

# Building on **iMarine** for fostering Innovation, Decision making, Governance and Education

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*ISTI-CNR*

# iMarine

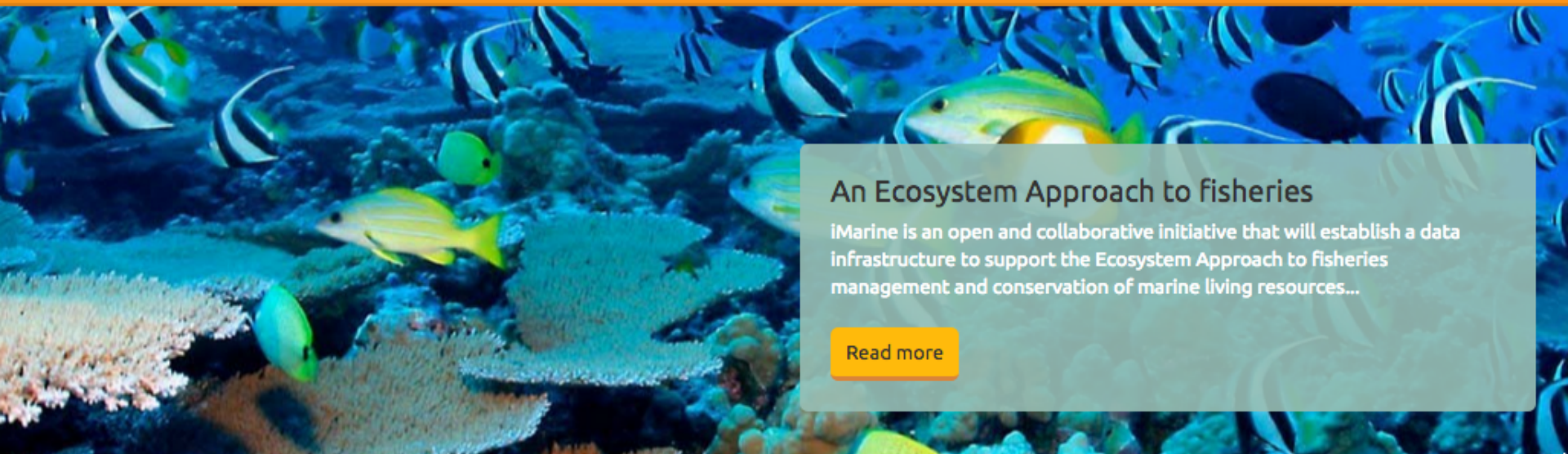
*EU FP7 e-Infrastructure (2013-2014)*



Data e-Infrastructure Initiative for Fisheries Management and Conservation of Marine Living Resources

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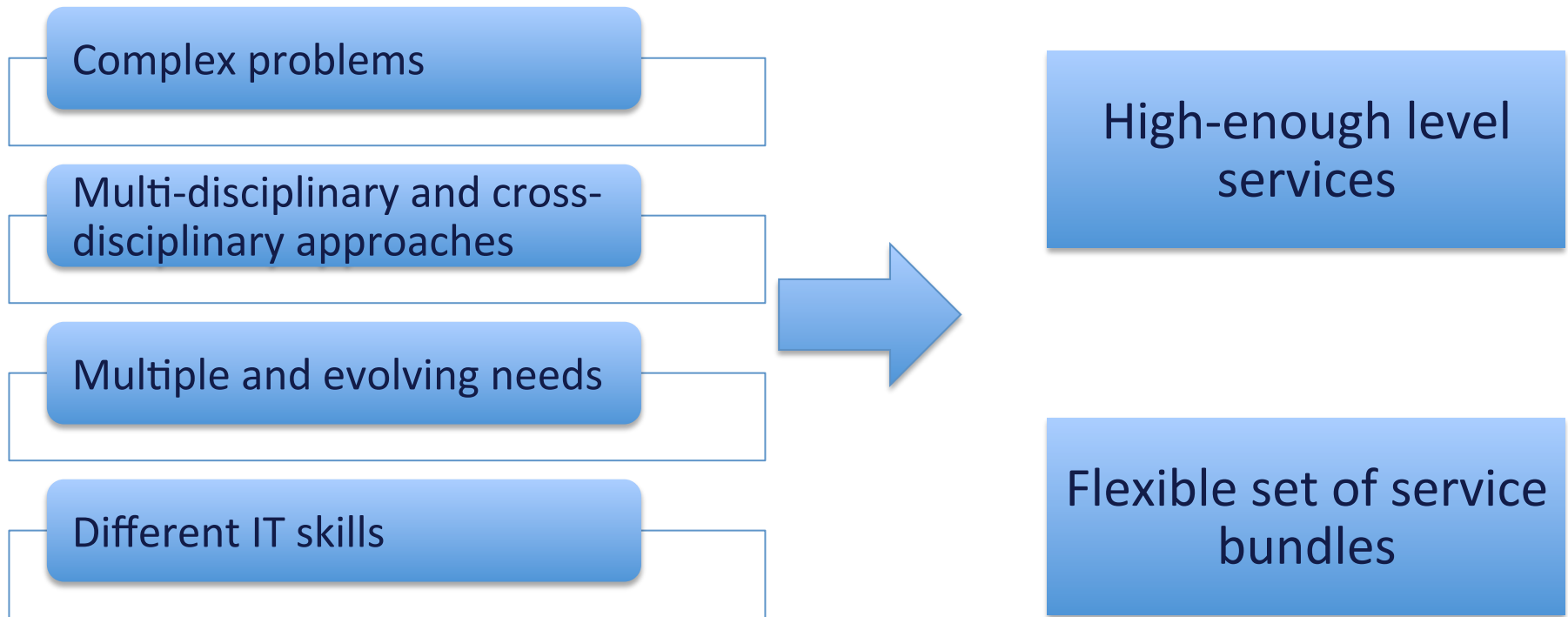


