Focus Group Strait of Sicily - Roma
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The state of the stocks and the role of the FRAs in management fisheries of the Strait of Sicily

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Consiglio Nazionale delle Ricerche (**CNR**)
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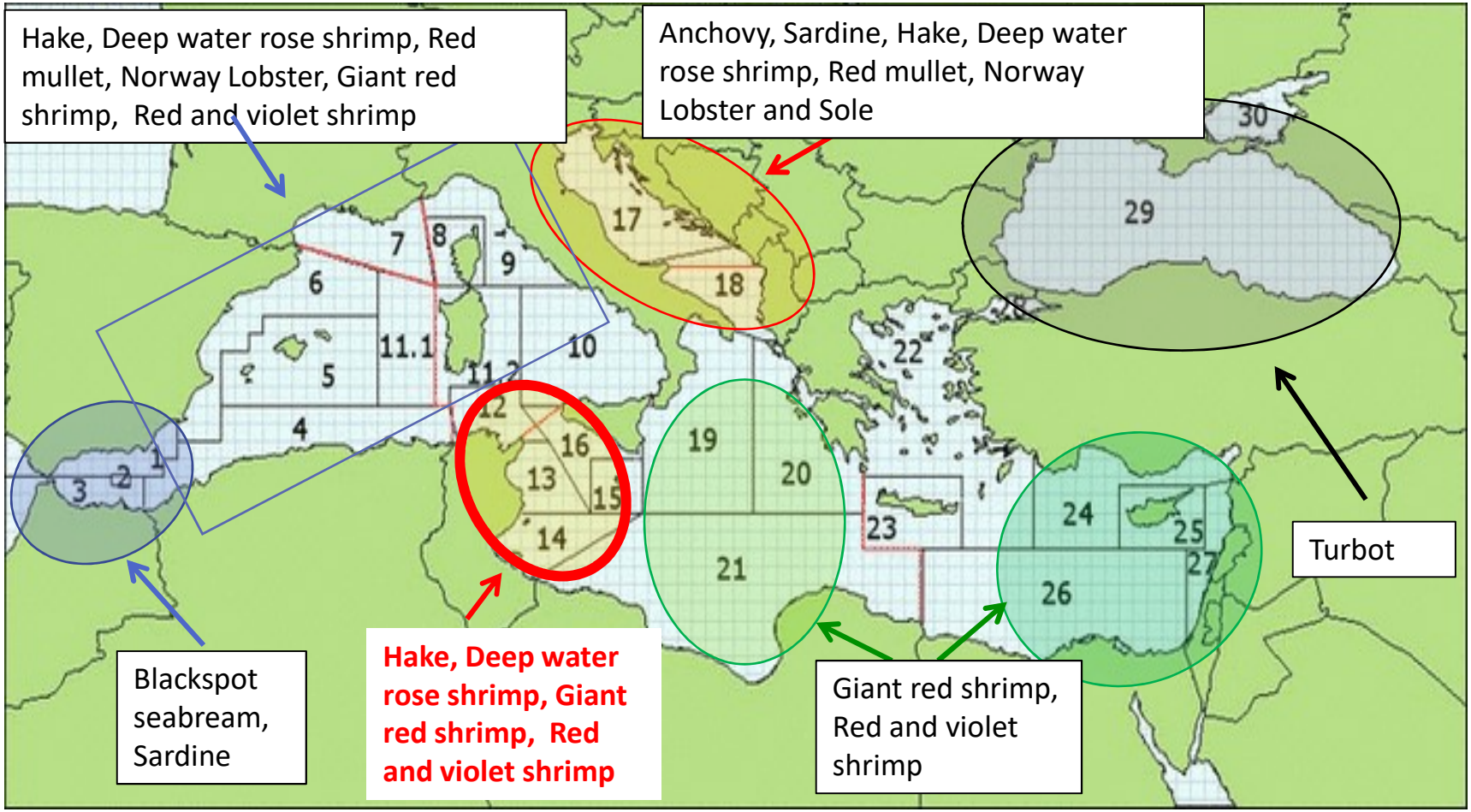
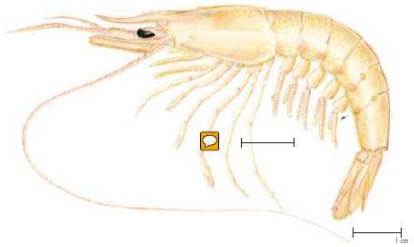
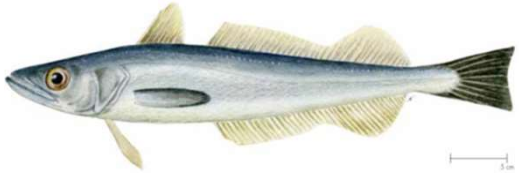
GSAs and species under international Fisheries Management Plans in the GFCM area

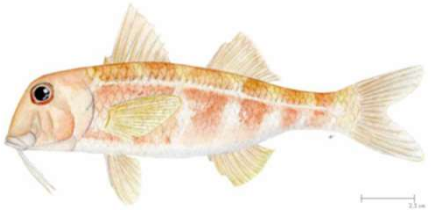


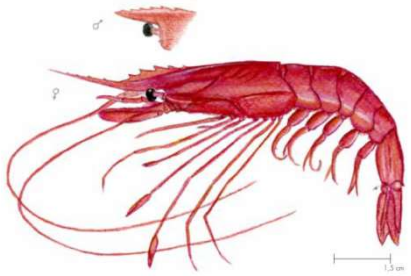
The main features of demersal stocks in the Strait of Sicily

Deepwater rose shrimp, giant red shrimp, hake, and red mullets are the main target species of trawlers operating in the Strait of Sicily









The demersal stocks are shared between Italian, Maltese and Tunisian trawlers. In the recent years shallow waters resources have been exploited by the Egyptian fleet too

The state of the stocks in the Strait of Sicily
The case of Hake - Merluccius merluccius

Assessment of hake in GSAs 12-16 was conducted using the Stock Synthesis (SS) model.

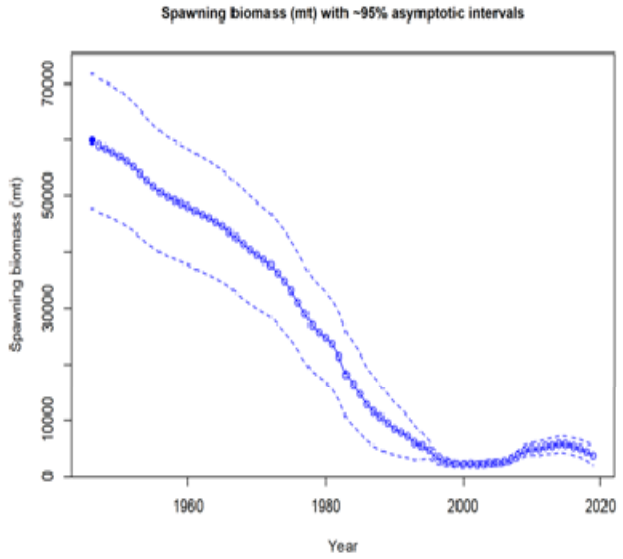
Landing data by years collected from Malta, Italy within DCF and Tunisia from 1947 to 2018

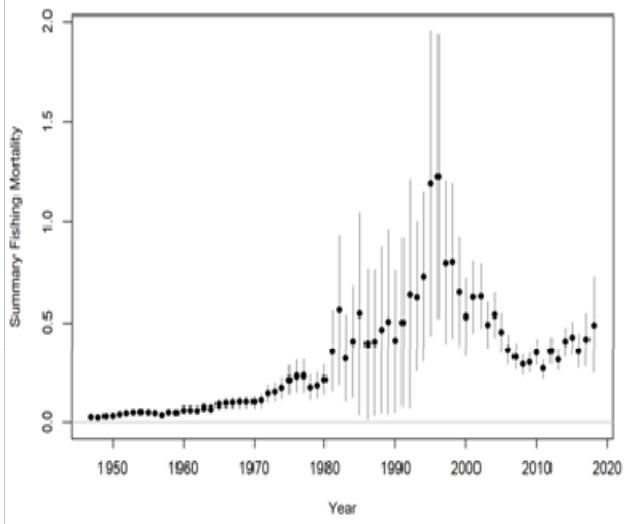
Biological data on landings and discards by years collected from Malta, Italy within DCF and Tunisia from 2007 to 2018

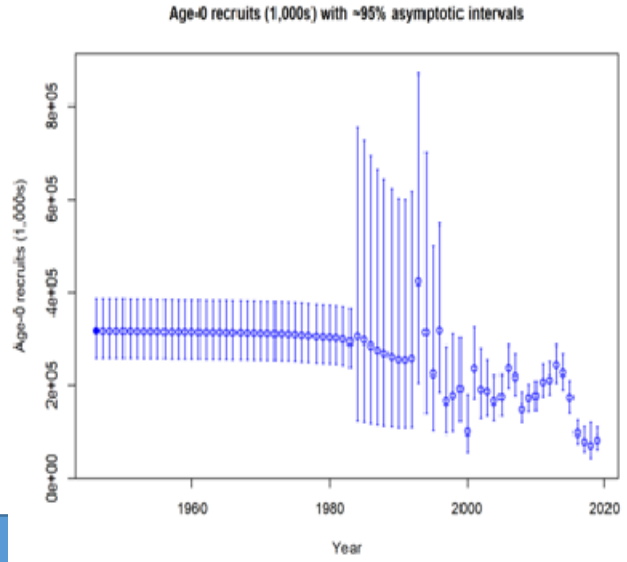
Survey data (Tuning data) from GSA 16 (MEDITS 1994-2018)

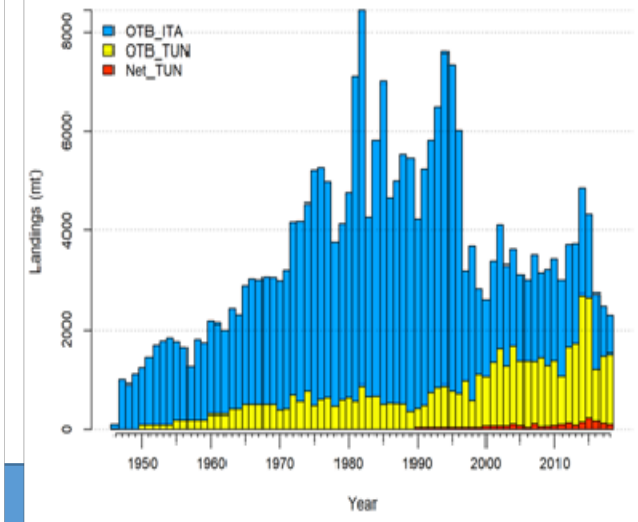
The state of the stocks in the Strait of Sicily
The case of Hake - *Merluccius merluccius*

