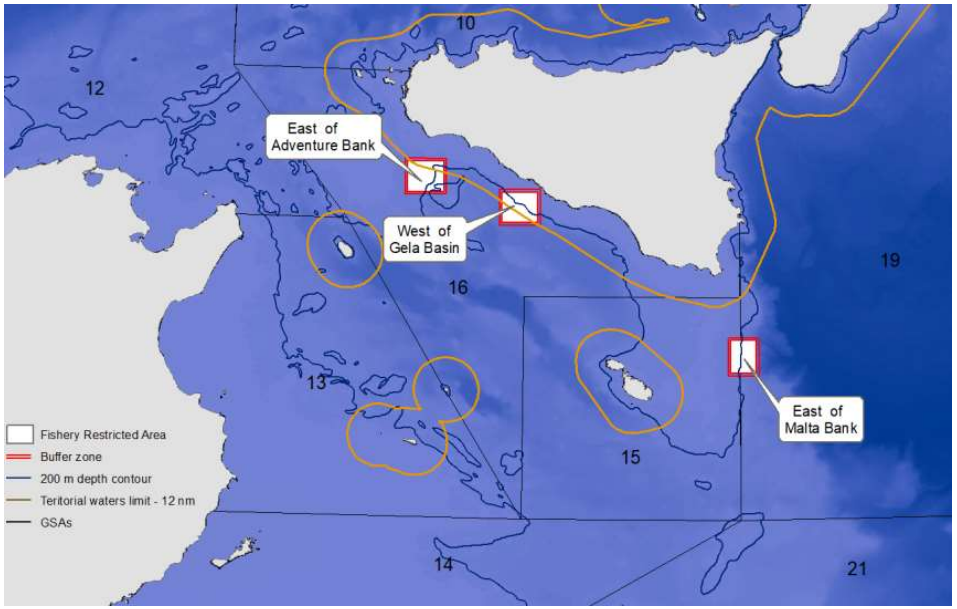
MEDAC - FG Strait of Sicily

Centro Congressi Cavour - Via Roma 50/a - Roma
27th February 2024

What we know and what we still need to know about the nurseries in the southern sector of the Strait of Sicily

Fabio Fiorentino
CNR IRBIM - Mazara del Vallo (TP) - Italy

FRAs protecting Essential Fish Habitats in the Strait of Sicily



Established by GFCM in 2016 and fully implemented in July 2019 to protect the main nurseries of:

- European hake (East of adventure Bank and East of Malta Bank)
- Deep water rose shrimp (West of Gela Basin)

Advice from 23rd Session of GFCM-SAC - June 2022 for the Central/Eastern Mediterranean

- **Assess the effectiveness and possible expansion of the FRAs in the Strait of Sicily in protecting spawners of key species**
- **Continue working towards the identification and proposal of priority essential fish habitat**
- **Confirm the persistence of identified nursery grounds in the southern Strait of Sicily**
- Investigate the existence of shark nursery areas in the subregion

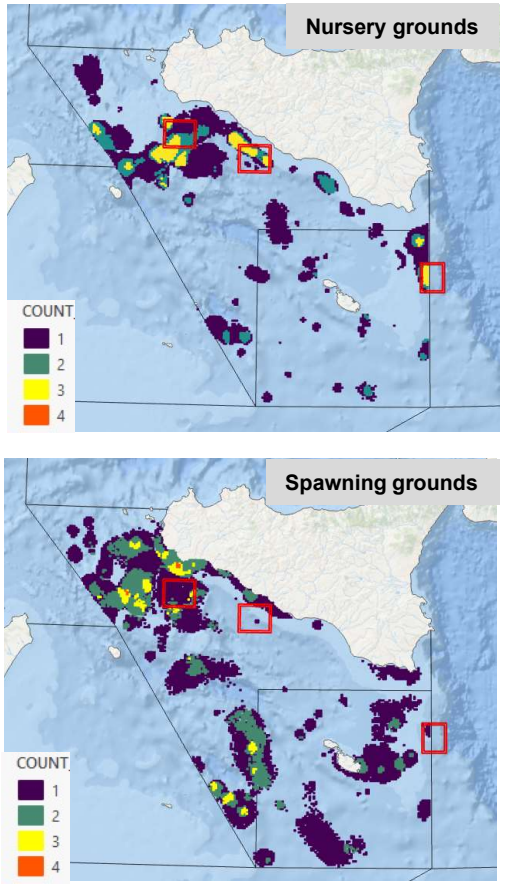
The main sources of data for identification and mapping of nurseries of demersal species are the standardized trawl surveys…

…but relevant information could also be obtained by monitoring of commercial fisheries and TEK & LEK

Consolidated information on nurseries and spawning areas on the northern sector are due to the long series of researches funded by the Italian and EU funds since 1985…

…the static approach by the Mediseh program…
…the identification of areas where critical stages are stable throughout time…