## An Ecosystem Approach to fisheries

iMarine is an open and collaborative initiative that will establish a data infrastructure to support the Ecosystem Approach to fisheries management and conservation of marine living resources...

[Read more](#)

# Context & Requirements



# Virtual Research Environments

[i-marine.d4science.org](http://i-marine.d4science.org)

**i-marine Gateway**  
Data e-Infrastructure Initiative for Fisheries Management and Conservation of Marine Living Resources


Powered by **D4SCIENCE.ORG**

Home Profile Available Research Environments

## Available Research Environment

**gCubeApps** a series of free-to-use applications to generate new knowledge from data comprising support for tabular data validation data enrichment and efficient analytical tools.


Public



**BiodiversityLab**

Enter this VRE Info


Public



**ScalableDataMining**

Enter this VRE Info


Public



**TabularDataLab**


Enter this VRE Info

**FARM** a series of community driven applications for the production of Fisheries and Aquaculture Fact Sheets the management of catch statistics and the dynamic generation of distribution maps.



**AquaMaps**


Request access Info



**BOBLME\_HilsaAWG**


Request access Info

Gudis morrua




**BiOnym**

Request access Info




**FAO\_TunaAtlas**

Request access Info




**TBTI\_VRE**

Request access Info




**VME-DB**

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**WECAFC-FIRMS**

Request access Info



**iMarineBoardVRE**

Request access Info

## Virtual Research Environment

- **web-based working environment**
- providing access to services and resources tailored to serve the needs of a community of practice **in accomplishing a specific goal**
- **open and flexible** with respect to service offering and lifetime
- providing fine-grained **controlled sharing** of both intermediate and final research results

## Public VREs

- Open to any interested users

## Private VREs

- Restricted to the members of a collaborating team performing specific experiments and tasks

# Data curation & integration:

## FAO Tuna Atlas VRE

Data collected by RFBs maintained in FAO managed DBs

- The Atlas of Billfish Catches
- The Global Tuna Catches by Stocks

### Curation

Normalise data, delete columns and aggregate catch data, delete duplicated records, aggregate valid duplicates, aggregate time dimensions, apply reference data codes, discovery error in codes, fix errors in codes, simple preprocessing, ...

FAO\_TunaAtlas



RFMOs



The screenshot displays a software interface with several components:

- Properties Panel (Left):** Shows metadata for a table named 'redfin\_catches'. Fields include Name, Description, Type, Agency, Date, Table Type, and Right.
- Data Table (Center):** A table with columns: year, quantity, reported\_quantity, value, and other identifiers. It shows data for years 1974 through 2010.
- Map (Right):** A world map with a red dot indicating a specific location in the Atlantic Ocean.
- Line Graph (Bottom):** A line graph showing 'Original Time Series' (red line) and 'Forecasted Time Series' (blue line) from 2008 to 2016. The y-axis represents a numerical value.

Tuna Atlas

# Analysis: Scalable Data Mining VRE

Public

01100000  
10010000  
11101010

Workspace > My Shared Projects > Meetings > Internal Project Meetings > 2013.06.17-20.5th.TCCom @ Siliabos > Day 2

Search in workspace

Tree Smart Folder

Completed Projects

ENVI

Meetings

Internal Proj

Data access & dataset preparation

Go to Manage search workspace

Statistical Manager Trendlyzer

MANAGER

### Access to the Data Space

The data space contains the set of input and output data sets of the users. It is possible to upload and share tables. Data sources can be chosen from those hosted by the infrastructure. Outputs of the computations can be even saved in this space.

### Execute an Experiment

This section allows to execute or prepare a Niche Modeling experiment. The section is endowed with a list of algorithms for training and executing statistical models for biological applications. Evaluation of the performances is possible by means of several kinds of measurement systems and processes.