The main results for the reference model in terms of Spawning Stock Biomass, Fishing mortality, Recruits and landings









The state of the stocks in the Strait of Sicily
The case of Hake - Merluccius merluccius

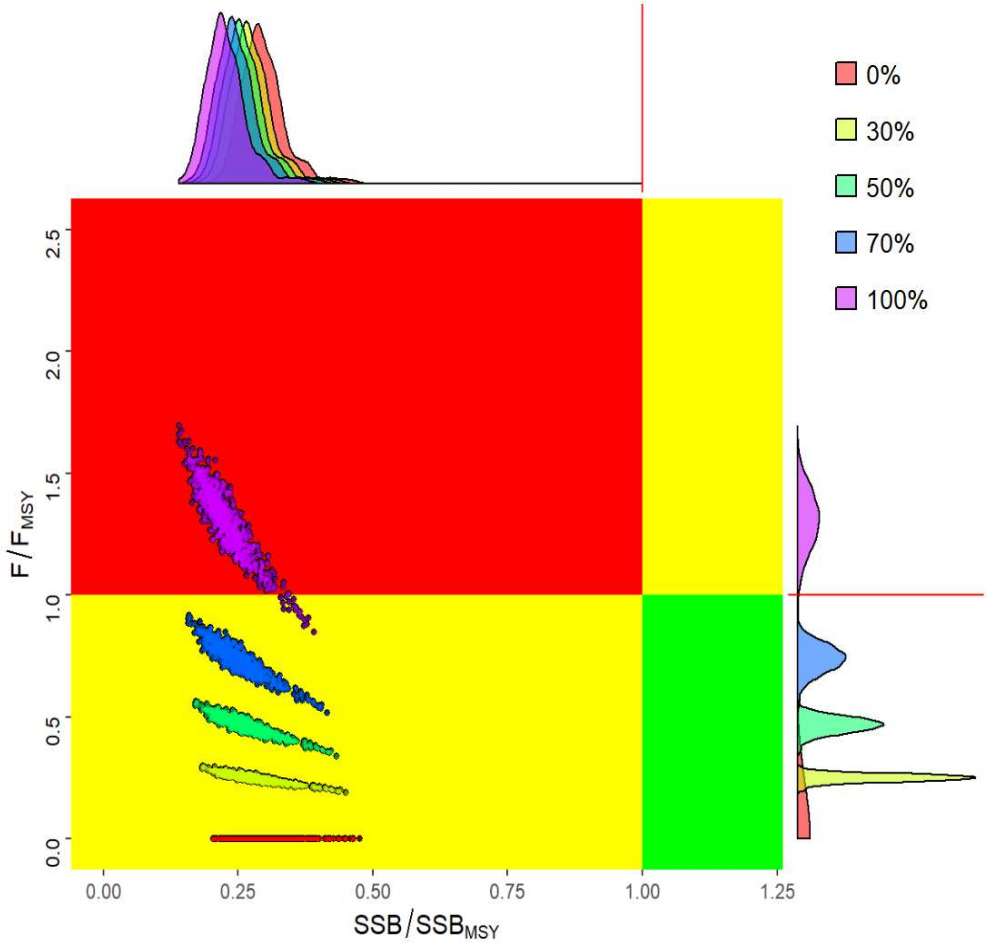
The stock is in overfishing and in overexploited status

Reference points

- FMSY = 0.29
- BMSY = 10744 tonnes
- Blim = 3208 tonnes (BMSY * 0.3)

Stock status

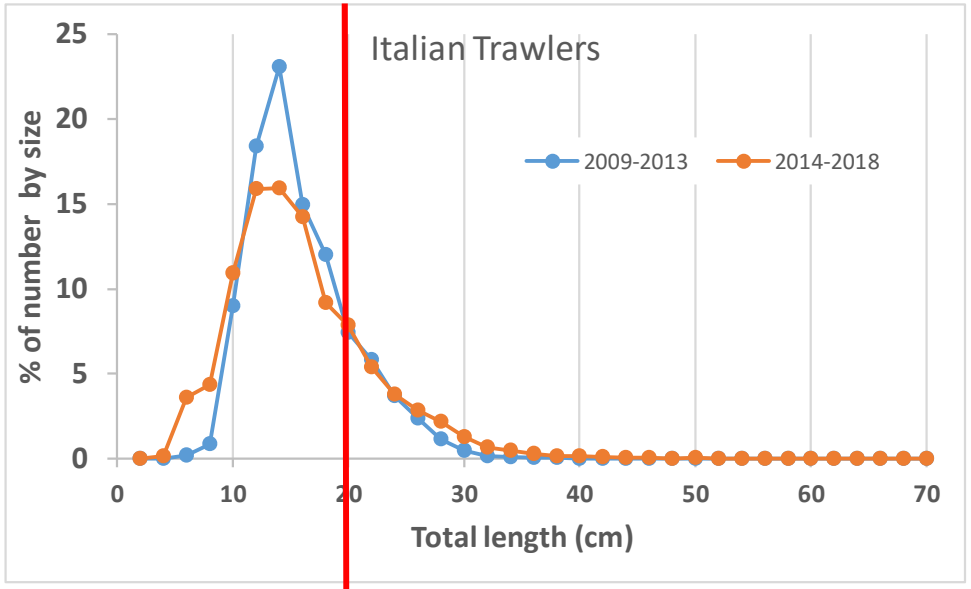
- F/FMSY = 1.82
- SSB/SSBMSY = 0.36

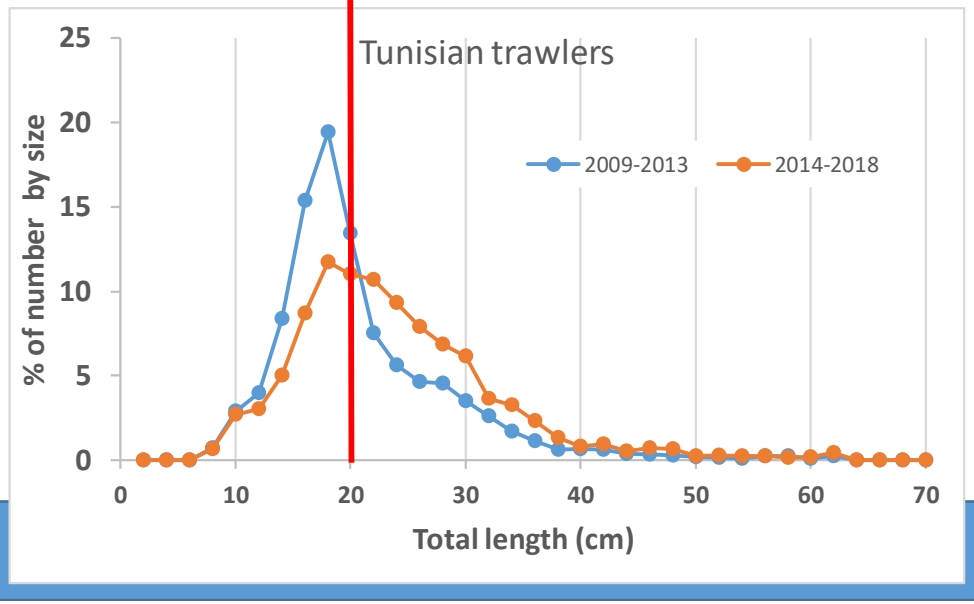


Probabilistic short term forecast at different levels of catches, based on last 10 years average recruitment

The state of the stocks in the Strait of Sicily
The case of Hake - Merluccius merluccius

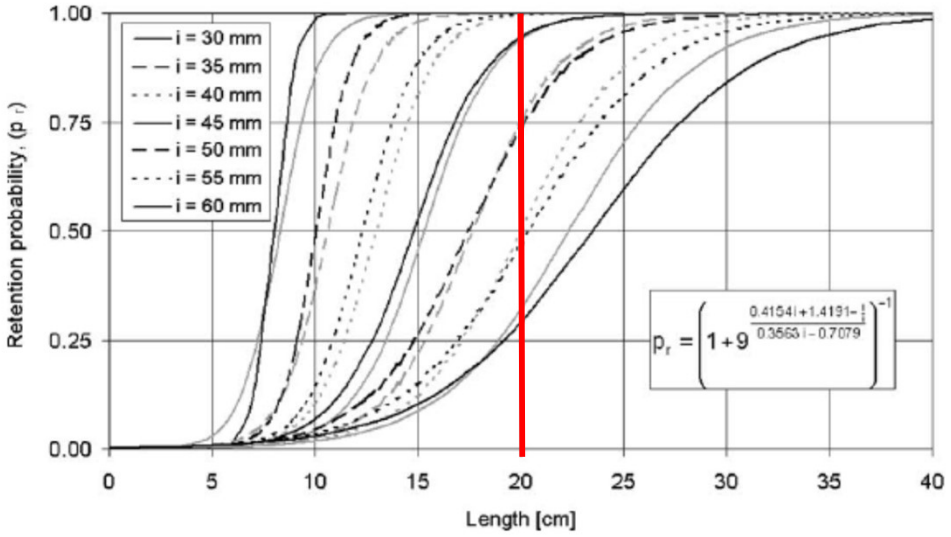
Due to the high level of undersized hake (Total Length<20 cm) in the catch, a reduction of fishing mortality and catches of juveniles is recommended by the GFCM Working Groups to improve the Hake stock status in the Strait of Sicily



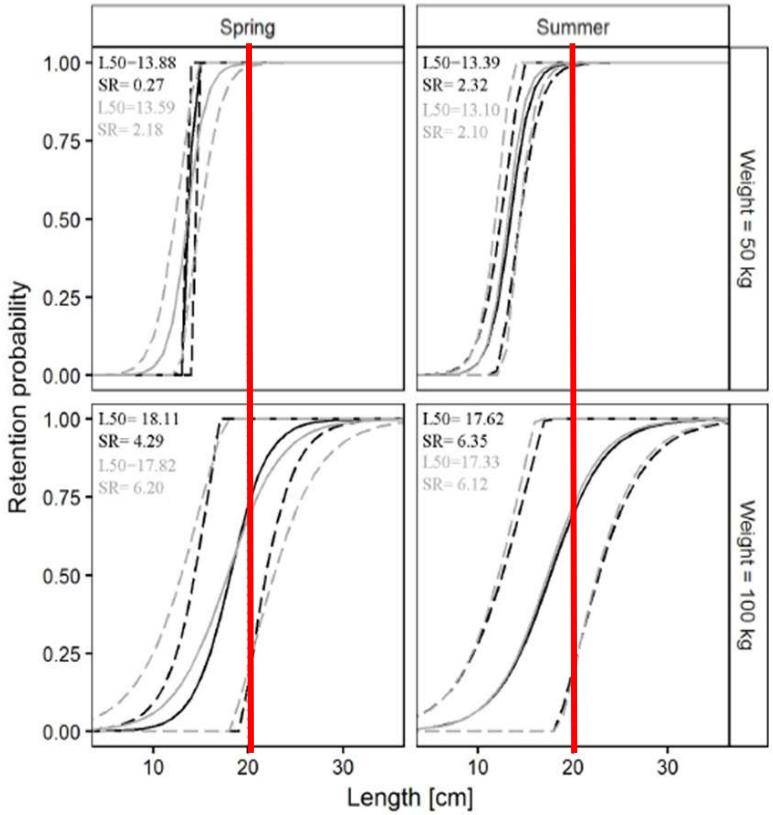


The state of the stocks in the Strait of Sicily
The case of Hake - Merluccius merluccius

