A macro-ecological approach to the study of the vulnerability of aquatic environments to NIS:

a case study by the Virtual Research Infrastructure LifeWatch Italy

Angela Boggero, A. Basset, G. Corriero, A Pugnetti

XXII Congresso dell'Associazione Italiana di Oceanologia e Limnologia

Le alterazioni del ciclo dell'acqua

Verbania, 28 settembre - 1 ottobre 2015

http://www.lifewatch.eu

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Show Cases

Search...

The LifeWatch show cases will facilitate the development of integrative researches on key scientific issues by using already existing evidences, which will be organized and reinforced with additional LifeWatch information and made accessible to the scientific community and the general public.
The case studies thus far identified (and now in the starting phase) are:

- Monitoring Alien Species (coordinated by Italy),
- Migrating Birds (coordinated by Netherlands) and
- Wetlands (coordinated by Spain).

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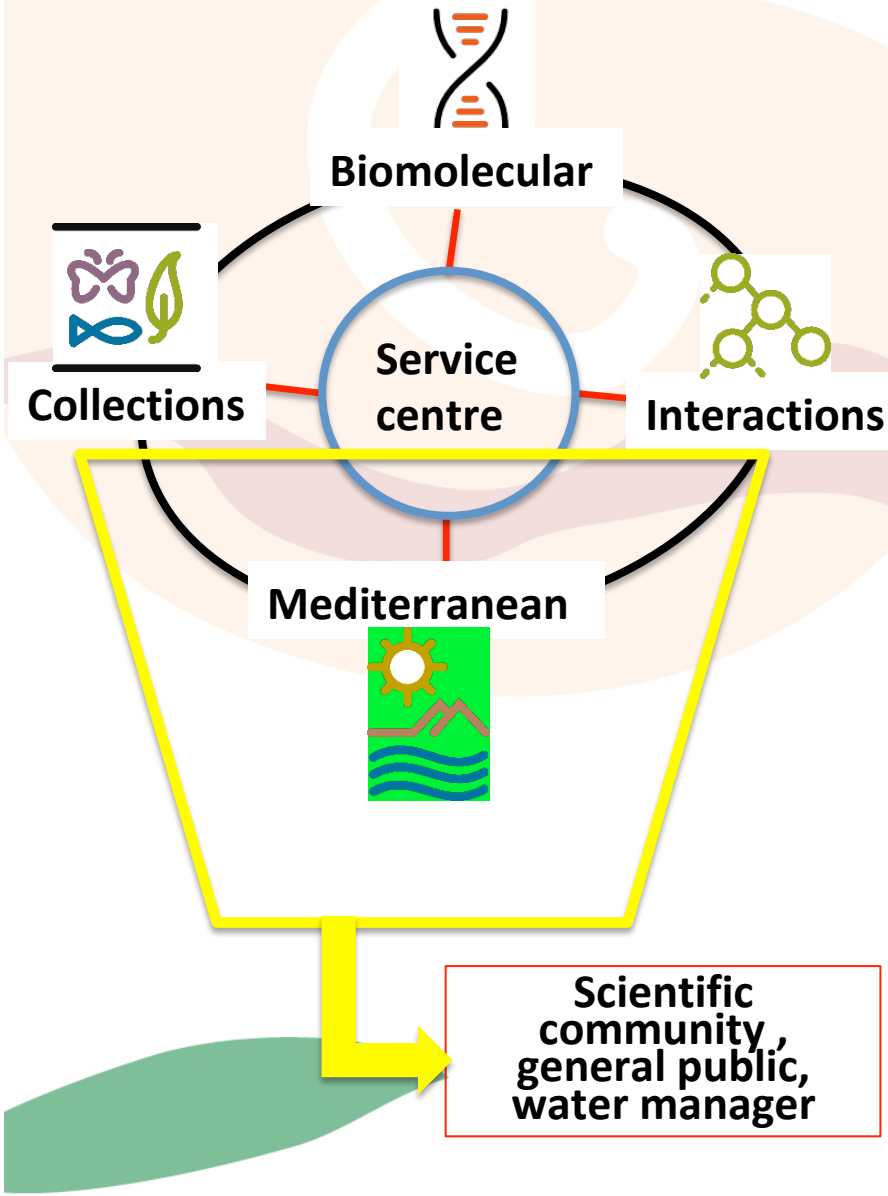
Targeted offers



LIFEWATCH opportunities:

- To capitalise on existing knowledge;
- To integrate inter-disciplinary fields, data sources and processing tools

for improving:

- our way to address innovative scientific questions;
- our current understanding of biodiversity;
- the certainty of environmental management, governance and policy

