Marine Protected Areas: Network for enhancement of sustainable fisheries in EU Mediterranean waters

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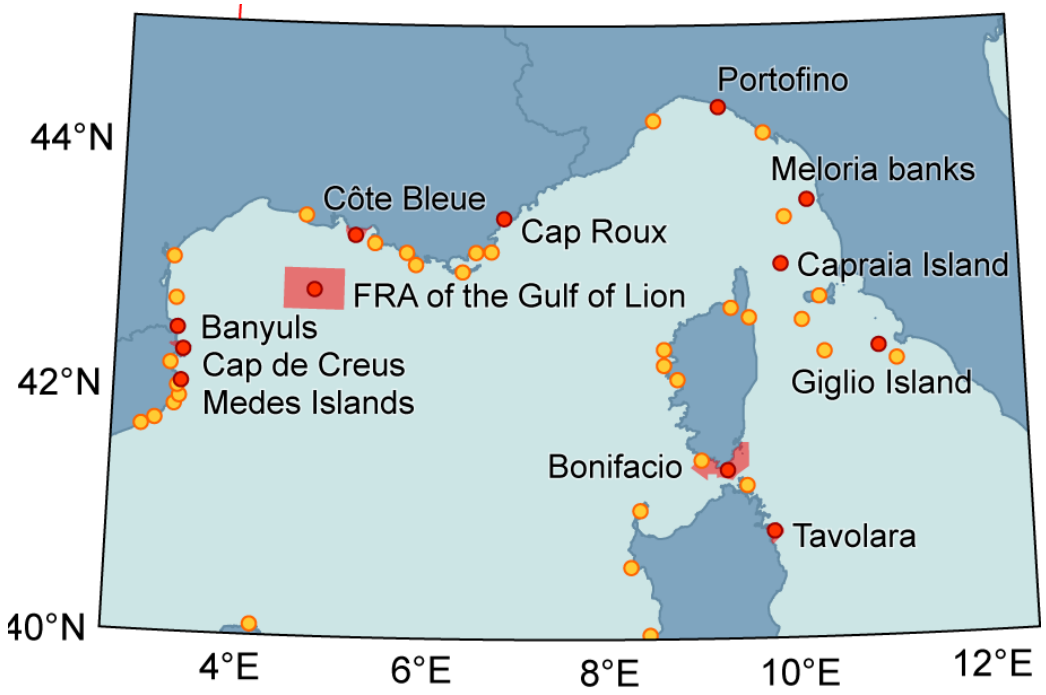
Prato G, Melia P, Di Franco A, Sève C, Coll M, Spedicato M.T, Belharet M, Calò A, Carbonara P, Costantini M, Corrales X, Font T, Guidetti P, Ligas A, Lloret J, Lembo G, Piroddi C, Sahyoun R, Sartor P,, Steenbeek J, Vilas D., Claudet J

OVERALL GOAL

Tool	Identify **coherent networks** of MPAs...
Process	…whose **emergent properties** (interactive effect of scaling-up MPAs)...
Outcome #1	…can help **achieve fisheries sustainability**...
Outcome #2	…and maximize over the **long-term socio-economic benefits**...
Target	…for the **stakeholders** in the north-western Mediterranean Sea.



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FIELD AND DATA COLLECTION

Characteristics of selected stocks

Main biological and population dynamics characteristics

Status of exploitation - 88 assessments of demersal stocks

Nursery and spawning areas

Coastal species data

- 163 sites
- 11 MPAs
- 117 Small Scale Fisheries

Stakeholders questionnaires

- 187 questionnaires

Data:

Catch, effort, biomass

Vulnerability

Socioeconomic data

Specific MPA regulations

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MODELLING APPROACH

1 **MPA network effectiveness for fisheries**

2 **Western Mediterranean spatial and temporal protection scenarios** – ecosystem models

3 **GSA 9 temporal and spatial fisheries management scenarios** - BEMTOOL

Fisheries benefits (MSY, Landings)

Conservation benefits (GES, species biomass, ecosystem indicators)

Socio-economic benefits (Revenues)

