

A GIS interface to the French Fisheries Information System of Ifremer

by

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Abstract

The Fisheries Information System of Ifremer aims to build an operational and multidisciplinary monitoring network for scientific purposes, allowing a comprehensive view of fishery systems including their biological, technical, environmental and economical components. One of its objectives consists in elaborating and providing data and indicators for a widespread public (researchers, fishermen, administration, general public...), including bio-economic diagnostics and assessment of the short and long-term impacts of fisheries management scenario and measures.

To further an integrated analysis of the fishery systems, the wide range kinds of data (landings, efforts, biological or environmental observations, economic data...) are managed in a single data management system, based on an integrated relational data base with geographical facilities.

Recent Ifremer developments have been dedicated to design, set up and interface a GIS to the FIS integrated database. Several data sources are combined together in the GIS, including the FIS fisheries data, but also complementary data such as regulation and administrative information, environmental, physical or climatology layers. For the fisheries data, the GIS is interfaced to the data warehouse-like part of the database made of aggregates being generated regularly on the 'raw' data part (as collected within the FIS system).

With the GIS interface, the FIS provides a tool to the stakeholders, to get a comprehensive, integrated and readable overview of the fisheries activity. This GIS is going to be available on-line by the end of 2008 on the FIS web site (<http://www.ifremer.fr/sih>), by controlled access (login/password) but also in a public version (restricted data access).

Keywords: geographic information system, fisheries, indicators, integrated database

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Introduction

The Fisheries Information System (FIS) contributes to fulfil one Ifremer's public interest missions to « identify, evaluate enhance marine resources and enable their sustainable exploitation » (Daurès et al, 2008).

It aims to build a permanent, operational and multidisciplinary monitoring network for the observation of marine resources and their associated uses, allowing a comprehensive view of fishery systems including their biological, technical, environmental and economical components.

The FIS is developed in strong collaboration with the French Ministry of Agriculture and Fisheries and is based on a strong participation of fishermen. It relies on a multidisciplinary management team, including scientists from each discipline and also computer engineers, and on a network of observers and technicians along the French coasts (including overseas territories).

This paper presents the data approach of the FIS, how it is implemented in an operational system managing an integrated database and its GIS (Geographical Information System) interface to the data.

Multidisciplinary data approach of the FIS

For scientific purposes, the objective of the FIS consists in the collection of relevant data to assess the complete activity of the French fleet and understand the dynamics of the fishing system. Thus the FIS is interested in the whole French fleet including small-scale vessels, with a gradual enlargement to recreational fisheries.

Combined with a statistical methodology, a multidisciplinary data approach is the major key of the FIS (figure 1).

The starting point of the method consists of a comprehensive characterization of the French national fleet, based on official and administrative data, supplied by the French Ministry of Fisheries, including data related to the vessels (technical characteristics, crewmembers...) and their owners. This fleet constitutes the reference population.

Other official data, declarative landings statistics, are made available by the French Ministry of Fisheries, but are incomplete. Therefore, in order to compensate the lack of complete information regarding activity of the vessels, Ifremer has carried out a comprehensive survey consisting of an exhaustive collection of annual activity calendars (follow up of the "metier" practiced by the vessel per month).

This set of information allows then the elaboration of typologies of fleets, the identification of significant features of the vessels and the set up of sampling plans for the collection of other data such as catches/discards data, economic indicators or biological data.

This wide-ranging data allow a multidisciplinary and integrated analysis of the fishing system together with a comprehensive and readable overview of the fisheries activities for a widespread public (researchers, fishermen, administration, general public...), including integrated indicators, bio-economic diagnostics and assessment of the short and long-term impacts of fisheries management scenario and measures. One of the tool to support this is the GIS interface to the FIS.

The FIS management system overview

The data sources and exchanges are the data collected by Ifremer within the FIS, combining official data from the French Ministry of Agriculture (particularly for fleet information and 'Fishing Statistics) and surveys data from Ifremer observers.

To further an integrated analysis of the fishery systems, the wide range of data (landings, efforts, biological or environmental observations, economic data...) is centralized and managed in a single data management system (figure 2), based on an integrated relational data base (called HARMONIE) with geographical facilities.

