

# Development of Regional Joint Master Program in Maritime Environmental Protection and Management - MEP&M -

## GIS applied to coastal and maritime environmental protection and management

**WP3. Capacity Building through staff training and equipment purchase .**

**DEV 3.4.4 KNOW-HOW TRANSFER TO TEACHING STAFF RELATED TO THE MEP&M**

**Alfredo Fernández Enríquez, Regional Geographic Analysis (University of Cádiz)  
12th of July 2022**

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**Project no. 619239-EPP-1-2020-1-ME-EPPKA2-CBHE-JP**



## GIS

### An integrated GIS approach for site selection of floating offshore wind...

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#### Renewable and Sustainable Energy Reviews, Volume 134

This study presents a novel method for the selection of sites for floating wind farms based on marine spatial optimization.

### IH-MSP Platform

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#### Instituto de hidráulica ambiental - Universidad de Cantabria

The IH-MSP Platform is the GIS platform which facilitates the implementation of maritime spatial planning in Spain. It focuses on the spatial potentials of off-shore aquaculture and wind energy.



European  
MSP Platform

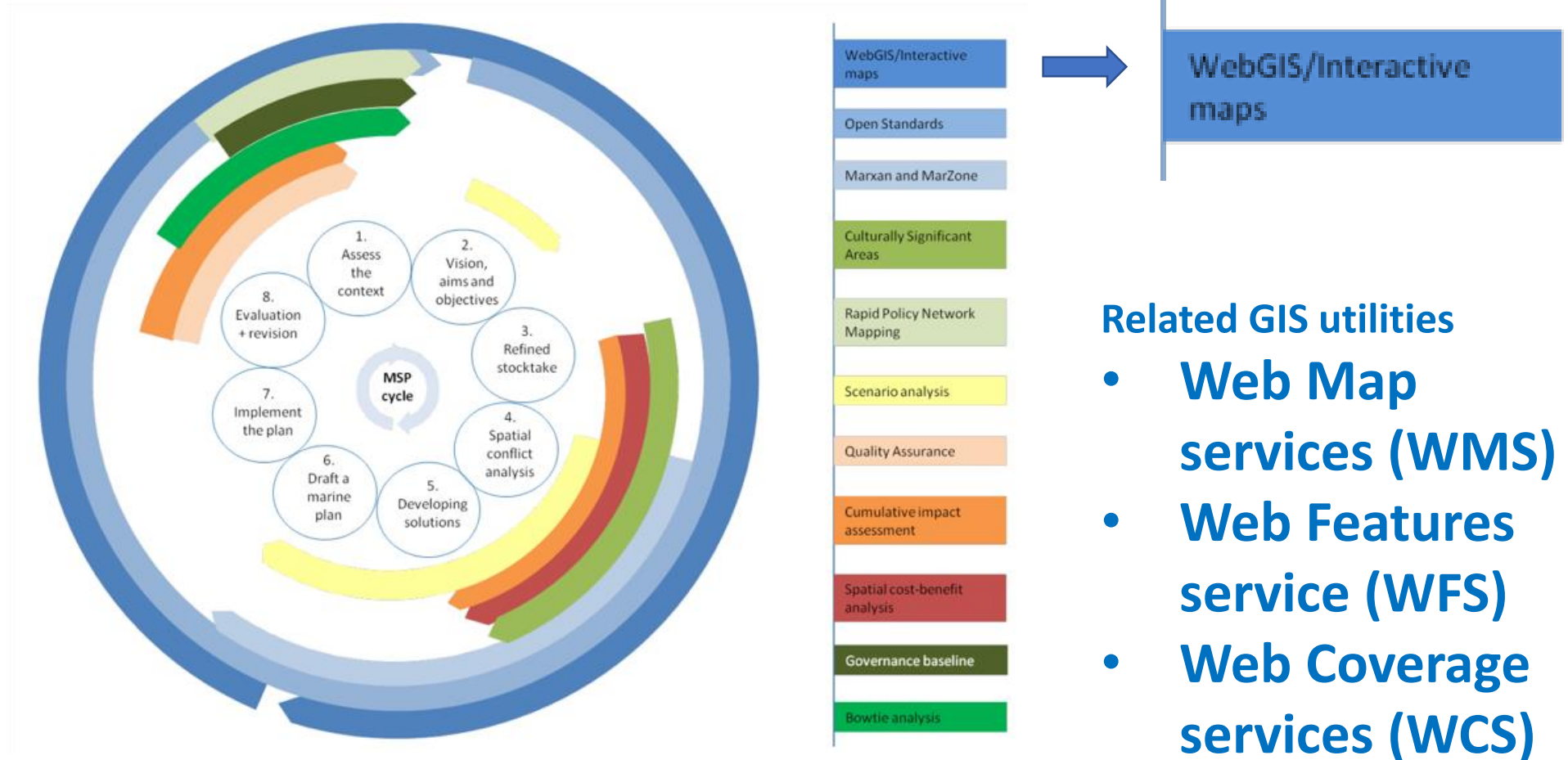


European  
Commission

Co-funded by the  
Erasmus+ Programme  
of the European Union



## A catalog of approaches and tools for MSP



### Related GIS utilities

- **Web Map services (WMS)**
- **Web Features service (WFS)**
- **Web Coverage services (WCS)**



## GIS tools for MSP and management

- **Biophysical – Species**
  - **Focal species abundance**
  - **Seabird abundance**
  - **Focal species distribution**
  - **Population structure**
  - **Community composition**
  - **Genetic diversity**
- **Biophysical – habitats**
  - **Fish nursery areas**
  - **Suitable environmental conditions (habitats) for species**
  - **Distribution of three key phytobenthic species**
  - **Coastal lagoons and large shallow inlets & bays (1150 & 1160)**
  - **Habitat heterogeneity indicator**

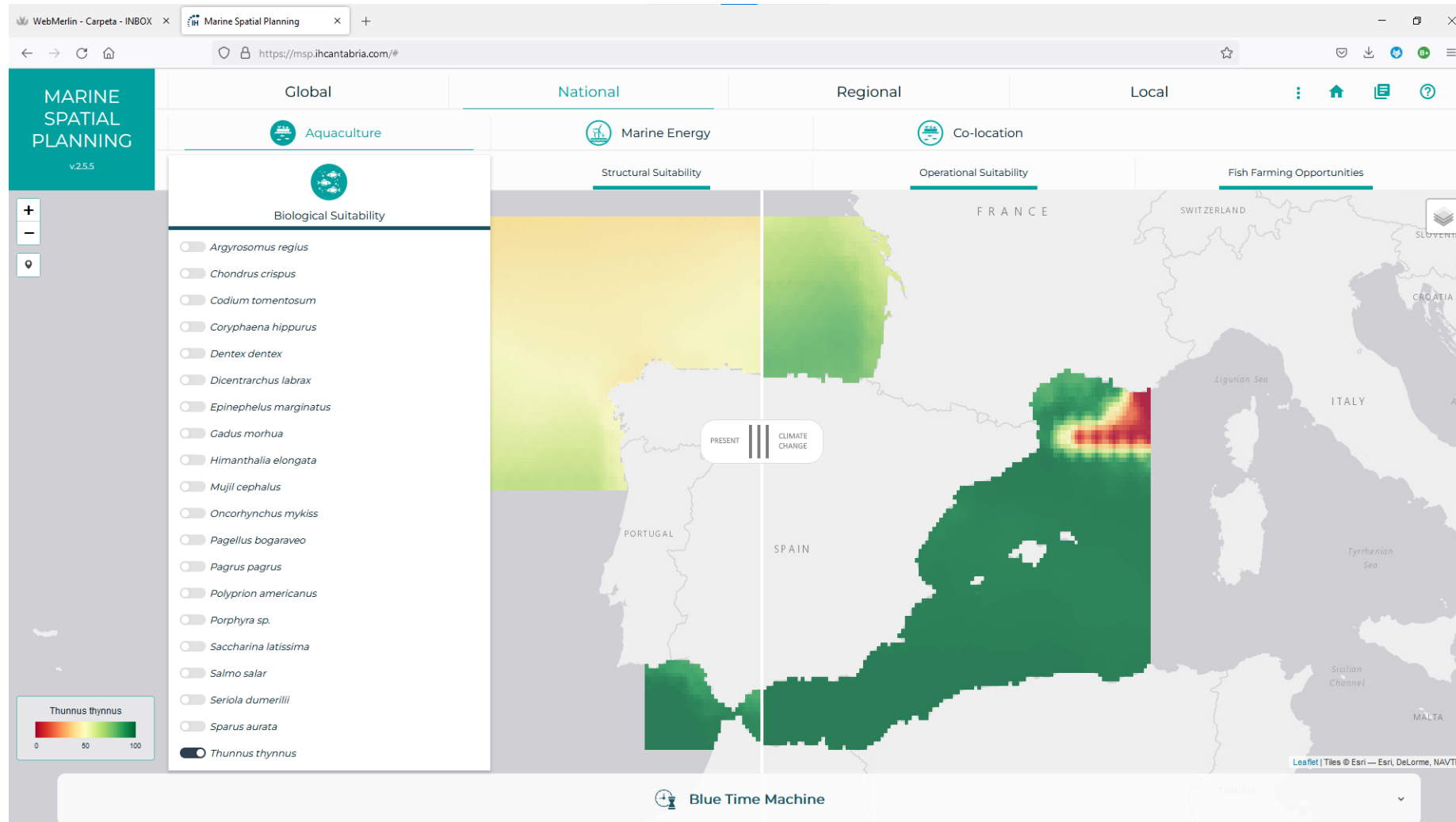


## GIS tools for MSP and management

- **Geophysical**
  - Interpolation of depth and elevation
  - Archipelago zonation
- **Socio-economical – Pressure**
  - Shoreline exploitation
  - Human influence on coastal lagoons and large shallow inlets and bays
  - Communication infrastructure
  - Effects of recreational boating and fishing on sensitive habitats
  - Marine noise disturbance from vessels
  - Potential dredging sites in shallow coastal areas
  - Shoreline erosion induced by navigational activities
- **Socio-economical – State**
  - Effects of marine management activities on fishing
  - Economic value of marine areas – exemplified for recreational activities
- **Governance – Stakeholder interaction**
  - The interaction between authorities and stakeholders
  - Compliance with management plans

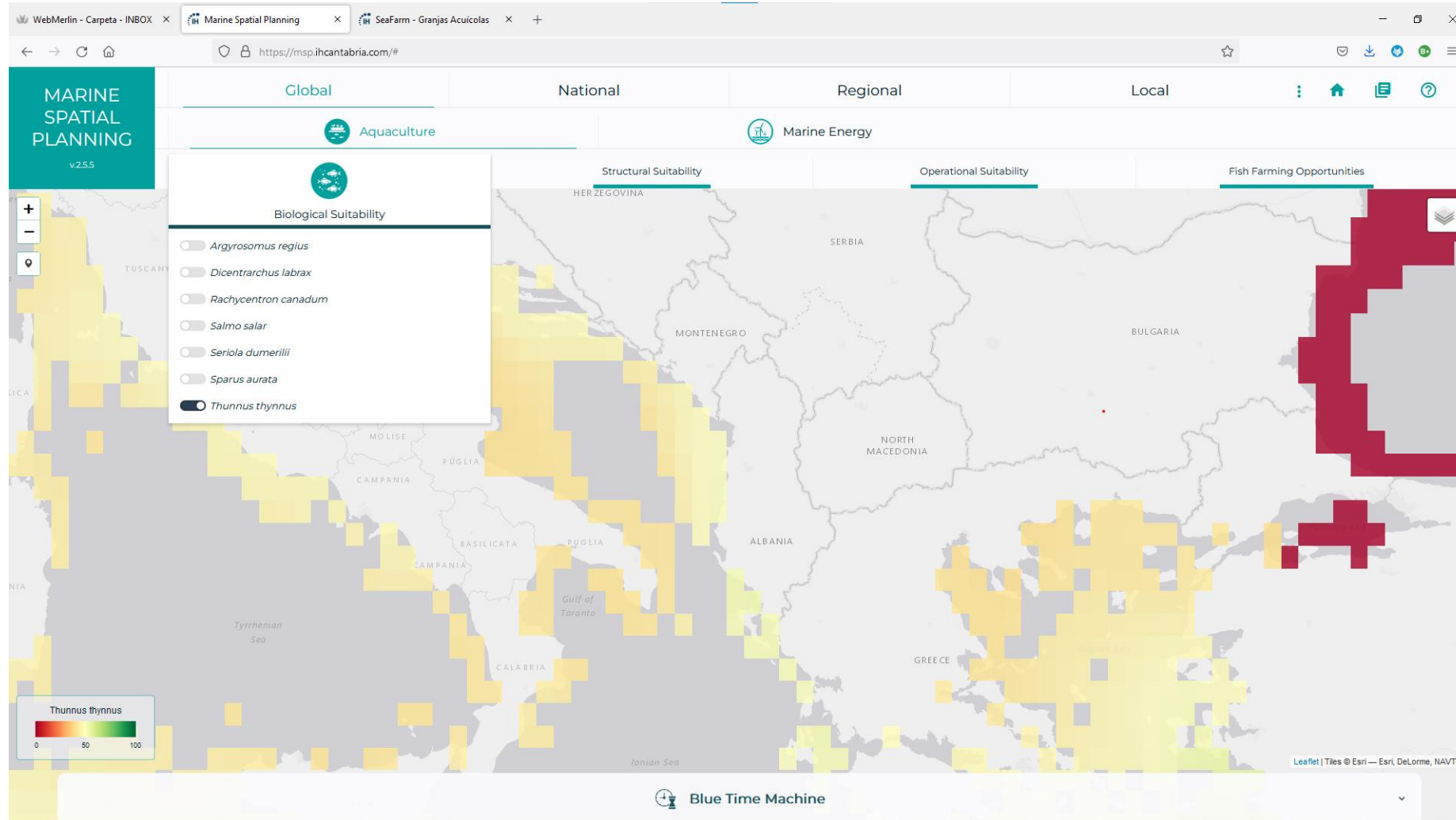


# Focal species abundance





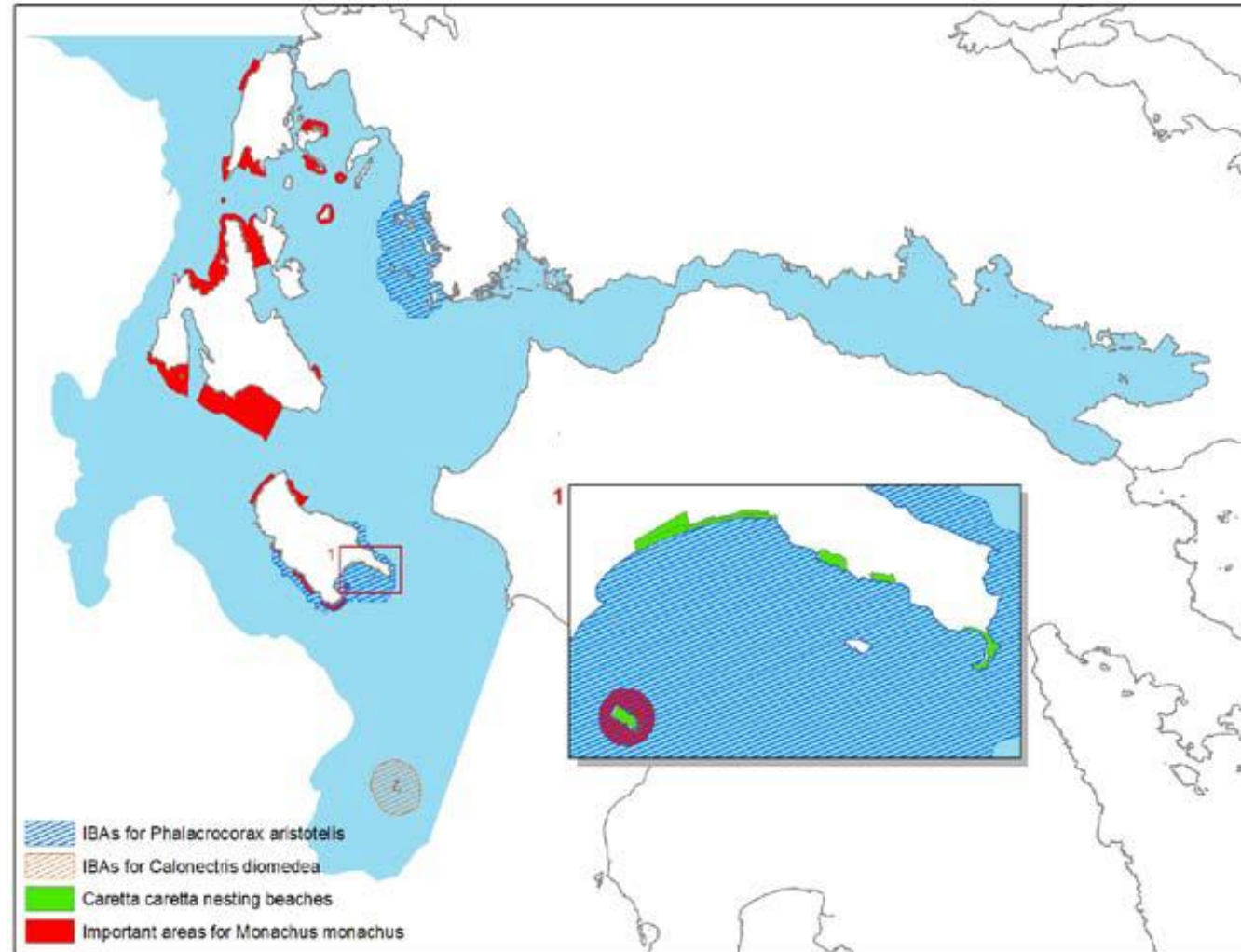
# Focal species abundance



WMS



## Seabird abundance



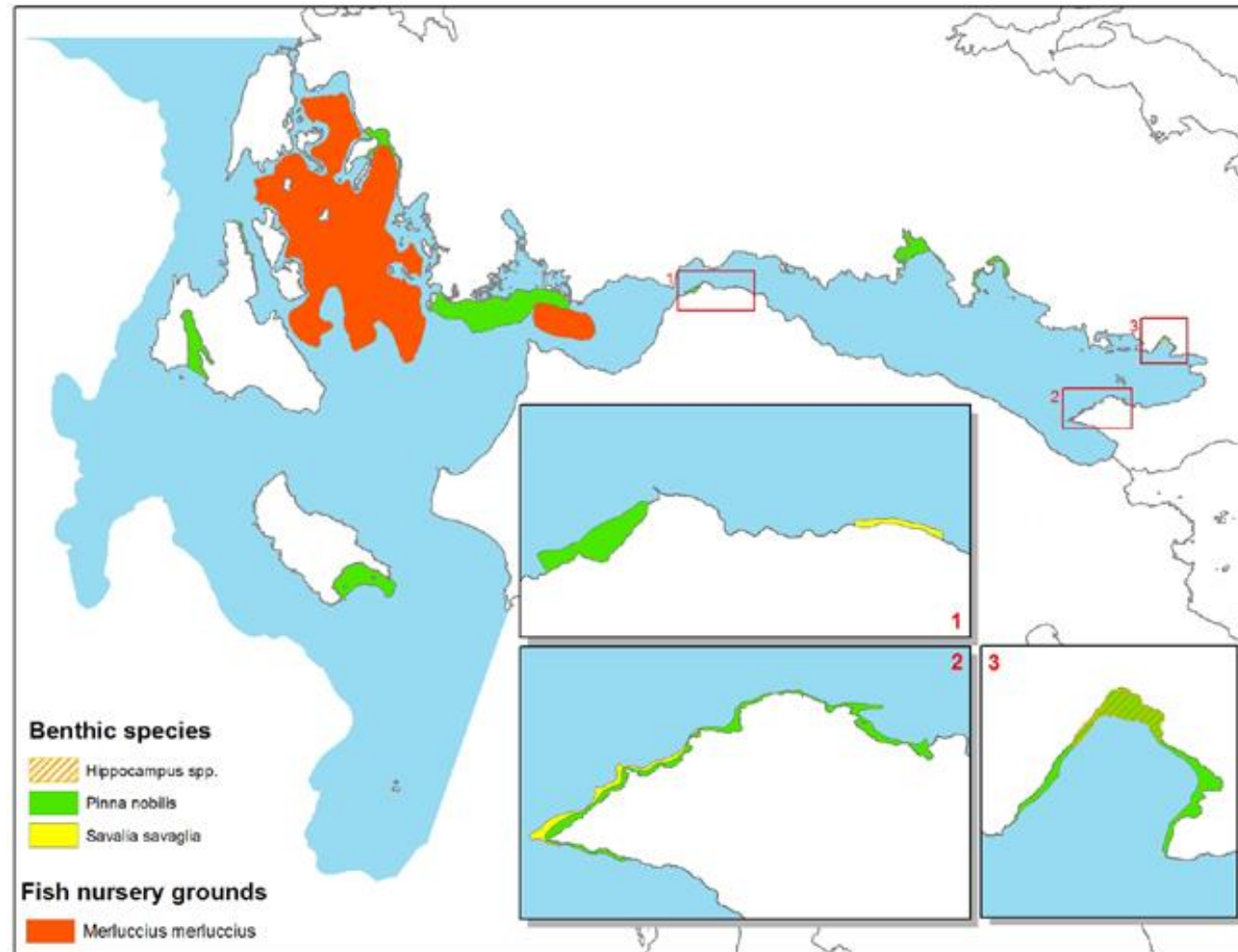
ESRI ArcGIS 9.3

- Geoprocessing tools





## Focal species distribution

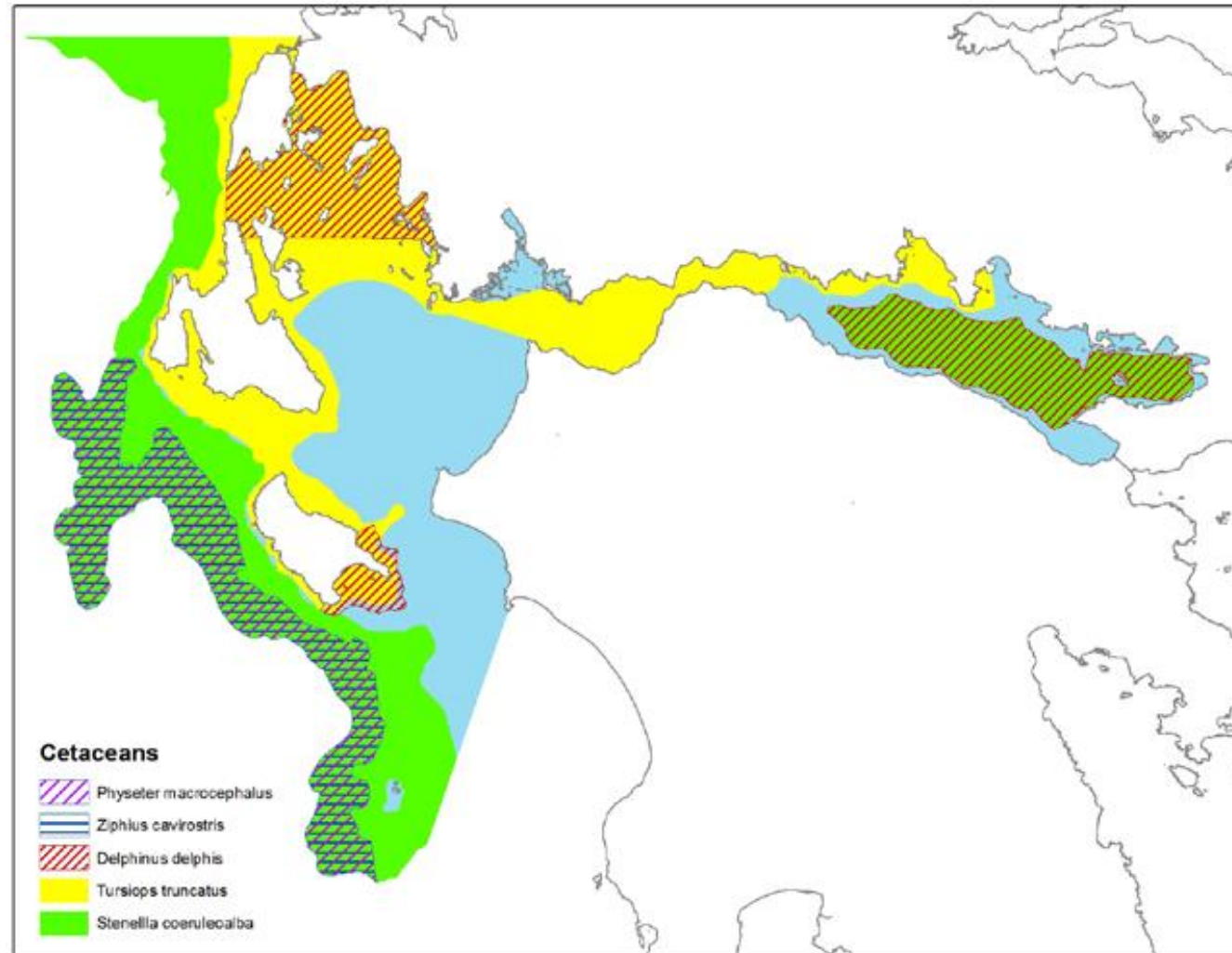


ESRI ArcGIS 9.3

- Geoprocessing tools



## Focal species distribution



**ESRI ArcGIS 9.3**

- **Geoprocessing tools (Overlay)**



## Population structure, community composition and genetic diversity

The screenshot displays the Rediam platform interface. On the left, a sidebar titled 'Información' provides details for a selected location. The main map shows the Gulf of Cádiz with orange outlines of sampling areas and a red location pin. A search bar at the top right contains 'Catálogo de servicios REDIAM'. A scale bar at the bottom left indicates 20 km, and the coordinate system is noted as WGS84.