### Check the Computations

This section allows to check the status of the computation. A list of processes launched by the user is shown along with meta-information. By clicking on the completed jobs it

STATISTICAL MANAGER

Configuration

Feed Forward ANN Distribution

Parameters

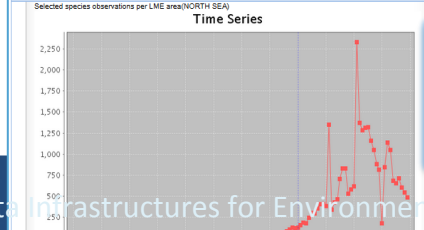
Feed Forward ANN Distribution

STATISTICAL MANAGER

Computations

ID	Cat.	Name	Operator	Infrastructure	Start Date	End Date	Status
1.	2.	Species Observation Lme Area Pe Year-2013-10-08 11:31	Species Observation Lme Area P...	LOCAL	10/08/20...	10/08/20...	Complete
2.	2.	Aquamaps Suitable-2013-09-10 15:14	Aquamaps Suitable	DASCENCE	09/10/20...	09/10/20...	Complete
3.	2.	Maps Comparison-2013-09-12 09:37	Maps Comparison	LOCAL	09/12/20...	09/12/20...	Complete
4.	2.	Taxonomy Observations Trend Pe... Year-2013-09-09 10:21	Taxonomy Observations Trend Pe...	LOCAL	09/09/20...	09/09/20...	Complete
5.	2.	Fin Taxa Match-2013-09-09 10:20	Fin Taxa Match	LOCAL	09/09/20...	09/09/20...	Complete

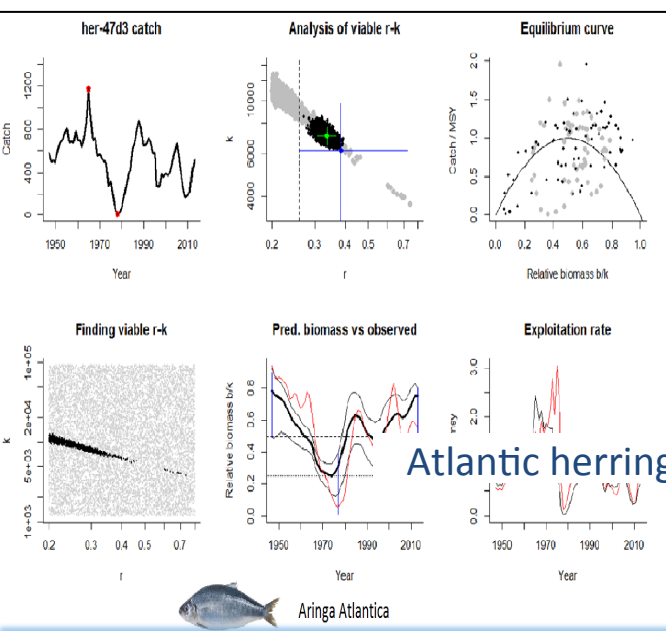
- 100+ statistical models
- Transparent use of cloud computing
- Automatically generated interfaces
- Integration with R



Monitoring of computation

# Statistical Manager: efficiency and efficacy

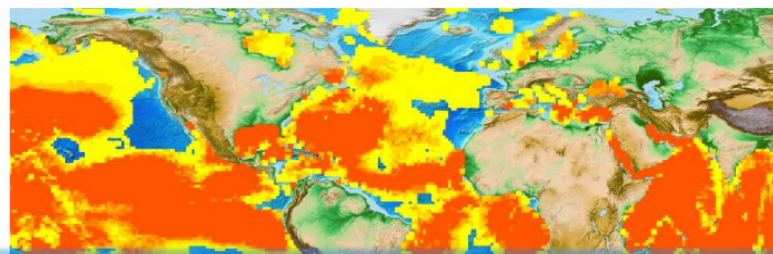
## Stock assessment



Atlantic herring

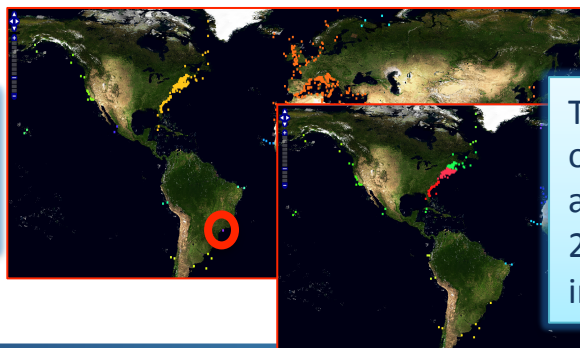
State-of-the-art models to estimate Maximum Sustainable Yield computational: reduced time by 95% in average

## Ecology



G. Coro et al. "Improving data quality to build a robust distribution model for Architeuthis dux.", Ecological Modelling", 2015 – "time to paper"= 2 months