Whereas the data are inherently wide-ranging, the different data sub-models in HARMONIE share common variables enabling the synthesis of data and are all linked to referential data being the basement of all the system. For example, data on fishing activity are of common interest between the sub-model of "Fishing statistics and fleet activity" and the sub-model of "Economic data". In the same way, sales data are shared between "Fishing statistics and fleet activity" and "Landings biological sampling". A major challenge of this database is to ensure the consistency between all the sub-models.

Upon what is called the '**source data**' part of the database, processes are set up to generate and update regularly **aggregates** in the data warehouse-like part of the database.

This central system has been developed since 2002 to integrate step by step all the data collected within the FIS. Three out of the five main sub-models are available, the two remaining concerns the 'Landings biological sampling' and 'Economic', yet managed in databases but separated from HARMONIE. The next step is to integrate those data during 2009-2010 period.

The GIS interface to the FIS data

Recent Ifremer developments have been dedicated to design, set up and interface a GIS to the FIS integrated database. This application is interfaced to the aggregates part of the HARMONIE database and makes use of the referential data. It is part of the WEB portal of the FIS.

As the FIS database contains only the fisheries data, the GIS also interacts with the SEXTANT database of Ifremer. This database manages for Ifremer's fields of activity, all the geographical objects complementary to the data hold in different systems like the FIS (figure 3), such as :

- Administrative information : landing places, fishing area (FAO zones, divisions,...),
- Physical (bathymetry lines) and regulation limits (12-miles limit, EEZ..)
- Environmental (sedimentology...),
- Climatologies

A user's request to the GIS interface can be for example (figure 4) to get a map of "value of trawler's catches' in 2004 by rectangle areas with the complementary information of the bathymetry line of 200 meters.

In terms of technical features, the Web-GIS application implements open source software : Mapserver engine and Cartoweb framework. Cartoweb is a comprehensive and ready-to-use Web-GIS as well as a convenient framework for building advanced and customized applications. It is released under the GNU General Public License (GPL).

Furthermore, the Web-GIS is interfaced through SQL and OracleSDO to data and geographical objects stored in Oracle 9i database. It is a Web 2.0 (Ajax) look and feel interface supporting multi-lingual configuration.

Finally, it enables direct access to up-to-date FIS agregates by controlled access (login/password) but also by public access, but with a restricted data access in this case. Once logged, the user is also identified by a profil that defines which data from the FIS he can request.

The GIS main user's interface is divided in 5 parts (figure 5):

- The '**1. Layers manager**' lets the user build a map
- The '**2. Tools**' and '**4. Map information and tools**' offers facilities on the map
 - zoom, pan, getting information on map attributes, short cuts, scale...
 - saving/loading map "context" : all the map definition (layers) but not the data
 - Exporting the map and its information in PDF or images (in a zip file)
- The '**3. Map display**'
- The '**5. Layers information**' displays the general description of each active layer of the map as listed in the '**1. Layers manager**'

A map is made of one or several **layers** chosen by the user, each layer being:

- either a static layer from SEXTANT database
- or a user's defined layer for FIS data (HARMONIE)

For this second type of layer, the GIS interface lets the user define the layer by selecting data in the aggregates of HARMONIE with a large range of queries, the criteria being:

- The variable to be represented in the list of variables for the type of aggregate, for example the 'value of catches' for declared catches (log-books information)
- The data period
- Then, the criteria on the data itself : gears, species and "metiers" (association of family of gear – for example 'trawler') and target species (for example 'hack')
- And criteria for vessels selection among :
 - Vessels being in or out European fleet registry, list of owners, list of flags
 - Also vessels characteristics like the 'length over all' or 'engine power'
 - And annual criteria on the fleets, like 'vessels fishing mainly along the coasts'

In addition to the data selection criteria, the user can choose between 3 types of output layer (figure 6), each being configurable:

- Geostatistical (choropleth)
- Statistic charts (pie or bar charts)
- Symbols

The user can access to **attributes information** on each type of output layer, and for symbols and charts it is possible to display **individual tooltips** (figure 7). All the tooltips and attributes information are available in the export file of a map.

Conclusion

With the GIS interface, the FIS provides a tool to the stakeholders, to get a comprehensive, integrated and readable overview of the fisheries activity.

