ALiens in the Aegean – a Sea under siege

https://alas.edu.gr/

ALAS: Assessing the impacts of invasive alien species on the marine ecosystems of the Aegean Sea using the CIMPAL index

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Interreg Europe
European Union | European Regional Development Fund

Interregional workshop on territories' vulnerability to invasive alien species
INVALIS, 20/5/2021

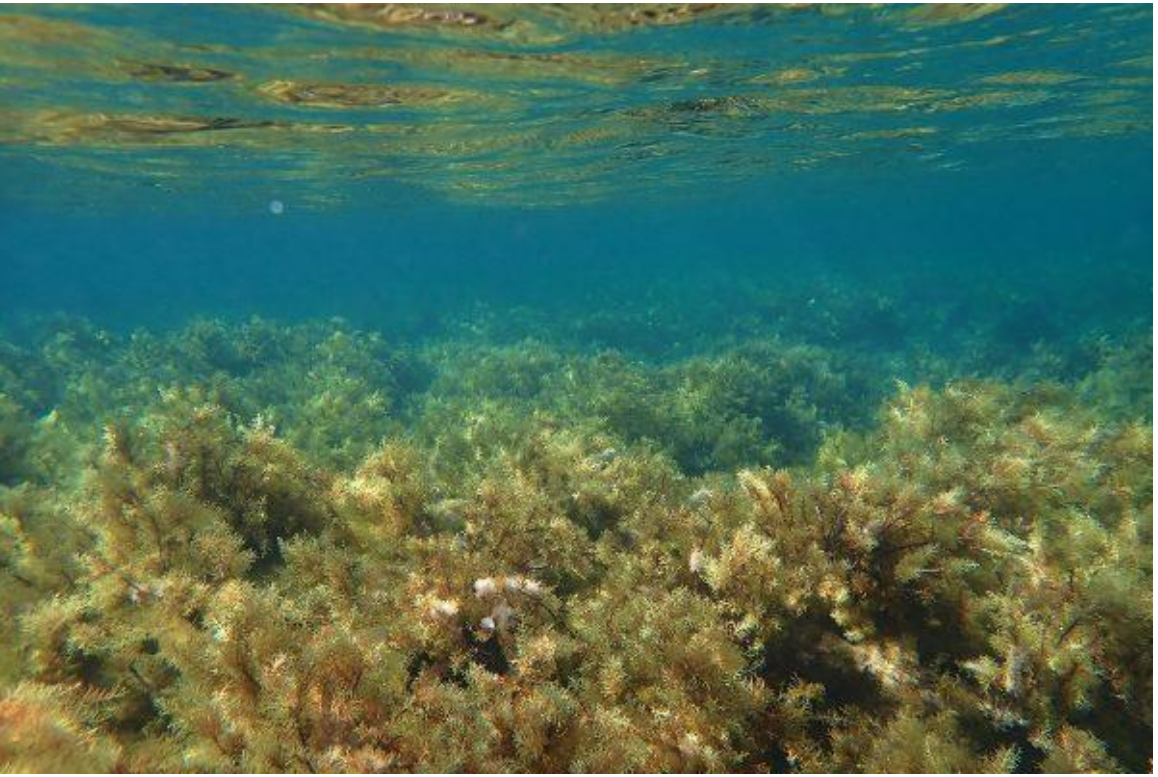
INVALIS
Interreg Europe

H.F.R.I.
Hellenic Foundation for Research & Innovation

The research work was supported by the Hellenic Foundation for Research and Innovation (H.F.R.I.) under the "First Call for H.F.R.I. Research Projects to support Faculty members and Researchers and the procurement of high-cost research equipment grant" (**Project Number: HFRI-FM17-1597**)

Invasive Alien Species in the Aegean Sea

- *Siganus luridus & Siganus rivulatus*



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Εισβολικά ξενικά είδη στο Αιγαίο

- *Siganus luridus & Siganus rivulatus*

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Katsanevakis S, Tsirintanis K, Sini M, Gerovasileiou V, Koukourouvli N, 2020. Aliens in the Aegean – a sea under siege (ALAS). Research Ideas and Outcomes 6: e53057

Main objective: assessment and mapping of cumulative impacts of alien species to marine habitats

CIMPAL (**C**umulative **IM**pacts of invasive **AL**ien species)*

- field experiments and surveys
- habitat mapping
- impact assessment for each species-habitat combination
- species distribution modelling of IAS

**Katsanevakis et al 2016. Mapping the impact of alien species on marine ecosystems: the Mediterranean Sea case study. Diversity and Distributions 22: 694–707.*

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CIMPAL

cell

$$I_c = \sum_{i=1}^{n} \sum_{j=1}^{m} A_i H_j w_{i,j}$$

- A_i: population status of IAS *i*
- H_j: status (% coverage) of habitat *j*

} [0, 1]

- $w_{i,j}$: impact weights of species *i* to habitat *j*
- ***n***: number of IAS
- ***m***: number of habitats

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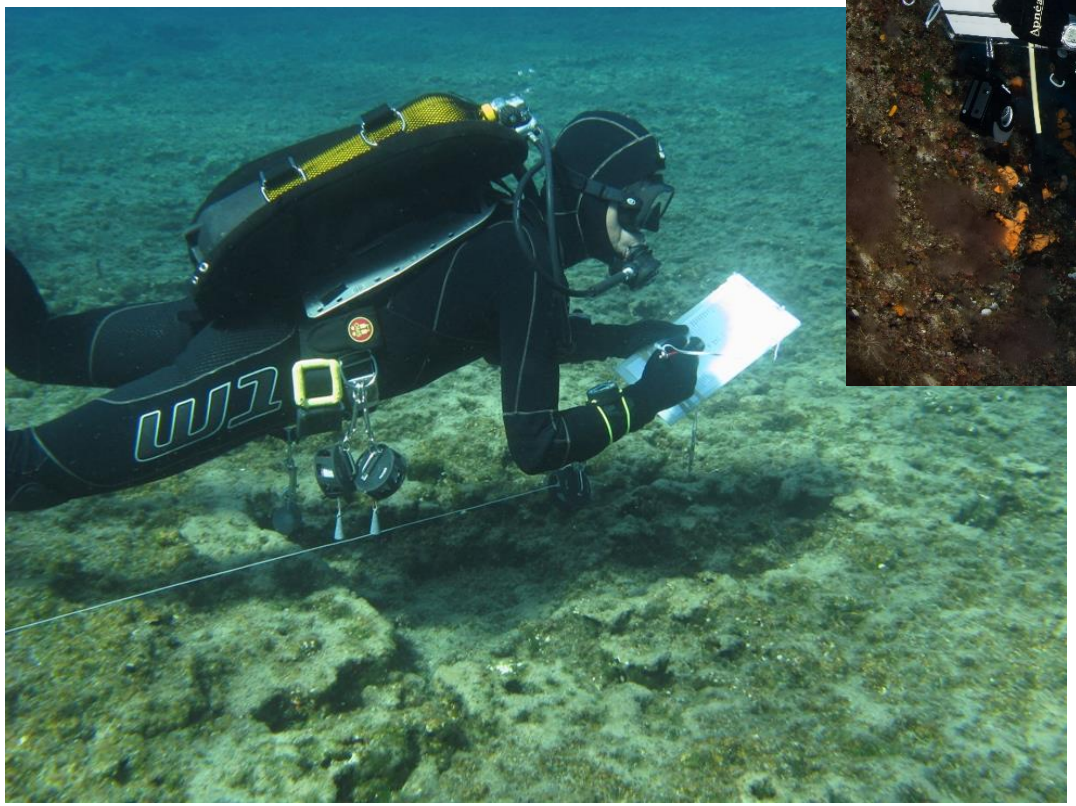
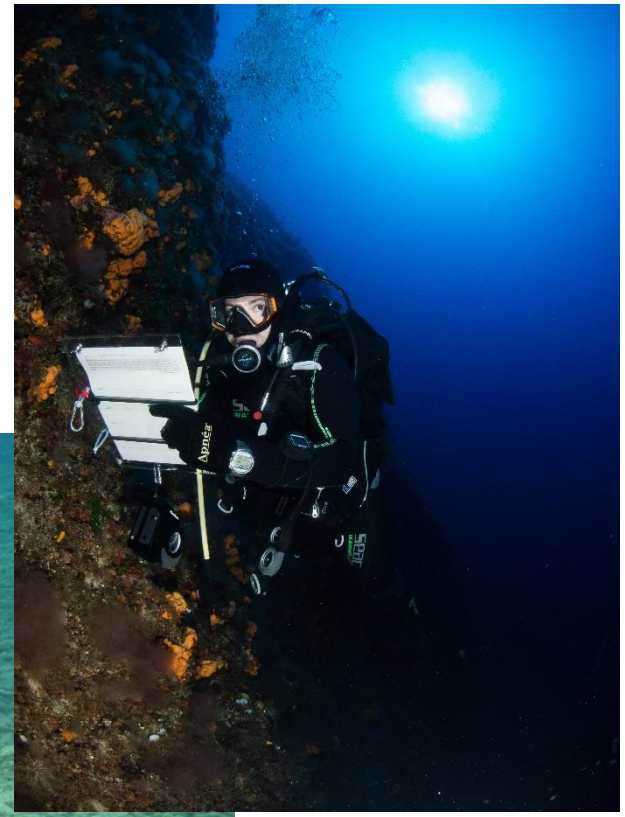
CIMPAL $$I_c = \sum_{i=1}^{n} \sum_{j=1}^{m} A_i H_j w_{i,j}$$

extensive surveys at the main habitats
(with SCUBA diving)