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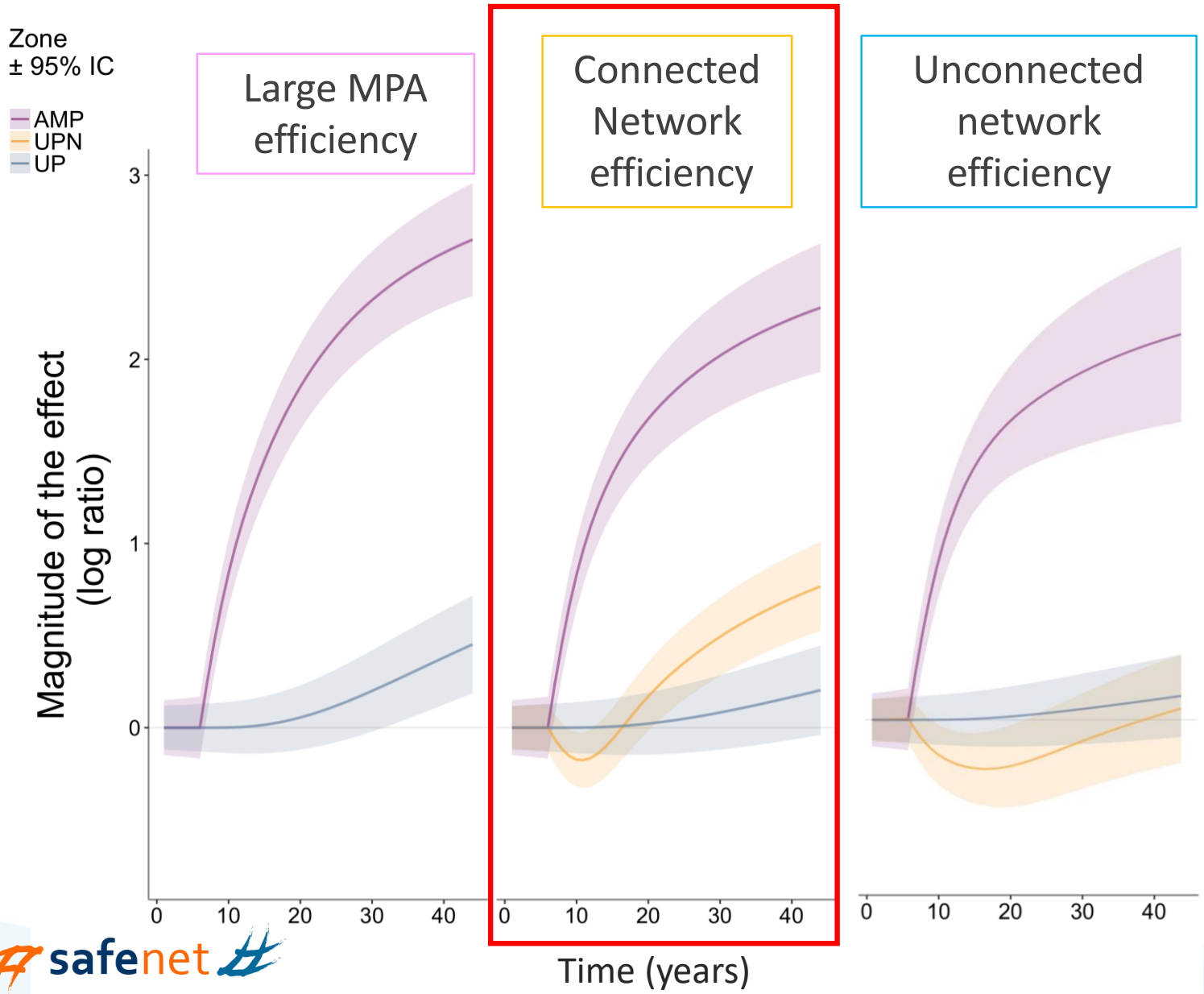
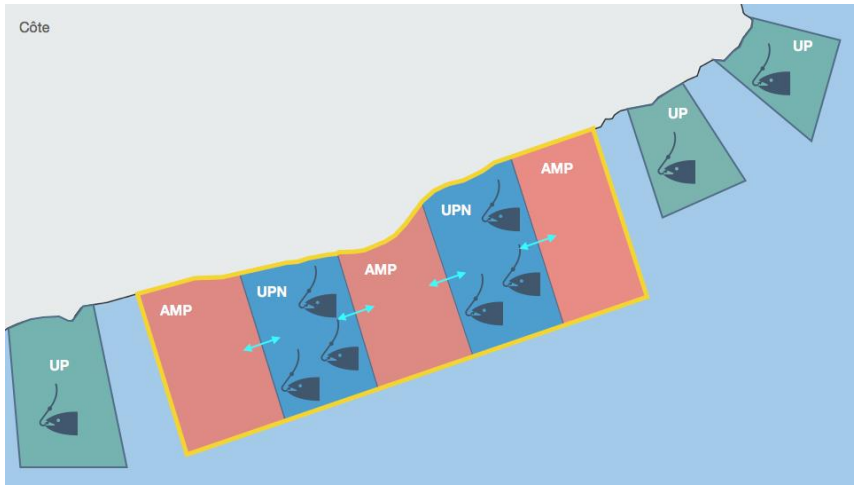
1 MPA NETWORK EFFECTIVENESS FOR FISHERIES





MPA networks :

- **Similar ecological benefits**
- **Fisheries benefits,** only if the network is **connected**

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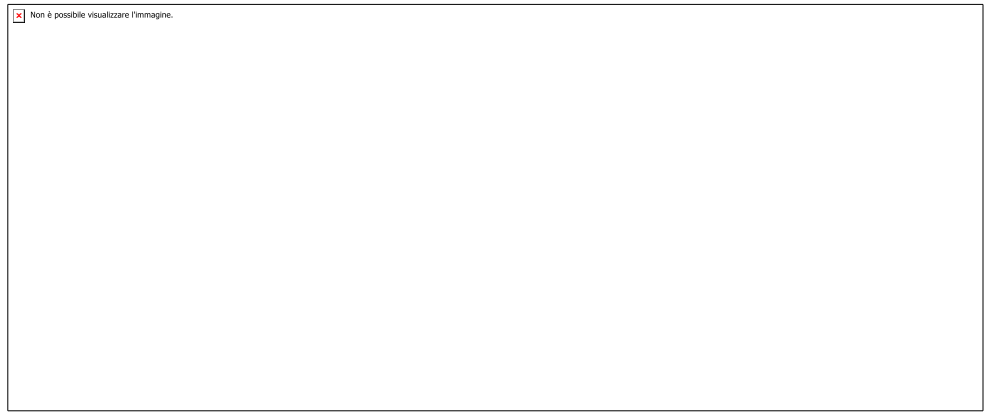
2 NW MEDITERRANEAN - ECOSYSTEM MODELS