sharing software facilities

LifeWatch

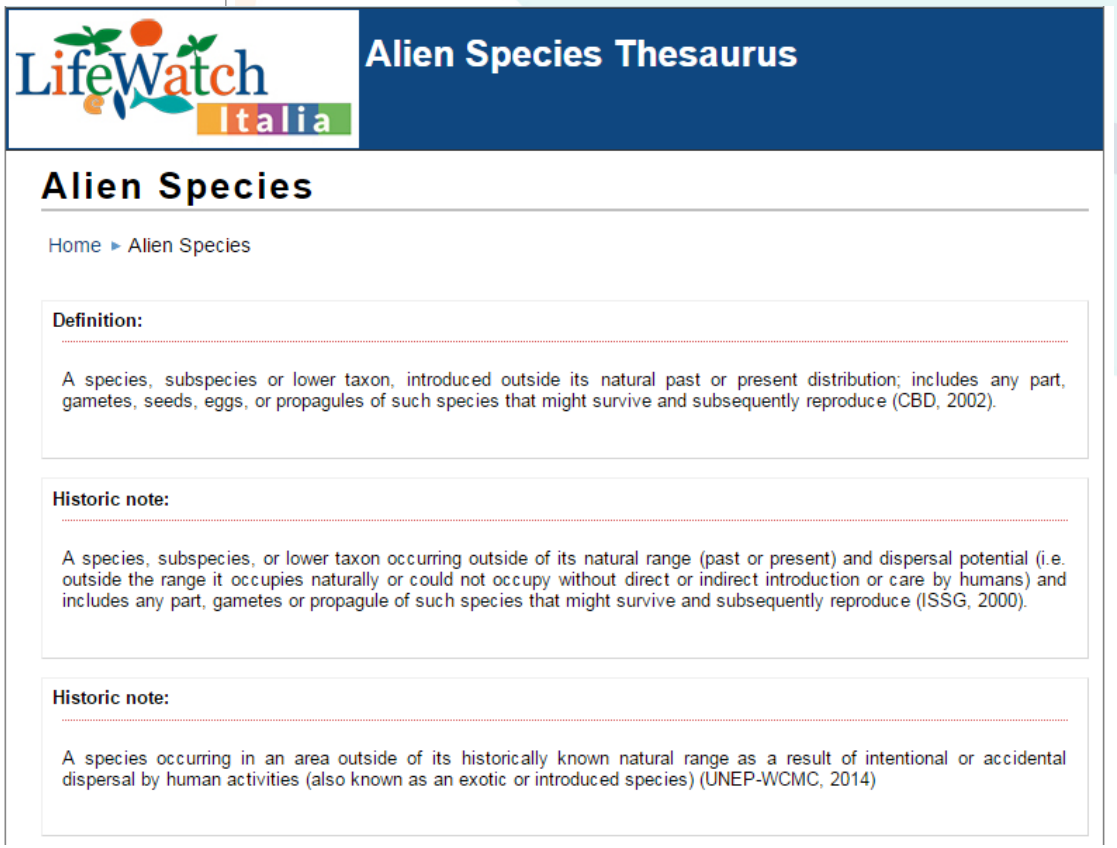
Show cases proposed

- *Wetlands* - SP (to study biodiversity in marine wetlands)
- *Migratory birds* - NL (to study their navigation and foraging strategies on land and at sea)
- *Alien species* - IT (to study the vulnerability of fresh-, marine and brackish waters and terrestrial habitats to AS invasion. The results will allow the mapping of the vulnerability of different ecosystem types)

These case studies were developed to demonstrate the functionality of the e-infrastructure and its potential

Data providers throughout Italy

Creation of a thesaurus



Alien Species definition

FW

- **1492**: any species deliberately or inadvertently introduced to Italy by human activities after the discovery of the New World by Columbus in 1492, similar to what plant invasion biologists call ‘neophytes’ (Pyšek, 1998)

MW & **TW**

- **1869**: all marine and lagoon species introduced into Italian waters since the opening of the Suez Canal (Zenetos et al., 2010)

The term alien is used in its broadest meaning, without considering the naturalization stage of species