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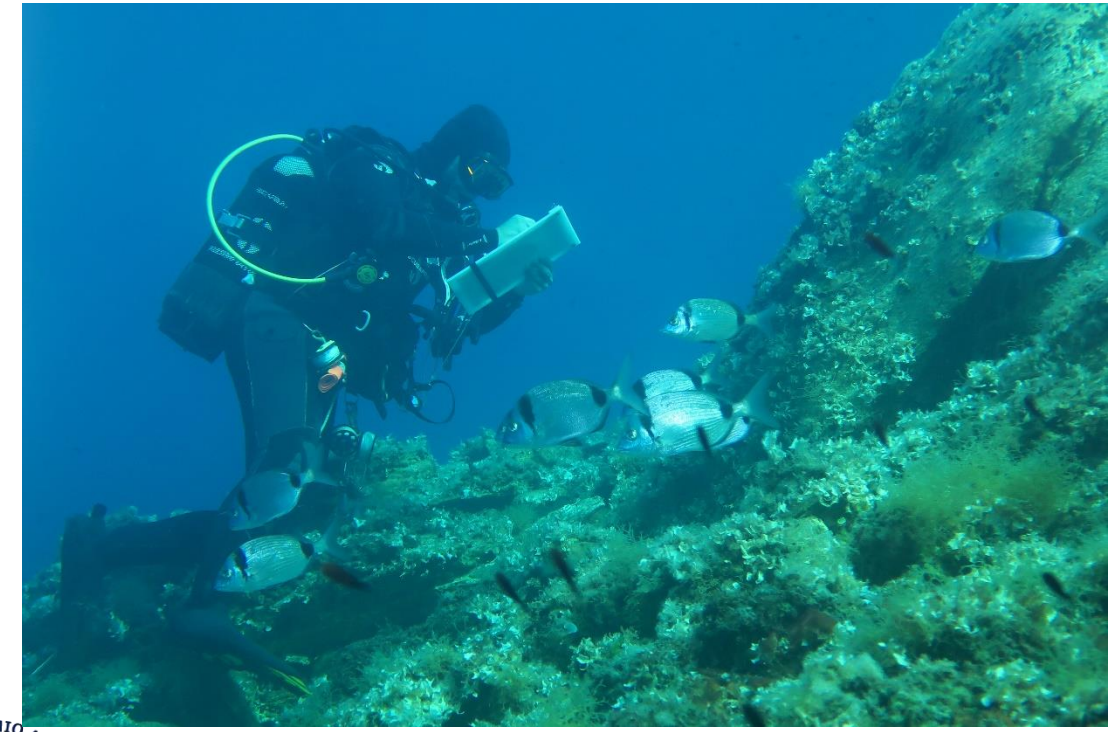

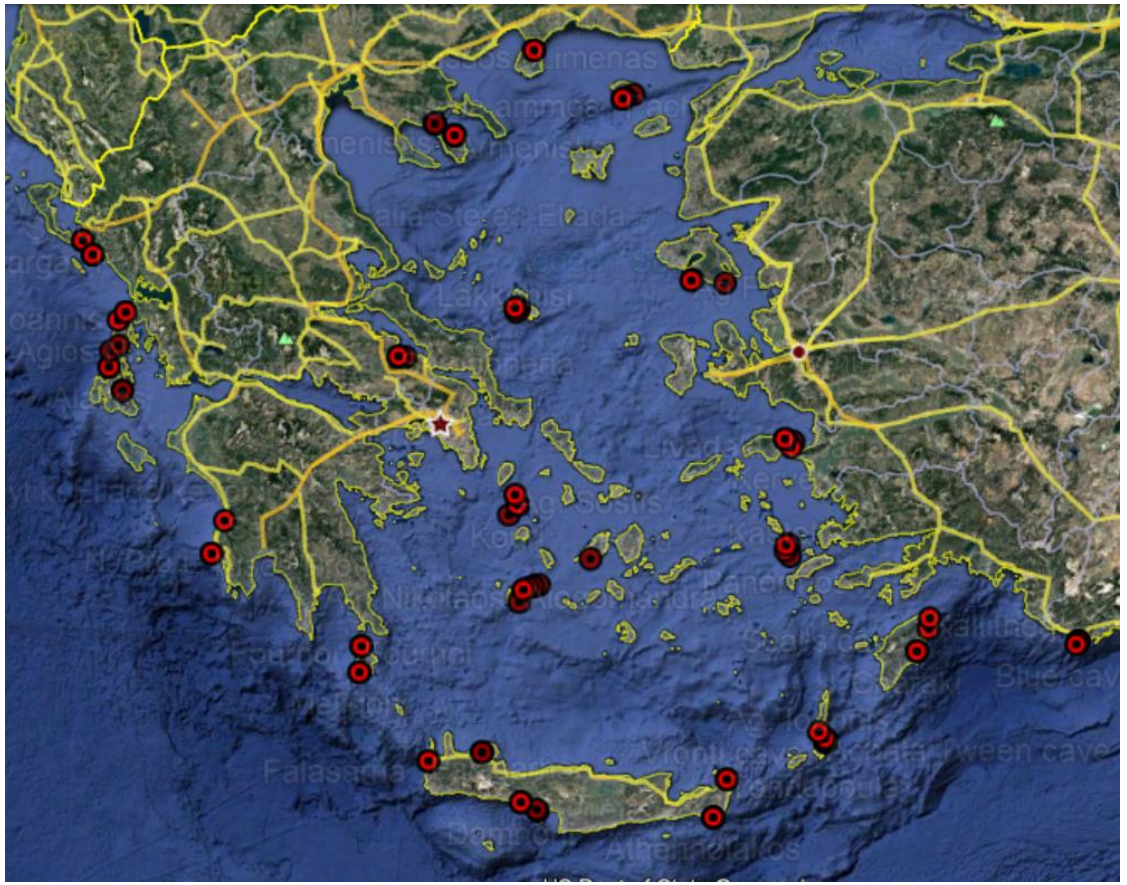

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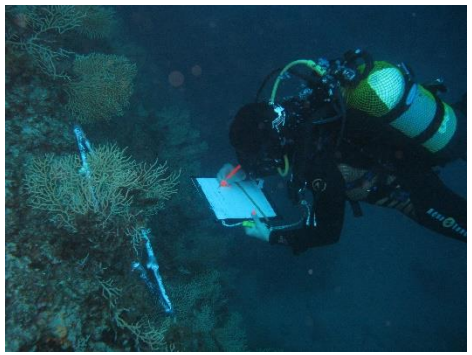
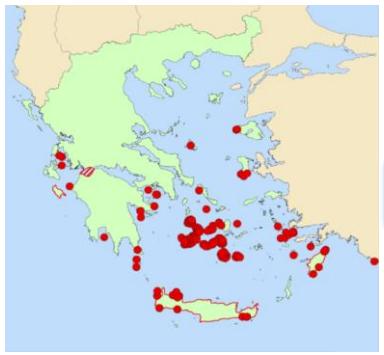


