Integration of fisheries and ecological data to support spatial management: the case of blackspot seabream (*Pagellus bogaraveo*) in the western Mediterranean Sea

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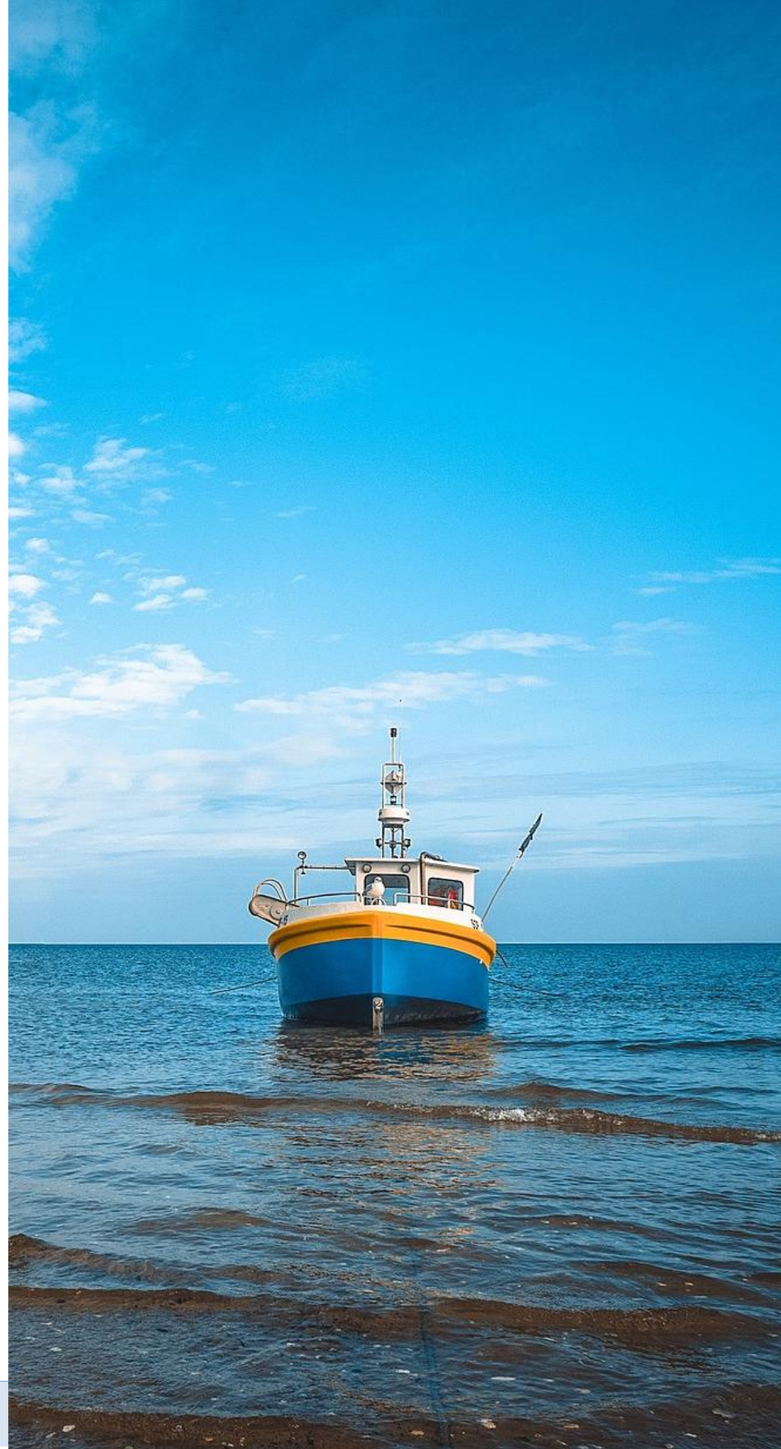
5 General Fisheries Commission for the Mediterranean, Food and Agriculture Organization of the United Nations (GFCM, FAO)



Background

The Mediterranean region has been facing increasing problems over years such as overfishing and the impact of climate change on fish stocks.

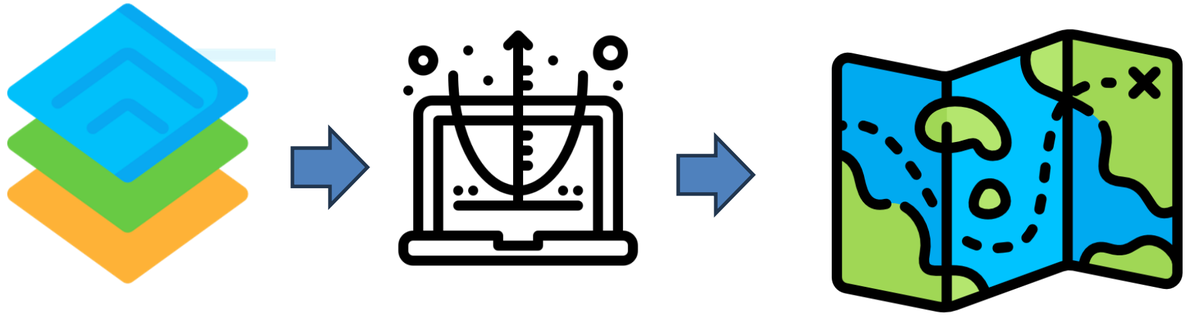
Although overfishing has recently decreased in response to management, still 58% of commercial stocks in the Mediterranean are overfished compared to their ecologically sustainable limit