**Información**

Haga clic en el mapa para obtener información de los elementos en esa ubicación

Utilizar plantilla para la visualización

Ir al punto seleccionado

**Caladeros**

**ZONA**  
GOLFO DE CADIZ

**ESPECIES**  
Gamba - Cigala-Almendrita-Puntilla-Jurel-  
Rape-Bacaladilla-Merluza-Japonesa

**ARTES**  
Tangonero - Clásico-Breca ó Raspita-  
Cadenero-Boquerón

**CALADERO**  
Chipiona

**FLOTAS**  
Huelva-Sanlúcar de Barrameda-Puerto de  
Santa María

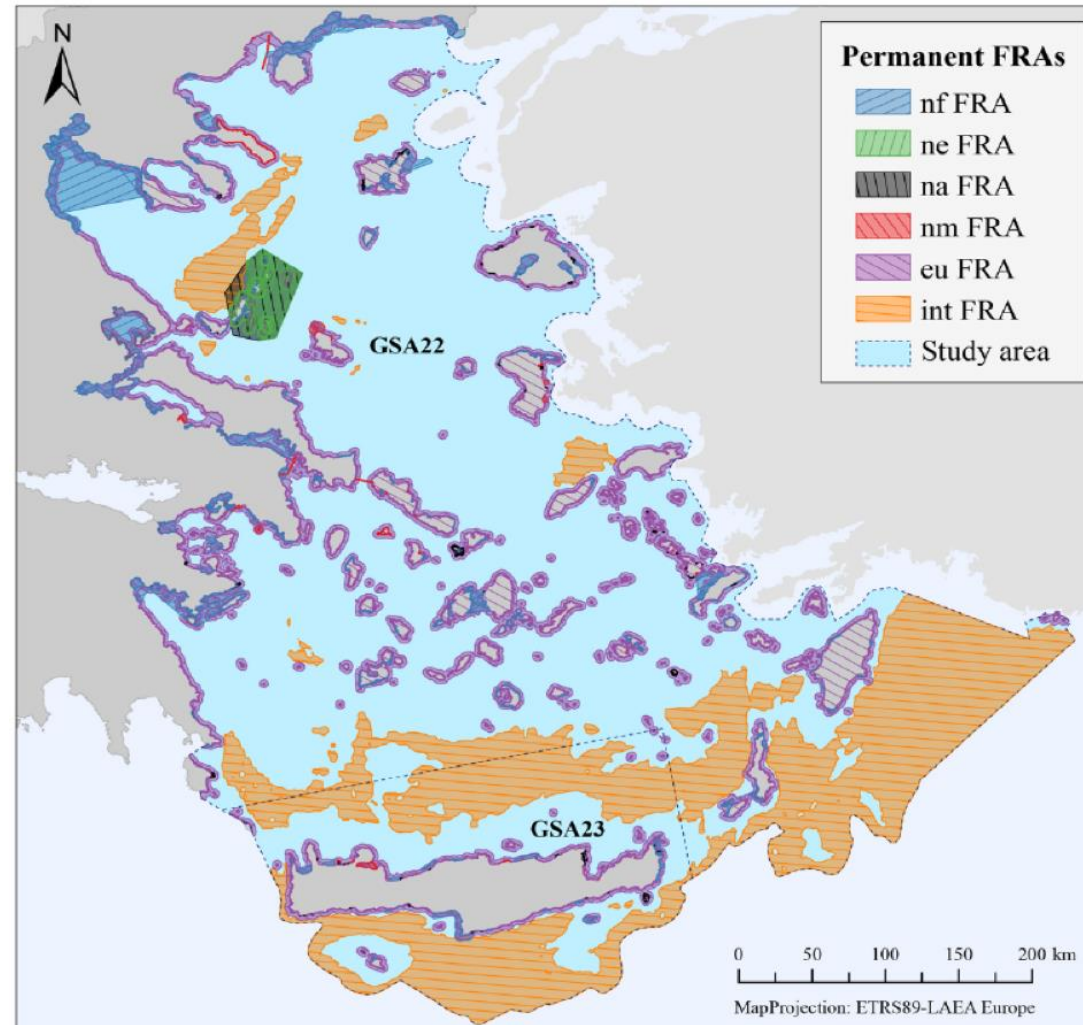
**AREA**  
243216992

20 km

WGS84 Sin coordenadas



## Fish nursery areas

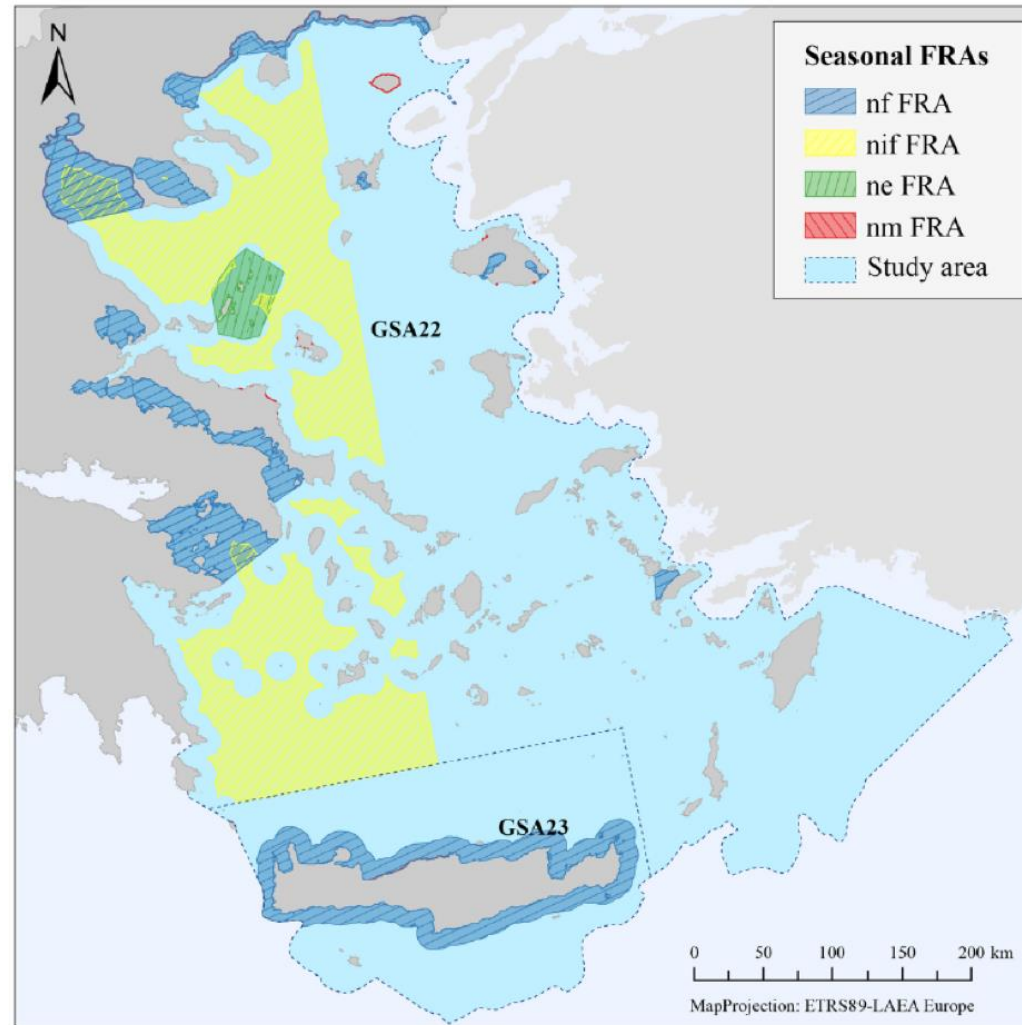


## ESRI ArcGIS 10.1

- Digitizing
- Geoprocessing tools



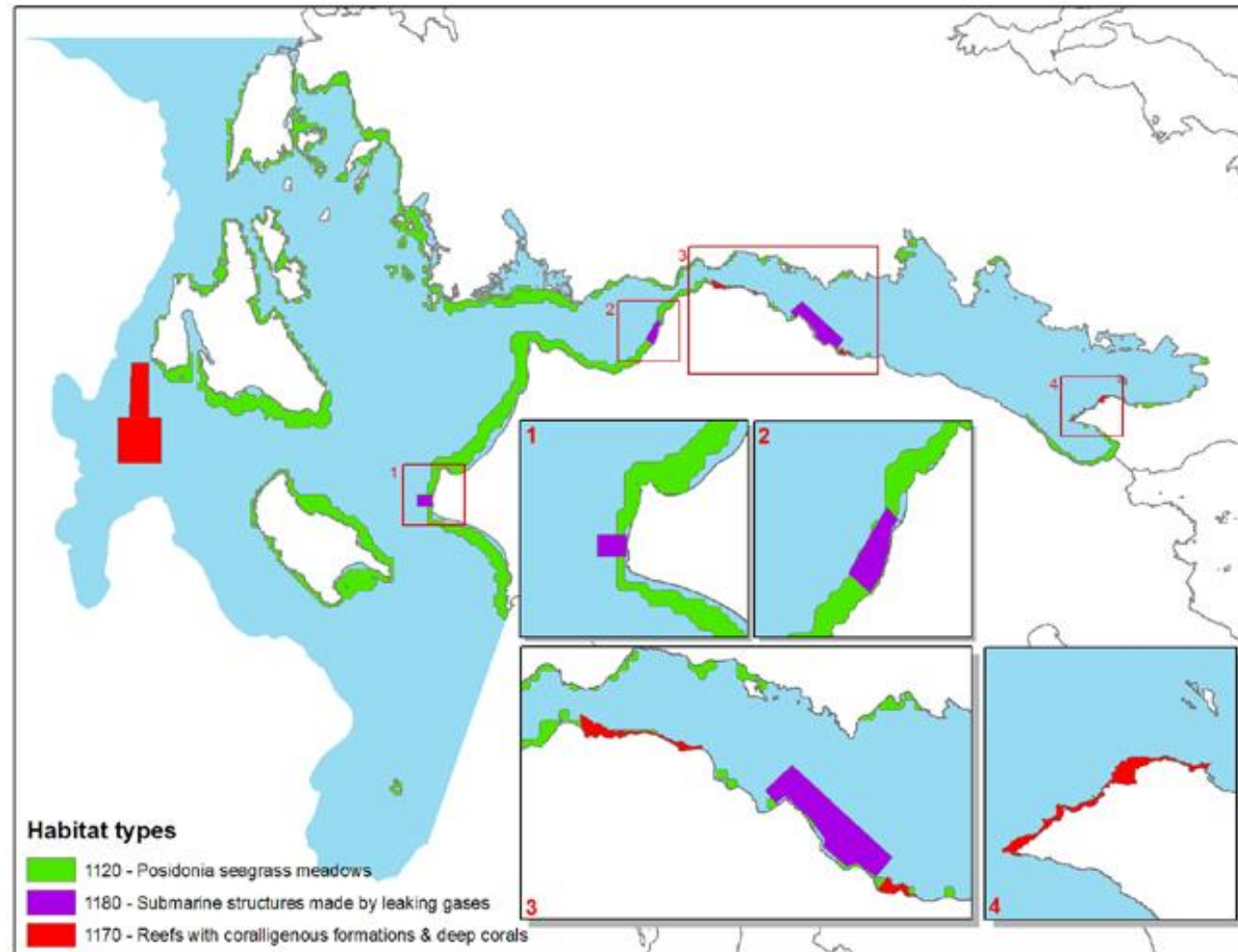
## Fish nursery areas



- ### ESRI ArcGIS 10.1
- Digitizing
  - Geoprocessing tools



## Suitable environmental conditions (habitats) for species

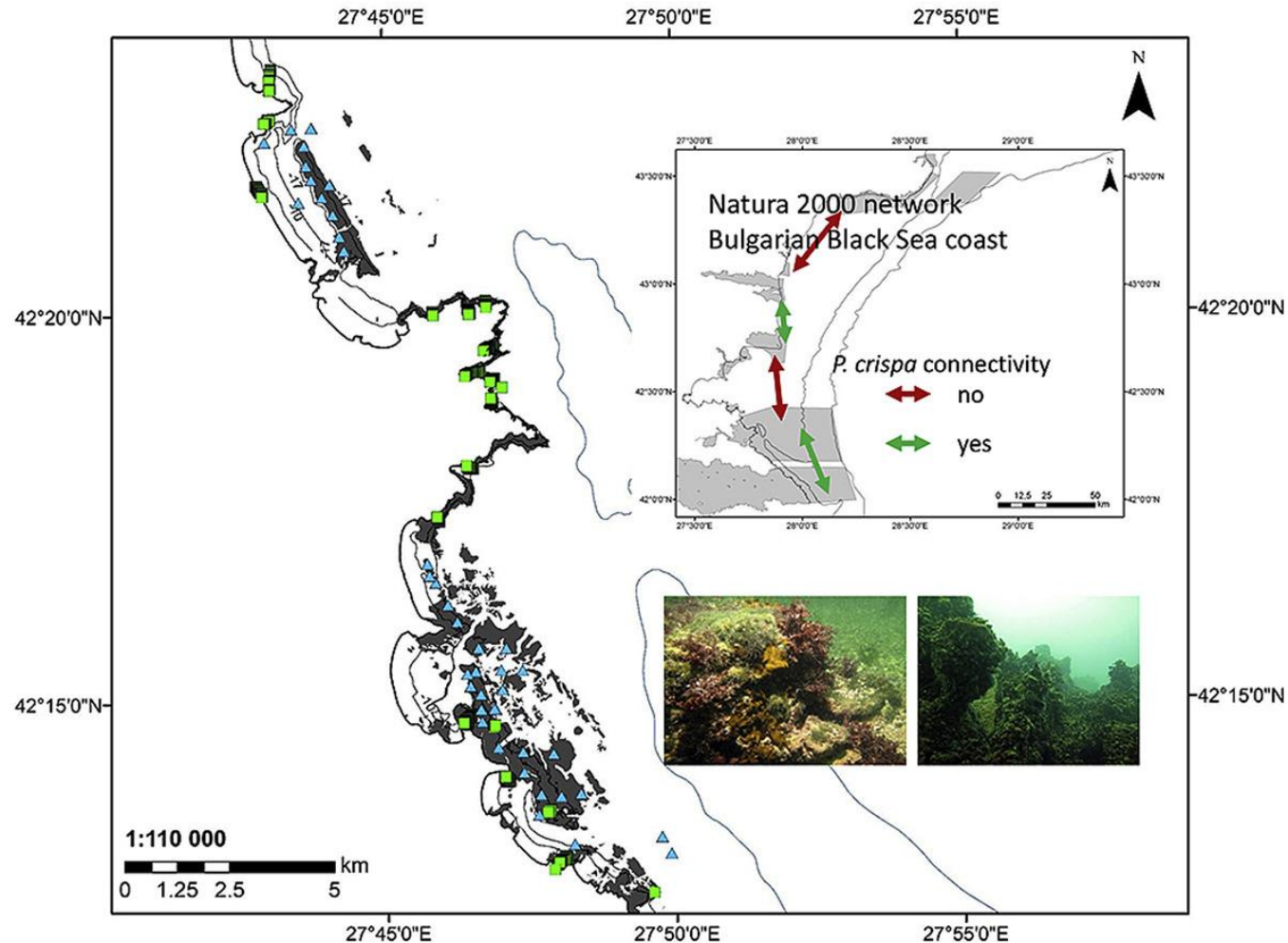


ESRI ArcGIS 9.3

- Geoprocessing tools (Overlay)



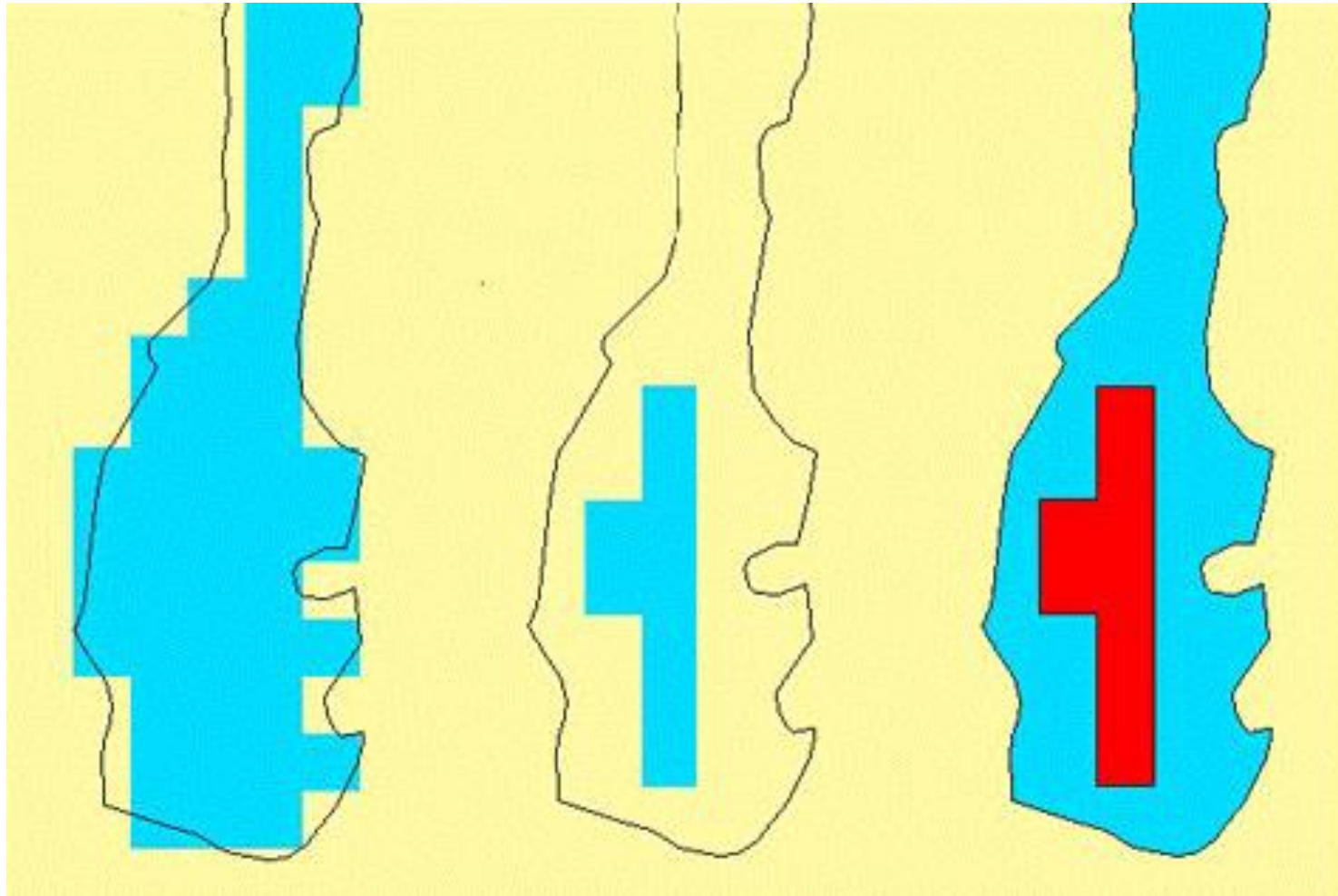
## Distribution of key phytobenthic species



ESRI ArcGIS 10  
Digitizing,  
Spatial Analyst



## Coastal lagoons and large shallow inlets & bays



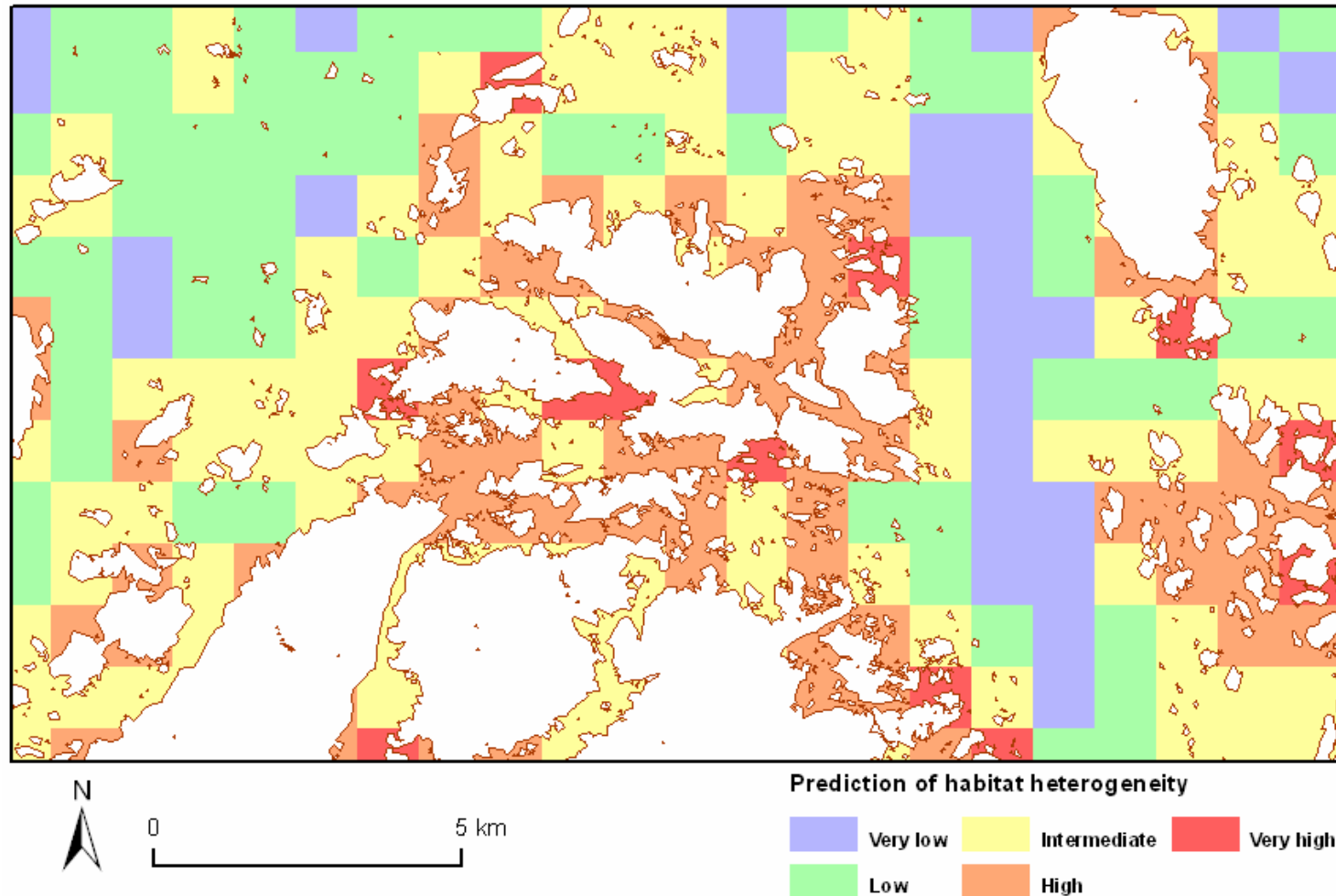
### ArcView 3

- Rasterize
- Vectorize
- Reclassify
- Select (SQL)



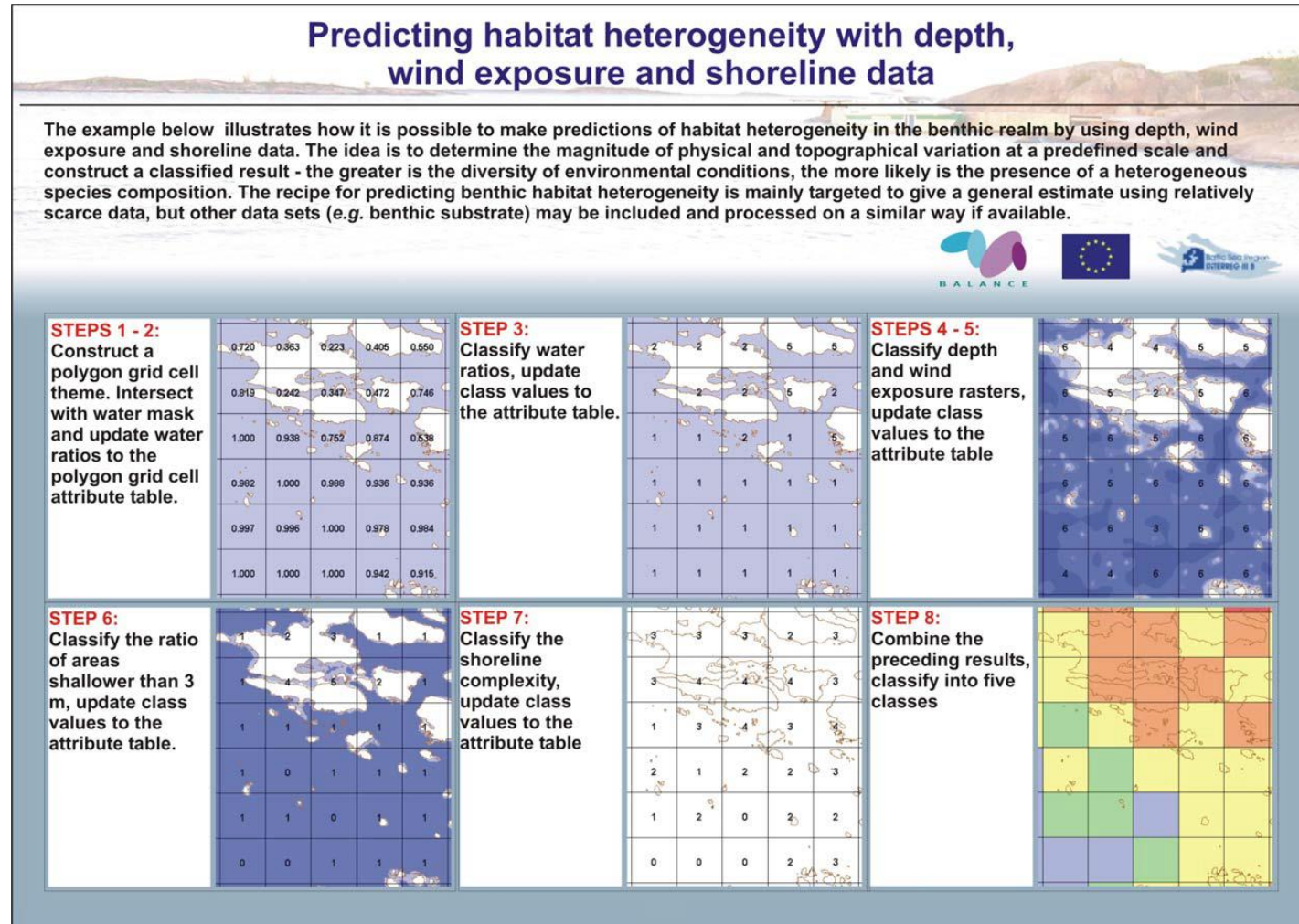


## Habitat heterogeneity indicator





## Habitat heterogeneity indicator

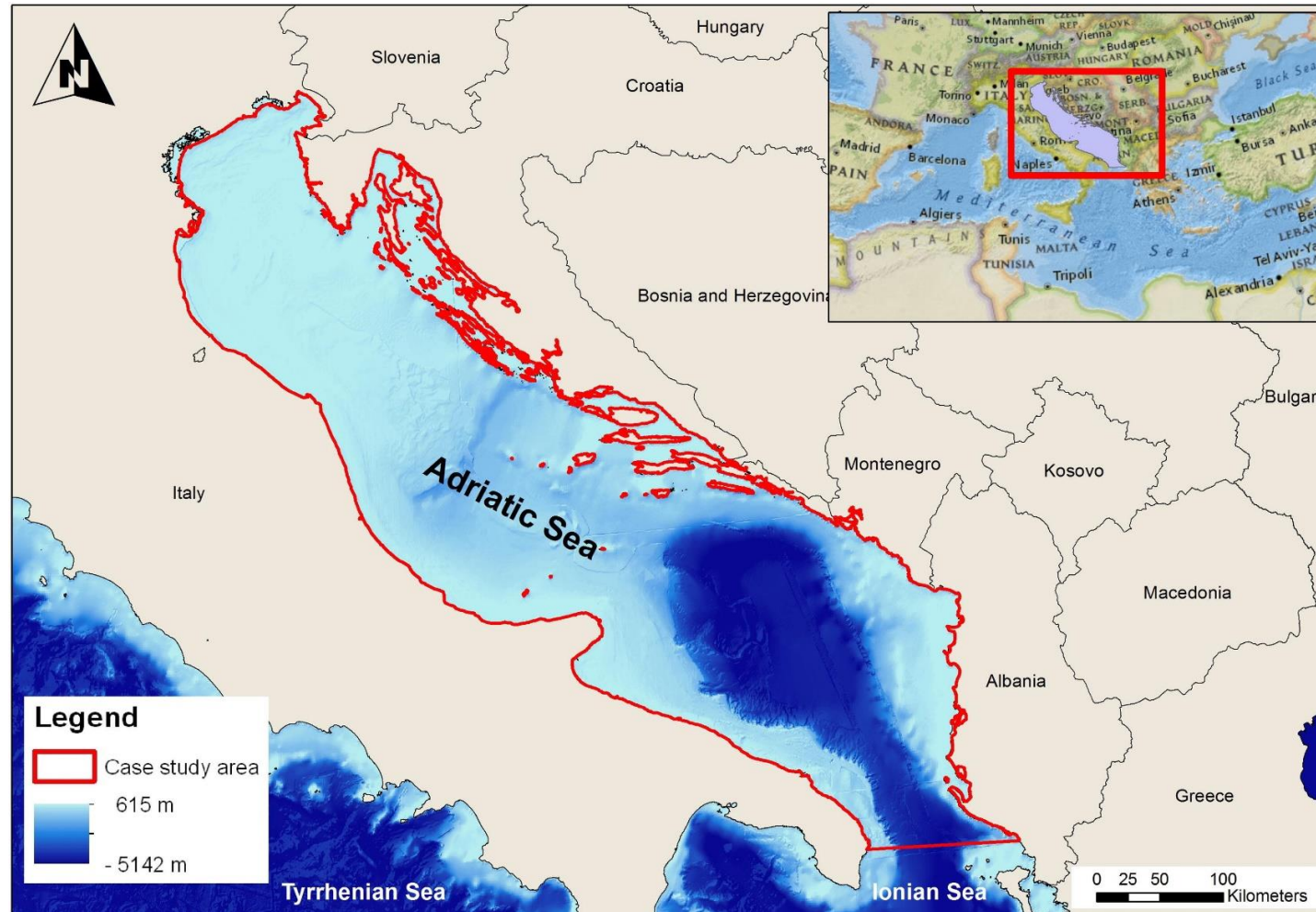


### ArcView 3

- Digitizing
- Field calculator
- Join table
- Geoprocessing
- Rasterize
- Reclassify



## Interpolation of depth and elevation

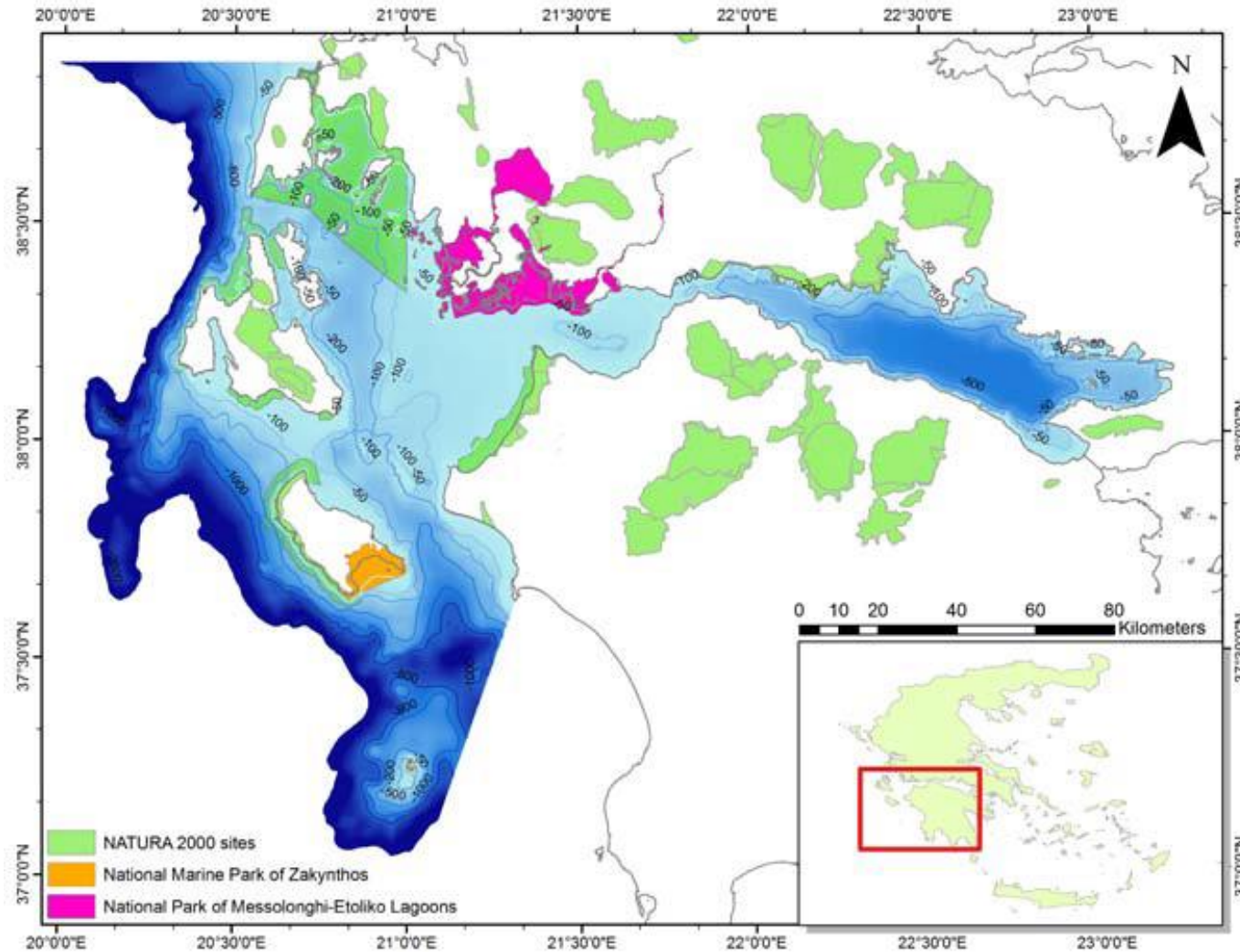


**ArcGIS 10**

- Geostatistical analyst**

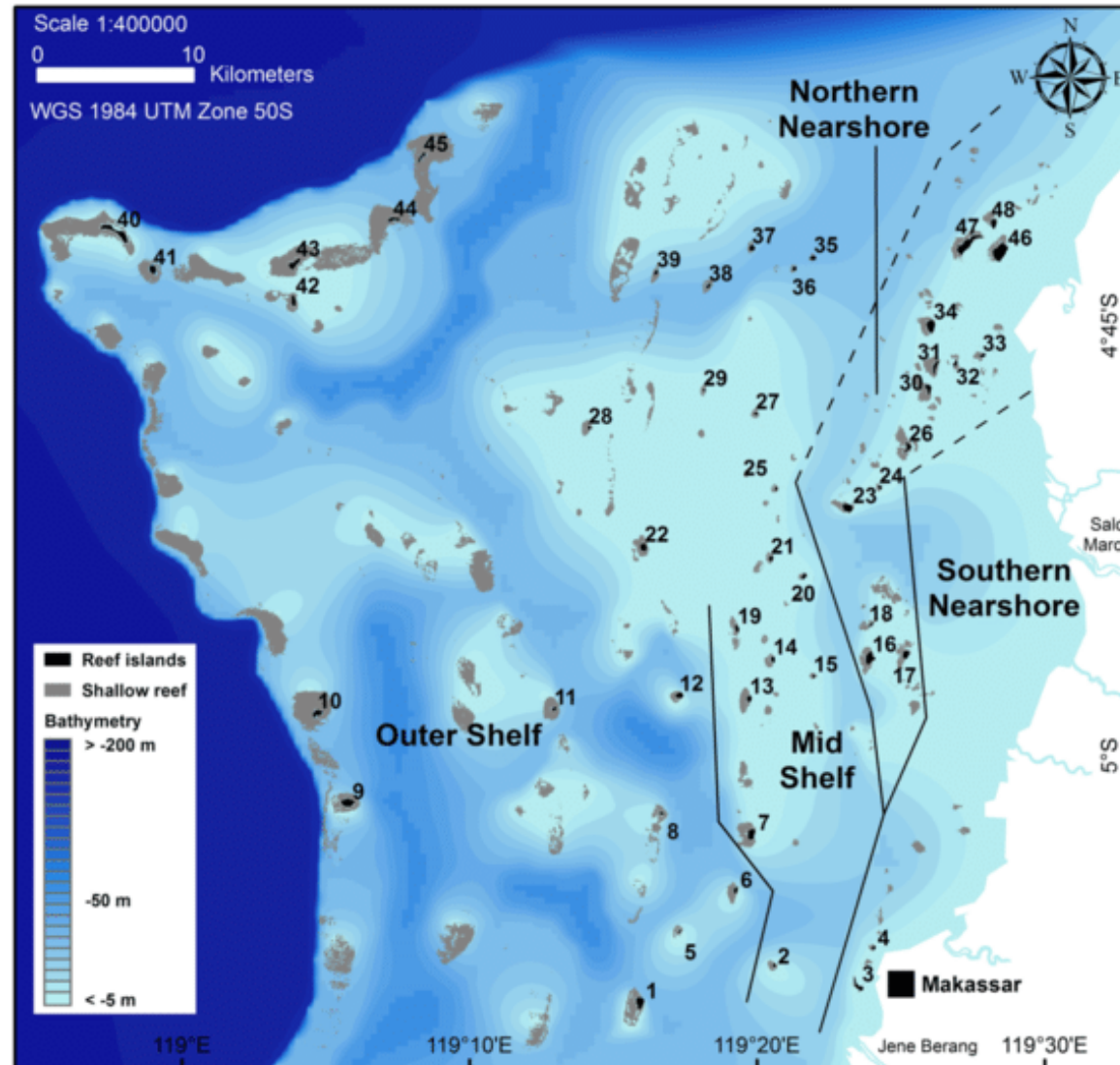


## Interpolation of depth and elevation



## ESRI ArcGIS 9.3

- Geostatistical analyst
- Geoprocessing tools (Overlay)