The first version available by the end of 2008 is going to include all the defined functions for "Fishing Statistics and fleets activity" sub-model of HARMONIE database:

- Log-books (declared fishing effort and catches)
- Landings (auction sales)
- Fishing activities
- Fishing fleets (number and characteristics)

The next FIS data to be integrated will be the aggregates for the further data sub-models of HARMONIE database:

- Biological surveys
- Estimation of catches aboard fishing vessels (landings/discards)
- ...

Moreover for regulation information, new sources are planned to be integrated in the SEXTANT database starting (from ? = à partir de) next year. The regulation objects will refer to official texts and references managed in the French Ministry of Agriculture and Fisheries' database (called BDR). An additional facility in the GIS interface will give access to regulations text stored in the BDR as PDF files (REST interface).

In term of functionalities it is foreseen that the GIS will interact with available WMS and WFS services on the net for complementary data, and also will serve predefined and validated maps from the FIS as WMS and WFS.

Acknowledgements

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References

Daurès F., Leblond E., Berthou P., Dintheer C., Merrien C., Tétard A., Vigneau J., Lespagnol P., 2008 (in prep.). The Fisheries Information System of Ifremer - a multidisciplinary monitoring network and an integrated approach for the assessment of French fisheries, including small-scale fisheries, ICES CM 2008.

