WP3 - Task3.2

Implementation of 3D planning tools in PSs

Funded by the European Union

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3D prioritisation

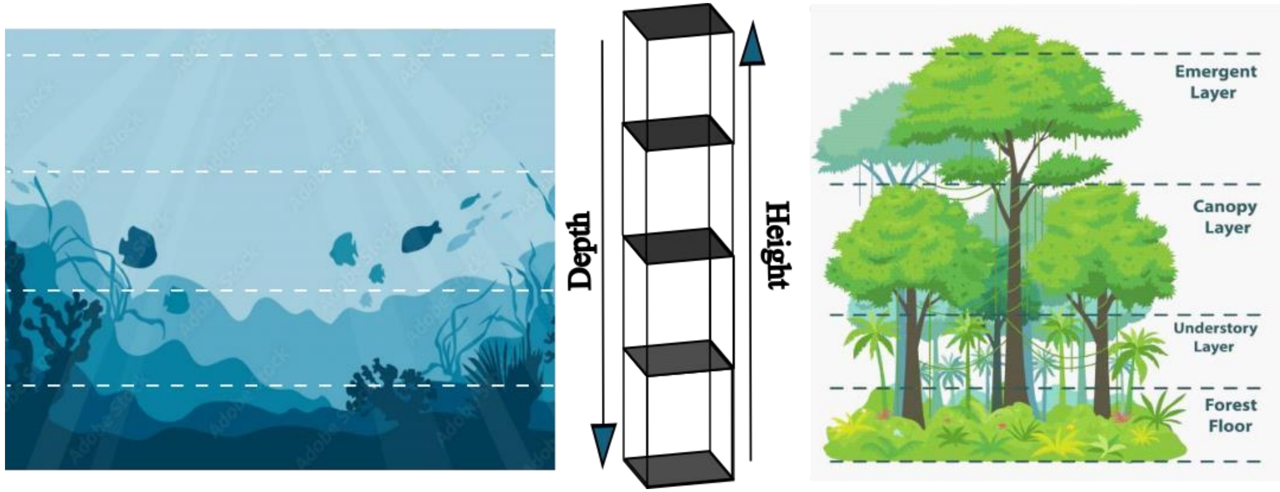
Identified needs for new approaches and tools

Challenges in SCP

Important challenges still persist

2D approaches → static representation of ecological processes

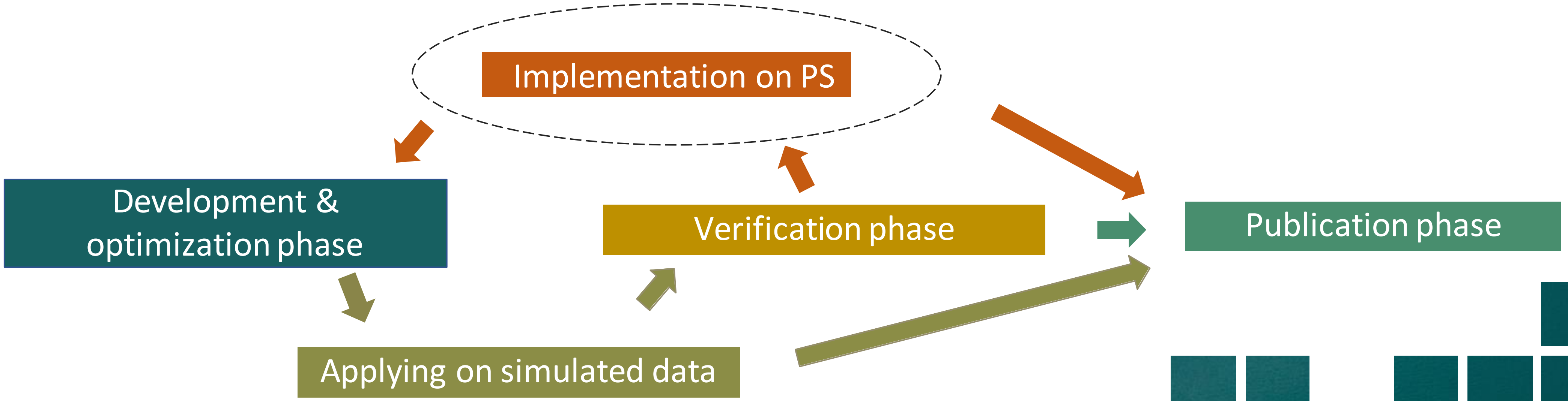
- oversimplify the dynamic, **three-dimensional nature of ecosystems** & species movements over space
- neglecting the conservation needs of **remote habitats**
- partial understanding of ecological **dynamics over time and space** / misrepresentations of the actual conservation needs

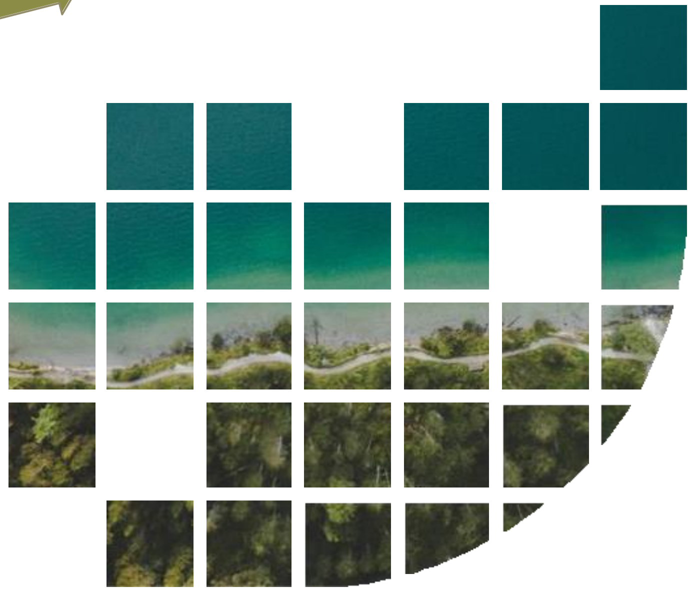


New methodological and conceptual frameworks are needed → climate-smart conservation planning

Where we stand?