## Clustering analysis

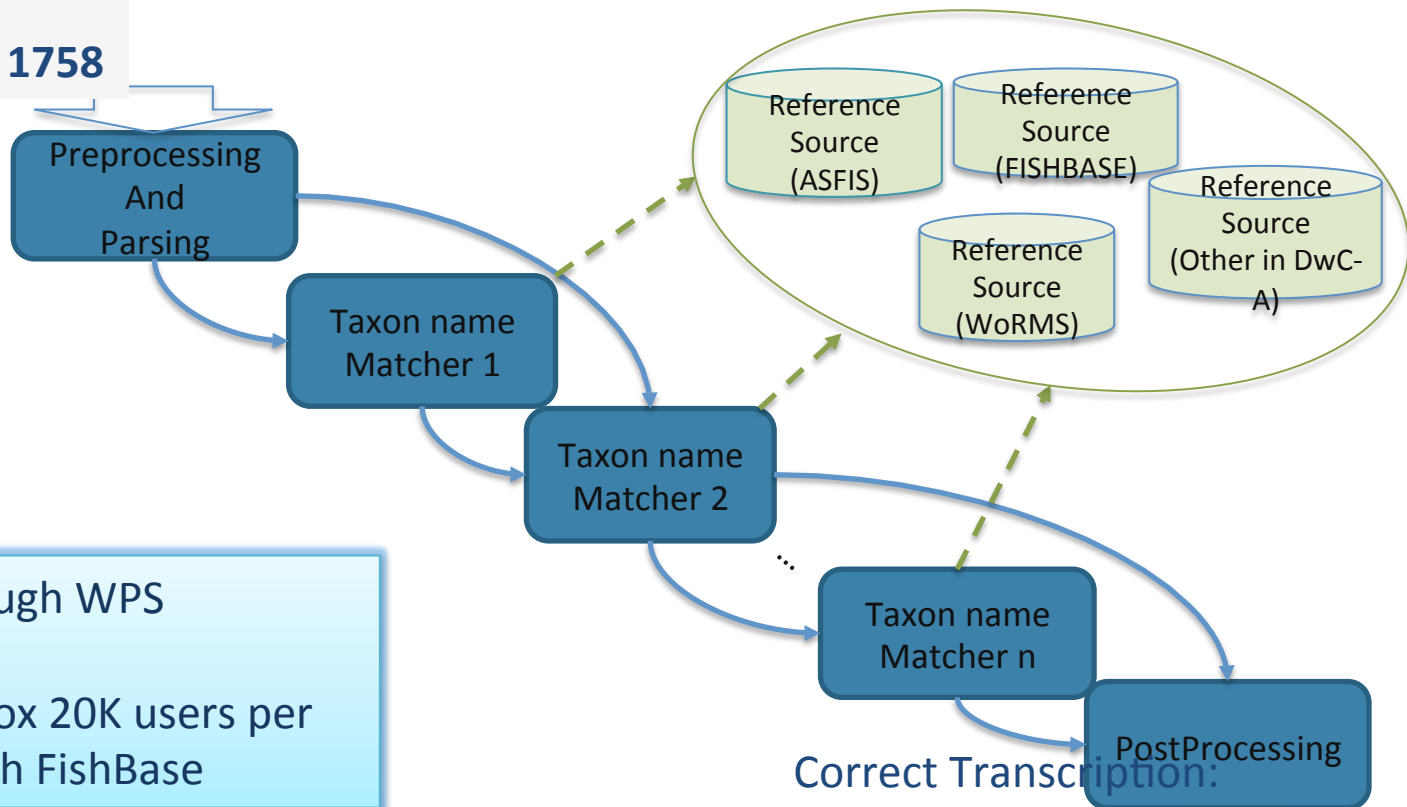


T.J. Webb et. al, "Detecting categories of species commonness: North Sea fish as a case study", Ecological Modelling, 2015, automatically produced validated indicators in 2 months