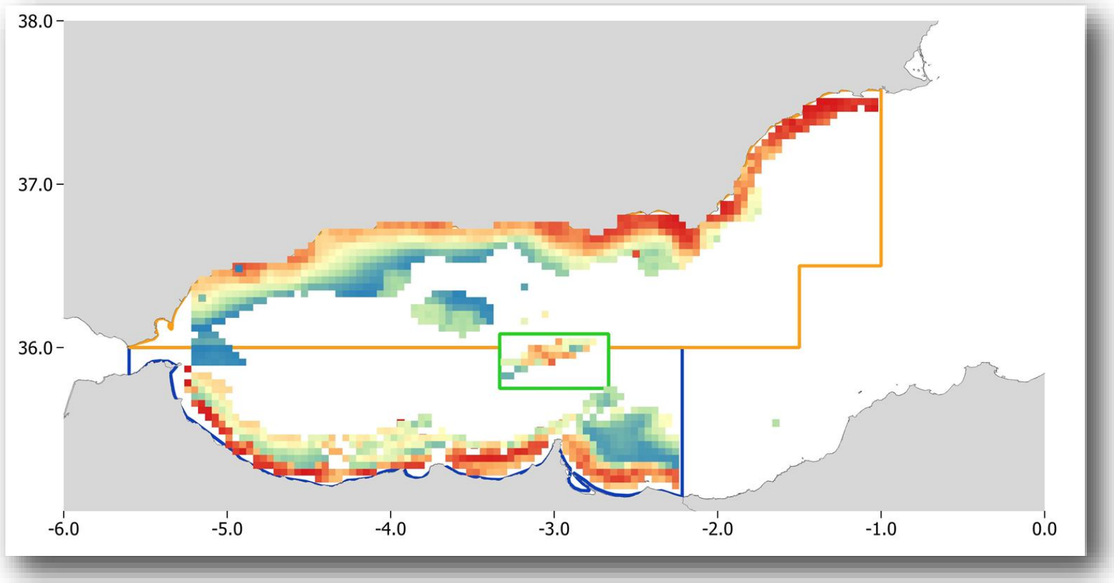
Fisheries management in the Mediterranean focuses primarily on controlling fishing effort to rebuild overexploited stocks as well as on the application of technical measures such as selectivity and temporal bans or spatial closures.

One main challenge in the Mediterranean region is represented by the need to integrate data, methods and objectives from different countries. This is particularly important for shared stocks, for which the definition of management areas could also be delineated in transboundary efforts in order to optimize the potential benefits from a fisheries management network

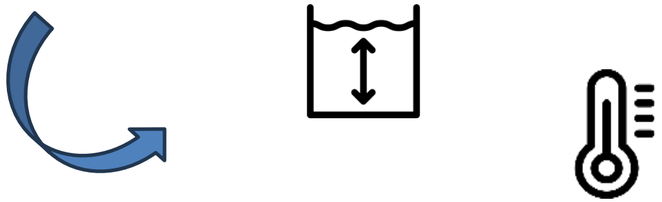
The species distribution models

- Using SDMs to understand the distribution of key commercial species in the study area





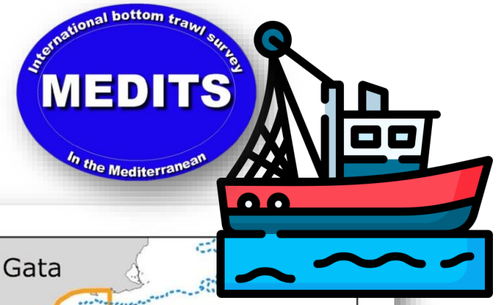
- Occurrence points – Geographical positions (presence/absence)
- Environmental variables (temperature, depth)



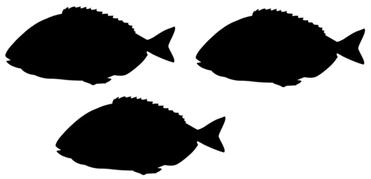
Materials and Methods

Data input: Survey - fishery independent data

The Alboran Sea is an important area for its diverse ecosystems and economically important fisheries. Among the commercial species in the region, the blackspot seabream (*Pagellus bogaraveo*, Brünnich, 1768) is of particular ecological and economic importance. This species supports local fisheries and has contributed to both food security and economic livelihoods.