Historical simulations from 1990s to 2016: Fisheries dynamics, MPAs implementation, environmental changes

Management scenarios

- Proposed new MPAs and networks (e.g., PPA as HPA, Natura 2000 as FPAs, closure of nursery and spawning grounds, et)
- Fisheries regulations (seasonal closures, bottom trawling limit < 100 m, FRAs)

1500 species in 90 functional groups, baseline in 1990s, pelagic and demersal habitats



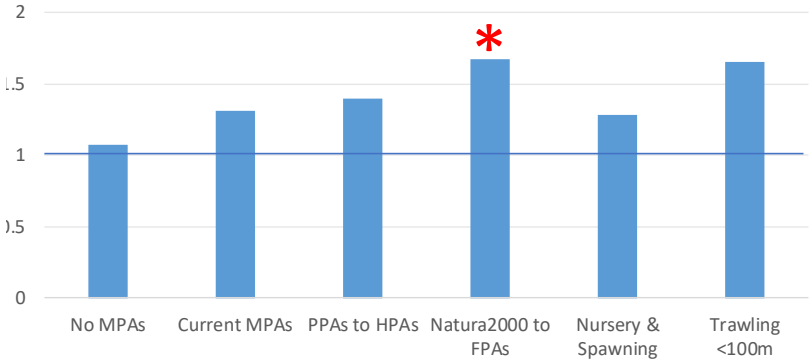
HPA: Highly Protected Area; PPA: Partially Protected Area;

NW MEDITERRANEAN – BASELINE TO DEVELOP SPATIAL AND TEMPORAL SIMULATIONS

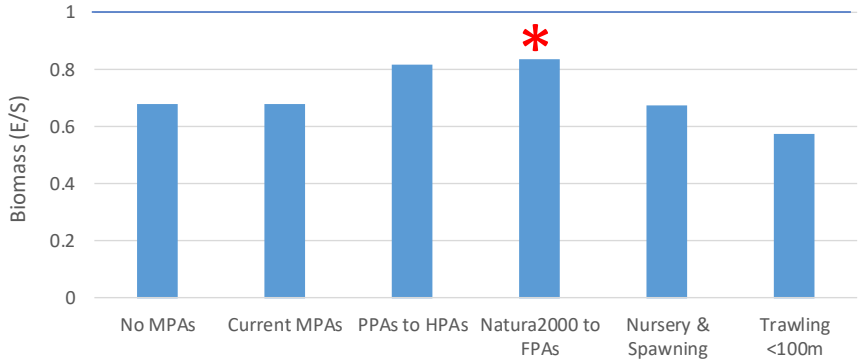
Changes on species biomass from 1995 to 2016