1. European hake (*Merluccius merluccius*)
2. Red mullet (*Mullus barbatus*)
3. Common Pandora (*Pagellus erythrinus*)
4. Blackmouth catshark (*Galeus melastomus*)
5. Thornback ray (*Raja clavata*)
6. Giant red shrimp (*Aristaeomorpha foliacea*)
7. Blue and red shrimp (*Aristeus antennatus*)
8. Norway lobster (Nephrops norvegicus)
9. Deep-water rose shrimp (*Parapenaeus longirostris*)
10. Broadtail shortfin squid (Illex coindetii)
11. Horned octopus (*Eledone cirrhosa*)



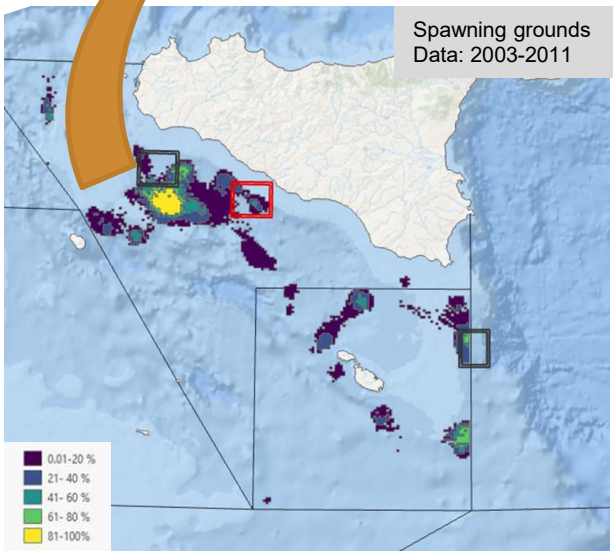
Overlap of essential fish habitat with a persistence level of 60%

An attempt to investigate the EFHs of Deepwater rose shrimp (DPS) by a dynamic approach

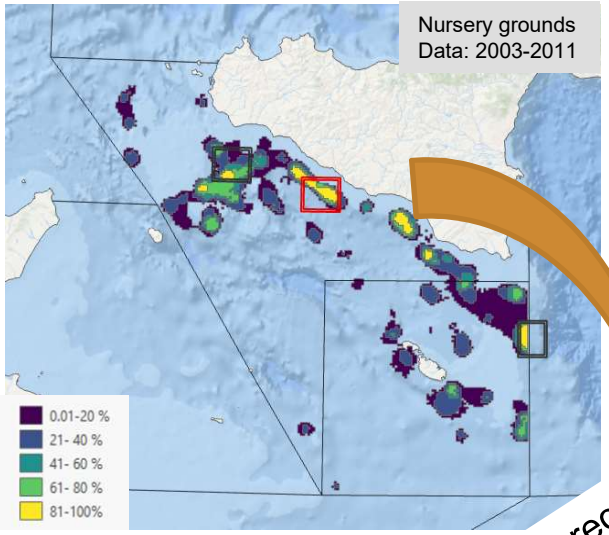
Consolidated knowledge of EFH in the northern part of the Sos

- two simulation studies have been conducted to investigate the connectivity between spawning and nursery areas

Where are the DPS eggs and larvae transported to?



Forward particle-tracking modelling, with eggs/larvae represented as Lagrangian drifters, was used to explore connectivity between known spawning areas and potential nurseries

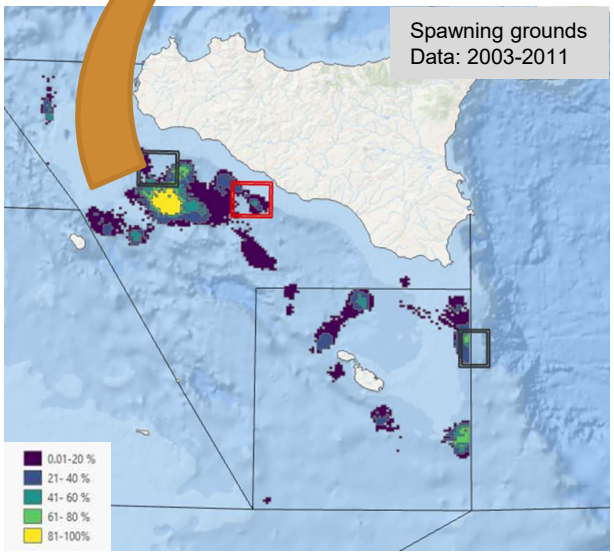


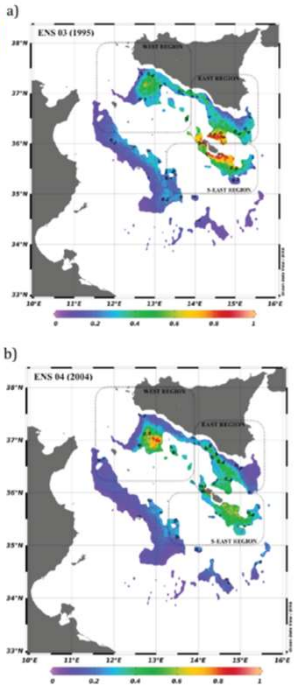
Where do the DPS recruits come from?"

