New science initiatives in the Mediterranean and Black Seas

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Big old and new data

Shiny new insights for what is not directly observed

- Climate models
- Niche models
- IBM
- GLMs, GAMs
- Classification Tree Analysis
- Random Forests
- Boosted Regression Trees
- Multivariate Adaptive Regression Splines
- Surface Range Envelope
The authors propose a new framework

Use of the coupling of species distribution and trophic models for predicting climate change impacts on food-web structure across the Mediterranean.
They used data from the Mediterranean continental shelf:

- published food webs
- stomach contents from literature and FishBase
- actual geographical distributions (occurrence maps) for 256 endemic and native coastal fish species
- Sea Surface water Temperature (SST) as the main forcing variable
- the Mediterranean regional marine model (NEMOMED8) that predicts observed and future SST based on a variety of drivers
- projected SST values were extracted for 2080–2099 from NEMOMED8 outputs, based on the SERS IPCC A2 scenario
- this scenario is conservative but not the most pessimistic.
species richness, 54 out of 256 endemic and native species would disappear.

Connectance of the fish web would increase, mainly due to the decrease of feeding links and species richness.

Differences in various attributes between 1961–1980 (baseline scenario) and 2080–2099.

Predator generality, estimated as the number of prey species per predator species, would decrease.
number of feeding links between fish species would decrease on 73.4% trophic level

Differences in various attributes between

1961–1980 (baseline scenario)

2080–2099.

Vulnerability, the mean number of consumer species per prey species, would decrease
The study highlights:

- the large-scale impacts of climate change on marine food-web structure
- with deep consequences on ecosystem functioning.
Meta-analysis of the contributions of food web modelling to marine science

Contributions of food web modelling to the ecosystem approach to marine resource management in the Mediterranean Sea

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39 EwE models for the Mediterranean
Differences in ecosystem traits by Mediterranean sub-basin

- Relative flows of detritus
- System omnivory
- Mean transfer efficiency
- Transfer efficiency from PP
- Mean community trophic level
Differences in ecosystem traits by fishing intensity

More detritus and smaller mean trophic level of catch in fished ecosystems
The results highlight differences in ecosystems structure and function between:

- ecosystem types
- sub-basins
- fished and non-fished areas
- which illustrate the environmental heterogeneity of the Mediterranean.

The results are important for supporting

- the ecosystem approach to fisheries management.
Annual probability maps and habitat allocation of the main small pelagic species

A series of solid work done within the framework of several projects with the participation of the different “Small pelagic” research groups in the Mediterranean

MARIFISH WP7: Collaborative Research Programmes
Regional Scale Study-The Mediterranean

REPROdUCE: MARIFISH Framework

SARDONE
EU FUNDED project, FP6 Framework

MEDISEH
DG MARE Contract Service

• Mediterranean Acoustic Survey since 2008
• Internationally coordinated
• Simultaneous hydrographic sampling
Data used to develop habitat maps:

Biological data (at different seasons/years/areas):
- Acoustic surveys (MEDIAS)
- Ichthyoplankton surveys
- Pelagic trawl data

Environmental data (satellites):
- Sea level anomaly
- SST, depth
- Chl-a
- Salinity
- Photosynthetic active radiation

Characterizing the potential habitat of European anchovy *Engraulis encrasicolus* in the Mediterranean Sea, at different life stages

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Summer ichthyoplankton surveys were used to model potential spawning habitat. Selected models were used to produce maps presenting the probability of anchovy presence (adults, juveniles and eggs) in the entire Mediterranean basin, as a measure of habitat adequacy. Bottom depth and sea surface chlorophyll concentration were the variables found important in all models. Potential anchovy habitats were located over the continental shelf for all life stages examined.
Biological & environmental data

Statistical models

Habitat maps at the Mediterranean scale
Initially development of annual probability maps

mean probability maps
standard deviation maps

for the whole Mediterranean

Giannoulaki et al. (2013), Fisheries Oceanography
Then habitat allocation maps were obtained based on the following:

**Preferential habitat:** High mean, low SD

**Occasional habitat:** High mean, high SD

**Rare habitat:** Low mean
This has been done for the following species (in different publications):

- Anchovy
- Sardine
- Mediterranean horse mackerel
- Mackerel
Practical uses of habitat suitability maps

- Evaluate existing FRAs /MPAs & Define new FRAs/MPAs
- Provide input to IBMs & Examine climate change scenario
- Covariates in other habitat suitability models
- Provide input to Ecosystem models with spatial perspective
- Set a framework to minimize discards H2020 MINOW
Species A
Species B
Species C
Species D
Species Z
And species assemblage

H-2020 MINOW Project... mapping of discards
Mapping of total discards online and in real-time with options for incorporating Bayesian priors from fishers.

Fishers can zoom in their own area of operation avoid areas and enrich the database.
Climate models
Niche models
IBM
GLMs, GAMs

Classification Tree
Analysis
Random Forests
Boosted Regression Trees
Multivariate Adaptive Regression Splines
Surface Range Envelope

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