Undersized hake are vulnerable to the legal mesh size… both to 40 mm square and 50 mm diamond

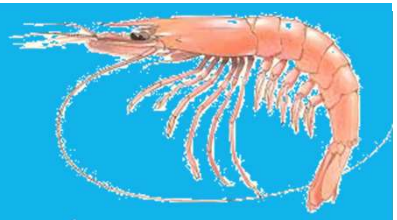


(from Bethke, 2004)



(from Brčić et al., 2018)

The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp *Parapenaeus longirostris*

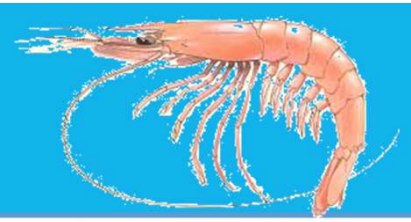


The assessment of the Deep water rose shrimp was carried out by an XSA

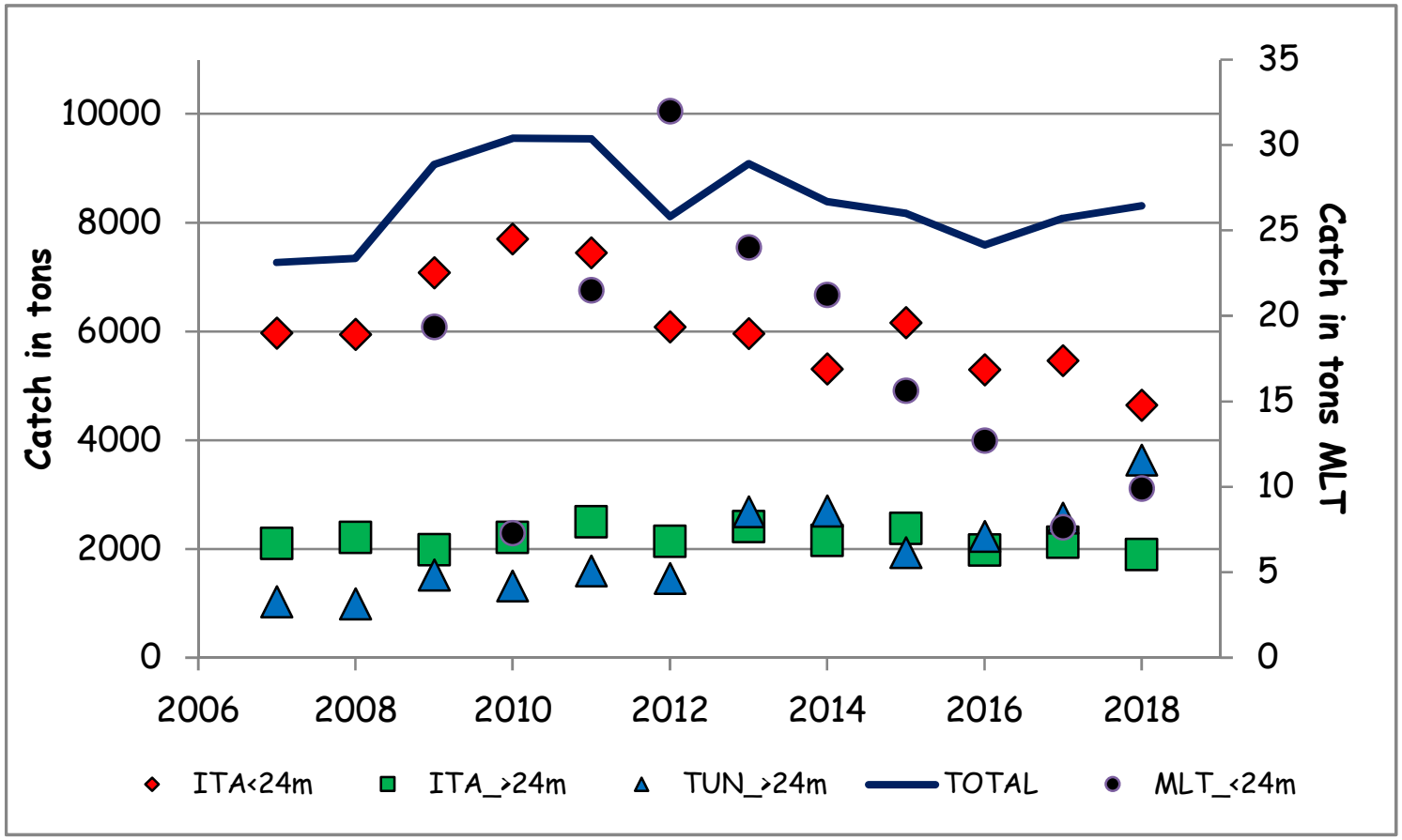
Catch data (landings and discards) by years collected from Malta, Italy within DCF and Tunisia from 2007 to 2018

Survey data (Tuning data) from GSA 15 and GSA 16 (MEDITS 2007-2018)

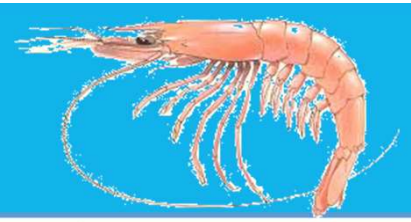
The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp
Parapenaeus longirostris



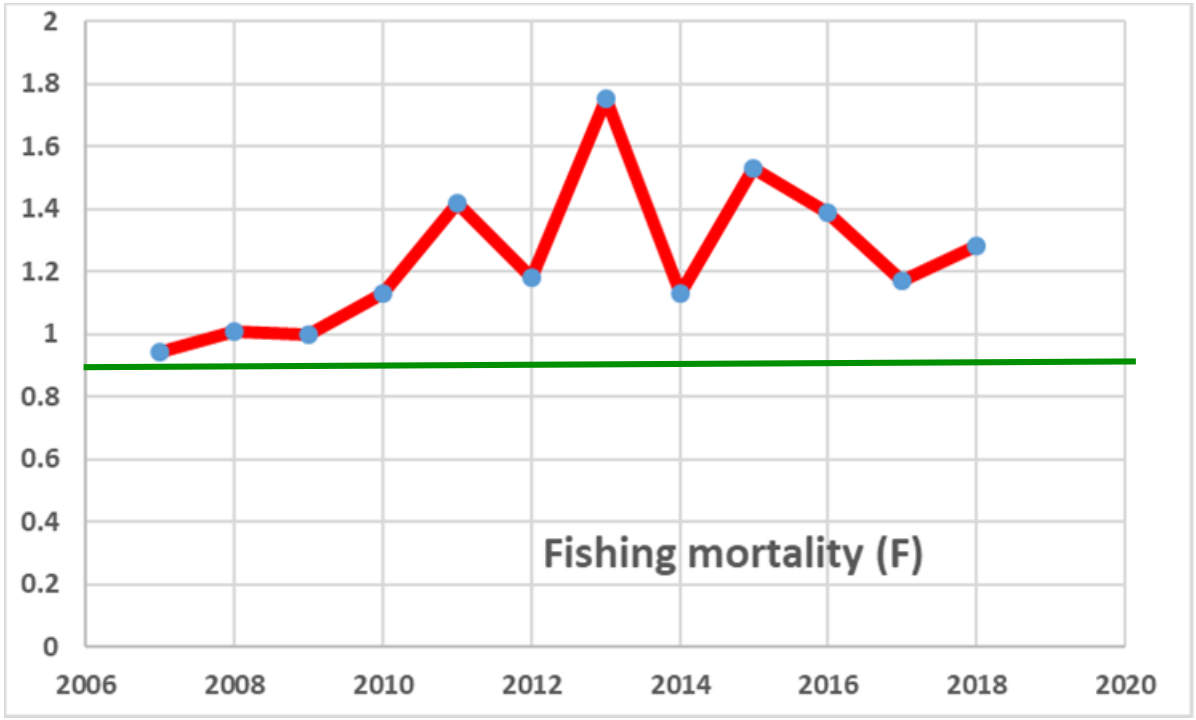
The trend of catch by fleet. While the Italian and Maltese catches are decreasing those of the Tunisian fleet are increasing



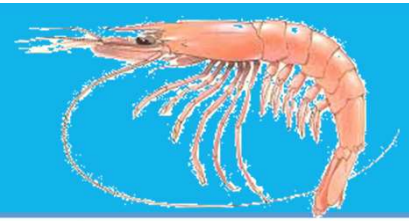
The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp
Parapenaeus longirostris



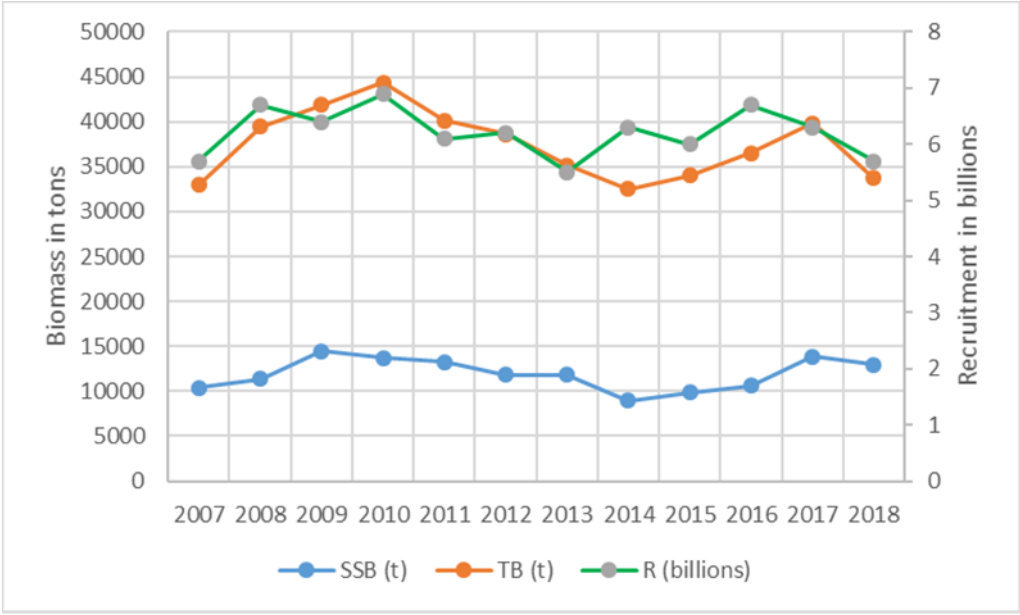
The overall fishing mortality (in red) is higher than that corresponding to the MSY (in green) with a progressive increasing trend