A large database…

30-year time span

346 sites

26 habitats

34386 observations

42 taxonomic groups

12406 species

201 AS

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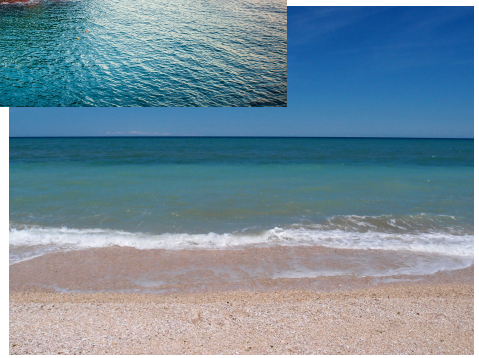
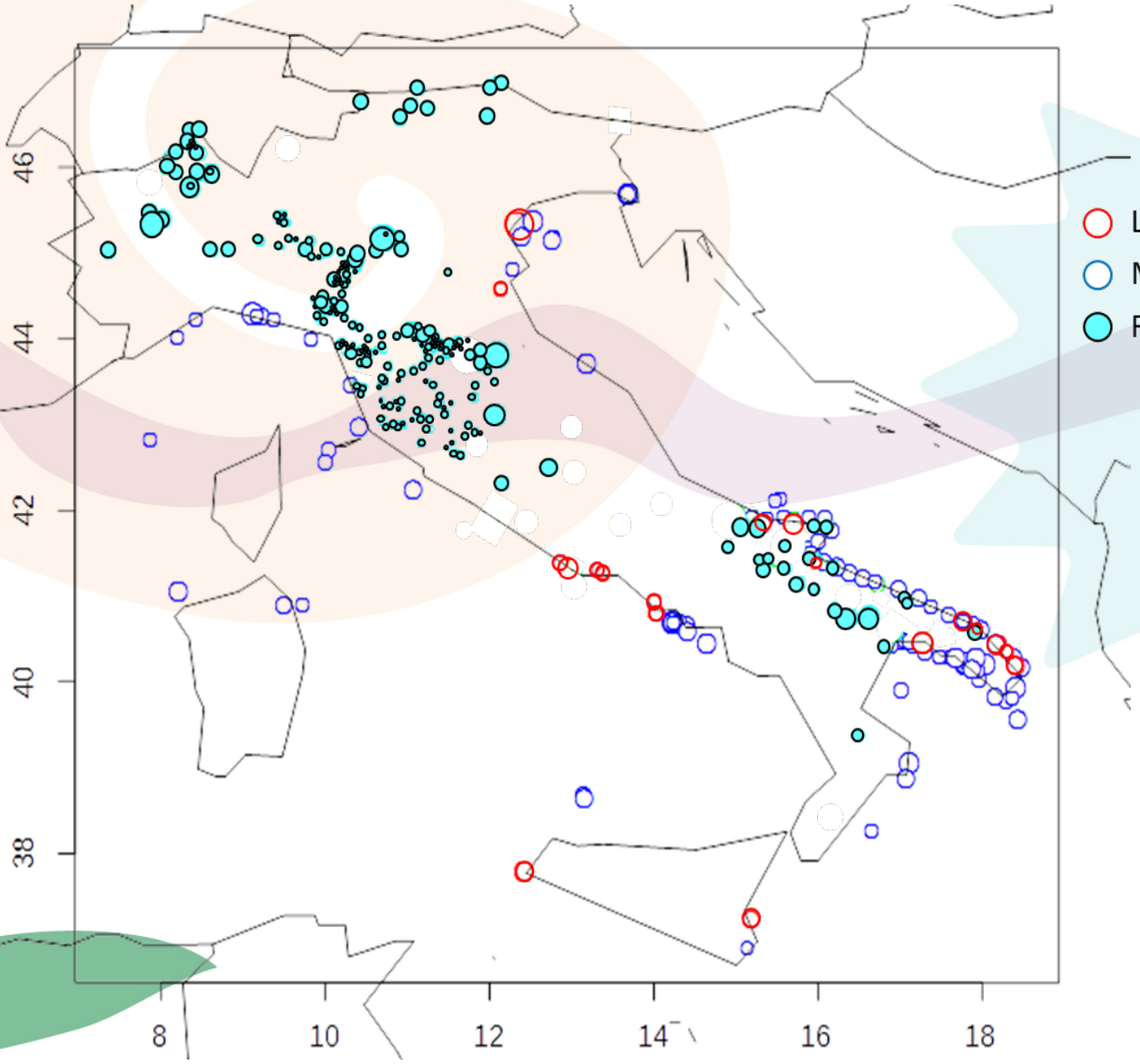
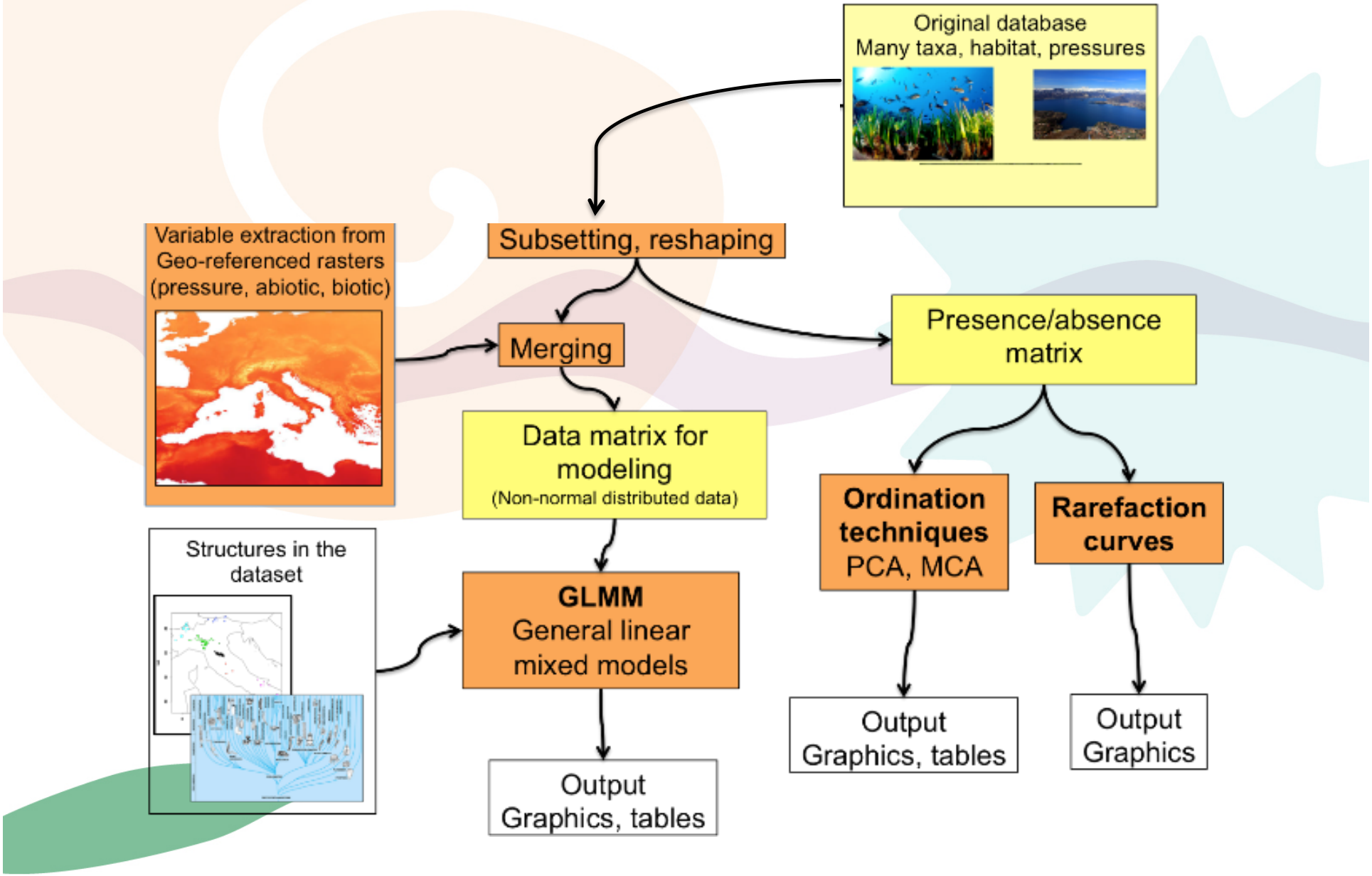


…covering the national territory

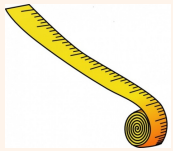


Lagoon	**21 sites**
Marine	**89 sites**
Freshwater	**236 sites**

A unified statistical workflow



…and integration of data



max length of a species (in mm)

precipitation amount (average 1950-2000)

WorldClim - Global Climate Data

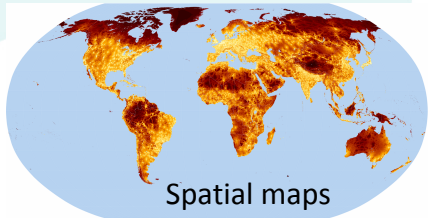
Free climate data for ecological modeling and GIS

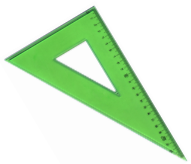
local temperature (average 1950-2000)

UNEP

United Nations Environment Programme

distance (in min) from large cities (inhabitants > 50000) (Nelson 2008)