Backward particle-tracking modelling, with eggs/larvae represented as Lagrangian drifters, was used to identify the potential spawning areas of the larvae that settle in the known nursery grounds

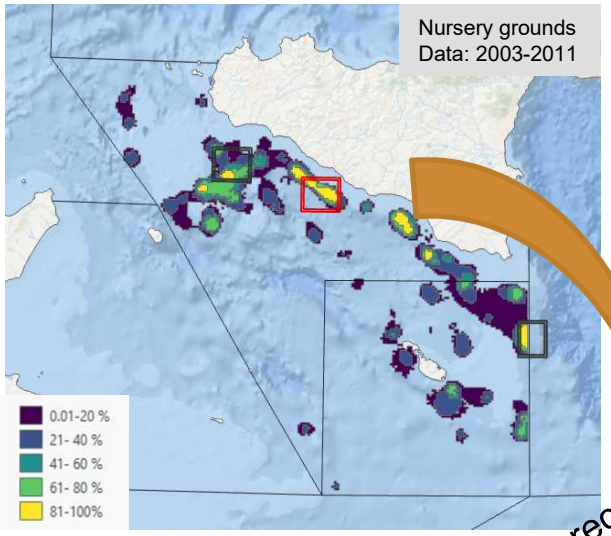
The dynamic approach for investigating EFHs of DPS

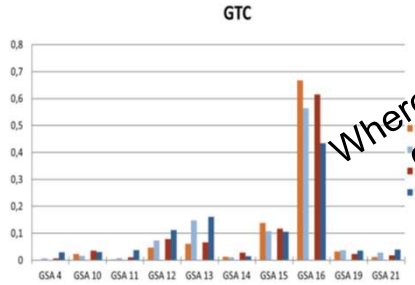
Where are DPS eggs and larvae transported to?





Changes in connectivity between spawning and nursery areas in the north side of the SoS have been found in relation to decadal features of SoS hydrodynamics (Quattrocchi *et al 2019*)

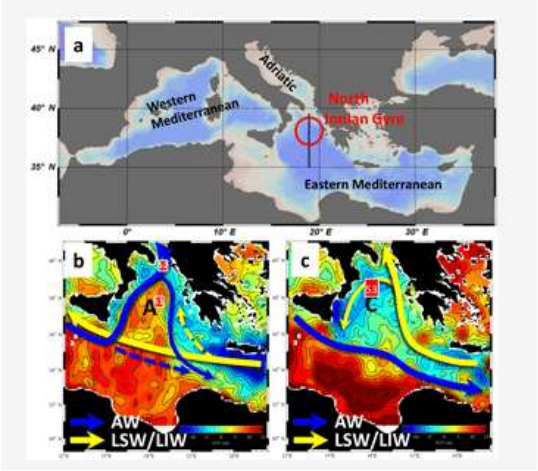




Where do the DPS recruits come from?"

Regardless of the simulation scenarios, the contribution of spawning areas of the Sicilian-Maltese shelf to recruitment in GSA 16 is predominant over the contribution from adjacent areas (*Gargano et al., 2022)*

The dynamic approach for investigating EFHs of DPS

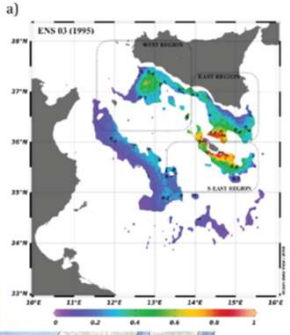


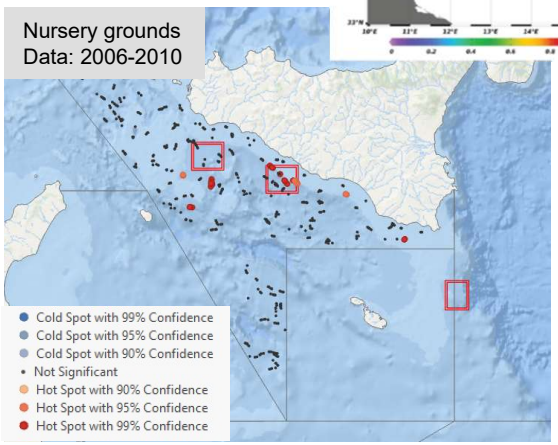
- Water of Atlantic origin flowing from west to east dominates (AW) the sub-surface ocean circulation in the northern part of the Strait of Sicily
- In the Ionian sea, a complete reversal of the Ionian upper-layer circulation from cyclonic to anticyclonic occurs at decadal timescale (Lavigne et al., 2018)

The impact of decadal inversions of the Ionian upper layer circulation

Anticyclonic regime

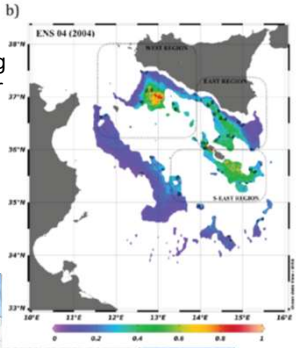
During the anticyclonic regime, the intense Atlantic Water (AW) flowing eastward along the Sicilian shelf, causes a rapid dispersion of larvae, shifting potential settlement and aggregation chances into the easternmost DPS nurseries of the SoS

