Progress in the analysis of VMS data: Scientific insights from Italian experience

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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN
General overview on Monitoring, Control and Surveillance with particular reference to the GFCM Area, including the role of controls in small-scale fisheries
Tunis, Tunisia, 1-2 October 2013

Introduction: VMS in fisheries sciences

- The exploitation of living resources by fisheries is a complex game played by different actors, each one having distinct dynamics and patterns **in space and time**.

- **Spatio/temporal** fluctuations of **resources** and **environment** are classic objects of ecological investigation and modeling...

- ...whereas the corresponding analysis of **fishing effort** has been historically hampered by the lack of tools for the survey of fishing fleet activities in space and time.
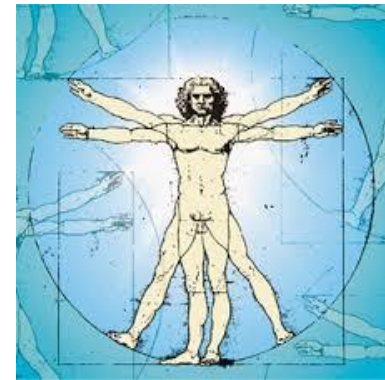
Human component

VMS: a little revolution in fisheries sciences

- This situation changed since 2006 by the introduction of the **Vessel Monitoring System (VMS)**, that is the possibility of track fishing activity in space and time by satellite data (position, speed and heading of fishing vessels)

VMS - Vessel Monitoring System

Navigation satellite

Communication satellite

Land control station

Fishing vessel
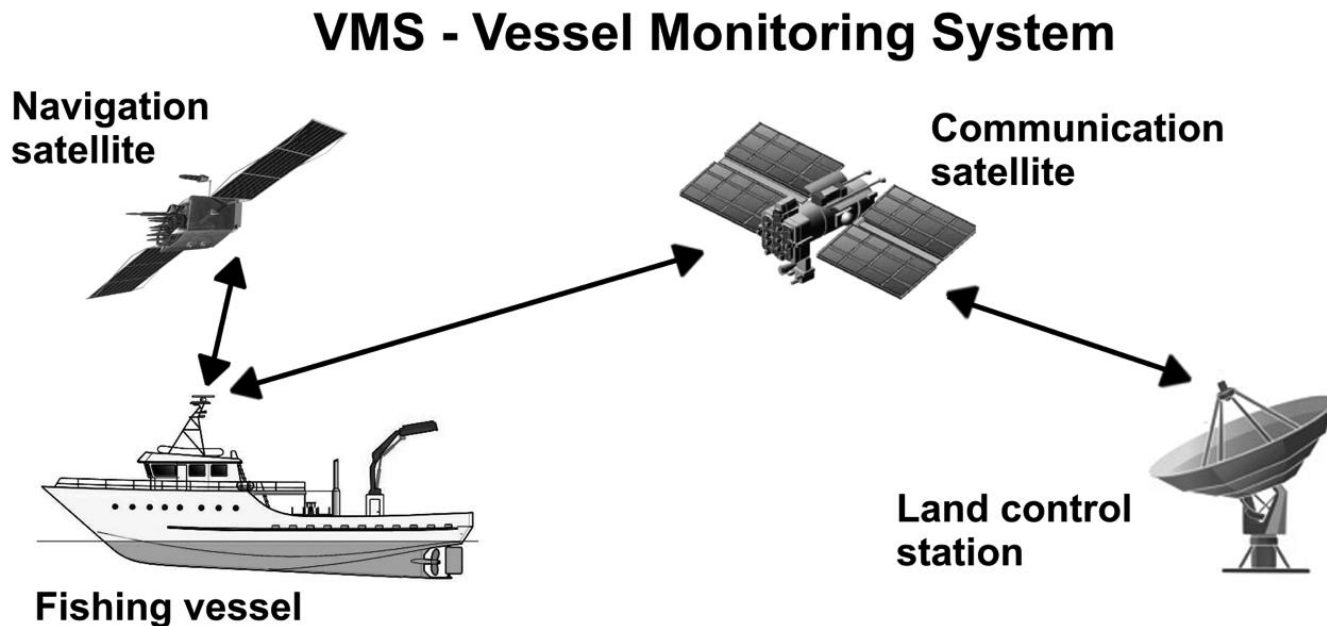
The context

- VMS data are routinary processed within the **Data Collection Framework** in order to assess and analyze the spatial extension of fishing effort
- This requires a complex flow since VMS data must be processed and coupled with other data sources (i.e. Logbooks)

Filling the tool box: VMS data need appropriate protocol to be integrated in fisheries models

Some key steps are:

- Disaggregation of VMS dataset into single "tracks", that are fishing trips starting by and ending to a given harbor;
- Interpolation at an adequate standard frequency (e.g. 10 minutes) in order to realistically represent fishing activity;
- Recognize fishing activity with respect to targeted resources (i.e. Métiers classification)