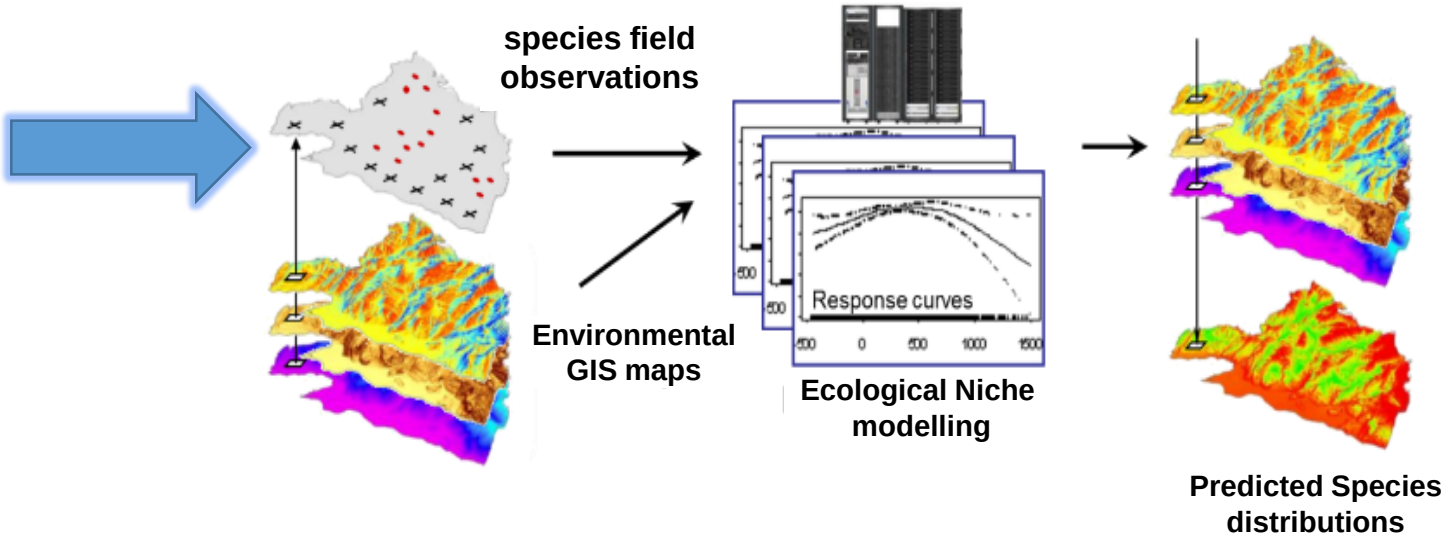
UW surveys



existing data

IAS distribution models

Data Collection | Statistical Models | Spatial Predictions



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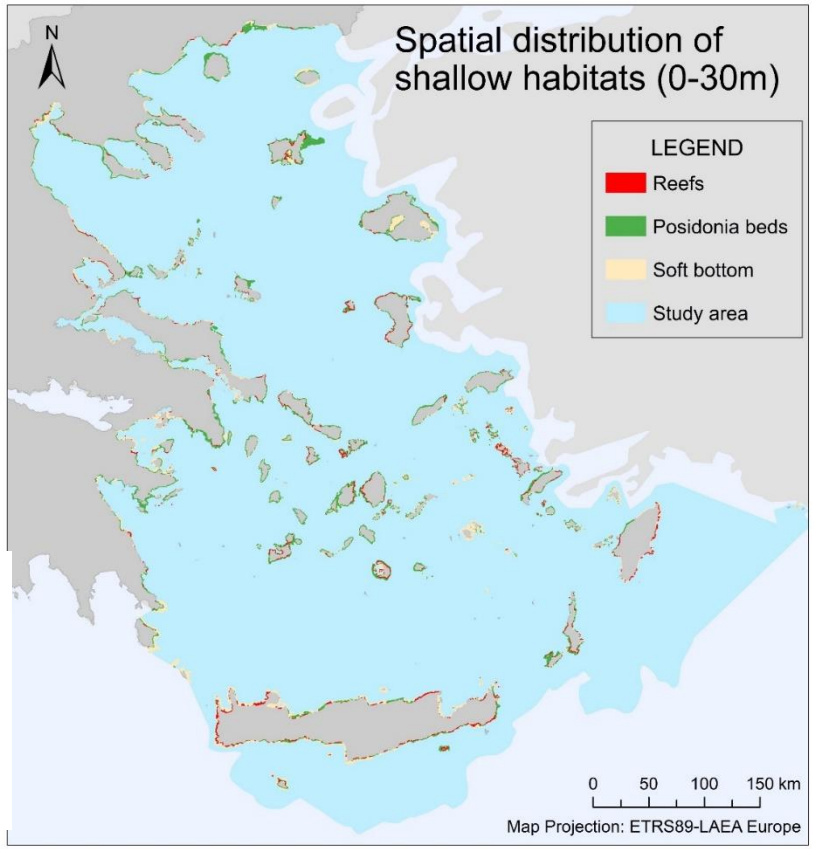
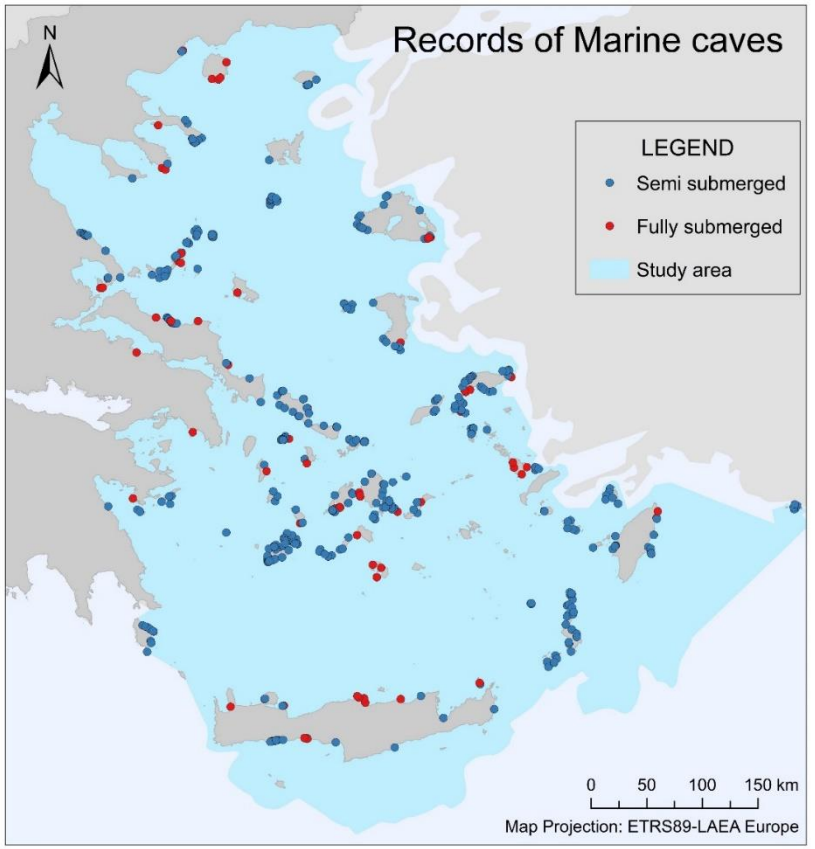
mapping marine habitats (updating MARISCA)

Sini et al. 2017. Assembling ecological pieces to reconstruct the conservation puzzle of the Aegean Sea. Frontiers in Marine Science 4:347.





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CIMPAL

$$I_c = \sum_{i=1}^{n} \sum_{j=1}^{m} A_i H_j w_{i,j}$$

w_{ij}: impact weights for species *i* and habitat *j*

Strength of Evidence	Impact: Minimal	Minor	Moderate	Major	Massive
High	0	1	2	4	8
Medium	0	0	1	2	4
Low	0	0	0	1	2

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	no or negligible	individual fitness	population level	community level reversible	community level irreversible

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experiments

modelling
observations
correlations

ex. judgement

no or negligible

individual fitness

population level

community level reversible

community level irreversible

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CIMPAL

$$I_c = \sum_{i=1}^{n} \sum_{j=1}^{m} A_i H_j w_{i,j}$$

- literature review at Mediterranean scale – involvement of experts (~100 species)
- field experiments and surveys to cover knowledge gaps