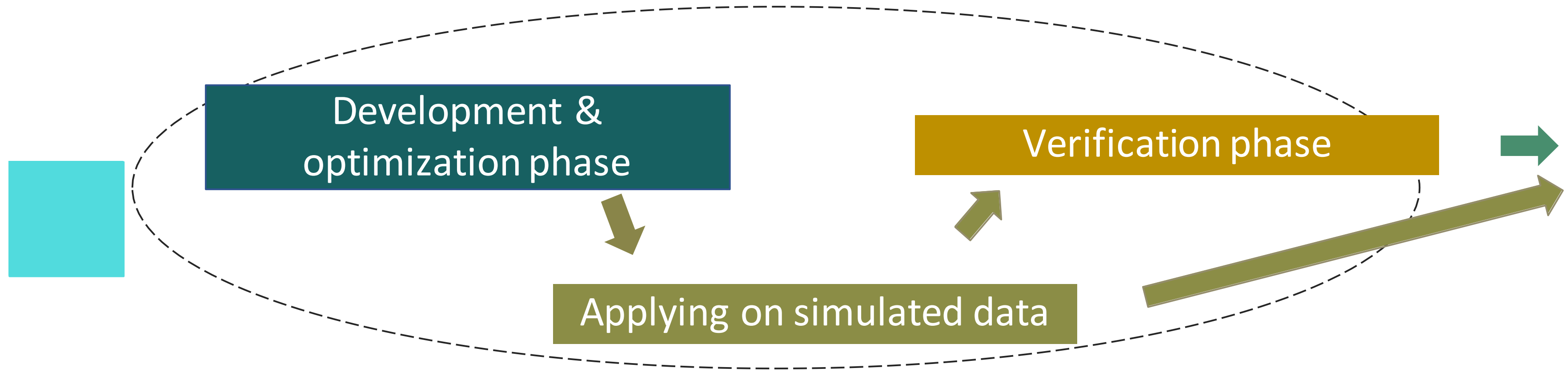
New 3D planning tools



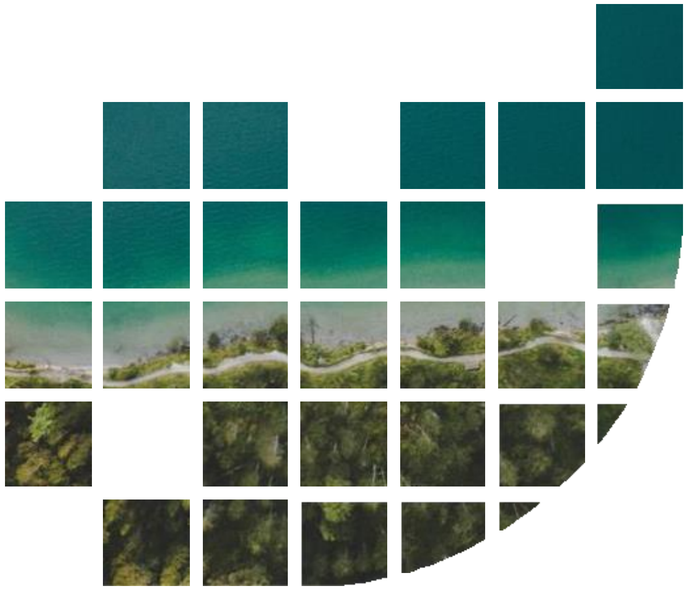


Where we stand?

New 3D planning tools

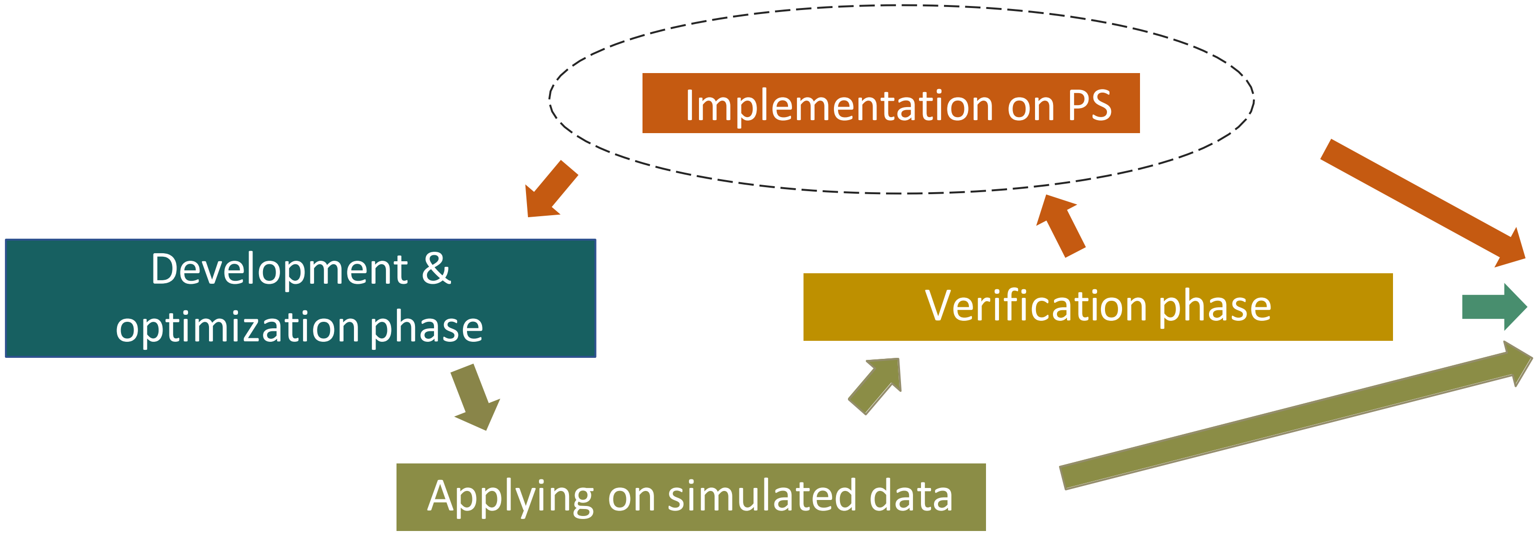


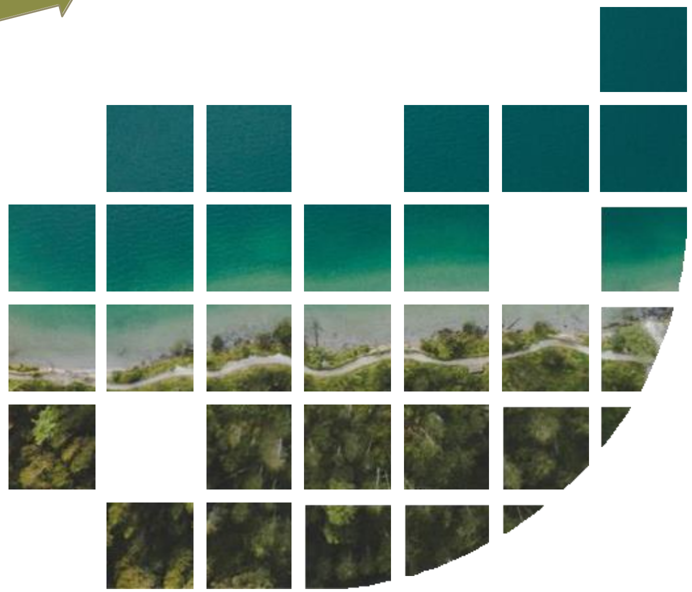
- ✓ Developed and optimized the 3D planning tool in R
- ✓ Optimized and developed various algorithm and budget distribution options that are now given to the users
- ✓ Conducted comparative studies between 2D and 3D prioritization approaches, suing both simulated and real case study data
- ✓ Ensured that inputs by users are simple and straightforward
- ✓ Developed a Shiny App for non-R-users
- ✓ Conducted a dedicated workshop in February



Where we stand?