- Distinguish between fishing and steaming points within each classified track;
- Aggregate fishing points per area, per activity and per time, on a spatial grid;
- Analyze the obtained pattern in order to:
1. Compute pressure indicators (extension of exploited area)
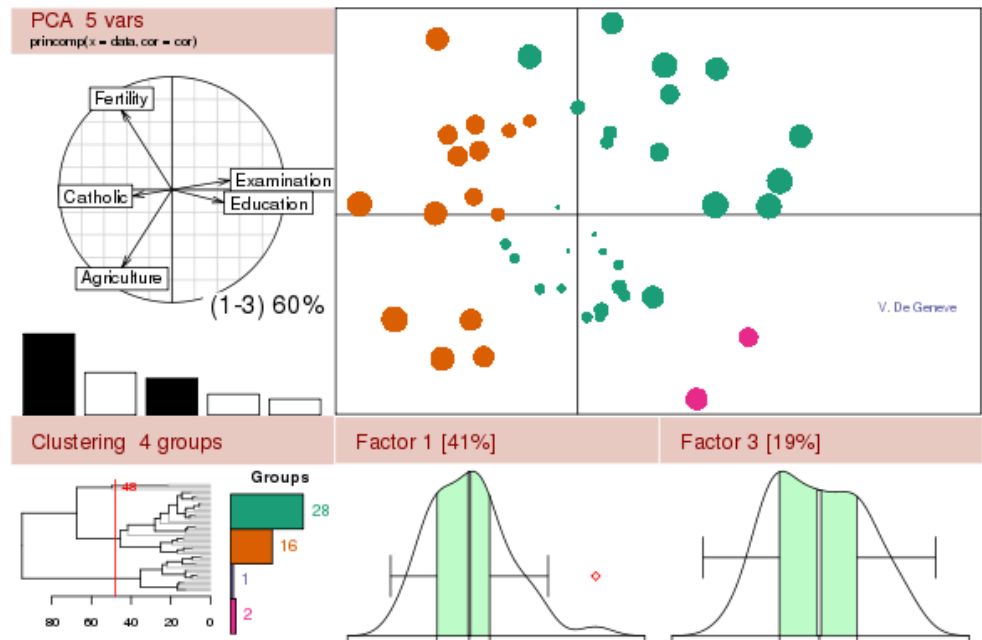2. Identify and monitoring fishing grounds through time

