

Fisheries in the Adriatic region a shared ecosystem approach **FAIRSEA**

BIOECO – A multi-fleet and multi-stock model platform
for mixed fisheries

MEDAC
1st Stakeholders meeting
February 21, 2019, Venice



WP4 - Implementation of a shared and integrated platform

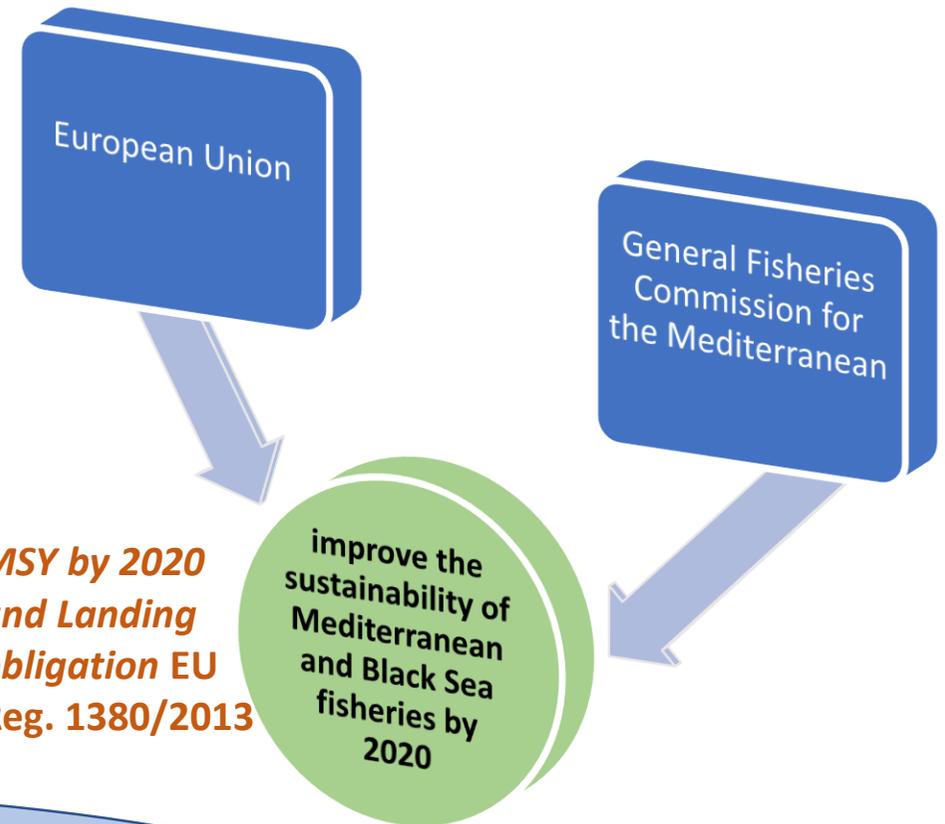
- ❖ The operational platform will integrate from the physical to the bio-economic dimension of the fishery into a spatial dynamic decision support tool.
- ❖ One of the component of the platform is:
 - ✓ *BIOECO – A multi-fleet and multi-stock model for mixed fisheries, which includes a module on the multicriteria decision analysis (MCDA) to weight sustainability objectives.*



The fishery management and its strategic objectives

Common targets :

- guarantee **biological, economic** and **social** sustainability;
- monitoring and incorporating stock assessment;
- balancing fishing pressure with the capacity of the stocks;
- risk evaluation of stock collapse and fleet unprofitability;
- improvement of the exploitation pattern (e.g. delay the size at first capture to mitigate growth overfishing and reduce discard)



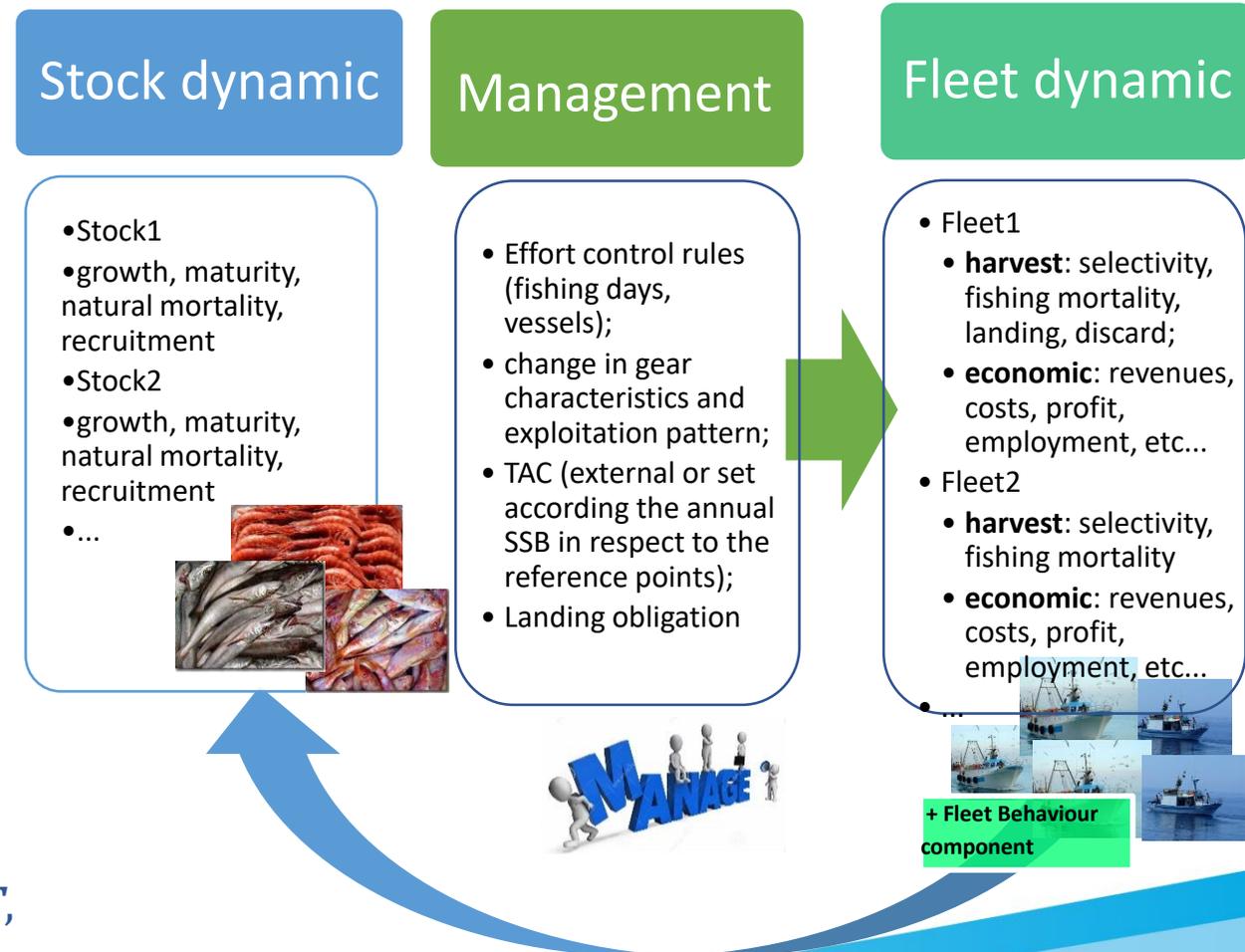
Need to integrate stock and fleet-based indicators through BIO-ECONOMIC models