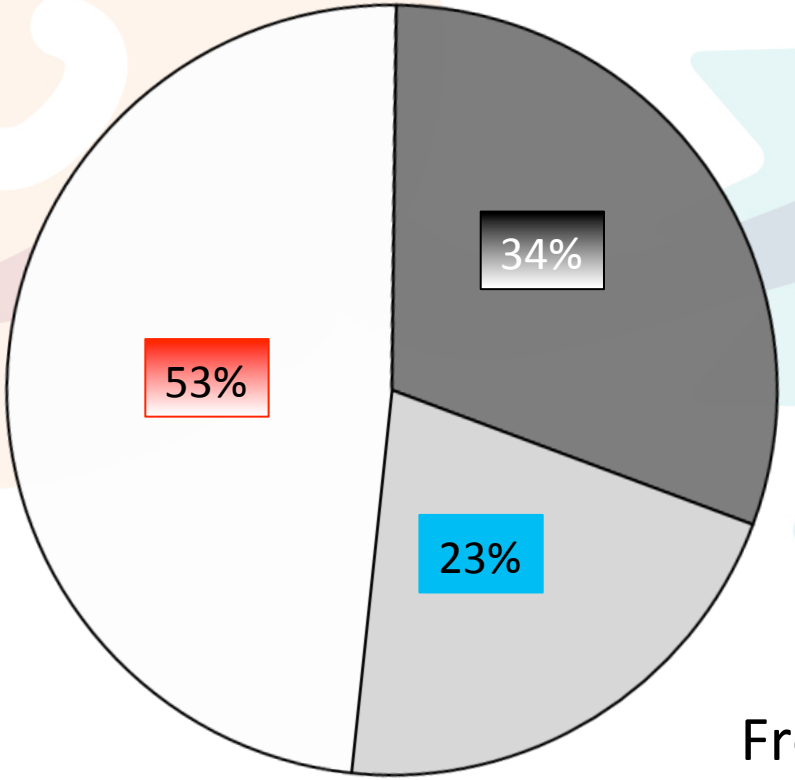
dimension of the study area (in m^2)

openness

other abiotic descriptors

AS distribution

201 AS

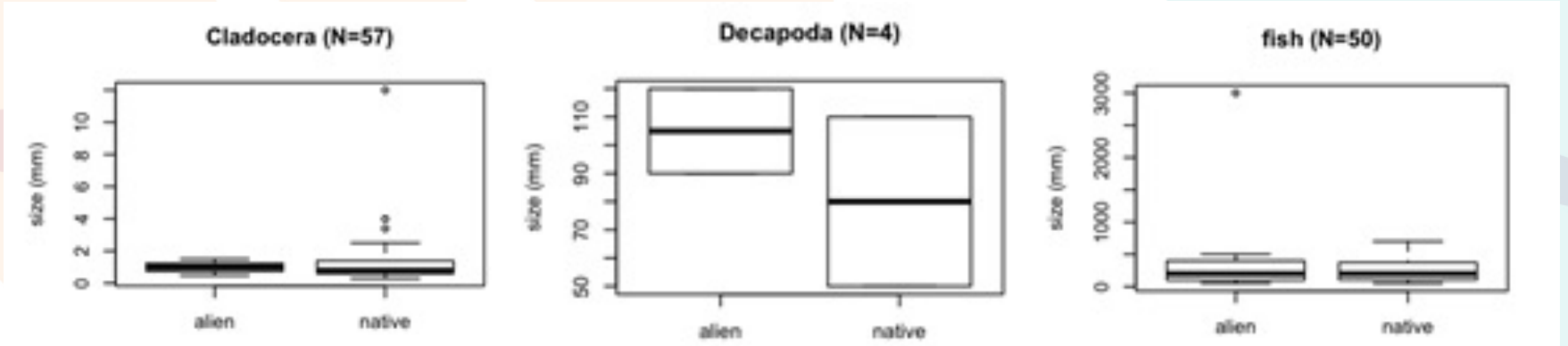


Marine waters
56 AS (1.5%)

Transitional waters
78 AS (4.9%)

Freshwaters
67 AS (2.6%)