Figures

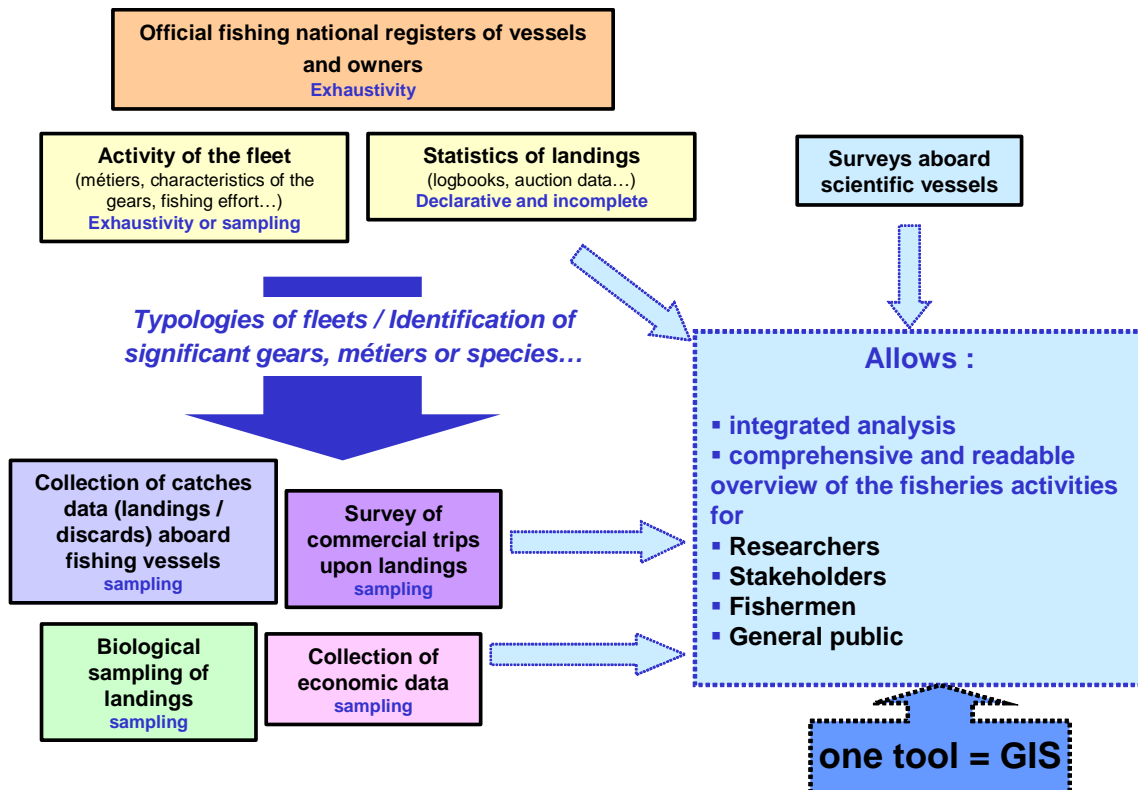


Figure 1 : A multidisciplinary data approach for the FIS

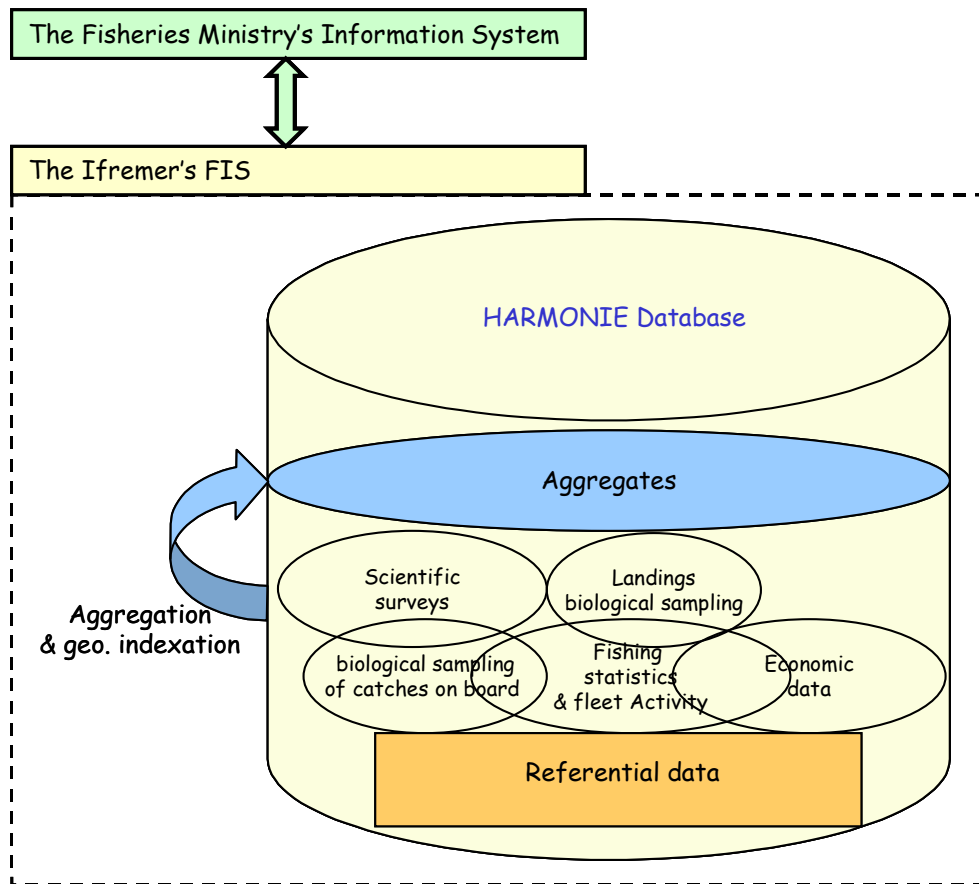
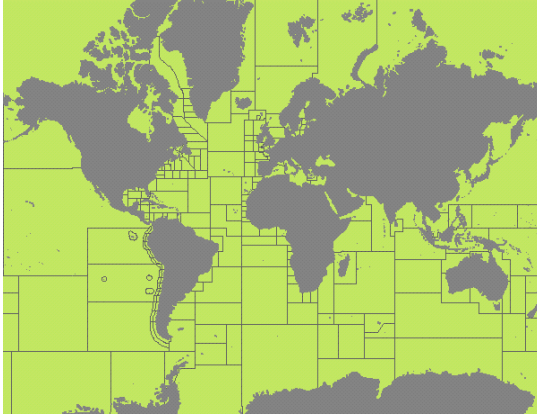
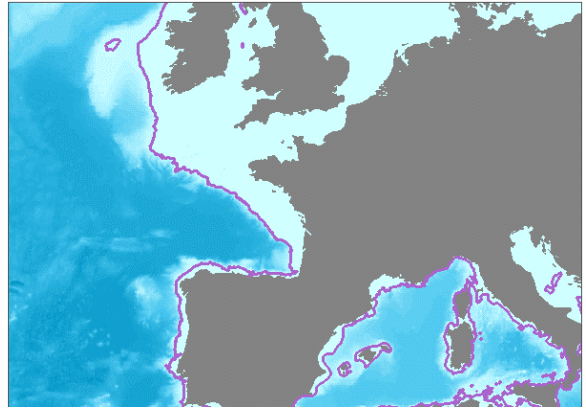