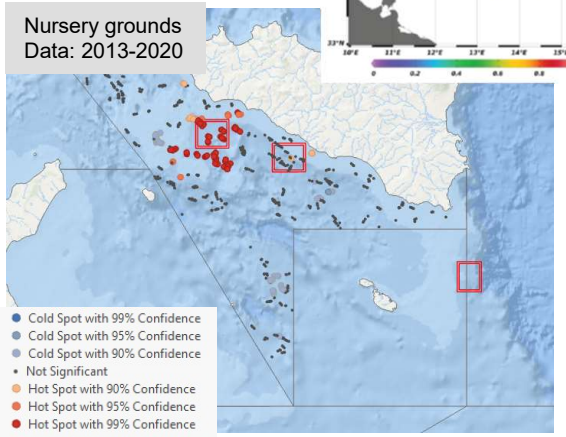




Cyclonic regime

During the cyclonic regime, a slightly less energetic AIS flowing towards the Ionian basin at lower latitudes causes a significant aggregation of larvae (hotspot) east of the Adventure Bank.





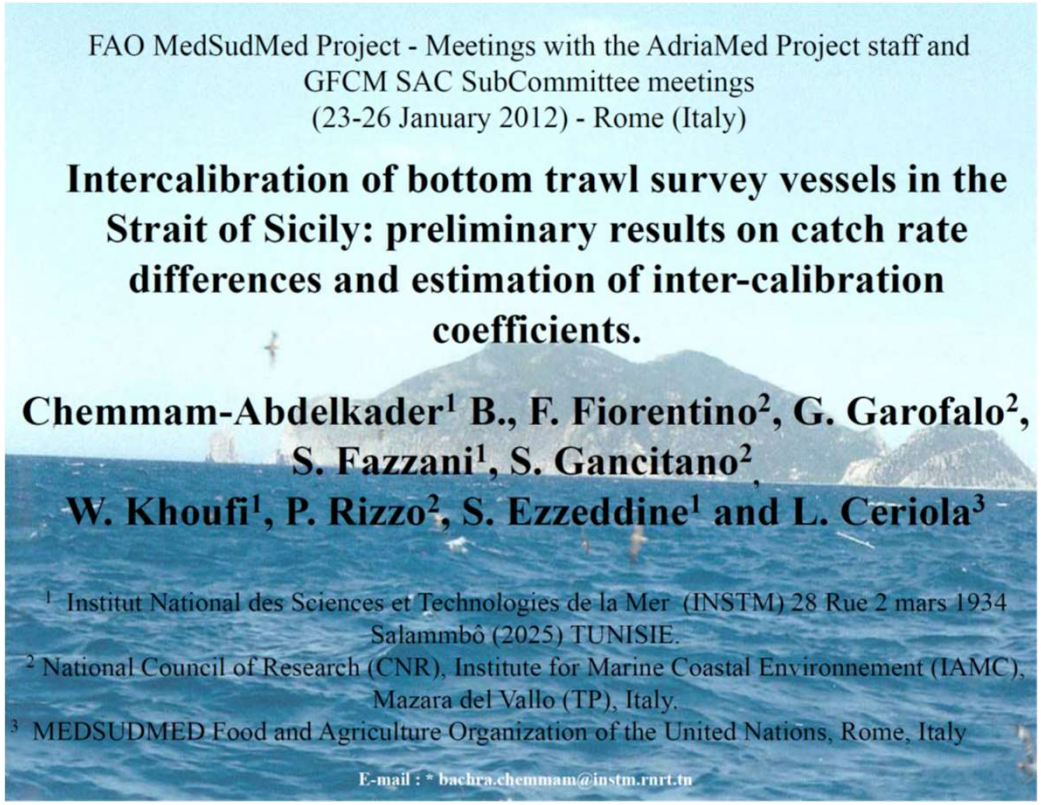
The two FRAs of GSA 16 provide a portfolio effect for the protection of DPS nurseries

EFHs of European hake off the African coasts

The joint analysis of bottom trawl survey data is a major problem in the case of stocks distributed on the area covered by more than one country, as the Deep water pink shrimp (DPS) and the European hake (HKE) in the Strait of Sicily.

To address this problem, the MedSudMed project promoted an intercalibration experiment between the R/V “Hannibal” used by INSTM and the M/P “Santanna” used by CNR.

The experiment aimed at comparing the fishing power of the two vessels and estimating the conversion coefficients of abundance indices of *HKE* and *DPS*



Nurseries of European hake in the whole Strait of Sicily

An attempt to identify the nurseries of Hake in the Strait of Sicily was done by modeling distribution of Young of the Year by means of generalized additive models using depth and seafloor characteristics as predictors.