The data used

VMS

Vessel Register

Logbook

OUTPUT
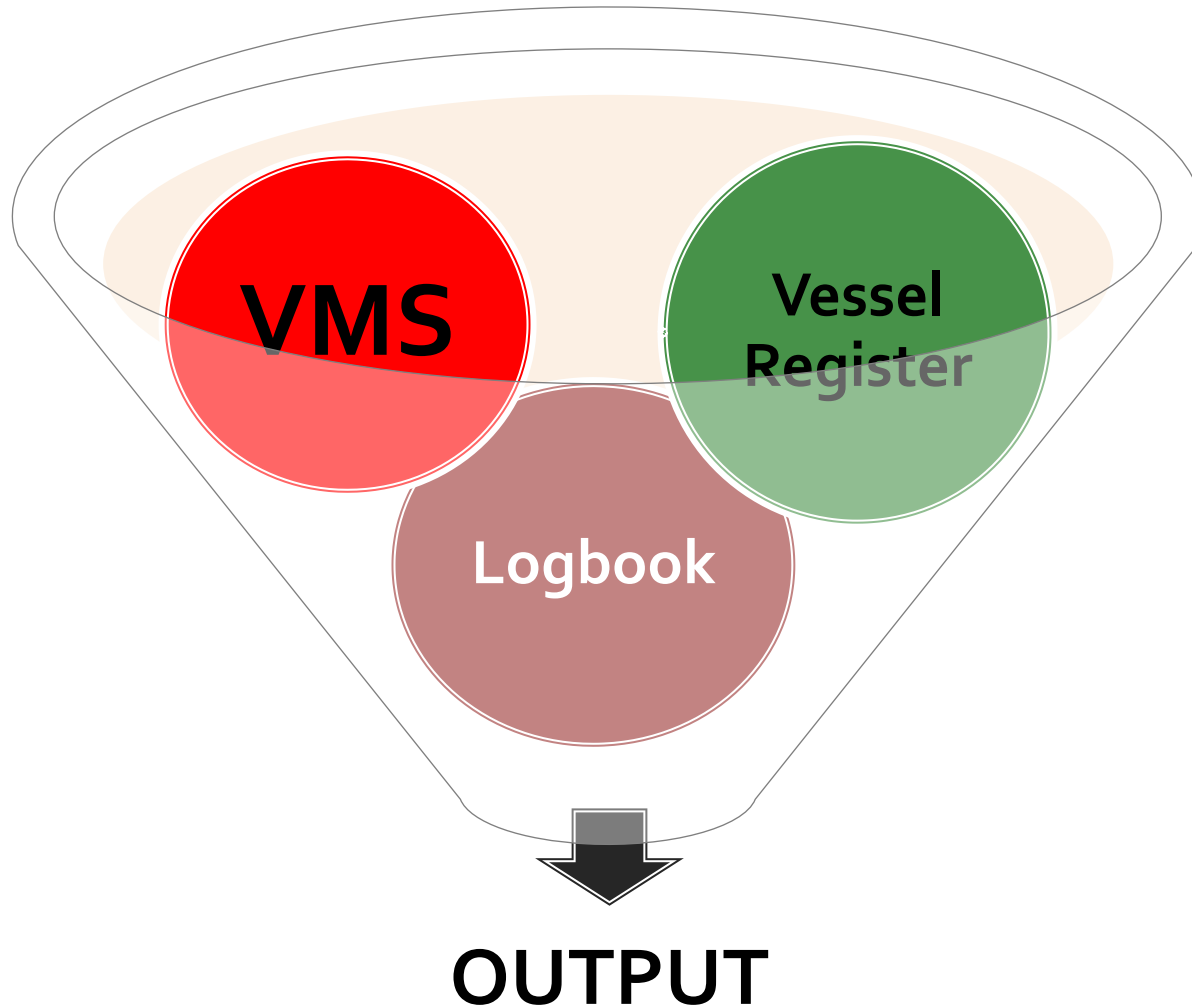
The way

- Development of **R code** (libraries, routines) in order to facilitate validation, sharing and enhancement of methological skills

The story till now

- ## We published 2 papers about methodologies for VMS data processing

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

New insights in interpolating fishing tracks from VMS data for different métiers

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Interpolation: high frequency tracks from VMS signals natively characterized by low frequency (e.g. 2 hours)

