:
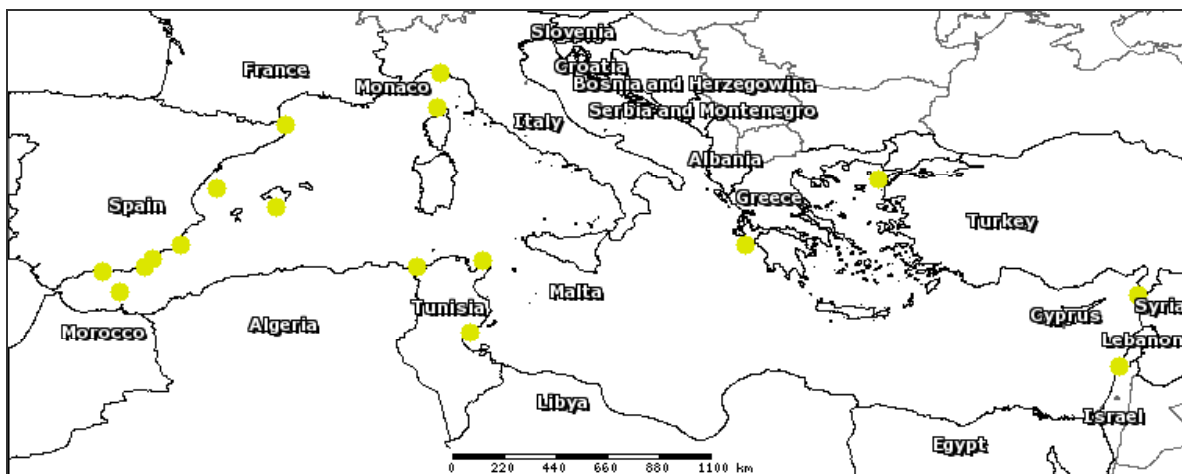
Presence of *Caretta caretta*

Additionally, the user gets an output table at the bottom of the page, which shows more detailed information: If the species is either resident, rare, common or threatened, the year the survey was conducted etc.

The coordinates represent the *centroid* of the survey locations and the *Maximum Error Distance* gives the user an idea about how far away the real location (which is not given here) may have been at the furthest.

Distribution of habitat and impact types works just the same, except that there are different levels (from rather general to very specific) at which the user may make the selection: For example, the
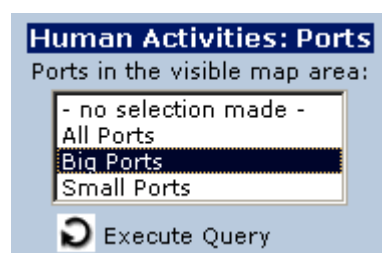
user may choose *'Fishing, hunting and collecting'* and get in return anything that falls into this category. Or she/he may as well be only interested in *'professional fishing'* and particularly in *'Trawling'*. In the latter case the query will only return this particular type of fishing. Please note, that not all of the sites have been surveyed using the same standards, so we had to choose the most adequate subset for this query. In other words: There are only few sites (perhaps none presently) that may return the type the user chooses.

QUERY RESULTS:
Trawling found at:

| Code	Impact Category	Impact Description	Name	Country	Intensity	% exposed	Influence	Location	Survey Year	Survey Project
212	Fishing, hunting and collecting	Professional fishing: Trawling	Promontorio di Portofino	Italy	High influence		Negative	Outside	2002	SDF
212	Fishing, hunting and collecting	Professional fishing: Trawling	Gökçeada - TÜDAV Marine Park	Turkey	High influence	100	Negative	Inside	2004	SDF
212	Fishing, hunting and collecting	Professional fishing: Trawling	Gökçeada - TÜDAV Marine Park	Turkey	High influence		Negative	Outside	2004	SDF

If the user has chosen a habitat type, she/he gets information on the area covered by this habitat and it's importance, while regarding impacts the user learns about how much is exposed to it, the intensity and whether its inside or outside the park.