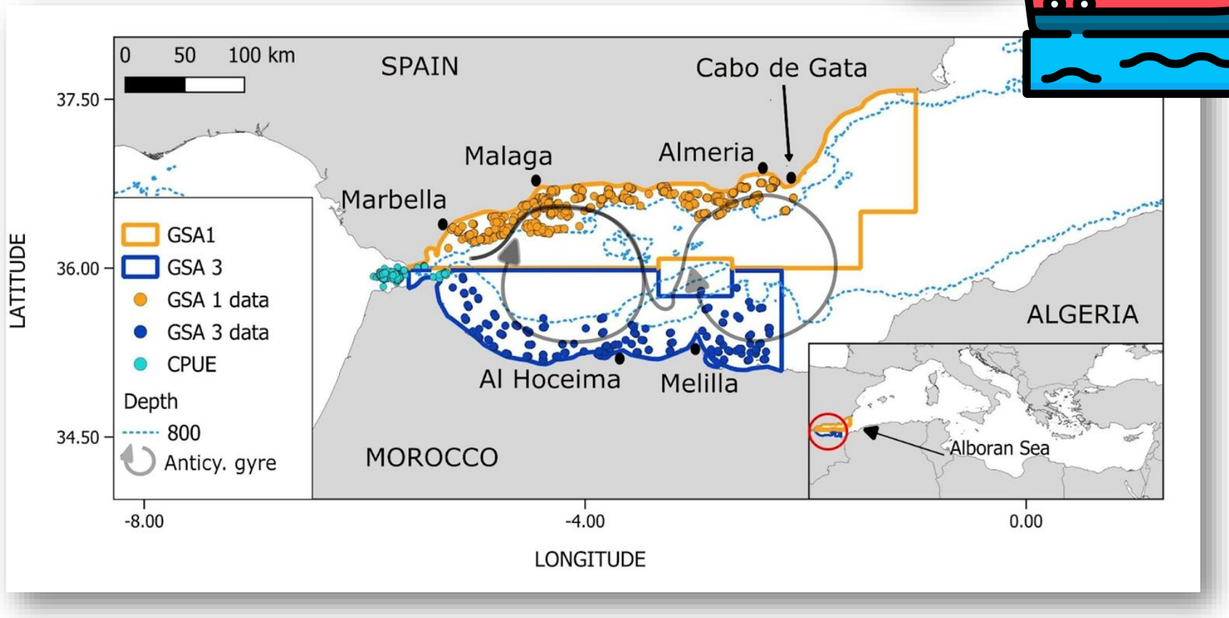


- Area of work: Alboràn Sea (GSA 1 and 3; depth 10- 800 m)
- Data for years 1999-2022 (MEDITS ESP) & 2018:2021 (survey MOROCCO) and CPUE of longlines in the Strait of Gibraltar
- Density index (Ind/km^2) for each haul
- using specific length thresholds to identify life stages



<= 20 cm

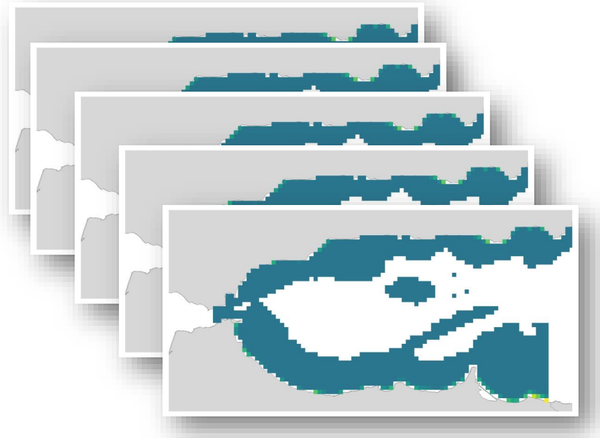
> 20 cm

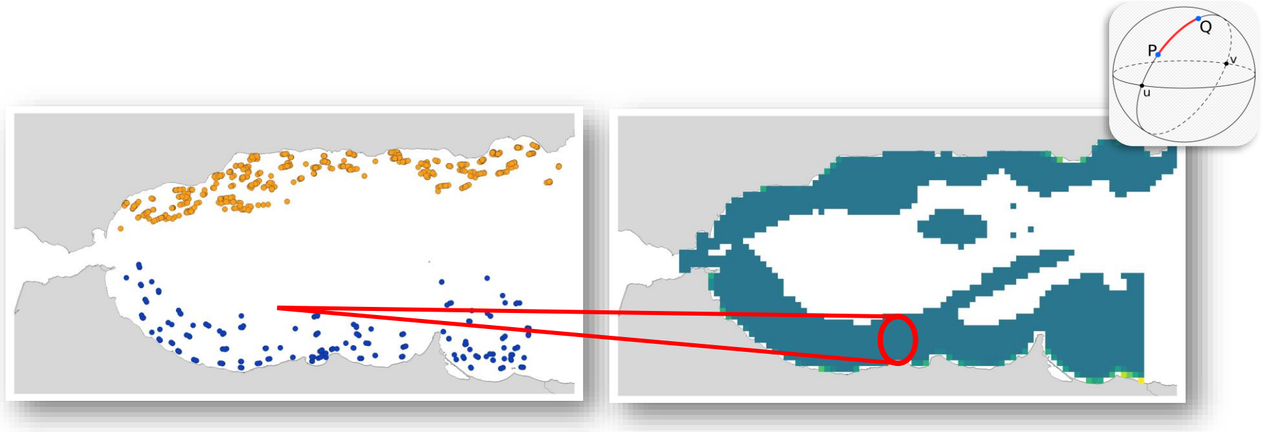


Data input: oceanographic variables

- Product from Copernicus Marine Service (CMS)
- Blending model and satellite or other data (reanalysis)
- Physical and biogeochemical 3D data (temperature, oxygen, chlorophyll and production)
- Monthly data, years 1994-2021, spatial resolution of 1/24°(approx. 4x4 km)

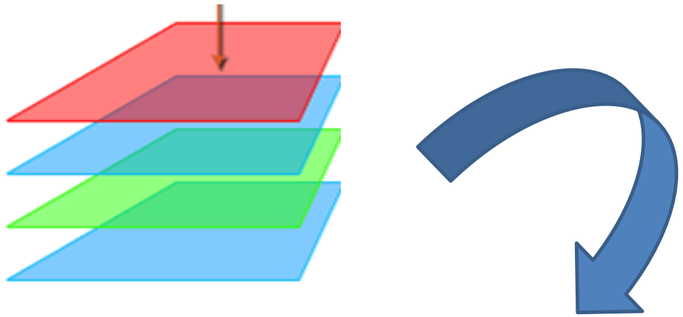
Copernicus Grid:
For each
- month
- year
- Variable
- depth
- 1/24° (~4km)