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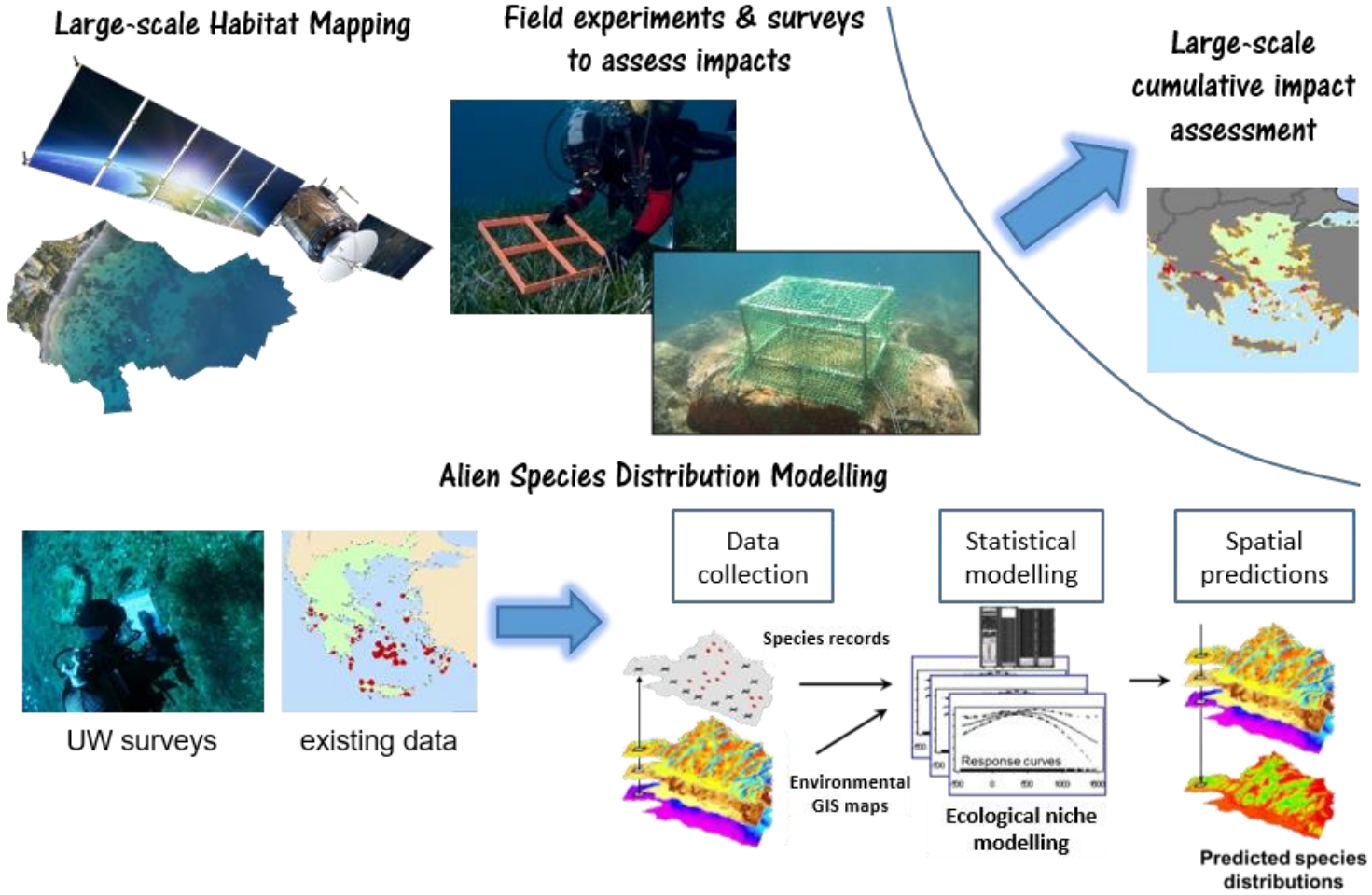
Impact assessment of IAS on marine habitats



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Application of CIMPAL in the Mediterranean

- 13 habitats
- 60 IAS (Katsanevakis et al. 2014)

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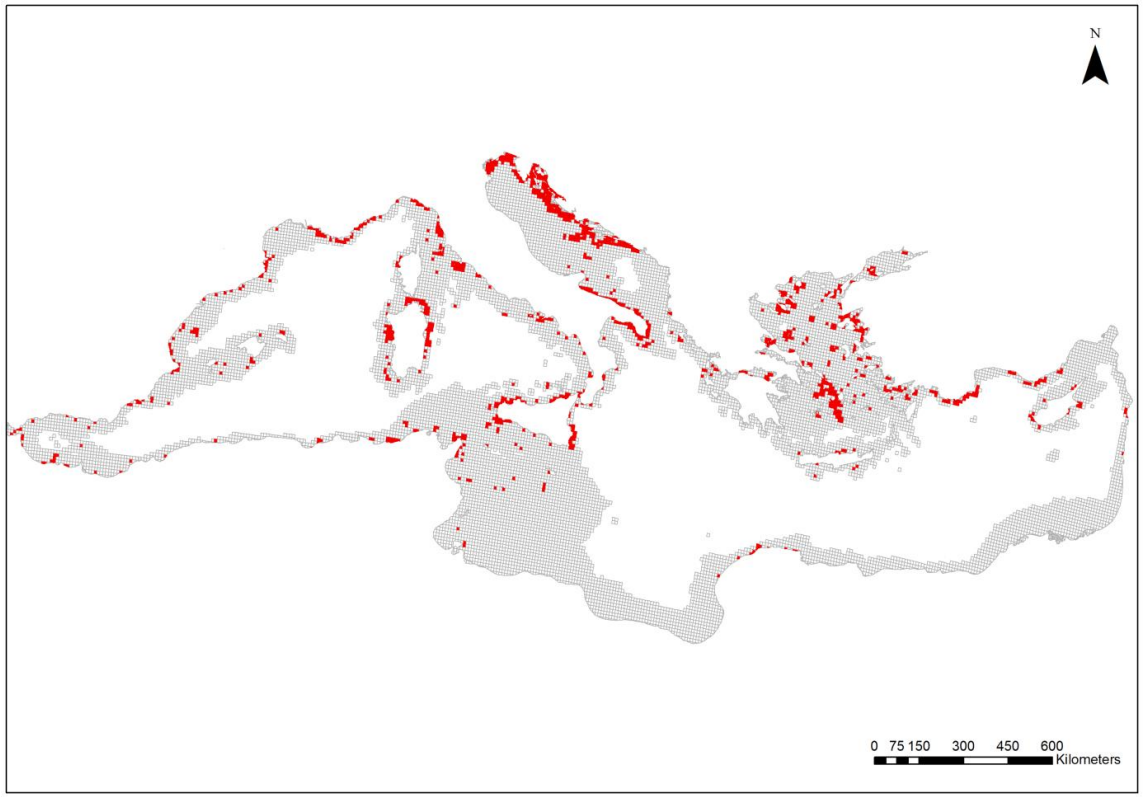
10 km

10 km

grid cell



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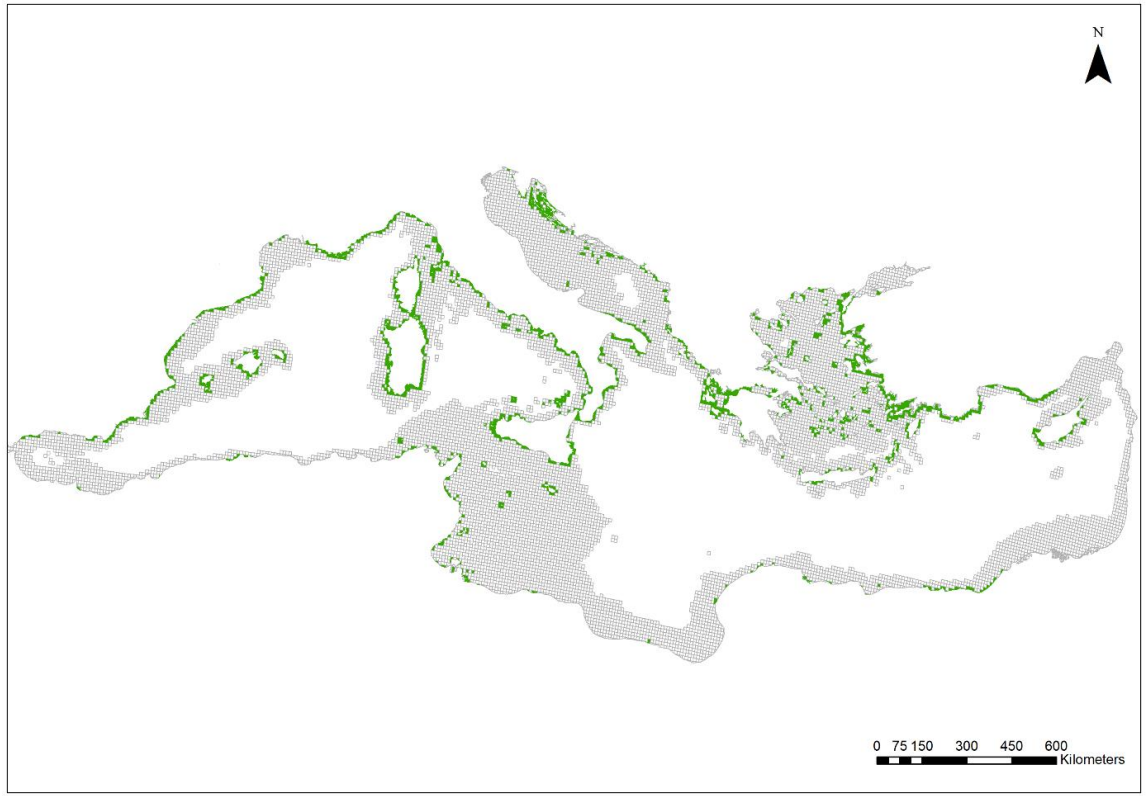