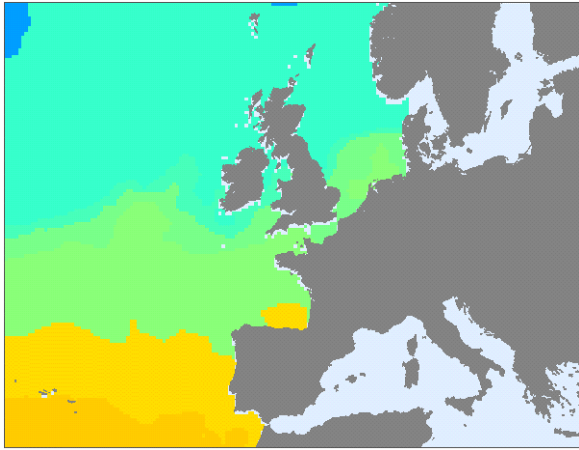
Figure 2 : The FIS management system overview in which the wide range of data is centralized and managed in a single database with geographical facilities



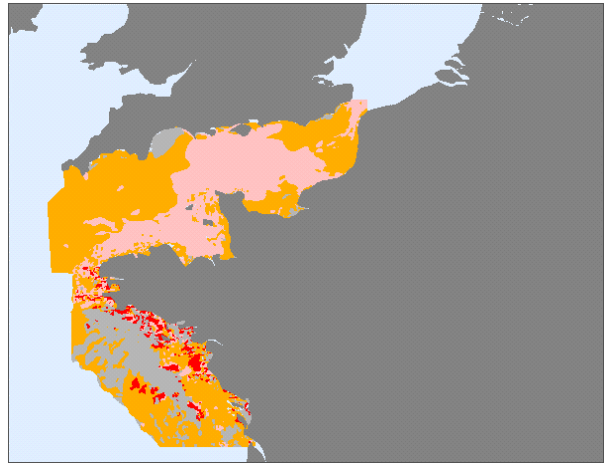
Administrative information : FAO divisions