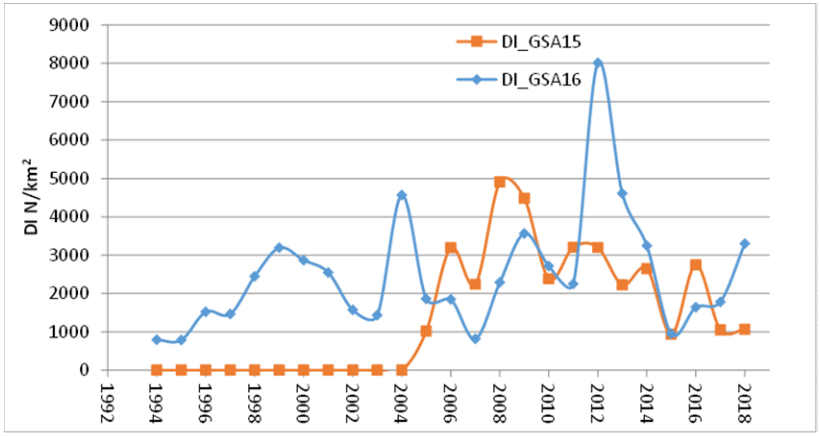


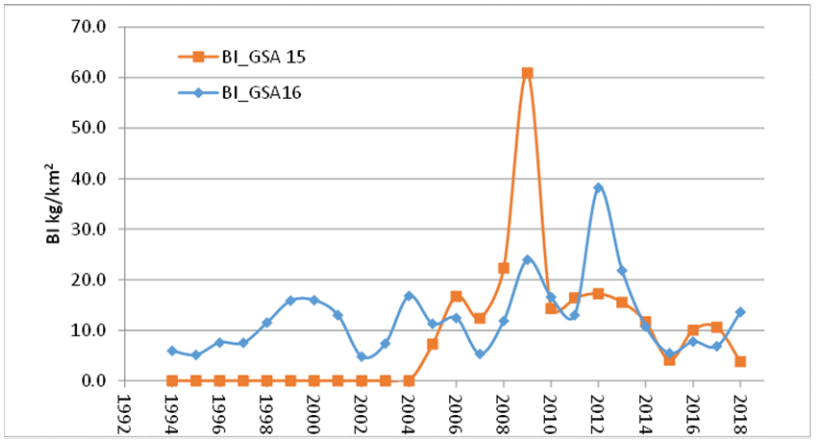
The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp
Parapenaeus longirostris



The standing stock (Total biomass in red and SSB in blue) and recruitment (in green) from XSA is quite stable

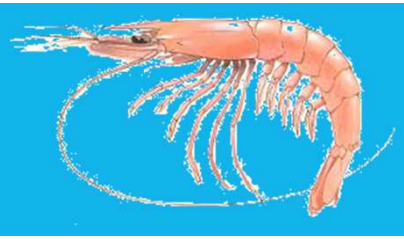






More strong fluctuations result in Medits trawl surveys data

The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp Parapenaeus longirostris



- The ratio $F_{curr}/F_{0.1}$ ranged between 1.52 ($F_{0.1}$ = 0.84) and 1.37 ($F_{0.1}$ = 0.93). Accordingly, the stock status is assessed as **Intermediate Overfishing**.

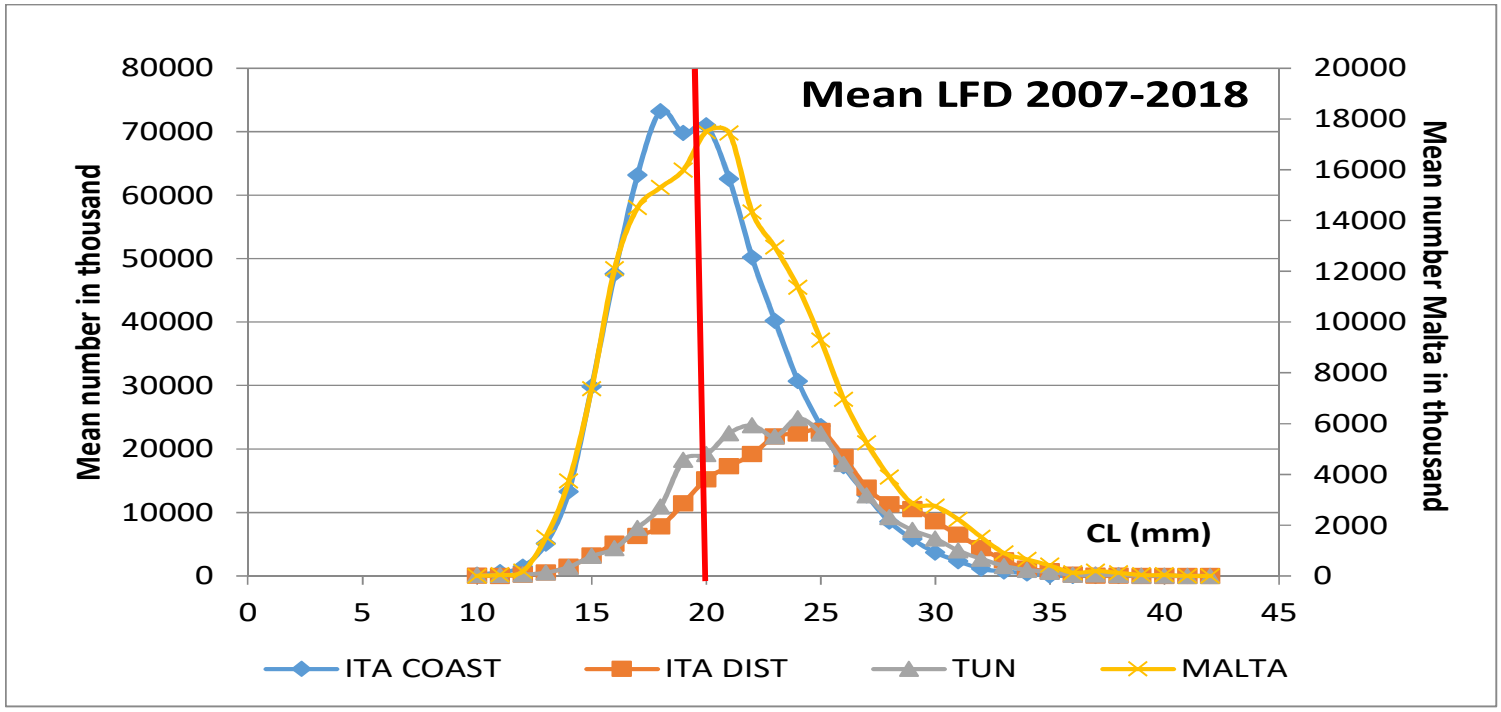
- SSB from XSA on the whole stock resulted at Relative **Intermediate** level in the available time series (2007-2018)

- To improve the stock status a reduction of fishing mortality and catches of undersized shrimps is recommended.

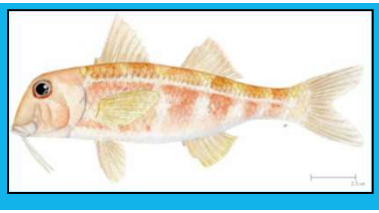
Based on	Indicator	Analytic al reference point (name and value)	Current value from the analysis (name and value)	Empirical reference value (name and value)	Trend (time period)	Stock Status
Fishing mortality	Fishing mortality	$F_{0.1}$ = 0.84 $F_{0.1}$ = 0.93	F_{curr} =1.27		I	O_I O_I
	Catch				N	
Stock abundance	SSB (tons) (XSA)	**11093** **13013** **12928**		33_{th} percentile 66_{th} percentile $SSB_{current\ xsa}$	N	O_I
Recruitment		5.7 billion		Rec 2018		
Final Diagnosis	The ratio $F_{curr}/F_{0.1}$ ranged between 1.52 ($F_{0.1}$ = 0.84) and 1.37 ($F_{0.1}$ = 0.93). Accordingly, the stock status is assessed as Intermediate Overfishing. SSB from XSA on the whole stock resulted at Relative Intermediate level in the available time series (2007-2018), trend of MEDITS biomass indices in the GSA 15 showed a low level of standing stock in the last years while it is in increase in GSA 16.					

The state of the stocks in the Strait of Sicily
The case of Deep water rose shrimp
Parapenaeus longirostris

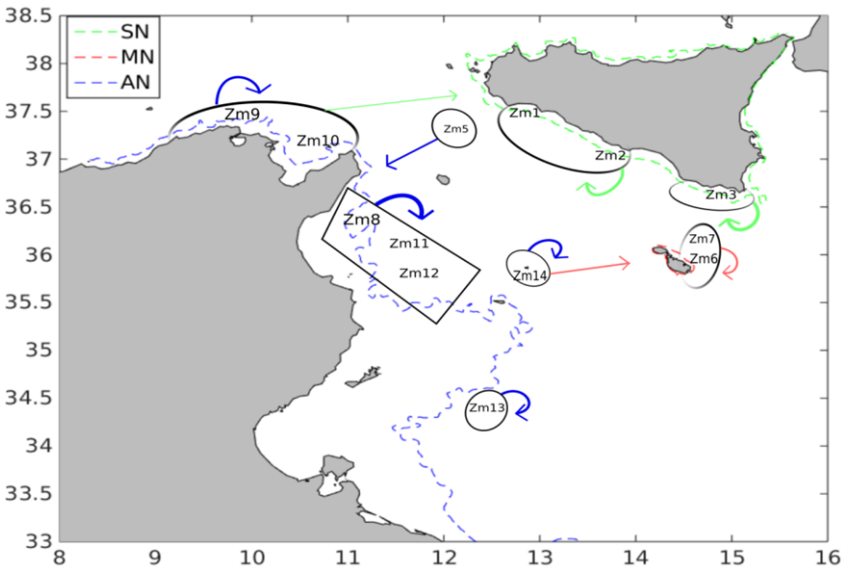
The mean length structure of catch of deep water rose shrimp by fleet segmentes of the trawlers operating in the Strait of Sicily. A lot of catches is below the minimum conservation size (20 mm CL)

