# Master's Thesis Opportunity in Ecology and Fisheries Science

Topic: Sustainable exploitation of Marine Resources

Potential title: "Integrating vessels detections from satellite imagery and Fisheries-Dependent Data to Estimate Bottom Trawl Effort and Deep-Water Shrimp Productivity in the Mediterranean"

Background

Monitoring fishing activity in the Mediterranean Sea remains challenging due to incomplete vessel tracking coverage and fragmented fisheries-dependent datasets. While the Automatic Identification System (AIS) provides valuable information on vessel movements, only a portion of the fleet is publicly tracked. Satellite remote sensing offers complementary and independent monitoring tools. Sentinel-1 Synthetic Aperture Radar (SAR) imagery enables vessel detection regardless of cloud cover or daylight conditions, while Sentinel-2 optical imagery can provide additional information on vessel presence, wake detection, and environmental context under clear-sky conditions. These datasets are publicly available through the Copernicus program. Processed vessel detections and AIS-derived fishing activity data are also accessible through Global Fishing Watch, which provides open datasets and APIs for research purposes.
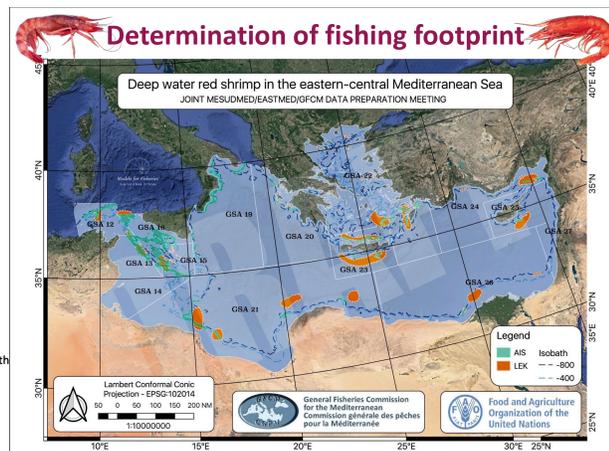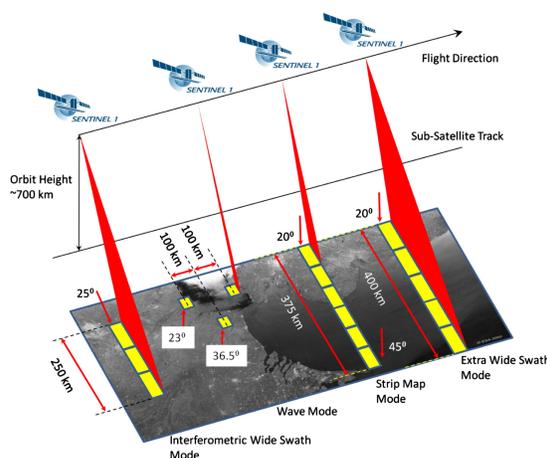
Previous studies have demonstrated that SAR vessel detections can be statistically linked to AIS-derived fishing activity to predict trawling intensity in areas with limited AIS coverage. However, spatially explicit effort estimates alone do not quantify fishery productivity. Integrating effort predictions with fisheries-dependent data—such as logbooks, landing declarations, or market records—can allow estimation of catch per unit effort (CPUE), providing insight into the spatial

productivity of bottom trawl fisheries, particularly those targeting high-value deep-water shrimp species.

Objectives

The overall objective of this thesis is to develop an integrated framework combining satellite remote sensing, AIS data, and fisheries-dependent datasets to estimate:

1. The spatial distribution and intensity of bottom trawl fishing effort.
2. The spatial productivity (e.g., CPUE) of deep-water shrimp fisheries.
3. The relationship between fishing intensity and productive fishing grounds.
4. An evaluation of the sustainability of this fishery

Specific research questions may include:

- How can Sentinel-1 SAR and Sentinel-2 optical detections improve predictions of bottom trawl effort in areas with incomplete AIS coverage?
- How well do satellite-derived effort estimates align with landing and logbook data?
- Where are the most productive deep-water shrimp fishing grounds, and how do they relate to spatial fishing pressure?
- What are the perspectives for this highly-important commercial stock?

The study area will focus on selected Mediterranean regions where bottom trawl fisheries targeting deep-water shrimp are prominent.

Expected Outcomes

- Spatially explicit estimates of bottom trawl effort derived from integrated AIS, SAR, and optical data.
- Improved detection of fishing activity in areas with limited AIS coverage. Spatial productivity estimates (CPUE) for deep-water shrimp fisheries.
- Identification of high-efficiency fishing grounds and potential management-relevant patterns.
- A reproducible, open-data-based methodological framework for combining satellite monitoring with fisheries-dependent datasets.

The results will contribute to enhanced transparency, compliance monitoring, and evidence-based fisheries management in data-limited contexts.

Candidate Profile

We are seeking a motivated Master's student with:

- Background in marine science, fisheries science, remote sensing, environmental science, data science, or related fields.
- Good or interested in learning quantitative skills to handle large datasets (R language, Phyton).
- Interest in spatial analysis, satellite data, modelling and fisheries monitoring. Ability to work independently

Experience with GIS, statistical modeling, Google Earth Engine, or remote sensing processing is an advantage but not mandatory.

Practical Information

- Duration: 6–9 months
- Start date: Flexible
- Location: University of Rome, Tor Vergata
- Supervision: Prof. Tommaso Russo, Dr. Luca Marsaglia

Interested candidates should send a CV and short motivation letter to:

Tommaso.Russo@Uniroma2.it and luca.marsaglia@students.uniroma2.eu