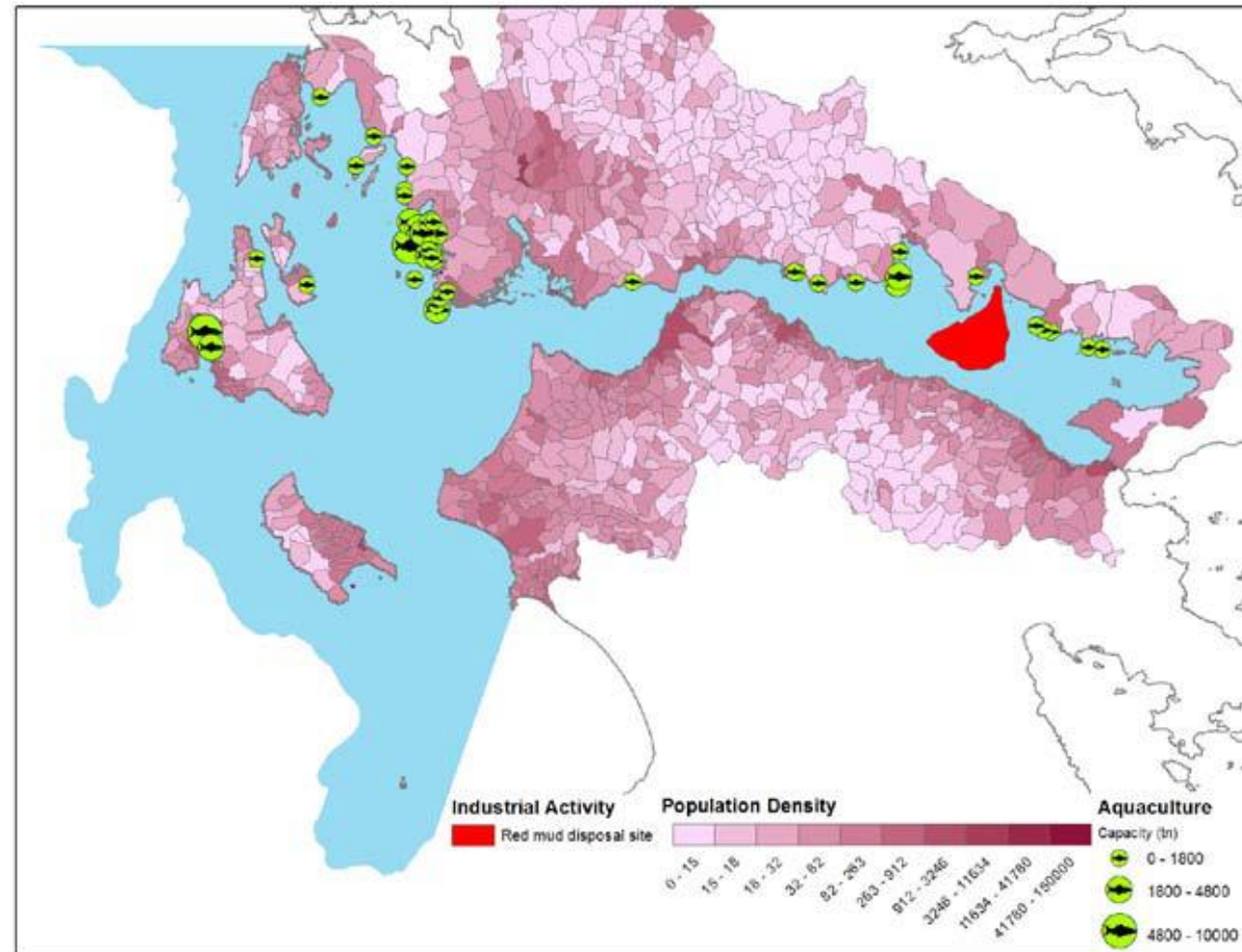


*sn*

- Digitizing
- Labeling
- Geostatistical interpolation

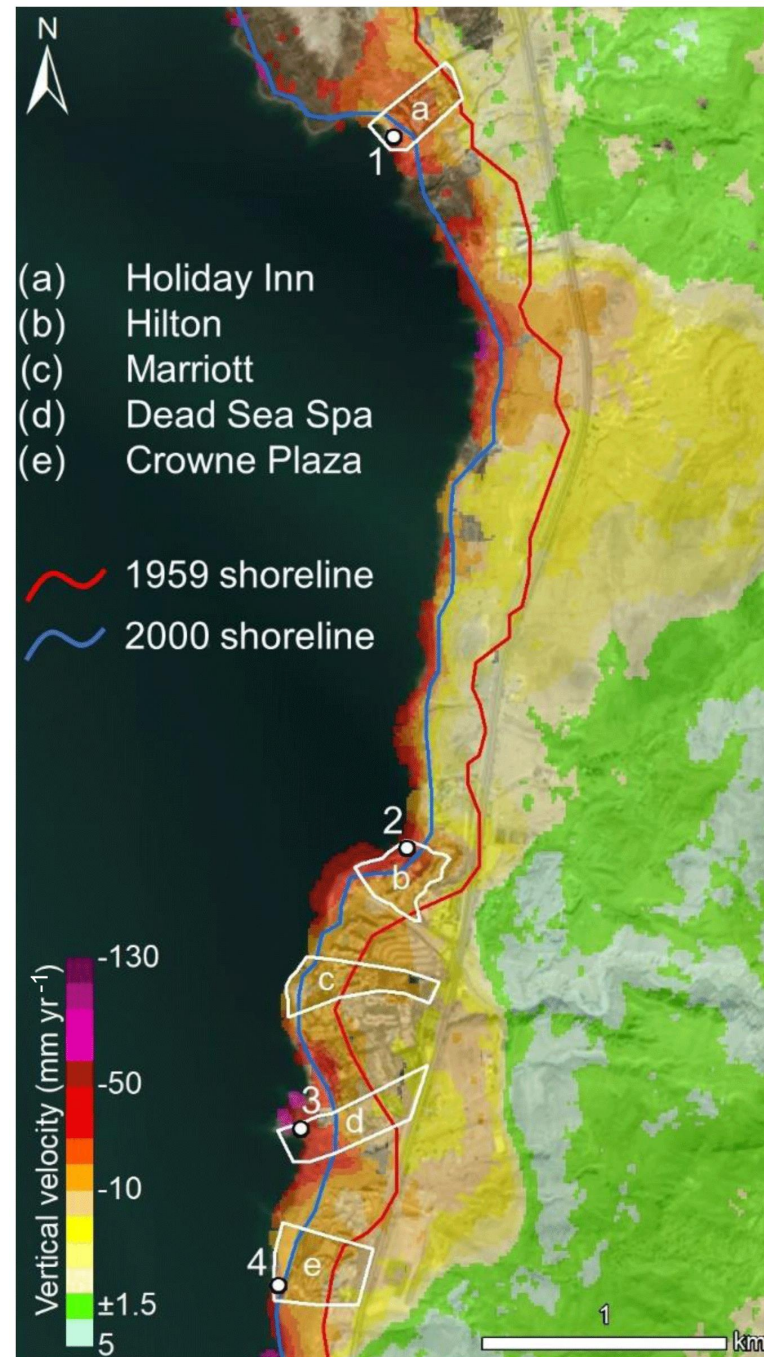


## Shoreline exploitation



ESRI ArcGIS 9.3  
Geoprocessing  
tools (Overlay)

## Shoreline exploitation

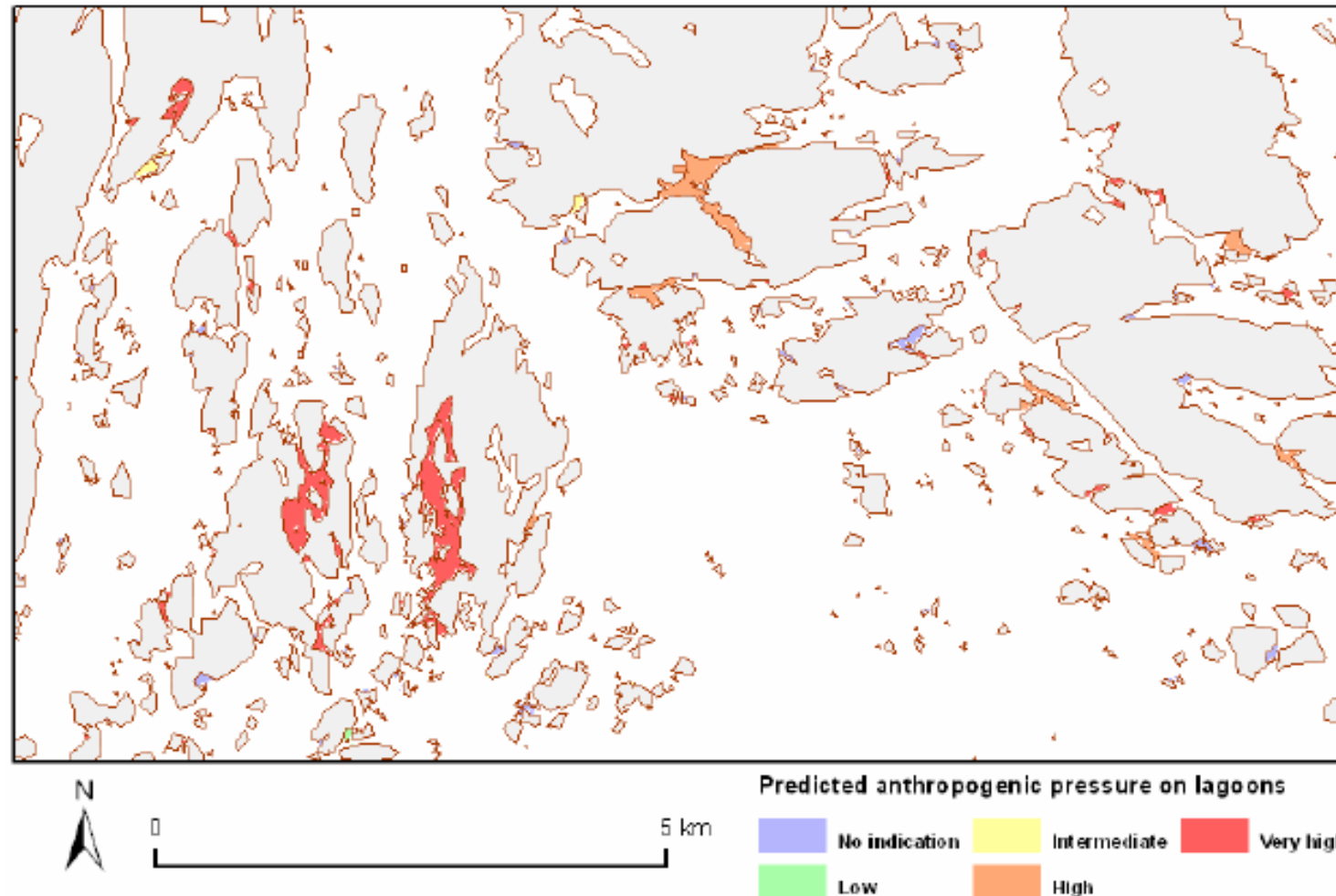


## ArcGIS 10

- Remote sensing
- Hydrological tools
- Digitizing
- WMS



## Human influence on coastal lagoons and large shallow inlets and bays









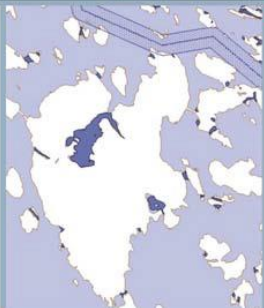




## Human influence on coastal lagoons and large shallow inlets and bays

**Predicting anthropogenic influence on coastal lagoons and large shallow inlets and bays**

The example below illustrates how anthropogenic influence on the natural conditions of marine environment can be modelled by using relatively simple data. On these instructions, three major sources of disturbance are recognized: housing (buildings), traffic (road network) and maritime (shipping / boating lanes) activities. Buffer limits and other methods used in the recipe are only suggestions; users are encouraged to alter them in order to be more reasonable for local conditions or specific research problems. The sample images below are constructed using lagoon data, but the procedure is applicable for inlets and bays as well.

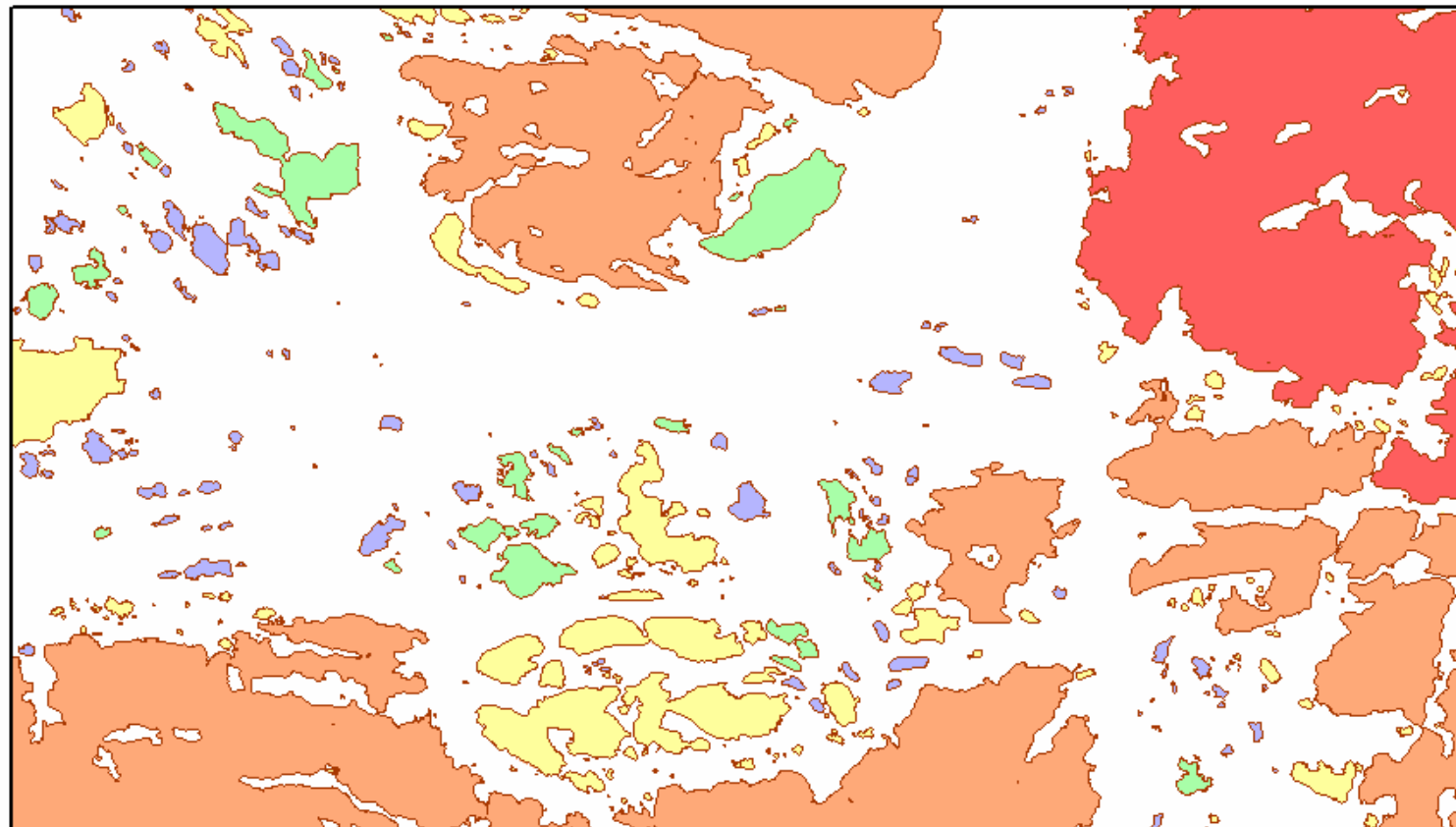
<b>STEP 1:</b> Collect the source data, preprocess		<b>STEP 2:</b> Separate buildings locating on the shoreline and create a buffer zone representing the area of anthropogenic influence		<b>STEP 3:</b> Create a buffer zone for road network representing the area of anthropogenic influence	
<b>STEP 4:</b> Create a buffer zone for boating / shipping lanes representing the area of anthropogenic influence		<b>STEP 5:</b> Combine the different buffer zones and clip to fit the lagoon area		<b>STEPS 6 - 7:</b> Calculate the proportional area of anthropogenic pressure on each lagoon, classify the result and make some corrections if needed	

### ArcView 3

- Field calculator
- Feature to point
- Join table
- Geoprocessing (buffer, clip)
- Spatial join
- Reclassify



## Communication infrastructure



Predicted communication status of islands

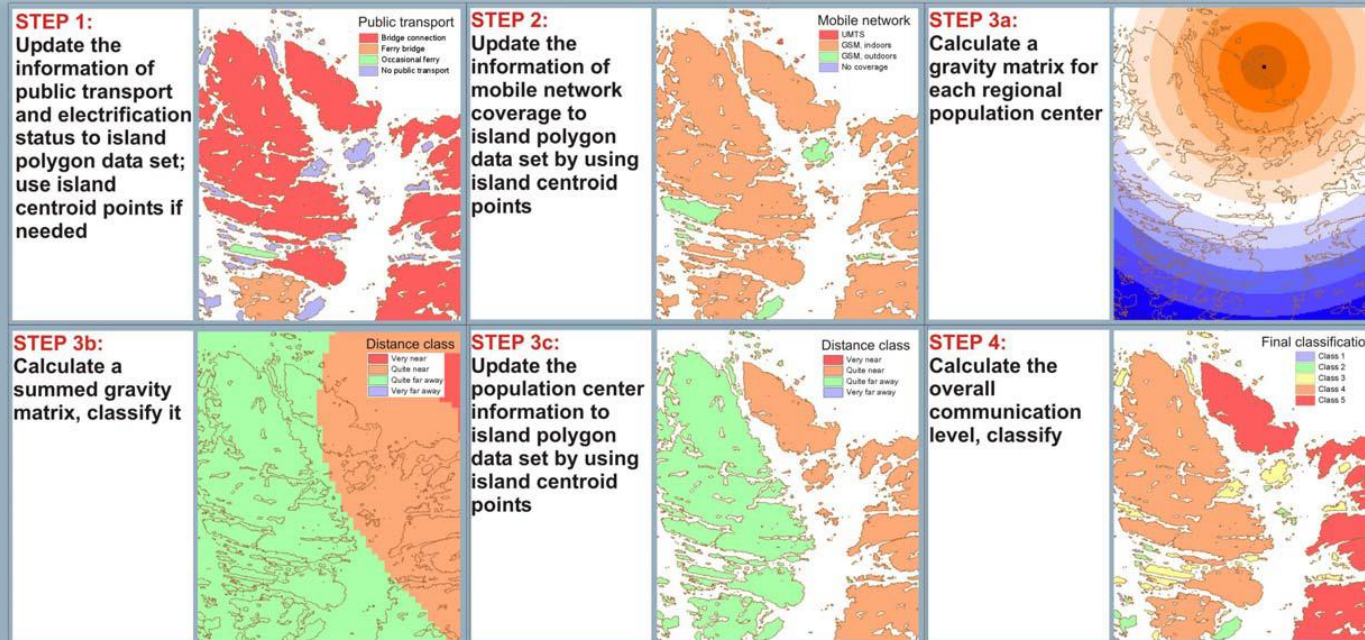




## Communication infrastructure

### Predicting pressure induced by anthropogenic influence on marine nature with a communication indicator

The images below demonstrate a procedure that can be used to measure the communication level in the archipelago region. Four different data sources are incorporated into the analysis: public transport status, electrification status, mobile network coverage and geographical distance from regional population centers. Generally, the most time-consuming part of the recipe is to combine the attributes of single data sets in order to construct the final classification of the communication level. Users should understand that the instructions given here are only suggestions and may be altered to find the most applicable approach.

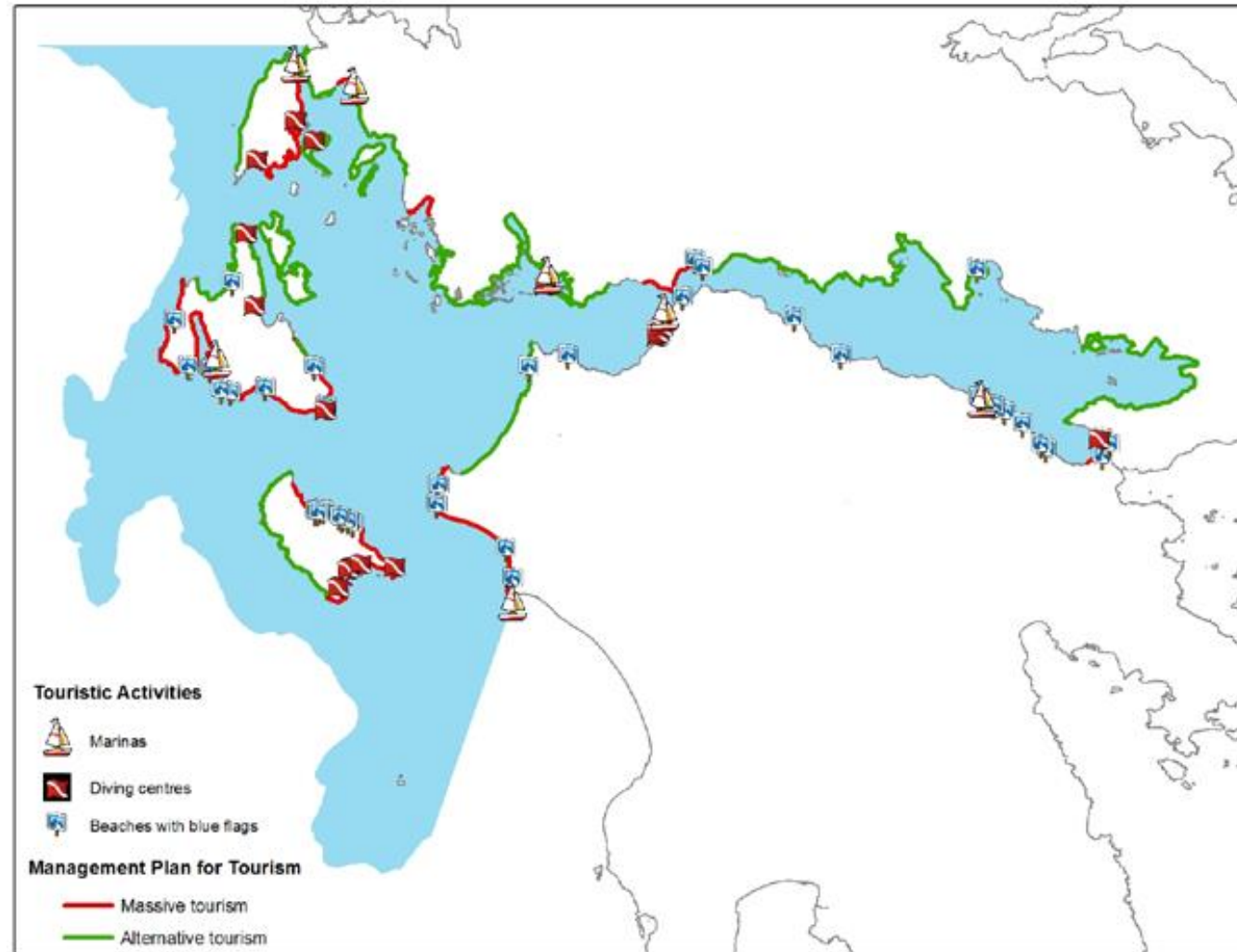


## ArcView 3

- Join table
- Feature to point
- Spatial join
- Distance raster
- Reclassify
- Geoprocessing (buffer, clip)
- Field calculator

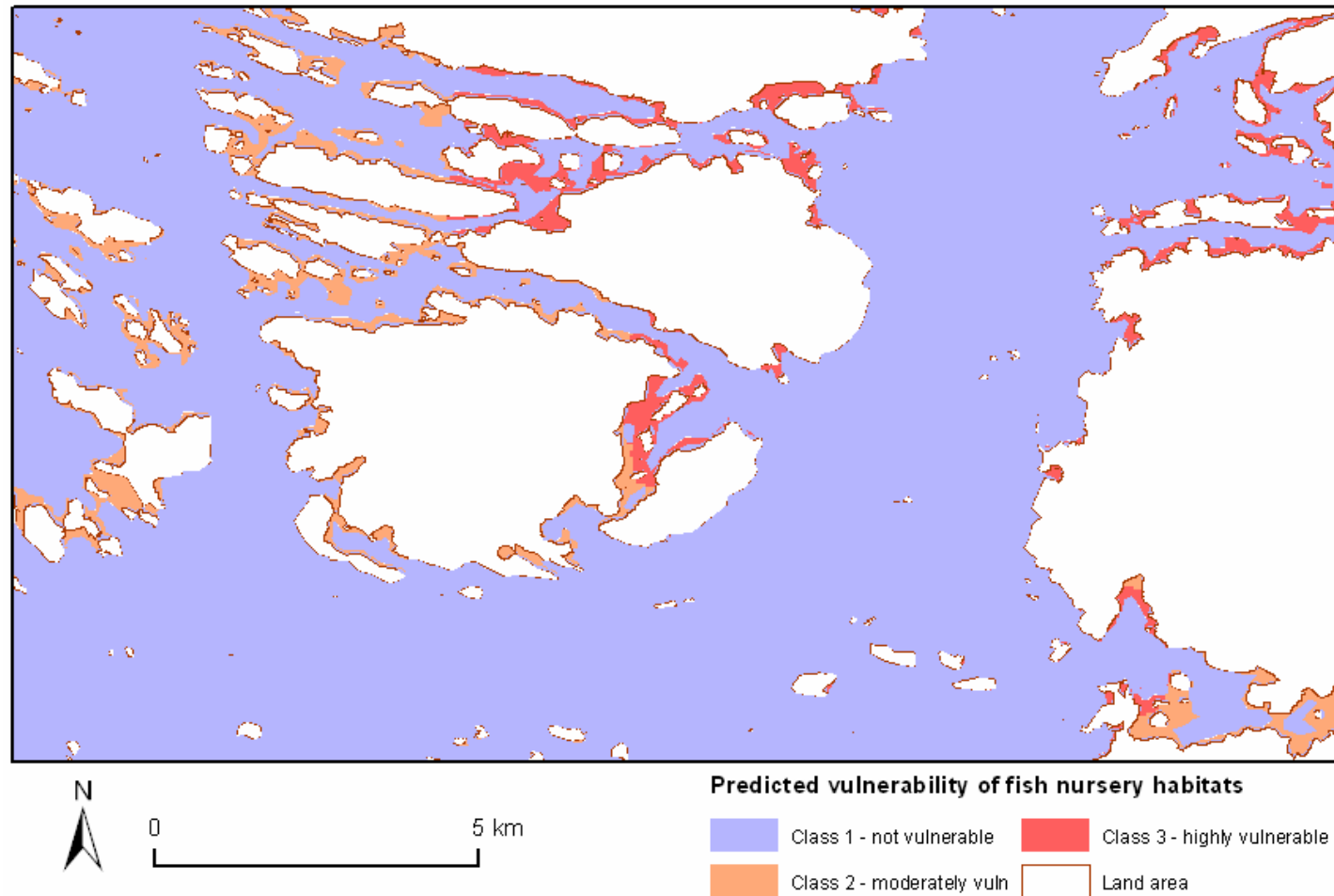


## Effects of recreational boating and fishing on sensitive habitats

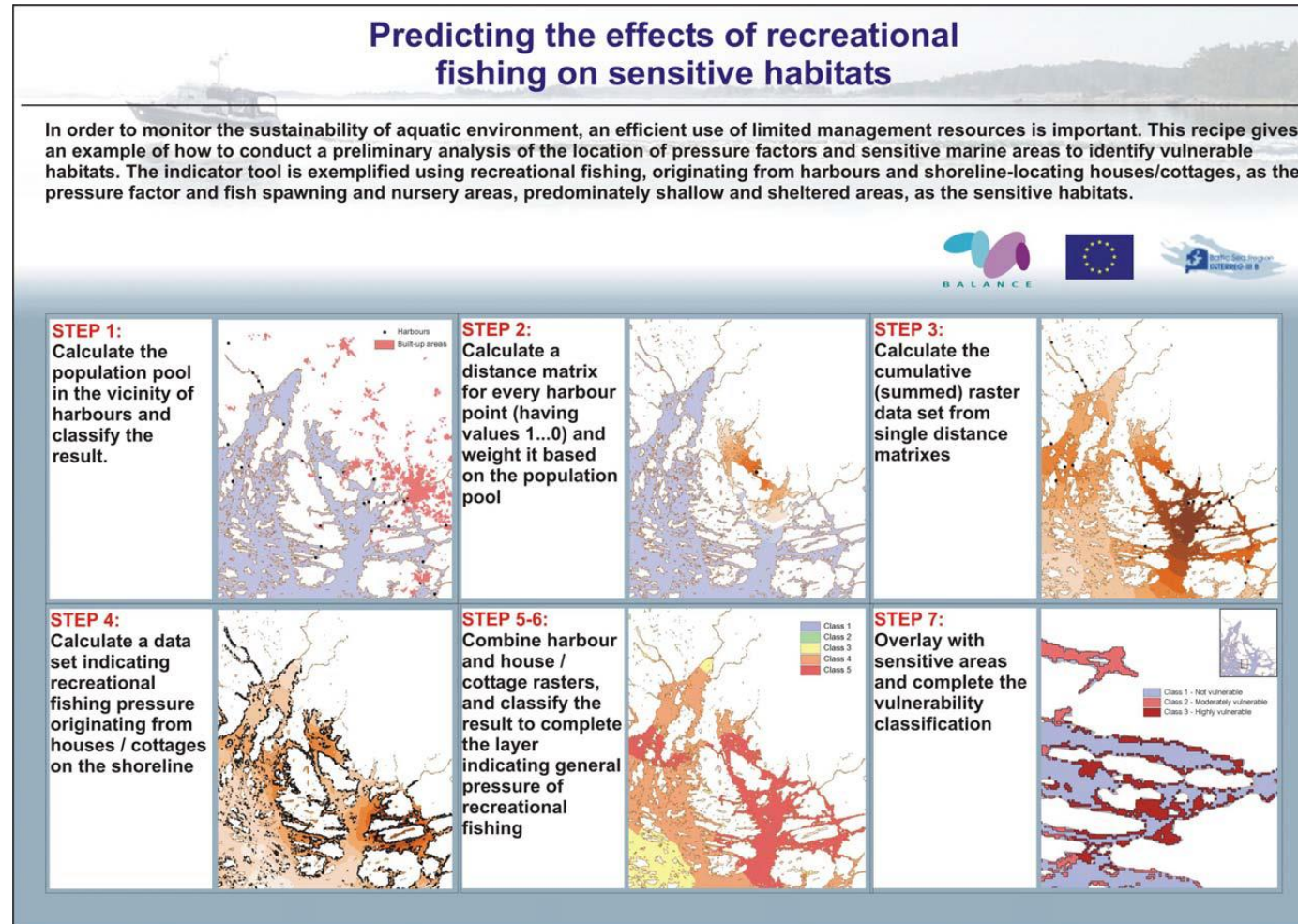


**ESRI ArcGIS 9.3  
Geoprocessing  
tools (Overlay)**

## Effects of recreational boating and fishing on sensitive habitats



## Effects of recreational boating and fishing on sensitive habitats

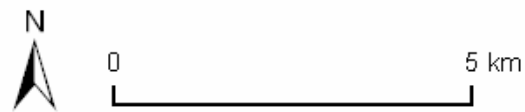
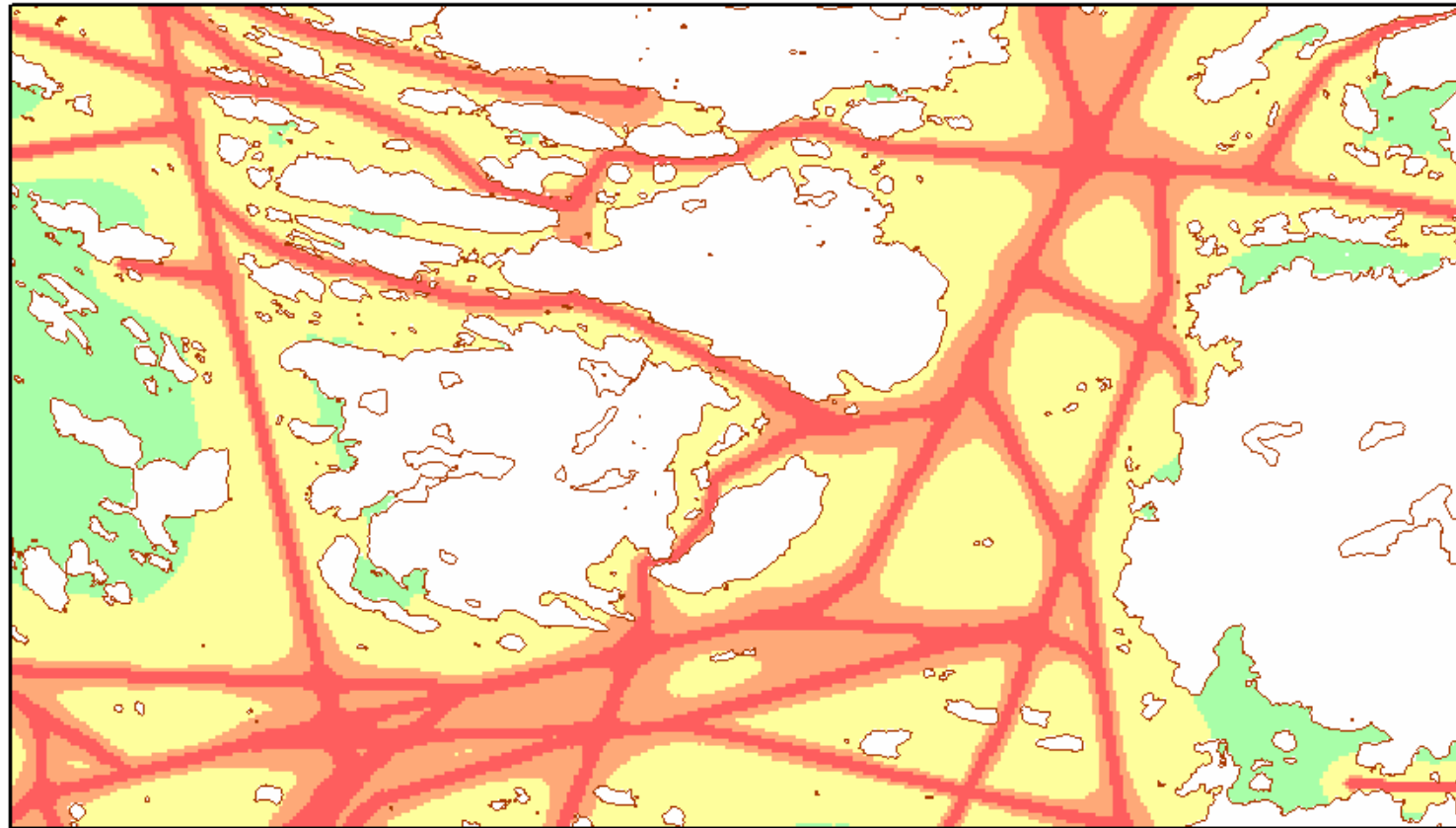


### ArcView 3

- Join table
- Distance raster
- Weighted sum
- Reclassify
- Geoprocessing (overlay)



## Marine noise disturbance from vessels



Predicted anthropogenic noise exposure







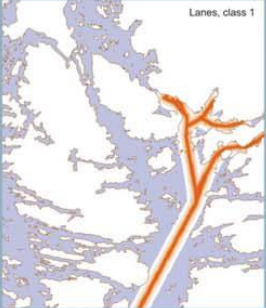
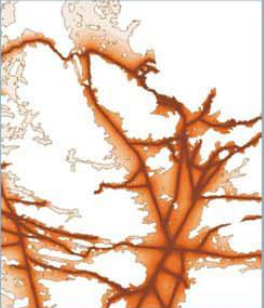

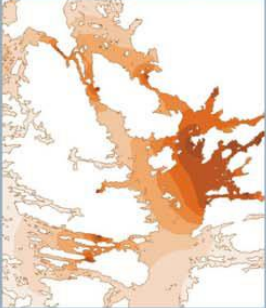
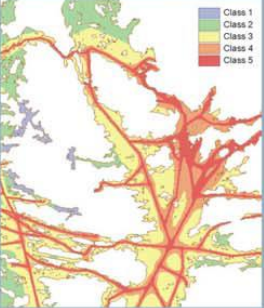


## Marine noise disturbance from vessels

**Predicting the impacts of anthropogenic noise in the marine environment**

There are many sources of anthropogenic noise in the marine environment that may have implications to marine species' survival, behaviour and breeding success. This recipe focuses on vessel traffic that probably is the most widespread and constant source of noise exposure and describes one way of producing a simple noise model without emphasizing especially on any single species. Two different source data sets are used: shipping lanes representing the noise effects induced by larger vessels, and the location of harbours indicating the probable accumulation of small boat noise. Users should understand that the instructions given here are only suggestions and may be altered to find the most applicable approach.