Biomass 2016/1995

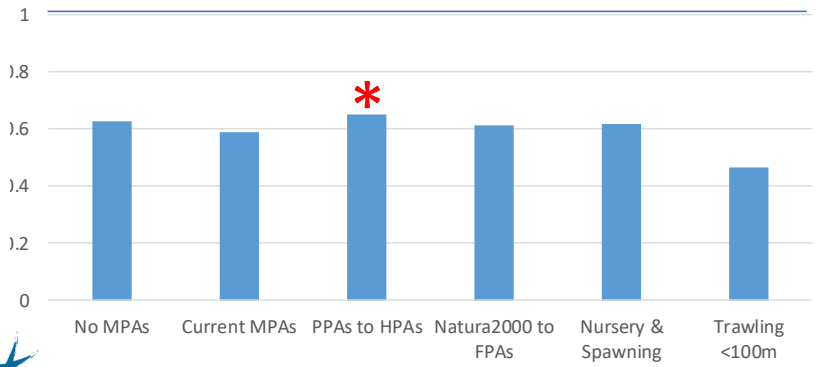
Biomass European hake



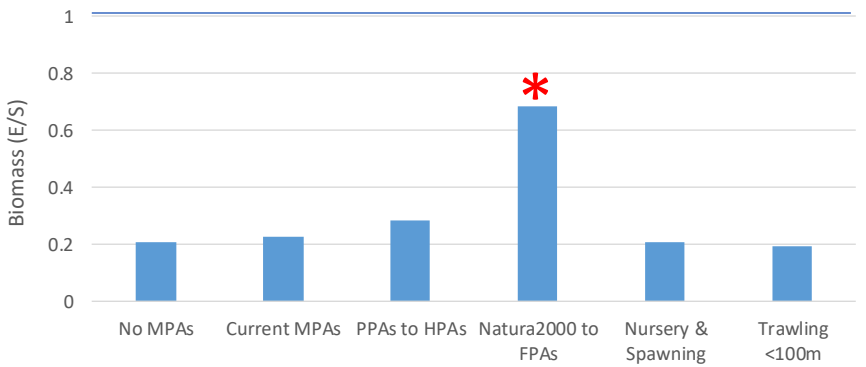
Biomass White seabream



Biomass Common two-banded seabream



Biomass Groupers



Simulations to for the future to be performed