Physical limits : bathymetry line 200 meters



Cimatology : sea surface temperature model output



Environmental : sedimentology

Figure 3 : Examples of complementary data to the FIS data

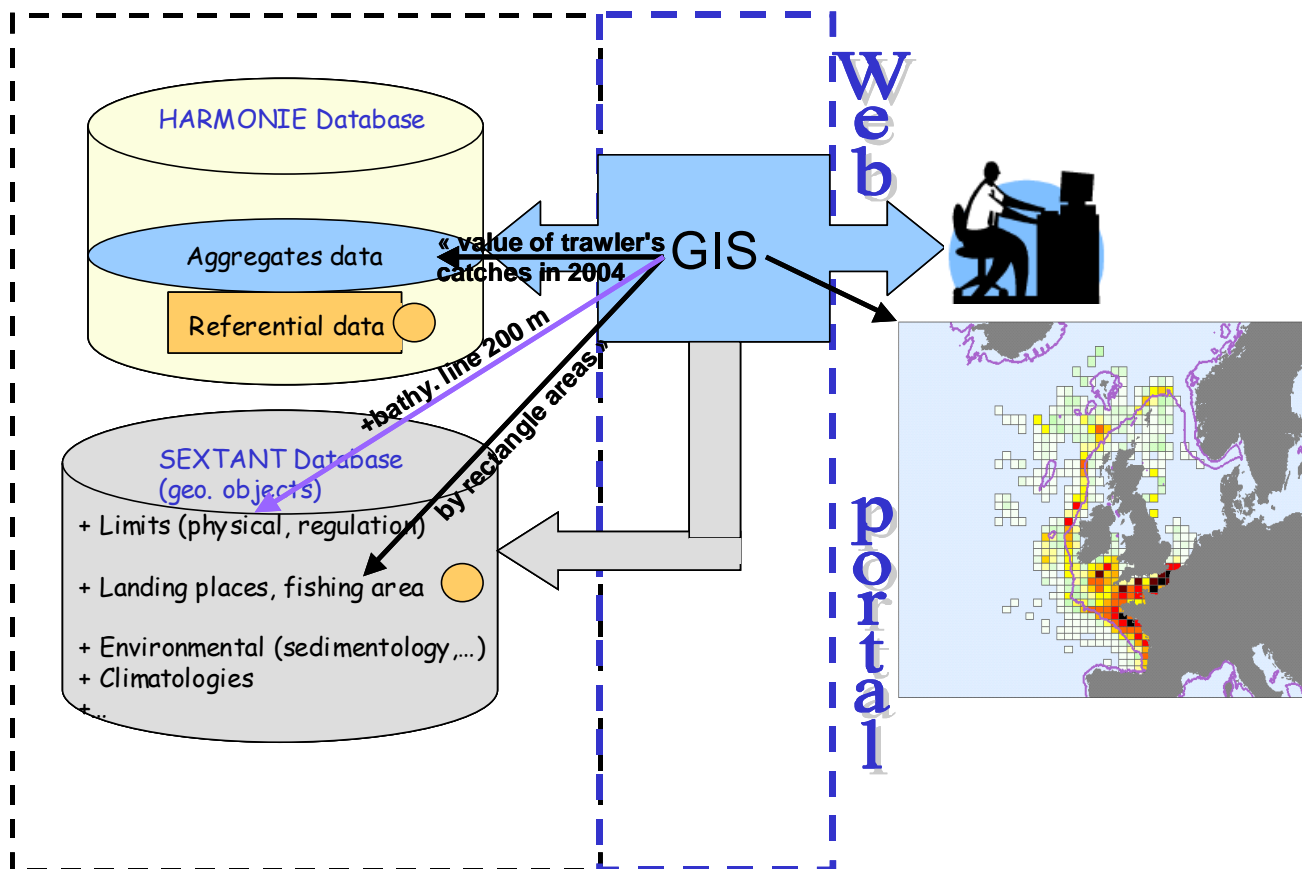


Figure 4 : The GIS interface to the FIS data requests aggregates in HARMONIE and the complementary data available in SEXTANT database.