<p><b>STEP 1:</b> Preprocess the shipping lane data and create a land / sea cost grid</p>		<p><b>STEP 2:</b> Calculate class-specific noise rasters for vessel traffic on shipping lanes</p>		<p><b>STEP 3:</b> Calculate a combined noise raster for all shipping lanes</p>	
<p><b>STEP 4:</b> Calculate harbour-specific noise rasters for small boat traffic</p>		<p><b>STEP 5:</b> Calculate a combined noise raster for all small boat traffic</p>		<p><b>STEP 6:</b> Calculate the final, combined noise raster and classify it</p>	

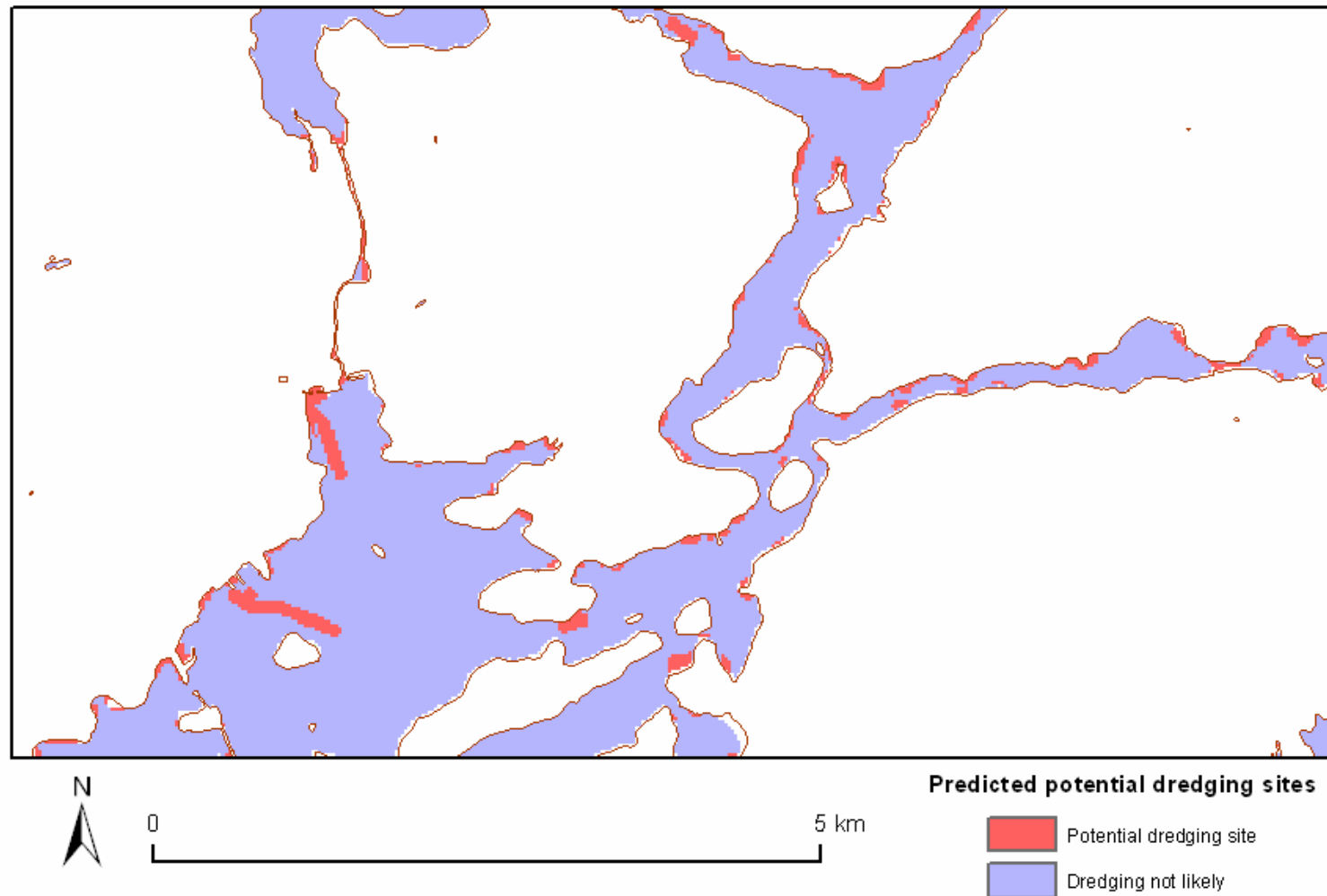
### ArcView 3

- Field calculator
- Reclassify
- Distance raster
- Map algebra



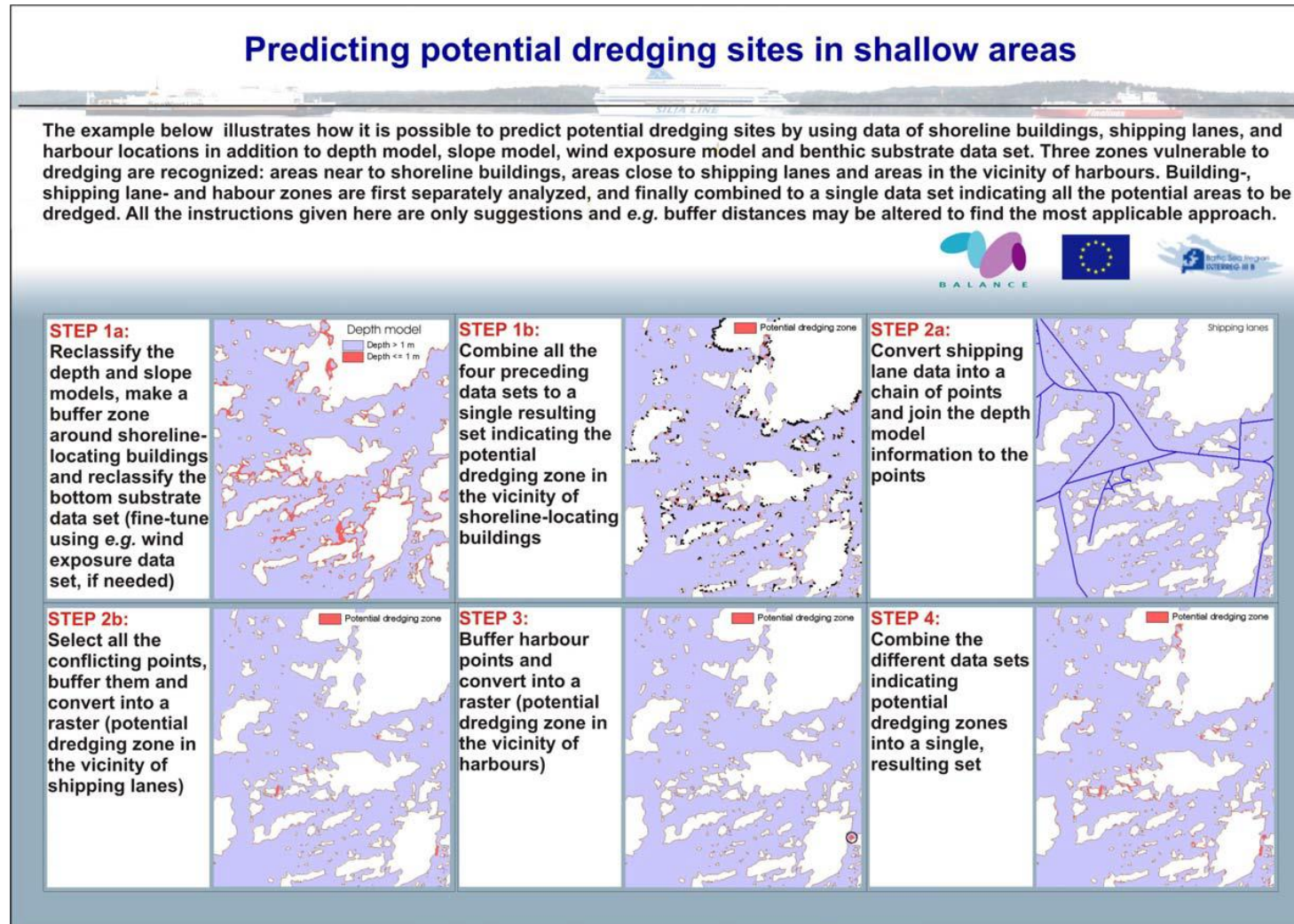


## Potential dredging sites in shallow coastal areas





## Potential dredging sites in shallow coastal areas

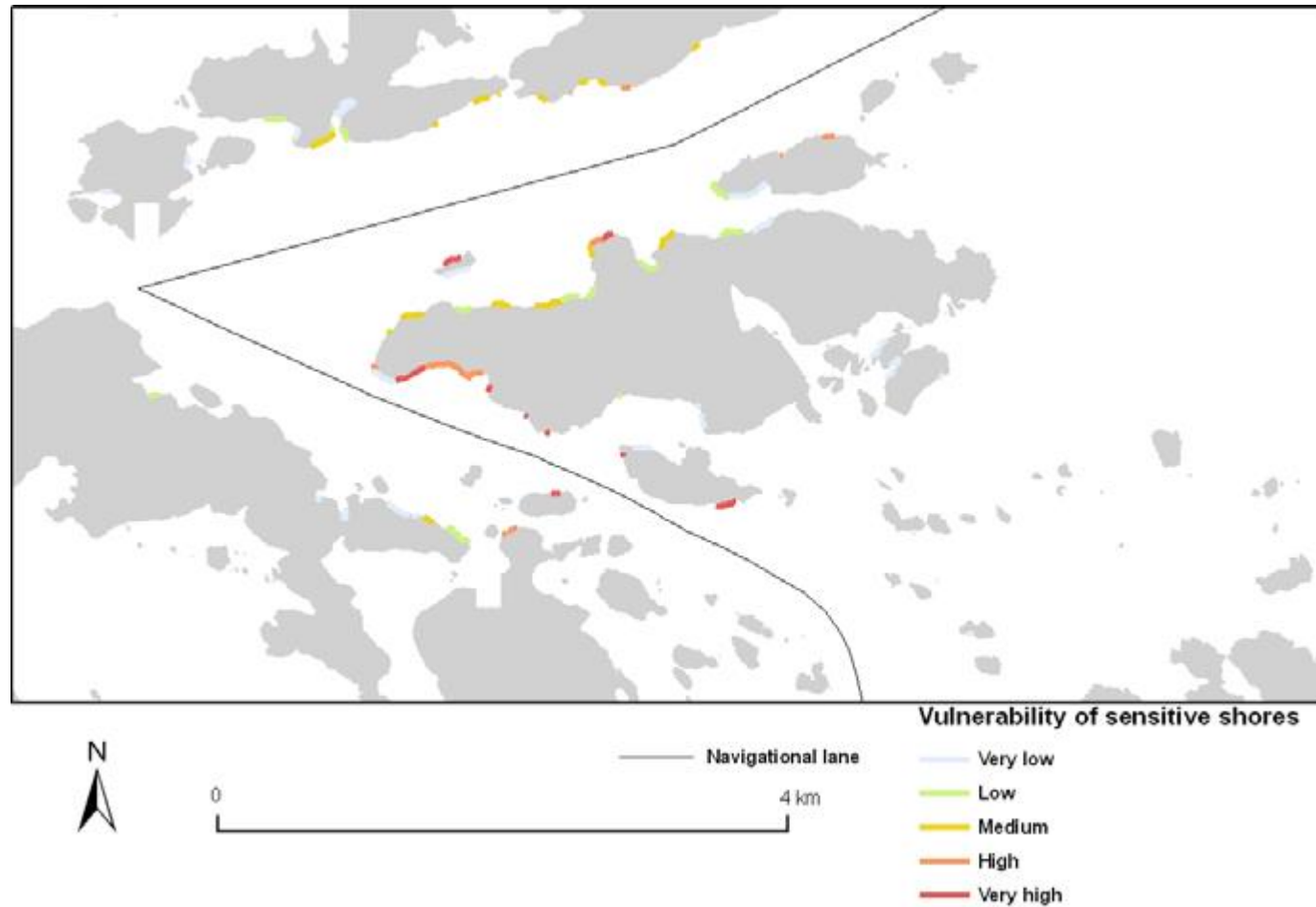


## ArcView 3-ArcGIS 9

- Reclassify
- Geoprocessing (buffer)
- Rasterize
- Map algebra
- Feature to point
- Field calculator



## Shoreline erosion induced by navigational activities

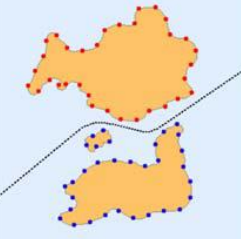
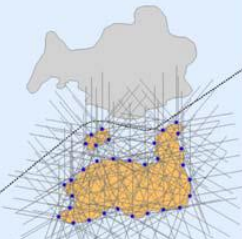
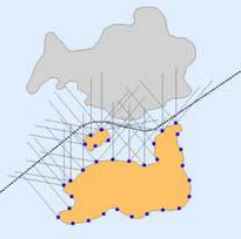
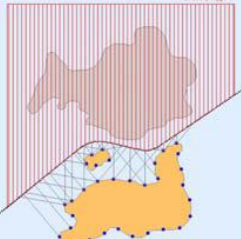

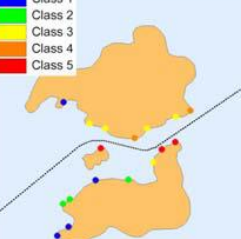




## Shoreline erosion induced by navigational activities

**Assessing shoreline erosion induced by navigational activities**

Navigational activities are widespread all over the world and the consequences to the marine nature can be severe near to shipping lanes. One significant effect of vessel traffic is the erosion of shorelines by waves and water movements, which may have highly pronounced effects on sensitive shorelines. The GIS recipe visualised below offers a simple way to make assessments of the potential erosion induced by navigational activities based on the location of the nearest shipping lane, visibility from the shipping lane to a certain shoreline point (no obstacles allowed) and the presence of shallow areas that reduce the power of the wave action. Finally, the preliminary results are overlaid with shorelines known to be sensitive to find out the most vulnerable locations.

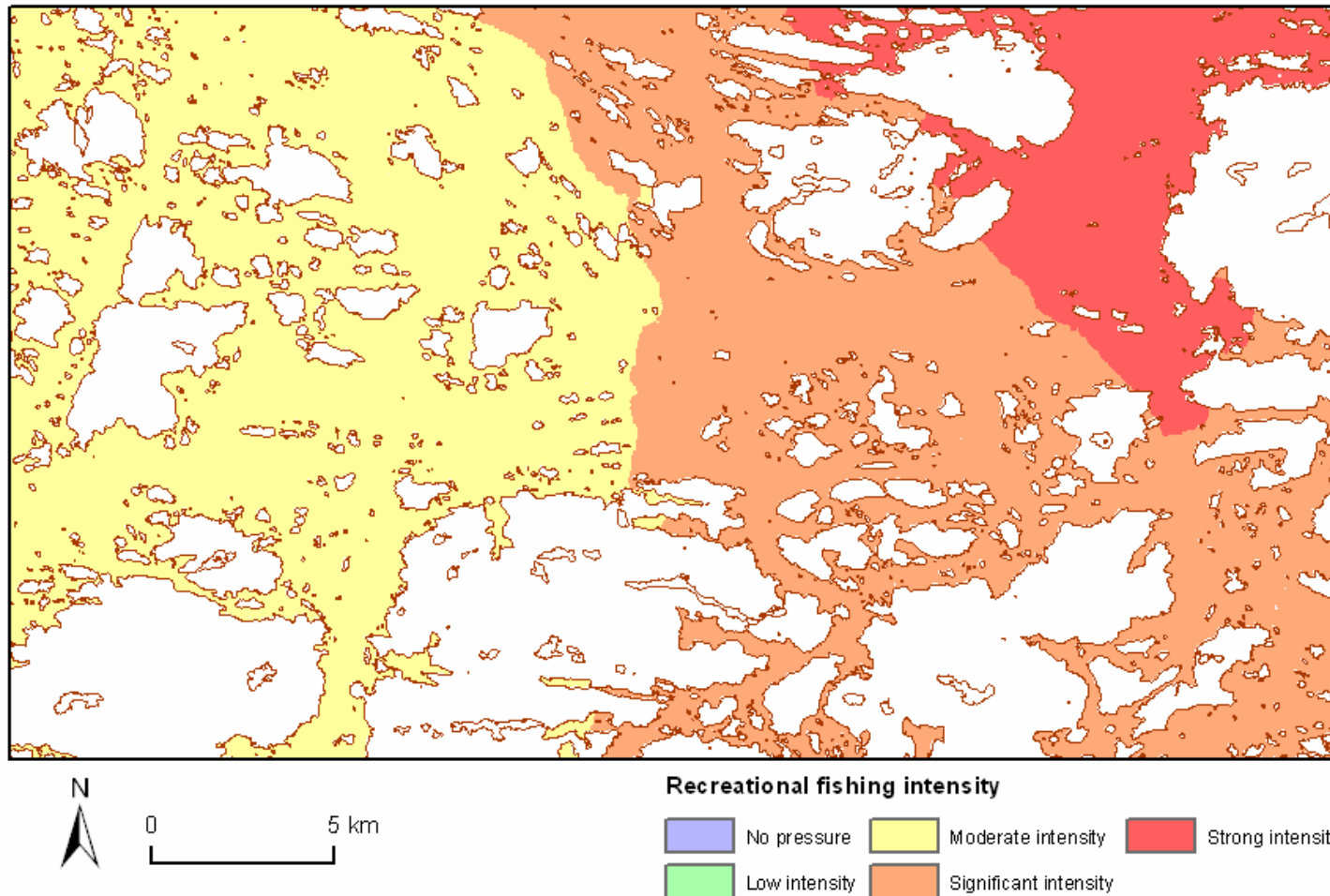
<p><b>STEPS 1 - 2a:</b> Convert shoreline to points and calculate a unique ID number for every point. Divide points to subsets by using shipping lanes as cutting lines</p>		<p><b>STEP 2b:</b> Run the <i>radiating lines</i> script using ArcView 3 to create all the fetch line subsets</p>		<p><b>STEP 2c:</b> Remove all the fetch lines not in contact with shipping lane, and fetch lines going through land areas</p>	
<p><b>STEP 2d:</b> Cut away residuary parts behind the nearest shipping lane and remove ending sections of lines passing the same shipping lane more than once</p>		<p><b>STEPS 2d - 3:</b> Combine all the subsets and clip with shallow areas</p>		<p><b>STEPS 4 - 6:</b> Summarize and update attributes to shoreline points. Calculate potential erosion level, discard points on insensitive shores and classify the result</p>	 <p> <span style="color: blue;">■</span> Class 1  <span style="color: green;">■</span> Class 2  <span style="color: yellow;">■</span> Class 3  <span style="color: orange;">■</span> Class 4  <span style="color: red;">■</span> Class 5         </p>

## ArcView 3-ArcGIS 9

- Feature to point
- Create lines
- Geoprocessing (intersect, clip, split, union)
- Field calculator



## Effects of marine management activities on fishing

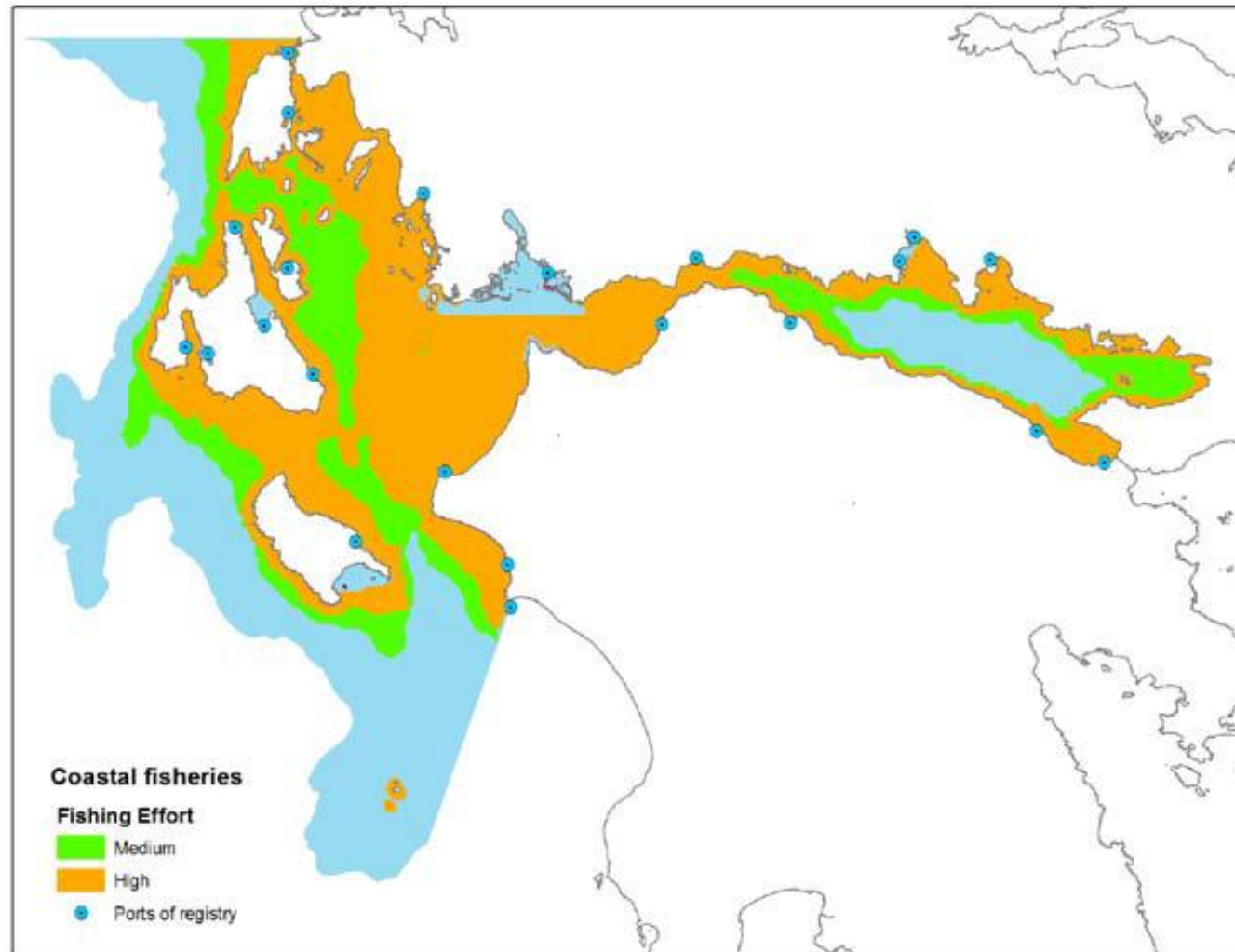


### ArcView 3

- Join table
- Distance raster
- Weighted sum
- Reclassify
- Geoprocessing (overlay)



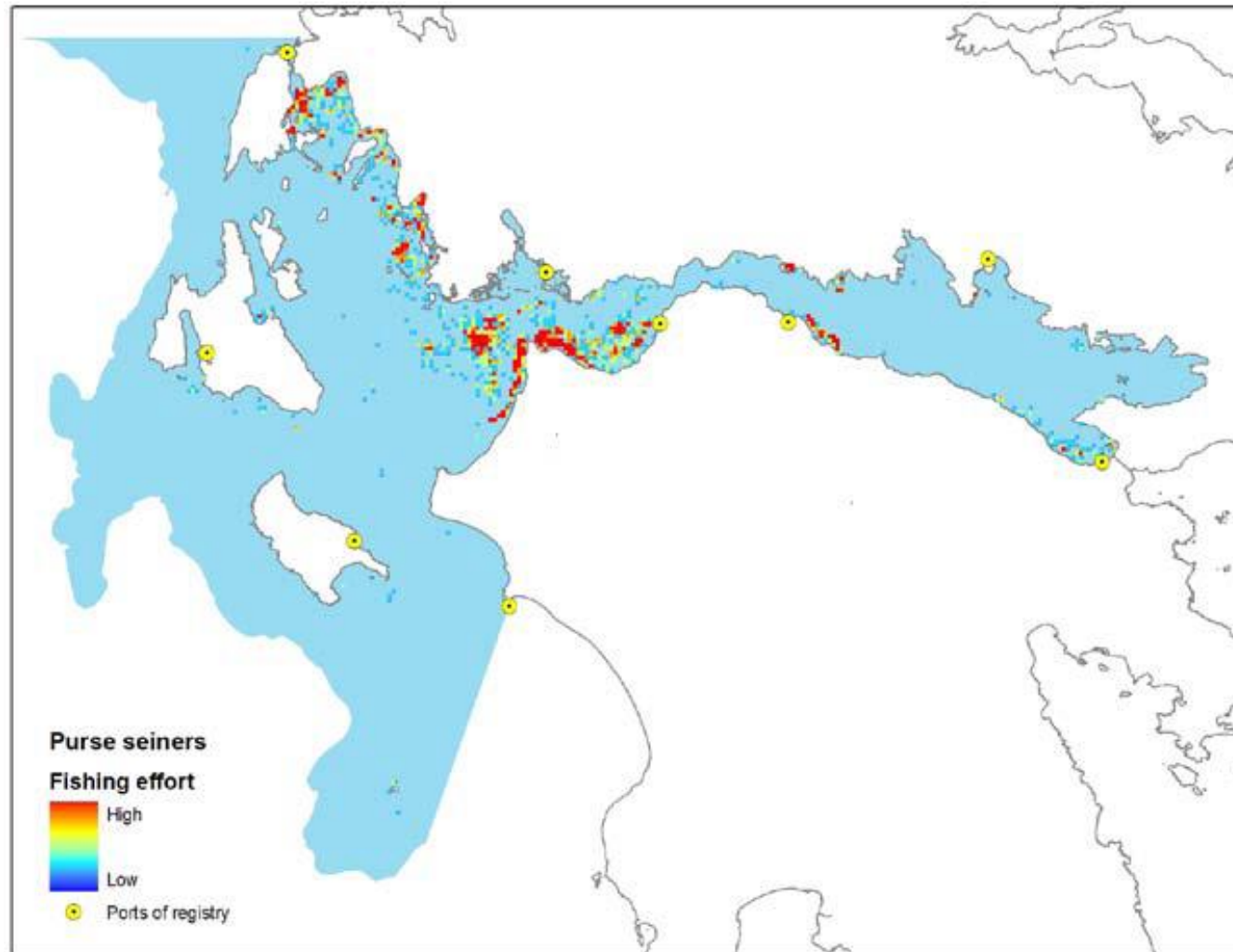
## Effects of marine management activities on fishing



ESRI ArcGIS 9.3  
Geostatistic  
tools



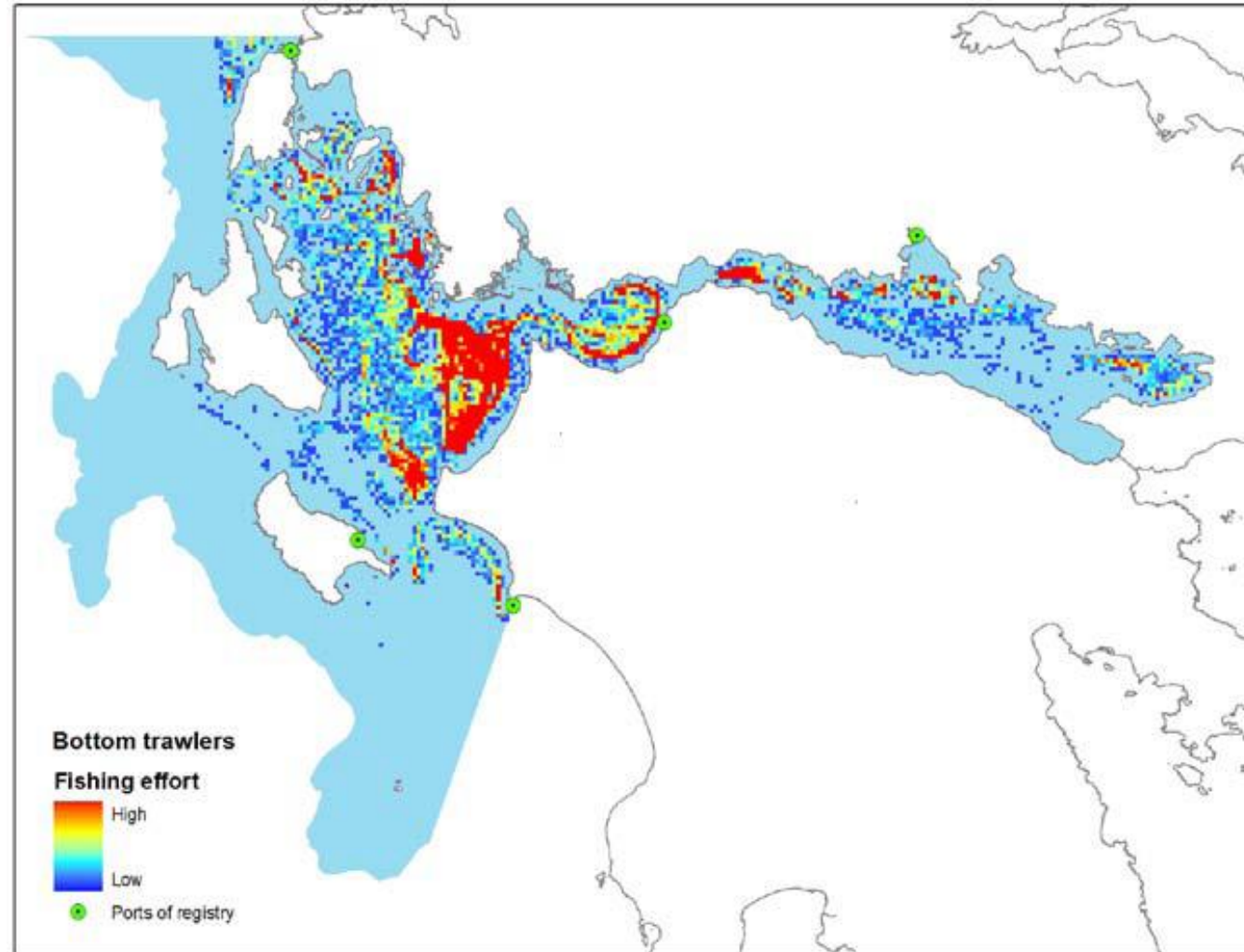
## Effects of marine management activities on fishing