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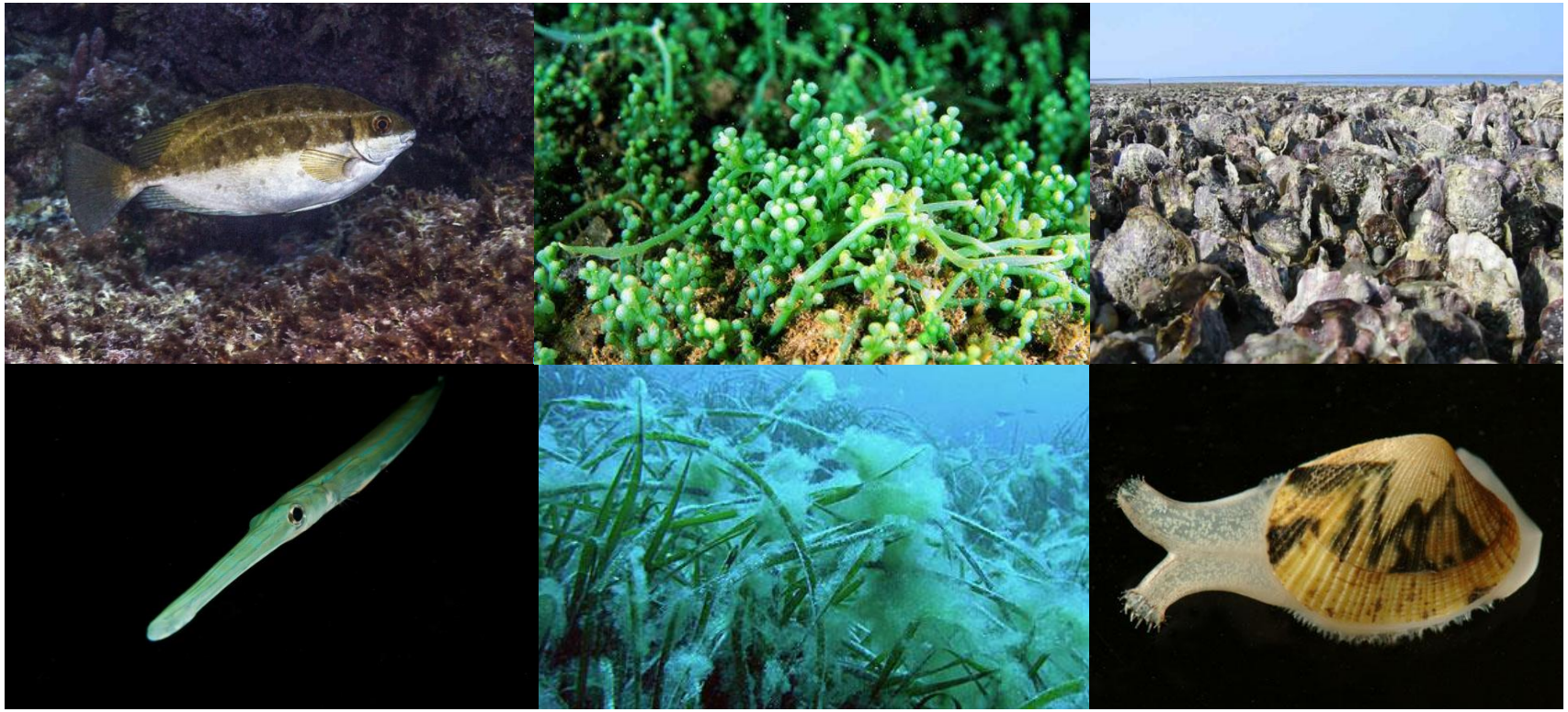

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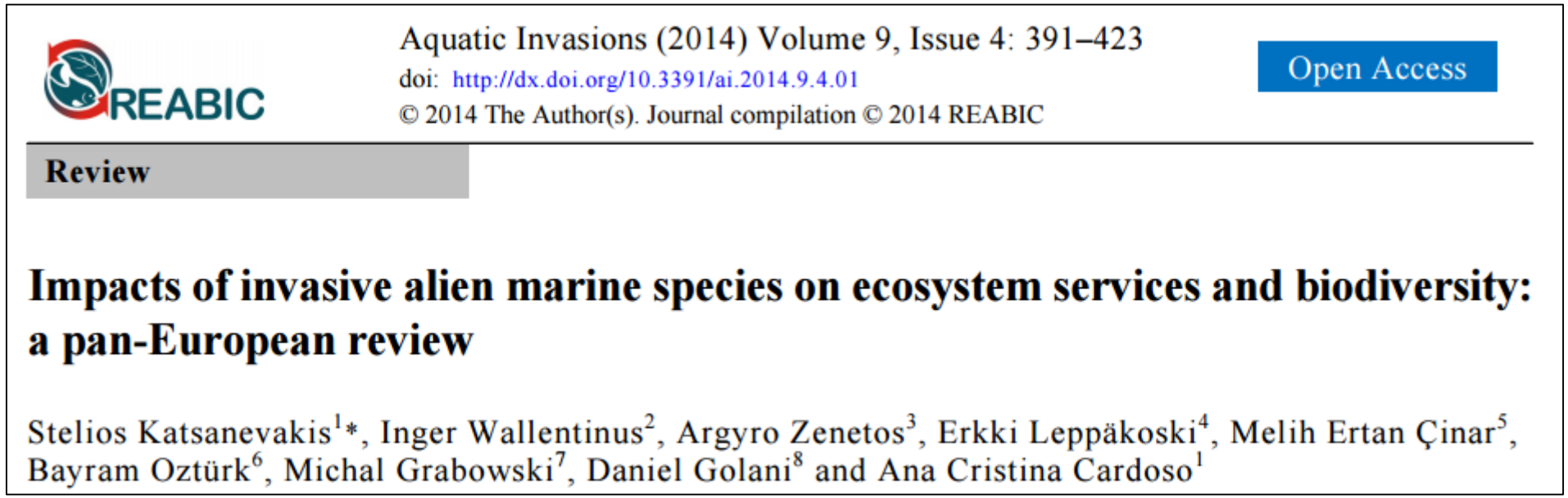

Aquatic Invasions (2014) Volume 9, Issue 4: 391–423
doi: http://dx.doi.org/10.3391/ai.2014.9.4.01

Open Access

Review

Impacts of invasive alien marine species on ecosystem services and biodiversity: a pan-European review

Stelios Katsanevakis[1]*, Inger Wallentinus[2], Argyro Zenetos[3], Erkki Leppäkoski[4], Melih Ertan Çinar[5], Bayram Oztürk[6], Michal Grabowski[7], Daniel Golani[8] and Ana Cristina Cardoso[1]

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Review of all reported **invasive alien species** in Europe

- DAISIE '100 of the worst' list
- NOBANIS factsheets
- SEBI 'List of worst invasive alien species'
- CABI's Invasive Species Compendium
- + literature, expert opinion of the authors

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Bibliographic search

- Using keywords → >20,000 articles
- After first screening → >2,500 articles
- In the end → 329 articles that reported impacts

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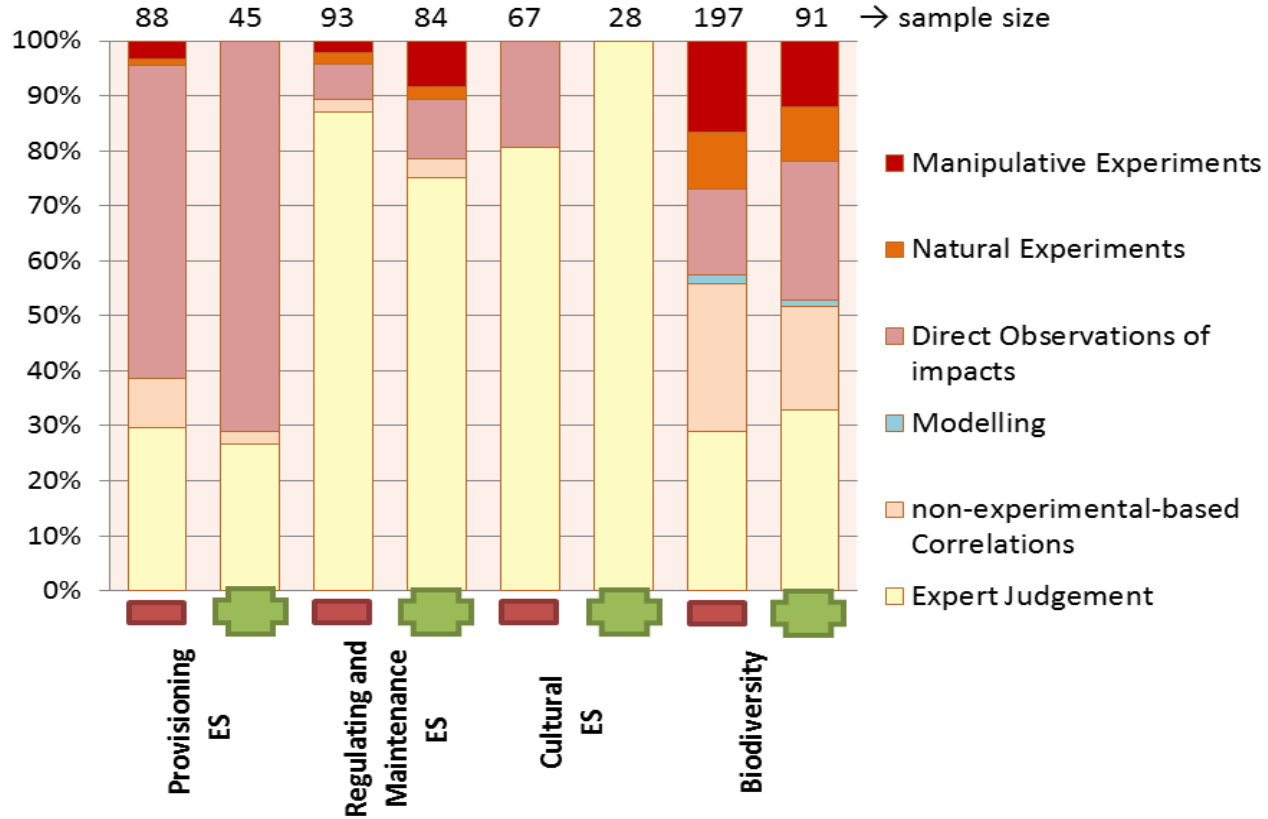