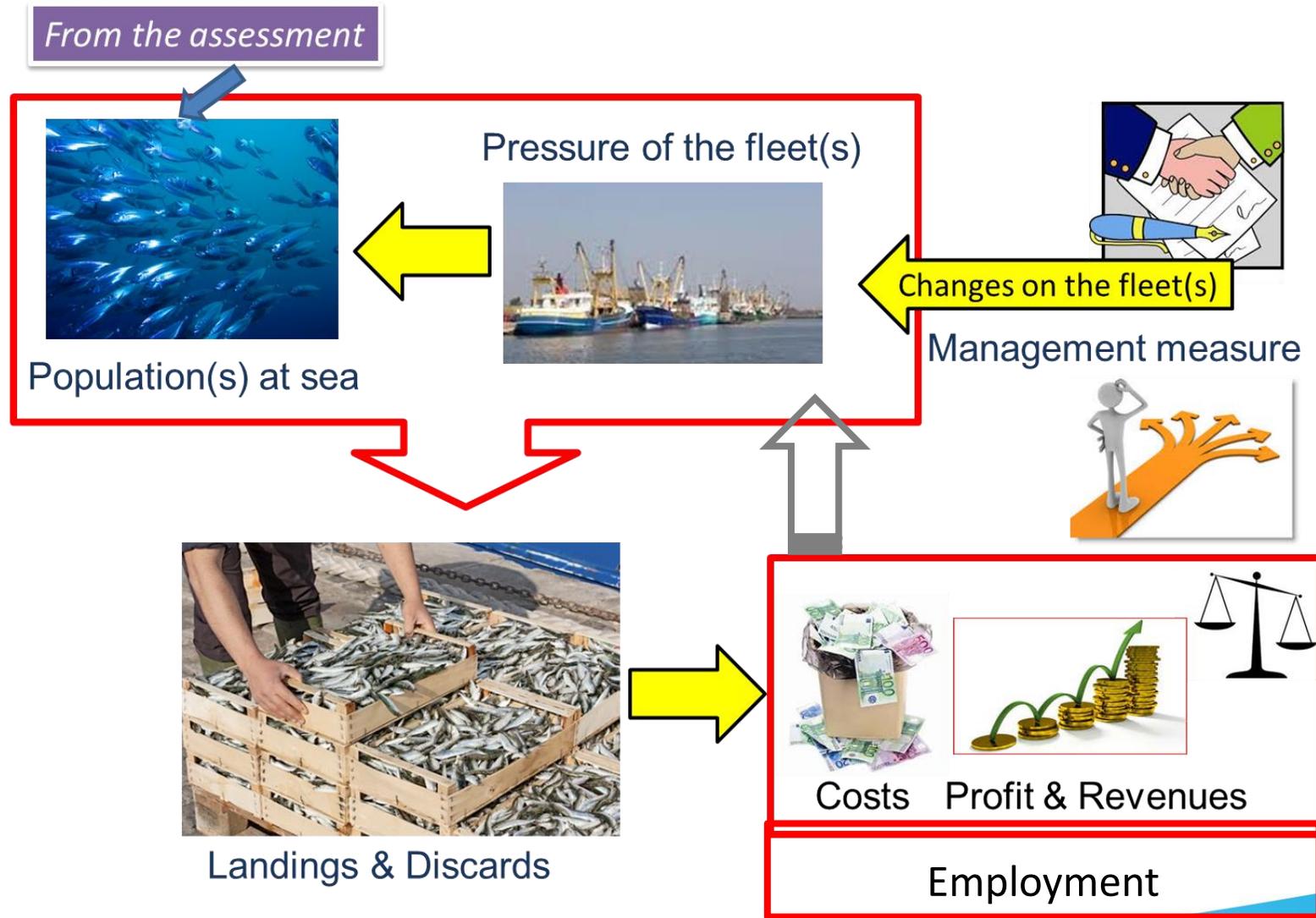
The bioeconomic model BEMTOOL (v3): main structure

BEMTOOL a **multi-fleet** and multiple stocks **bio-economic model** in **R** software, mimicking the effects of **management strategies (scenarios)** on the stocks and on the mixed fisheries:

- stock dynamics;
- economic and social performances;
- length/age-specific selection effects;
- discard (estimation, discard survivability);
- effects of compliance with landing obligation;
- reference points (MSY, MEY);
- uncertainty and risk evaluation;
- decision modelling (*MCDA and MAUT*, e.g Rossetto et al., 2014)



The bioeconomic model BEMTOOL (v3): workflow



Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



Explore the bio-economic benefits of hake recruitment protection in Ligurian Sea and northern Tyrrhenian Sea (GSA 9), accounting for the **spatial dimension** of fisheries management and the role of **protection networks** in supporting fisheries in their surroundings.

The basis for the scenarios was the **time or spatial closure of nursery areas**.