* *Largest increase*

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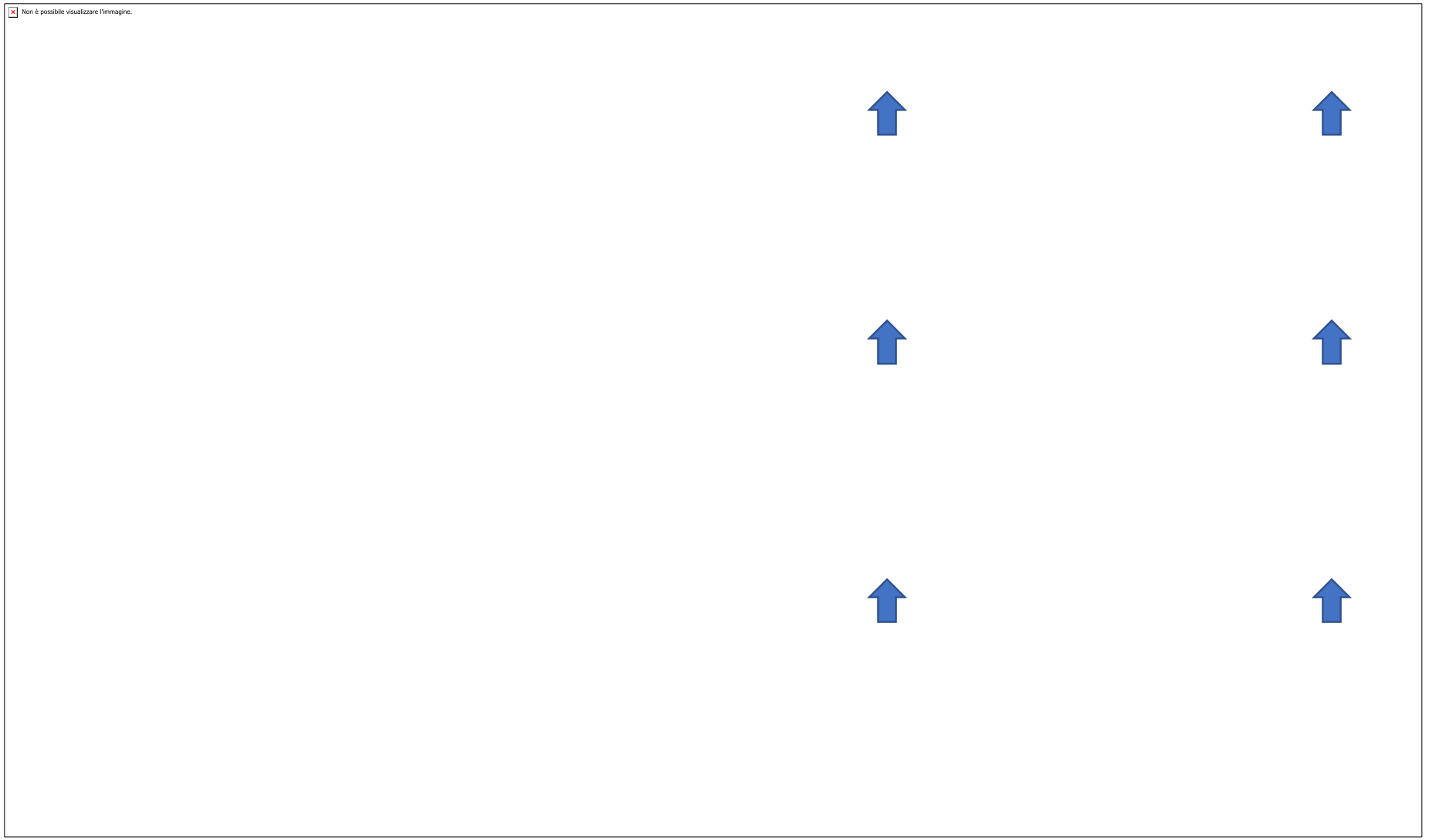
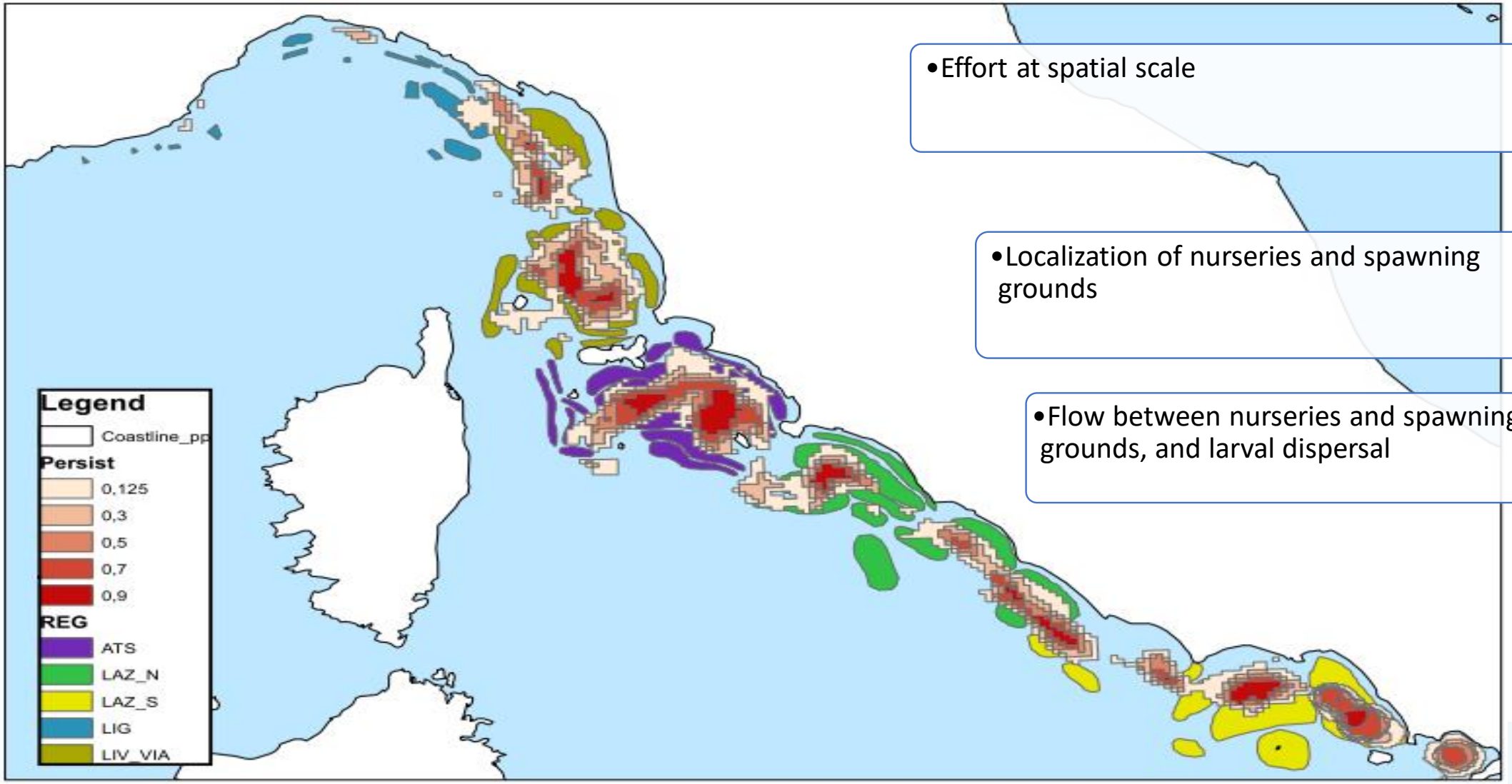
NW MEDITERRANEAN – BASELINE TO DEVELOP SPATIAL AND TEMPORAL SIMULATIONS

