AIME

Artificial Intelligence for Marine Ecosystems

Supporting the achievement of Sustainable Development Goal 14 on life below water by using artificial intelligence to generate knowledge on marine ecosystems in the Mediterranean and the Pacific seas.

Project key information

Project leader: Jihad Zahir, CAU / UMMISCO, Morocco; j.zahir@uca.ac.ma
Project duration: 48 months
Starting date: January 2021
Total budget: 649 K€

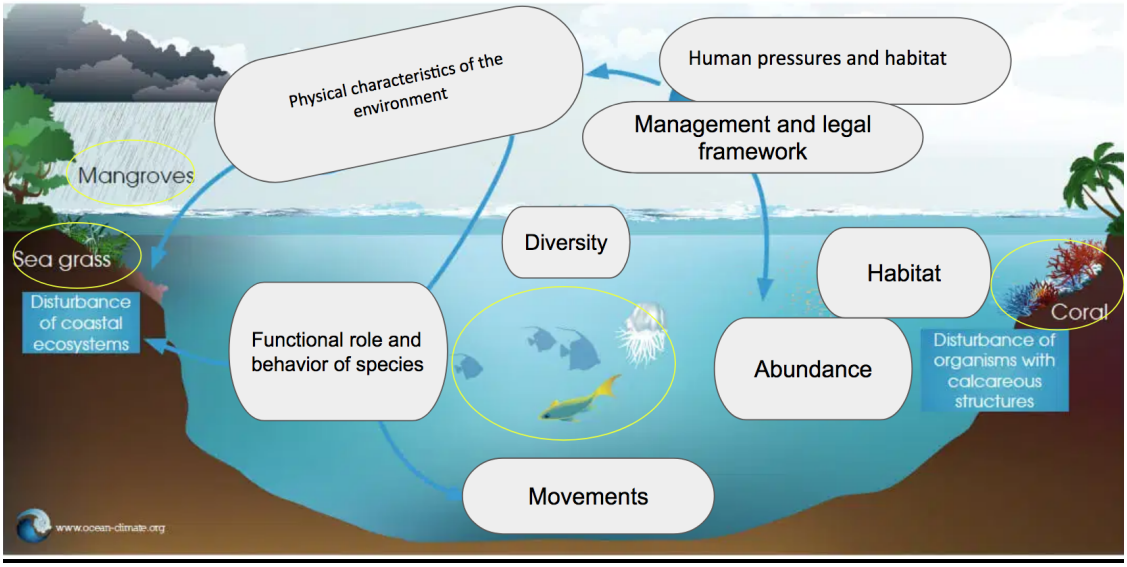
Partner institutions

Cadi Ayyad University Morocco/UMMISCO, IRD/Entropie, IRD/Marbec, IRD/UMMISCO, IRD/LEMAR, Yaounde 1 University Cameroon/UMMISCO, Cheikh Anta Diop University Senegal/UMMISCO, Gaston Berger University Senegal/UMMISCO, Sorbonne University/ISYEB, La Reunion University/LIM

Context

In the present age of anthropogenic defaunation, innovative methodologies are needed to monitor ecosystem health over large spatial scales and at high temporal frequencies, and predict its evolution, especially as a consequence of human intervention, while accounting for the complexity of ecological systems. The diversity of an ecosystem depends on multiple factors, including the physical characteristics of the environment, human pressures and habitat, ecosystem management and legal framework, the diversity, abundance, functional role and behavior of species, the interactions that they have with each other and with the environment, and the retroactions among all ecosystem components. Each WP of the project AIME addresses one of these boxes. In AIME, we are addressing these aspects by improving the automatic quantification of biodiversity dynamics.

Main factors influencing marine biodiversity



Objectives

- Identify and quantify impacts of human activities and induced pressures on the state and dynamics of marine habitats.
- Pairing AI with environmental DNA (eDNA) metabarcoding for fast and improved assessments of species identification and biodiversity indices (BI)
- Automatically measure abundance at a local scale; Monitor abundance and interspecific interactions.
- Integration of movement data to support conservation and assess effectiveness of management
- Automatically extract information from legal texts to assess protection of marine biodiversity

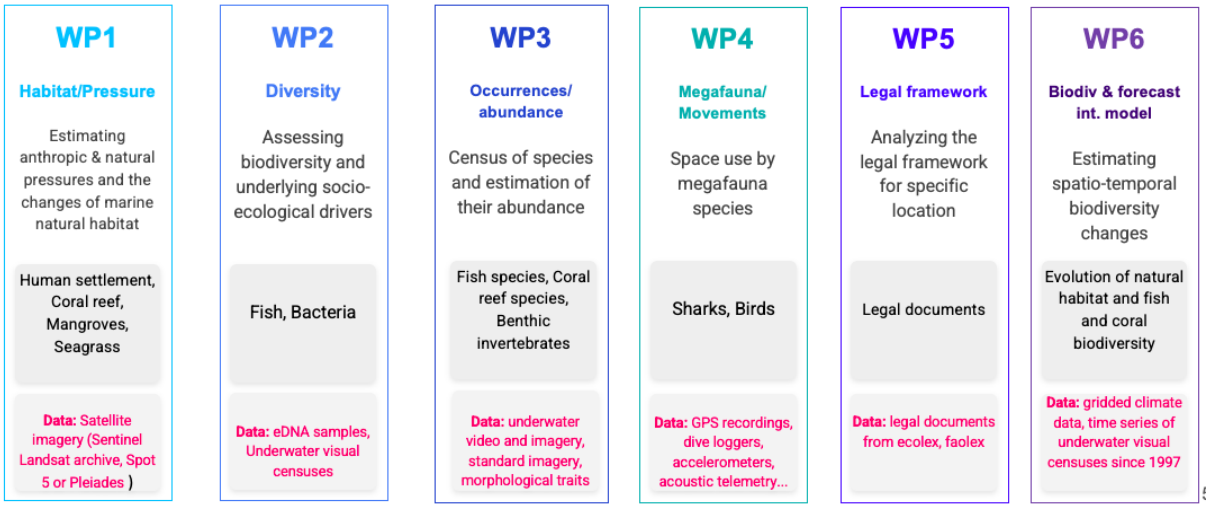
Specific challenges

The main challenge of this project is ***building an adequate model architecture that efficiently integrates heterogeneous data, at multiple scales, to accurately model biodiversity dynamics.***

Other specific challenges include:

- Integration of heterogeneous data with different spatial and temporal resolution, different sensors and view angles.
- Complexity of the different bioinformatic pipelines needed to process eDNA data as they link together several steps (e.g. paired-end reads merging, demultiplexing, taxonomic assignment) achieved through disparate programs.
- Linking the eDNA signature found within ecosystems to their environmental status
- Making a knowledge base adapted to fish and coral reef species identification.
- Building an efficient interface between subsymbolic and symbolic models.

Work Packages



Expected results

- Spatial extent of marine habitats and their dynamics, i.e. temporal evolution ; proxy of human pressure on marine habitats
- New pipelines and models to process eDNA data and infer BI more efficiently and accurately. Predictive models to infer the effect of management strategies vs. human activities based on eDNA and predictions under different scenarios.
- Automated and accurate abundance indicators
- Models for the simulation of realistic animal movement patterns.
- Models for information extraction from legal documents
- A probabilistic model able to aggregate the different components and estimate biodiversity dynamics taking into account different scenarios of global change (populated area change, climate change).