Hydrobiologia (2018) 821:153–172
https://doi.org/10.1007/s10750-017-3338-5

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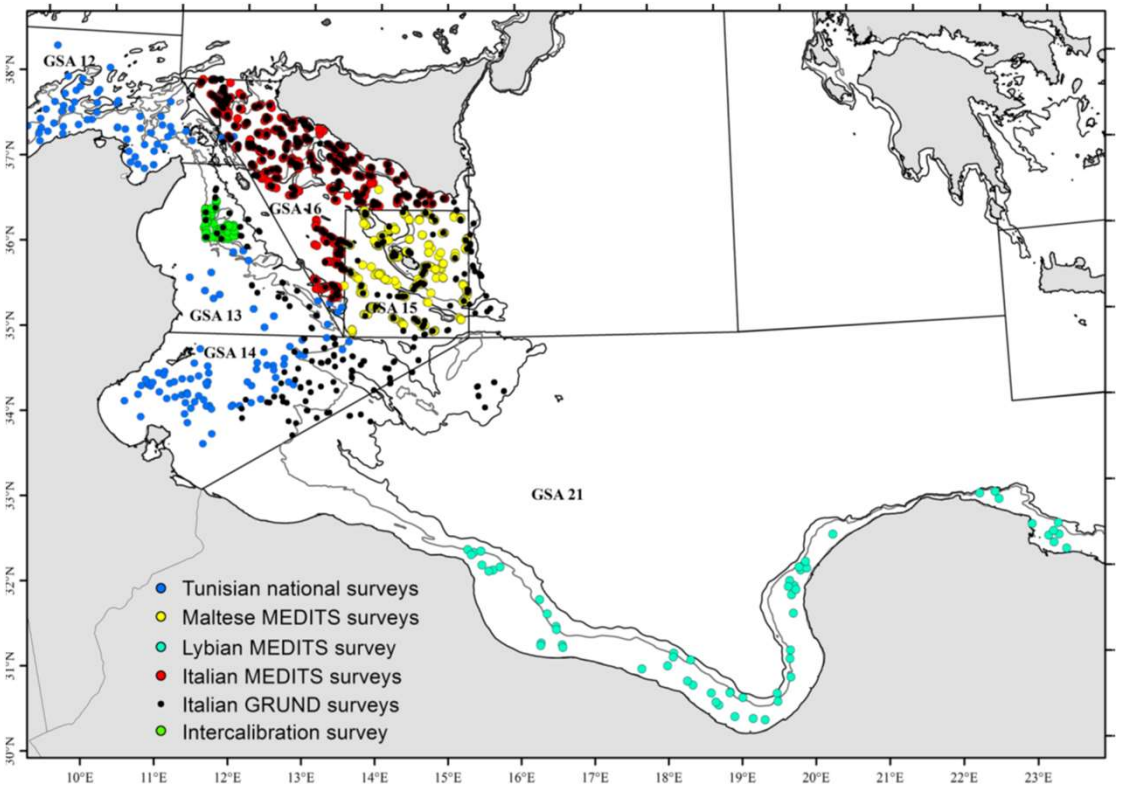
CENTRAL MEDITERRANEAN ECOSYSTEMS

Predictive distribution models of European hake in the south-central Mediterranean Sea

G. Garofalo · S. Fezzani · F. Gargano · G. Milisenda · O. Ben Abdallah · N. Ben Hadj Hamida · O. Jarboui · B. Chemmam-Abdelkader · W. Khoufi · R. Micallef · R. Mifsud · S. Gancitano · P. Rizzo · S. Zgozi · L. Ceriola · E. Arneri · F. Fiorentino