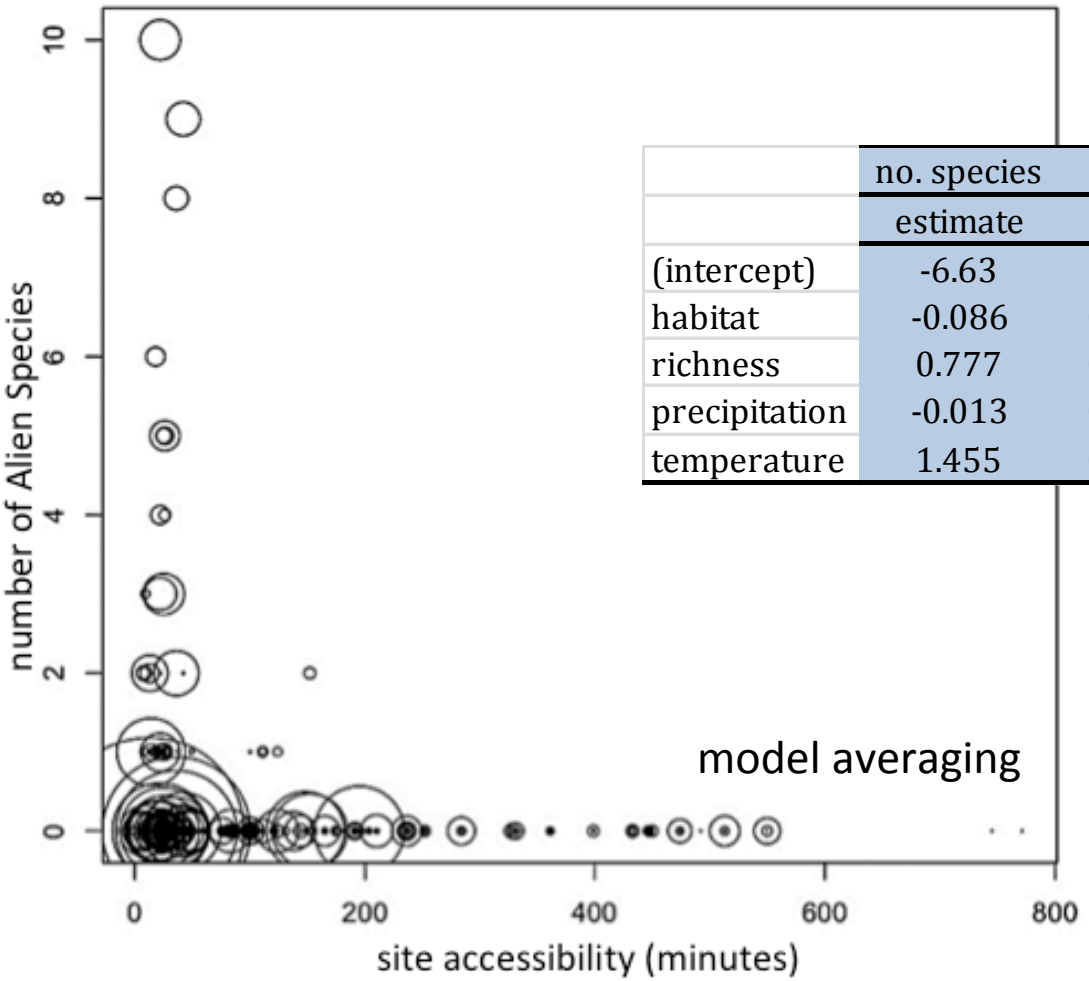
Freshwaters case study



One way ANOVA

In general, AS are not larger or smaller than native species

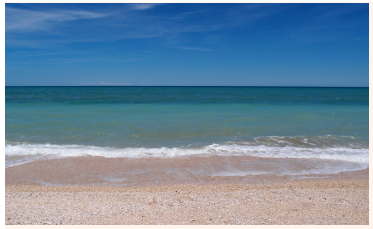
Freshwaters case study



linear Mixed Effect Model

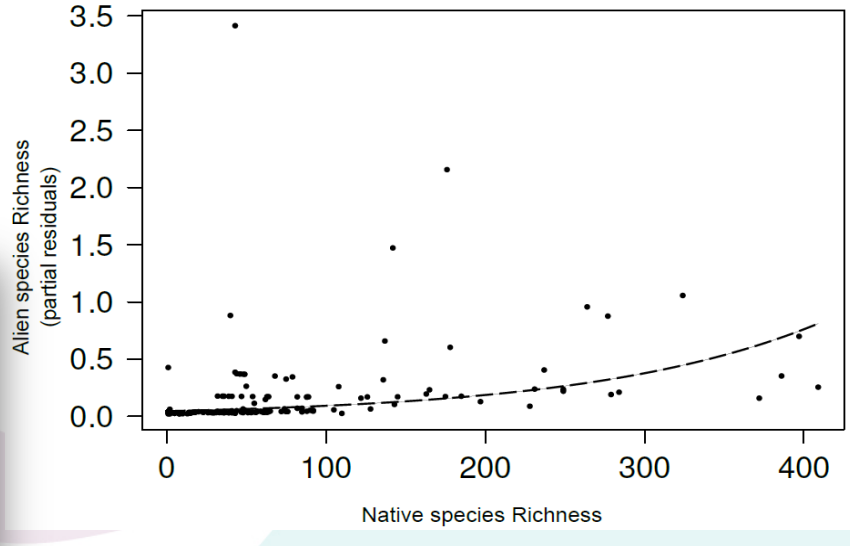
	no. species			% species		
	estimate	SE	p-values	estimate	SE	p-values
(intercept)	-6.63	1.19	<0.0001	-6.358	0.77	<0.0001
habitat	-0.086	0.398	0.8289	-0.603	0.376	0.1091
richness	0.777	0.204	0.0001	0.148	0.177	0.4012
precipitation	-0.013	0.138	0.9196	0.149	0.124	0.2277
temperature	1.455	0.302	<0.0001	1.112	0.266	<0.0001

AS no. positively correlated with species richness, accessibility and air temperature



Marine waters case study

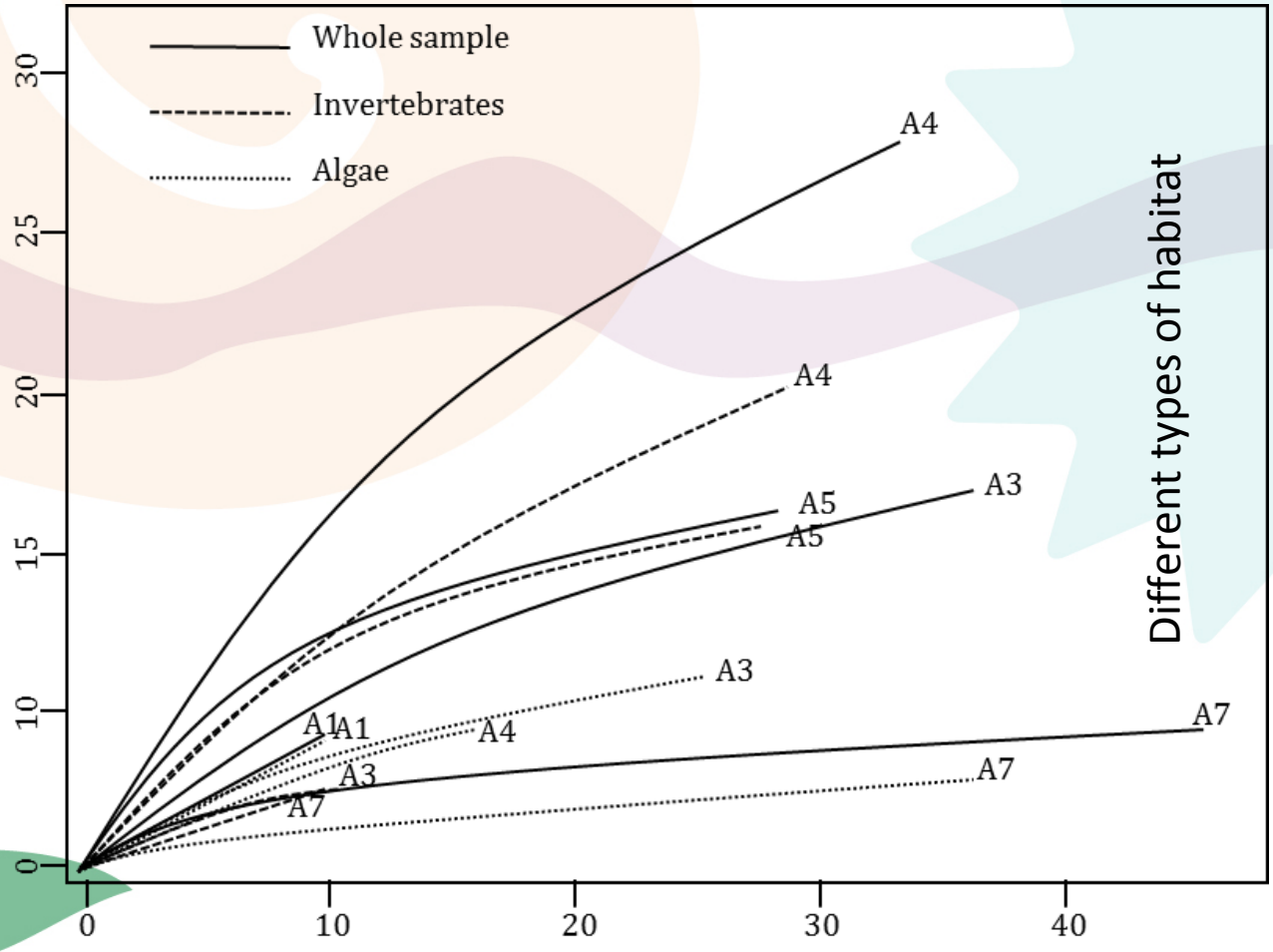
Positive correlation with species richness