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

When behaviour reveals activity: Assigning fishing effort to métiers based on VMS data using artificial neural networks

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Identify the different types of fishing activity by the analysis of the vessel behaviour at sea

A first target: the VMS Base freeware software

- These methodologies flowed into an open source R-based software
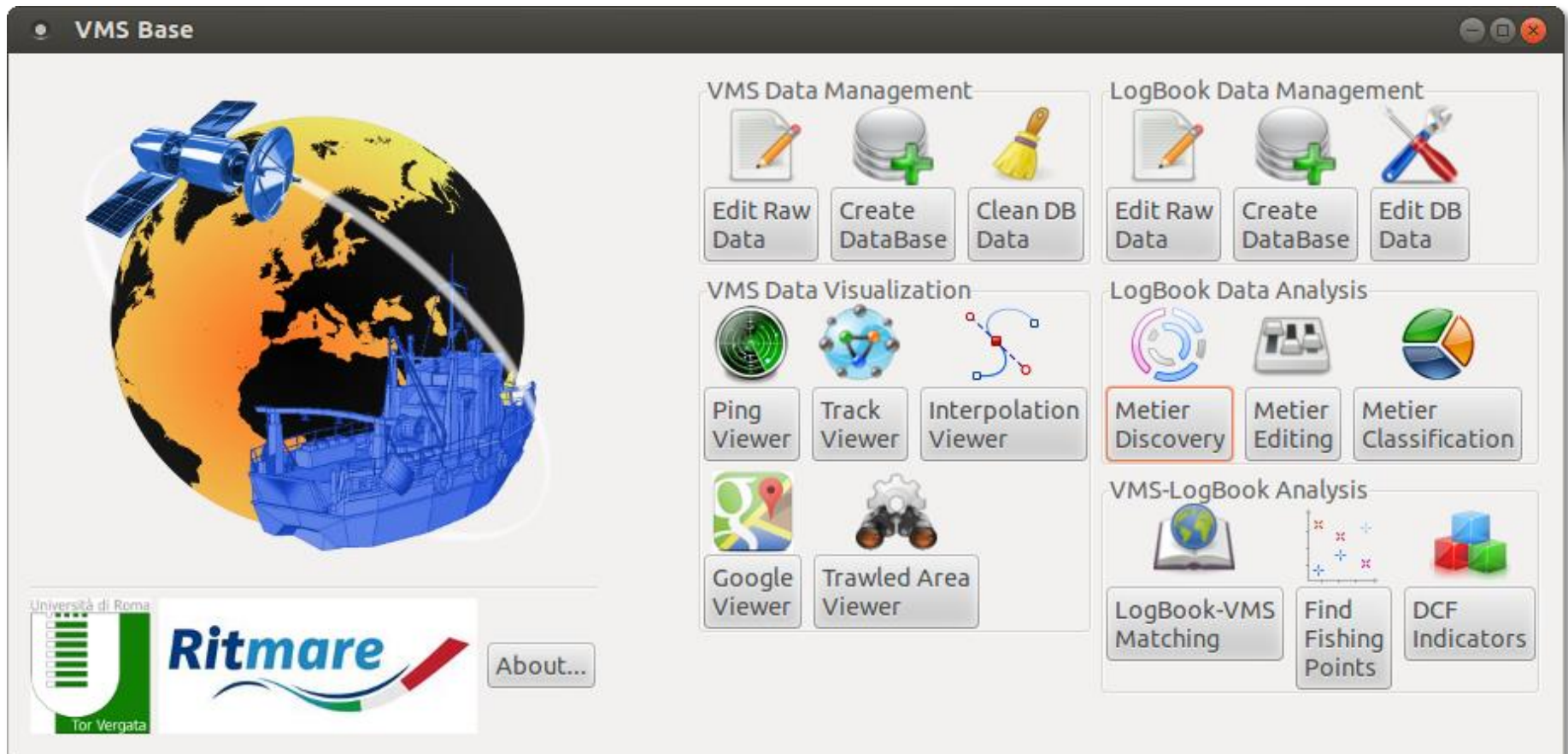
VMS Base allows to:

- Importing, processing, storing (SQL Database manager), and visualizing large VMS/Logbook dataset with great efficiency
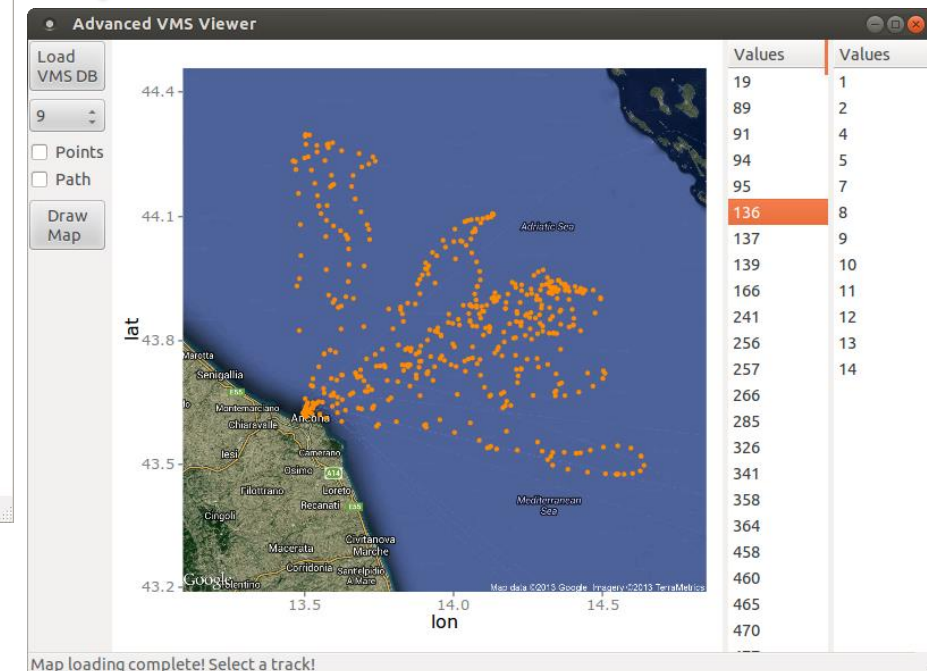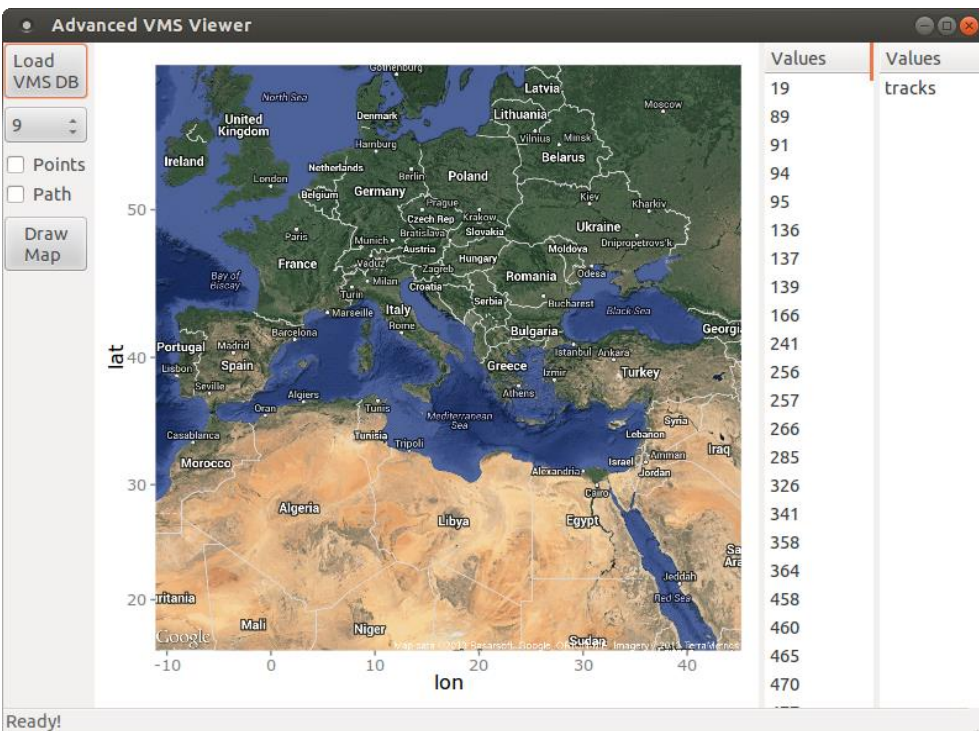
VMS Base allows to:

- Enhancing information from VMS data by reconstructing vessel trips
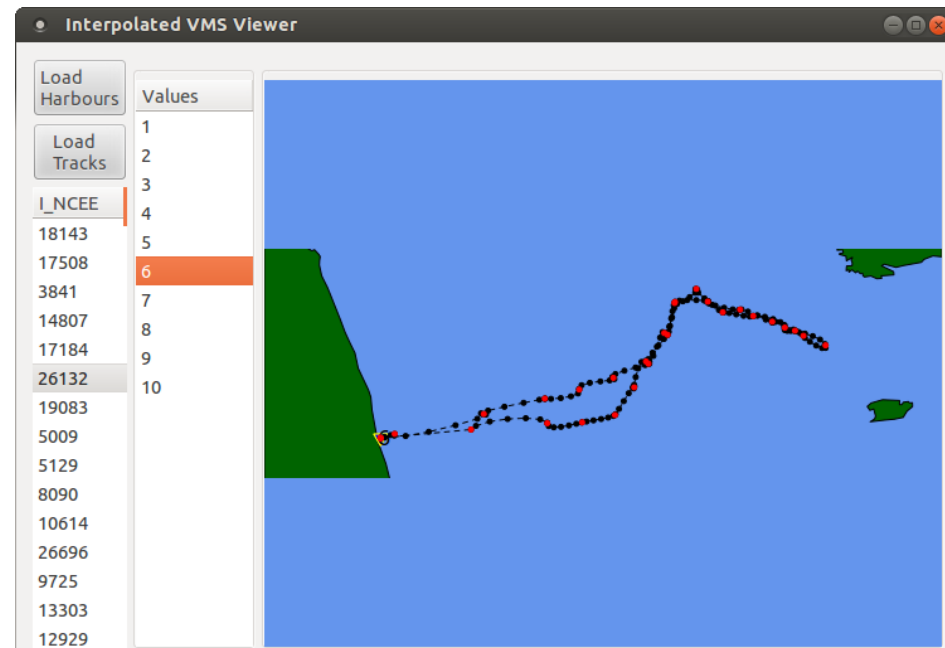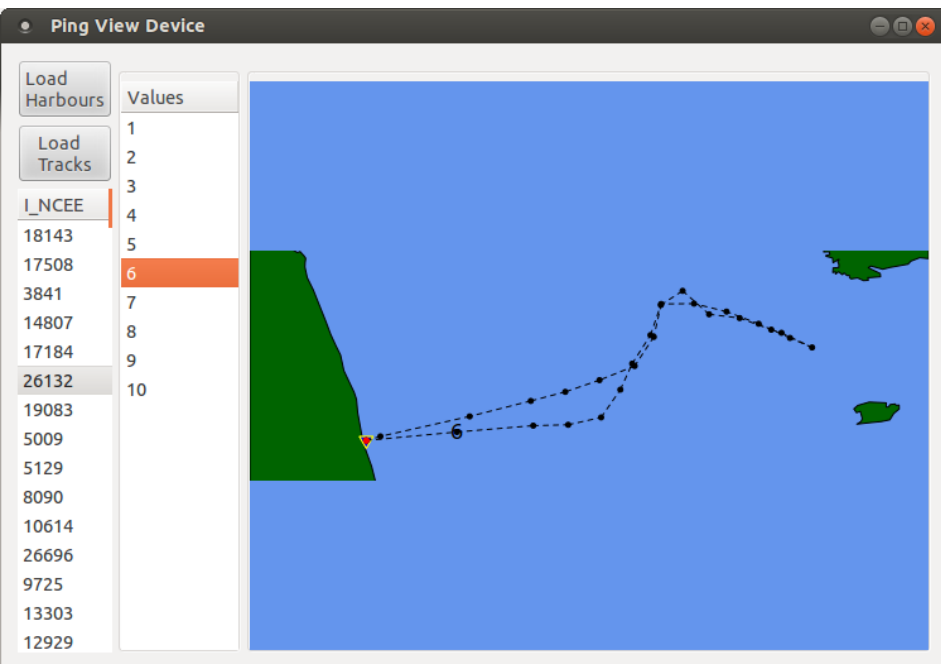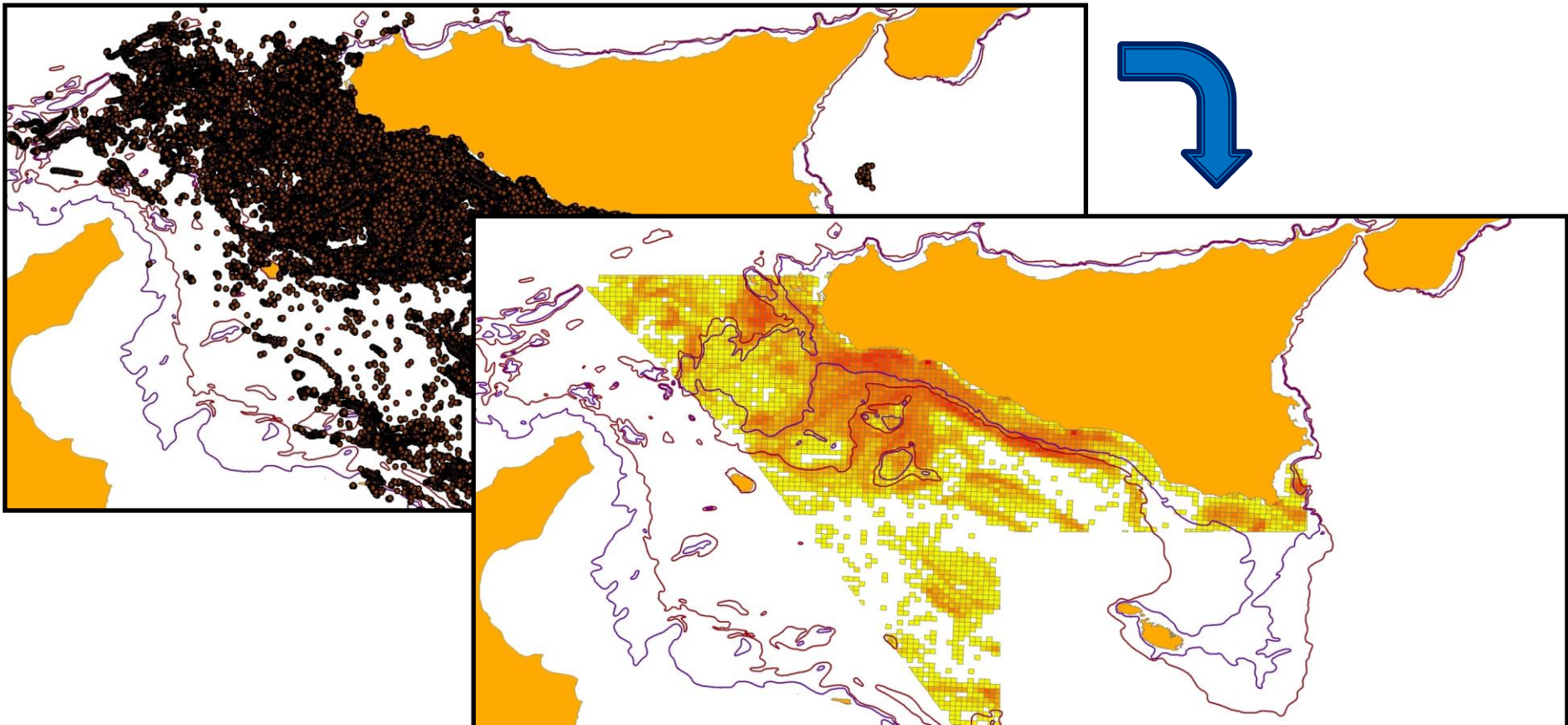
VMS Base allows to:

- Map the fishing effort (using google maps resources)

VMS Base allows to:

- Analyzing and mapping fishing effort pattern for whatever spatio-temporal window

Main applications and results

1. **Data Collection Framework**: 7 years of survey on spatial pattern of fishing efforts
2. **Fishing Grounds evolution**: where and how much we fish
3. Supporting the **Marine Strategy Framework**: the role of fishing effort in ecosystems disturbance
4. Developing **SMART**: a spatially explicit bioeconomic model for assessing and managing demersal fisheries

2. Fishing Grounds evolution: where and how much we fish

Contents lists available at SciVerse ScienceDirect
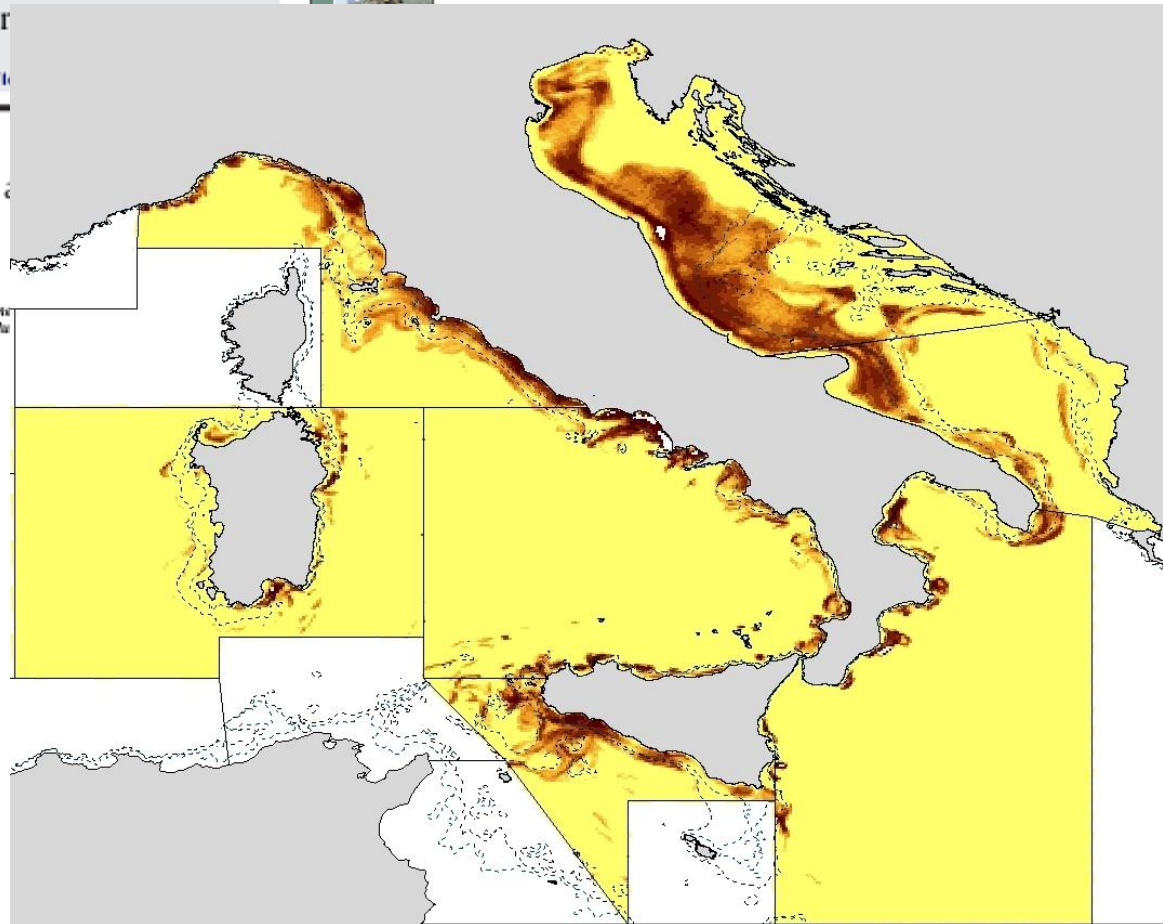
Ecological Indicator

journal homepage: www.elsevier.com/l

ELSEVIER

Spatial indicators of fishing pressure: Preliminary a developments

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**We developed a statistical method to identify fishing grounds and to track spatio-temporal changes in their pattern.**

- Analysis of fishing effort for large areas and in relation with sensible habitats
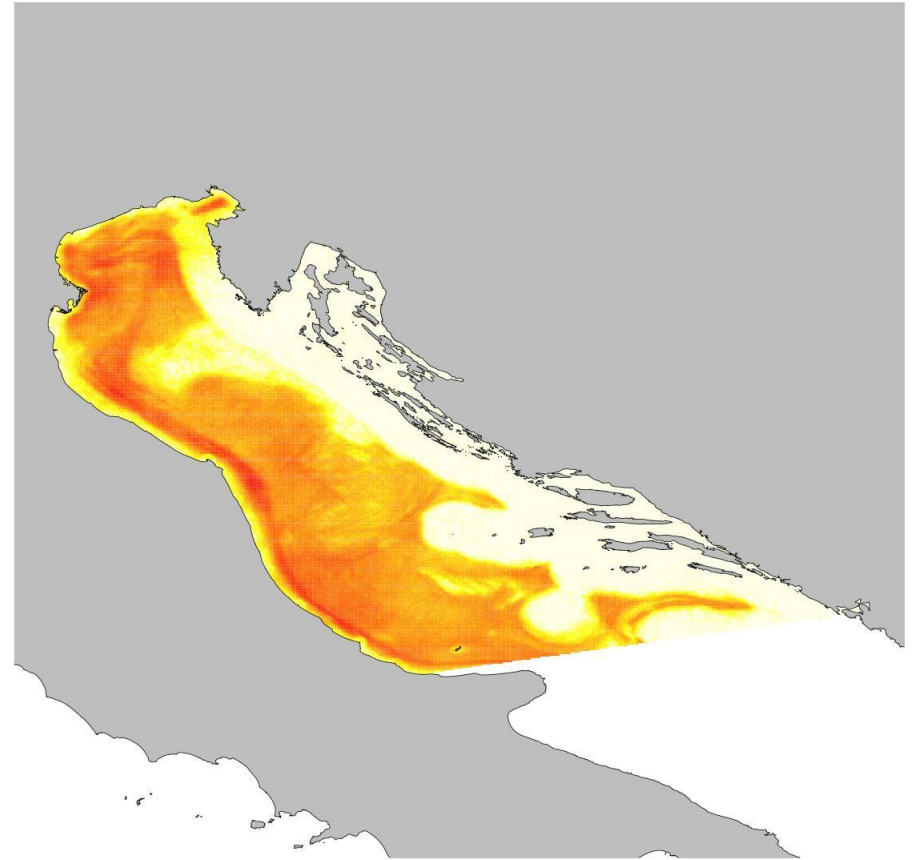
4. Developing SMART: a spatially explicit bioeconomic model for assessing and managing demersal fisheries