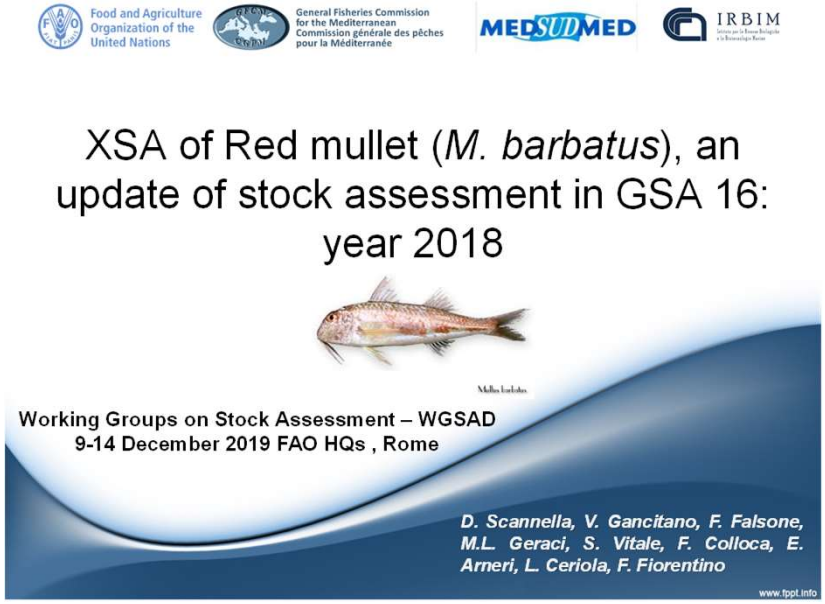


The state of the stocks in the Strait of Sicily
The case of Red mullet - Mullus barbatus



- ✓Unlike wise for the Hake and Deep water rose shrimp, the Red mullet inhabiting the GSA 16 is considered as a single stock
- ✓The assessment was carried out by an XSA
- ✓Catch data (landings) by years collected in GSA16 within the DCF 2006 to 2018.
- ✓Survey data (Tuning data) from GSA 16 (MEDITS 2006-2018)

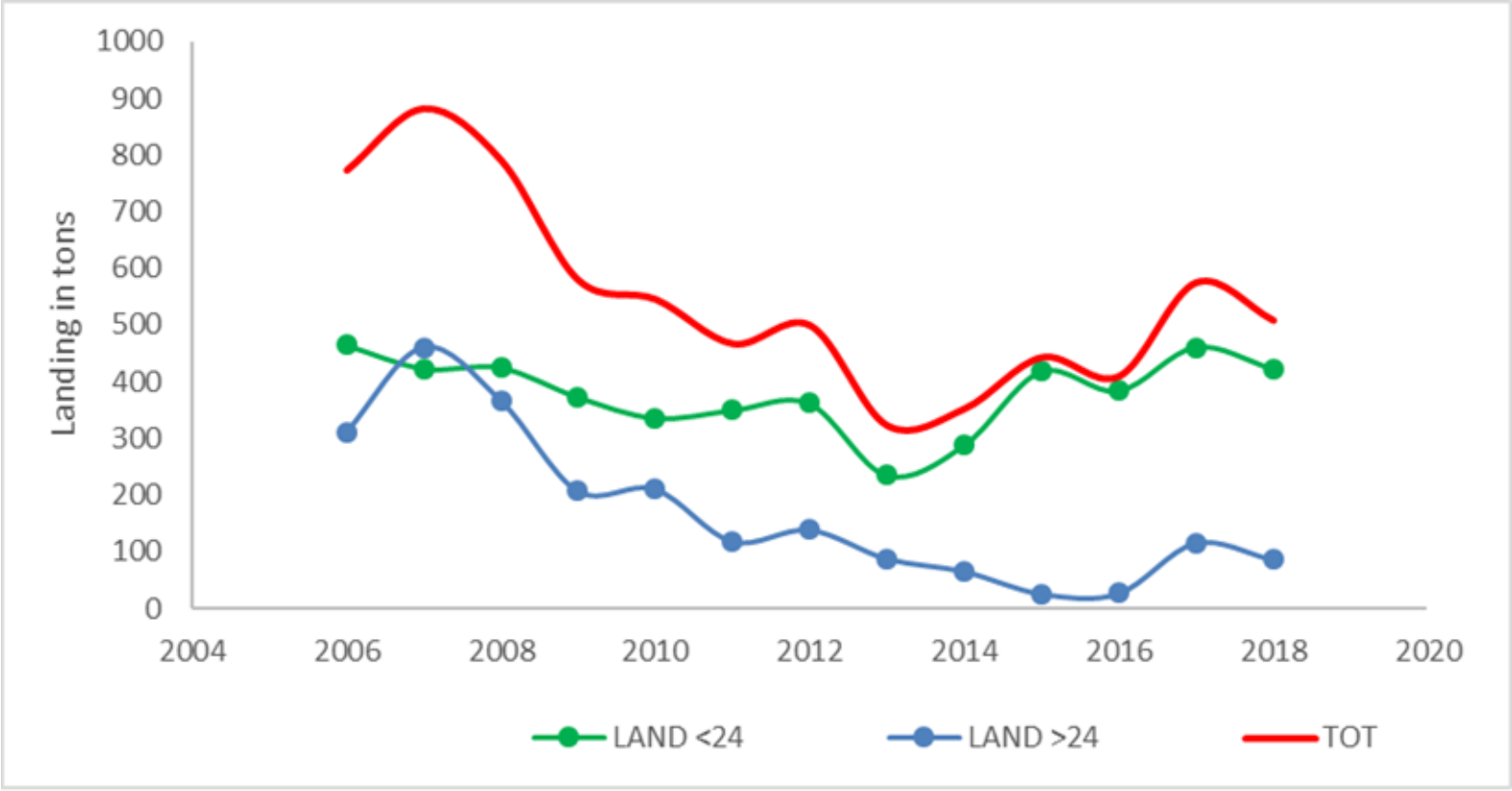




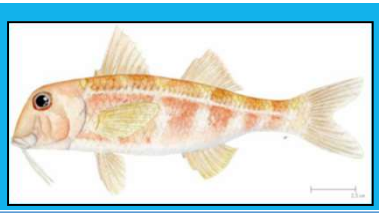
from Gargano et al., 2017

The state of the stocks in the Strait of Sicily
The case of Red mullet - Mullus barbatus

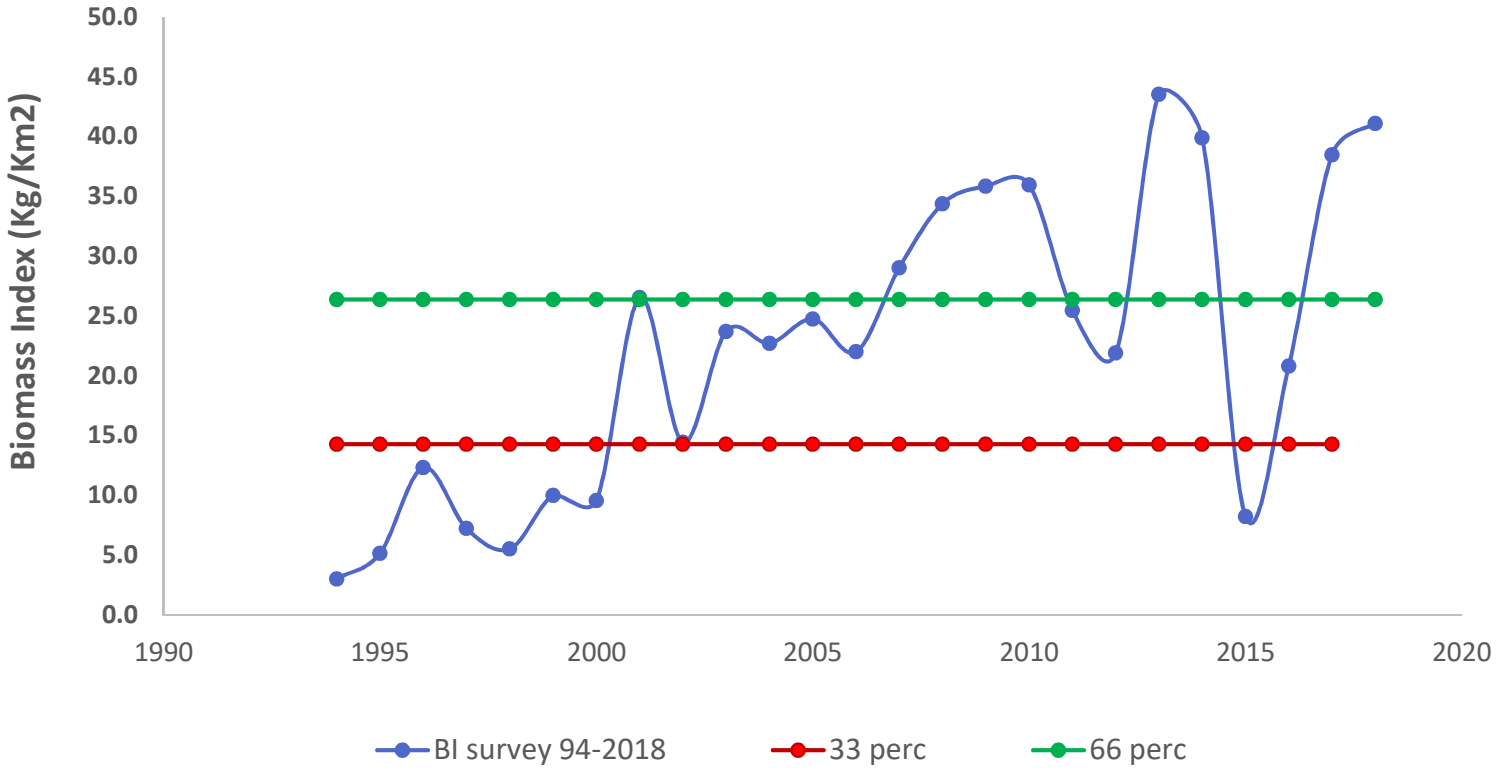
The trend of catch by the Italian fleet segments. Catch has been decreased from the middle 2000s with a recovery since 2013 for the coastal trawlers and since 2016 for the distant ones.