Positive correlation with species richness and accessibility

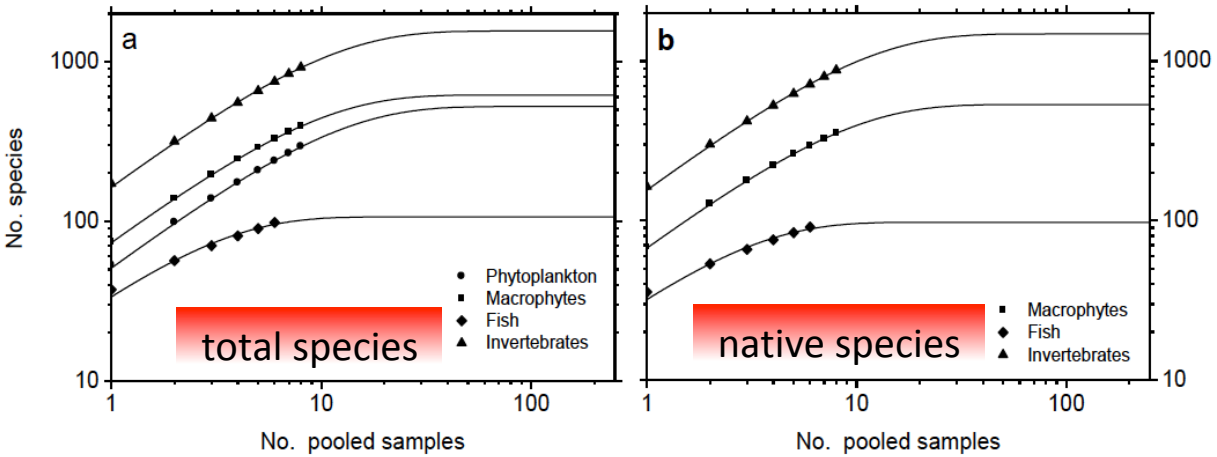
Marine waters case study

No habitat reached a plateau indicating that could host an even larger AS number



Transitional waters case study

Transitional waters represent ecotone ecosystems, naturally exposed to immigration from their freshwater and marine input environments



collected data on the growing portion of the curves suggest that the colonisation process is at an early stage

LagunNet

italian network for lagoon research

Transitional waters case study

Number of alien species			
	estimate	se	p
(intercept)	-3.252	0.714	<0.001
Openness	-0.500	0.145	<0.001
Richness (N Taxa)	-0.0004	0.0005	0.437
Salinity	0.005	0.016	0.769
Surface	0.006	0.002	<0.01
Habitat	-0.198	0.328	0.546
Vettori	0.028	0.053	0.592

