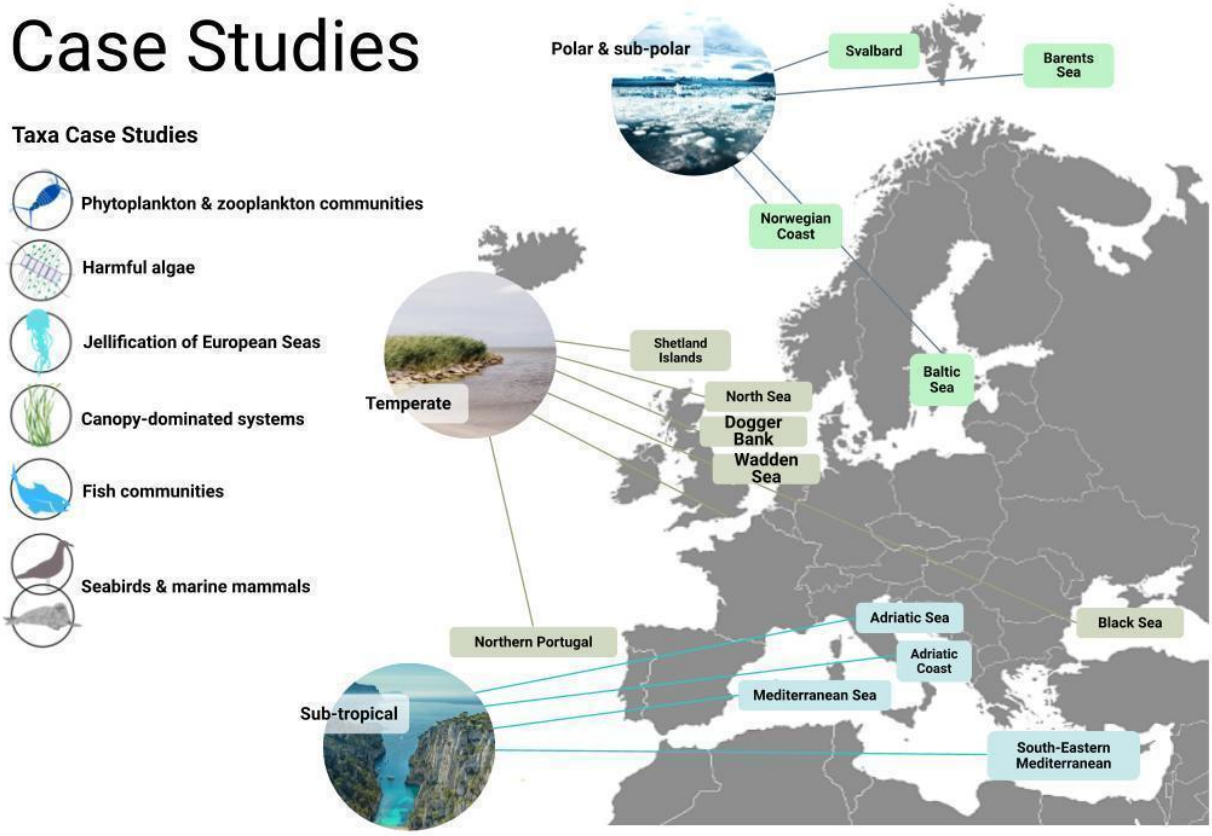
Case Study 11
Sub-tropical

Mediterranean Sea MPAs



ACTNOW

ACTNOW is an EU-funded research project aimed at understanding the cumulative impacts on European marine biodiversity, ecosystem functions, and services for human wellbeing. The project equips regulators and decision-makers with essential knowledge and tools to combat biodiversity loss in coastal and marine habitats threatened by climate change and other regional drivers.

Conducted across various Case Study Regions in Europe, ACTNOW focuses on delivering scientific support for adaptation and mitigation measures, sustainable blue economy expansion, and contributions to the UNFCCC.

The project is structured into six Workpackages: WP1 (Data, Indicators and Scenarios), WP2 (Marine Organisms under Multiple Drivers), WP3 (Community, Food-Web and Ecosystem), WP4 (Cumulative Risks & Biodiversity Assessments), WP5 (Synthesis, Impacts & Solutions Options), and WP6 (Communication and Dialogue).

Objectives include developing 'what if' scenarios, understanding combined impacts on ecosystems, employing advanced biologging and molecular methods, and enhancing awareness of the links between marine biodiversity and human health.

ACTNOW has 17 CSs, 11 are regional CSs while 6 are pan-European (group / taxon) CSs. All are designed to deliver a cause-and-effect understanding, build predictive capacity in models, and to develop indicators and tools for decision-makers charged with the stewardship of European marine biodiversity under threats from multiple drivers (stressors in call) (see fig below). In each case, drivers examined represent the local/regional priorities from regulators who co-create what-if scenarios of interacting drivers including envisioned management actions.