# Usage by third-party services providers: BiOnym

A flexible workflow approach to taxon name matching

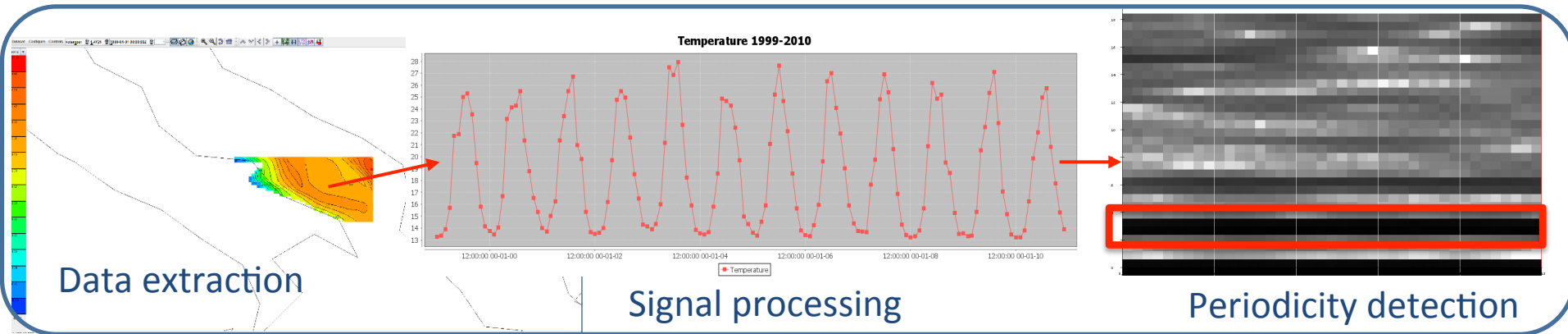
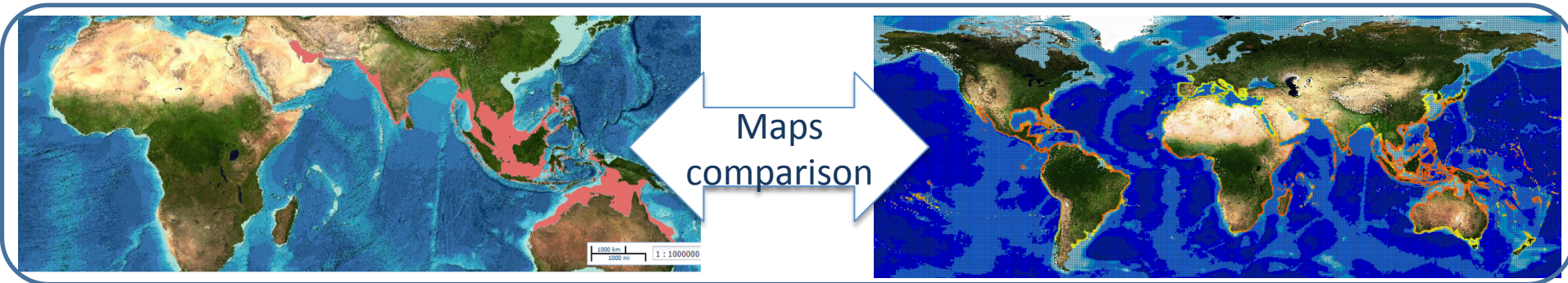
Raw Input String  
**Gadus morua Linnaeus 1758**



Available through WPS  
Currently approx 20K users per months through FishBase

Correct Transcription:  
**Gadus morhua (Linnaeus, 1758)**

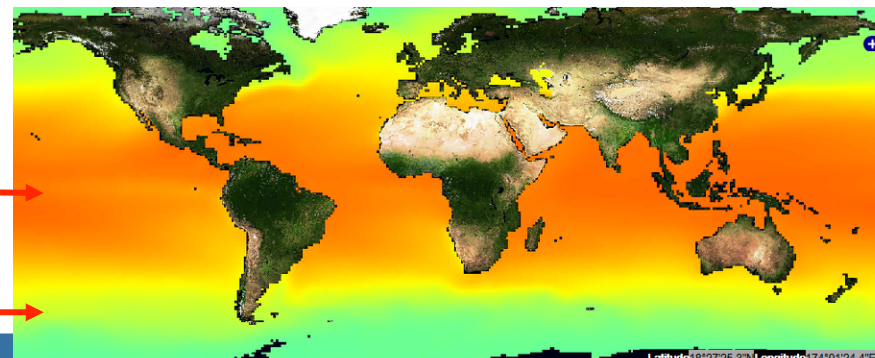
# Geospatial data processing








AD_MAJO	un_country	CL_SPECIES	Year	obsvalue	unit
27	56	HER	2008	0	t
27	833	HER	1990	552	t
27	833	HER	1991	629	t
27	833	HER	1992	856	t
27	833	HER	1993	775	t
27	833	HER	1994	716	t
27	833	HER	1995	615	t
27	833	HER	1996	693	t
27	833	HER	1997	821	t
27	833	HER	1998	0	t
27	833	HER	1999	1	t
27	833	HER	2001	35	t
27	833	HER	2002	0	t
27	833	HER	2003	4	t
27	833	HER	2004	3	t
27	833	HER	2007	1	t
27	833	HER	2008	2	t
27	833	HER	2009	1	t
27	833	HER	2010	0	t
27	56	HER	1996	2	t
27	246	HER	1990	67748	t
27	246	HER	1991	53216	t
27	246	HER	1992	74051	t
27	246	HER	1993	79234	t