Evaluations focused on:

- ✚ the state of the stock (F/F_{MSY} ; SSB);
- ✚ the fisheries profitability (landings, revenues);
- ✚ the reduction of the impact on the recruits (discard volume, mean length of catches);
- ✚ effects on economic and social indicators.

Seasonal closure by fleet/ground (following recruitment peaks) differentiated according to the relative impact to nursery grounds



Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



THE SET OF MANAGEMENT SCENARIOS

(S1) - Status quo (baseline, **SQ**);

(S2) - **Seasonal fishing ban** (following recruitment peaks) for one or more fleet segments associated to a nursery ground. **Flat**/synchronised closure by fleet/ground (**SFBf**);

(S3) - **Seasonal fishing ban** (following recruitment peaks) for one or more fleet segments associated to a nursery ground. Closure by fleet/ground **differentiated** according to the relative impact (**SFBd**);

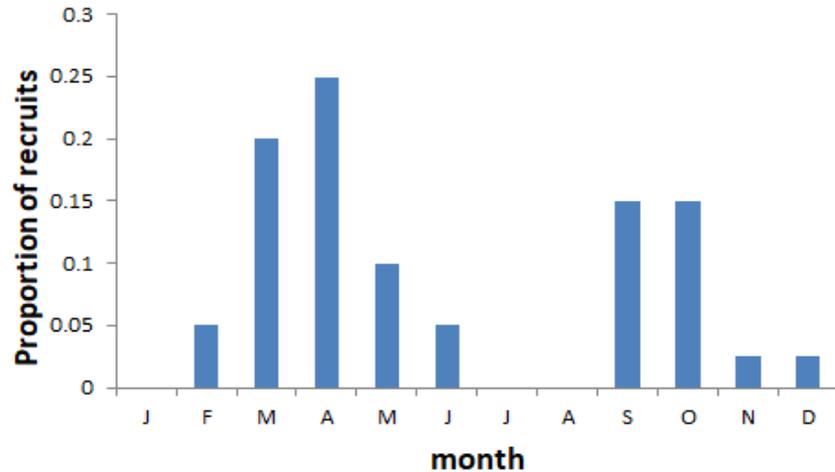
(S4) - **Closure of nursery grounds (SC)**.



Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



SCENARIO MODELLING IN PRACTICE



Proportion of recruits entering in the stock by month

Temporal closures synchronized or differentiated by fleet segment.
 Spatial closure all year round for trawlers (excluding OTB_Lig_VL1224)

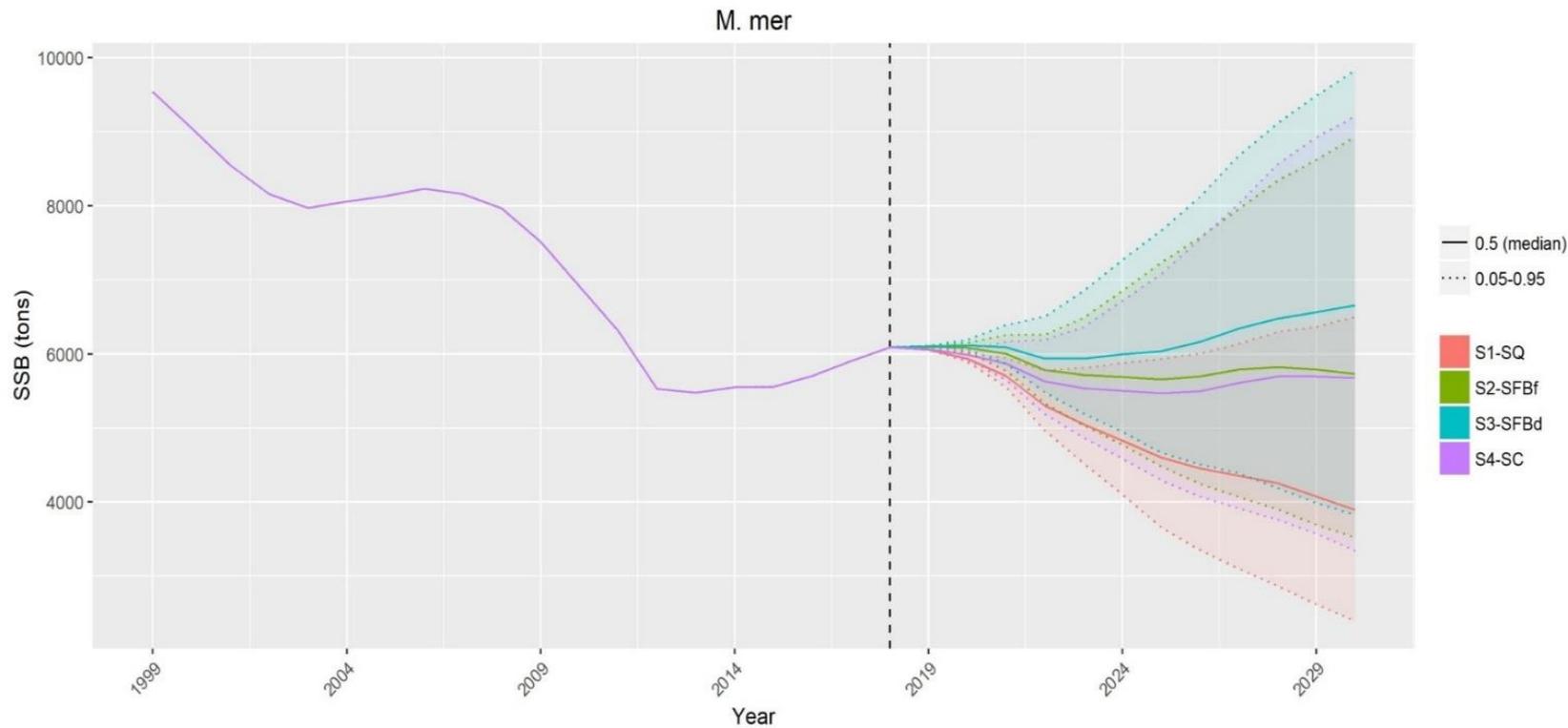
Fleet segment	SC1-SQ												SC2-SFBf												SC3-SFBd												SC4-SC												
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
OTB_Lig_VL1224																																																	
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Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