**ESRI ArcGIS 9.3**  
**Geostatistic**  
**tools**



## Effects of marine management activities on fishing

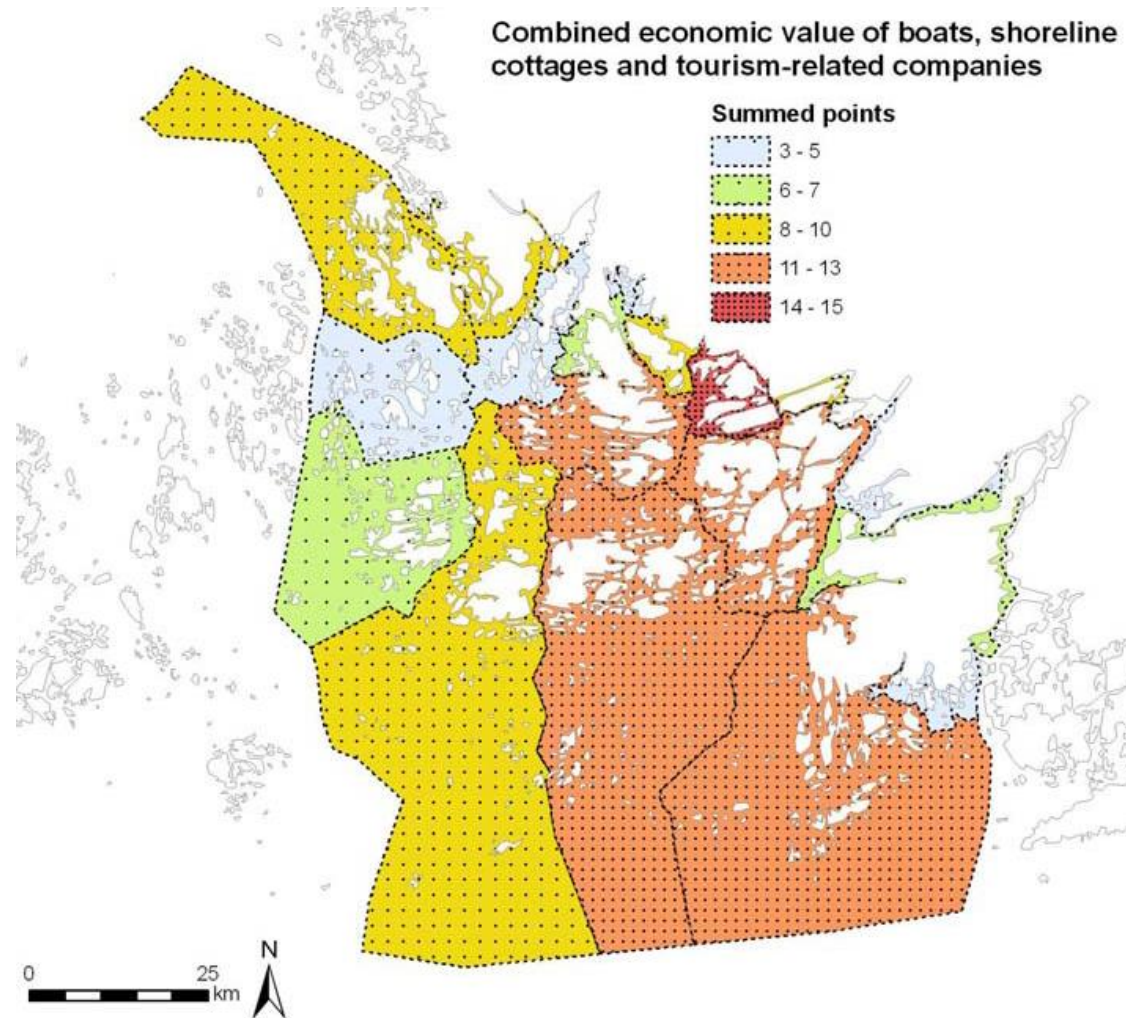


**ESRI ArcGIS 9.3**  
**Geostatistic**  
**tools**



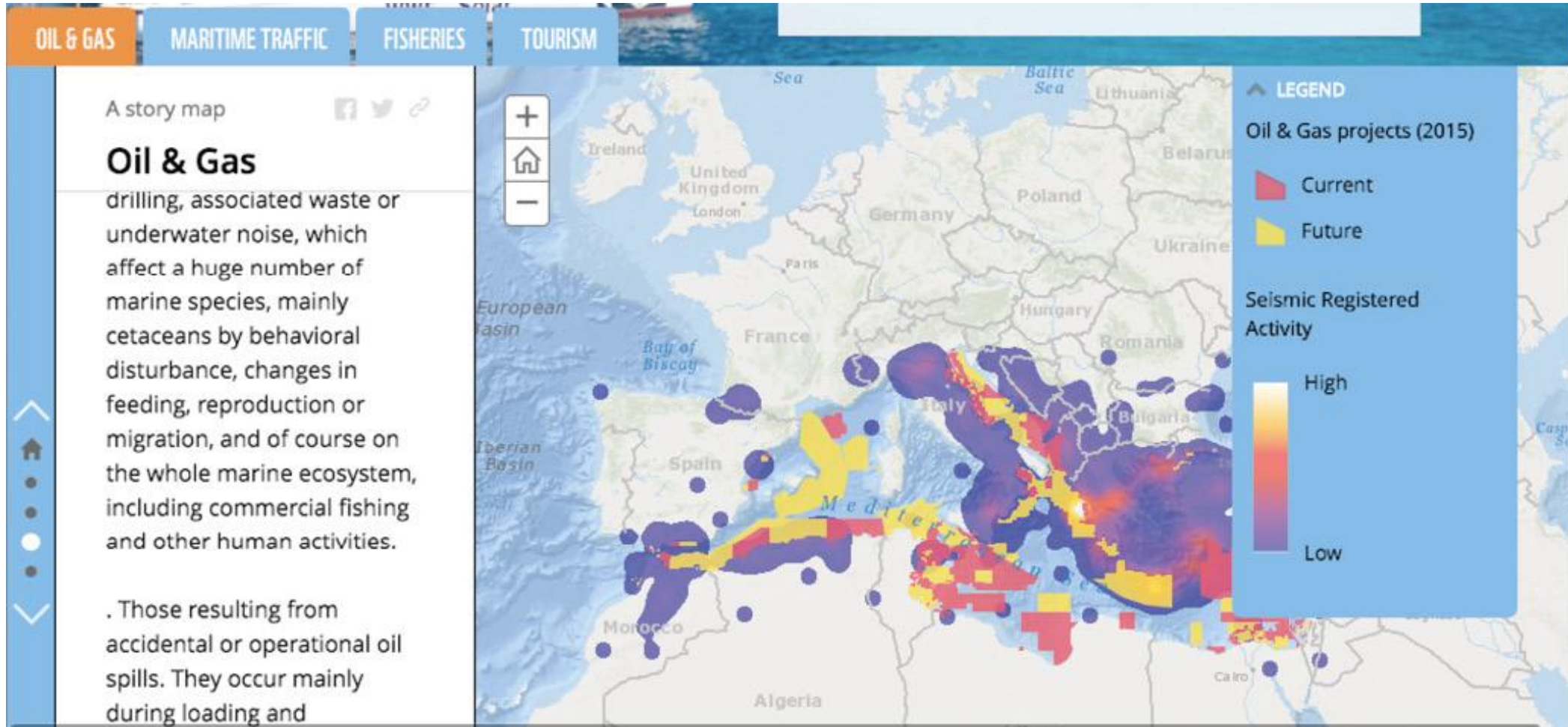


## Economic value of marine areas – exemplified for recreational activities



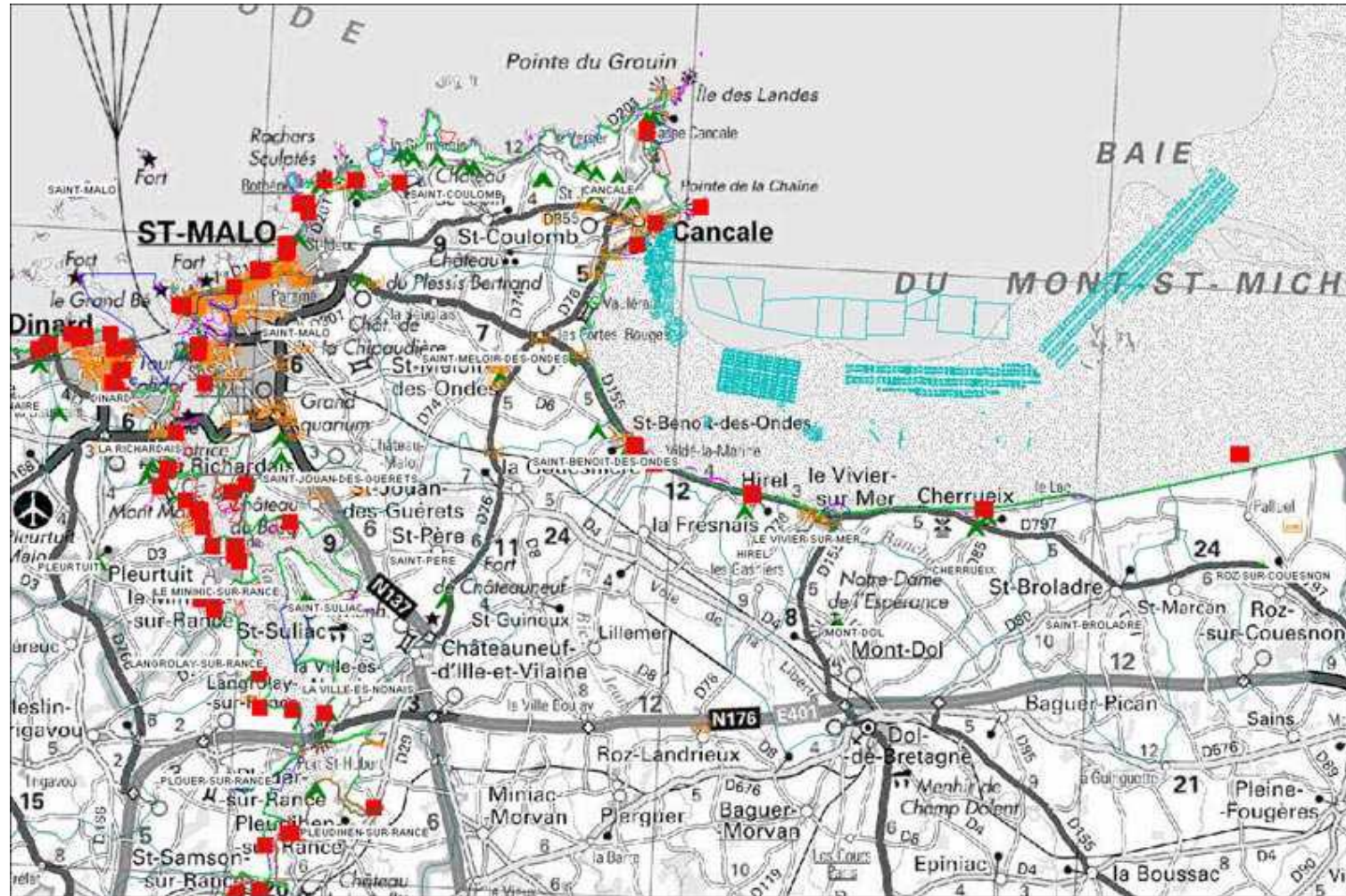
ArcView 3-ArcGIS 9  
Weighted overlay

## The interaction between authorities and stakeholders





## Compliance with management plans



## Compliance with management plans



GéoBretagne® catálogo visualizador servicios Iniciar sesión

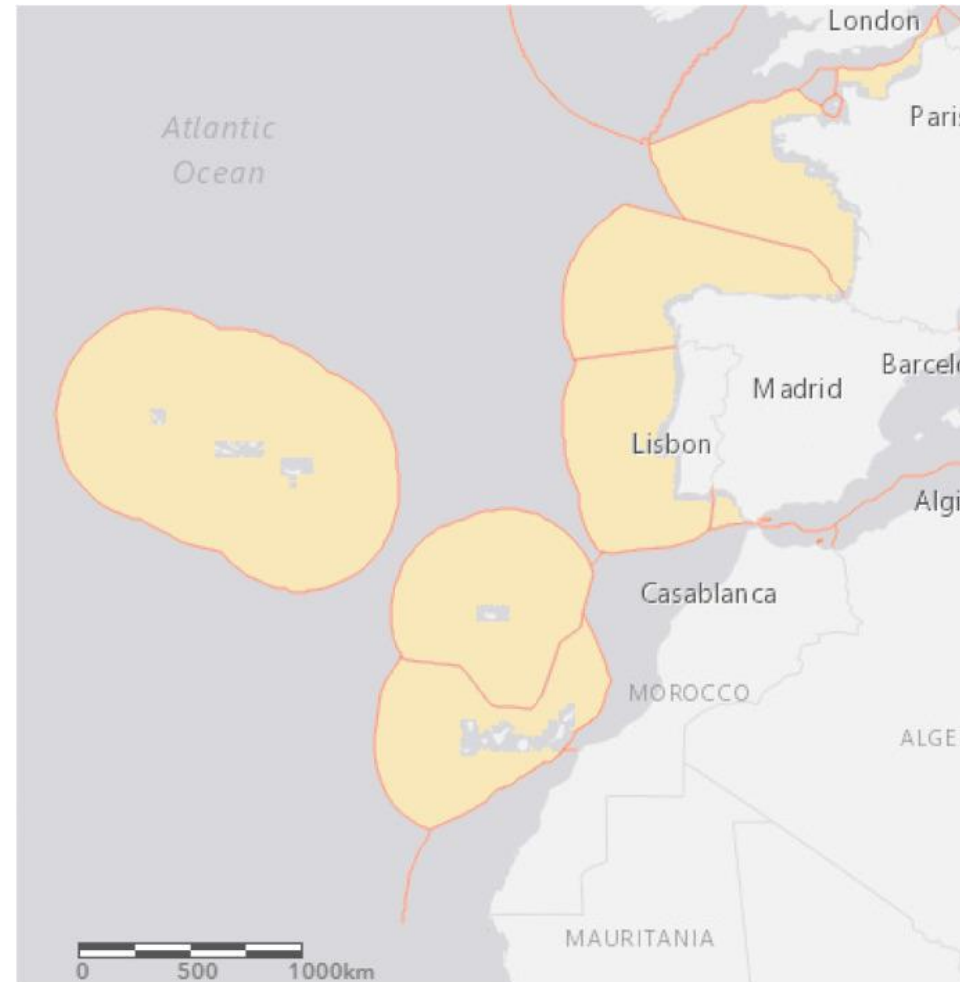
The screenshot displays the GéoBretagne platform interface. The main map shows a coastal region of Brittany with various administrative boundaries and land use data. The interface includes a top navigation bar with 'GéoBretagne®', 'catálogo', 'visualizador', and 'servicios' buttons, along with a 'Iniciar sesión' button. The map itself has a toolbar with navigation and zoom controls. On the right side, there is a 'Capas disponibles' (Available Layers) panel with the following layers:

- Piscicultures - Normandie (1:267 a 1:559 082 264 | fuente: CEREMA)
- Cadastre conchylicole - zone de défen... (1:267 a 1:559 082 264 | fuente: CEREMA)
- Zones de présomption de prescription... (1:267 a 1:559 082 264 | fuente: DRAC Bretagne)
- Communes (1:267 a 1:559 082 264 | fuente: geobretagne.fr)
- Départements (1:267 a 1:559 082 264 | fuente: geobretagne.fr)
- IGN cartes scan25 et scan régional (1:267 a 1:559 082 264 | fuente: tile.geobretagne.fr)
- OpenStreetMap (1:267 a 1:559 082 264 | fuente: osm.geobretagne.fr)
- Photographie aérienne composite (1:267 a 1:559 082 264 | fuente: tile.geobretagne.fr)

At the bottom of the map, there is a scale bar (1:136 495, 1 km) and coordinate information: 'Coordenadas en WGS 84 Lon = -2.99554, Lat = 47.48647'. A 'Ciudades' panel is also visible at the bottom right with an 'Ir a:' field.



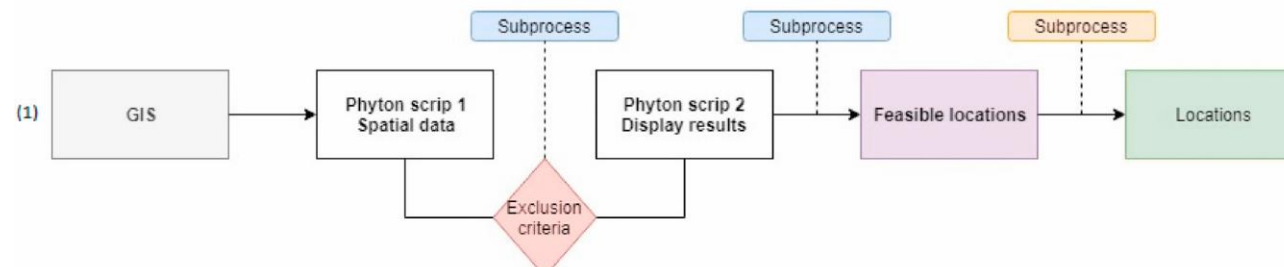
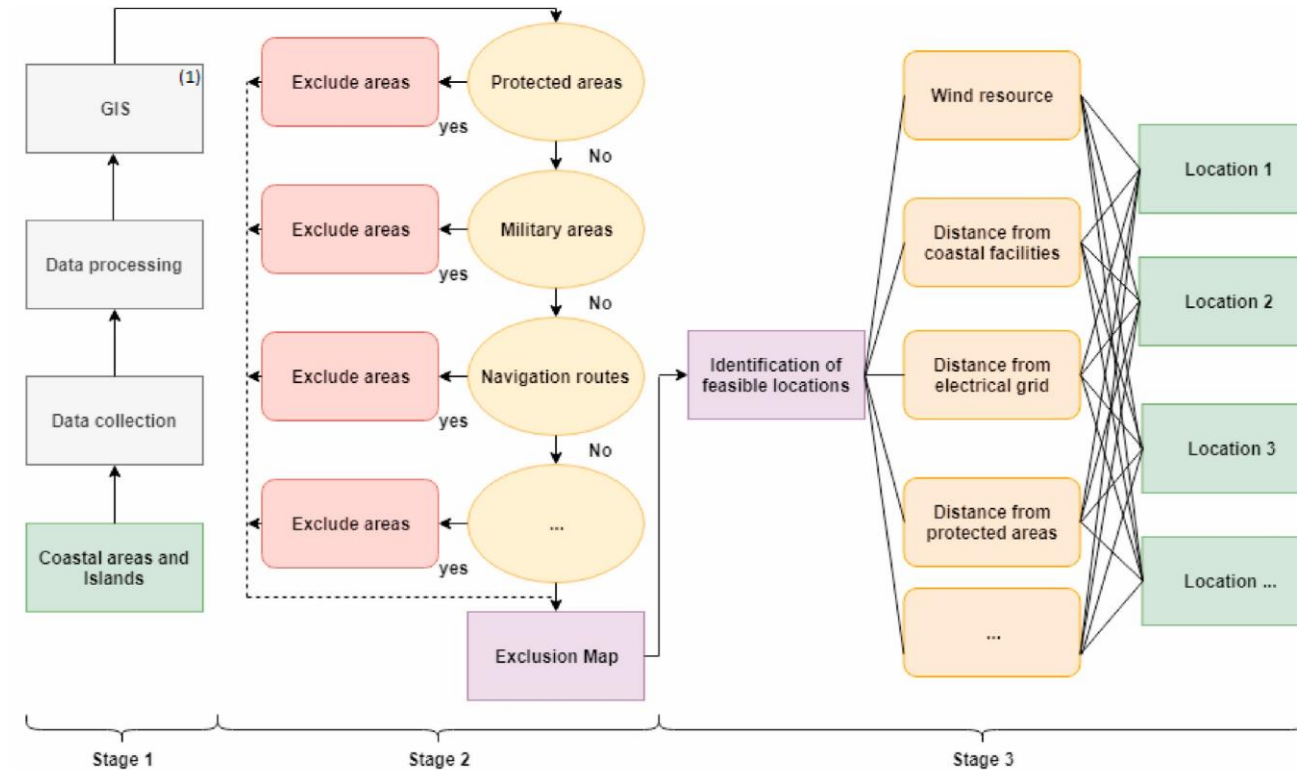
## An integrated GIS approach for site selection of floating offshore wind farms in the Atlantic continental European coastline



**ArcGIS 10**  
**Geoprocessing**  
**(buffer)**



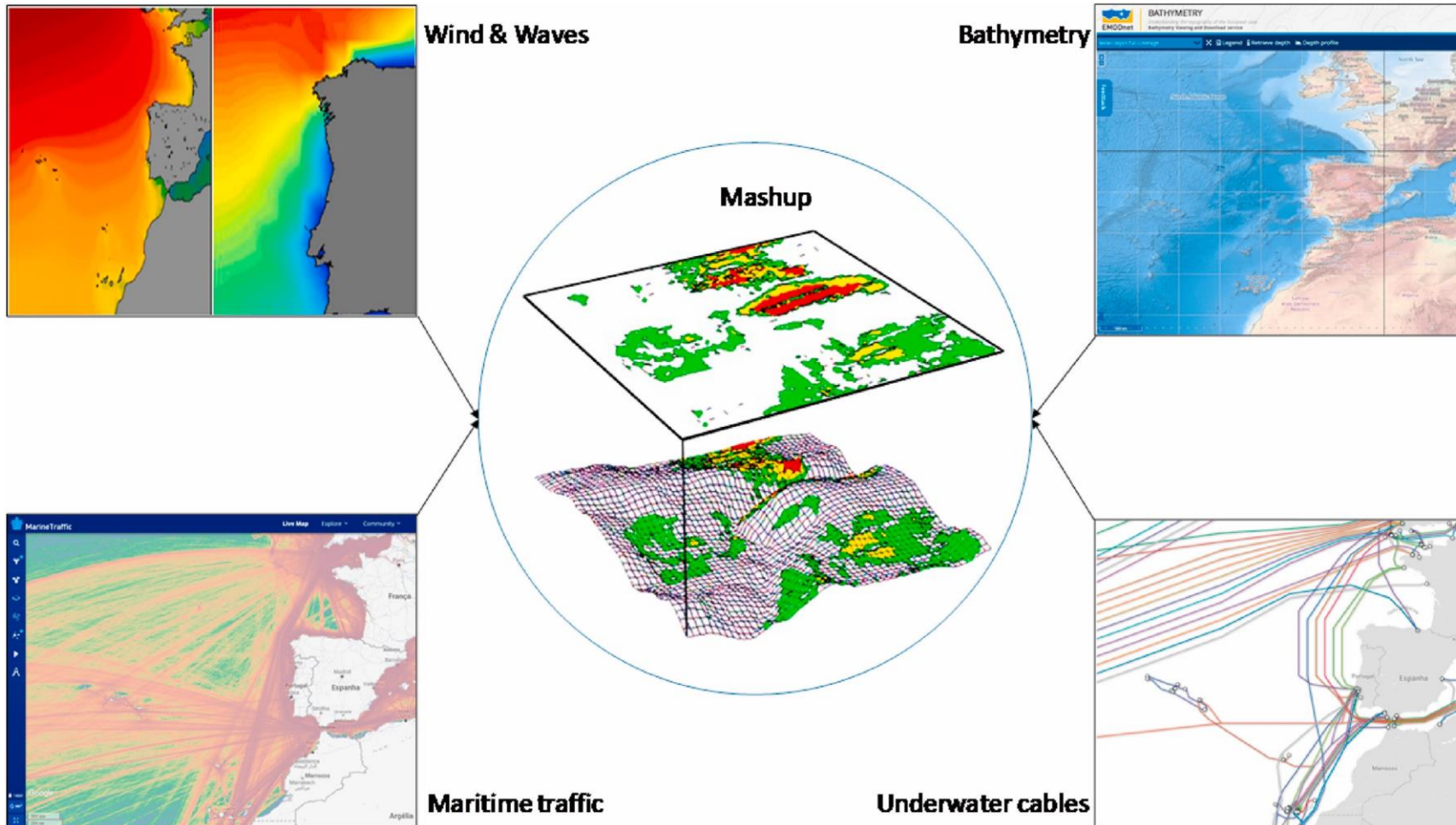
## An integrated GIS approach for site selection of floating offshore wind farms in the Atlantic continental European coastline



**Spatial Decision Support System (SDSS) workflow**



## An integrated GIS approach for site selection of floating offshore wind farms in the Atlantic continental European coastline

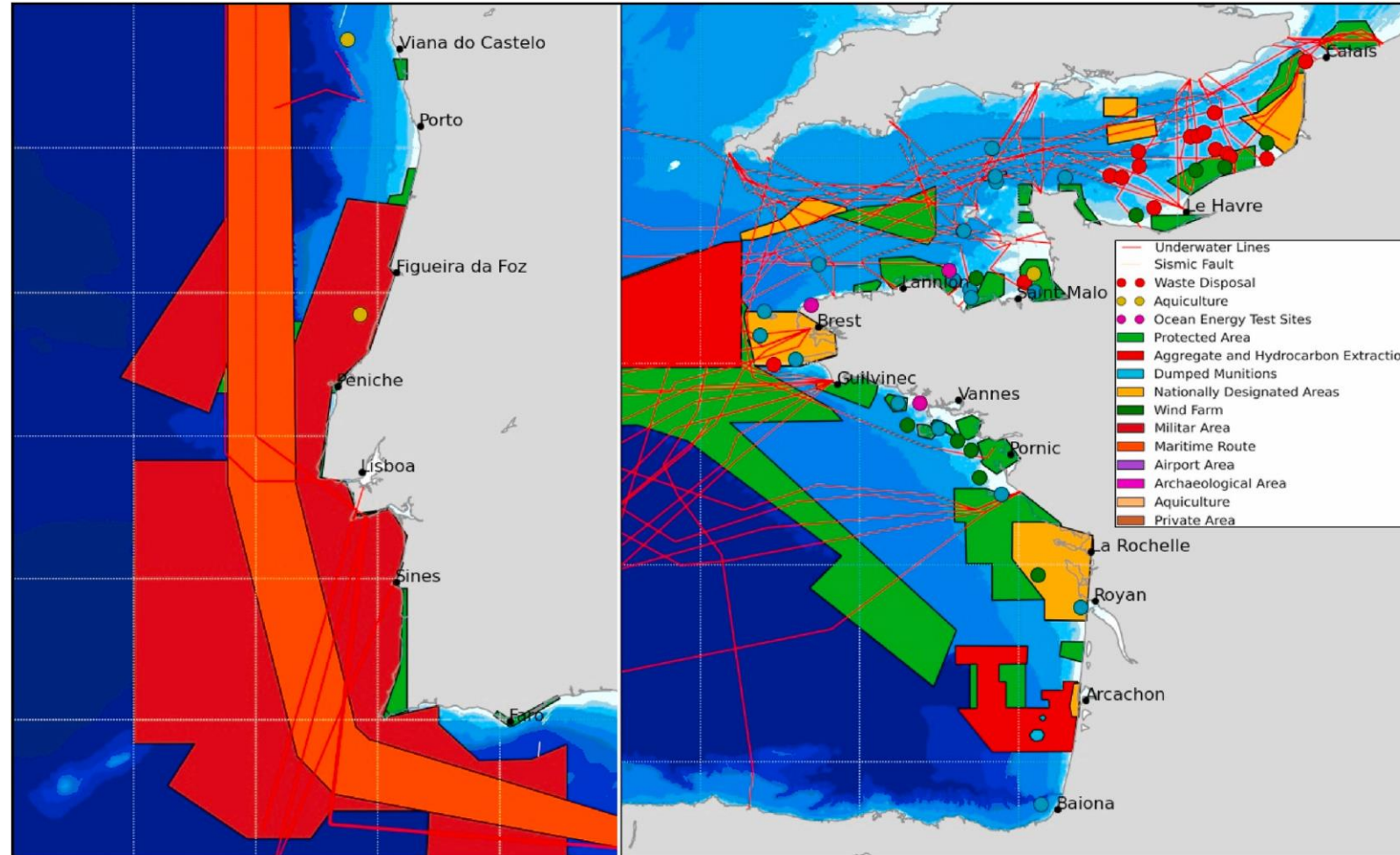


### ArcGIS 10

- Geostatistical analyst
- ArcPy
- Geoprocessing tools (buffer, overlay)
- Euclidean distance
- Weighted overlay



## An integrated GIS approach for site selection of floating offshore wind farms in the Atlantic continental European coastline



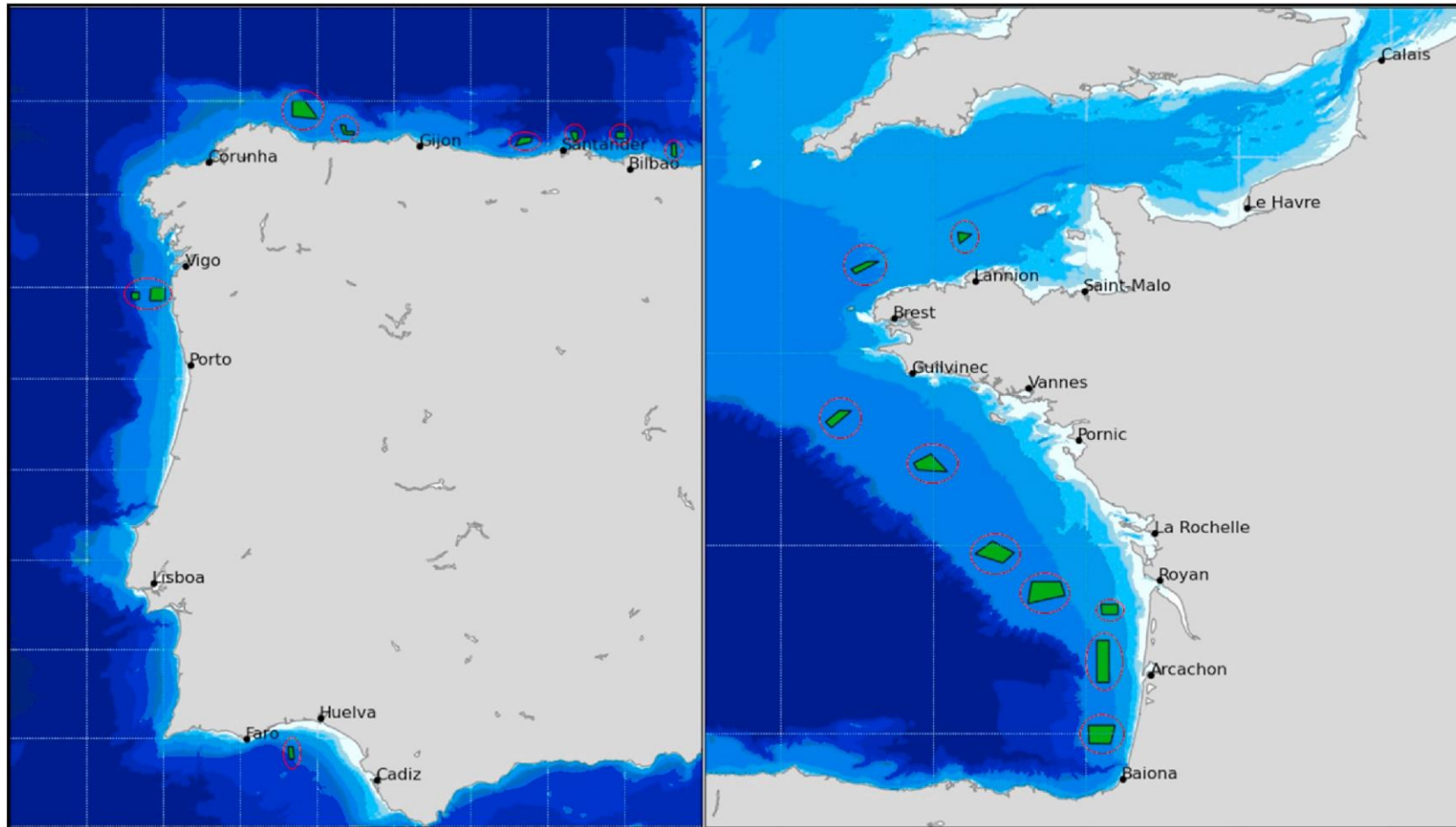
ArcGIS 10

- Digitizing
- Overlay

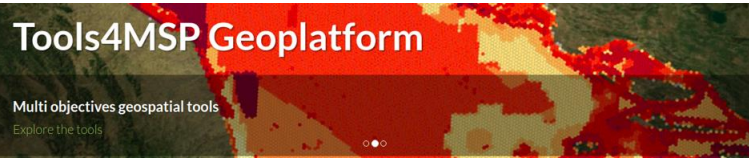




## An integrated GIS approach for site selection of floating offshore wind farms in the Atlantic continental European coastline



**ArcGIS 10  
SDSS layout**










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# Tools4MSP Geoplatform

## Layers by Categories

			
Coastal Defence and sand extraction	Energy	Environmental protection	
			
Environment and ecosystem	Fisheries and Aquaculture	Maritime Transport and Tourism	Miscellanea

## Relevant Maps

		
Coastal Defence and sand extraction	Energy	Environmental protection
		
Environment & Ecosystems	Fisheries and Aquaculture	Maritime transport & tourism



**660 Layers**

Clicca per la ricerca di dati geospaziali pubblicati da altri utenti, organizzazioni e fonti pubbliche. Scaricare i dati in formati standard.

[Add layers »](#)



**186 Mappe**

I dati sono disponibili per la navigazione, l'aggregazione e lo stile per generare mappe che possono essere condivisi pubblicamente o riservato solo agli utenti specifici.

[Creare mappe »](#)

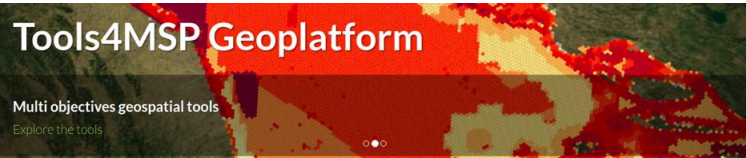


**315 Utenti**

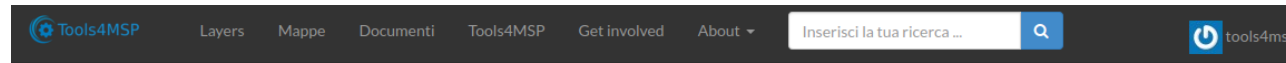
GeoNode consente agli utenti registrati di caricare facilmente i dati geospaziali in diversi formati, tra cui shapefile e GeoTiff.

[See users »](#)

**WMS**



# Tools4MSP Geoplatform



Tools4MSP - step 0

## Tools4MSP

The Tools4MSP are a set of web and open source tools developed to support the implementation of Maritime Spatial Planning (MSP), with a specific focus on the analysis of conflicts between marine uses and the analysis of cumulative impacts (CI) of human activities on marine environments.

For a short tutorial on how to use the Tools4MSP, click [here](#).

### Maritime Use Conflicts (MUC) Analysis

The **Maritime Use Conflicts Analysis tool** was developed during ADRIPLAN project. The tool is based on a methodology developed for the FP7 [COEXIST Project](#) and has the aim to (1) support MSP process through reallocation of maritime uses, (2) creation of collaborative conflict scores analysis; (3) iteration of the analysis over different time periods through integration of new conflict scores and geospatial datasets on sea uses, (4) sea use scenario analysis and (5) overlay analysis. For more information on the methodology press the button below. The MUC tool was initially developed during the ADRIPLAN Project and further development in a newer version within the Italian Flagship Project RITMARE (Italian Research for the Sea).

[Maritime Use Conflicts Analysis - more info](#)

### Cumulative Effects Assessment (CEA)

The **Cumulative Effects Assessment tool** aims to support the MSP process under an Ecosystem-Based Approach (EBA) by assessing the potential cumulative impacts of maritime activities on the marine environment. The CI assessment tool was developed during the ADRIPLAN project (<http://adriplan.eu>). It is the core tool of the Tools4MSP, an open source geopython library. The tool was tested for the Adriatic-Ionian sub-basin, but can be deployed to any research area around the globe. For more information on the methodology press the button below. The CEA tool was initially developed during the ADRIPLAN Project and further development in a newer version within the Italian Flagship Project RITMARE (Italian Research for the Sea).

[Cumulative Effects Assessment - more info](#)

### Marine Ecosystem Services Threat Assessment (MES-Threat)

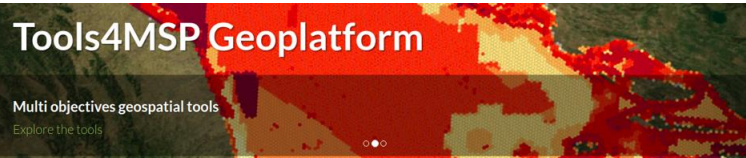
The **MES-Threat tool** is based on an expert-based MES services supply index (0 - none/neglectable to 2 - high) for EUNIS habitats developed by Galparsoro et al., 2012 and adopted for the Adriatic Sea by Depellegrin et al. (2017). The webtool combines the expert-based MES supply index with the CEA modelling capabilities generating a threat index describing the risk of reduction of ES capacity, loss or impairment of use due to cumulative effects from anthropogenic impacts (Worm et al., 2007; Maron et al., 2017).