- A predictive model (based on Artificial Neural Network) that allows to predict the effects of fishing effort management on exploited species

RESOURCES

ENVIRONMENT

FISHING EFFORT

VMS

Input

Hidden

Output

EVALUTION OF MANAGEMENT SCENARIO
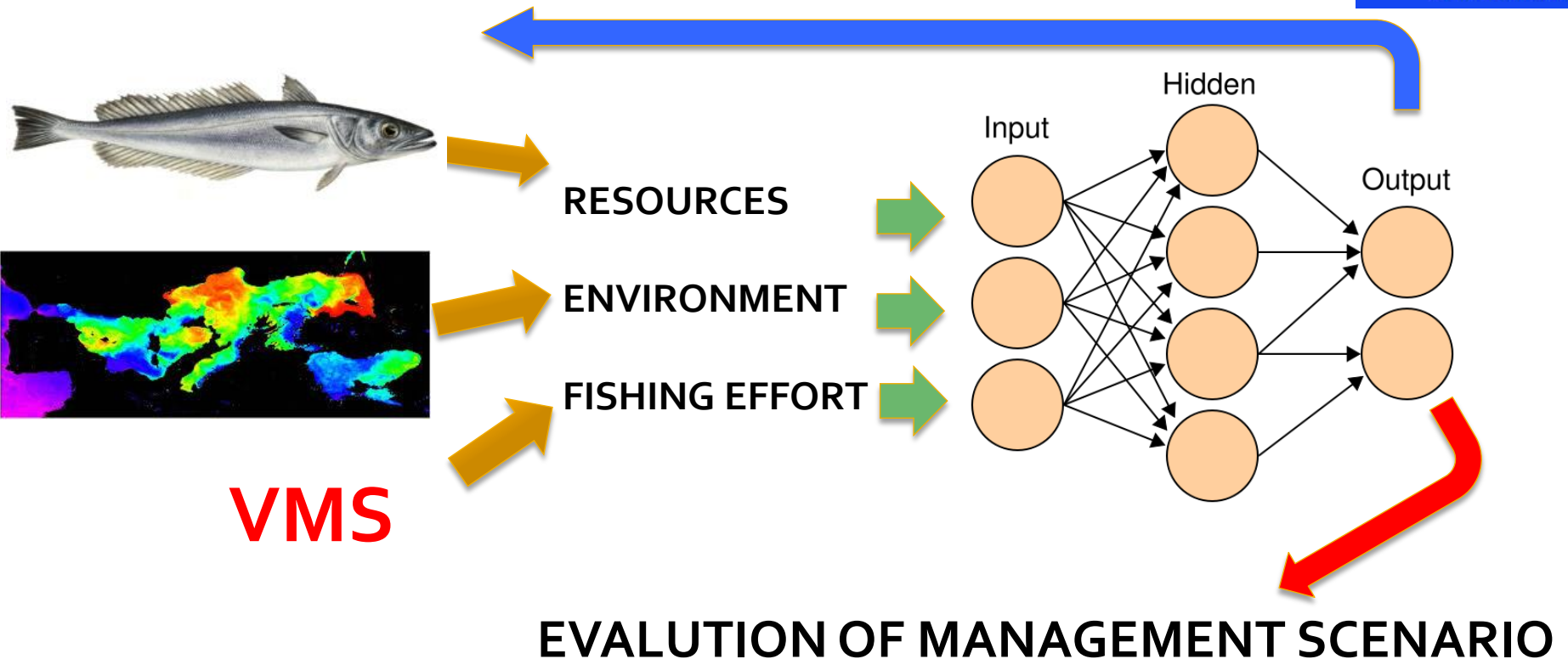
VMS Base: planned release

- The software will be distributed and supported **freeware** by a dedicated webpage

- The first planned release is:

  - **15 november 2013**

- Future developments:

  - integration of VMS with Automatic Identification System (AIS)

  - Possibility to download and process environmental data (e.g. sea surface temperature)

Thank you for the attention

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