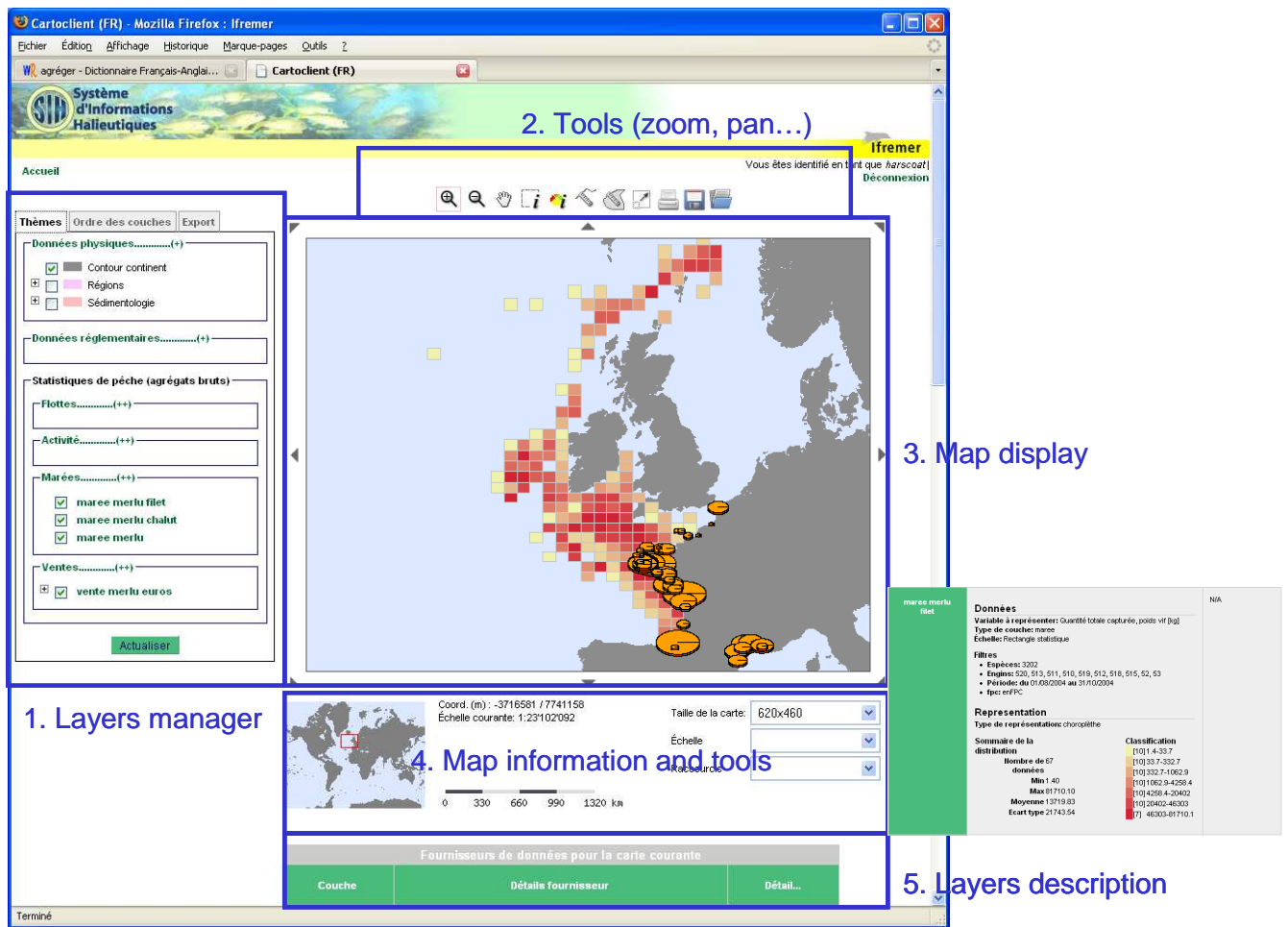
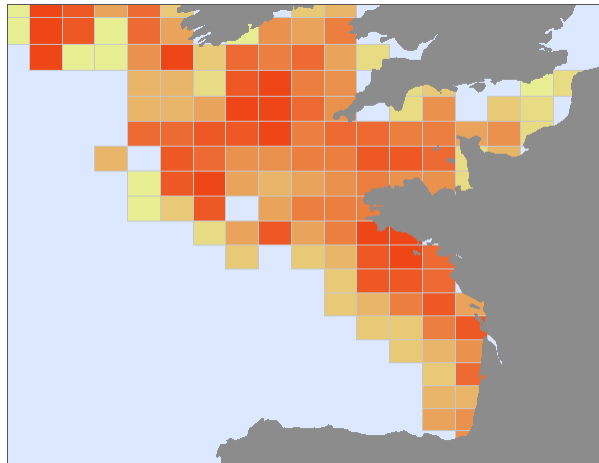
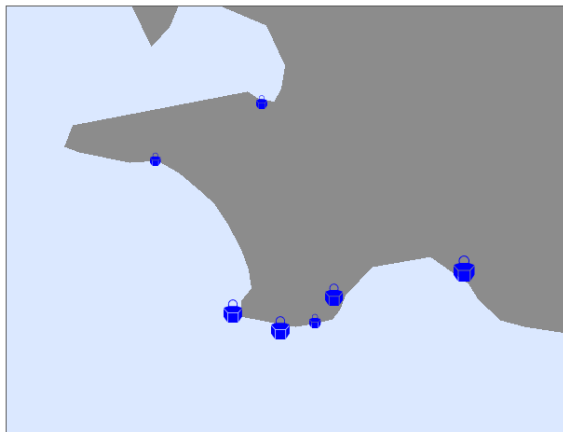


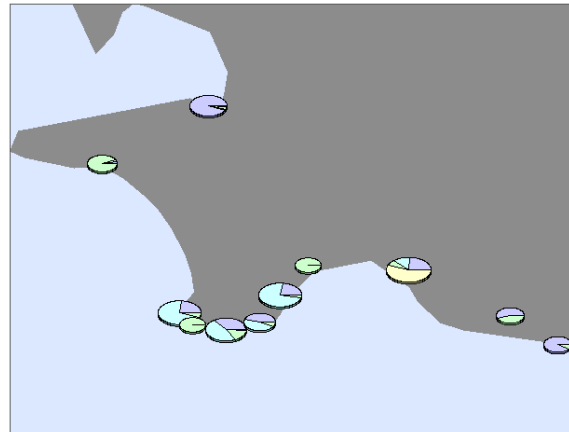
Figure 5 : The five parts of the GIS main user's interface that lets a user build a map by defining all the layers of the map, manipulate the map with standard facilities (zoom, ...), get information on it or export it as PDF for example.