[Marine Ecosystem Services Threat Assessment - more info](#)

## Tools selection

- [Run Maritime Use Conflicts Analysis](#)
- [Run Cumulative Impact Analysis](#)
- [Marine Ecosystem Services Assessment](#)

# Scripts



## Tools4MSP Geoplatform



### Tools4MSP: webtools workflow

**Step 0: tool selection**

CEA: Cumulative Effects Assessment  
MUC: Maritime Use Conflict  
MES-Threat: Marine Ecosystem Services Threat Analysis



**Step 1: case study selection**

Case study: a pre-configured, complete and consistent set of input data. Spatial domain, time reference, resolution.



**Step 2: configuration**

Dataset configuration: select uses, environmental components and pressures.  
Study area selection



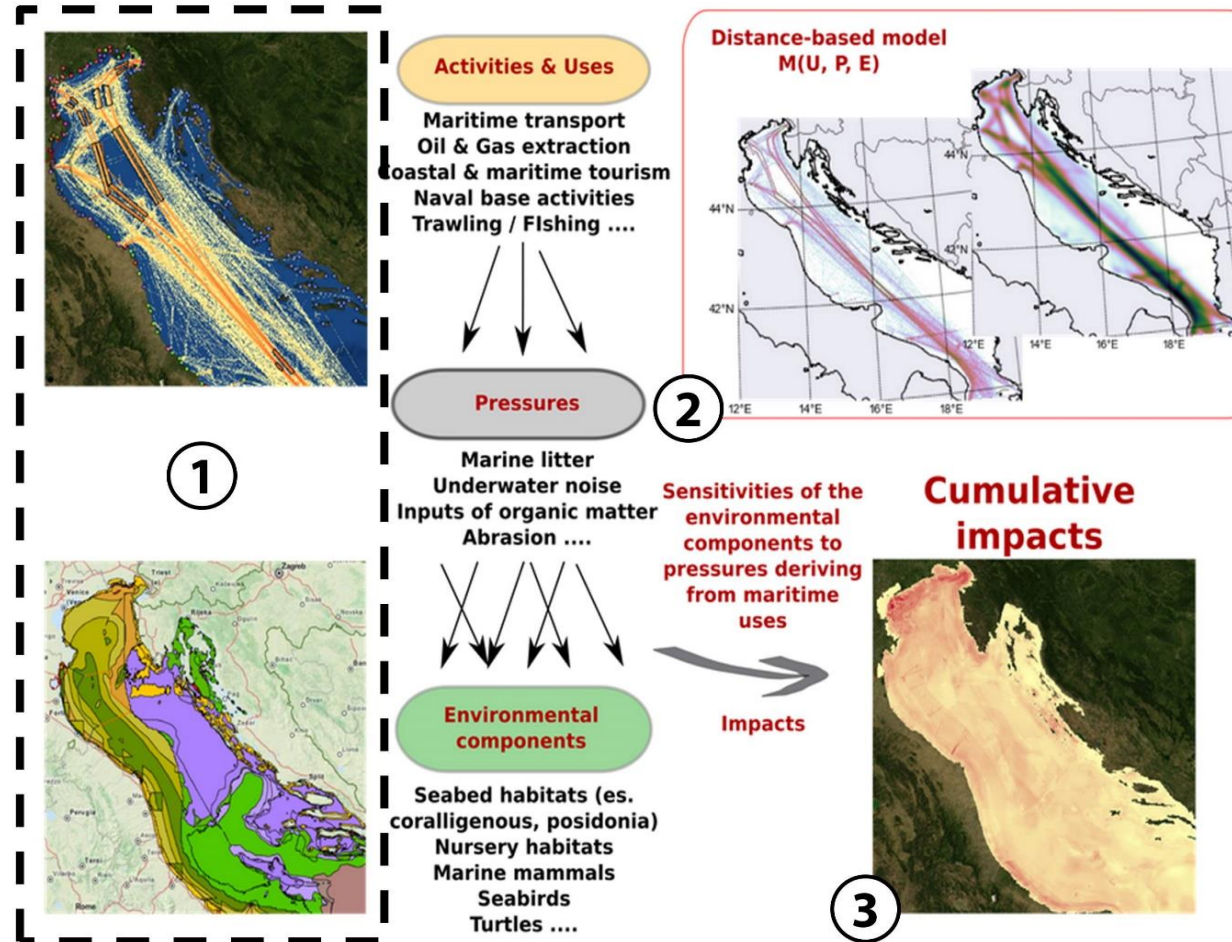
**Step 3: results**

Geospatial results: automatic republishing  
Statistical outputs

**Workflow**



# Tools4MSP Geoplatform



## Cumulative Effects Assessment



### Step 1: Case Study selection

In step 1 you can select a predefined set of input data that you can use for your geospatial analyses. The Case Study areas can be differentiated by region (e.g. Adriatic Ionian Region - AIR), resolution and temporal scenario (e.g. 2014, 2020).

Case Study	Description	Additional info
<a href="#">CI - AIR assessment 2014 LR ci</a>	Low resolution (10km) Adriatic Ionian Region Cumulative Impact Assesment 2014	Resolution: 10000.0 m
<a href="#">CI - AIR assessment 2014 ci</a>	Run to be prepared for the paper on Cumulative Impacts. Based AIM - 2014	Resolution: 1000.0 m
<a href="#">RER_CI ci</a>	High resolution dataset for the Emilia-Romagna region suitable for COEXIST analysis - 2014	Resolution: 500.0 m



## Tools4MSP Geoplatform

Tools4MSP / Step1 / Step2

### Step 2: Case Study Setup

- Configure the list of "Activities and uses" and "Environmental Components" to be included in your case study. (NOTE: By default the case study runs with all Activities/Uses and Environmental Components).
- Select the area of interest for your scenario analysis on the map interface: click with your mouse to define the vertices of the polygon and double click to confirm.
- Press RUN ANALYSIS.

#### Activities & Uses

Available: 15 - Selected: 15

Configure

#### Environmental Components

Available: 36 - Selected: 36

Configure



#### Configuration

##### Input Dataset

Case Study: CI - AIR assessment 2014 LR  
Type: EEA Reference Grid  
Reference System: ETRS89 / LAEA Europe EPSG: 3035  
Resolution: 10000.0 m  
Area: 297764.2 km<sup>2</sup>

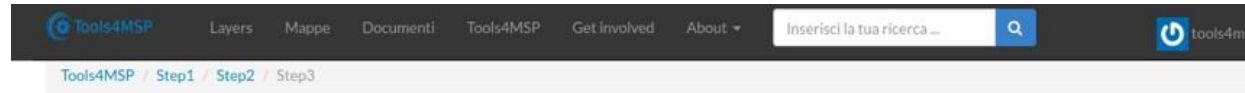
##### Analysis Area

By default the analyses will be performed for the whole input grid.

The user can draw a new area of analysis (polygon) on the map.

Run Analysis

# Cumulative Effects Assesment



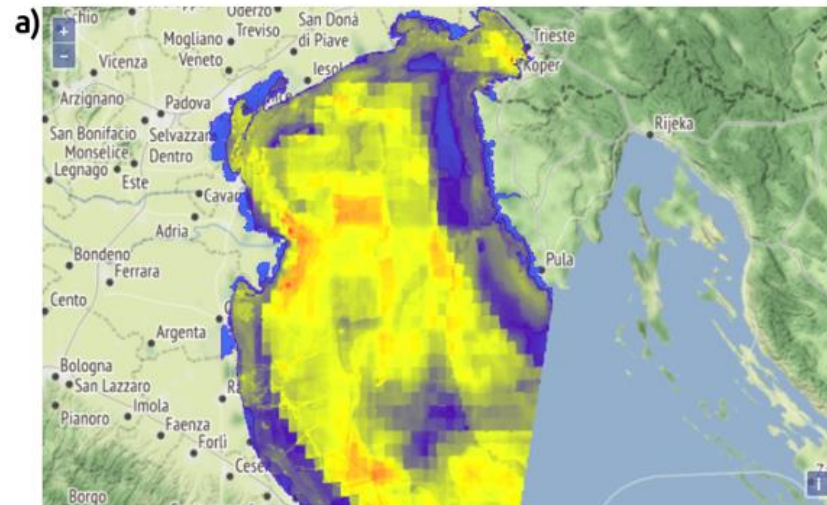
### Step 3: Results

The spatial distribution of "Cumulative Effects Assessment" score has been published on the Data Portal.

Click on "View layer" to visualize the output layer in the Data Portal: you'll be able to download the raster file, to visualise and modify the metadata, to create a new map by integrating your results with other geospatial layers and to share the layer with others.

Click on "Complete metadata" to directly add more information related to the output of your case study.

b) [View layer](#) [Complete metadata](#)



**Details**

**Input Dataset**  
Case Study: Northern Adriatic Sea 2018 - Cumulative Impact  
Type: EEA Reference Grid  
Reference System: ETRS89 / LAEA Europe EPSG: 3035  
Resolution: 500.0 m  
Area: km<sup>2</sup>

**c) CEA Scores**  
Total score: 263559.219

**Legenda**

- X 0.0 > x
- 1.0E-5 = x
- 3.93512177467 = x
- 7.87024354935 = x
- X 7.87024354935 = x

**d) CEA score distribution**

# Cumulative Effects Assessment



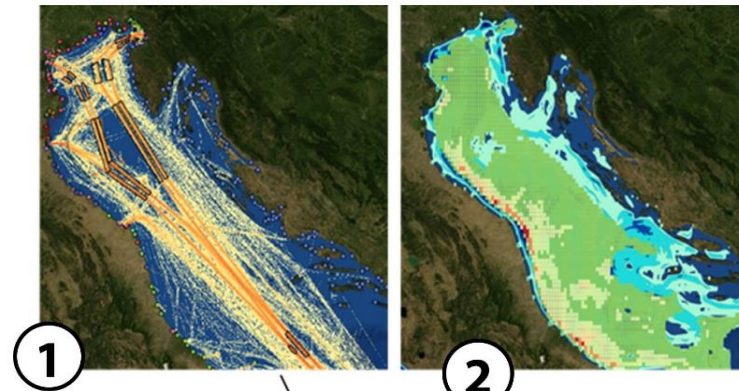
# Tools4MSP Geoplatform

Multi objectives geospatial tools  
Explore the tools

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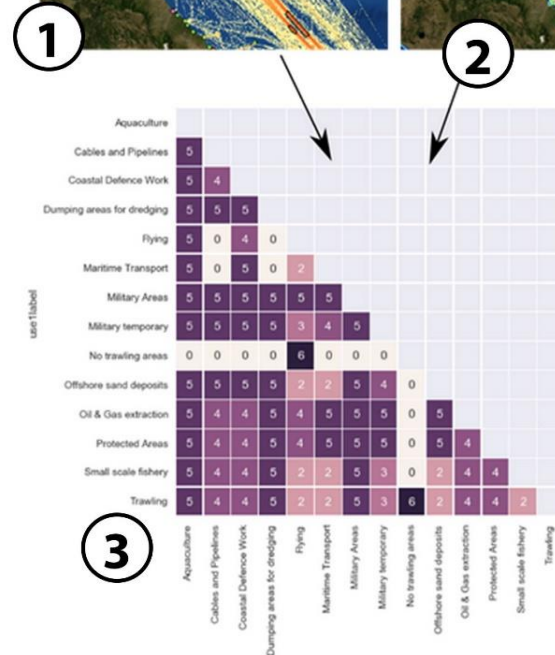


## Tools4MSP Geoplatform

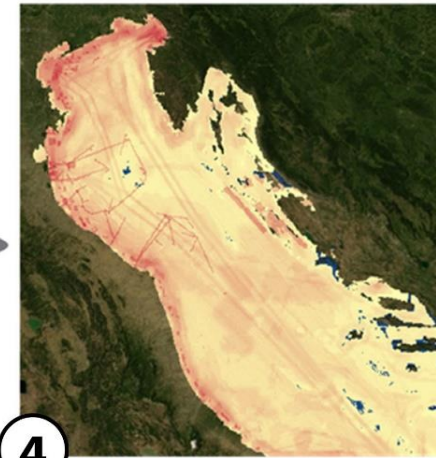


### Activities & Uses

- Maritime transport
- Oil & Gas extraction
- Coastal & maritime tourism
- Naval base activities
- Trawling / Fishing ...



### Spatial conflict scores



## Maritime Use Conflicts (MUC) Analysis



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## DST-MPA platform

Start DST-MPA

### Recommendations for sustainable Blue Economy in Mediterranean Marine Protected Areas

Welcome to the Decision Support Tool for Blue Economy in Marine Protected Areas (DST-MPA)

The tool has been developed by **CNR ISMAR** within the **Interreg MED PHAROS4MPAs** project.

The main objectives of the tool is to support the operationalization of the recommendations produced within the project, translating the knowledge from the capitalization baselines reports into a fully user-friendly online tool.

The tool is specifically intended for three kind of users: MPA managers and planners, public authorities and economic operators, to help them to easily find the recommendations and other information (e.g. best practices or case studies) that are more useful for their specific needs.

#### PHAROS4MPAs' core partners



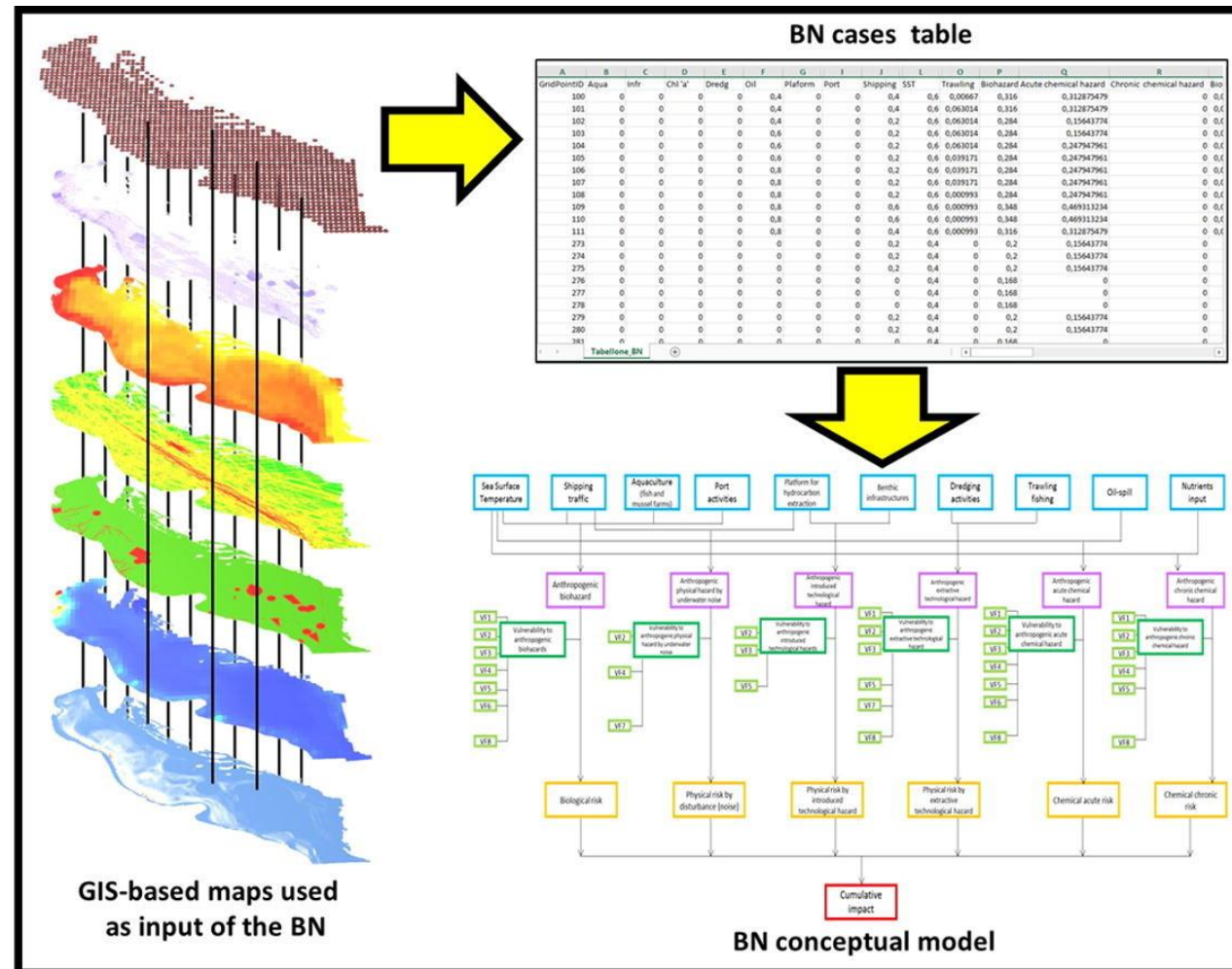
#### PHAROS4MPAs' associated partners



## SDSS for Blue Economy in MPAs

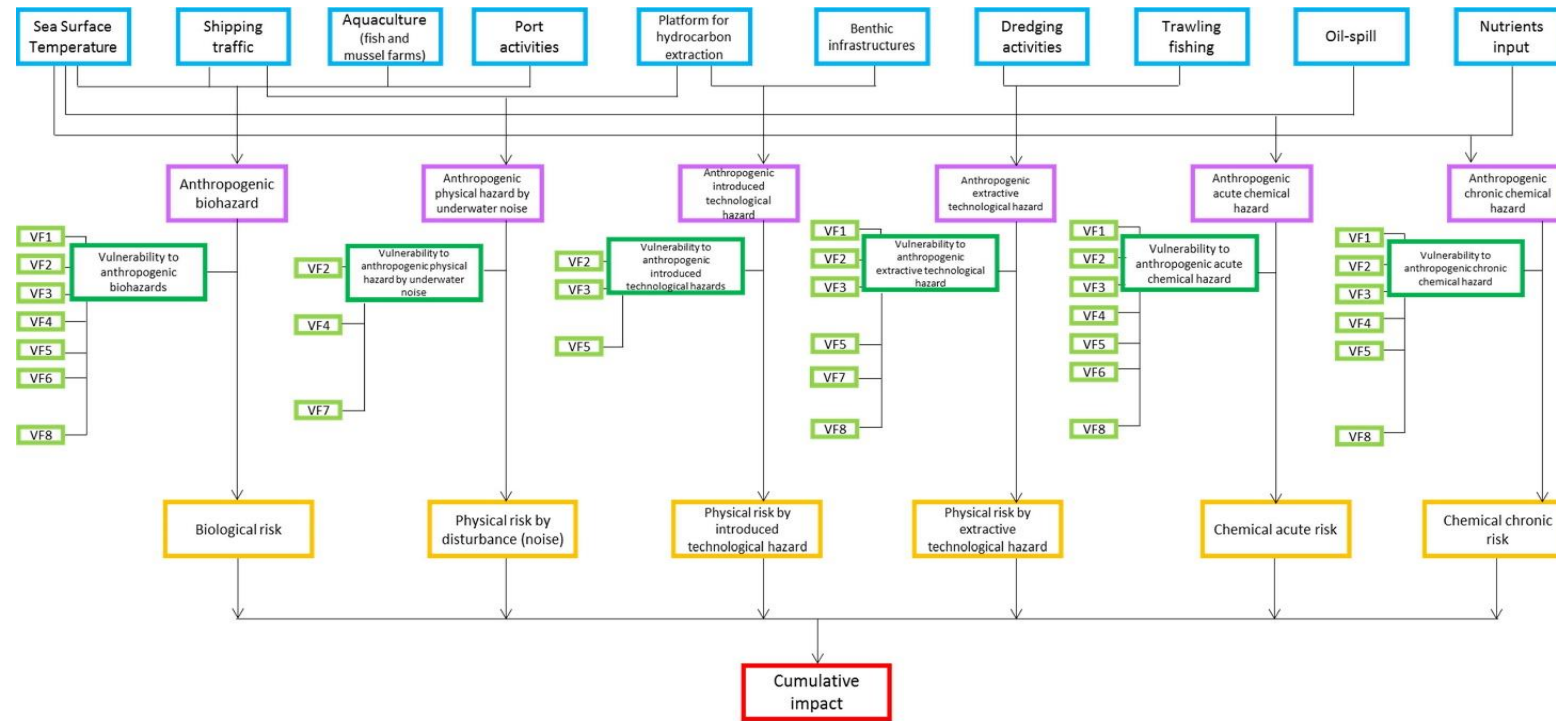


# Multi-scenario analysis in the Adriatic Sea: A GIS-based Bayesian network to support maritime spatial planning





# Multi-scenario analysis in the Adriatic Sea: A GIS-based Bayesian network to support maritime spatial planning



- Module pressures
- Module multi-hazards
- Module vulnerability factors
- Module vulnerability
- Module risks
- Module cumulative impact
- VF1 Seabed typology
- VF2 MPAs proximity-connectivity
- VF3 Extension of seagrasses
- VF4 Shannon Index
- VF5 Extension of coral and maërl beds
- VF6 Aquaculture typology
- VF7 Forbidden fishing areas
- VF8 Seagrasses species richness

## Bayesian network conceptual model



## Multi-scenario analysis in the Adriatic Sea: A GIS-based Bayesian network to support maritime spatial planning



**What if...  
scenarios**



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### 14. Tools4MSP Geoplatform. <http://data.tools4msp.eu/>

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# Open source GIS software

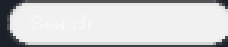
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QGIS is available on Windows, macOS, Linux and Android.

We are currently in feature freeze preceeding the release of QGIS 3.26. **Please consider testing the prereleases.** See [road map](#).

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QGIS is open source software available under the terms of the **GNU General Public License** meaning that its source code can be downloaded through tarballs or the git repository.

QGIS Source Code is available [here \(latest release\)](#) and [here \(long term release\)](#)

Refer to the INSTALL guide on how to compile QGIS from source for the different platforms: [here](#) <sup>↗</sup>

Note that you can also install the development version (nightly) via an installer from the normal downloads for your platform: [here](#)

Plugins for QGIS are also available [here](#) <sup>↗</sup>.



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## Index of /downloads

### Download for Windows

QGIS in OSGeo4W (recommended for regular users):



OSGeo4W Network Installer

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In the installer choose **Express Install** and select QGIS to install the *latest release* or QGIS LTR to install the *long term release*. The express installations have several optional packages including non-free software. To avoid those you have to use the **Advanced Install** and choose **qgis** and/or **qgis-ltr** in the desktop section.

**CAUTION:** Upgrades of old setups from OSGeo4W v1 using this repository are not supported. You need to do a fresh install or use a different directory.

**CAUTION:** 32 bit binaries are not produced anymore. Also Windows 7 no longer works as we are now using Python 3.9, which dropped support for it.

Standalone installers (MSI) from OSGeo4W packages (recommended for new users)

Latest release (richest on features):



QGIS Standalone Installer Version 3.24

68

sha256

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Long term release (most stable):



QGIS Standalone Installer Version 3.22

68

sha256

68

Note that the MSI installers are much bigger than the previous installers. This is because they include significant larger packages (eg.

[Name](#)

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-



[Inetc.zip](#)

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2017-12-02 20:33 181M




[QGIS-OSGeo4W-2.0.1-3-Setup-x86\\_64.exe.md5](#)

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🏠 QGIS Documentation



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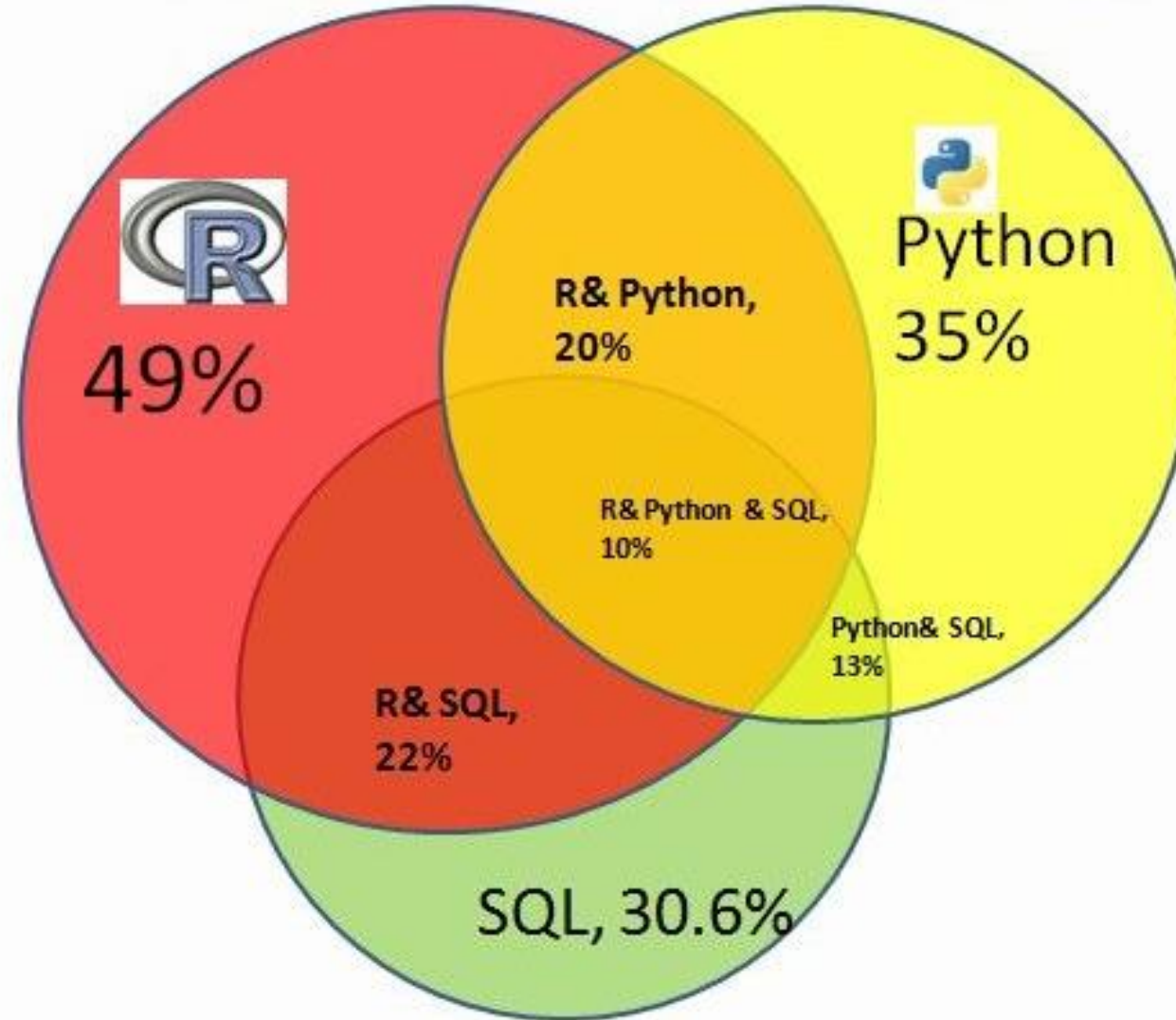
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The screenshot displays the QGIS desktop application. The main window shows a map of a coastal area with several layers loaded. The 'Capas' (Layers) panel on the left lists the following layers: 'Nucleo puntos', 'Hidrografia', 'Grupo de capas vectoriales', 'Delimitacion\_marina' (containing 'Limite de mar interior', 'Limite de mar territorial', and 'Limite de zona econó'), 'Batimetria', 'Intervalos batimetricos', 'Fisiografia\_medio\_marit', 'Masas\_agua', 'Grupo de capas WMS', and 'Grupo de capas WFS'. The map shows a coastline with numerous red circular points scattered across the land area. Three lines are drawn along the coast, labeled 'Limite de mar territorial' and 'Limite de zona económica exclusiva'. The 'Caja de herramientas de Procesos' (Processing Toolbox) on the right contains a search bar and a list of processing tools such as 'Usado recientemente', 'Análisis de redes', 'Análisis de vector', 'Análisis del terreno ráster', 'Análisis ráster', 'Base de datos', 'Cartografía', 'Creación de vectores', 'Geometría vectorial', 'Gráficos', 'Herramientas de archivo', 'Herramientas de capa', 'Herramientas ráster', 'Interpolación', 'Malla', 'Raster creation', 'Selección vectorial', 'Superposición vectorial', 'Tabla vectorial', 'Vector general', 'Vector tiles', 'GDAL', 'GRASS', 'QNEAT3 - Qgis Network Analysis Toolbox', 'SAGA', and 'Visibility analysis'. The status bar at the bottom shows 'Coordenada: 556125,3957548', 'Escala: 1:2487917', 'Amplificador: 100%', 'Rotación: 0,0°', and 'Representar: EPSG:25830'.

## QGIS 2 WMS, WFS



# Open source GIS software QGIS

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The screenshot displays the QGIS 2.18.0 interface. The main map area shows a hydrography map with a network of blue lines representing water features. The left sidebar contains the 'Capas' (Layers) panel, which is expanded to show the 'Hidrografia' (Hydrography) group. The 'ma corrientes marinas' layer is selected and highlighted in blue. The right sidebar shows the 'Caja de herramientas de Procesos' (Processing Toolbox) with a search bar and a list of tools including 'Usado recientemente', 'Análisis de redes', 'Análisis de vector', 'Análisis del terreno ráster', 'Análisis ráster', 'Base de datos', 'Cartografía', 'Creación de vectores', 'Geometría vectorial', 'Gráficos', 'Herramientas de archivo', 'Herramientas de capa', 'Herramientas ráster', 'Interpolación', 'Malla', 'Raster creation', 'Selección vectorial', 'Superposición vectorial', 'Tabla vectorial', 'Vector general', 'Vector tiles', 'GDAL', 'GRASS', 'QNEAT3 - Qgis Network Analysis Toolbox', 'SAGA', and 'Visibility analysis'. The bottom status bar shows the current coordinates (90807,4121748), scale (1:2763978), zoom level (100%), rotation (0,0°), and projection (EPSG:25830).

## QGIS 2 WMS, WFS



# Open source GIS software QGIS

Co-funded by the  
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The screenshot displays the QGIS desktop application. The main window shows a map of a coastal region with a complex network of blue lines representing hydrography (rivers and streams) and various colored lines representing infrastructure (cables and conduits). The interface includes a menu bar at the top with options like 'Proyecto', 'Editar', 'Ver', 'Capa', 'Configuración', 'Complementos', 'Vectrial', 'Ráster', 'Base de datos', 'Web', 'Malla', 'Procesos', 'Ayuda', 'Ráster', and 'Vectr'. Below the menu is a toolbar with numerous icons for map navigation and processing. On the left side, there is a 'Capas' (Layers) panel with a tree view showing the following layers:

- Nucleo\_puntos
- Hidrografia
  - h01
  - h02
  - h03
  - h04
- Grupo de capas vectoriales
  - Delimitacion\_marina
    - Límite de mar interior
    - Límite de mar territorial
    - Límite de zona económica exclusiv
  - Batimetria
    - Intervalos batimetricos
    - Fisiografia\_medio\_marino
    - Masas\_agua
- Grupo de capas WMS
- Grupo de capas WFS
  - edar
  - restriccion\_navegacion\_pesca\_morun
  - lim\_plataf\_talud\_llanura\_abisal
    - 1
    - 2
  - ma\_corrientes\_marinas
- v\_cables\_y\_conducciones
  - CABLES DE TELEFONO ABANDONA
  - CABLES DE TELEFONO OPERATIVO
  - CABLES ELECTRICIDAD
  - CONDUCCION DE AMONIACO
  - GASODUCTO
  - OLEODUCTO
  - TRAMO DE CONDUCCION ENTERR
- v\_zooplancton
- v\_vegetacion\_submarina
- restriccion\_navegacion\_pesca

On the right side, there is a 'Caja de herramientas de Procesos' (Processing Toolbox) with a search bar and a list of processing tools, including 'Usado recientemente', 'Análisis de redes', 'Análisis de vector', 'Análisis del terreno ráster', 'Análisis ráster', 'Base de datos', 'Cartografía', 'Creación de vectores', 'Geometría vectorial', 'Gráficos', 'Herramientas de archivo', 'Herramientas de capa', 'Herramientas ráster', 'Interpolación', 'Malla', 'Raster creation', 'Selección vectorial', 'Superposición vectorial', 'Tabla vectorial', 'Vector general', 'Vector tiles', 'GDAL', 'GRASS', 'QNEAT3 - Qgis Network Analysis Toolbox', 'SAGA', and 'Visibility analysis'. At the bottom of the window, there is a status bar showing 'Coordenada 434051,4355531', 'Escala 1:2787728', 'Amplificador 100%', 'Rotación 0,0°', 'Representar', and 'EPSG:25830'.