Changes on ecological indicators



3 GSA 9 TEMPORAL AND SPATIAL FISHERIES MANAGEMENT SCENARIOS



- Effort at spatial scale
- Localization of nurseries and spawning grounds
- Flow between nurseries and spawning grounds, and larval dispersal

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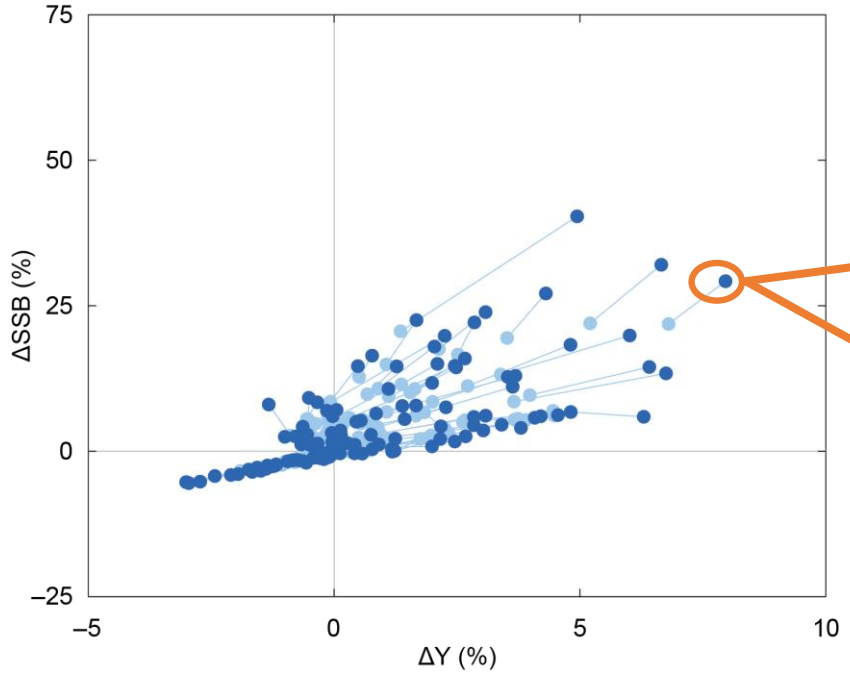
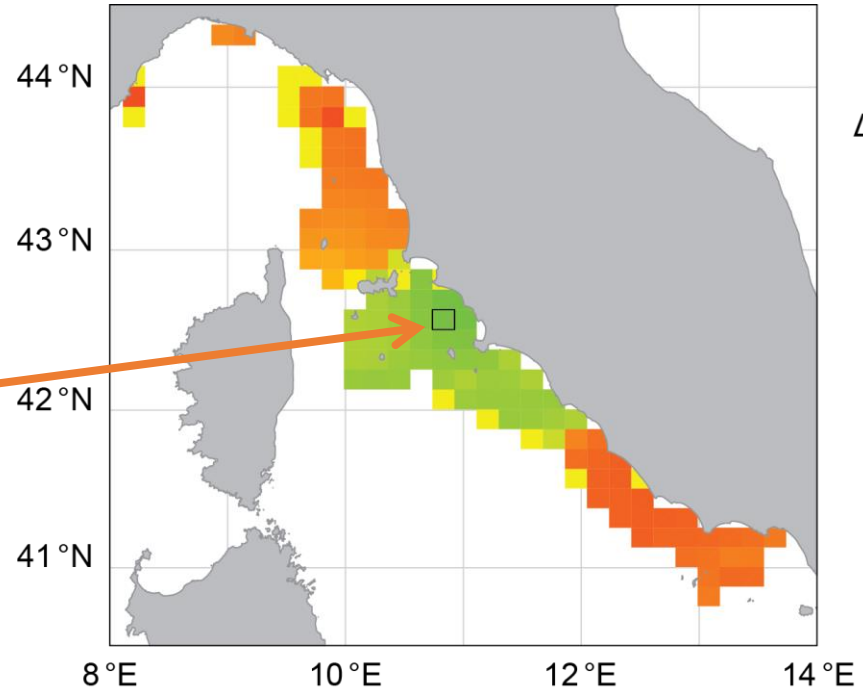
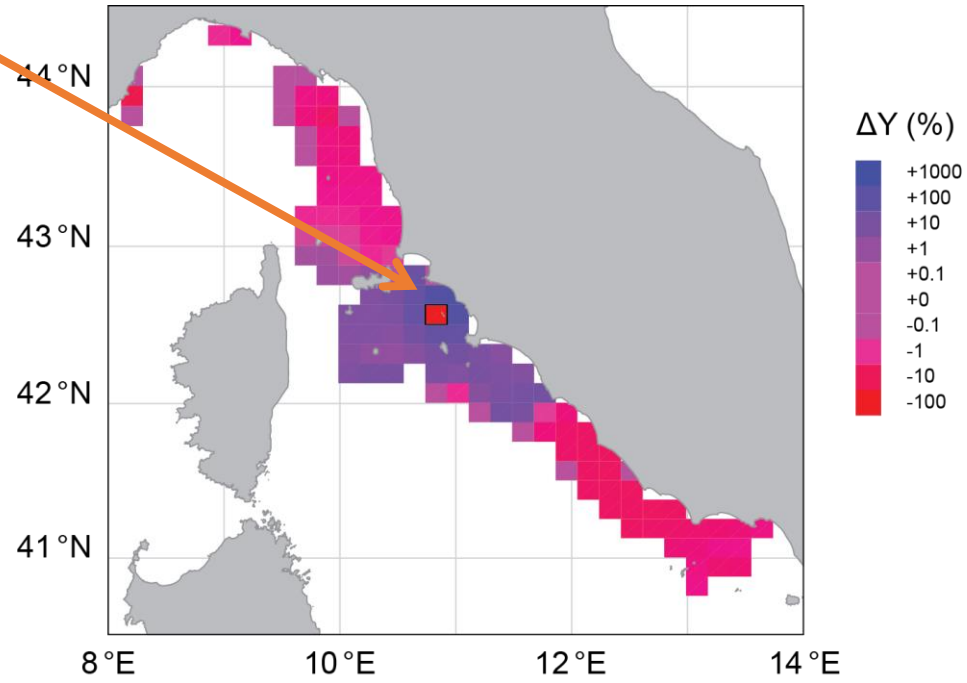
GSA 9 - FISHERIES CLOSURES IN 1 CELL



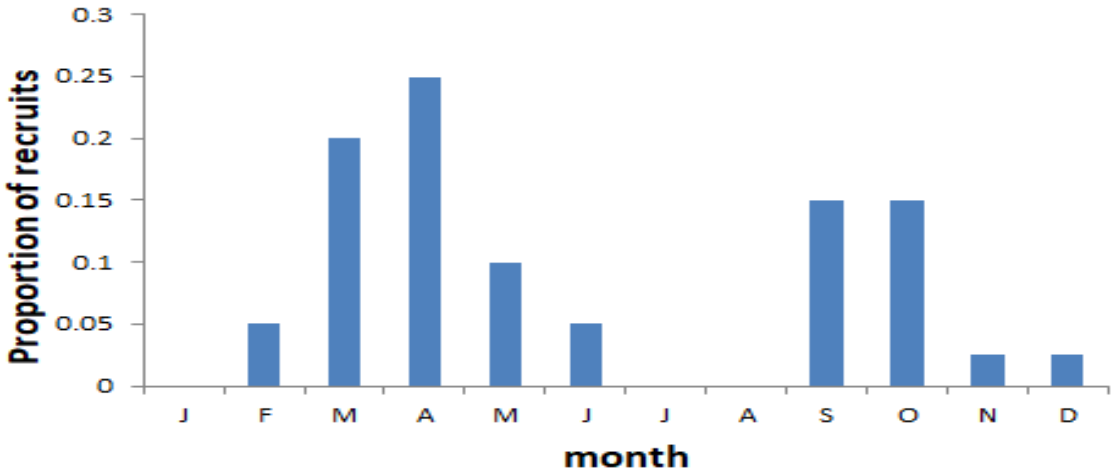




Effects on:

- increase of **fishing yield** (ΔY) and **spawning stock biomass** (ΔSSB)
- in the **short term** (● 10 years) and in the **long term** (● 50 years)
- over the **entire GSA9 and** on each **single cell**

GSA9 - SIMULATING TEMPORAL AND SPATIAL CLOSURES



Proportion of recruits entering in the stock by month

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																																																
OTB_ViaLiv_VL1224																																																
OTB_ATS_VL1224																																																
OTB_Lazio_VL1240																																																
GNS_LazioS_VL0624																																																
GNS_Lig_VL1224																																																
GNS_ATS_VL1224																																																

Status quo

Synchronised seasonal fishing ban

Seasonal fishing ban differentiated by fleet segment

Closure of nursery grounds

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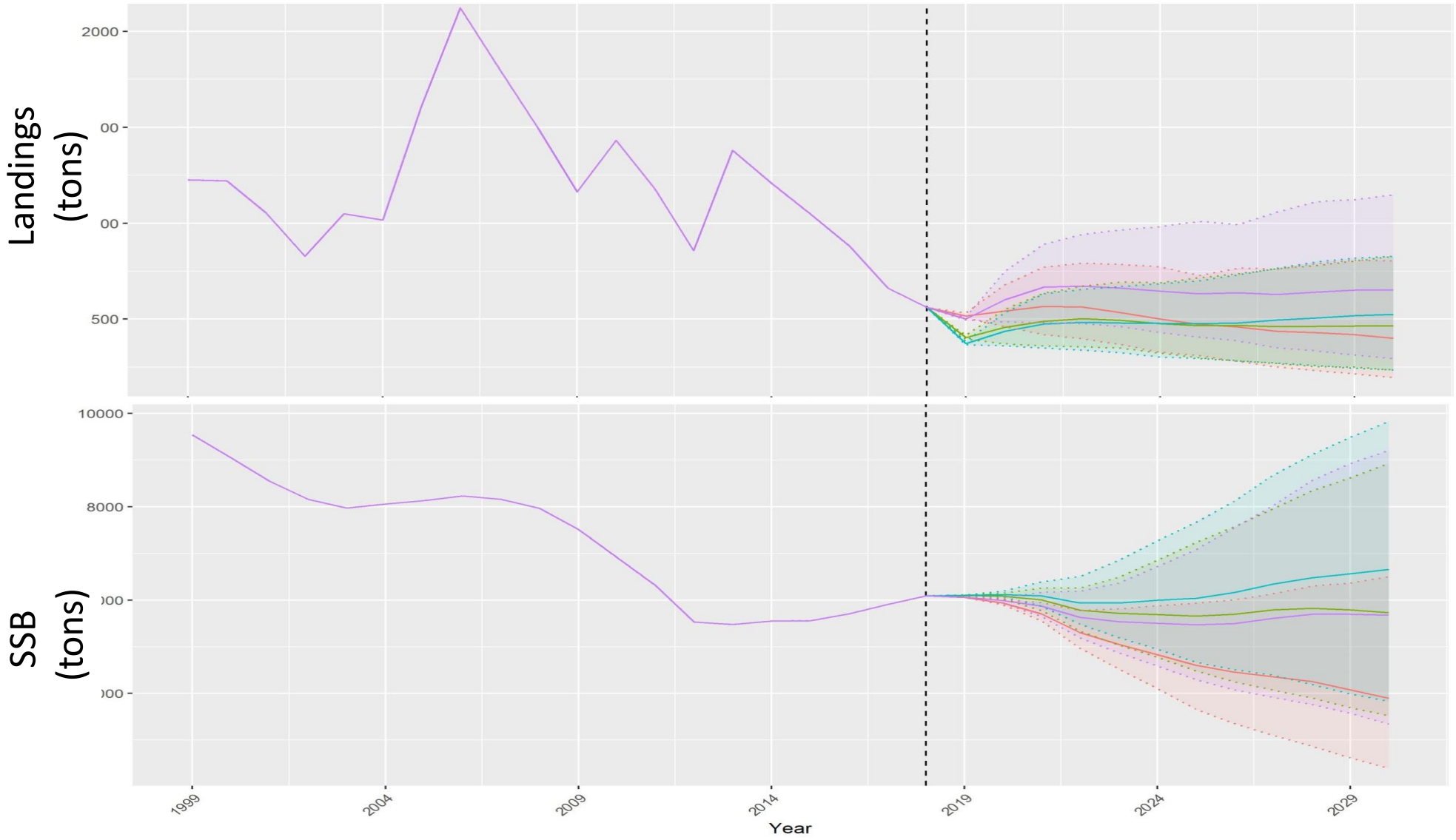
GSA9 - FORECAST FOR HAKE LANDINGS AND SSB