New 3D planning tools



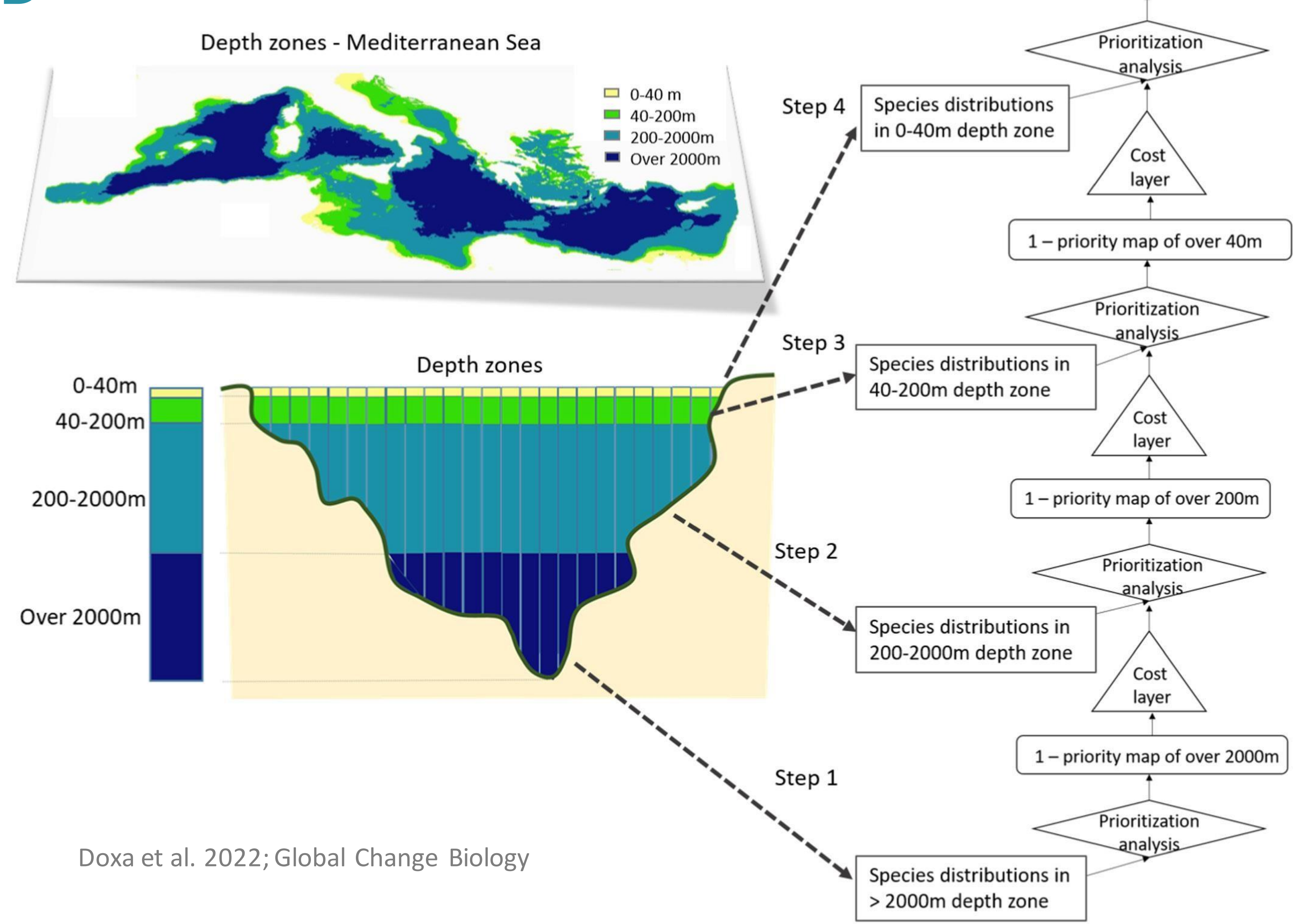


- ✓ Helpful testing and bug reporting
- ✓ Participation of different PSs
- ✓ Meetings and brainstorming with each one of the participating teams
- ✓ Co-working: testing phase; validation phase, implementation phase & fine tuning.

Adopting a holistic 3D perspective

Nested prioritization analyses

Vertical connectivity



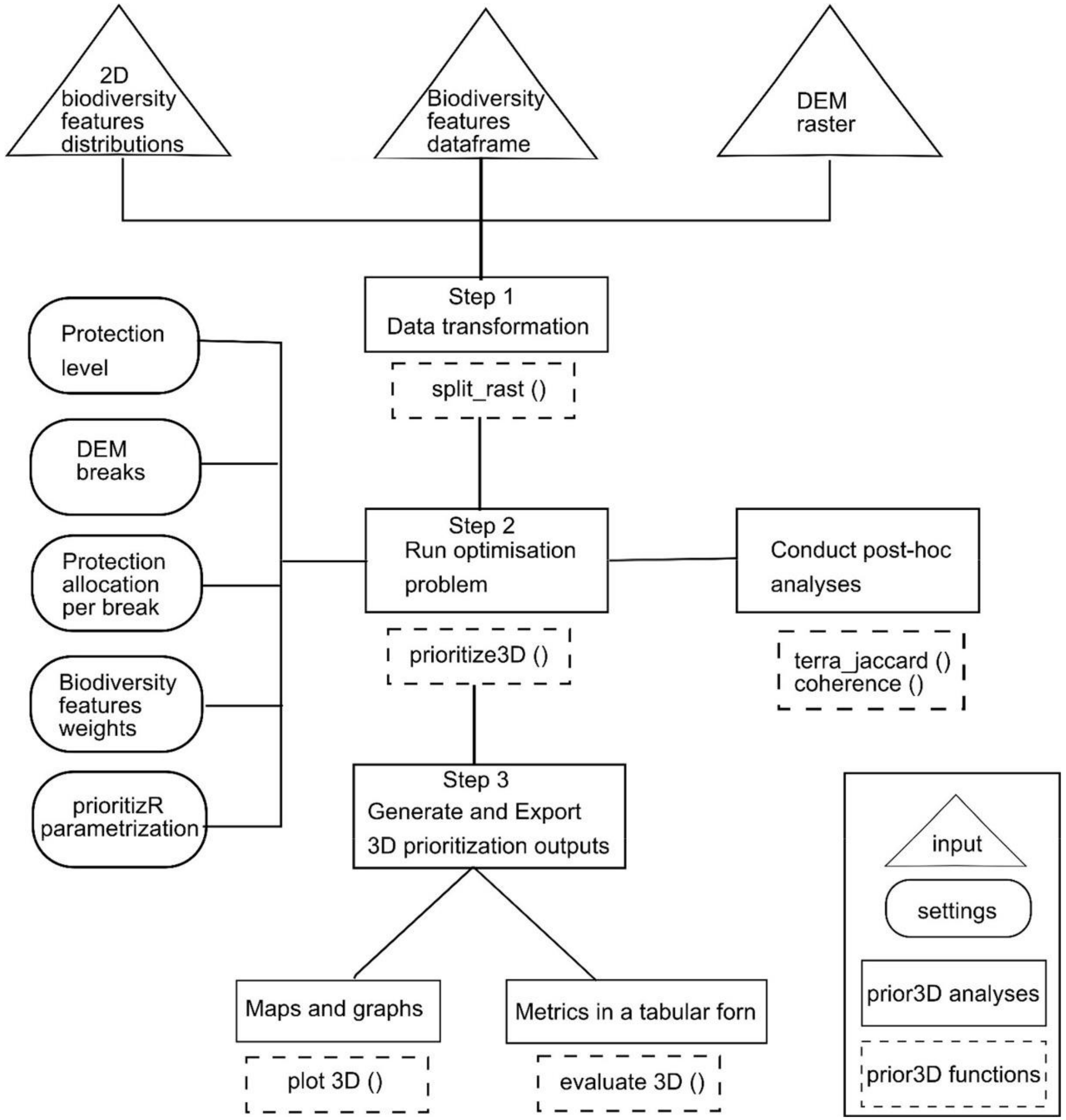
Doxa et al. 2022; Global Change Biology

3D prioritization tool

prior3D: 3D Prioritization Algorithm

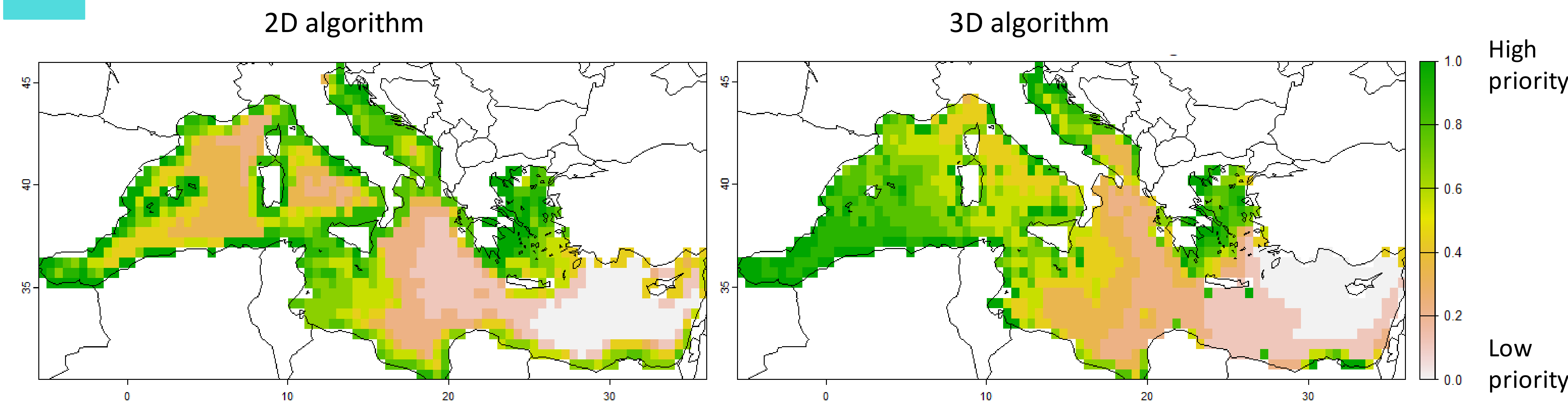
Three-dimensional systematic conservation planning, conducting nested prioritization analyses across multiple depth levels and ensuring efficient resource allocation throughout the water column. It provides a structured workflow designed to address biodiversity conservation and management challenges in the 3 dimensions, while facilitating users' choices and parameterization (Doxa et al. 2025 <doi:10.1016/j.ecolmodel.2024.110919>).