- **Case Study 11: Mediterranean Sea MPAs**

Leader

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Description

The Mediterranean Sea is the largest semi-enclosed sea on the planet, and one of the main reservoirs of marine biodiversity; it contains between 4 to 18% of identified marine species while covering only 0.82% of the global ocean surface. However, at EU scale it is also the region with the strongest evidence of habitat loss, although with limited knowledge of the key drivers.

Despite hosting more than one thousand marine protected areas (MPAs), the Mediterranean Sea is still poorly protected with 72% of the protected areas lacking regulations and the most effective levels of protection representing only 0.23% of the basin. So testing the effect of MPAs on biodiversity and services across the Mediterranean basin is of paramount importance.

More generally, we will test the effects of multiple drivers on iconic species groups (shark, IUCN) in shallow habitats to the mesophotic.

Services

We will focus on six services through indices:

- Functional diversity
- Phylogenetic diversity
- Trophic web robustness
- Mean trophic level
- Aesthetic value
- Public interest

Interacting Drivers of Biodiversity Change

- Human direct pressure through fishing activities
- Marine Protected Areas regulating fishing pressure
- Climate change
- Habitat loss
- Human gravity

Regional Context

The Mediterranean Sea is widely known as one of the world's marine biodiversity hotspots, hosting an exceptional wealth of species and habitats. This region represents only 0.82% of the ocean's surface area but is home to 18% of known marine species (around 17,000 marine species), with almost 10% of fish species endemic. This diversity is the result of the unique combination of geographical, climatic and historical factors that have shaped its ecosystems.

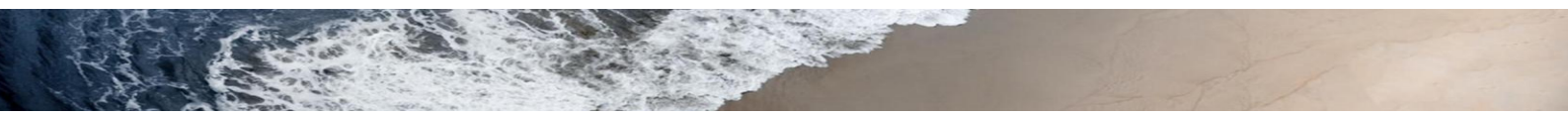
Coastal habitats, in particular, are highly productive and diverse. They provide numerous ecosystemic services such as economic development, human well-being, cultural heritage preservation, and atmospheric carbon sequestration.

In response to these threats, the creation of Marine Protected Areas (MPA) is one of the most recognised conservation strategies to mitigate the multiple pressures on species and ecosystems. However, only 6.01% of the surface area of the Mediterranean Sea is currently included in marine protected areas, with only 0.23% benefiting from full or very strict protection, prohibiting or severely restricting fishing. To achieve the international objective of covering 30% of marine surface with MPA by 2030, it will be necessary to increase the coverage of marine protected areas across the Mediterranean.

Research Needs

Historically fish monitoring has been carried out using underwater visual surveys (UVC) or video surveys. These methods have limitations in terms of spatial and temporal coverage and are biased for certain groups of species like sharks or IUCN species. A method allowing to lever these limitations in highly diverse ecosystems is environmental DNA (eDNA) metabarcoding, a non-invasive method demonstrating higher detection capabilities and cost-effectiveness compared to other methods. By collecting water samples from a given site, it is possible to extract and amplify the DNA of an organism present in that location. This method is promising to tackle large scale survey challenges, and furthermore overcomes some of the limitations of conventional methods for characterising marine fish assemblages, including cryptic, rare and elusive species.