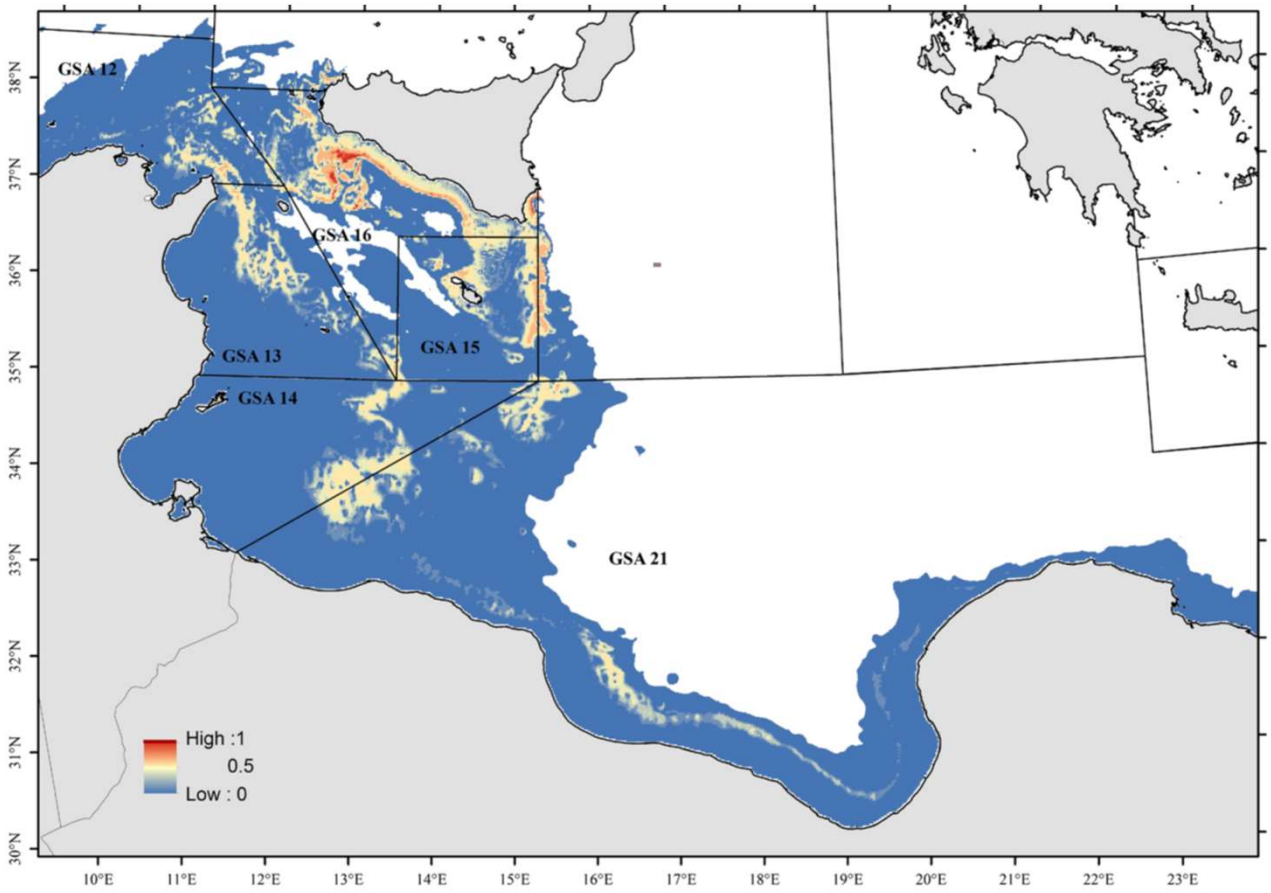


EFHs of European hake

Modelling results largely matched previously reported knowledge on habitat preference of the species and its critical life phases.

Hake recruits showed an occurrence peak at 200 m depth with preference for soft bottoms.

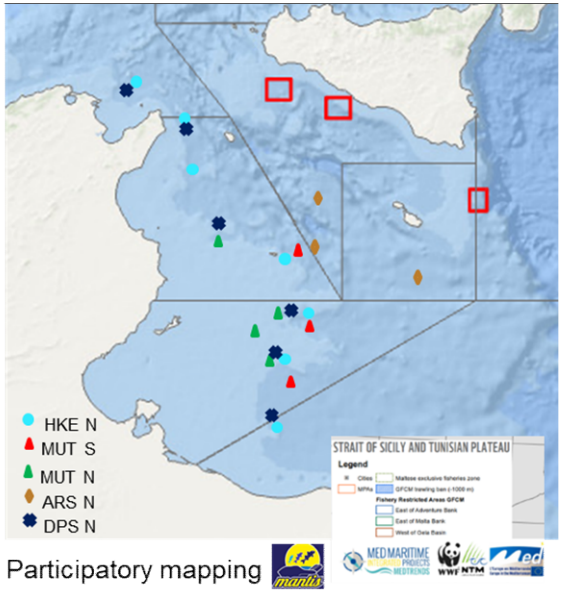
The areas with the highest probability to find hake YOY are reported in red and orange

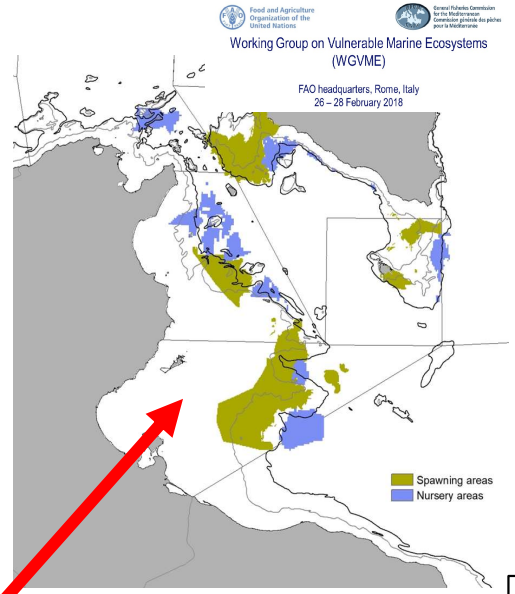


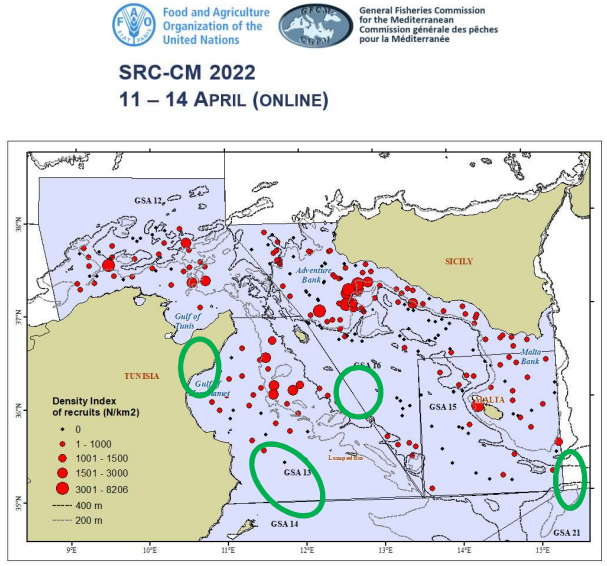
EFHs of European hake in the Striat of Sicily

Ongoing process of identification of nursery areas in the southern part of the Strait of Sicily

- it is necessary to confirm the persistence of identified potential nursery grounds by trawl surveys







Map of cumulated evidence of presence of EFHs, obtained integrating heterogeneous sources of information, such as modeling output, scattered fishery-dependent and fishery-independent data, at varying spatial resolutions, and even with incomplete data

Based on standardized trawl surveys 2019. Further standardized data were collected in GSA 14 by Tunisia and GSA 21 W by Libya in 2022.