3D prioritization tool

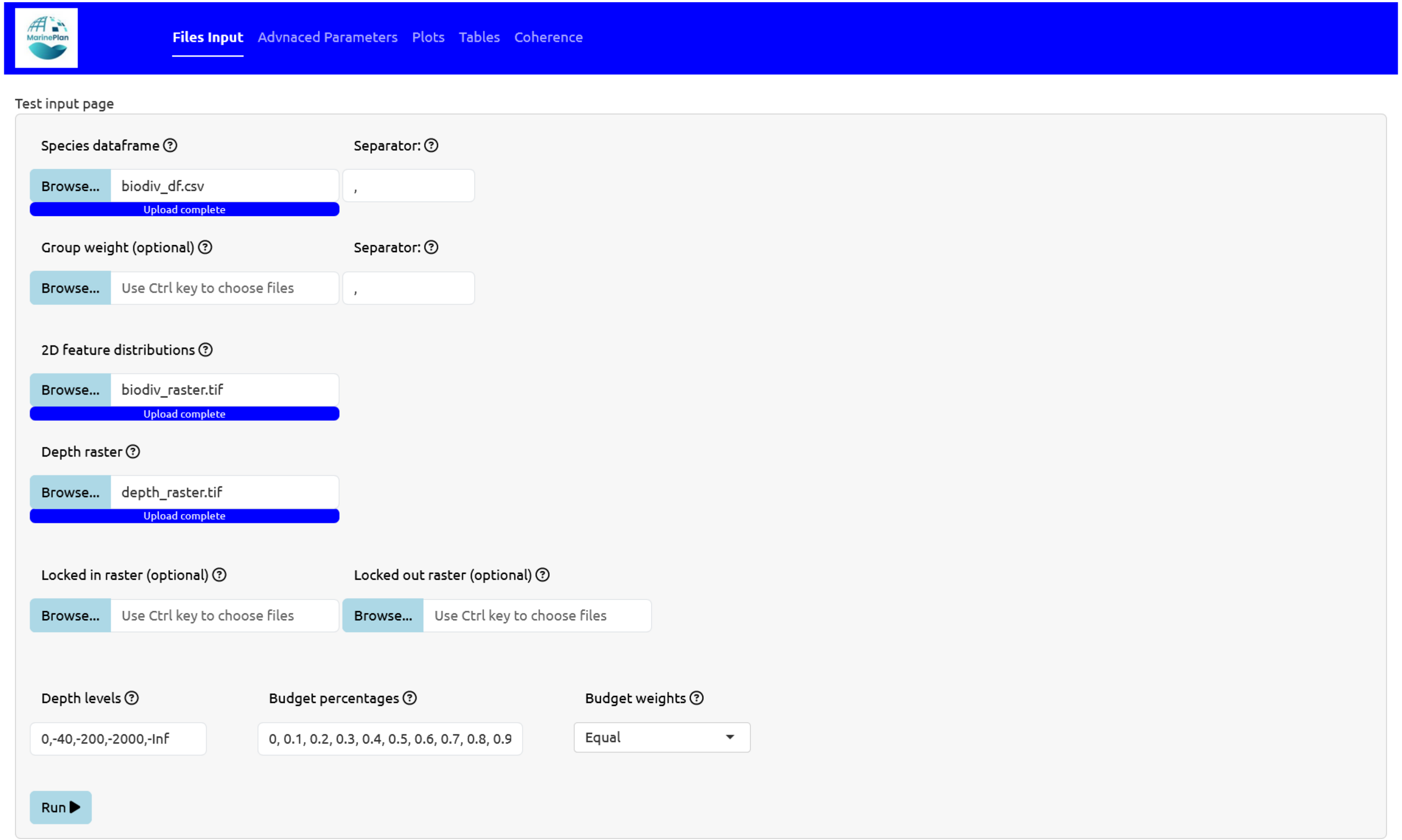


2D and 3D prioritisation approaches

Implementing the new tools – Comparative outputs for 2D & 3D planning (examples from the workshop)



3D prioritization online app



3D prioritization online app

Files Input | Advnaced Parameters | **Plots** | Tables | Coherence

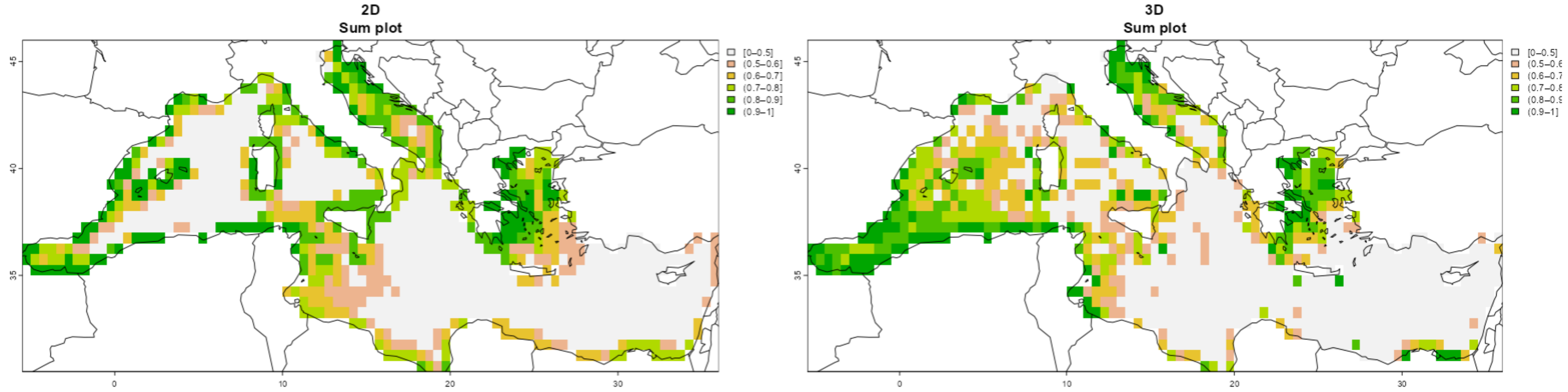
Choose plot

Maps

Choose budget percentage:

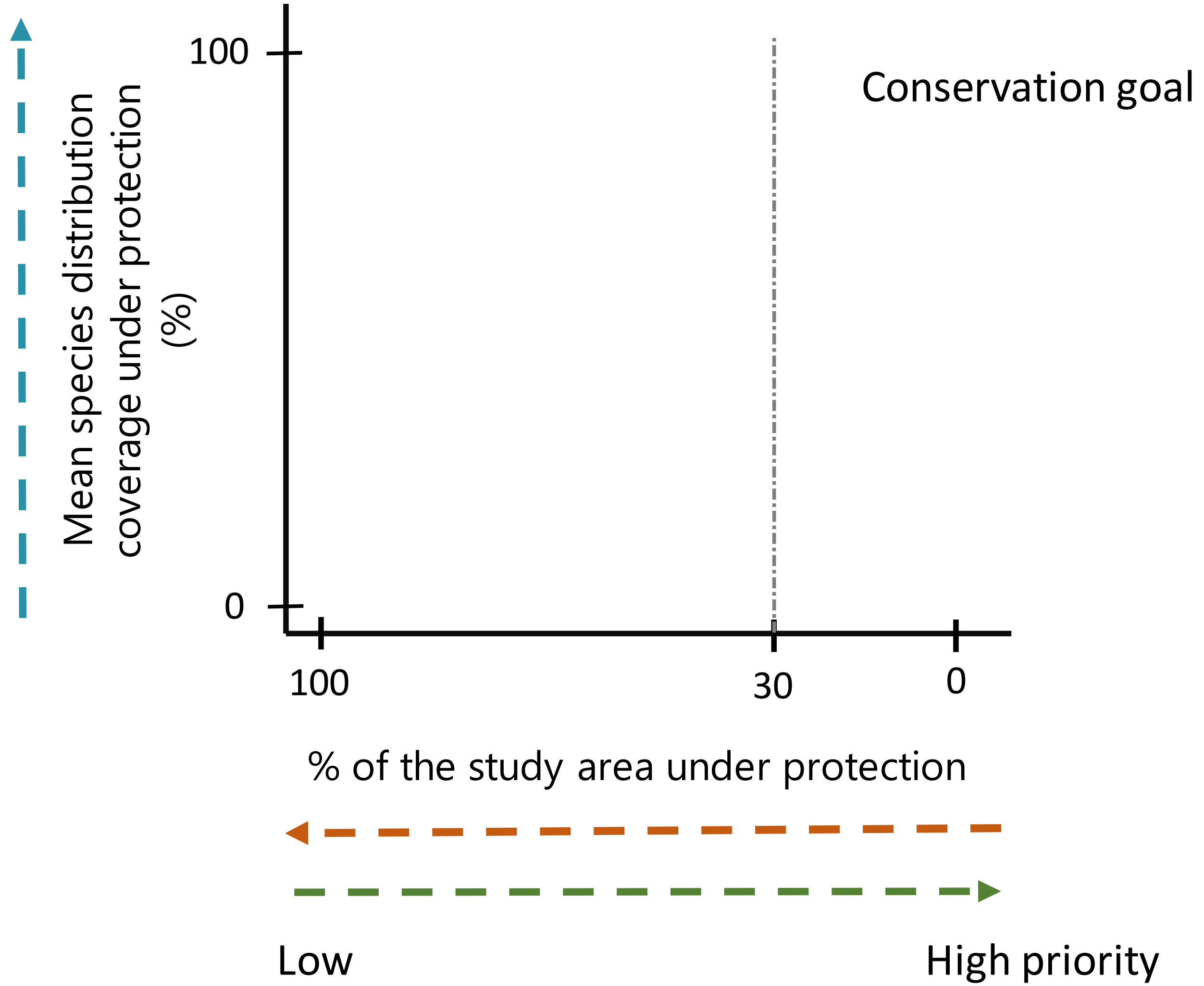
all

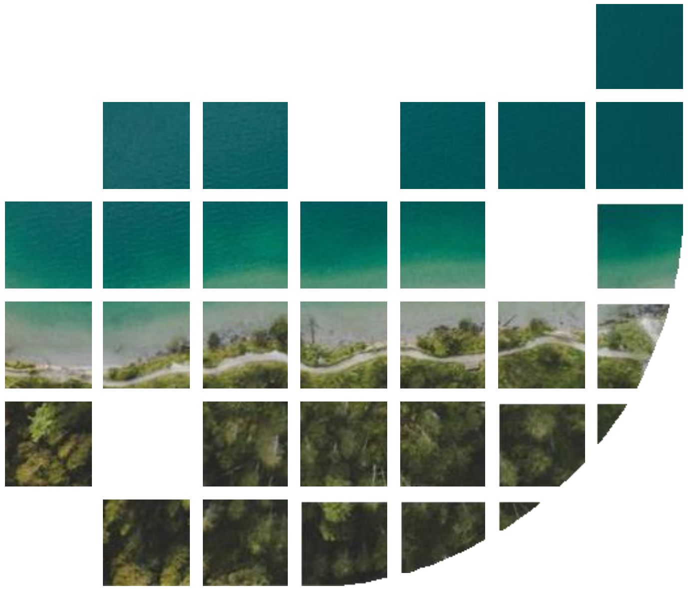
Save as PNG



Comparative outputs for 2D & 3D planning

species distribution coverage under protection

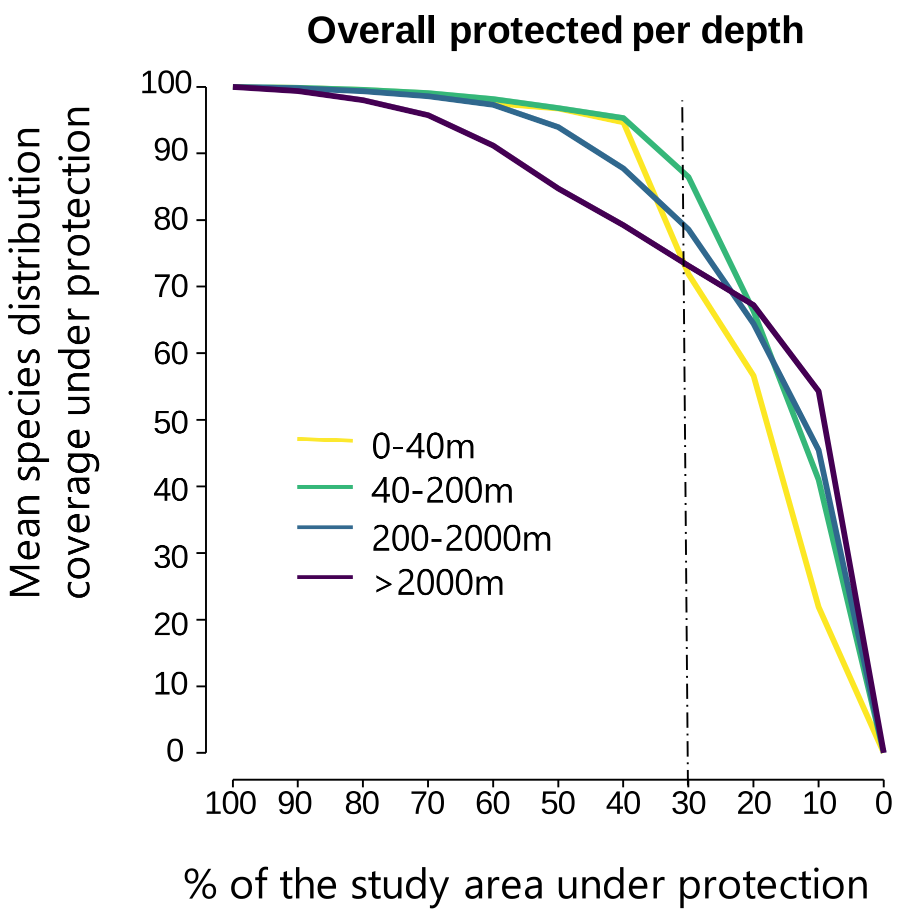




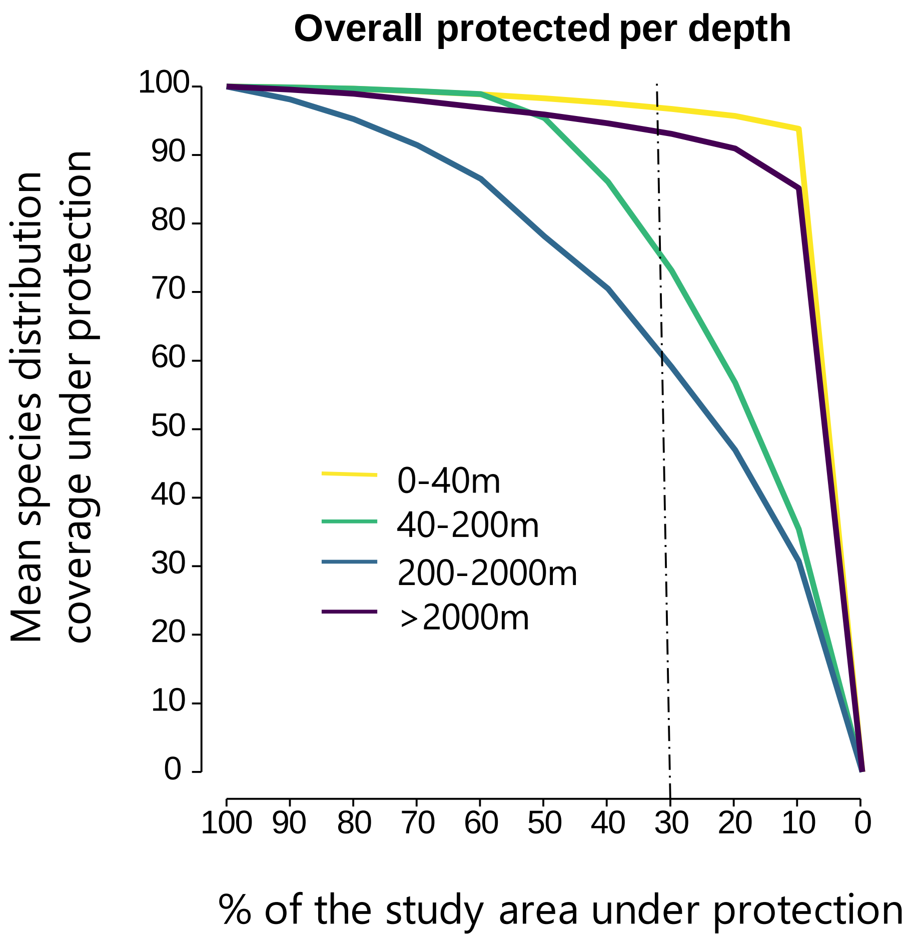