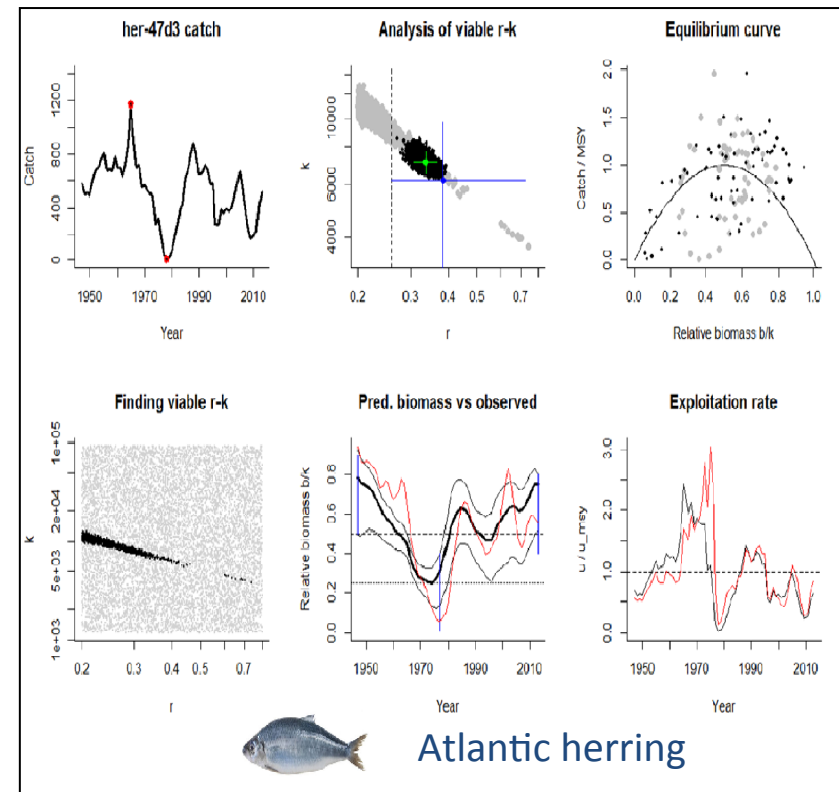
Maps generation

NetCDF file



# Stock assessment

-  **Length-Weight Relations:** estimates Length-Weight relation parameters for marine species, using Bayesian methods. Developed by R. Froese, T. Thorson and R. B. Reyes
-  **SGVM interpolation:** interpolation of vessels trajectories. Developed by the Study Group on VMS, involving ICES
-  **FAO MSY:** stock assessment for FAO catch data. Developed by the Resource Use and Conservation Division of the FAO Fisheries and Aquaculture Department (ref. Y. Ye)
-  **ICCAT VPA:** stock assessment method for International Commission for the Conservation of Atlantic Tunas (ICCAT) data. Developed by Ifremer and IRD (ref. S. Bonhommeau, J. Bard)
-  **CMSY:** estimates Maximum Sustainable Yield from catch statistics. Prime choice for ICES as main stock assessment tool. Developed by R. Froese, G. Coro, N. Demirel, K. Kleisner and H. Winker



**i-Marine reduced time-to-market:**  
 State-of-the-art models to estimate  
 Maximum Sustainable Yield  
 computational time reduced of 95%  
 in average

# Uniform access to data: *BioDiversityLab*



Search: Taxon By: Scientific name Term: sarda sarda

Advanced Option Filter by Source Filter by BBox Filter by Date Synonyms From Expand

Filter your results

By Classification

Group by: class

- Biota
  - Animalia
    - class - actinopteri(3)
    - class - actinopterygii(2)

Scientific Name	S.N. Authorship	Data Source
<input type="checkbox"/> Sarda sarda	(Bloch, 1793)	OBIS
<input type="checkbox"/> Sarda sarda	(Bloch, 1793)	CatalogueOfLife
<input type="checkbox"/> Sarda sarda chilensis	(Cuvier, 1832)	CatalogueOfLife
<input type="checkbox"/> Sarda sarda chilensis	(Cuvier, 1832)	CatalogueOfLife
<input type="checkbox"/> Sarda sarda	(Bloch 1793)	ASFIS
<input type="checkbox"/> Sarda sarda	(Bloch, 1793)	WoRMS
<input type="checkbox"/> Sarda sarda chilensis	(Cuvier, 1832)	WoRMS
<input type="checkbox"/> Sarda sarda chilensis	(Cuvier, 1832)	WoRMS