Fishery independent survey

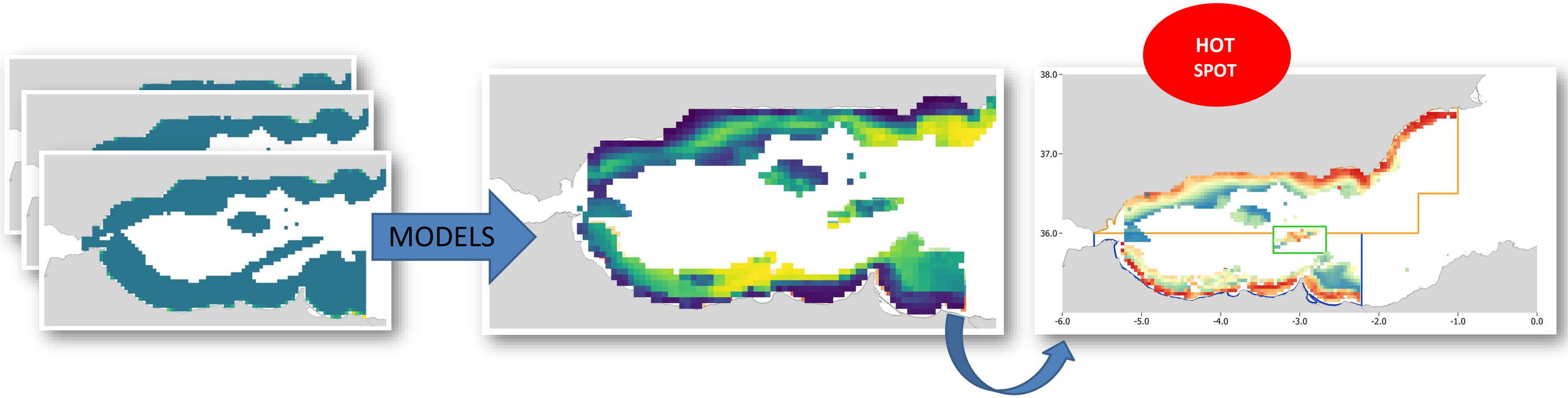
Env variables



- Temperature: surface & bottom in degC
- Depth m

Process

1999:2021, 1 species, 2 life stages



Abiotic variables
1999-2022

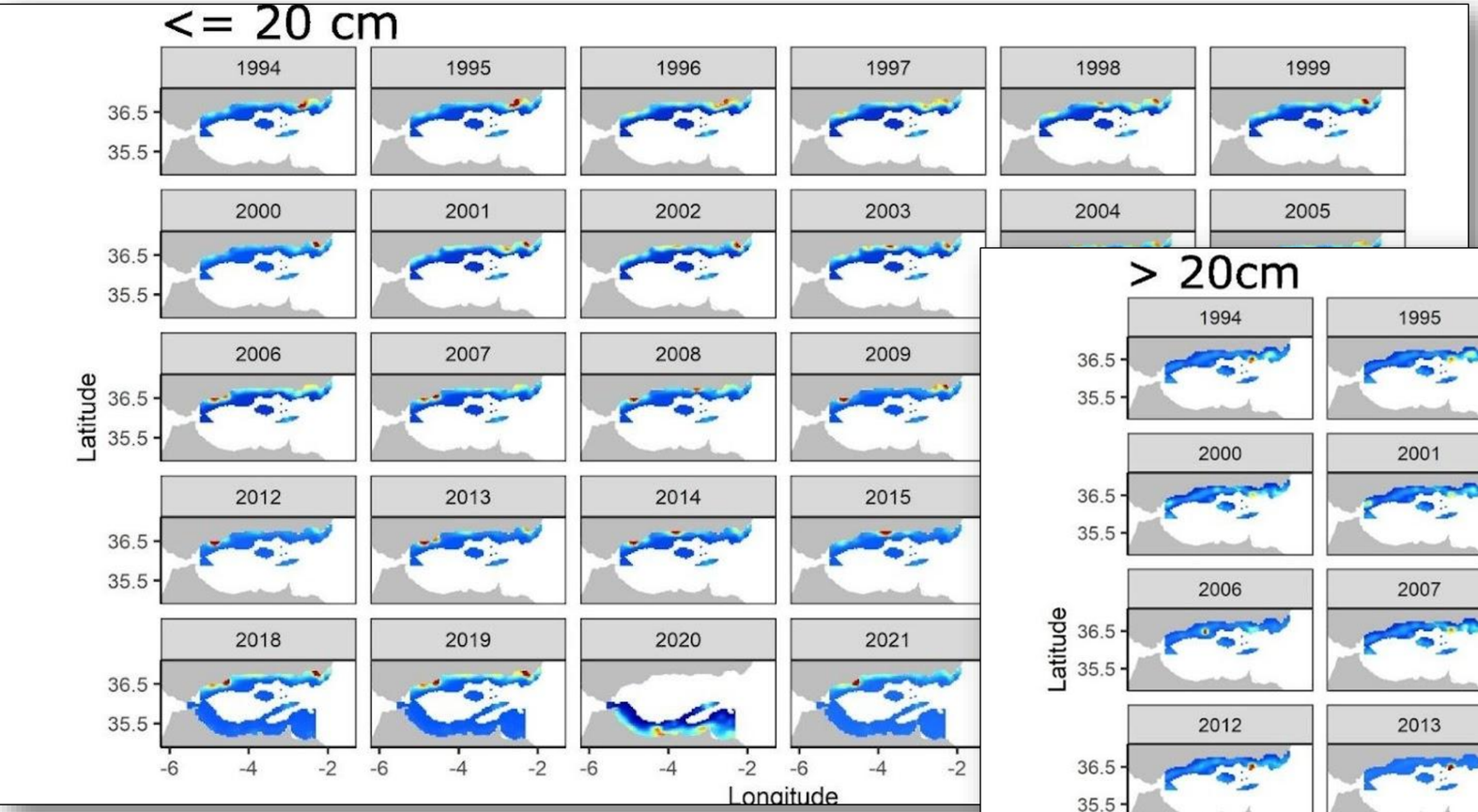
Prediction