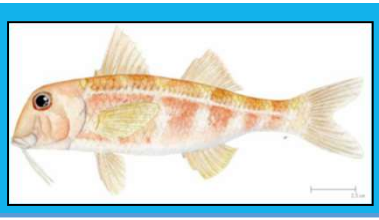
The state of the stocks in the Strait of Sicily
The case of Red mullet - Mullus barbatus



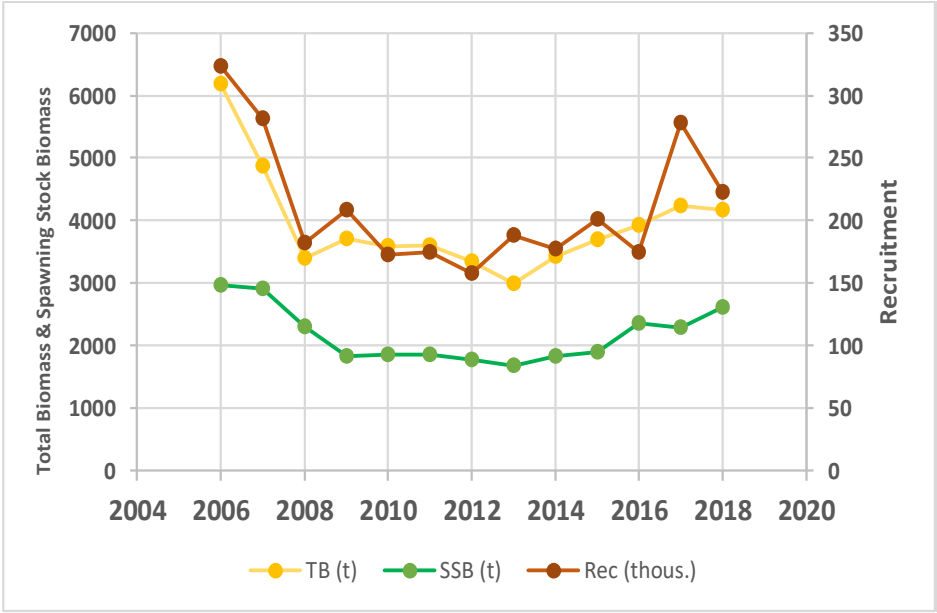
Overall the trawl survey data shows an increasing trend of the standing stock of red mullets in GSA 16

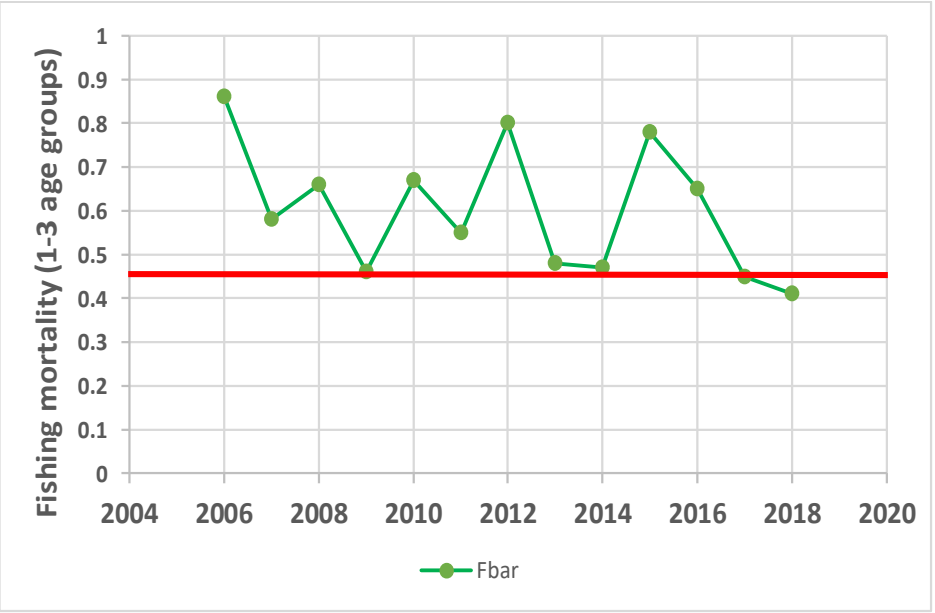


The state of the stocks in the Strait of Sicily
The case of Red mullet - Mullus barbatus



According to the XSA, after a decreasing phase, the standing stock and recruitment (on left) has been recovered. On the other hand the red mullet fishing mortality (on right) in the last two years (in green) resulted under that corresponding to the MSY (in red)





The state of the stocks in the Strait of Sicily
The case of Red mullet - Mullus barbatus

The stock status of red mullet is in Sustainable Exploitation with Relative High Biomass

CONCLUSIONS

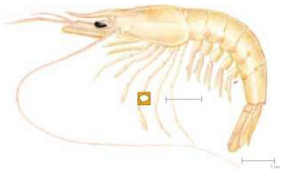
Scientific advice

Fishing mortality		SSB by analysis	
$F_{curr\ (avg\ 3y)}$	0.32	$SSB_{33^{rd}}$	1851
$F_{0.1}$	0.44 (est. '06-'17 -bench)	$SSB_{66^{th}}$	2305
$F_{curr}/F_{0.1}$	0.72	$SSB_{curr(xsa)}$	2613

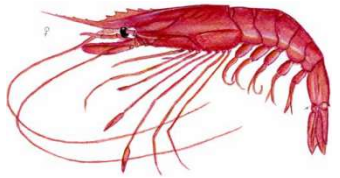
$F_{curr}/F_{0.1}$=0.95 Benchmark '06-'17

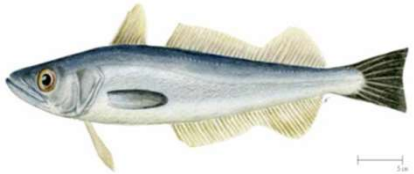
Final Diagnosis	$F_{curr}/F_{0.1}$ is below to 1.33(fishery reference points): the stock resulted in Sustainable exploitation status The SSBcurr(xsa) is higher than SSB_{66rd} (2192) Relative high biomass.
Manangement advice	NOT INCREASE FISHING MORTALITY

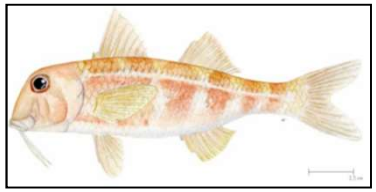
The role of Fishery Restricted Areas (FRAs) to improve sustainable fisheries in the Strait of Sicily - The European project MANTIS

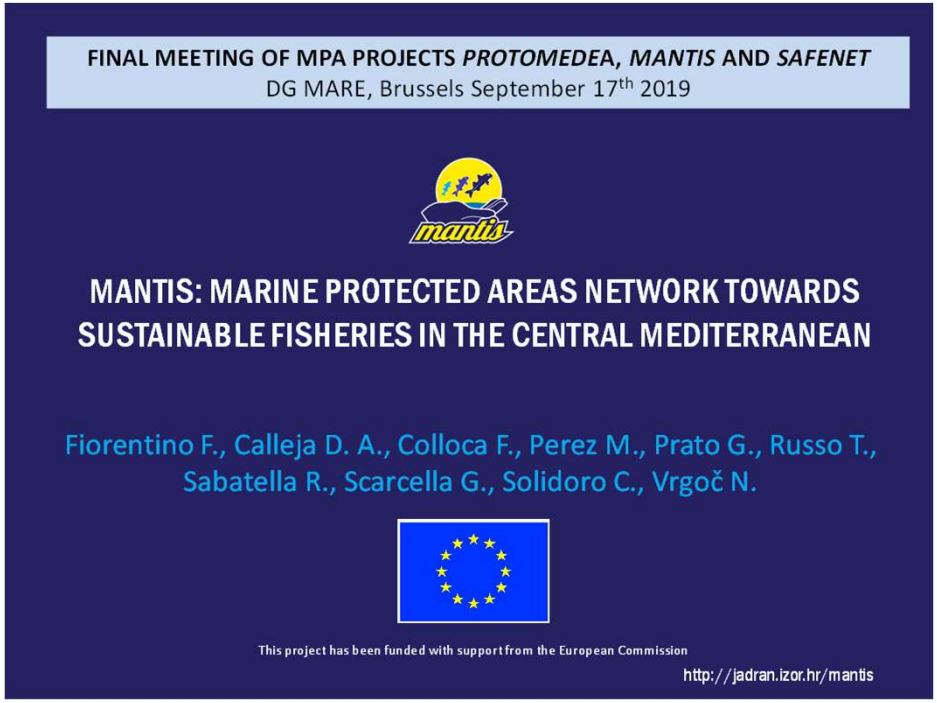


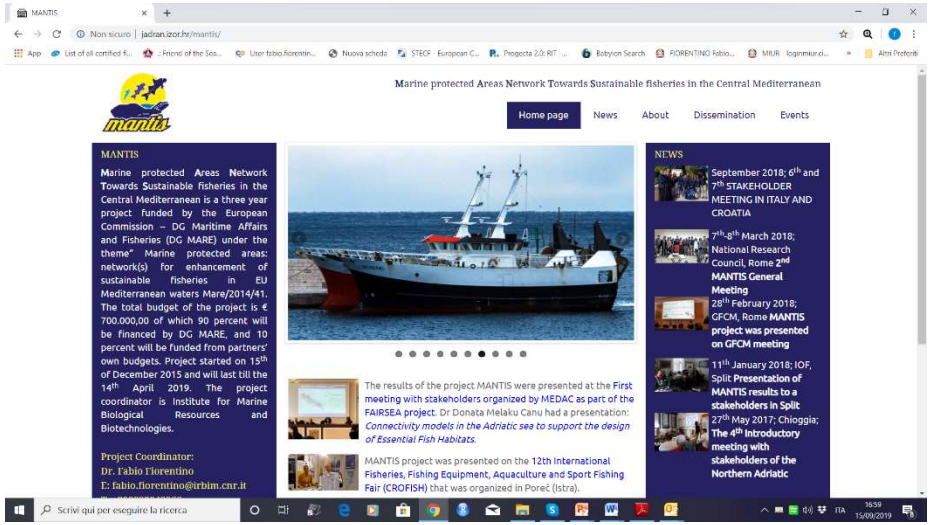
The target species for the MANTIS Project in the Strait of Sicily were *Parapenaeus longirostris*, *Merluccius merluccius*, *Mullus barbatus*, and *Aristaeomorpha foliacea*