## QGIS 2 WMS, WFS



# Open source GIS software QGIS

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The screenshot displays the QGIS 2.18.0 desktop application. The main window shows a map of a coastal region with a network of blue lines representing cables and conduits. The interface includes a menu bar at the top with options like 'Proyecto', 'Editar', 'Ver', 'Capa', 'Configuración', 'Complementos', 'Vectrial', 'Ráster', 'Base de datos', 'Web', 'Malla', 'Procesos', 'Ayuda', 'Raster', and 'Vectr'. Below the menu bar is a toolbar with various icons for map navigation and processing. On the left side, there is a 'Capas' (Layers) panel with a tree view showing the following layers:

- v\_cables\_y\_conducciones (expanded)
- v\_zooplankton (expanded)
  - < 0.5 ml/m3
  - < 1 ml/m3
  - > 1.5 ml/m3
  - > 2 ml/m3
  - > 3 ml/m3
  - > 6 ml/m3
  - > 9 ml/m3
  - 0.5-1 ml/m3
  - 1.5-2 ml/m3
  - 1-1.5 ml/m3
  - 2.5-3 ml/m3
  - 2-2.5 ml/m3
  - 3.5-4 ml/m3
  - 3-3.5 ml/m3
  - 4.5-5 ml/m3
  - 4-4.5 ml/m3
  - 5.5-6 ml/m3
  - 5-5.5 ml/m3
  - 6.5-7 ml/m3
  - 6-6.5 ml/m3
  - 7.5-8 ml/m3
  - 7-7.5 ml/m3
  - 8.5-9 ml/m3
  - 8-8.5 ml/m3
  - COSTA
  - MAR
- v\_vegetacion\_submarina
- restriccion\_navegacion\_pesca
- v\_clorofila
- urbano\_1998\_nv1
- urbano\_2007\_nv1

On the right side, there is a 'Caja de herramientas de Procesos' (Processing Toolbox) with a search bar and a list of processing tools, including 'Usado recientemente', 'Análisis de redes', 'Análisis de vector', 'Análisis del terreno ráster', 'Análisis ráster', 'Base de datos', 'Cartografía', 'Creación de vectores', 'Geometría vectorial', 'Gráficos', 'Herramientas de archivo', 'Herramientas de capa', 'Herramientas ráster', 'Interpolación', 'Malla', 'Raster creation', 'Selección vectorial', 'Superposición vectorial', 'Tabla vectorial', 'Vector general', 'Vector tiles', 'GDAL', 'GRASS', 'QNEAT3 - Qgis Network Analysis Toolbox', 'SAGA', and 'Visibility analysis'. At the bottom, the status bar shows the coordinates '90335,4205801', the scale 'Escala: 1:2787728', the zoom level 'Amplificador: 100%', the rotation 'Rotación: 0,0°', and the coordinate system 'Representar: EPSG:25830'.

## QGIS 2 WMS, WFS



# Open source GIS software QGIS

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The screenshot shows the QGIS 2.18.12 interface. The main map area displays a coastal region with a blue stream network and a chlorophyll-a concentration map. The layer list on the left shows the following layers:

- v vegetacion submarina
  - CYMODOECA NODOSA
  - CYMODOECA NODOSA Y ZOSTERA
  - CYSTOSEIRA USNEOIDES
  - FUCUS SPIRALIS
  - GELIDIUM SESQUIPEDALE
  - LAMINARIALES
  - POSIDONIA OCEANICA
  - POSIDONIA OCEANICA Y CYMOD
  - RISSOELLA VERRUCULOSA
  - ZOSTERA MARINA
  - ZOSTERA NOLTII
- restriccion\_navegacion\_pesca
- v\_clorofila
  - < 10 mg/m2
  - < 20 mg/m2
  - < 40 mg/m2
  - < 80 mg/m2
  - > 120 mg/m2
  - > 150 mg/m2
  - > 200 mg/m2
  - > 30 mg/m2
  - > 40 mg/m2
  - > 500 mg/m2
  - 10-20 mg/m2
  - 120-150 mg/m2
  - 150-200 mg/m2
  - 200-500 mg/m2
  - 20-30 mg/m2
  - 30-40 mg/m2
  - 40-60 mg/m2
  - 60-80 mg/m2
  - 80-120 mg/m2

The process tool box on the right contains the following tools:

- Usado recientemente
- Análisis de redes
- Análisis de vector
- Análisis del terreno ráster
- Análisis ráster
- Base de datos
- Cartografía
- Creación de vectores
- Geometría vectorial
- Gráficos
- Herramientas de archivo
- Herramientas de capa
- Herramientas ráster
- Interpolación
- Malla
- Raster creation
- Selección vectorial
- Superposición vectorial
- Tabla vectorial
- Vector general
- Vector tiles
- GDAL
- GRASS
- QNEAT3 - Qgis Network Analysis Toolbox
- SAGA
- Visibility analysis

The status bar at the bottom shows the following information:

- Coordenada: 199498,4366595
- Escala: 1:2787728
- Amplificador: 100%
- Rotación: 0,0°
- Representar: EPSG:25830

## QGIS 2 WMS, WFS



# Open source GIS software QGIS

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The screenshot displays the QGIS 2.18.0 desktop application. The main window shows a map of a coastal region with several layers loaded. The 'Capas' (Layers) panel on the left lists various data sources, including WMS, WFS, and local vector/raster files. The 'Caja de herramientas de Procesos' (Processing Toolbox) on the right provides access to a wide range of geoprocessing tools. The status bar at the bottom indicates the current coordinate system (EPSG:25830), scale (1:348466), and other map parameters.

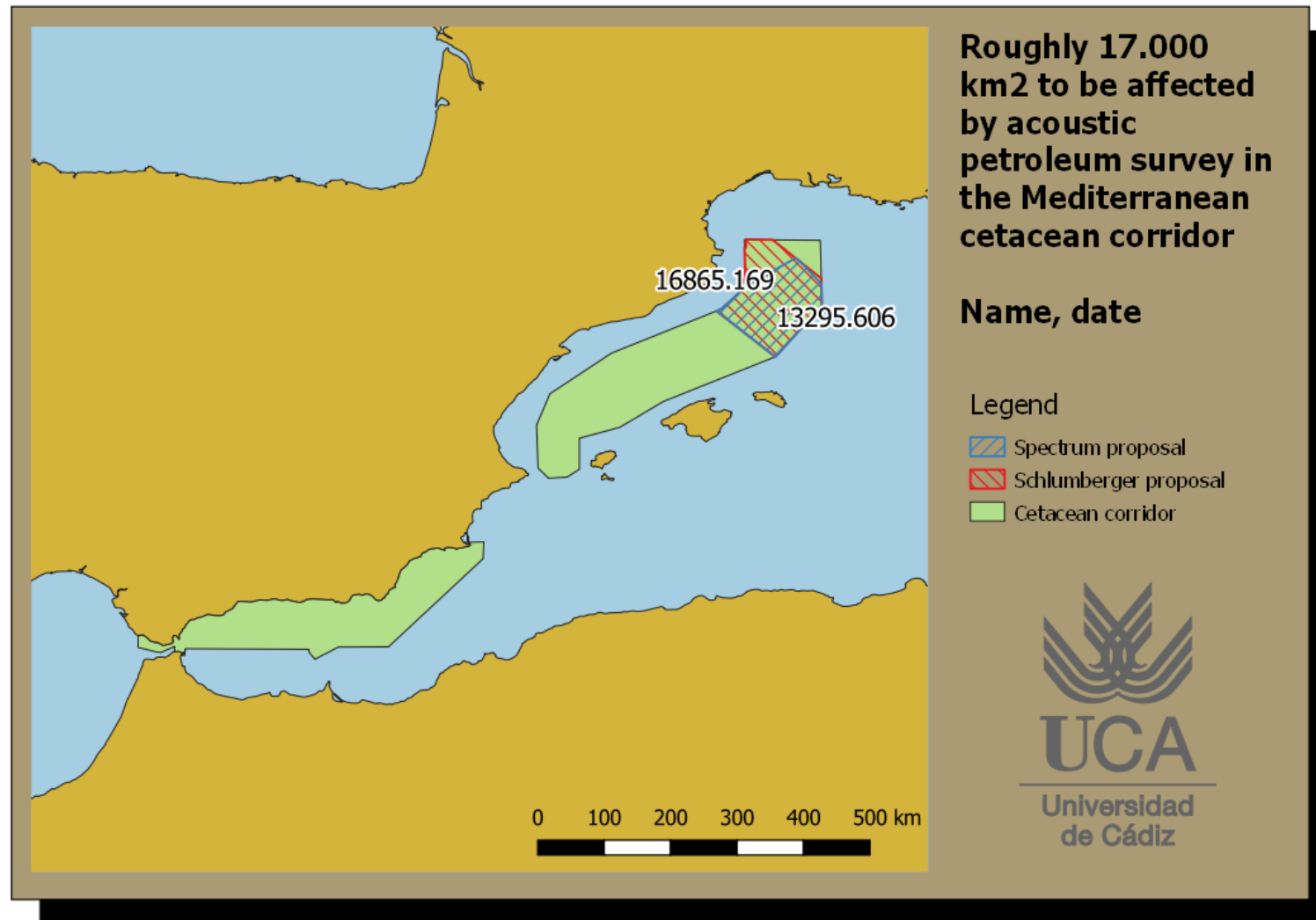
**Capas (Layers):**

- Límite de mar interior
- Límite de mar territorial
- Límite de zona económica exclusiva
- Batimetría
  - Intervalos batimétricos
  - Fisiografía medio marino
  - Masas agua
- Grupo de capas WMS
- Grupo de capas WFS
  - edar
  - restricción\_navegacion\_pesca\_morun
  - lim\_plataf\_talud\_llanura\_abisal
    - 1
    - 2
    -
  - ma\_corrientes\_marinas
  - v\_cables\_y\_conducciones
  - v\_zooplancton
  - v\_vegetacion\_submarina
    - CYMODOCEA NODOSA
    - CYMODOCEA NODOSA Y ZOSTERA
    - CYSTOSEIRA USNEOIDES
    - FUCUS SPIRALIS
    - GELIDIUM SESQUIPEDALE
    - LAMINARIALES
    - POSIDONIA OCEANICA
    - POSIDONIA OCEANICA Y CYMODO
    - RISSOELLA VERRUCULOSA
    - ZOSTERA MARINA
    - ZOSTERA NOLTII
  - restricción\_navegacion\_pesca
  - v\_clorofila
- urbano\_1998\_nv1
- urbano\_2007\_nv1

**Caja de herramientas de Procesos (Processing Toolbox):**

- Usado recientemente
- Análisis de redes
- Análisis de vector
- Análisis del terreno ráster
- Análisis ráster
- Base de datos
- Cartografía
- Creación de vectores
- Geometría vectorial
- Gráficos
- Herramientas de archivo
- Herramientas de capa
- Herramientas ráster
- Interpolación
- Malla
- Raster creation
- Selección vectorial
- Superposición vectorial
- Tabla vectorial
- Vector general
- Vector tiles
- GDAL
- GRASS
- QNEAT3 - Qgis Network Analysis Toolbox
- SAGA
- Visibility analysis

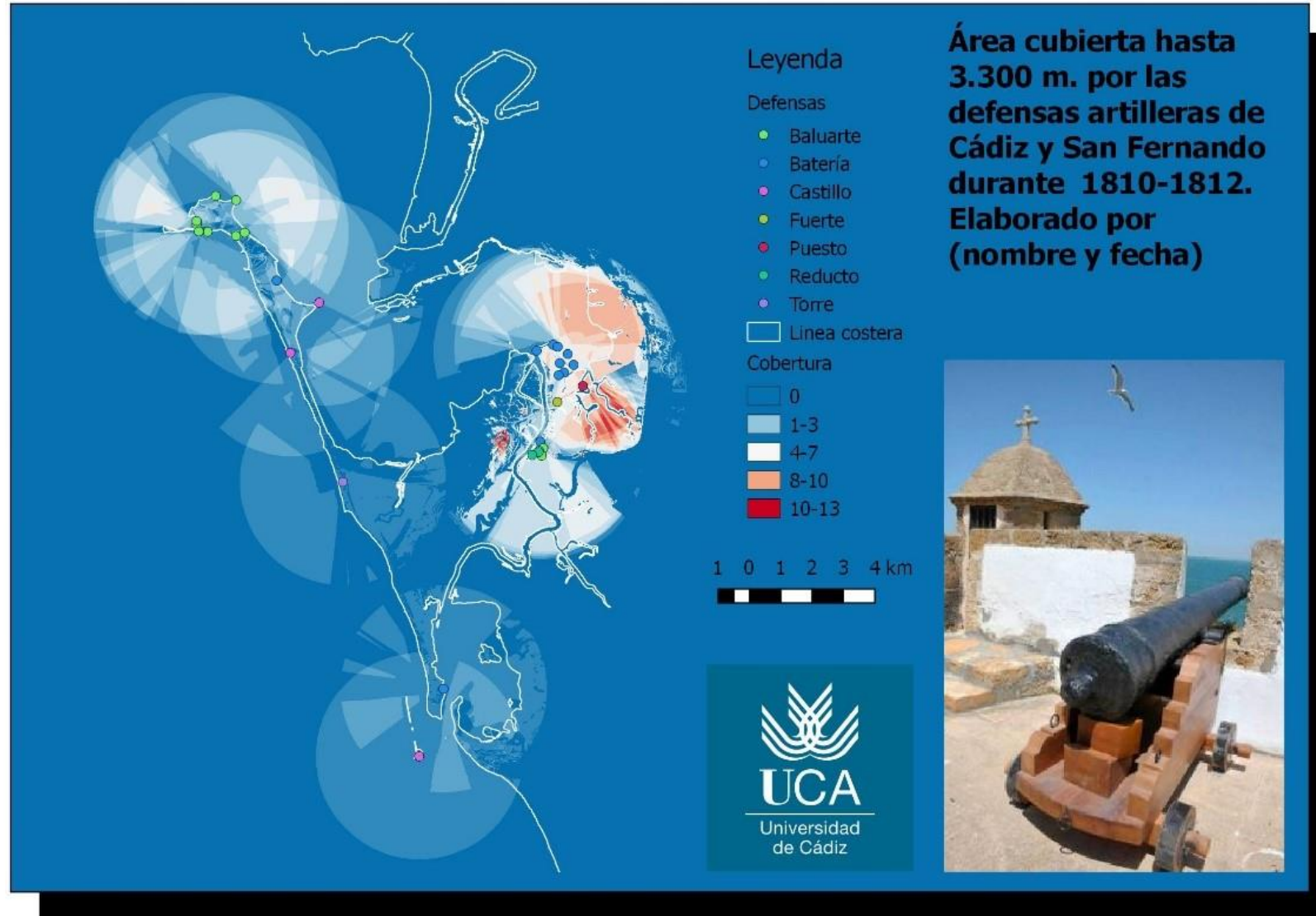
## QGIS 2 WMS, WFS



## QGIS 3.22

- Georeferencing
- Digitizing
- Geoprocessing





## QGIS 3.22

- Georeferencing
- Digitizing
- Geoprocessing
- Rasterizing
- Map algebra
- Viewsheed



Georreferenciador - Baterias de la Carraca.jpg

Archivo Editar Ver Configuración

Introducir coordenadas de mapa

Introducir coordenadas X e Y (DMS (*dd mm ss.ss*), DD (*dd.dd*) o coordenadas proyectadas (*mmm.mm*)) que correspondan con el punto seleccionado en la imagen. De forma alternativa, haga clic en el botón con el icono de un lápiz y luego haga clic en un punto en el lienzo del mapa de QGIS para rellenar las coordenadas de ese punto.

X / Este  Y / Norte

Automáticamente ocultar ventana del georeferenciador

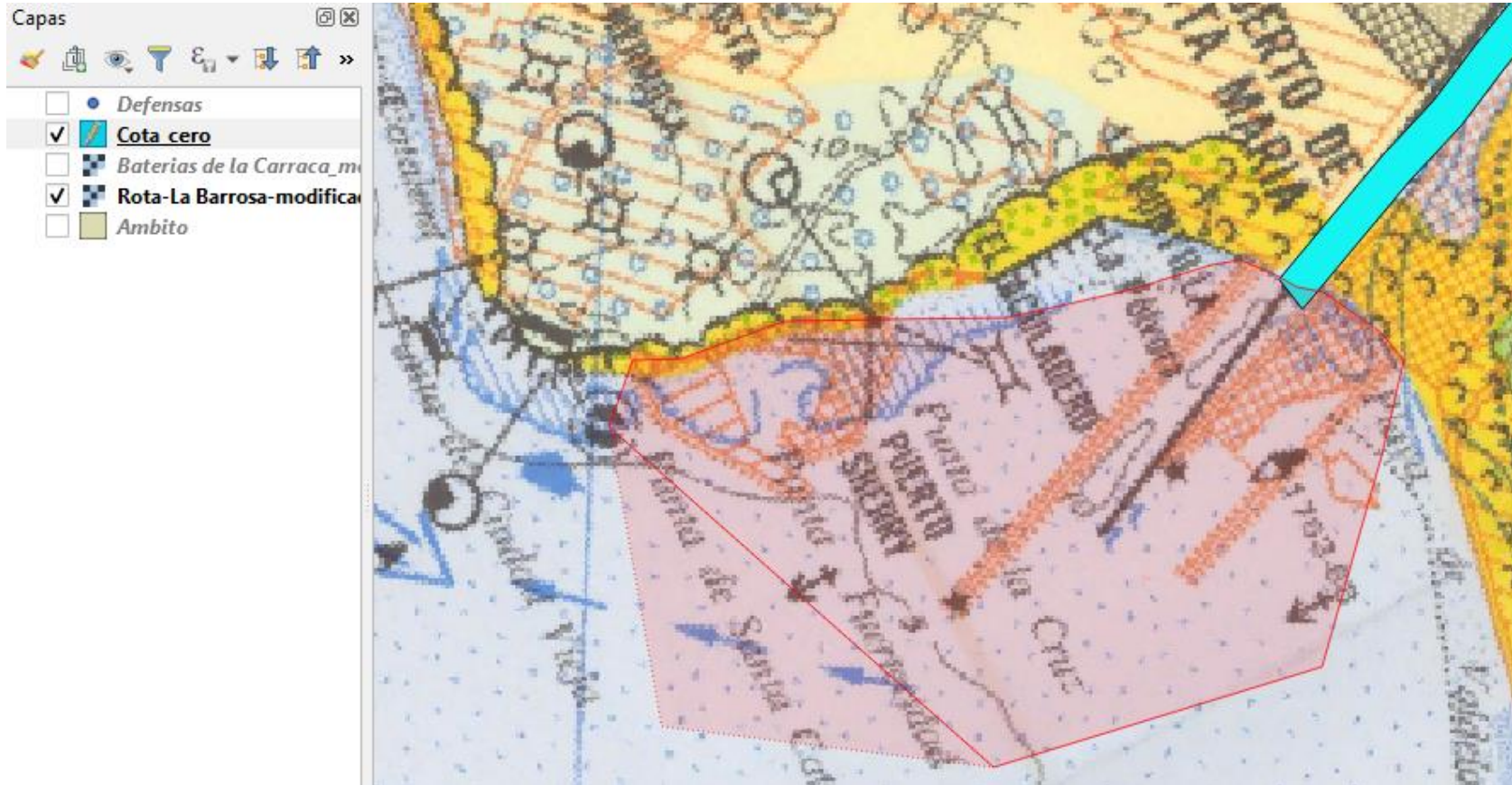
Aceptar Desde el lienzo del mapa Cancelar

Tabla de PCT

Visible	ID	X de origen	Y de origen	X de destino	Y de destino	dX (píxeles)	dY (píxeles)	Residual (píxeles)
<input checked="" type="checkbox"/>	0	219,945	-71,0924	214830	4,04384e+06	0	0	0
<input checked="" type="checkbox"/>	1	429,694	-71,9862	215265	4,04406e+06	0	0	0

Transformación: No establecido 257.7,-429.2 Ninguno

## QGIS 3.22 Georeferencing



QGIS 3.22  
Digitizing




Complementos | Todos (727)

Todos

visibility

- LoS Tools
- MapSwipe Tool
- POI Visibility Network
- QWeather
- Toggle Active Layer
- Toggle Group Visibility
- Visibility Analysis**

## Visibility Analysis



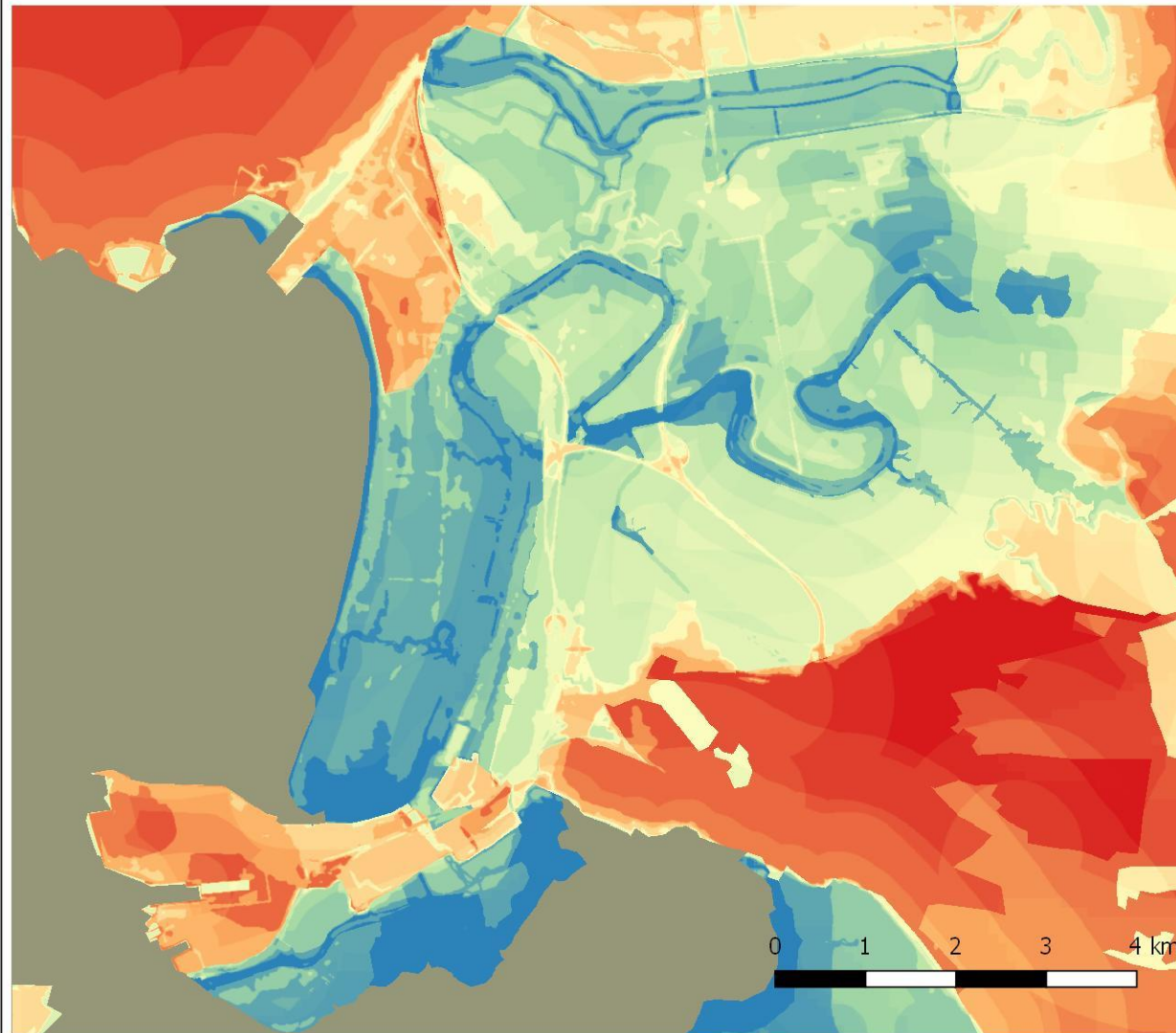
### Visibility analysis over raster DEM

Viewshed analysis calculates visible surface from a given observer point over a digital elevation model. Additionally, this plugin can be used for modelling intervisibility networks between groups of points. It is particularly performant for multiple viewshed calculations from a set of fixed points.

★★★★☆ 127 voto(s) de valoración, 107616 descargas

Actualizar todos    Instalar complemento    Cerrar    Ayuda

**QGIS 3.22**  
**Visibility**  
**analysis plug-in**



**Proceso analítico  
jerárquico (AHP).  
Idoneidad de la  
conservación  
natural en la  
marisma de  
Aletas-Cetina y su  
entorno**

Leyenda

Vocación conservacionista

- Alta
- Media-alta
- Media
- Media-baja
- Baja



Elaborado por:

Máster en conservación y  
gestión del medio natural

## QGIS 2

- Digitizing
- Geoprocessing
- Rasterizing
- Map algebra
- Analytical  
Hierarchy  
Process (AHP)



Calculadora ráster

**Bandas ráster**

- Changed Grid@1
- Distancia\_ENP\_ZZVW@1
- Distancia\_Jaminas@1
- Distancia\_poblacion@1
- MDT\_10@1
- Naturalidad@1
- ctras@1
- distancia@1

**Capa de resultado**

Capa de salida: s/Distancia\_carreteras.tif

Formato de salida: GeoTIFF

Extensión de la capa actual

X mín: 207459.16820, X Máx: 221649.16820

Y mín: 4044688.87720, Y máx: 4056238.87720

Columnas: 1419, Filas: 1155

SRC de salida: SRC seleccionado (EPSG:25830, E)

Añadir resultados al proyecto

**Operadores**

+ \* raíz cuadrada cos sen tan log10 (

- / ^ arcos arcsen arctan ln )

< > = != <= >= Y O

**Expresión de la calculadora de campos**

```
("distancia@1" <= 642) *5+("distancia@1" > 642 AND "distancia@1" <= 1286)*4+("distancia@1" > 1286 AND "distancia@1" <= 1928)*3+("distancia@1" > 1928 AND "distancia@1" <= 2571)*2+("distancia@1" > 2571 AND "distancia@1" <= 3215)*1
```

Expresión válida

Aceptar Cancelar

## QGIS 2 Map algebra: raster calculator



Easy AHP

? X

## STEP 1: Choose Input Layers (Parameters)

Available Raster Layers

Input Layers

Naturalidad  
Inundabilidad  
Distancia\_laminas  
Distancia\_ENP\_ZZVV  
Distancia\_carreteras  
Distancia\_poblacion

>>>

<<<

Back

Next

Cancel

## QGIS 2 Analytical Hierarchy Process (AHP)



## STEP 2: Fill The Pairwise Matrix

	turalidi	undabilid	ancia_lam	cia_ENP_	icia_carre	ncia_pobl
Naturalidad	1	1.0	3.0	5.0	7.0	9.0
Inundabilidad	1.0	1	3.0	5.0	7.0	9.0
Distancia_laminas	0.333	0.333	1	1.0	3.0	5.0
Distancia_ENP_ZZVV	0.2	0.2	1.0	1	3.0	5.0
Distancia_carreteras	0.143	0.143	0.333	0.333	1	1.0
Distancia_poblacion	0.111	0.111	0.2	0.2	1.0	1

AHP Indicators

$$\lambda = 6.154$$

$$CI = 0.031$$

$$CR = 0.025$$

Calculate

## QGIS 2 Analytical Hierarchy Process (AHP)



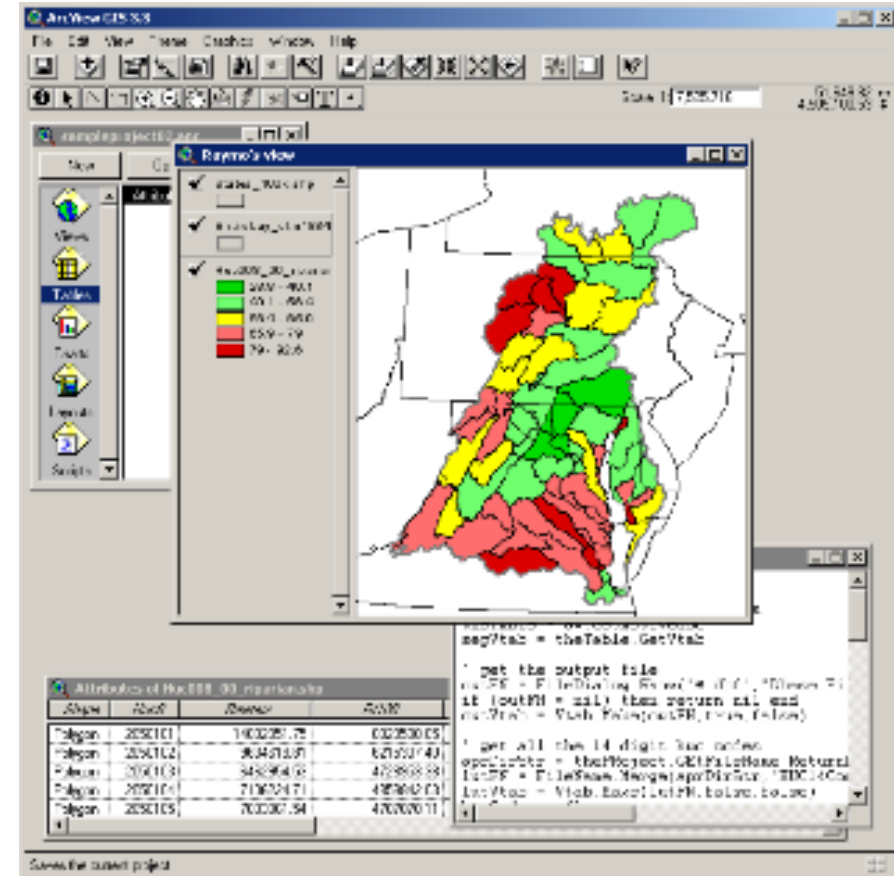


Environmental Systems Research Institute (ESRI, 1969)

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ArcInfo® (1986)

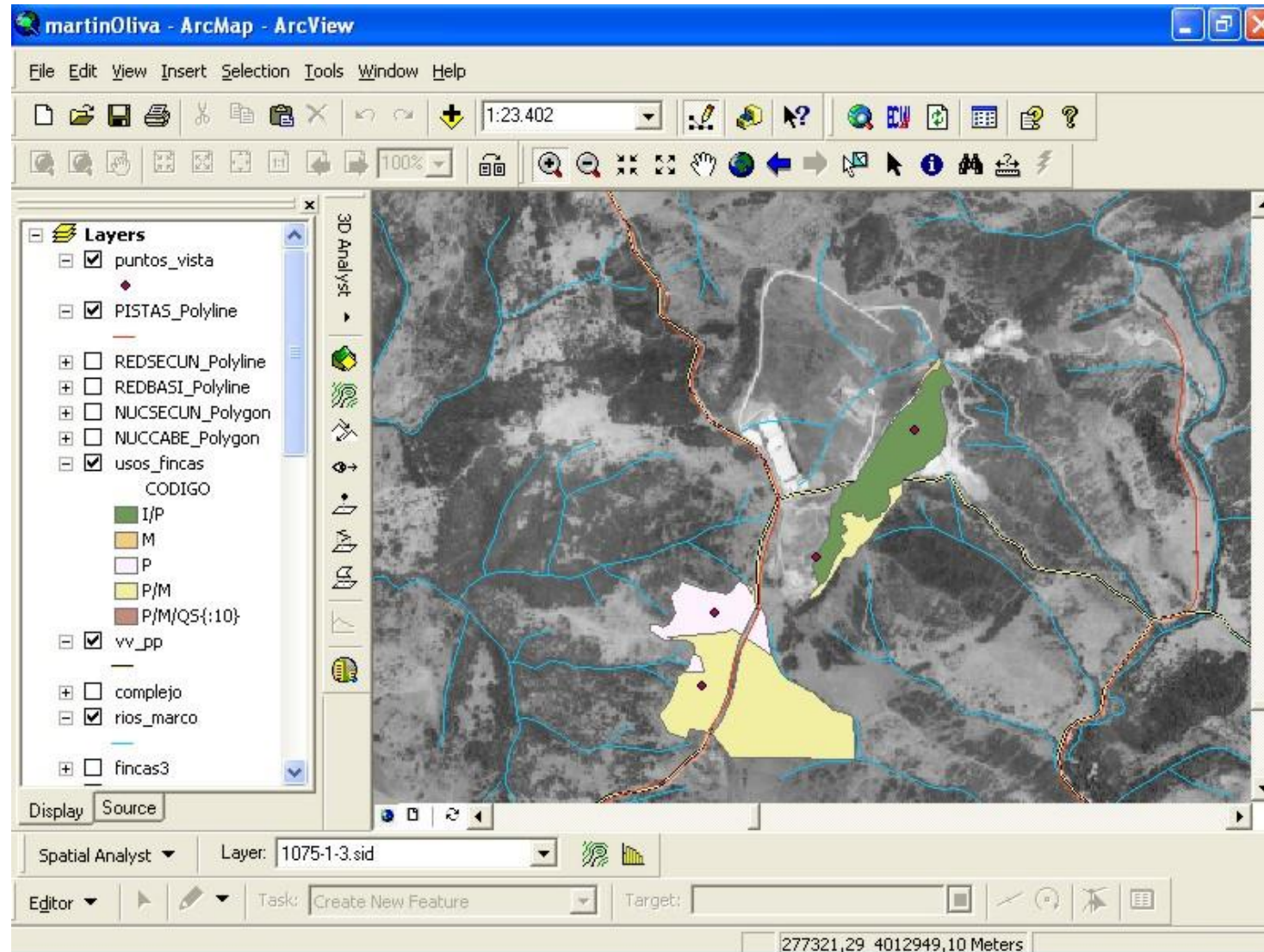


ArcView® (1991)  
Shapefile (estándar ISO 1998)



# Arc GIS 9<sup>®</sup> (ESRI, 1999)

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The screenshot displays the ArcGIS Pro interface with a 3D visualization of a GeoTOP model. The main window shows a 3D perspective view of a river area, with a yellow base layer and a top layer of green and grey voxels. The interface includes a ribbon with various toolbars and a 'Contents' pane on the left. The 'Exploratory Analysis' pane on the right is open, showing the 'Interactive Volume' tool. The status bar at the bottom indicates the current location and scale.