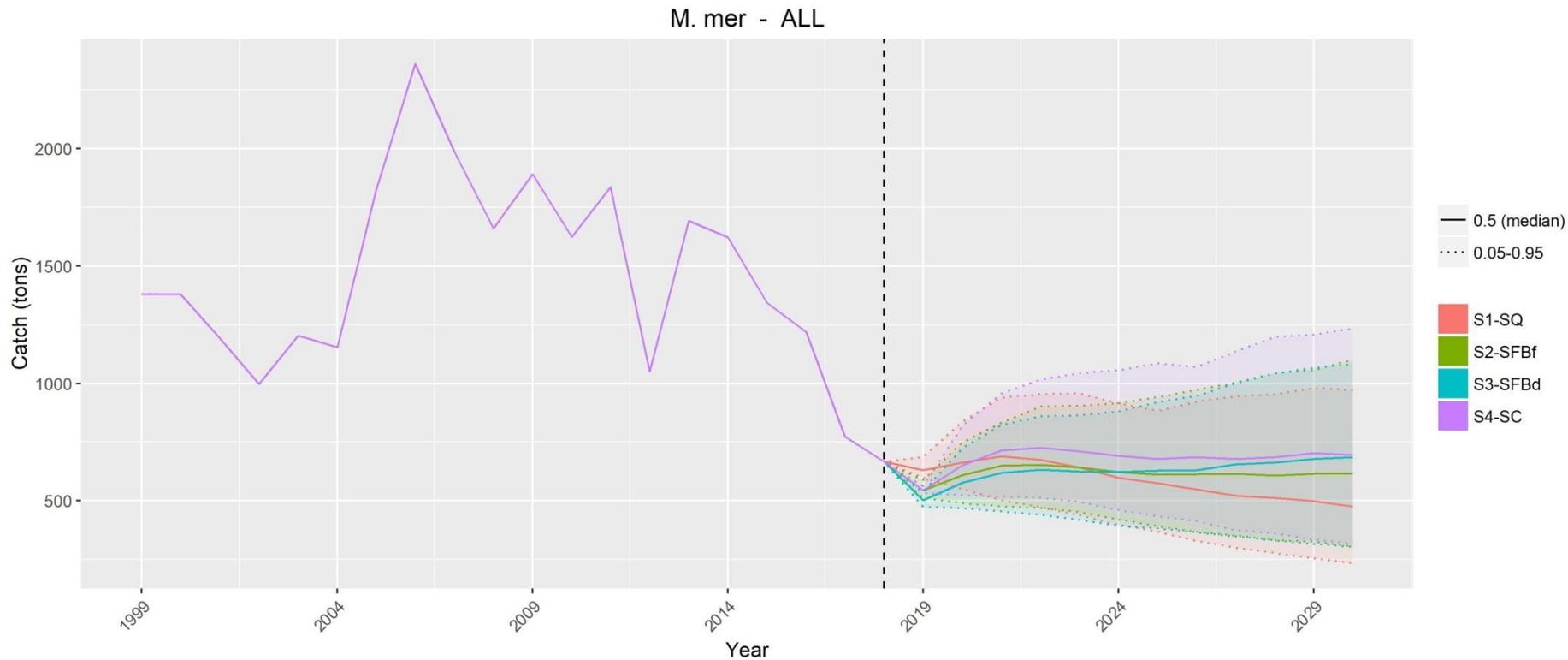
EFFECTS ON INDICATORS



Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



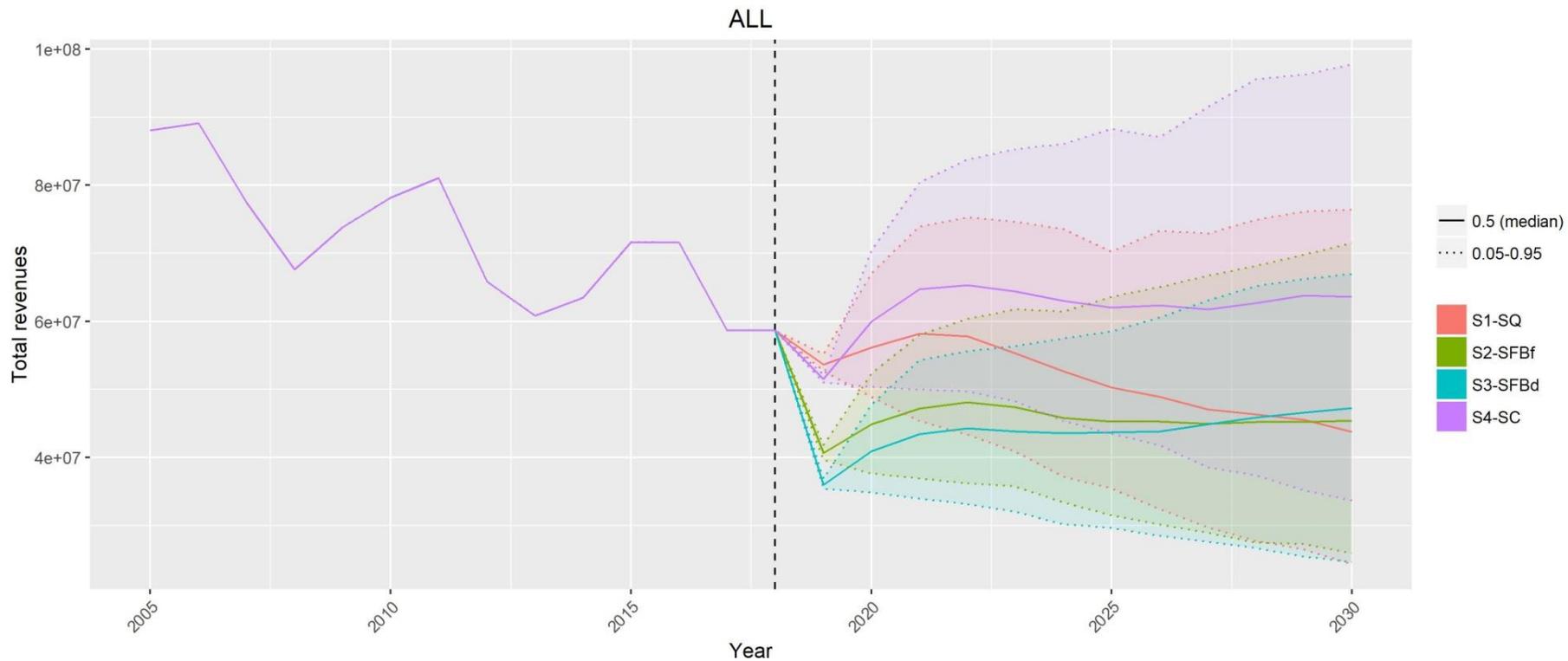
EFFECTS ON INDICATORS



All scenarios are comparable and perform better than SQ (S1)