An ecological niche approach to go towards a dynamic management of fisheries..the importance of ecological variables and processes in producing the spatial/temporal distribution of organisms

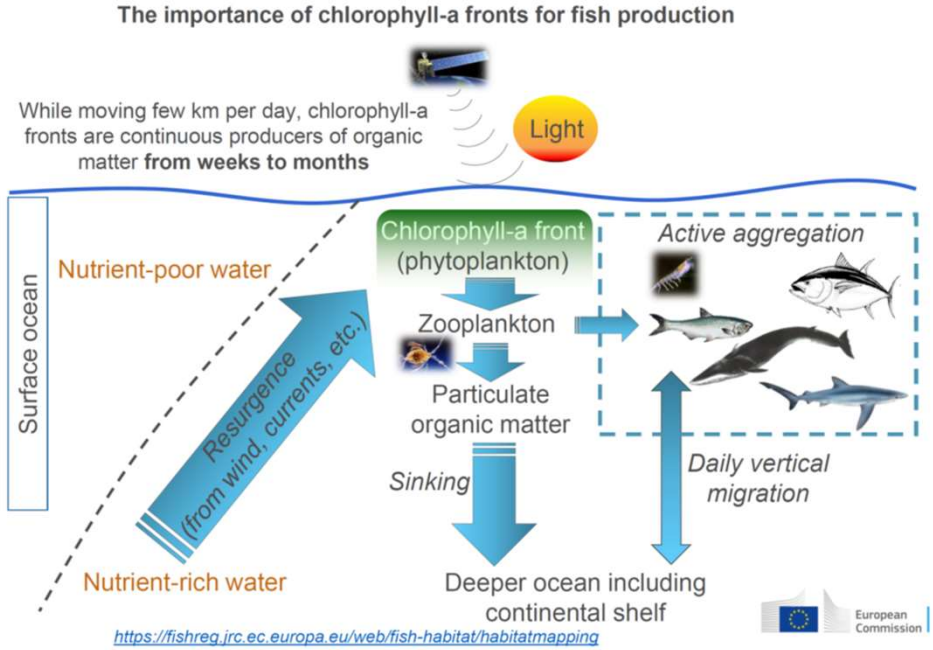
European Commission

Food, Farming, Fisheries

Sustainable Fisheries

Dynamic management

Tracking fish habitat for a dynamic fisheries management



(by Druon et al., 2023)

https://sustainable-fisheries.ec.europa.eu/spatial-fish-habitat-and-fishing-effort/fish-habitat/dynamic-management_en

Available tools for dynamic mapping of hake EFHs

Progress in Oceanography 130 (2015) 188–204

Contents lists available at ScienceDirect

Progress in Oceanography

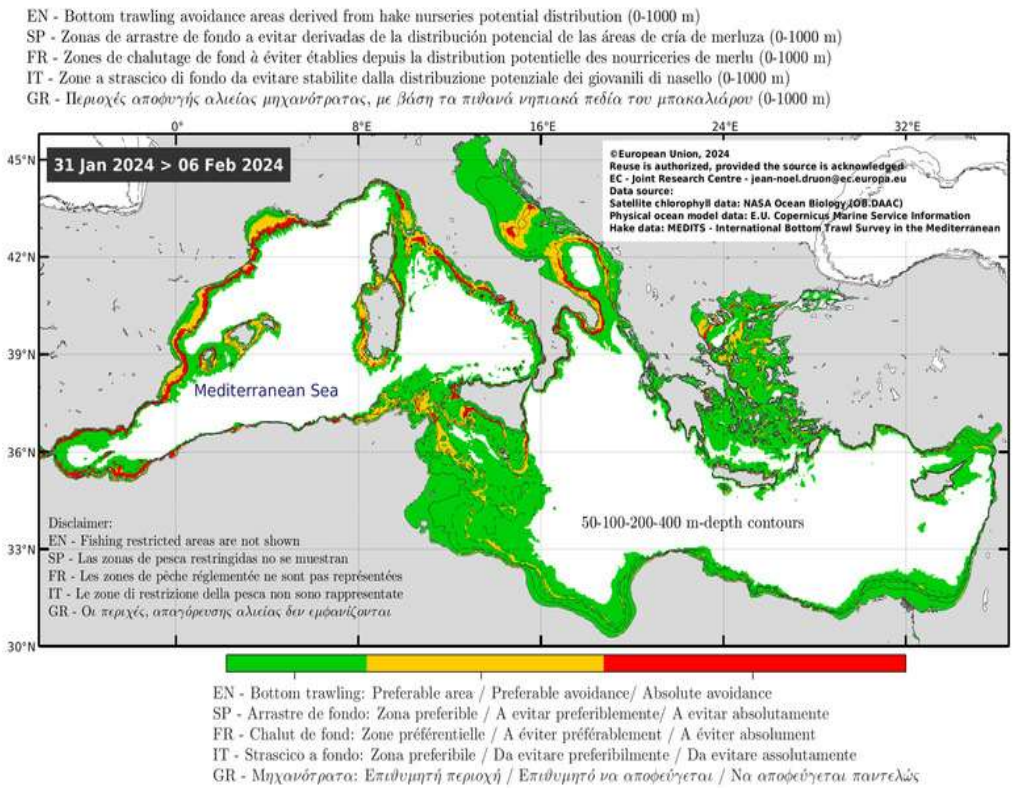
journal homepage: www.elsevier.com/locate/pocean