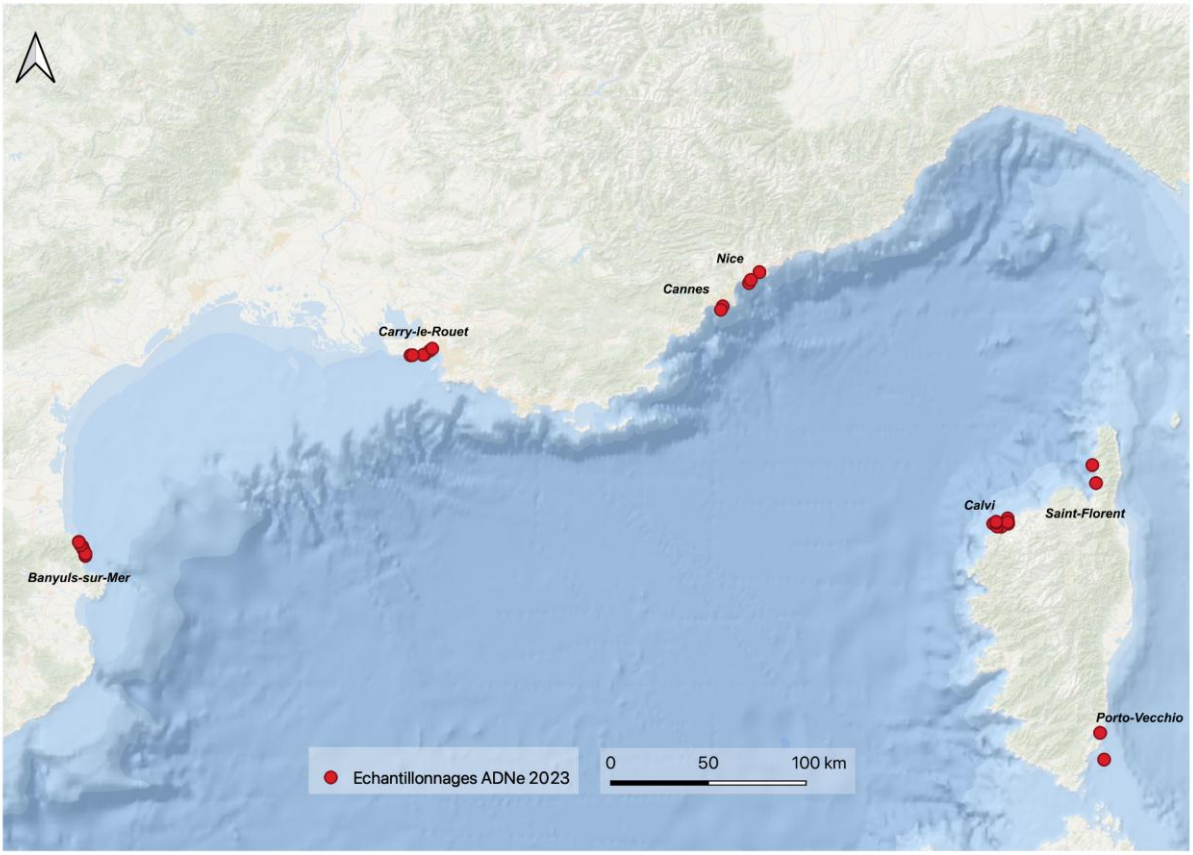
So the urgent need is to test the effects of MPAs across the Mediterranean using eDNA surveys?

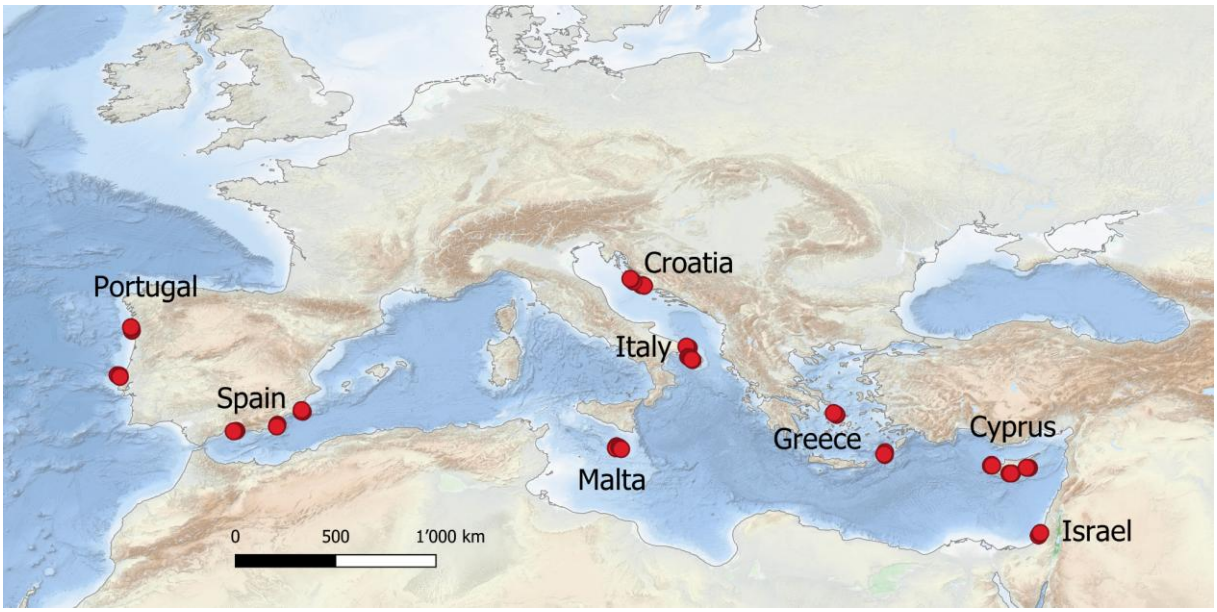


Research Planned in ACTNOW

- T4.1 Sampling eDNA in more than 20 Mediterranean MPAs and their outside
- T4.2 Performing eDNA metabarcoding
- T4.3 Calculating indicators of services
- T6.2 Contributing to the development of the serious game "*Playing for change: Using experiential learning for bridging science and policy making to drive holistic understanding "*

Pictures, graphs and maps





Sampled locations