By Data Provider +

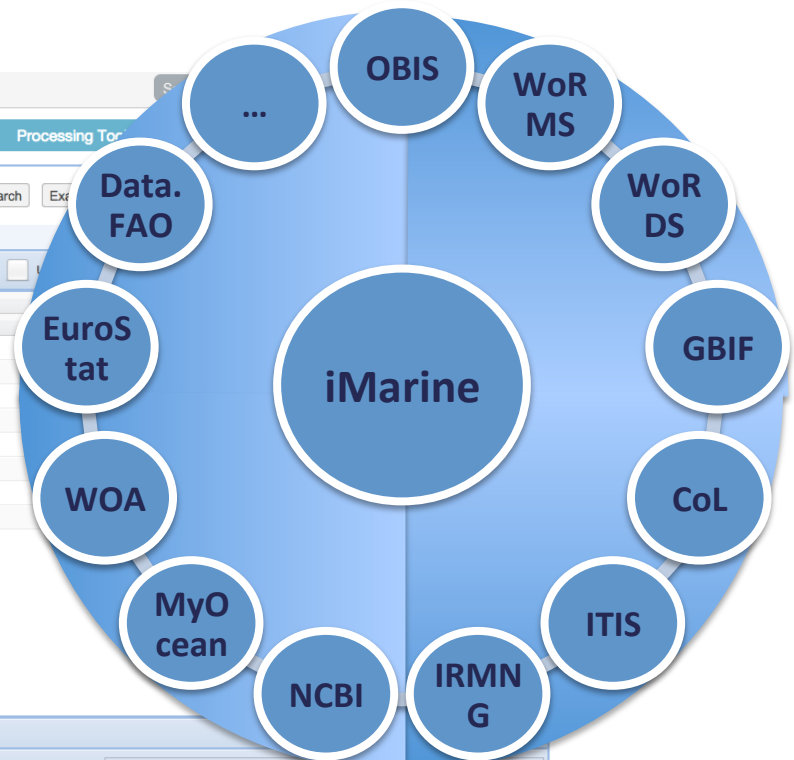
By Data Source +

By Rank +

Page 1 of 1

Species Taxonomy Jobs Species Occurrence Jobs

Current query: SEARCH BY SN 'sarda sarda' IN ASFIS, CatalogueOfLife, OBIS, WoRDS



# Report production: *VME-DB*

The **International Guidelines for the Management of Deep-Sea Fisheries on the High Seas**. **VME database** to assist in informed decision making and the development of further **measures to increase sustainability** and reduce impacts.

Time



VME record

Description (Habitat & Biology)

Specific measures

**Corner Seamounts** Selected year: 2012 Print PDF XML Source Citation

**Description** | **Map** | **Management** | **Regional overview** | **Meeting reports** | **Media**

**Measures specific to this VME area**  
 Area closed to bottom fishing until 31 Dec 2014, with exploratory fishing option. Vessels fishing this area shall have a scientific observer onboard. (Art 16.1-3)  
 Period in force: 2007 - 2014  
 Source of information  
 NAFO Conservation and Enforcement Measures 2012 (NAFO FC Doc 12/1 Serial No. N6001) Fisheries Commission 2012

**General measures**  
**Fishing areas**  
 The comprehensive map of existing bottom fishing areas (as delineated by the coordinates shown in Table 1 and illustrated in Figure 4) shall be revised regularly to incorporate any new relevant information. Contracting Parties may, in the future, consider the possibility of refining the comprehensive map on the basis of haul by haul information, if available. (Art.17)

**Exploratory fishing protocol**  
 Exploratory fishing covers all bottom fishing activities (a) outside of the existing bottom fishing area and (b) to fisheries within the existing bottom fishing area that show significant change. (Art 15.8). Exploratory fisheries must be conducted according to an exploratory fisheries protocol (Art 18; Annex 1E.I-IV) and are subject to review FC and SC. Exploratory fisheries will be allowed only if there are adequate mitigation measures to prevent SAI to VMEs (Art 19).

**Encounter protocols**  
 In existing bottom fishing areas, encounters with VME indicator species above a threshold value are reported to the Executive Secretary and trigger a 2 nmile move on rule. In new fishing areas, such encounters also result in temporary closures of 2 nmile radius and require a more detailed report

**Management Body/Authority**  
**Northwest Atlantic Fisheries Organization (NAFO)**  
 The Northwest Atlantic Fisheries Organization's (NAFO) overall objective is to contribute through consultation and cooperation to the optimum utilization, rational management and conservation of the fishery resources of its area of competence, and to ensure the long term conservation and sustainable use of the fishery resources and, in so doing, to safeguard the marine ecosystems in which these resources are found.

**Web site**  
<http://www.nafo.int/>

**Regional Fishery Body fact sheet**  
<http://www.fao.org/fishery/rfb/NAFO/en>



Historical information on fishing areas and closed areas

Meetings & other Sources of Information

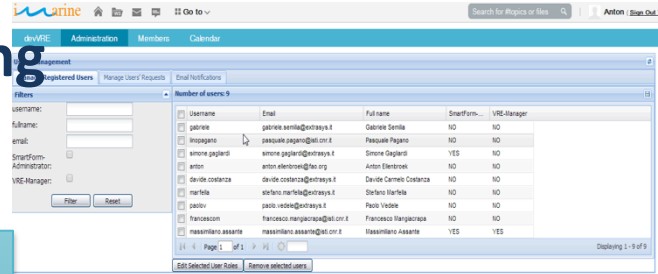
General Measures

RFMO

# Data collection: SmartForm VRE

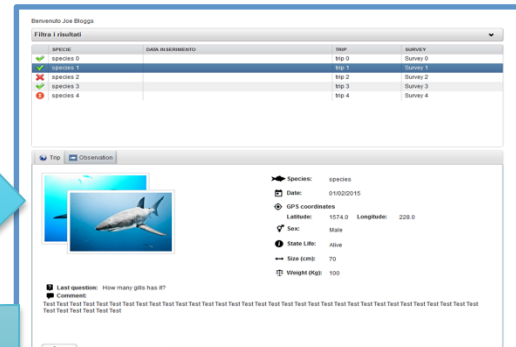
## On Board Bycatch recording

- Dutch Elasmobranch society
- SEAFO RFB, .....



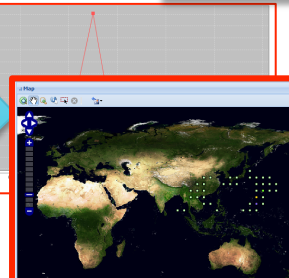
Define forms, controlled vocabularies, ...