The MANTIS web site

http://jadran.izor.hr/mantis

The main rationale of the MANTIS project

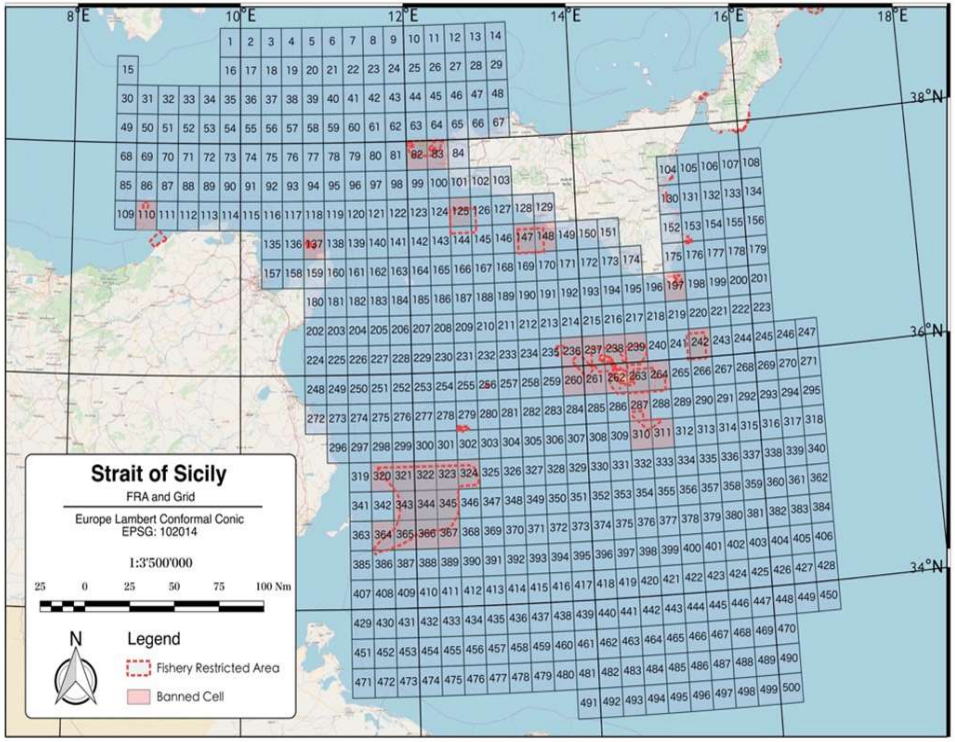
- Spatial domain defined as a grid of cells submultiple of the GFCM grid;

- Estimation of the spatial/temporal productivity (standardized LPUE or CPUE) by species, age, area, and time using:

  - **VMS data on fishing effort (E)**;

  - Logbook data or Landing data (often aggregated at weekly or monthly level);

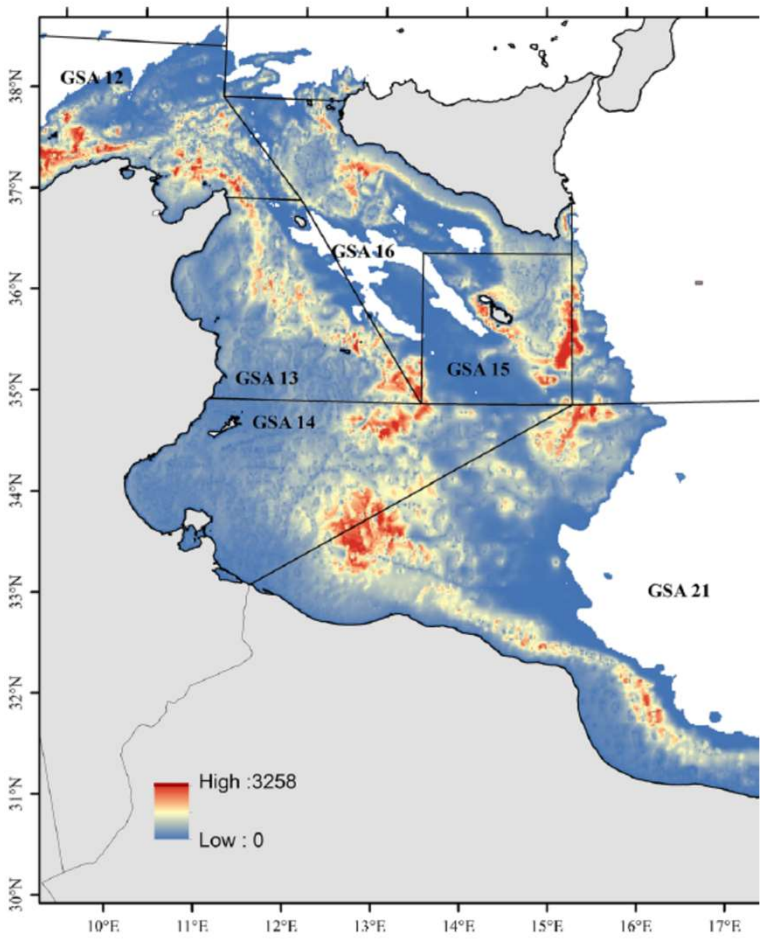
  - Biological sampling of catches: age/length structure of catches by area and time

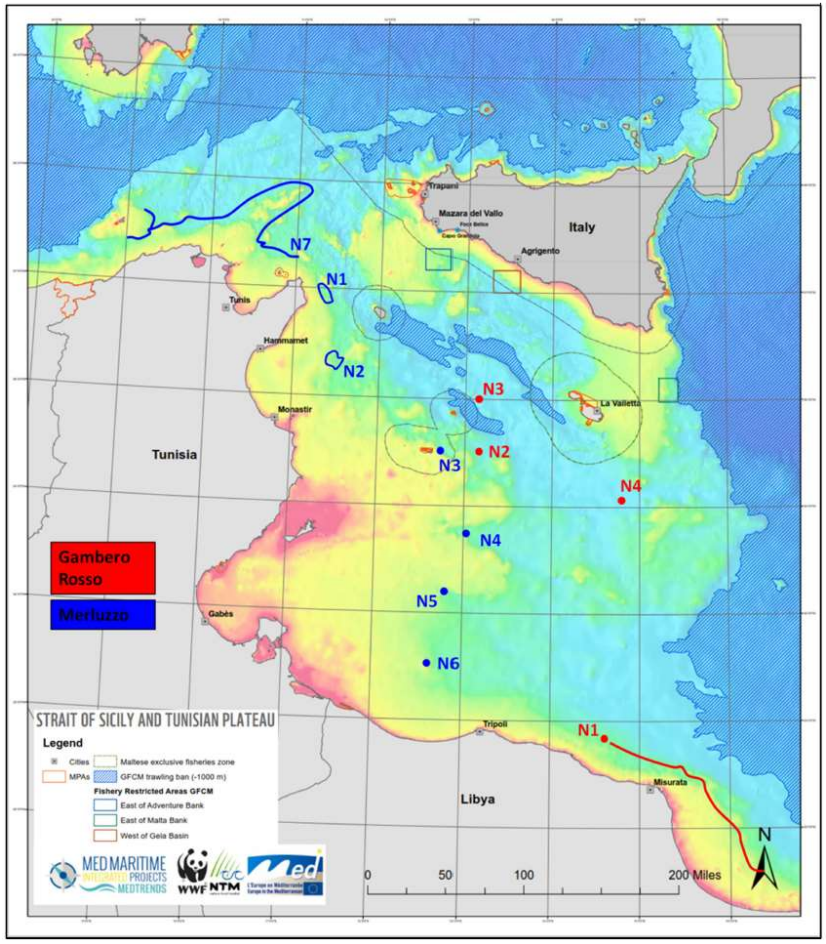


LPUE (Kg/m of LOA/hour fishing)

Estimating catch and simulating management scenarios by using the catch equation C= CPUE*E

Distribution maps of predicted nurseries of hake obtained by means of generalized additive models using depth and seafloor characteristics as predictors from Garofalo et al., 2018 (left) and the nurseries position by the participatory mapping with Sicilian distant fishers from the MANTIS Project (right)

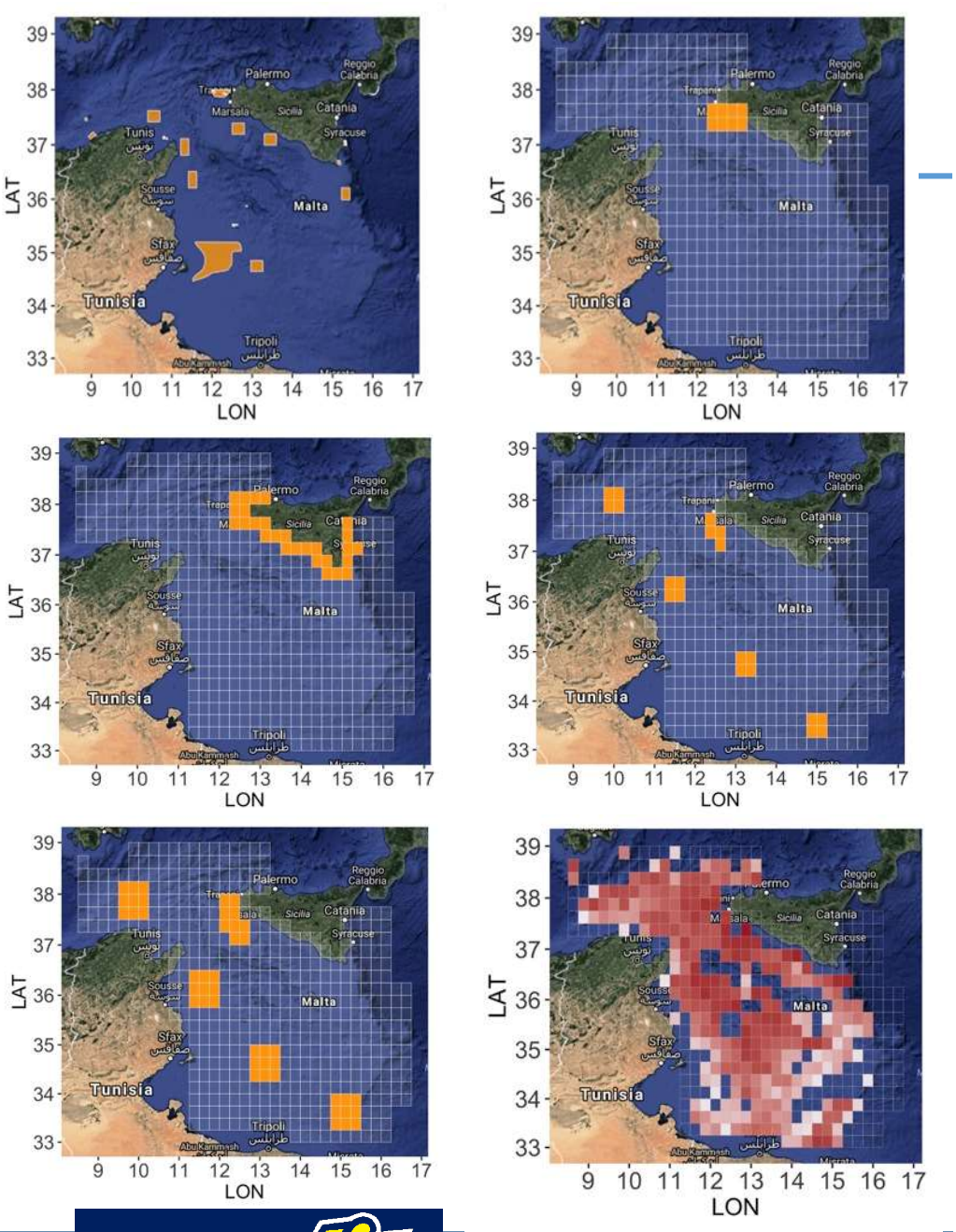




An important result of participatory mapping involving the Traditional Ecological Knowledge of fishers