Combined Spatial and Attribute Queries

Human Activities: Ports
Ports in the visible map area:

- no selection made -
All Ports
Big Ports
Small Ports

↻ Execute Query

Under *Impacts/Human Activities* the user will also find a query on *ports*. This query type does not use the relational database, but executes an attribute query on the spatial data layer. While the same information is also returned by using the map query tool clicking on a particular port, this query permits to retrieve information selecting either big ports, small ports or any ports.

Additionally, only features in the visible extent of the map are returned, so that the user can limit the output to the area of her/his interest (this is actually a query by rectangle).
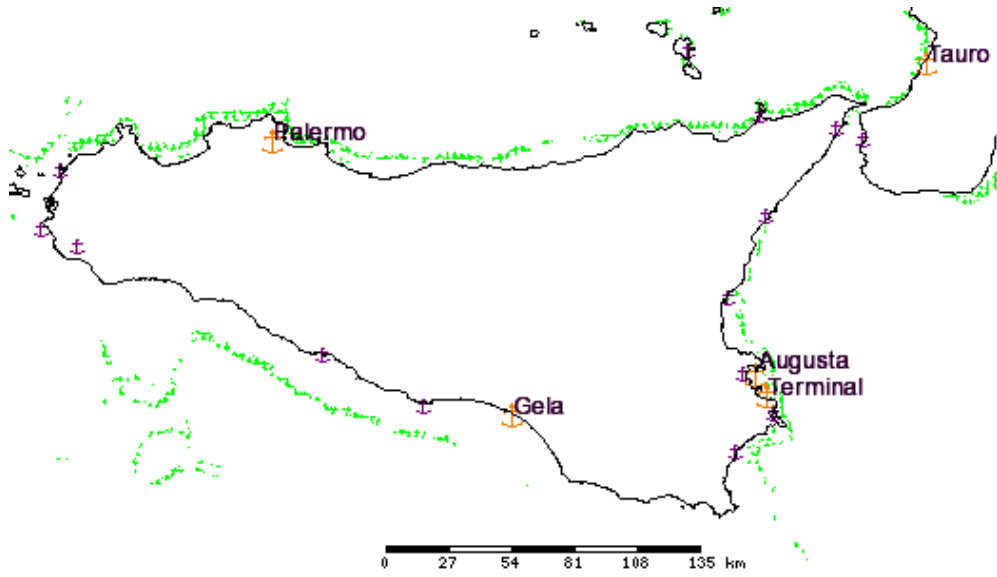
All ports that meet the condition selected (big, small or any) are highlighted on the map.

QUERY RESULTS:
Number of big ports in this area: 5

Lat: 37.2 | Long: 15.23 | Augusta | Italy
Approx 6,000,000t of cargo handled annually. The port handles general and bulk cargoes but is primarily a tanker port; 30 of the 36 berths are
Esso, Chimica, Macet and others.

Lat: 37.05 | Long: 14.27 | Gela | Italy
Approx 1,100 vessels are handled annually

Lat: 38.43 | Long: 15.9 | Tauro | Italy
Approx 1,000,000 moves annually

Lat: 37.12 | Long: 15.27 | Terminal | Italy
Approx 37,000,000t of petroleum products are handled annually. Crude oil washing (COW) is permitted, anti-pollution floating oil booms are co

Lat: 38.12 | Long: 13.33 | Palermo | Italy
Approx 5,000,000t handled annually.

Ports results table

Within-Distance Query

A special case is the last option: an oil spill simulation. The objective was just to demonstrate how one can find and identify any features (all or just the closest feature of each theme) which are located within a determined distance to a particular point location. The oil spill is a hypothetical case and we didn't consider neither wind nor current speed and directions.

The user may create his own disaster simulation by indicating other coordinates and distances, in order to see what would be affected and how far away it is.

Potential Impacts

Event type: Oilspill

Location:

Lat: 34.5   Lon: 12.205

○ Find all features   ● Find closest feature

Within 500 Km distance

Execute Query ↻

Note: This is for demonstation purposes only. It does not represent a real case.
The default location lies between Tunisia and Malta but the coordinates (in decimal degrees) may be changed by the user. Please note, that the map is not automaticlaly recentered.