Select a Fishery survey



Validate & Enrich

Analyse



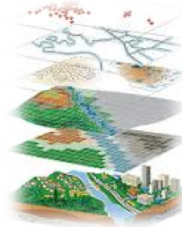
# iMarine e-infrastructure



Databases



Cloud storage



Geospatial data

## Storage

## Data management



Metadata generation and management



Harmonisation



Sharing



Cloud computing



Elastic resources assignment



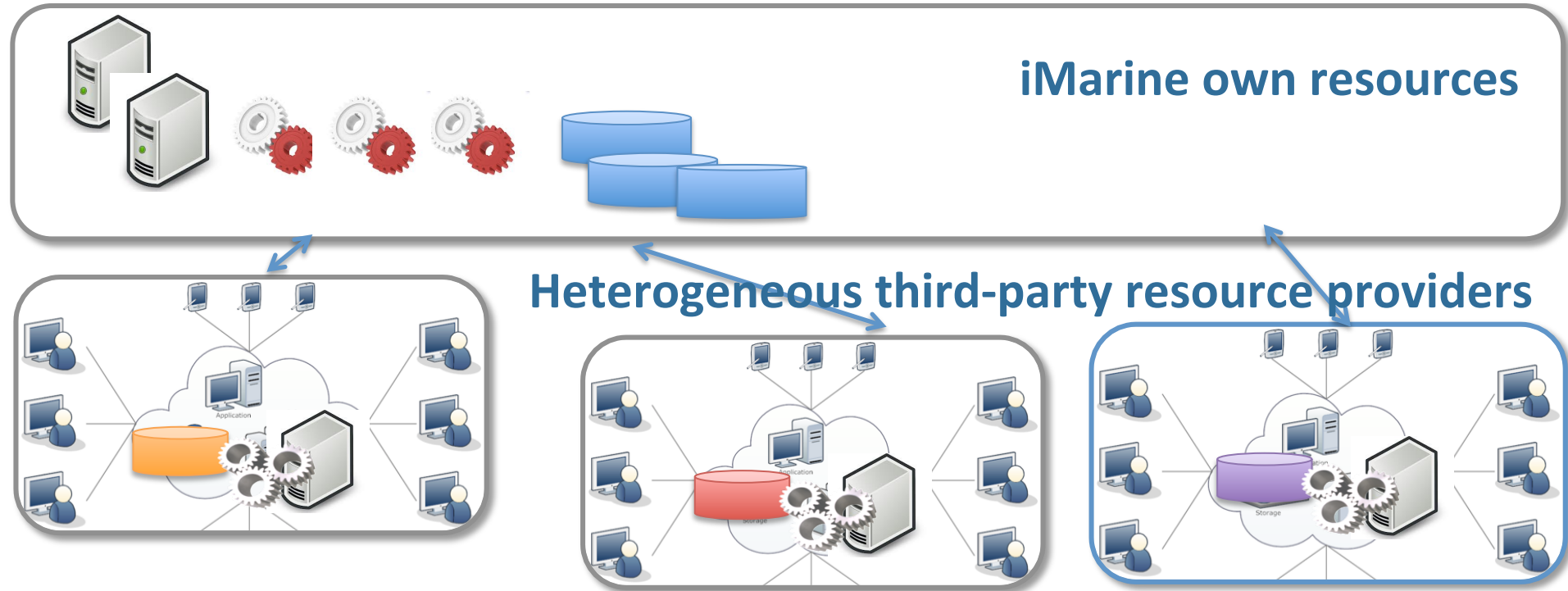
Multi-platform: R, Java, Fortran

## Processing

# iMarine from inside

iMarine own resources

Heterogeneous third-party resource providers



# Data Infrastructures: beyond research

- Solid ground for **informed advice to competent authorities**
- **Cost effective training & knowledge bridging** between research and innovation
- Enlarged spectrum of **growth opportunities**

Building Research environments fostering  
Innovation, Decision making, Governance and  
Education  
for Blue growth

Read More

H2020 EU EINFRA  
Sept 2015 –Febr 2018

# Six interrelated detailed objectives

## Blue Assessment

Collaborative production of scientific knowledge required for **assessing the status of fish stocks** and **producing a global record of stocks and fisheries**

## Blue Economy

Production of scientific knowledge for **analysing socio-economic performance in aquaculture**

## Blue Environment

Production of scientific knowledge **for fisheries & habitat degradation monitoring**

## Blue Skill

**Education and knowl. bridging** between research & innovation in the area of protection and mgmt of marine resources

## Blue Commons

**Service commons** across VREs to facilitate the exploitation of existing infrastructure resources

## Blue Uptake

**Uptake of the BlueBRIDGE tools and services**, with specific focus on SMEs, other scientific domains & policy making contexts

# References

- [www.i-marine.d4science.org](http://www.i-marine.d4science.org)
- [www.i-marine.ee](http://www.i-marine.ee)
- [www.bluebridge-vres.eu](http://www.bluebridge-vres.eu)
- [www.d4science.org](http://www.d4science.org)
- [www.gcube-system.org](http://www.gcube-system.org)