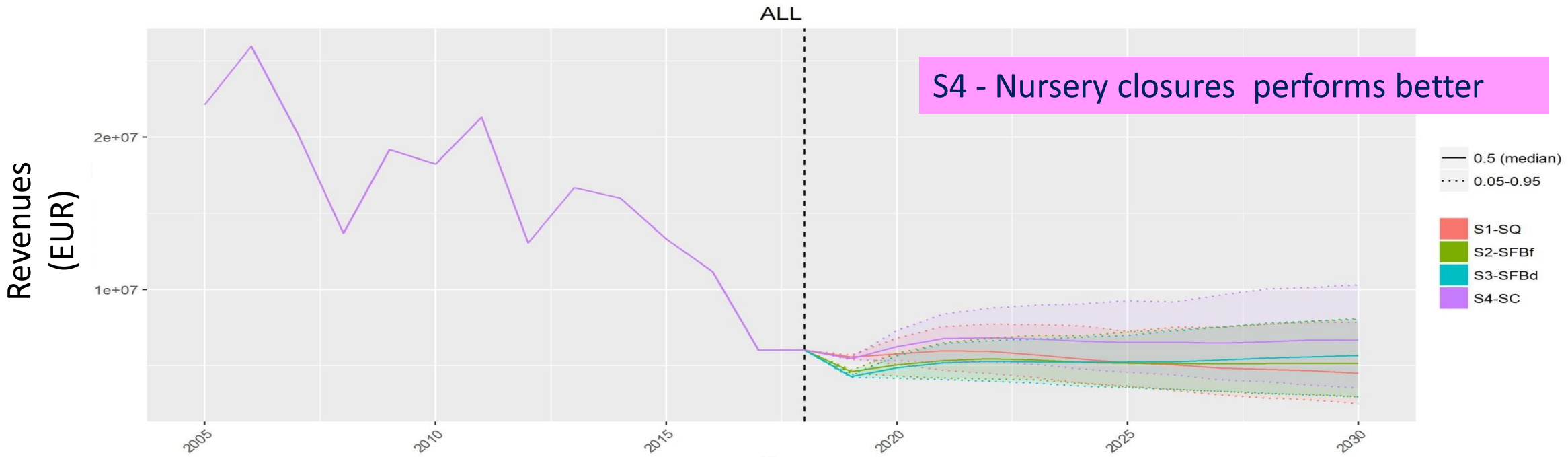


Nursery closures

Differentiated seasonal bans

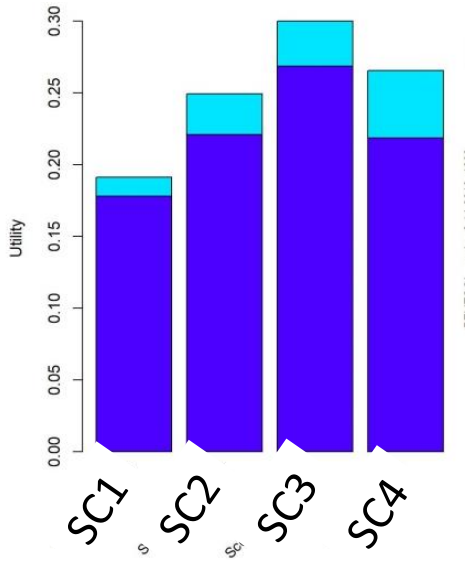
All Scenarios perform better compared to the status quo

GSA9 -FORECAST OF THE REVENUES ASSOCIATED TO HAKE



S4 - Nursery closures performs better

SYNTHESIS



Biological

Socio-economic

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CONCLUSIONS

- Current MPA settings **contribute modestly** to fisheries sustainability
- **Plausible modifications** to current MPA settings can positively impact fisheries

Win-win benefits for fisheries and conservation can be achieved through:

- **Ecologically connected networks of MPAs**
- **Multiple local fisheries closures**, either simultaneously or in rotation, which allow a more **equitable distribution** of benefits
- **Closures of nursery areas or seasonal closures during recruitment peaks**

Common Fisheries Policy

Marine Strategy Framework Directive

Spatial and temporal modelling and Bemtool ready to provide support for EBFM

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WHICH SCENARIOS WOULD YOU LIKE TO TEST?

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Thank you!

Safenet presentations at FISHFORUM

Coll et al. Benefits of MPA networks in the Western Mediterranean Sea: a geographically-nested ecosystem modelling approach
Vilas et al. Contributions of coastal MPAs to marine ecosystem recovery and fisheries sustainability in the NW Mediterranean
Melia et al. Addressing the spatial dimension of fisheries sustainability: a case study in the Western Mediterranean Sea
Belharet et al. Age-structured and spatially explicit metapopulation models to assess fisheries sustainability in the Northwestern Mediterranean Sea
Prato et al. Fisheries management in the North Western Mediterranean: the word to stakeholders

Scenario	Scale
Status quo (= baseline) *Direct drivers:* - *100% enforcement* - *No enforcement* - *Current enforcement*	Regional
Effort regulation between MPAs of a network	Sub-regional Regional
Establishment of EBSAS	Regional
Protect Nursery areas	Local
Protect spawning areas	Local
Turn all PPA into FPA	Local
Turn all MPA into HPA (new!)	Local
Effort reduction in nursery areas	Local
Effort reduction in spawning areas	Local
Regulations on recreational fishing	Local Sub-regional
Natura 2000 → FPA	
Consensus areas → MPAs	
100m limit to trawling	
MCRS to size at maturity	
Proposed FRAs	
UNESCO world heritage	
Achieve 2% of no-take	