Tunisia

Sfax

Kneiss Nature Reserve
Ashtart Termi
Kerkennah Islands

Gabes   Skhira

Lagoon of Farwa

(Libya)

Terminal

0   47   94   141   188   235 km

This is (the top of) the list of affected features (protected areas were switched on):

In the future we will hopefully link MedGIS to the REMPEC oils-database, so that the simulation will be finally replaced by real locations. Anyway, this type of query may be very interesting for decision makers, since it shows all potentially affected features within a determined area even before the event occurs.

Checklists at predefined regions

If the user is looking at one of the predefined regions, we assume that she/he wishes to get a checklist of all endangered or threatened species or a list of habitat types or human activities and impacts on the area. So, instead of sending the selected name(s) to the database the user just executes the query and retrieves the required list directly.

The returned species checklist shows any species present at the predefined regions currently displayed and which is included in either Annex 2 (threatened and endangered) or Annex 3 (under regulated exploitation).

The remaining data fields of the table vary according to the survey protocol used: While some of them register information on relative abundance, global and local status of the species, others register instead its presence as resident or migrating species, as well as evaluate the population, conservation and the role of the site.

The checklists on impacts and habitat types are similar. The cases integrated in MedGIS have also been using different protocols and lists. But here the type lists didn't match, so we decided to query only those which applied the 'Standard Data-Entry Form' (see link to the document). This Standard Data-Entry Form distinguishes between 'marine', 'coastal' and 'other' habitats, while earlier inventories registered only marine and coastal habitats according to the Habitats Directive (Annex I) of the European Commission which has less classes, especially among the marine habitats.

QUERY RESULTS:
Zakynthos Marine National Park, Greece

Code	Habitat Type	Representativity	Conservation Status	Vulnerability	Coverg.[%] within the site
II.3.1.1	Facies of banks of dead leaves of P. oceanica and other	Non-significant presence	The habitat is very discontinuous and the assemblage is sparse and residual	Medium	1
III.2.2.2	Association with Halophila stipulacea	Significant	The habitat is very discontinuous and the assemblage is sparse and residual	Low	1
III.5.1	Posidonia oceanica meadows (= Association with Posidonia oceanica)	Excellent	The habitat is continuous and the assemblage compact	Low	35
III.6.1.2	Association with Cystoseira amentacea (var. amentacea, var. stricta, var. spicata)	Good	The habitat is continuous and the assemblage compact	Low	5
III.6.1.20	Association with Sargassum vulgare	Excellent	The habitat is continuous and the assemblage compact	Low	10

Habitat checklist for Zakynthos Marine National Park

HOW DOES ALL THIS WORK?

To develop this application we have almost exclusively applied open source software. MedGIS is running on an ordinary desktop PC, connected to Internet, and the only commercial component is the operating system (Windows2000 NT). Server software (Apache) and database system (MySQL) are open source software, as well as the scripting languages we use (PHP, MapScripts, JavaScript). The web mapping system itself has been built using MapServer[1] 4.4 which is a CGI program, created by the University of Minnesota. The user just needs any **web browser** supporting HTML 4.0, such as Internet Explorer or Netscape Navigator. No additional software has to be installed. The user interacts locally with his/her web browser and submits requests to the Application Server (this is where MapServer is installed and the MedGIS data allocated). The Application Server processes these requests (the user's selections or clicks on the map) and dynamically generates HTML pages which are returned to the user. In a similar way one would interact with an online bank account, accept that most of the MedGIS data is available without using a password.

WHAT NEXT?

Now that the prototype is up and running, it has to be defined what else MedGIS needs in order to become a suitable tool for research, decision making, protected area management, conservation and emergency response. What data should be available and which functionalities do users need for to query the spatial database and their attributes? Which data should be restricted to internal use and not be available to the public? Who shall control the restricted access (give out passwords)? How can data authorship be adequately cited?

RAC/SPA also seeks collaboration from Parties, other Centres and initiatives, in order to get different expert groups with their survey and research results closer together. An improvement in data availability and usage will also create new management and research opportunities.

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[1] MapServer home page: http://mapserver.gis.umn.edu/