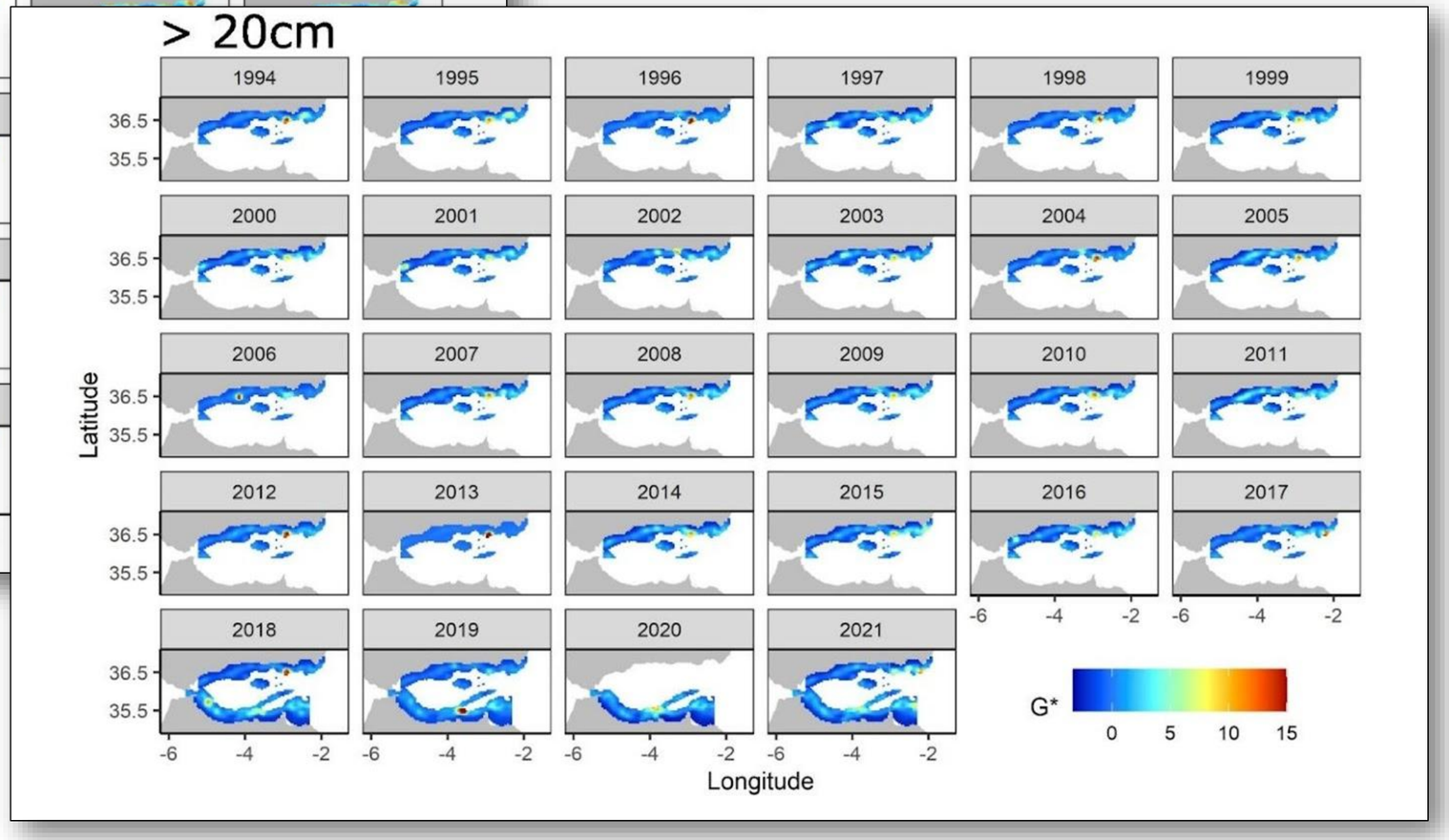
Hot spots defined as: grid cells with Getis index >= zero to highlight aggregation zones

Main results

Hotspot distribution

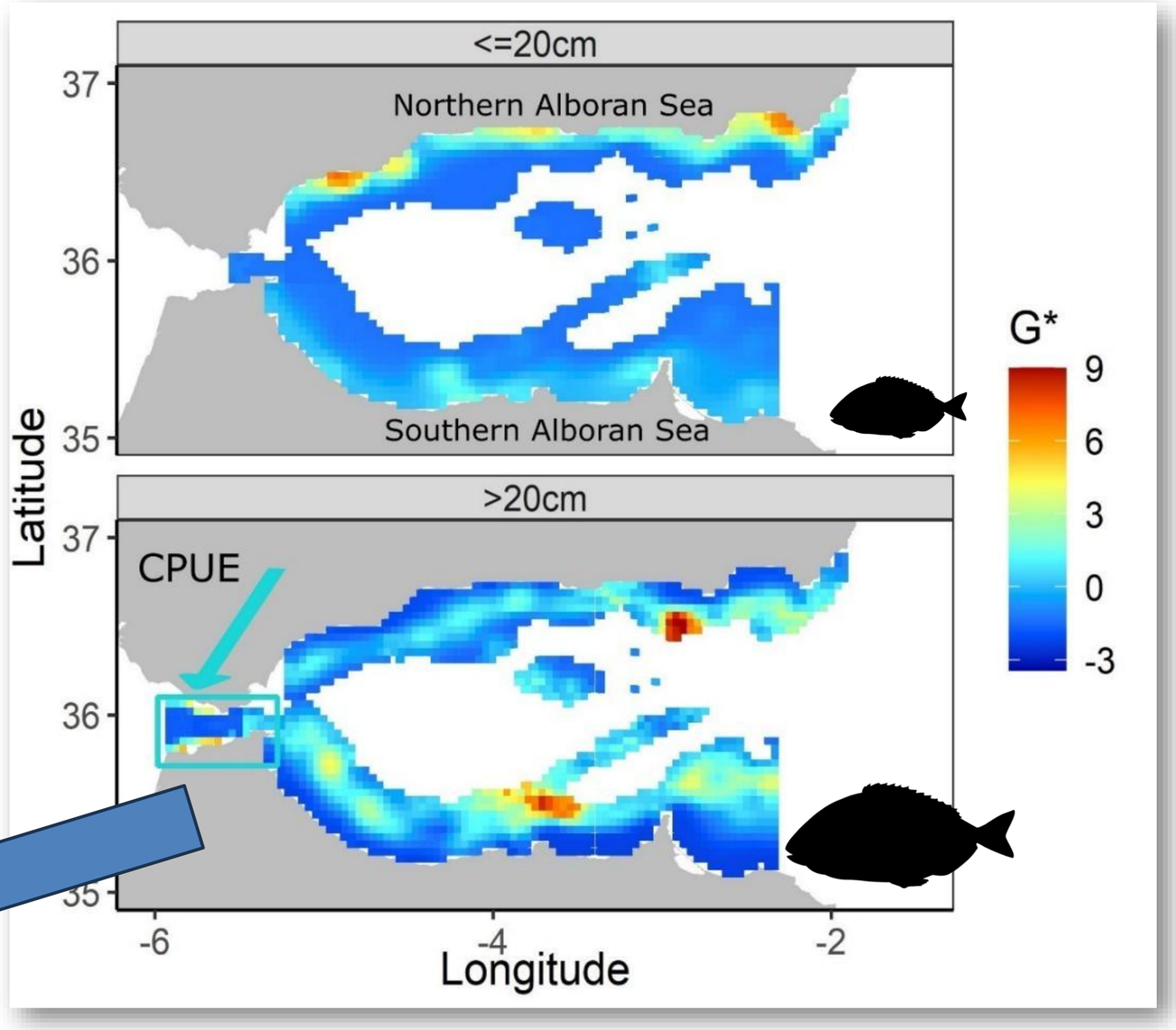
- Distribution by species and life stage over years expressed as Getis index.