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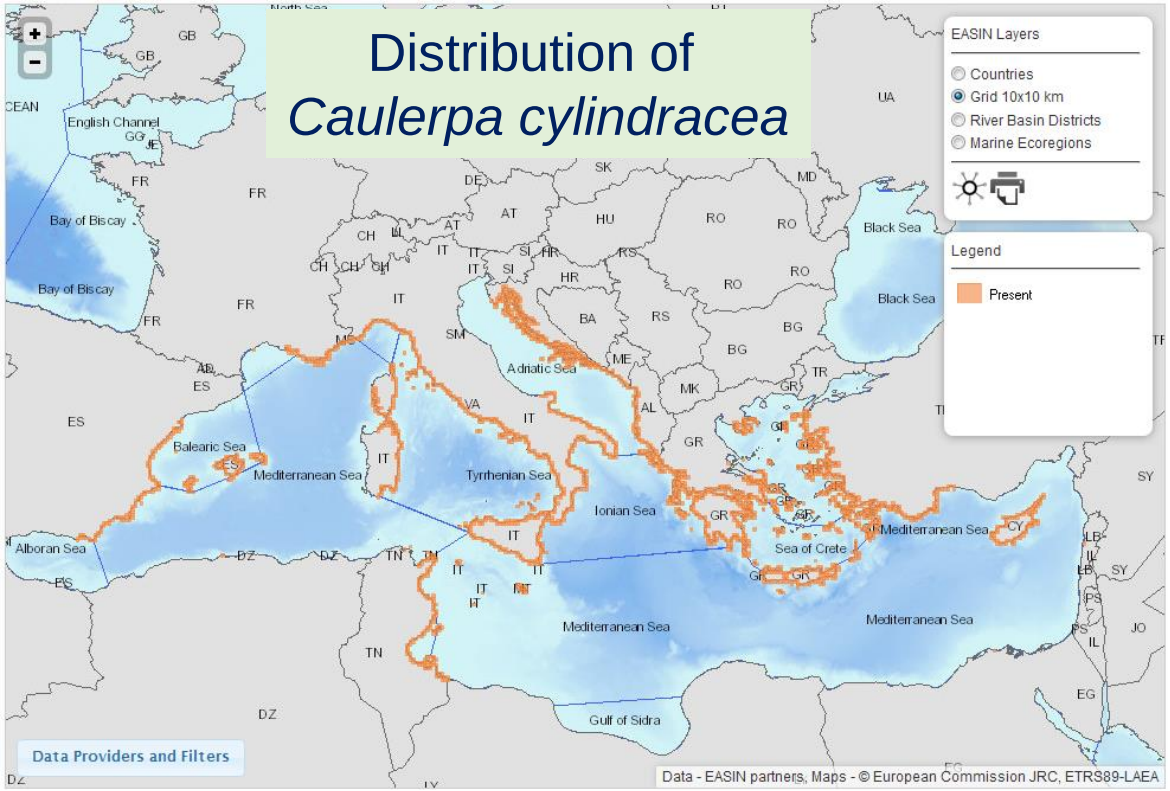

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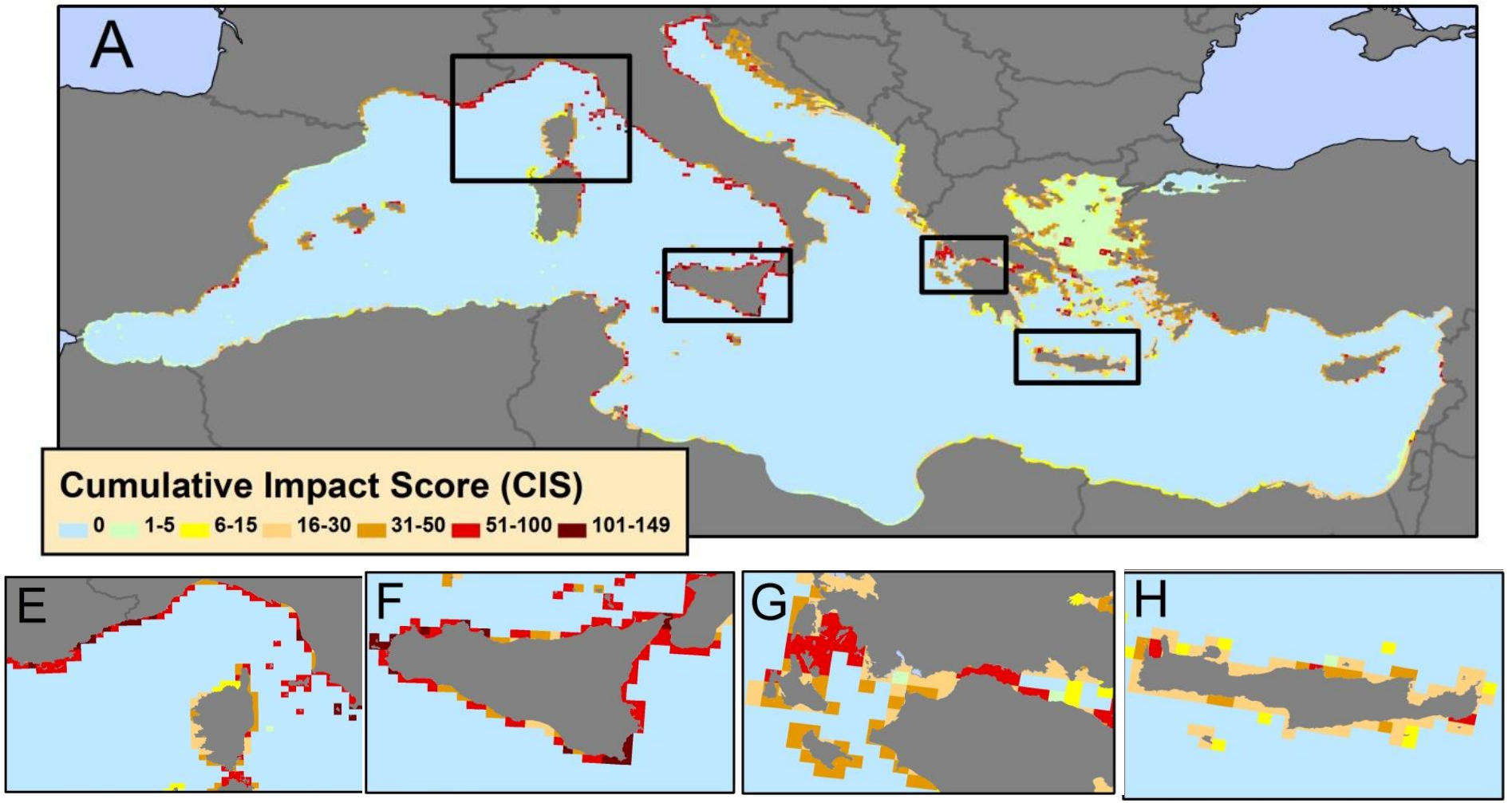
Cumulative impact score (CIMPAL): 13 habitats, 60 IAS