**TNO-GDN GeoTOP model van de Vechtstroom**

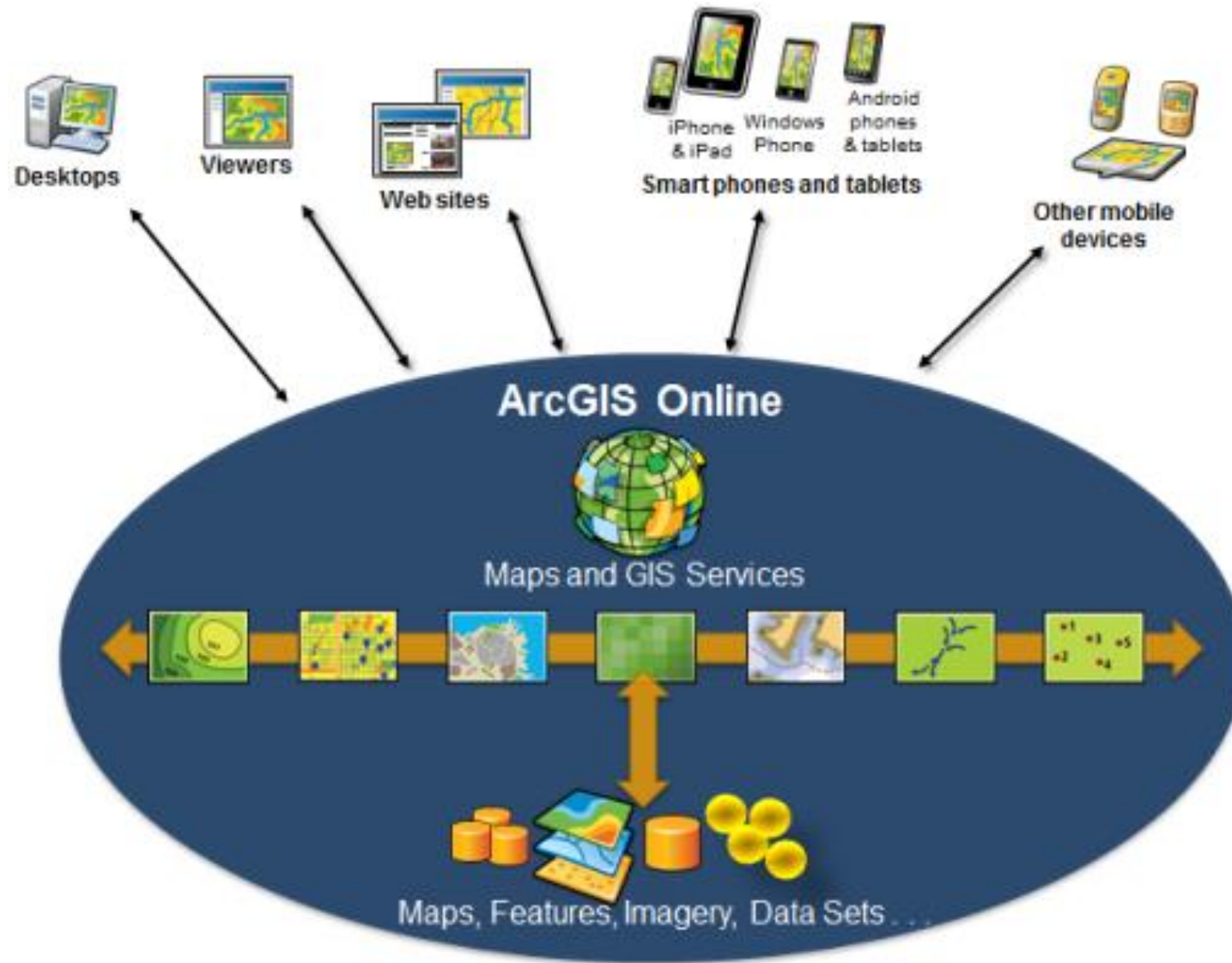






ArcGIS online

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ArcGIS Enterprise®

Co-funded by the  
Erasmus+ Programme  
of the European Union



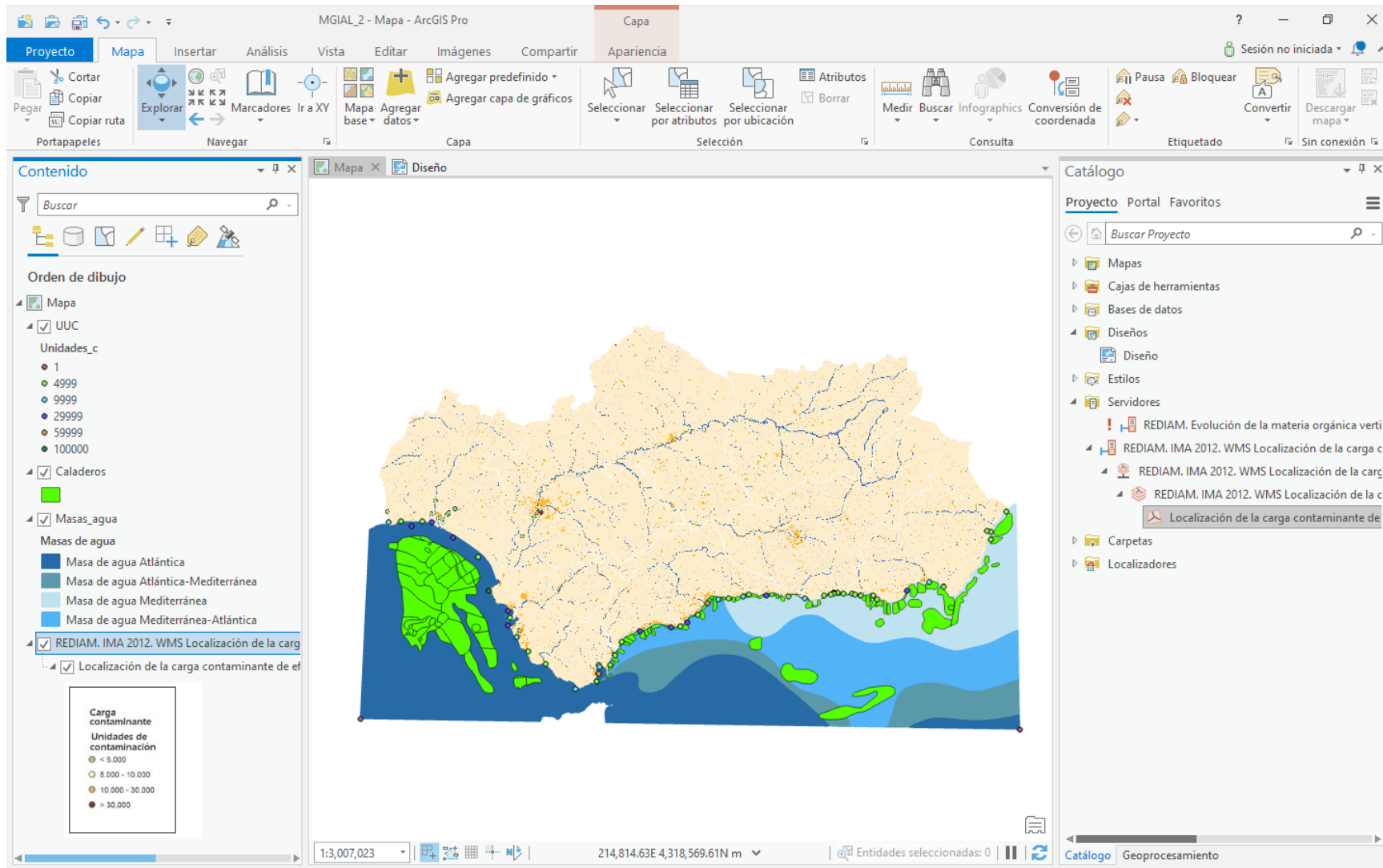
The screenshot shows the ArcGIS Pro interface with a 3D city model of Portland. A table of selected features is displayed on the left, and a pie chart shows the feature count by layer.

OBJECTID	FIRSTGEN_USE	BUILDID	MAXHEIGHT	ZonalPop
21	Institutional	182	113.465	25154
23	Vacant	196	45.968	5085
35	Restaurant	224	26.23	4539
39	Retail	230	75.263	10098
47	Vacant	244	39.651	4752
78	Public	1316	1196	194279

Selected Feature Count by Layer

- Trees
- Buildings





- ## ArcGIS Pro 2.7
- Geostatistical analyst
  - Geoprocessing



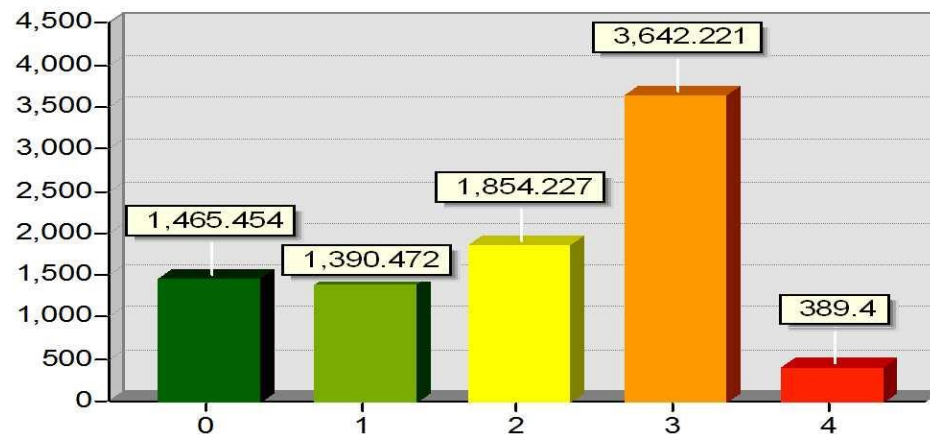


Arc GIS Pro<sup>®</sup>

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of the European Union



#### Superficie por carga contaminante estimada



En Kilómetros cuadrados

#### CARGA DE EFLUENTES URBANOS

- Muy baja
- Baja
- Media
- Alta
- Muy alta

#### MASAS DE AGUA

- MASA DE AGUA ATLANTICA
- MASA DE AGUA ATLANTICA-MEDITERRANEA
- MASA DE AGUA MEDITERRANEA
- MASA DE AGUA MEDITERRANEA-ATLANTICA



Fuentes; REDIAM y datos estimados

ETRS 89 UTM H30N 1:2,000,000



## ArcGIS Pro 2.7

- Geostatistical analyst
- Geoprocessing



Arc GIS Pro<sup>®</sup>

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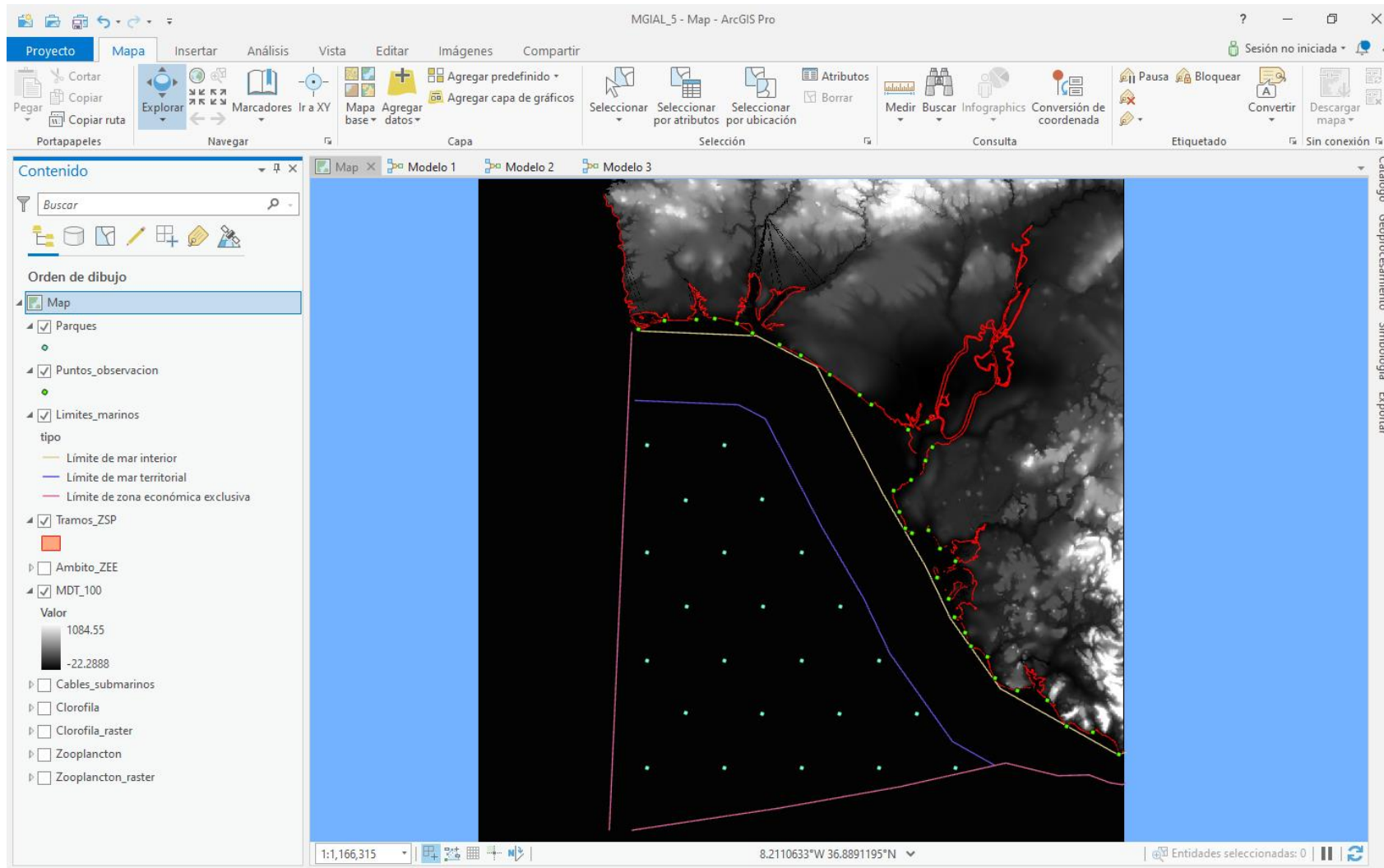


ArcGIS Pro 2.7  
Fuzzy logic



Arc GIS Pro<sup>®</sup>

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of the European Union



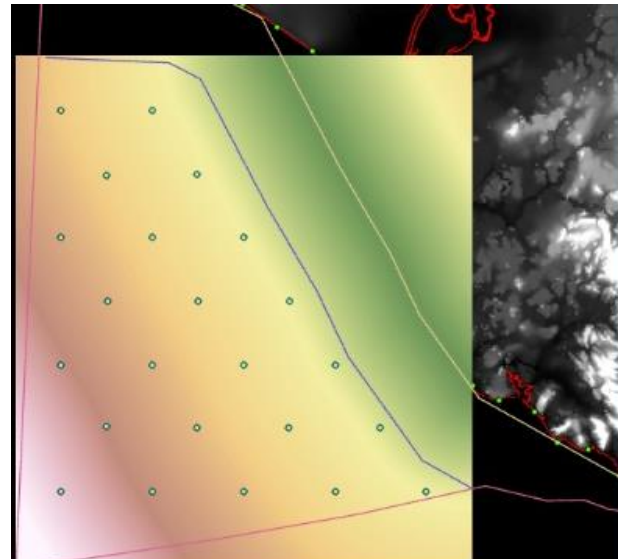
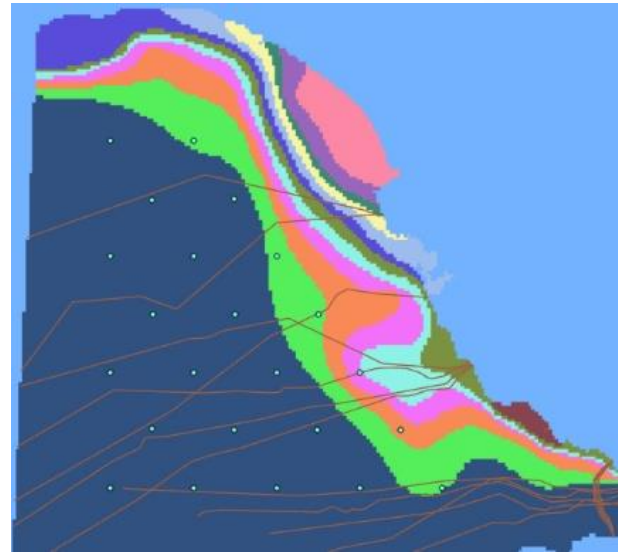
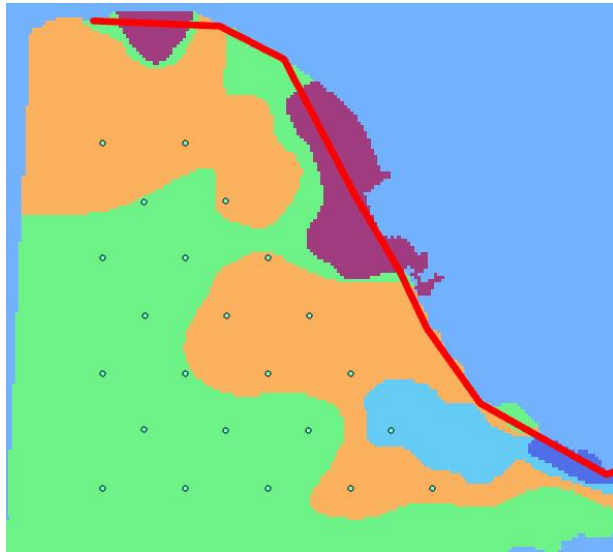
## ArcGIS Pro 2.7

- Viewshed
- Fuzzy logic



Arc GIS Pro<sup>®</sup>

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## ArcGIS Pro 2.7

- Rasterizing
- Reclassify
- Euclidean distance



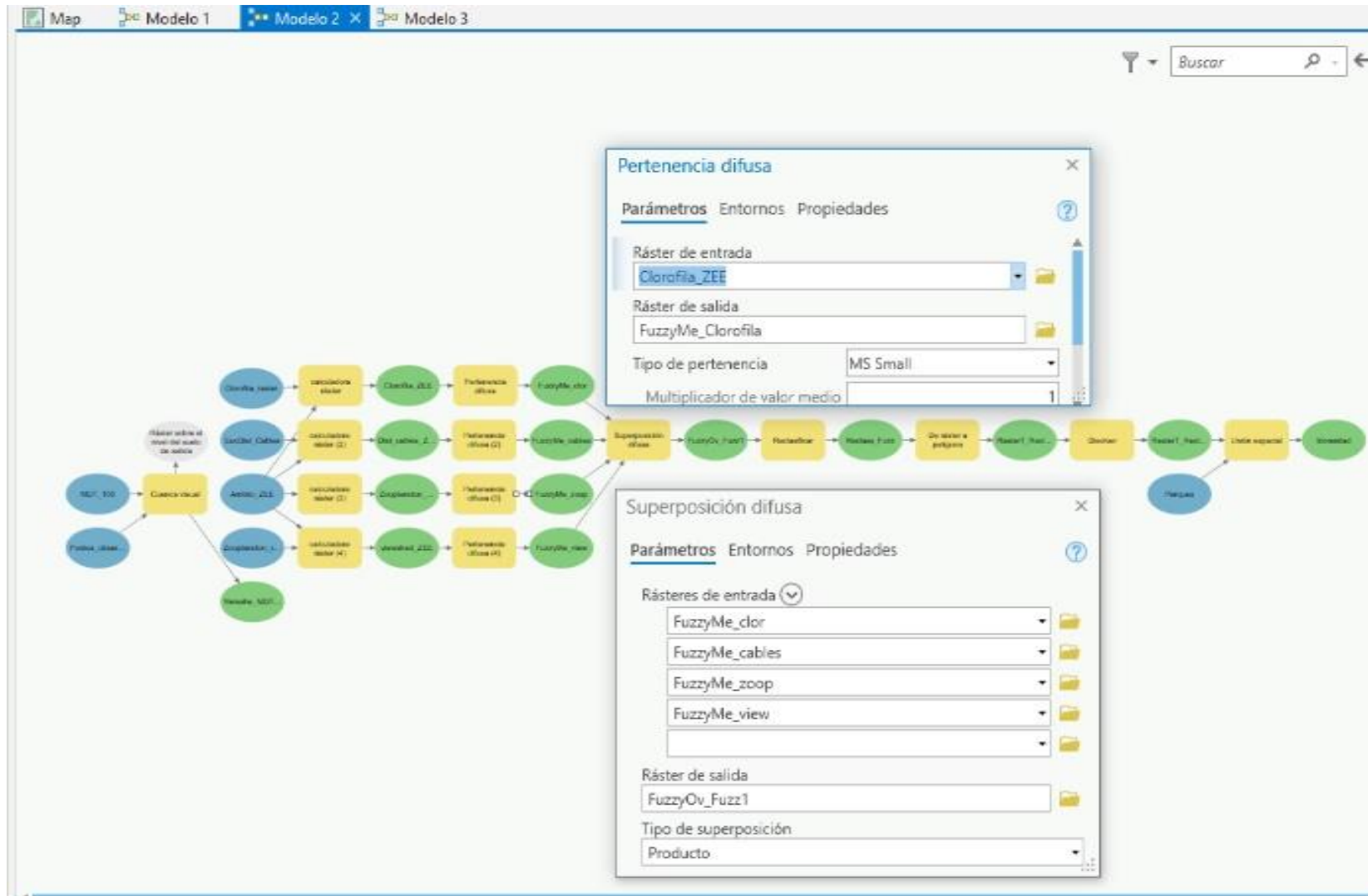
The screenshot displays the ArcGIS Pro Model Builder interface. On the left, there are two workflow diagrams. The top diagram shows a process named 'Distancia euclidiana' (Euclidean Distance) with inputs 'Celda\_entrada' and 'Máscara de dirección de salida', and outputs 'Euclid\_Celda' and 'Máscara de dirección hacia otros de salida'. The bottom diagram shows a process named 'Asignación' (Assignment) with inputs 'Celda\_entrada' and 'Máscara de salida', and output 'Celda\_salida'. In the center, a detailed diagram shows a 'Distancia euclidiana (2)' process connected to three 'Máscara de dirección de salida (2)' processes, which are then connected to a 'Distancia euclidiana (1)' process. On the right, the 'Geoprocetamiento' (Geoprocessing) pane is open, showing a search for 'distancia euclidiana'. It lists several tools: 'Distancia euclidiana', 'Dirección euclidiana', 'Dirección euclidiana', 'Asignación euclidiana', 'Asignación de distancia', and 'Asignación de la distancia de ruta'. Each tool entry includes a brief description of its function.

## ArcGIS Pro 2.7 Model builder



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**ArcGIS Pro 2.7  
Model builder**



### Modelo 2

Procesando 10 de 14  
Ejecutando...

Completado correctamente el Monday, May 16, 2022 7:11:27 PM (Tiempo transcurrido: 2.03 segundos)

Ejecutando (Pertenencia difusa (3)): FuzzyMembership C:\MGIAL\_5\MGIAL\_5.gdb\Zooplancton\_ZEE C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_Zooplancton "MSSMALL 1 1" Ninguna  
Tiempo de Inicio: Monday, May 16, 2022 7:11:27 PM

Completado correctamente el Monday, May 16, 2022 7:11:29 PM (Tiempo transcurrido: 1.65 segundos)

Ejecutando (Cuenca visual): Viewshed C:\MGIAL\_5\MGIAL\_5.gdb\MDT\_100 C:\MGIAL\_5\MGIAL\_5.gdb\Puntos\_observacion C:\MGIAL\_5\MGIAL\_5.gdb\Viewshe\_MDT\_100 200 FLAT\_EARTH 0.13 #  
Tiempo de Inicio: Monday, May 16, 2022 7:11:29 PM

Completado correctamente el Monday, May 16, 2022 7:12:17 PM (Tiempo transcurrido: 47.82 segundos)

Ejecutando (calculadora ráster (4)): RasterCalculator " "C:\MGIAL\_5\MGIAL\_5.gdb\Viewshe\_MDT\_100" \* "C:\MGIAL\_5\MGIAL\_5.gdb\Ambito\_ZEE" " C:\MGIAL\_5\MGIAL\_5.gdb\viewshed\_ZEE  
Tiempo de Inicio: Monday, May 16, 2022 7:12:18 PM

Raster("C:\MGIAL\_5\MGIAL\_5.gdb\Viewshe\_MDT\_100") \*  
Raster("C:\MGIAL\_5\MGIAL\_5.gdb\Ambito\_ZEE")

Completado correctamente el Monday, May 16, 2022 7:12:20 PM (Tiempo transcurrido: 1.98 segundos)

Ejecutando (Pertenencia difusa (4)): FuzzyMembership C:\MGIAL\_5\MGIAL\_5.gdb\viewshed\_ZEE C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_viewsheed "MSSMALL 1 1" Ninguna  
Tiempo de Inicio: Monday, May 16, 2022 7:12:20 PM

Completado correctamente el Monday, May 16, 2022 7:12:22 PM (Tiempo transcurrido: 1.96 segundos)

Ejecutando (Superposición difusa): FuzzyOverlay C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_Clorofila;C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_cables;C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_Zooplancton;C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyMe\_viewsheed C:\MGIAL\_5\MGIAL\_5.gdb\FuzzyOv\_Fuzz1 Producto 0.9  
Tiempo de Inicio: Monday, May 16, 2022 7:12:23 PM

Cerrar al terminar

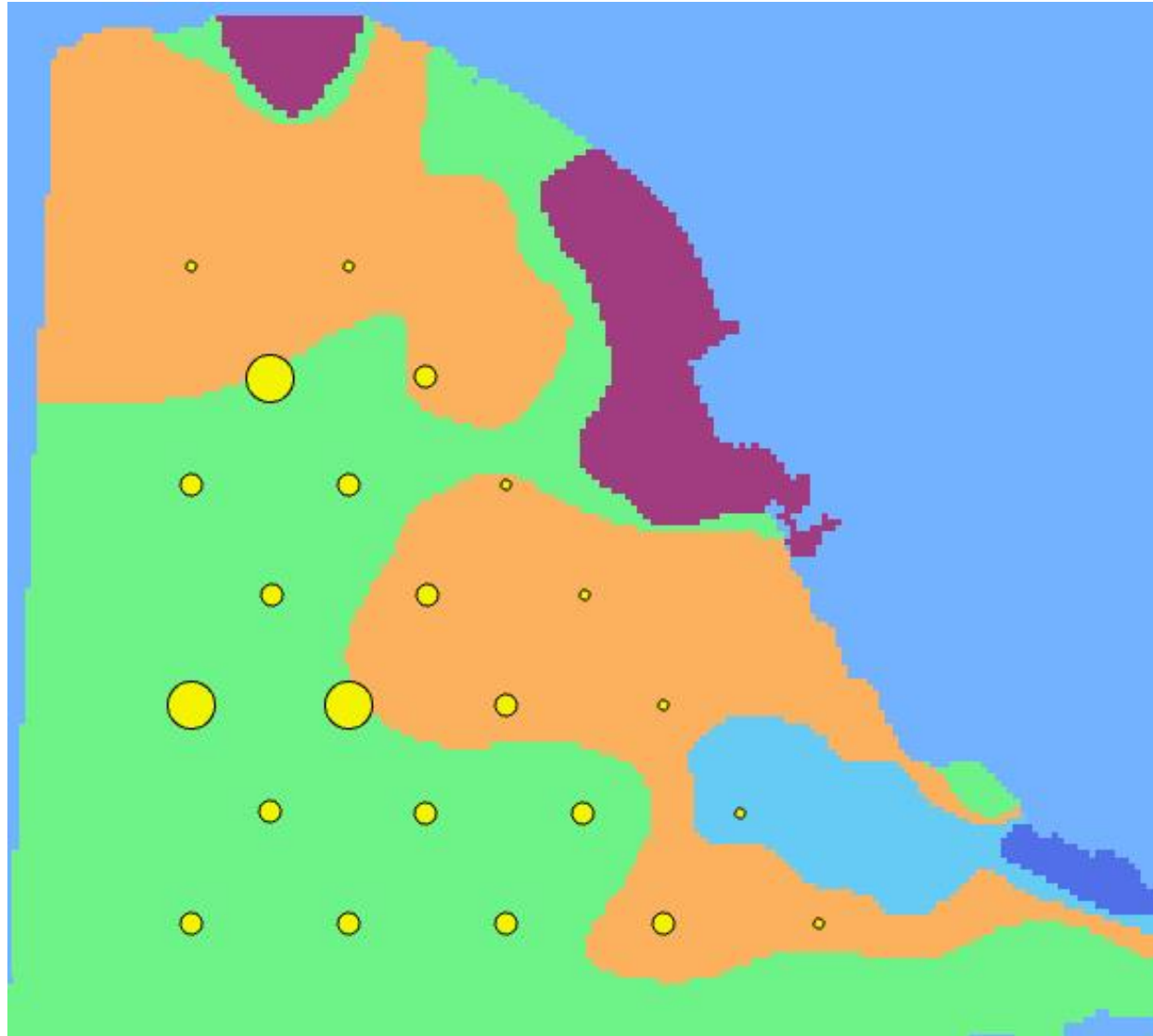
The diagram shows a workflow starting with input rasters: Chlorofila\_raster, Euclid\_Cables, Ambito\_ZEE, and Zooplancton\_raster. These feed into intermediate processing steps: calculadora ráster (3), Dist\_cables\_Z, calculadora ráster (2), and Viewshed\_ZEE. These then lead to membership functions: Pertenencia difusa (3), FuzzyMe\_cables, FuzzyMe\_zoop, and FuzzyMe\_view. These membership functions are combined in a 'Superposición difusa' tool. The output then goes through 'FuzzyOv\_Fuzz1', 'Reclasificar', 'Reclasif. Fuzz', 'De raster a polígono', 'Raster1\_Haci...', 'Disolver', 'Raster1\_Haci...', 'Unión espacial', and finally 'Intersección'.

# ArcGIS Pro 2.7 Model builder



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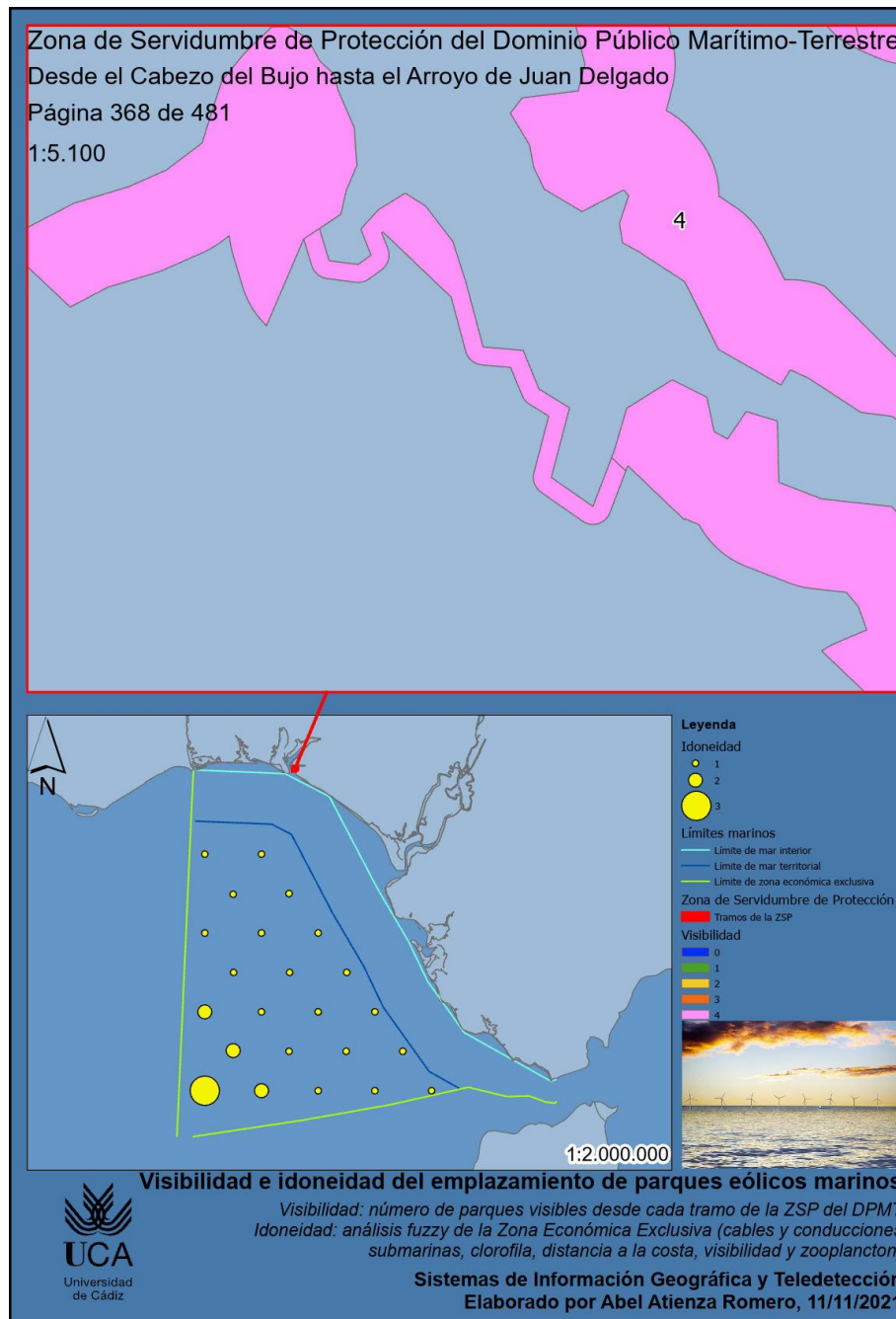
**ArcGIS Pro 2.7**  
**Fuzzy logic**  
**(chlorophyll)**





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## ArcGIS Pro 2.7

- Viewshed
- Fuzzy logic
- Data driven pages

# ¡GRACIAS!

# Thank you

# Faleminderit

# Hvala.

**[NAME]**

**E-mail**

**OTHER INFORMATION:**

[Links to the oficial web of the master or personal information]