Comparative outputs for 2D & 3D planning

species distribution coverage under protection

2D algorithm

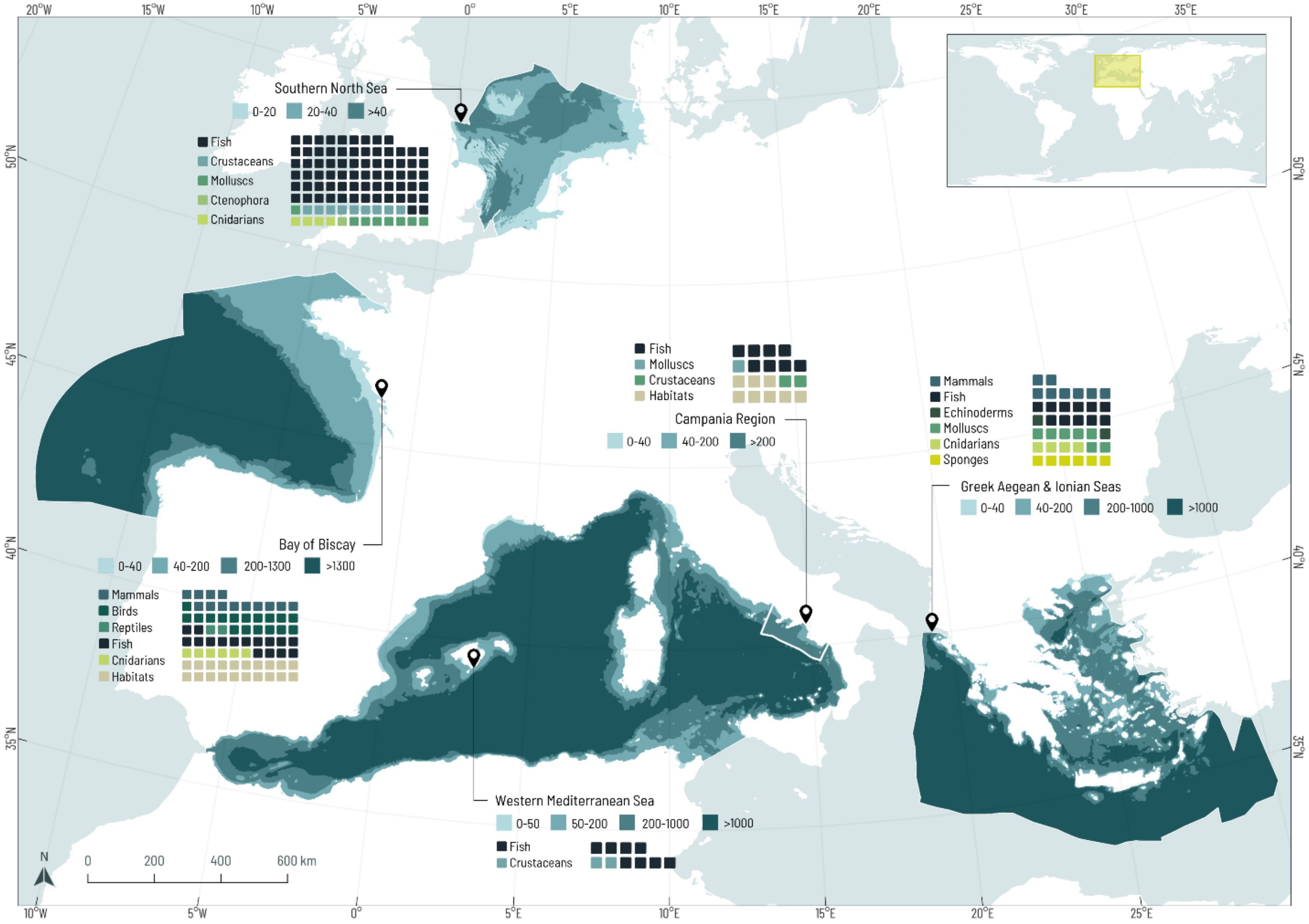


3D algorithm



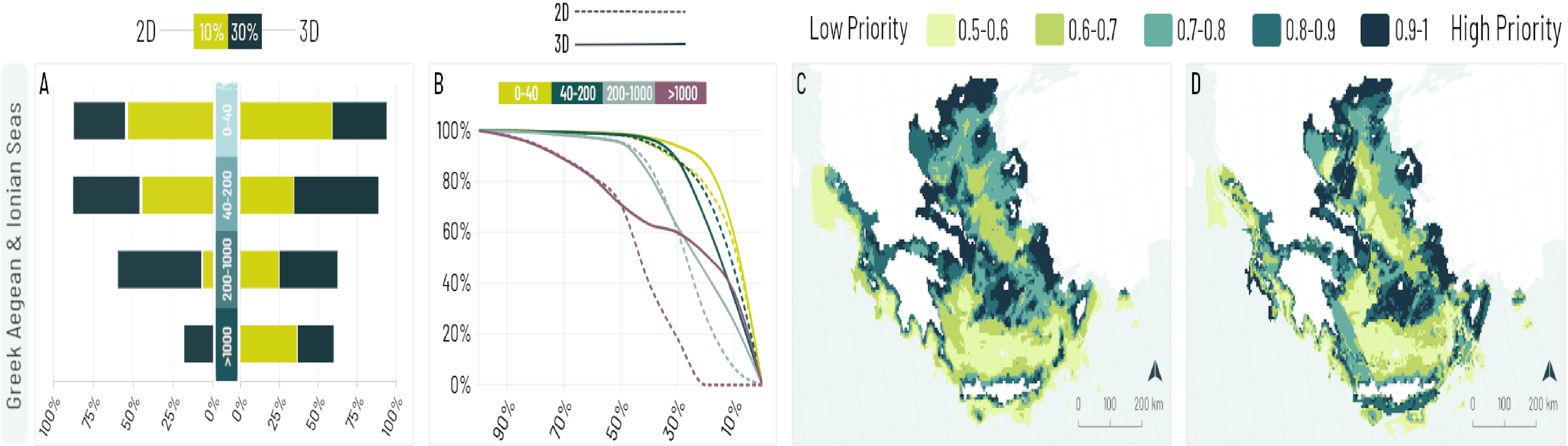
Better encompasses deep sea and coastal species