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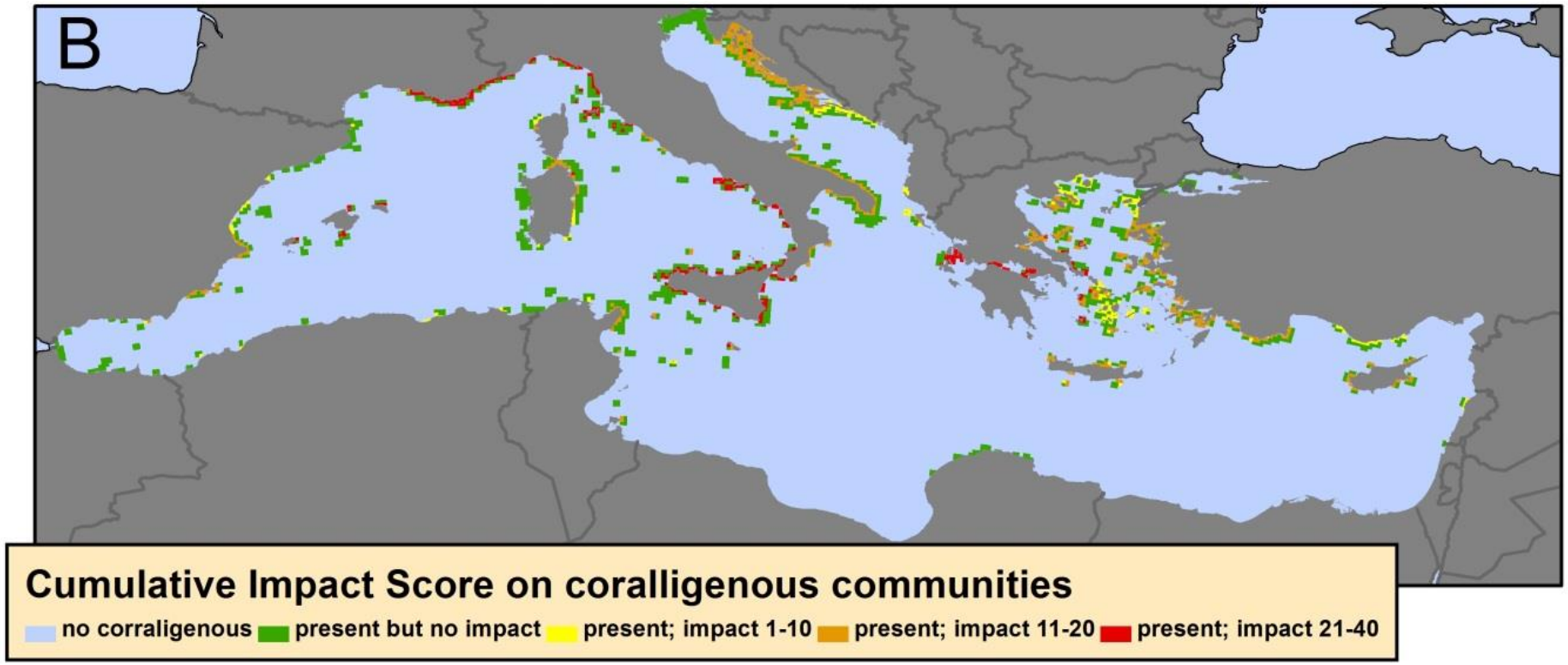
Disaggregation by habitat: coralligenous communities



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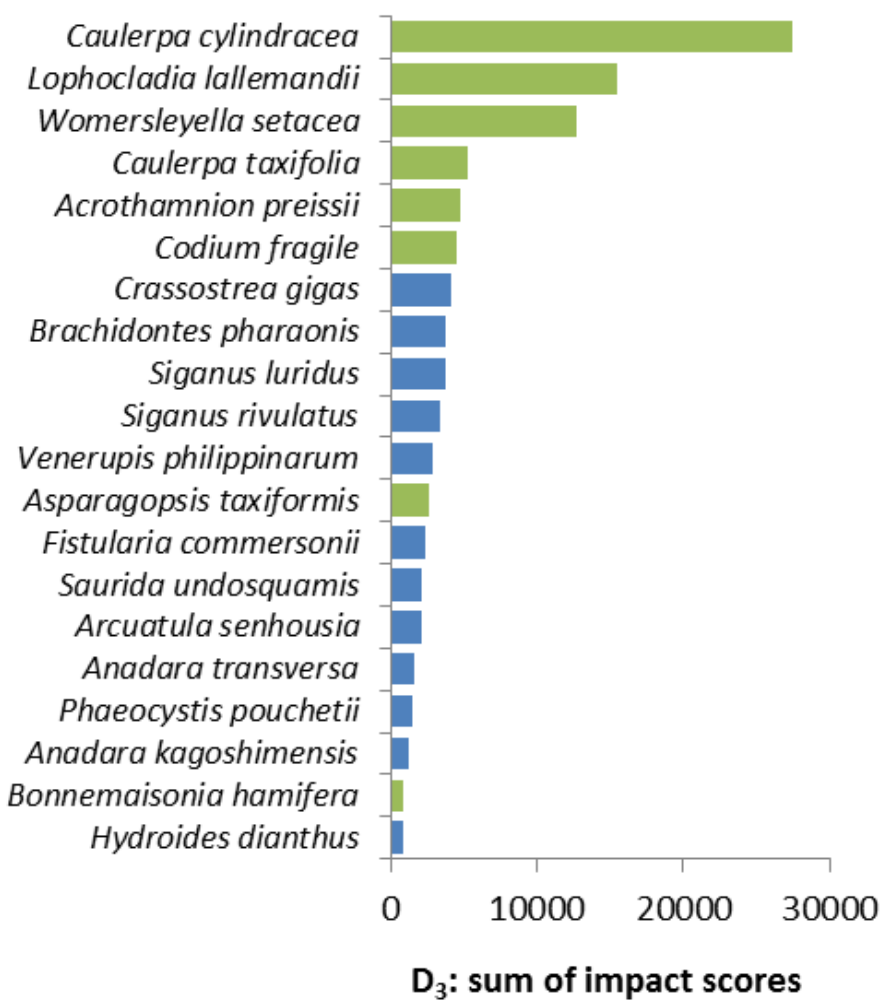
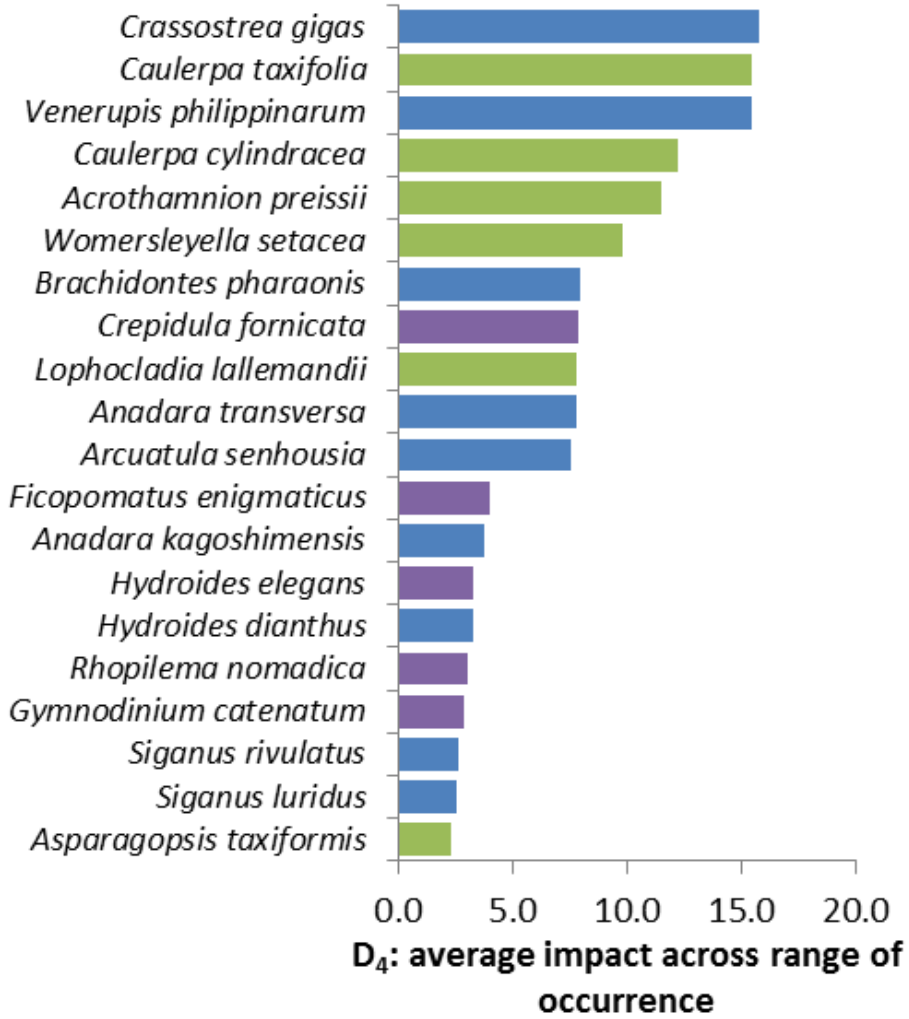
Mediterranean: Ranking species by impact





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Greek case study: CIMPAL in NATURA-2000 sites