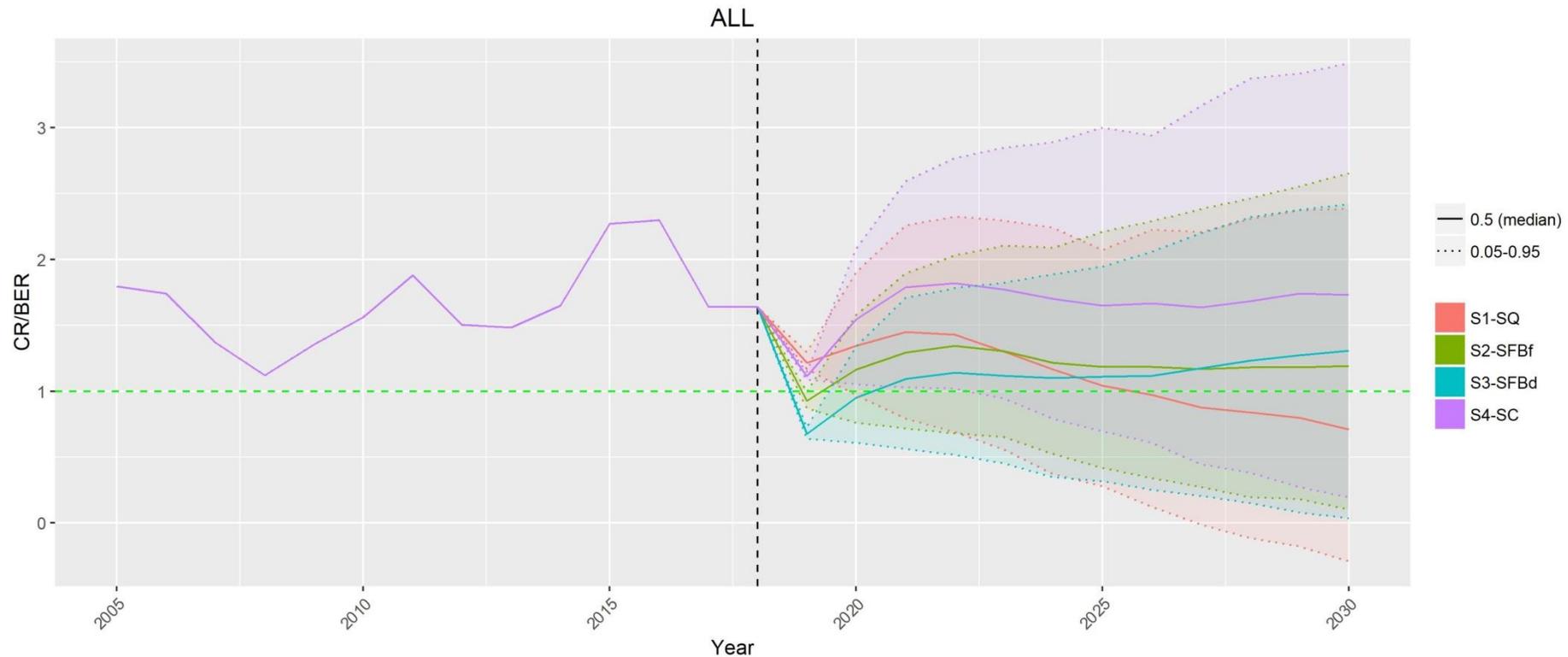
Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



In S2 and S3 revenues are slightly increasing compared to the SQ despite the activity limitation



Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake



S4 performs better than the other scenarios that however highlight an improvement compared to S, which is getting down the reference point =1 (at BER profit is 0)

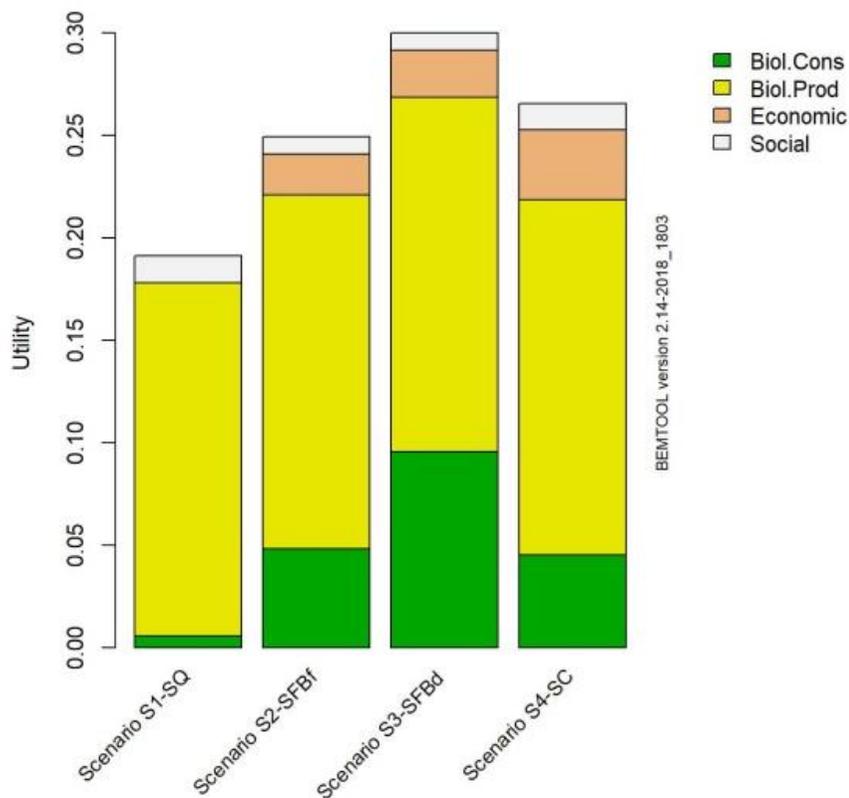


Applications of BEMTOOL.v3 - GSA9 (western Mediterranean) protect nursery grounds of hake