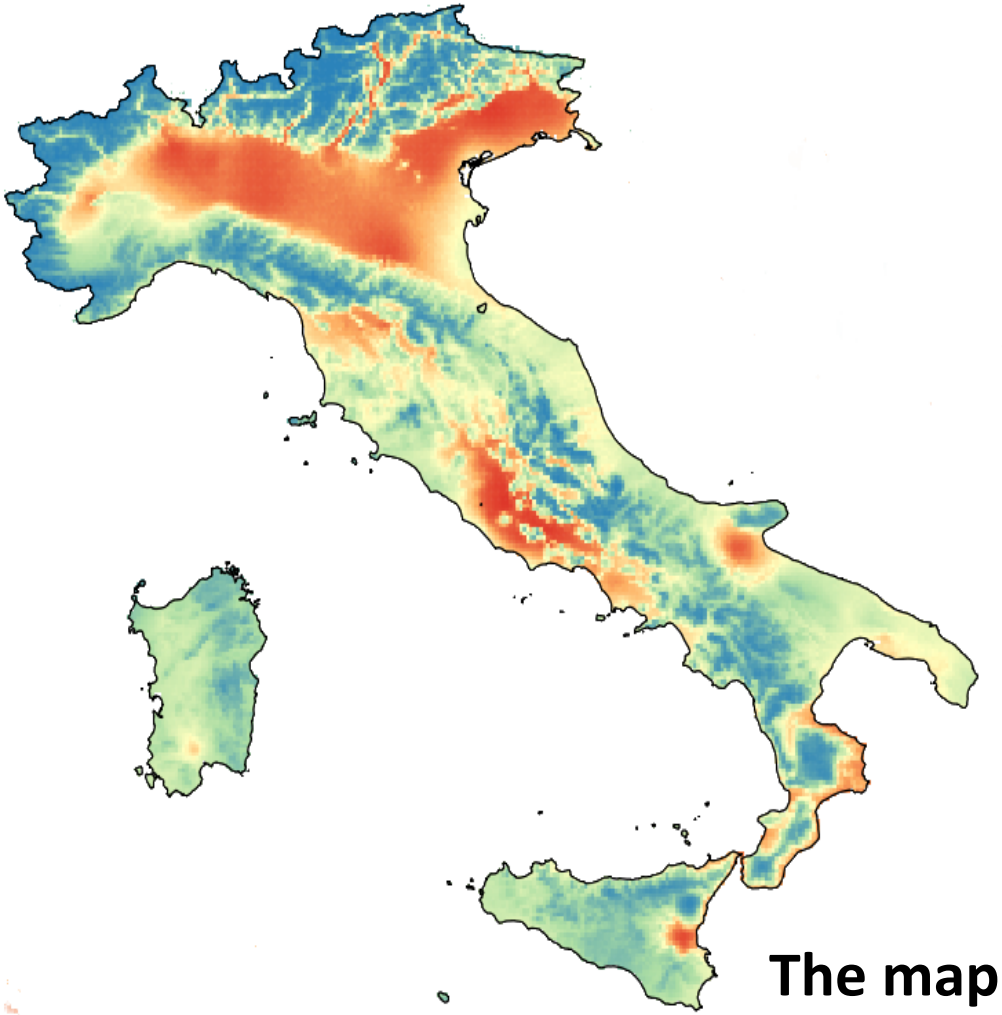
linear Mixed Effect Model

Openness and lagoon surface area show a positive effect on AS presence

Conclusions

- It is difficult to define the vulnerability of a habitat in relation to AS, being the vulnerability an intrinsic characteristic of the ecosystem related to stability, temporal variability, local climatic conditions, evenness, species succession, resistance etc.
- LifeWatch will contribute achieving a better understanding and managing of biological invasions in different habitats (from terrestrial to aquatic) along different perspectives, from macroecology to genomics.
- LifeWatch, through its network, favours the cooperation among researchers from diverse backgrounds, the sharing and the availability of data, and the request for information.
- LifeWatch leaves a professional asset to be used from persons concerned

Risk maps



Based on a model explaining AS occurrence through:

- Air temperature
- Precipitation amount
- site accessibility

Resolution ~ 5 km

The map highlights areas at high/low risk of invasibility

Implementation of tools

All analyses performed using dedicated R packages are one of the services provided by LifeWatch on the web

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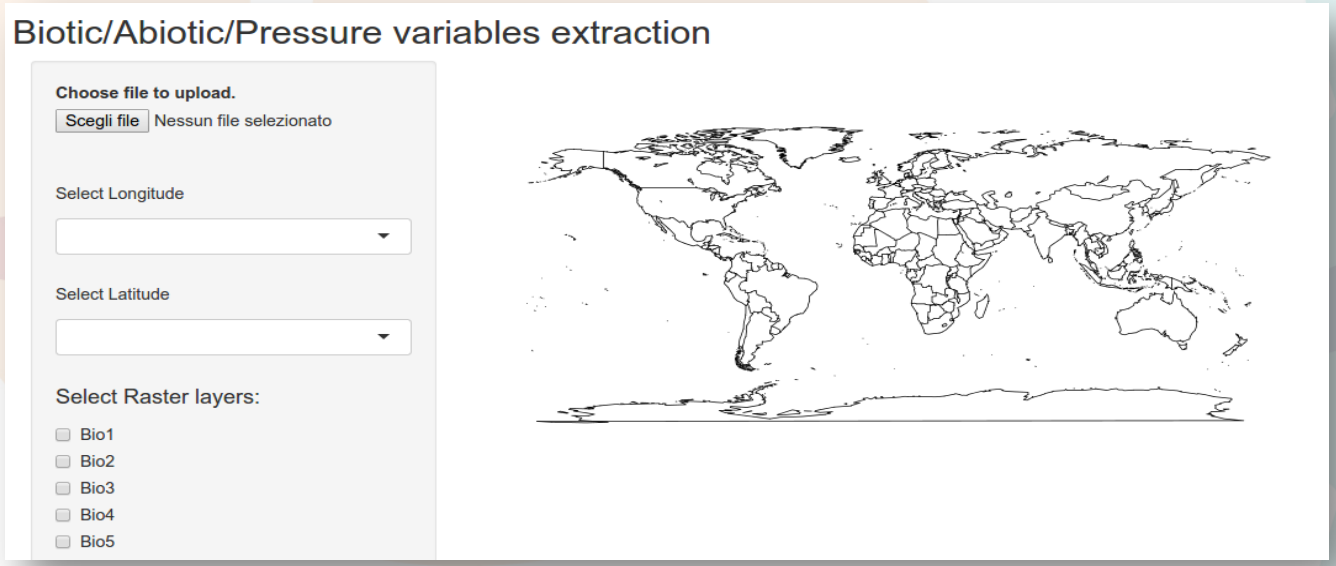

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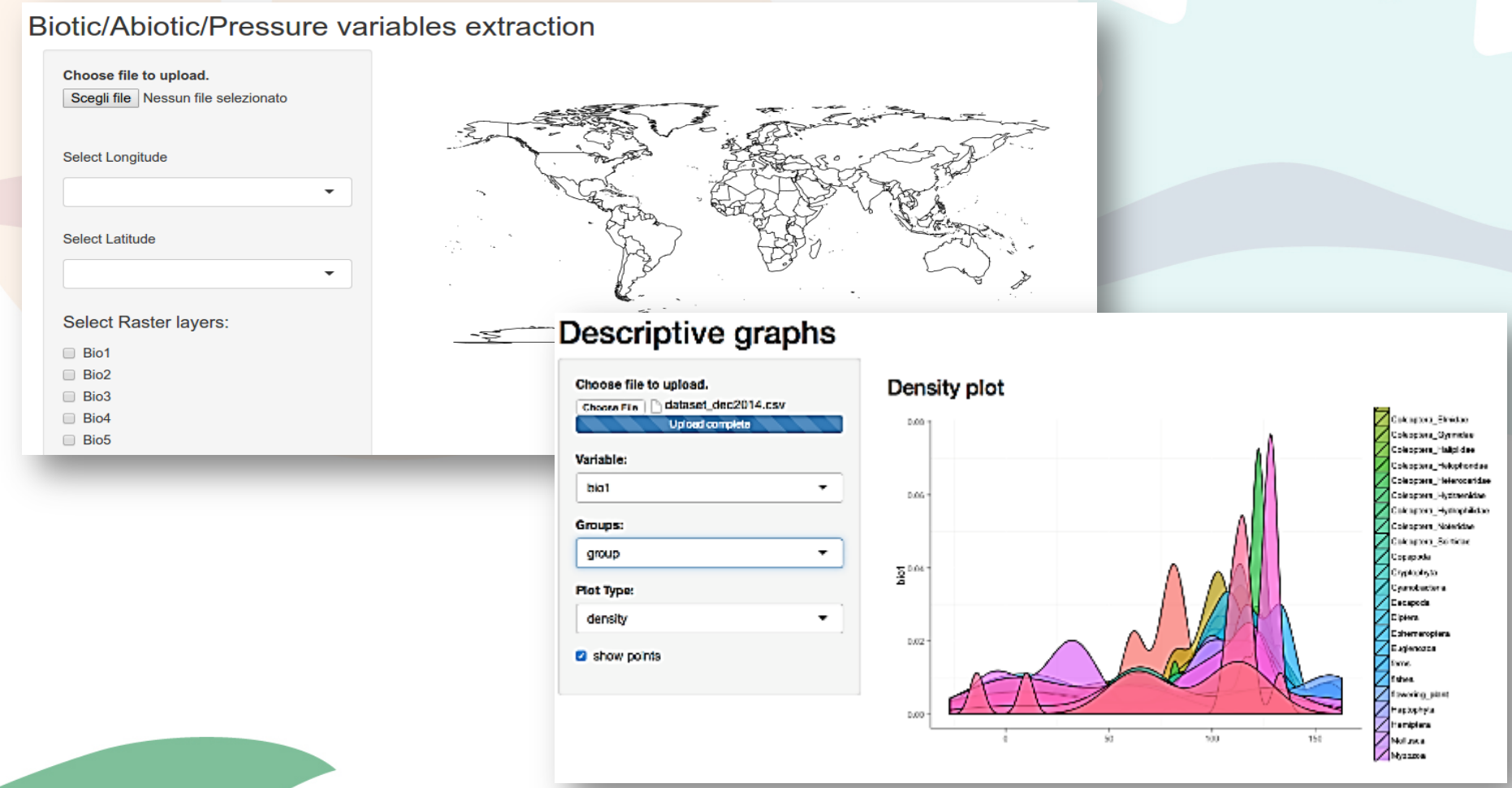