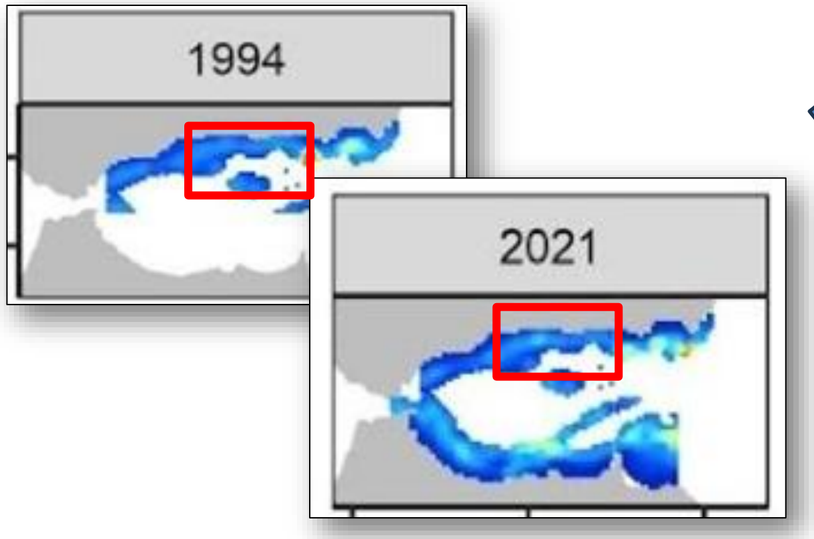
Hot Spot

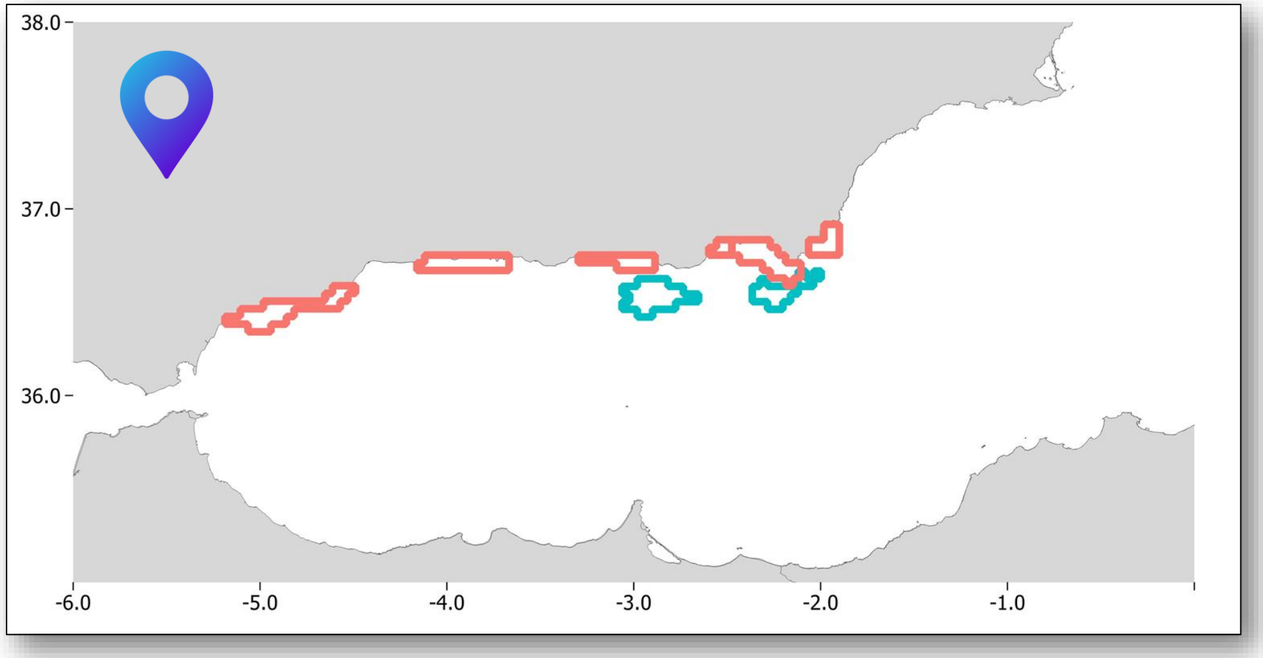
Maps of the hot spot in the Alboran Sea for each length sampled with bottom trawl survey (Alboran Sea, northern and southern) and CPUE (light blue square square) data set. EFH is identified independently for length by the high values of the Getis index (G*). Individuals <=20cm and individuals >20cm.



