Multi-objective zoning for biodiversity and aquaculture in the Adriatic-Ionian region

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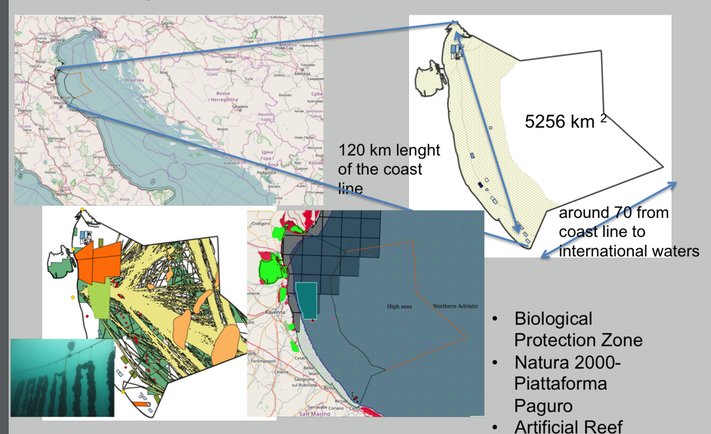
Introduction (Why - What - How)

- Aquaculture is now the fastest growing form of food production on the planet. An **Aquaculture Sustainable Development** is required within the EU Marine Spatial Planning (MSP) Directive (2014/89/EU) and the Blue Growth initiative in the Adriatic Ionian Region.
- **Spatial decision-support tools** can be used for scenario analysis and guide decision-makers towards transparent and knowledge-based spatial planning.
- Objective: **multi-objective zoning** for **aquaculture expansion** and **biodiversity protection** in the Emilia Romagna Region (Italian Northern Adriatic Sea).
- The decision support tools **Marxan** and **Marxan with Zones** are applied to develop alternative planning scenarios then compared using a novel nearest-neighbour statistical analysis to understand similarities and differences.

Methods

Study Area



- Biological Protection Zone
- Natura 2000-Piattaforma Paguro
- Artificial Reef

Emilia Romagna marine waters (5256 km^2); several maritime uses (highest production of mussels); hotspot of biodiversity: Essential Fish Habitats, bottlenose dolphins and feeding ground of the loggerhead turtle, vulnerable seabed habitats.

Methodology workflow

STEP 1_a: profitability surface

1) Computation of the distance from main ports

STEP 1_b: aquaculture suitability

1) Definition of the indicators of suitability and relative suitability range
2) Collection and processing of spatial data
3) Definition of the criteria, relative parameters and weights
4) Implementation of the multicriteria analysis

STEP 2: Prioritize Biodiversity

1) Definition of CONSERVATION FEATURES, COSTS, TARGETS
2) Collection and processing of spatial data
3) Preparation of the input dataset

STEP 3: Prioritize Aquaculture and simultaneously Biodiversity (Marxan with Zones)

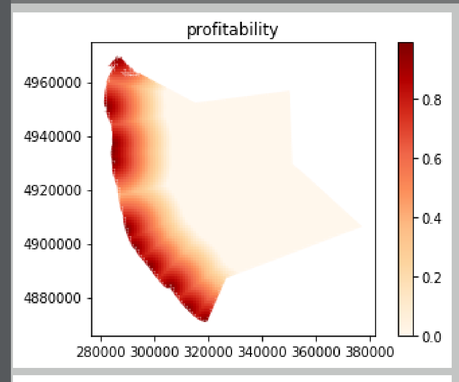
1) Definition of CONSERVATION FEATURES, COSTS, TARGETS
2) Collection and processing of spatial data
3) Preparation of the input dataset