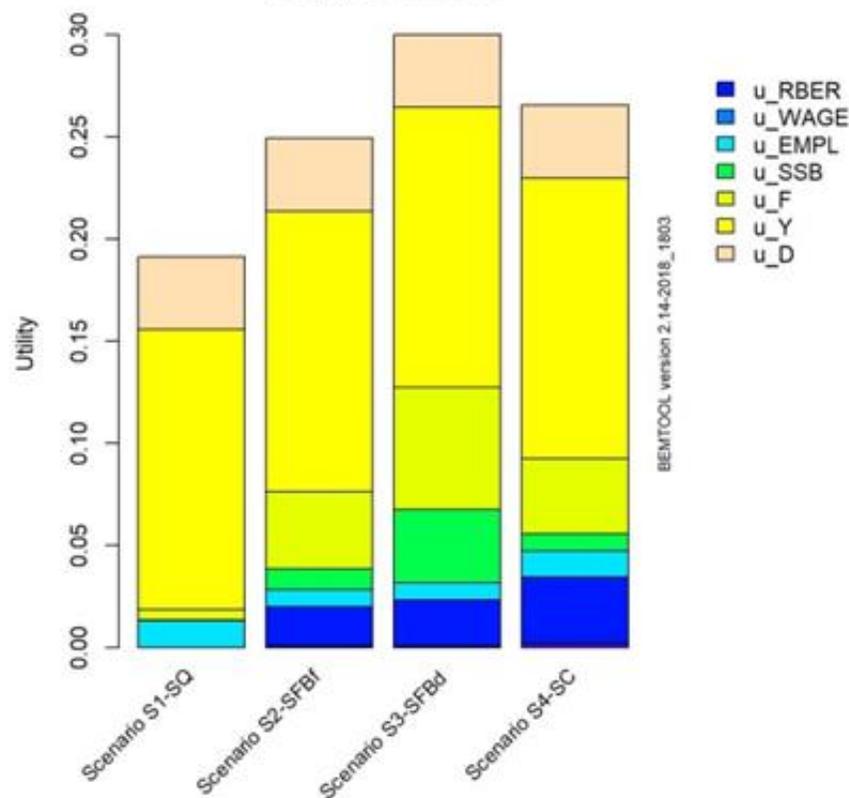


SYNTHESIS FROM THE MCDA ROUTINE IN BEMTOOL

Utility per group of indicators



Utility per indicator



Applications of BEMTOOL.v3 - Demersal fisheries in the Adriatic-Ionian Region

Spatial, temporal, economic, and biological characteristics of demersal fisheries of GSA 19 analyzed focusing on *M. merluccius*, *M. barbatus*, *A. foliaceus* and *P. longirostris*.

Significant improvements of the exploitation pattern by introducing spatial and/or temporal gear-specific bans of the fishing activity (**differentiated fishing ban by rotation of the areas**)

A Holistic Approach to Fishery Management: Evidence and Insights from a Central Mediterranean Case Study (Western Ionian Sea)

Tommaso Russo^{1,2†}, Isabella Bitetto^{3†*}, Pierluigi Carbonara³, Roberto Carlucci⁴, Lorenzo D'Andrea^{1,2}, Maria T. Facchini³, Giuseppe Lembo³, Porzia Maiorano⁴, Letizia Sion⁴, Maria T. Spedicato³, Angelo Tursi⁴ and Stefano Cataudella¹

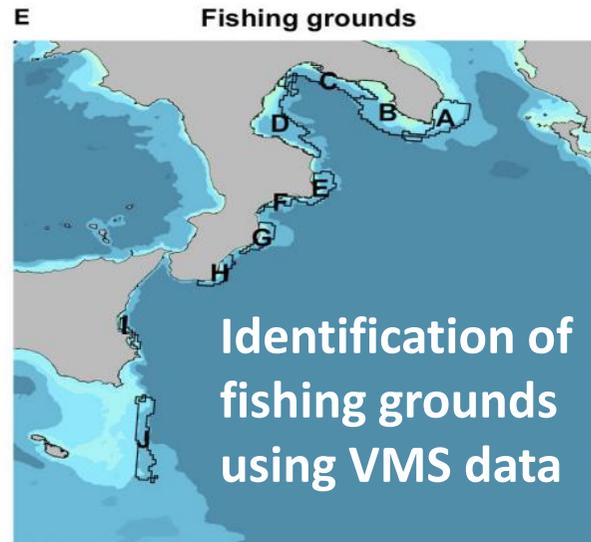


TABLE 3 | Differentiated fishing ban related to scenario S3.

Fleet segment codification	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A_DTS_VL1224							■	■				
BCD_DTS_VL1224							■	■				
EGH_DTS_VL1224				■	■							
F_DTS_VL1218												■
IJ_DTS_VL1224												

The gray cells stands for month of fishing ban.