Hot Spot: persistence area

We also evaluated the persistence of areas of high aggregation (areas with G* above 0) by considering the "presence" of each grid cell for each year of our time series (presence of the same grid cell for 28 years, in this case only for the longest time series of the northern Alboran Sea bottom trawl survey).

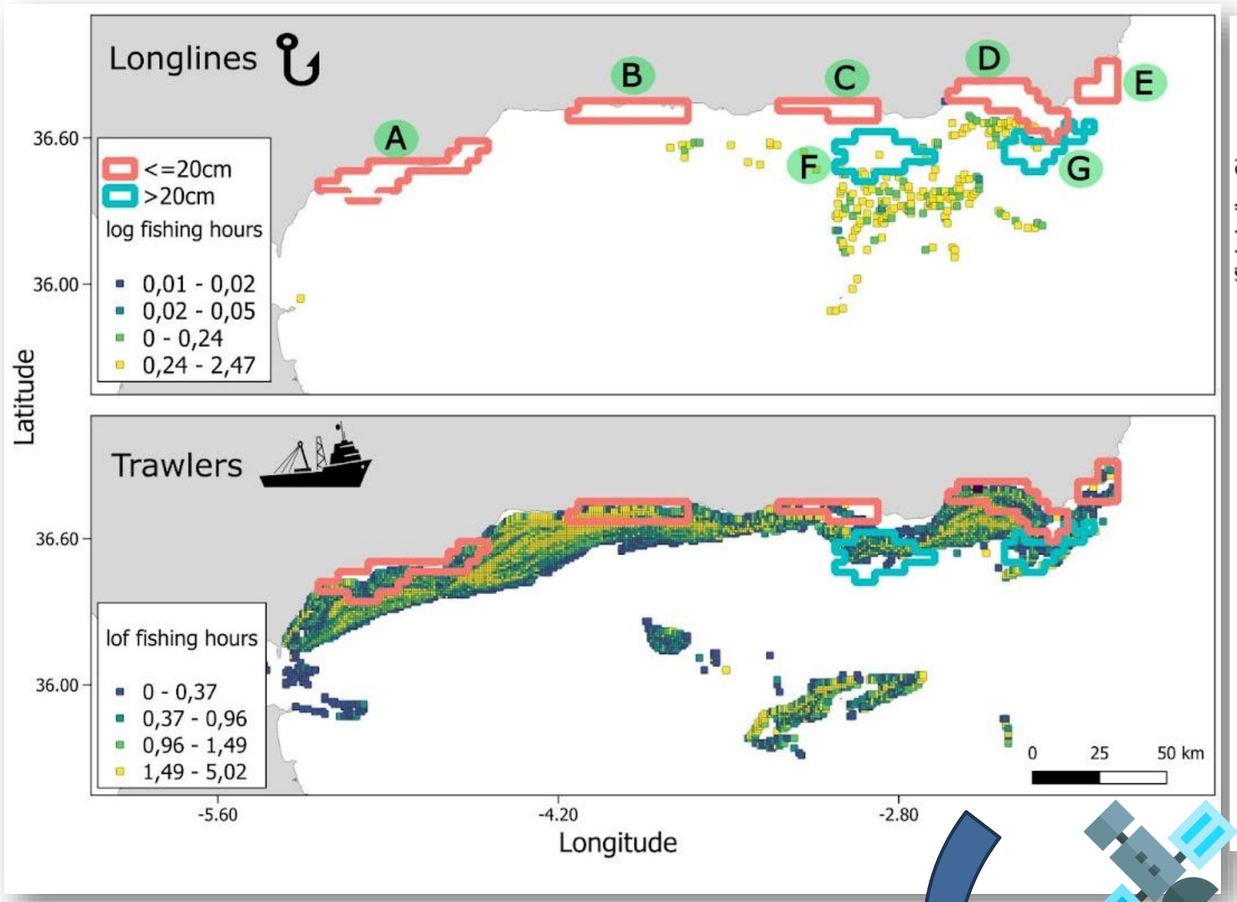


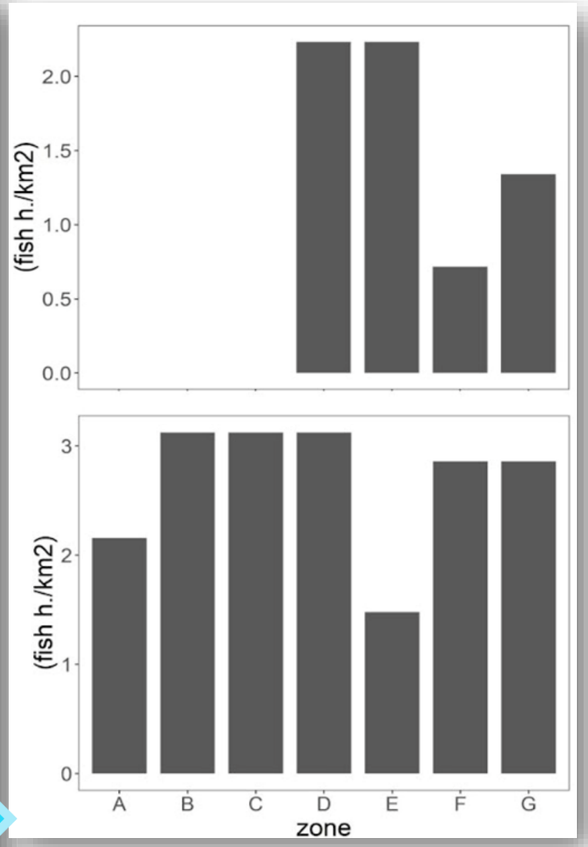


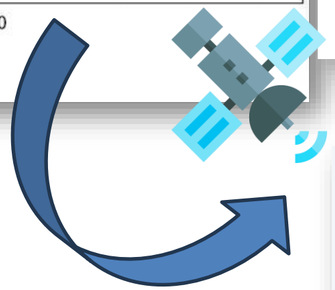
Hot spot for 28 years

Overlapping with effort

Analysis of hot spots of aggregation and effort in the GSA 1. The key ecological areas for management, derived from the persistence of the hotspots are named A, B, C, D, E for individuals <=20cm, and F and G, for individuals >20cm and are depicted on the maps of effort for longlines (upper panels) and trawlers (lower panels). Effort is obtained from the analysis of AIS data in 2020. The bar chart on the right shows the average fishing effort (fishing hours per Km2) within the 7 key ecological areas that might be potentially future management zones.