Simulated scenarios in the Strait of Sicily

Name	Type
Status quo	Capacity/Effort-based
Effort Regime	Capacity/Effort-based
GFCM FRA	Spatial-based
FRA Network	Spatial-based
Adventure Bank	Spatial-based
Coastal closure	Spatial-based
Network 2×2	Spatial-based
Network 3×3	Spatial-based
Short Winter stop	Temporal-based
Short Summer stop	Temporal-based
Extended Winter stop	Temporal-based
Extended Summer stop	Temporal-based
GFCM FRA – 4 Effort	Combined
GFCM FRA – 8 Effort	Combined



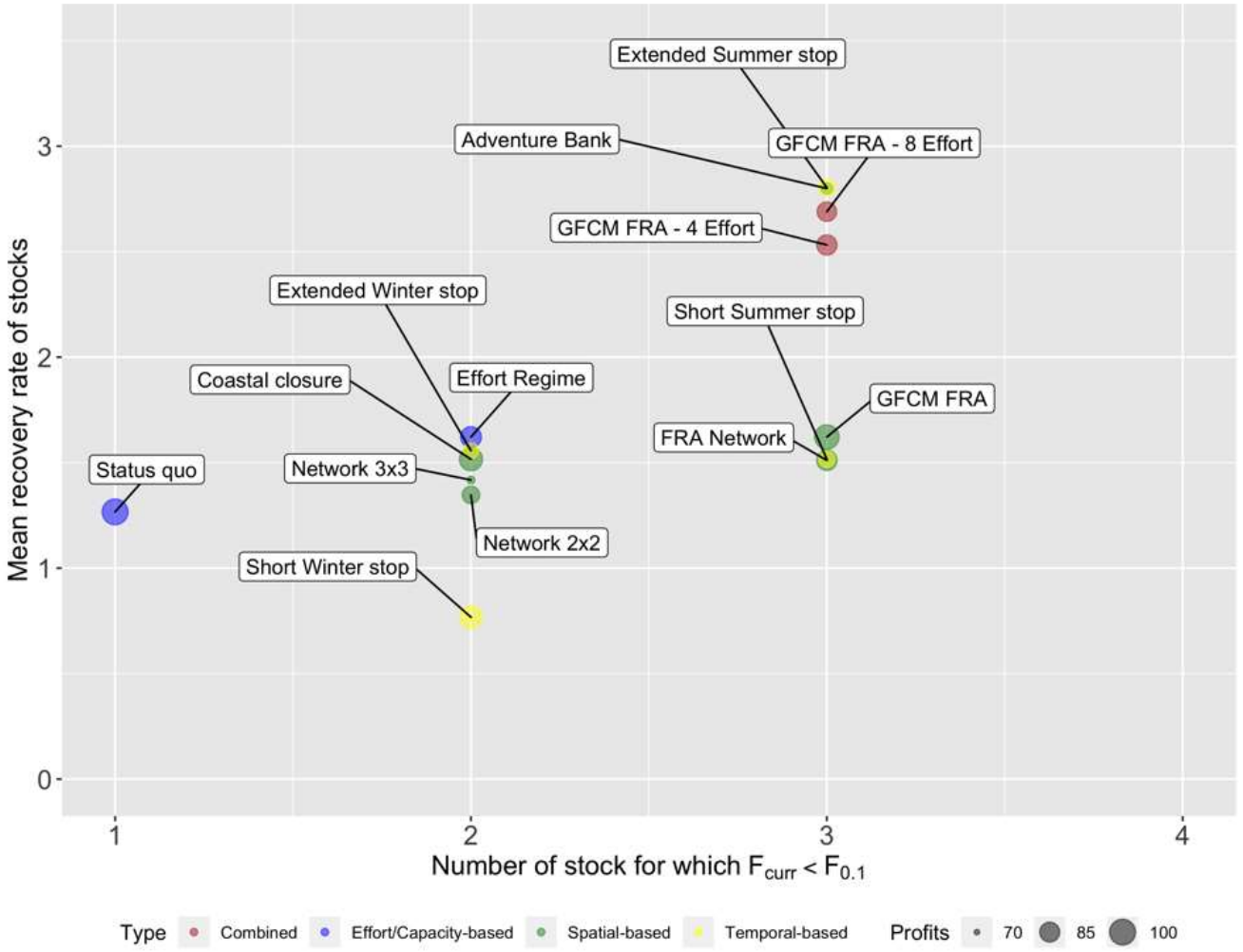
The main results of Mantis Project in comparing different management scenarios

i) the closure of the three established GFCM FRA are likely to allow reaching $F_{0.1}$ for three stocks considered with exclusion of Hake

ii) an Extended Summer stop (trawling ban for 2 months followed by two months of reduced activity) represents another effective approach (but costly)

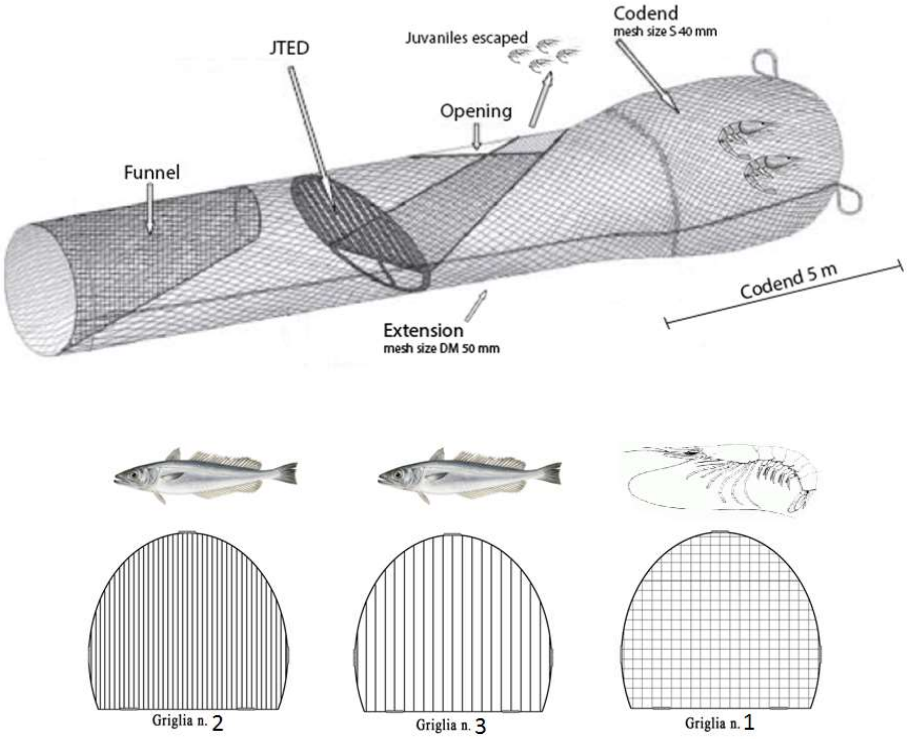
iii) all the management scenarios are always associated in their first phase of enforcement to a decrease of the profit for the fleet (between 10 and 40%)

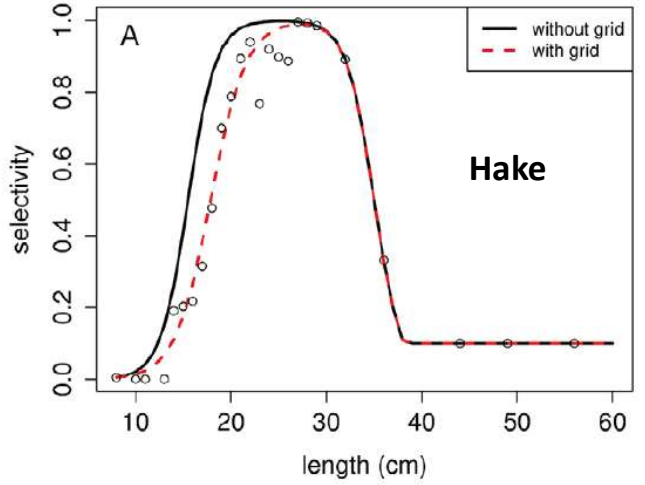
The demersal resources of the Strait of Sicily

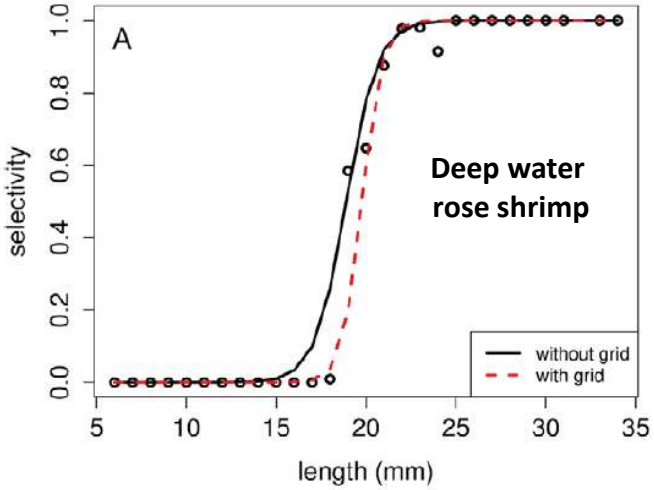


The implementation of FRAs and the trawl net technologies

The use of JTED on bottom trawls can significantly reduce the catch of undersized hake and improve the exploitation status of the stock.







from Vitale et al., 2018

Final remarks to improve stocks status and fishery performances in the Strait of Sicily

- The main demersal resources recruiting in offshore bottoms are characterised by overfishing and high fraction of undersized catches
- The obligation to land all species with minimum catch size has been extended to all demersal fisheries since the 1st January 2019
- The current minimum mesh size is not suitable to avoid catching large fish such as hake, anglerfish, sharks and skates and rays
- The implementation of trawling ban in critical zones (FRA) and periods (temporary closures) aimed at delaying the first catch size of species for which the current minimum mesh size is not appropriate would improve their exploitation patterns
- Closure of some areas with a high density of juvenile hake, combined with effort reductions, would achieve effects comparable to those expected with higher effort reductions
- In some FRA areas, more selective fishing gears (e.g., panels, grids) or behavioural changes (e.g., nocturnal hauls) to vessels with specific authorization may be experimented
- Technological advances in VMS/AIS make feasible to adopt management measures based on spatial regulation of fishing effort