Choropleth : catches in Kg by rectangle areas



Symbols : sales in Kg on landing places



Pie charts : landings in Kg by species

Figure 6 : Examples of the three types of configurable output layer for the FIS data, being choropleth (area color filling) or symbols or statistics charts.

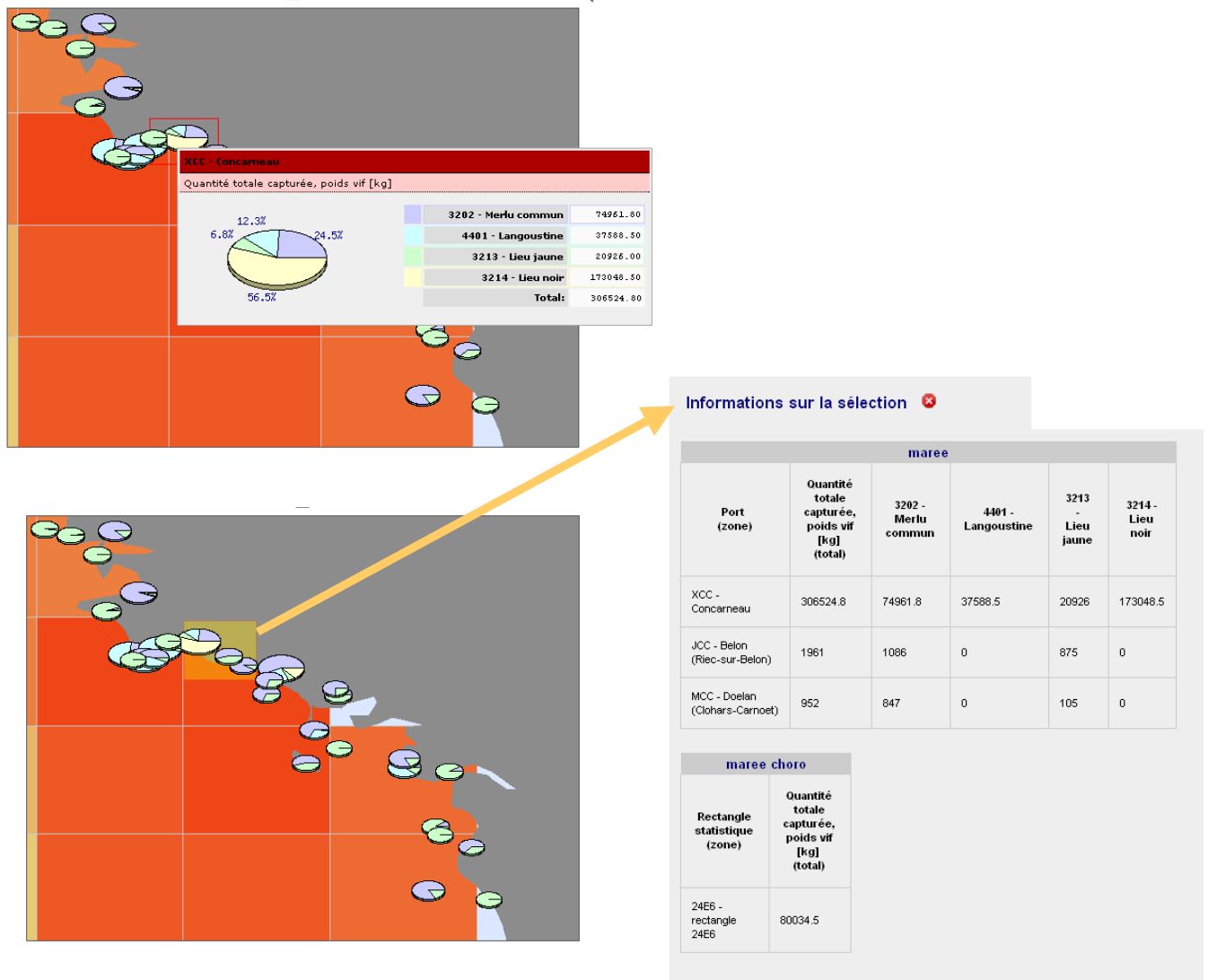


Figure 7 : Examples of attributes information facility on a map **either** individually as a tooltip when a user flies over an object on a layer (the top example), **or** as information tables for all the objects included in the selection area drawn by the user (the bottom example).