Modelling of European hake nurseries in the Mediterranean Sea: An ecological niche approach

Jean-Noël Druon [a,*], Fabio Fiorentino [b], Matteo Murenu [c], Leyla Knittweis [d], Francesco Colloca [b], Chato Osio [a], Bastien Mérigot [e], Germana Garofalo [b], Alessandro Mannini [f], Angélique Jadaud [g], Mario Sbrana [b], Giuseppe Scarcella [i], George Tserpes [j], Panagiota Peristeraki [j], Roberto Carlucci [k], Jukka Heikkonen [l]

Hake nurseries require stable bottom temperature (**11.8–15.0 °C**), low bottom currents (**<0.034 m s^{-1}**) and a frequent occurrence of productive fronts in low chlorophyll-a areas (**0.1–0.9 mg m^{-3}**) to support a successful recruitment.

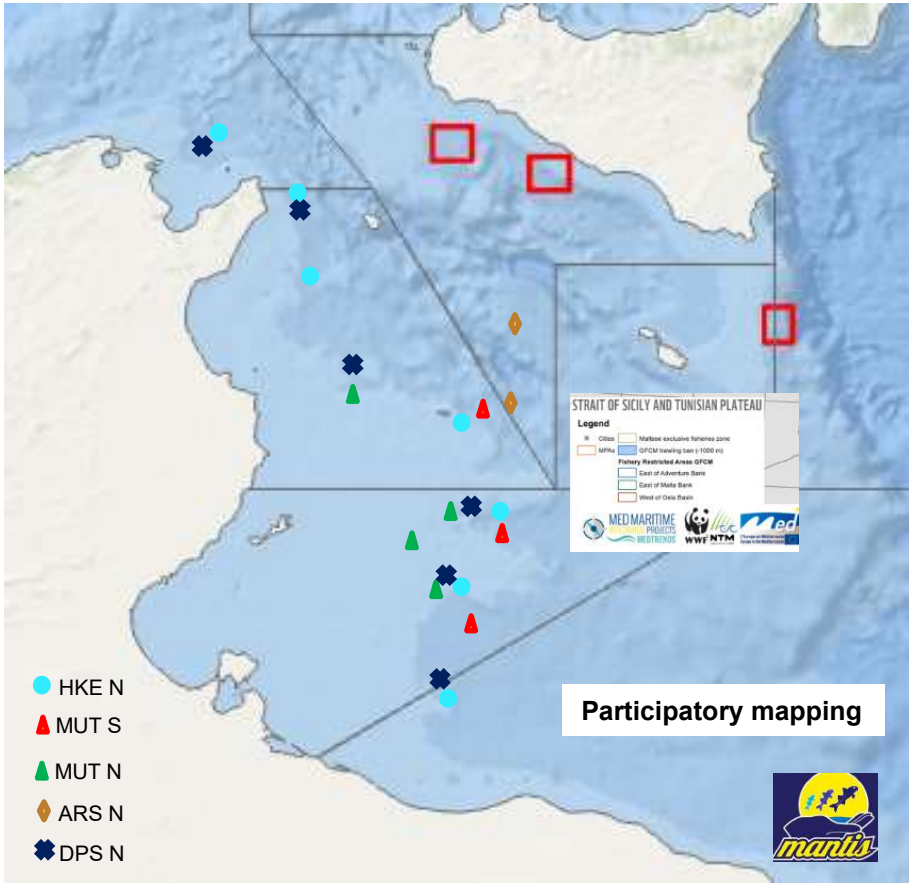
On the basis of information by satellite chlorophyll data and physical model ocean data it is possible to forecast where it the highest probability to find undersized hakes



https://sustainable-fisheries.ec.europa.eu/spatial-fish-habitat-and-fishing-effort/fish-habitat/dynamic-management_en

Some points for discussion

- The established **FRAs in GSA 16**, although originally designed for protecting nursery areas of single species, have shown **a broader purpose protecting also spawning areas and Vulnerable Marine Ecosystems**;
- Areas that probably constitute **EFHs in the southern sector of the Strait of Strait** were preliminarily identified **by means of models and TEK/LEK**;
- It is essential **to improve standard trawl surveys covering the whole area of the Strait of Sicily** to have in situ data **to confirm available information** on spatial distribution of juveniles and **produce more feasible maps of nurseries** to be protected;
- **Connectivity studies** need to be developed to **identify networks of priority EFHs** for which **spatial and/or temporal measures could be implemented.**



(by Fiorentino et al., 2019)

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