Studied PSs

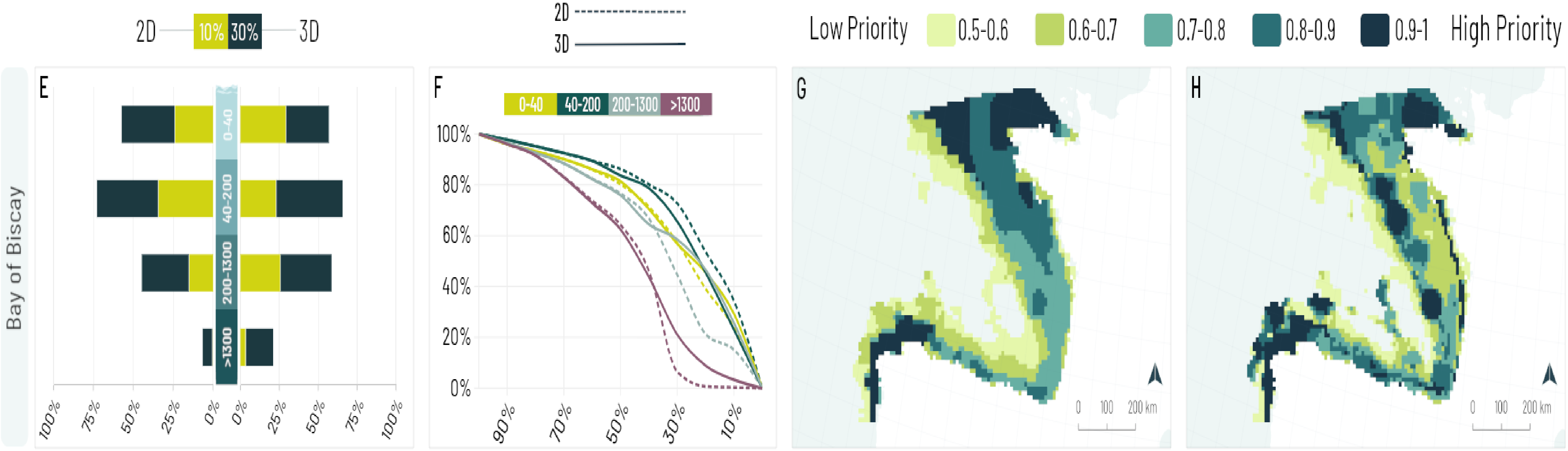


Southern North Sea
0-20 20-40 >40
Fish
Crustaceans
Molluscs
Ctenophora
Cnidarians
Bay of Biscay
0-40 40-200 200-1300 >1300
Mammals
Birds
Reptiles
Fish
Cnidarians
Habitats
Fish
Molluscs
Crustaceans
Habitats
Campania Region
0-40 40-200 >200
Mammals
Fish
Echinoderms
Molluscs
Cnidarians
Sponges
Greek Aegean & Ionian Seas
0-40 40-200 200-1000 >1000
Western Mediterranean Sea
0-50 50-200 200-1000 >1000
Fish
Crustaceans
N
0 200 400 600 km