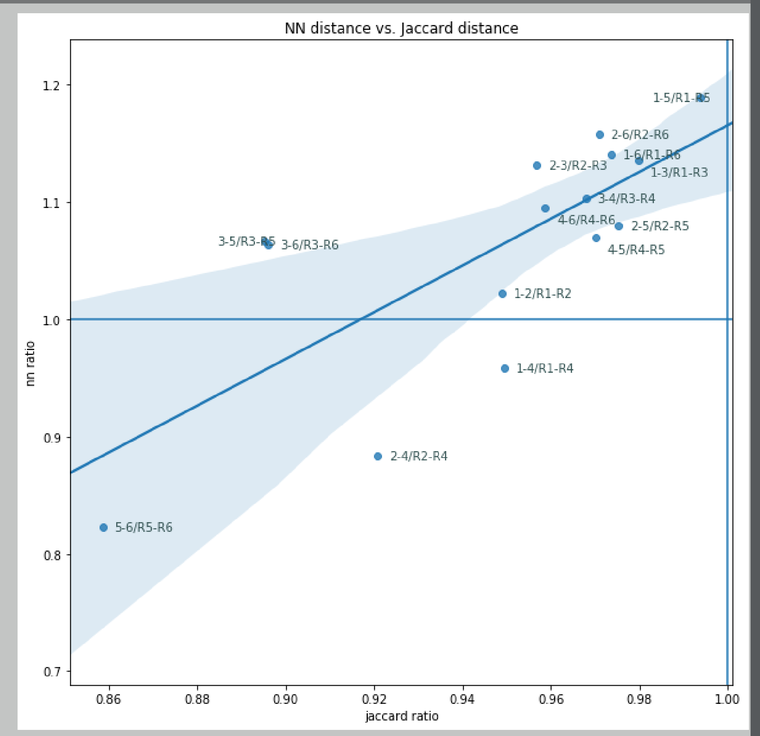
STEP 4: scenario comparison analsyis

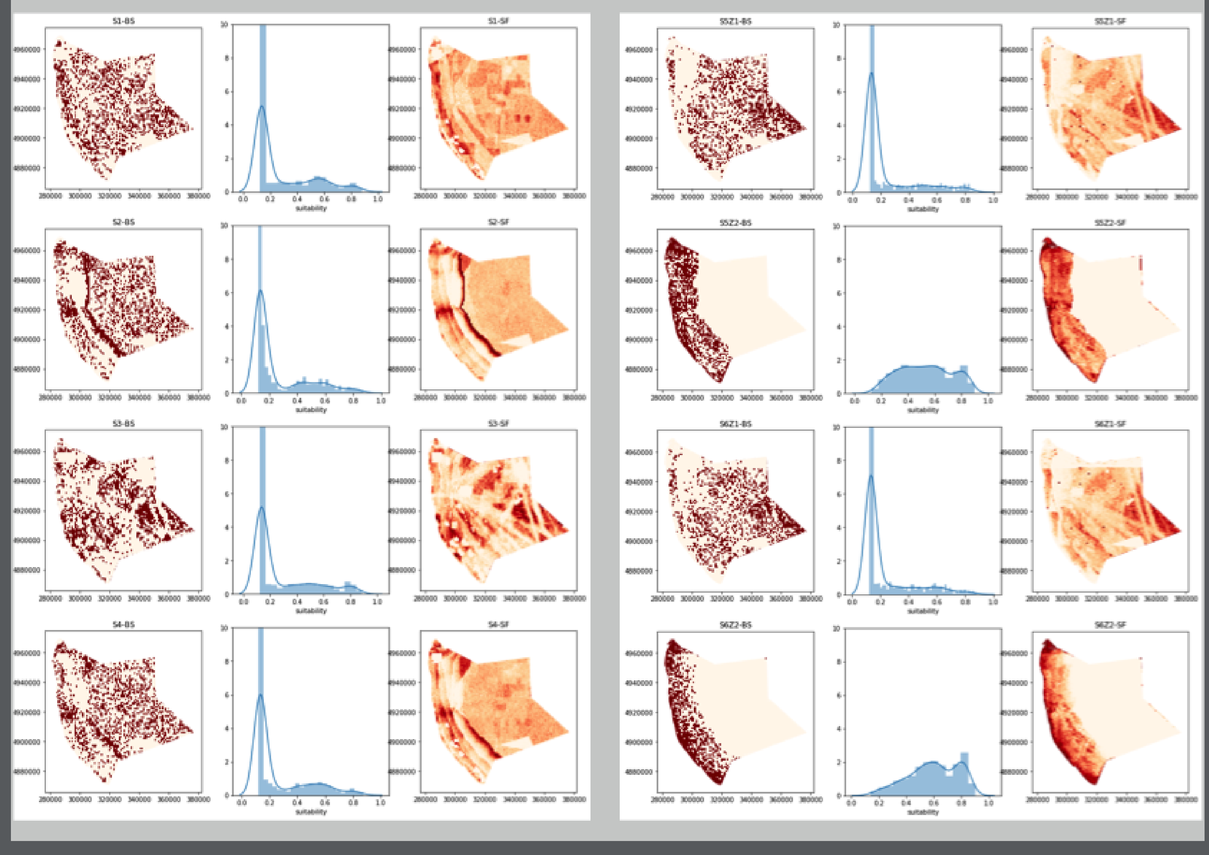
Scenario configuration strategy

Objective	Scenario	Conservation Features and Targets	Cost used
Biodiversity Prioritization (Marxan)	1	• Seabed habitats (30%) • Nursery and spawning areas (30%) • Species distribution (10%)	Area
	2		Profitability surface
	3		Number of human uses
	4		Aquaculture Suitability
Biodiversity and Aquaculture Prioritization (Marxan with Zones)	5	BIODIVERSITY ZONE • Seabed habitats (30%) • Nursery and spawning areas (30%) • Species distribution (10%)	Number of human uses
		AQUACULTURE ZONE • Aquaculture Profitability (40%)	Number of uses in conflict with aquaculture
	6	BIODIVERSITY ZONE • Seabed habitats (30%) • Nursery and spawning areas (30%) • Species distribution (10%)	Number of human uses
		AQUACULTURE ZONE • Aquaculture Suitability(40%)	Number of uses in conflict with aquaculture

Results







Conclusions

- **Statistical analyses** allows us to **compare differences across scenarios**. We found scenarios developed using the **profitability** surface and the **suitability** surface **produced the most similar plans** of all scenarios which has important implications for the **value of the information** provided by the more comprehensive suitability surface.
- **Integrated multi-objective zoning** approaches, which simultaneously plans for biodiversity and aquaculture, will support more efficient, and therefore more **effective strategies** for **Blue Growth** objectives in the AIR.
- Application for multi-objective zoning in marine socio-ecological systems is beneficial for supporting the on-going **Maritime Spatial Planning (MSP)** process and the **sustainable development of aquaculture**.

Acknowledgement

This research is funded by: RITMARE Flagship Project of the National Research Programmes funded by the Italian Ministry of University and Research; Short Term Mobility (STM) Grants funded by the Italian National Research Council; Research Grant Program of The Ministry of Research and Higher Education of Indonesia in academic year 2017/2018 and by the Erasmus Mundus Master Course on Maritime Spatial Planning.

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