Global Fishing Watch

Conclusions

The approach allows the integration of oceanographic variables to describe the distribution of demersal species.

The results allow the identification of ecologically significant "hot spots" and can be used to optimize the definition of spatial fisheries management measures.

The results could apply to evaluate Essential Fish Habitat for FRA, especially in juvenile of blackspot seabream. Future applications could assess the re-designation of multi-species EFH and potential new areas that could be considered for future fishing restrictions.

Since the approach embeds oceanographic variables, it is possible to project into a future with climatic conditions possibly changing hot spots and thus supporting ad adaptive management.

GFCM 2030 STRATEGY

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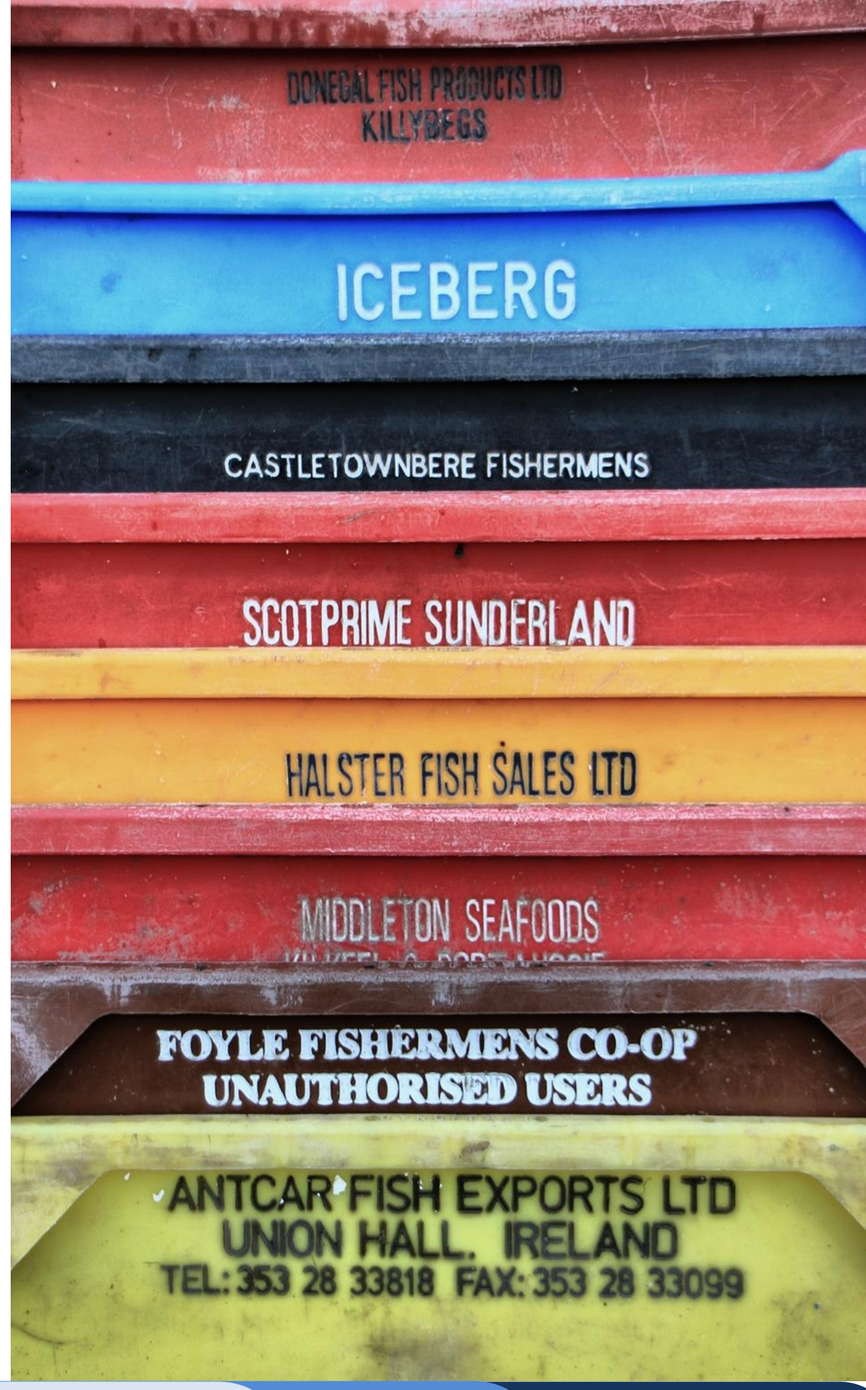

Thank You

For Your Attention

Any questions?

You can find me at

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Supp material