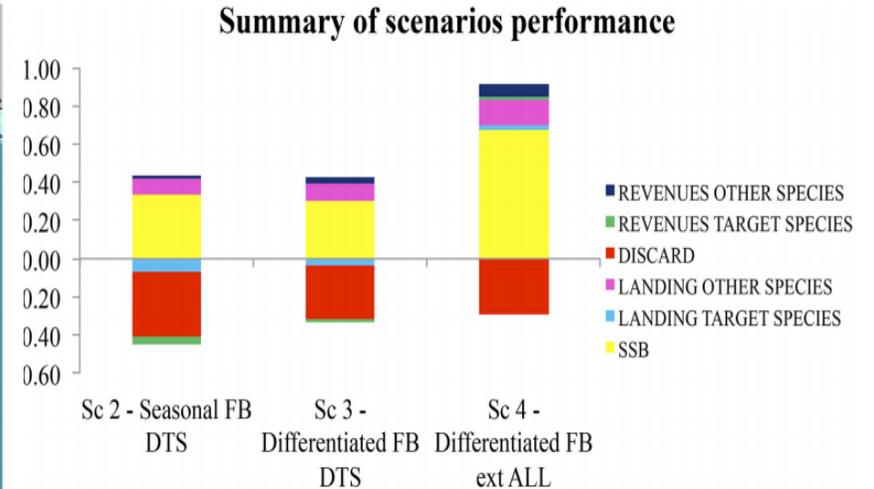


FIGURE 9 | Summary of the performance of the management scenarios compared to the status quo (difference in %) considering the following model-based indicators: spawning stock biomass (SSB), landing of target species, landing of other species, discards, revenues of target species, and revenues of other species.

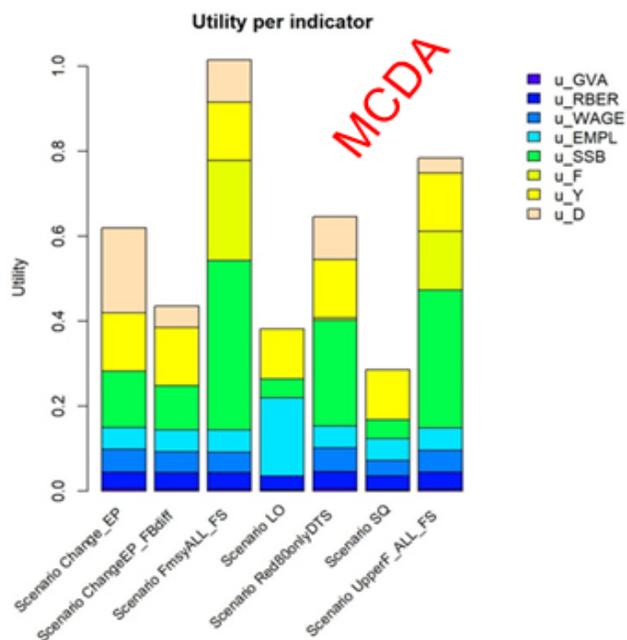


Applications of BEMTOOL.v3 - Discard ban, landing obligation and MSY in the Western Mediterranean Sea

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B
STRUCTURAL AND COHESION POLICIES



5 A quantitative bio-economic analysis



LO scenario was ineffective, except for the employment.
At smaller aggregation levels, i.e. fleet segment, results may depend by the indicator selected besides the specific fleet

(source: authors)

GSA9_DTS_VL2440 Results in % to 2021						
	Salary	CR.BER	ROI	Revenues	Empl	Catch M. mer
Scenario SQ	19148	1.266	0.078	2506907	30	38
Scenario Change_EP	51.45	57.5	273.08	30.45	0	21.85
Scenario ChangeEP_FBdiff	-0.33	-0.32	-1.28	-11.48	0	17.05
Scenario FmsyALL_FS	45.36	50.71	241.03	-5.81	0	-8.26
Scenario LO	-24.62	-2.21	-10.26	-0.27	30	0.51
Scenario Red80onlyDTS	-14.21	-15.8	-75.64	-41.07	0	-48.04
Scenario UpperF_ALL_FS	71.26	79.62	378.21	14.41	0	13.76

GSA9_DTS_VL2440 Results in % to 2025						
	Salary	CR.BER	ROI	Revenues	Empl	Catch M. mer
Scenario SQ	20743	1.384	0.112	2630563	30	40
Scenario Change_EP	90.37	100.07	362.5	55.22	0	52.99
Scenario ChangeEP_FBdiff	30.09	33.31	120.54	7.63	0	48.98
Scenario FmsyALL_FS	72.33	80.06	290.18	13.07	0	15.91
Scenario LO	-25.49	-3.47	-12.5	-1.04	30	-0.99
Scenario Red80onlyDTS	5.66	6.29	23.21	-27.66	0	-32.58
Scenario UpperF_ALL_FS	112	123.99	448.21	41.98	0	49.18

Impact of discard ban and the landing obligation evaluated on Maximum Sustainable Yield (MSY) of *M. merluccius* in GSAs 9-10-11 (western Mediterranean), taking into account the EU COM proposal on a multiannual plan for demersal fish stocks in the Italian regions of the western Mediterranean Sea.

For discards, utility will be higher in the scenario of change in the exploitation pattern (Change_EP).