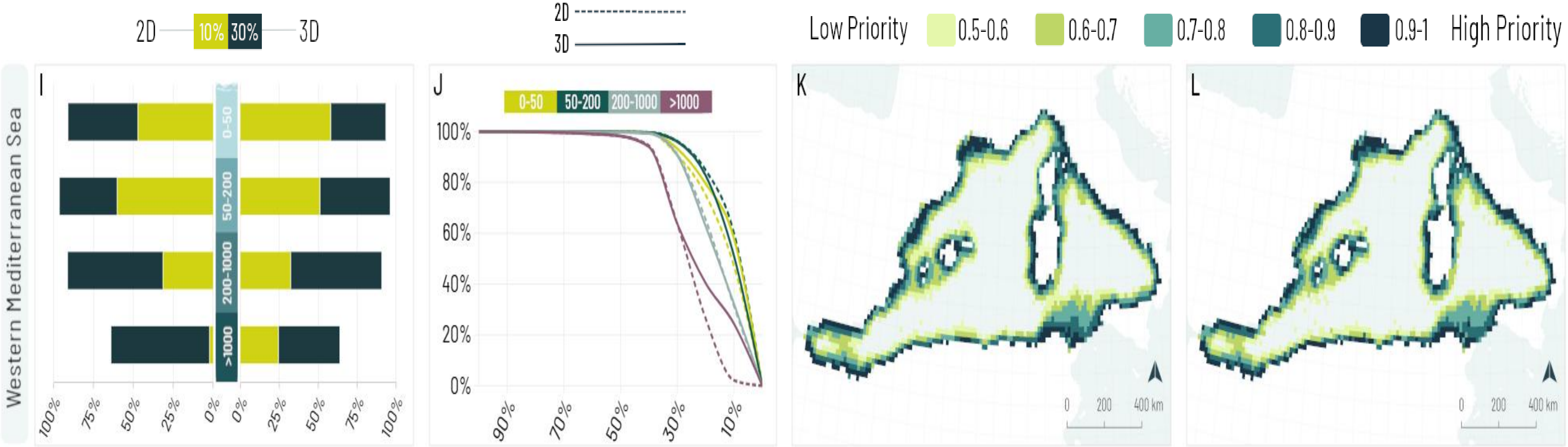
Greek Aegean & Ionian Seas



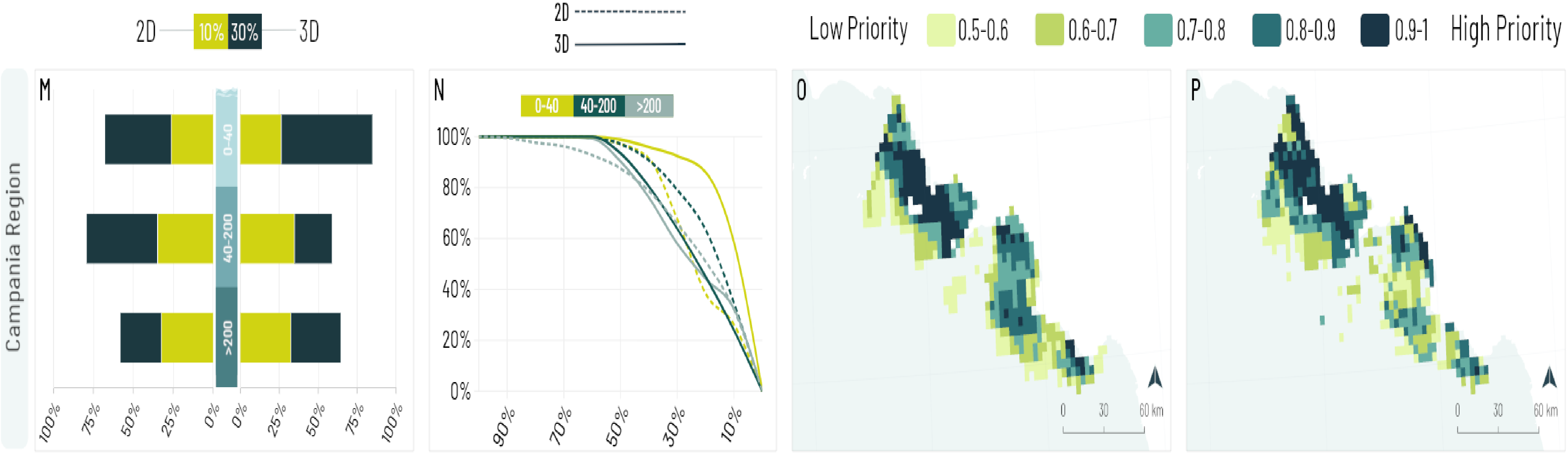
Bay of Biscay



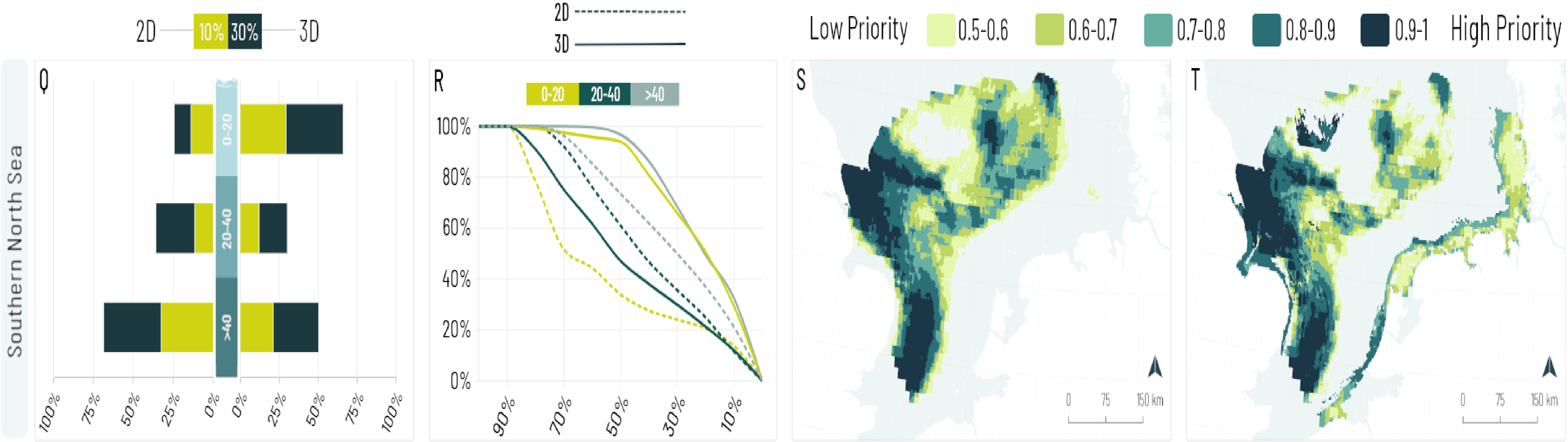
Western Mediterranean Sea



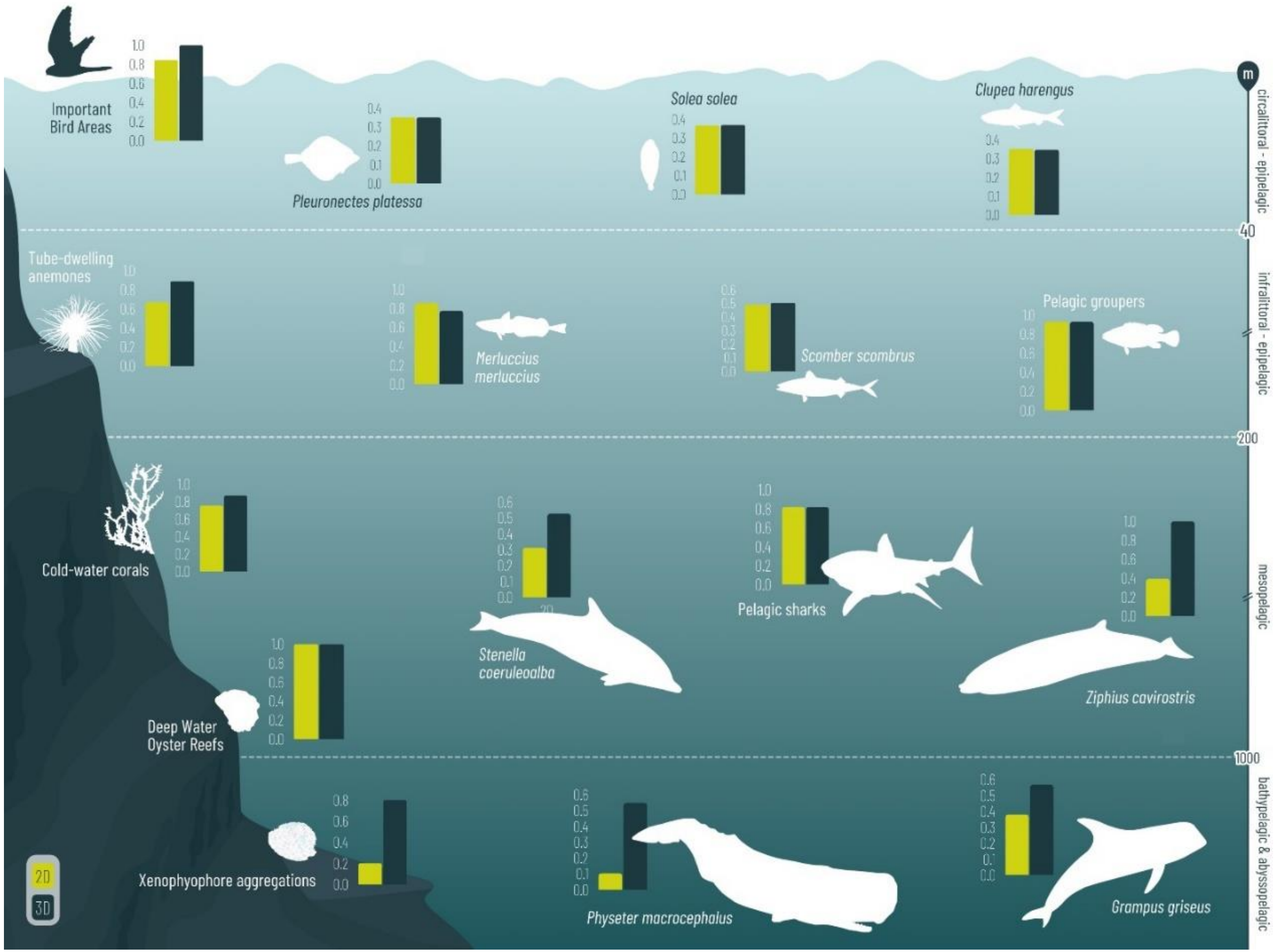
Campania Region



Southern North Sea



Overall coverages examples



Publications

Research Papers:

Doxa A., Adam C, Papazekou M., Nagkoulis N., Bas M., Lukyanova O., Gerven A. V., Fabbrizzi E., Coll M., Degraer S., Fraschetti S., Galparsoro I., Giakoumi S., Kruse M., Mazaris A. D., Moro S., Patel T., Pouso S., Stelzenmüller V., Katsanevakis S. (*forthcoming*). Filling the gap: 3D marine conservation planning helps to achieve biodiversity conservation targets across the marine realm.

Doxa, A., Adam, C., Nagkoulis, N., Mazaris, A. D., & Katsanevakis, S. (2025). prior3D: An R package for three-dimensional conservation prioritization. *Ecological Modelling*, 499, 110919.

CRAN packages

Doxa, A., Adam, C., Nagkoulis, N., Mazaris, A. D., & Katsanevakis, S. (2025). prior3D: 3D Prioritization Algorithm (R package version 0.1.5). Retrieved from https://cran.r-project.org/package=prior3D

Thank you!

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