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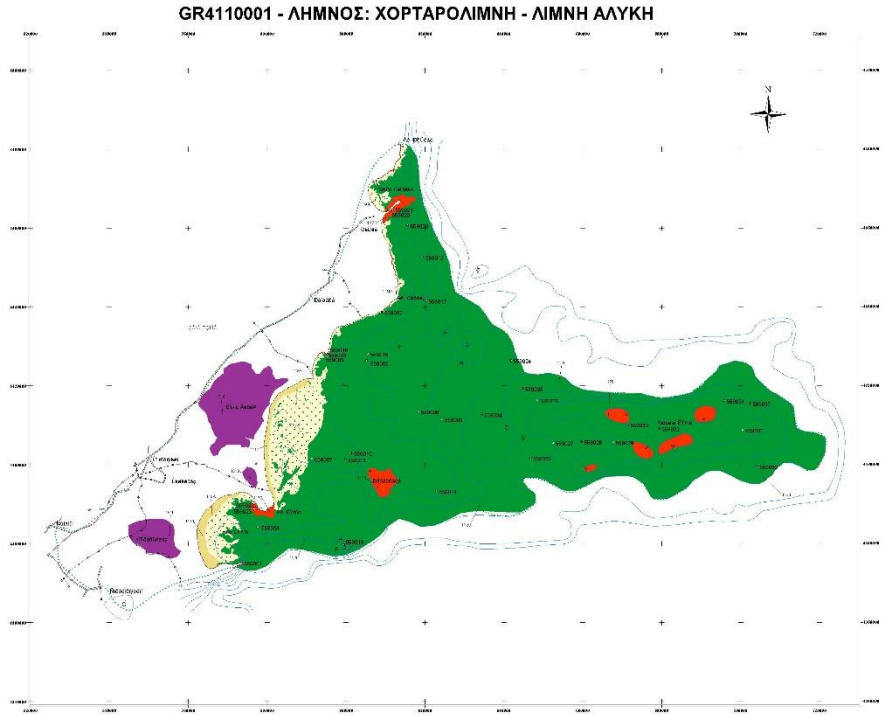

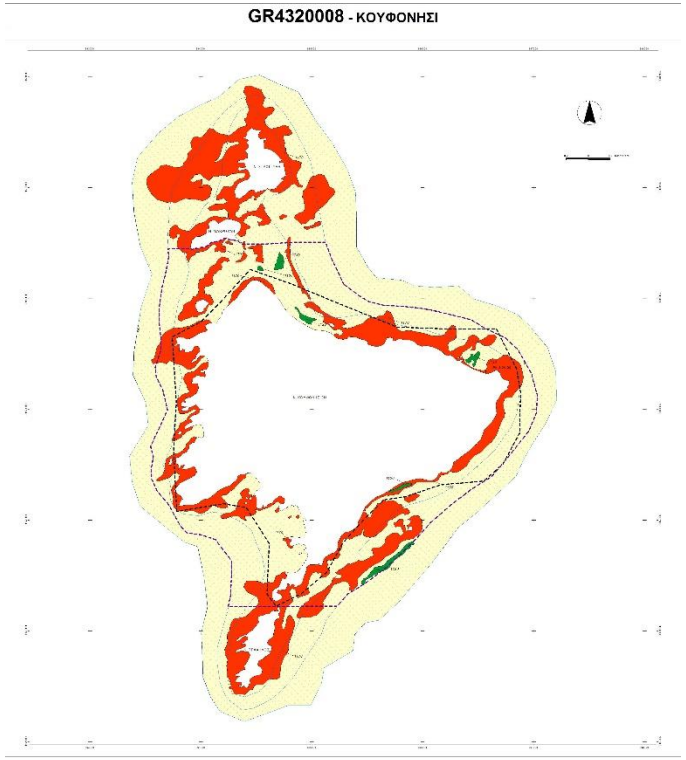

Boltsis E, Katsanevakis S, 2016. Cumulative impacts of alien species on the marine Natura sites of Greece. 51st European Marine Biology Symposium, 26-30 September 2016, Rhodes, Greece, p.72

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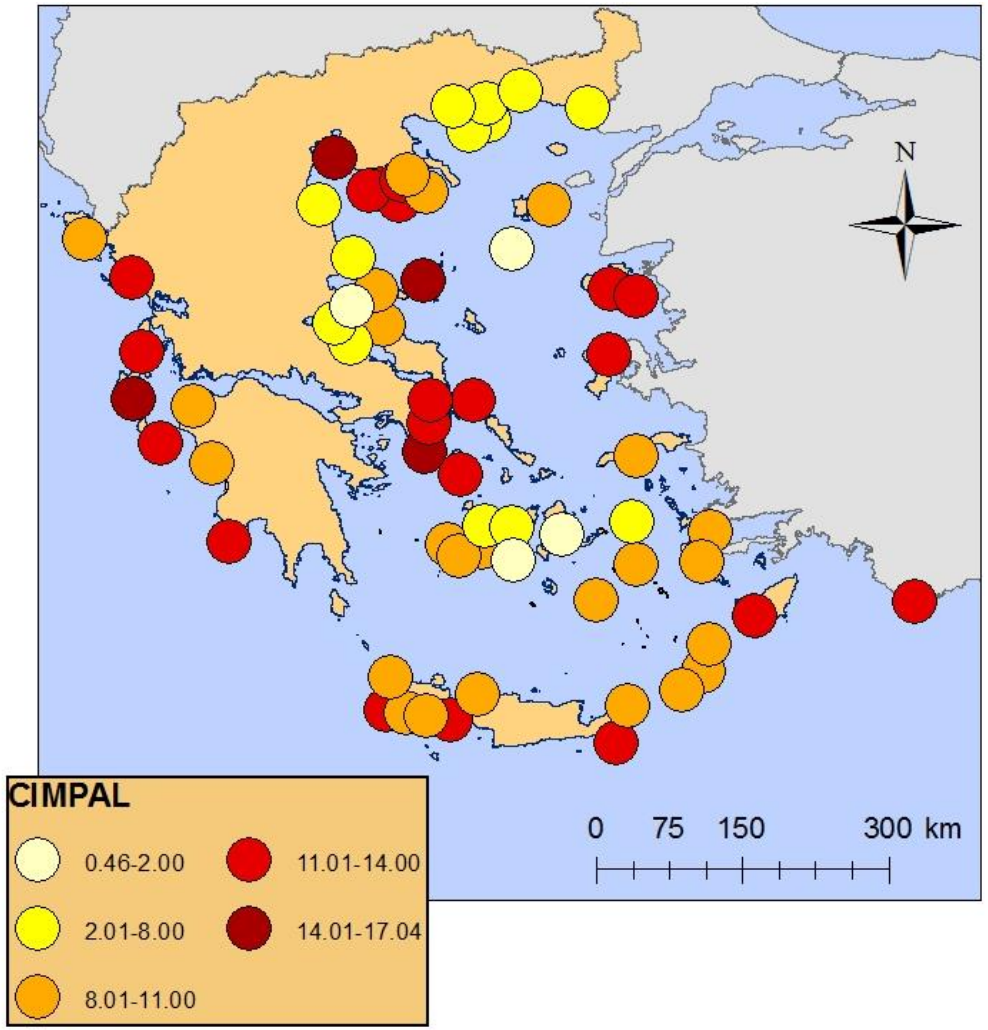
Greek case study: CIMPAL in NATURA-2000 sites



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Improvements in ALAS

- account for interactions

$$I_c = \sum_{i=1}^{n}\sum_{j=1}^{m} A_i H_j w_{i,j} + \sum_{i=1}^{n}\sum_{k=i+1}^{n}\sum_{j=1}^{m} A_i\, A_k H_j f_{i,k,j}(A_i, A_k)$$

- better habitat maps
- abundance or coverage instead of presence/absence (IAS distribution modelling)
- improved impact assessments

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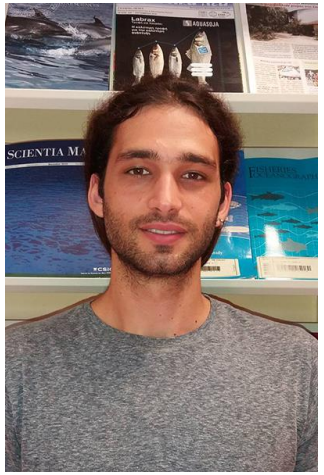
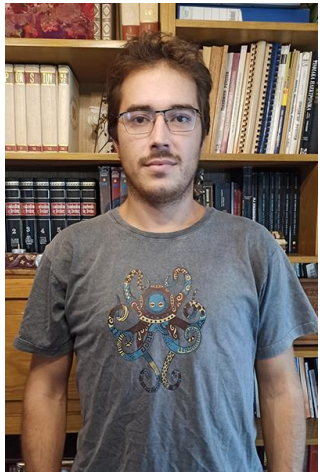
https://alas.edu.gr/







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