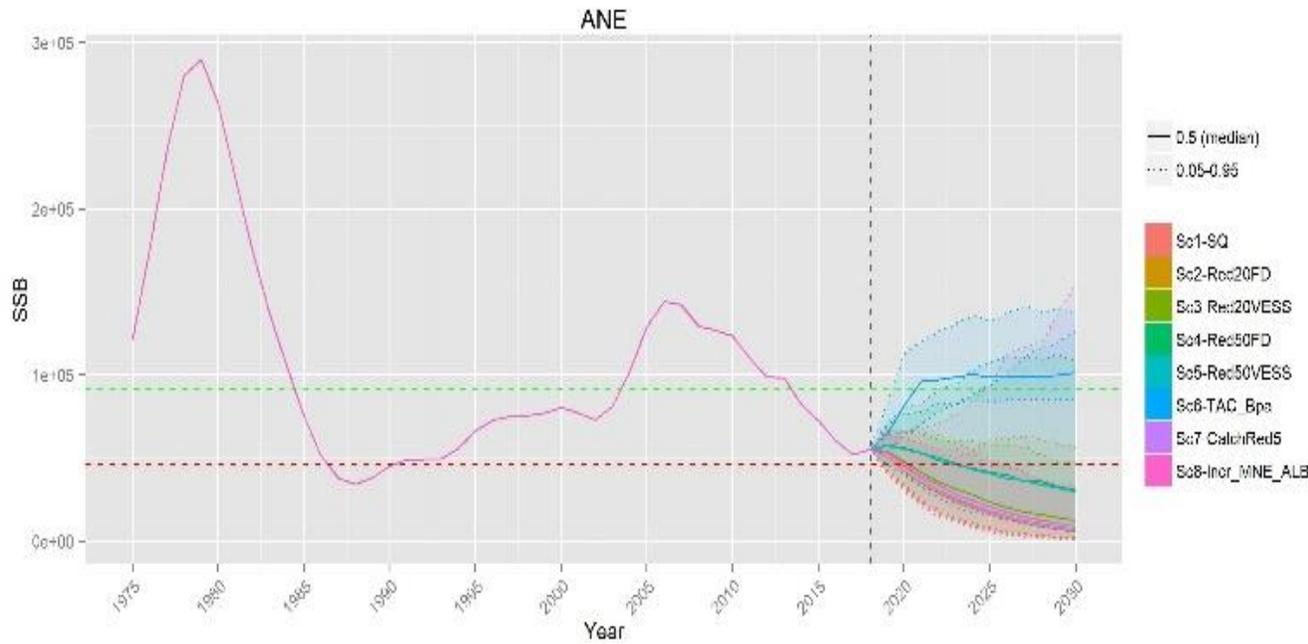
22/11/2018

Presentation for the Committee on Fisheries

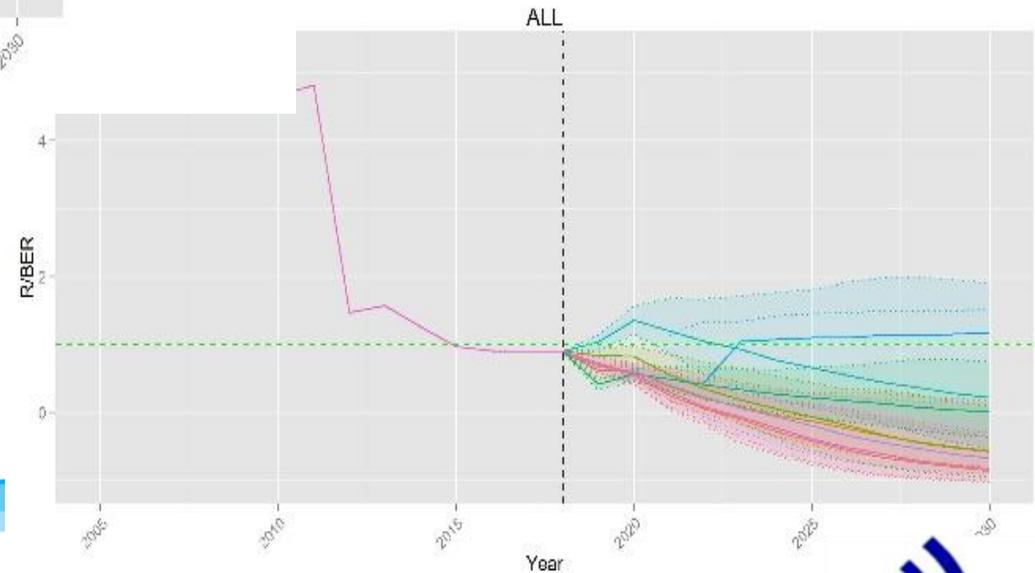
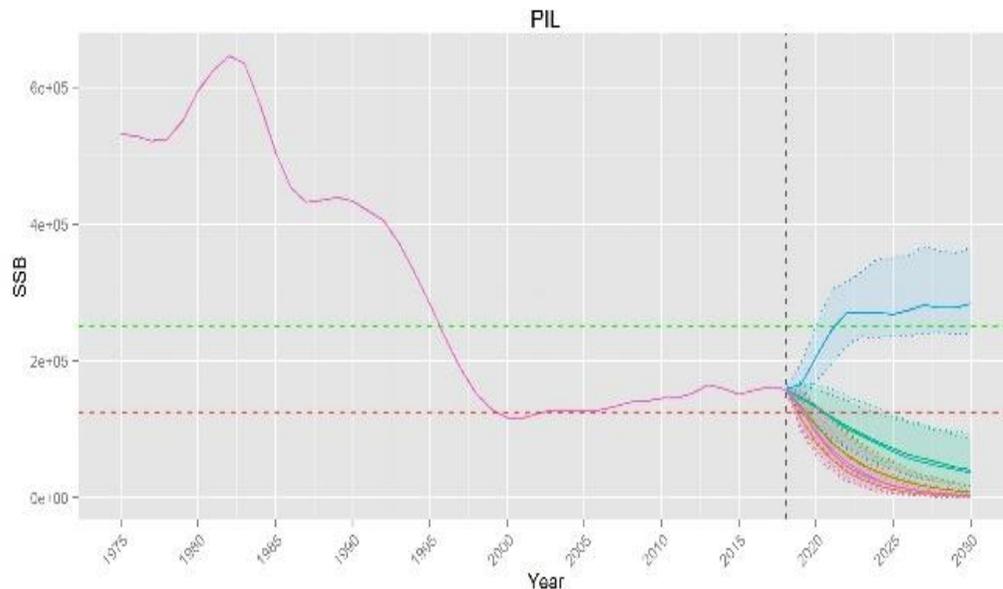
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Applications of BEMTOOL.v3 - WKMSE 2018 simulations on small pelagic fisheries in the Adriatic Sea



Annual TAC based on escapement strategy
 $(B_{esc} = B_{pa}; F_{cap} = F_{MSY})$



Conclusions

BEMTOOLv.3 proved to be useful to:

- predict the effects of several alternative management measures on **mixed fisheries**, integrating **biological, economic and social indicators**
- differentiate the strategies by fleet in order to **calibrate the measure according to the type of exploitation of each single fleet**
- include different sources of **uncertainty** to support designing multi-annual management plans under an **MSE framework**
- include the MCDA component to **balance** the weight of different indicators, accounting for **the different pillars of the sustainability: biological, economic, social**



The forthcoming MAP for the fisheries exploiting demersal stocks in the Adriatic Sea – a new challenge



Fisheries in the Adriatic region a shared ecosystem approach FAIRSEA

THANK YOU
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European Regional Development Fund



EUROPEAN UNION