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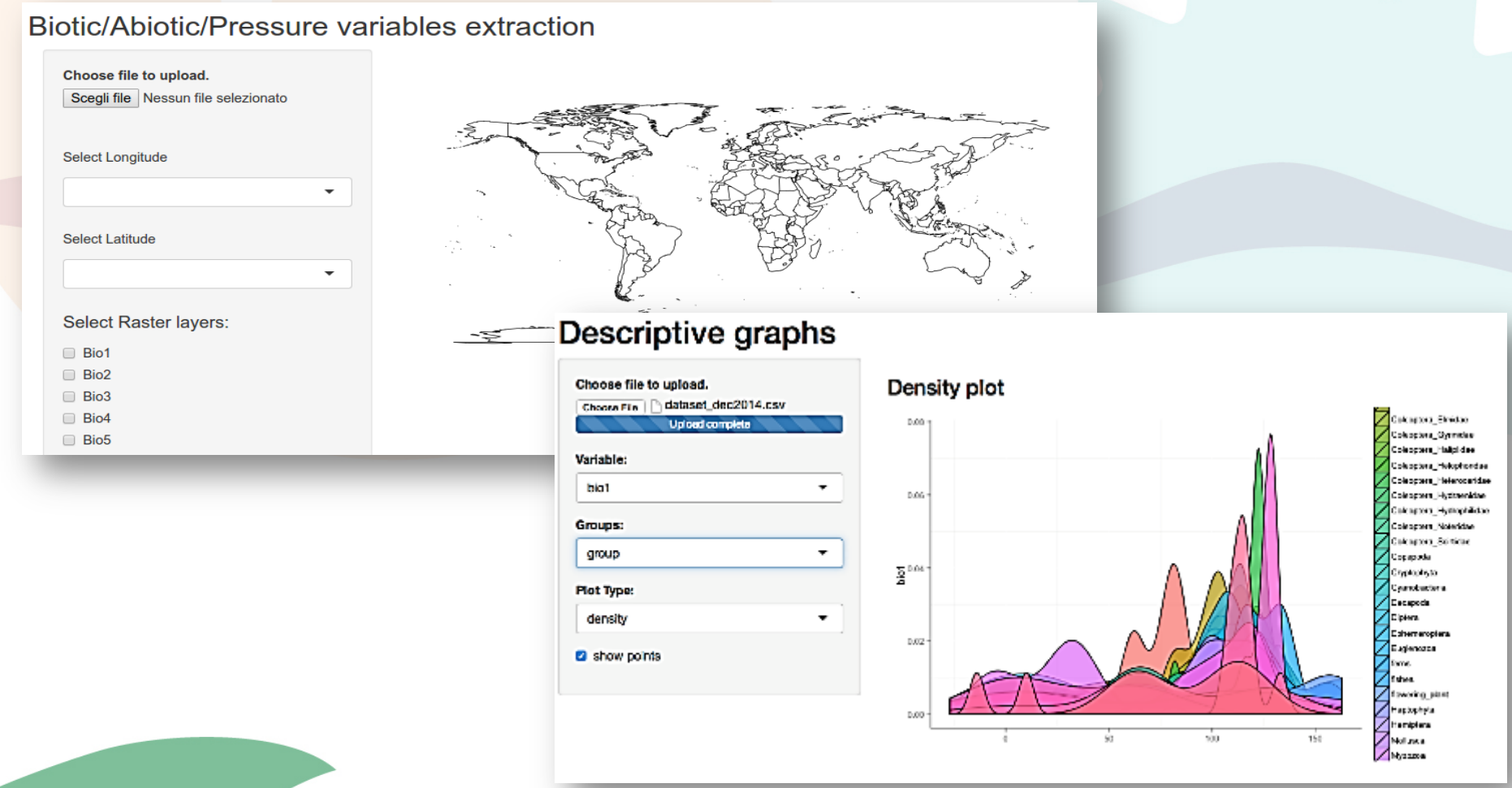

No more excuses for not sharing data!!

Thanks for your kind attention

Alien species ecological impacts: from genomics to macroecology

Chair: Angela Boggero, CNR-ISE, Verbania
Chair: Monica Santamaria, CNR-IBBE, Bari
Chair: Alberto Basset, Università Salento, Lecce

Three main issues will be addressed, from single species, to individual populations and whole ecosystems: i) the state of the art of biological invasion in freshwaters, ii) the comparison across typologies (from inland to coastal marine aquatic ecosystems), iii) the eScience approach to alien species impacts