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INSTITUTO ESPAÑOL DE OCEANOGRAFÍA
European Maritime & Fisheries Fund

Workshop 6: Small Pelagic Fish Reproductive Resilience

Monitoring programme of the Canary small pelagic fish (Spain, NW Africa) in the Spanish Data Collection Framework

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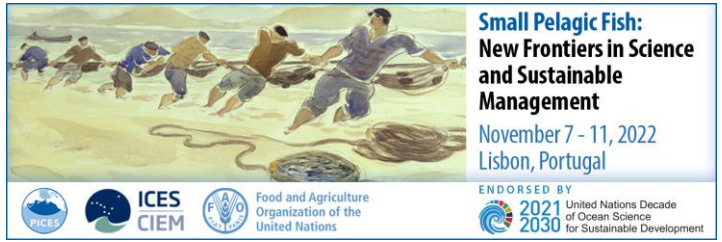

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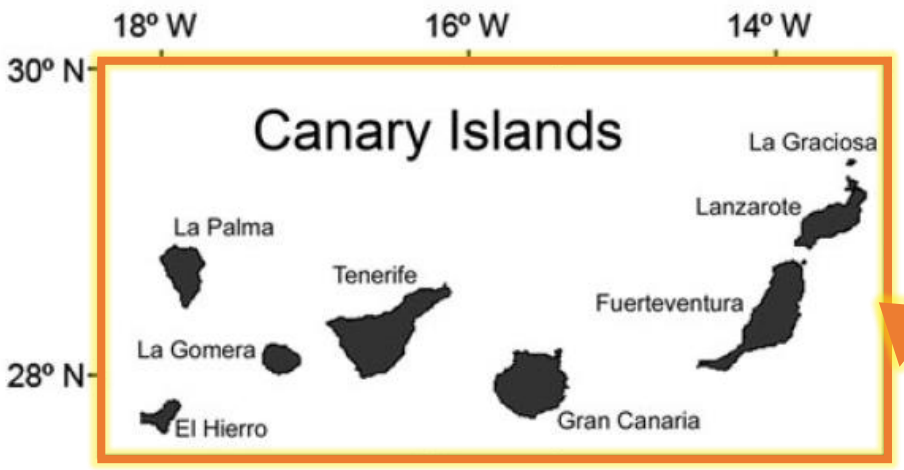
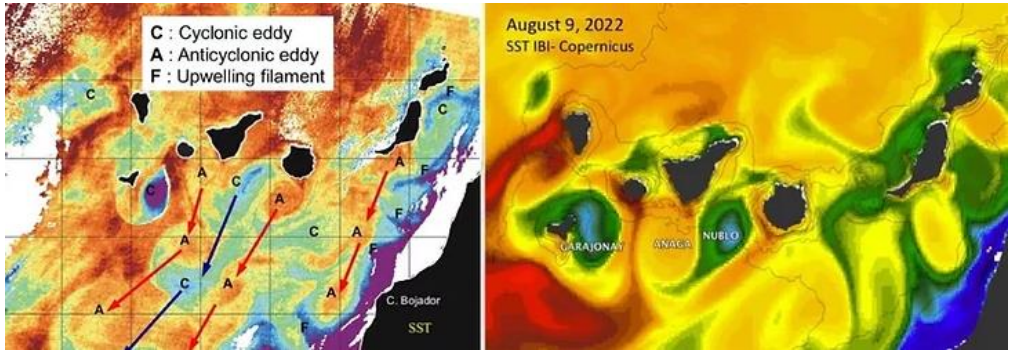
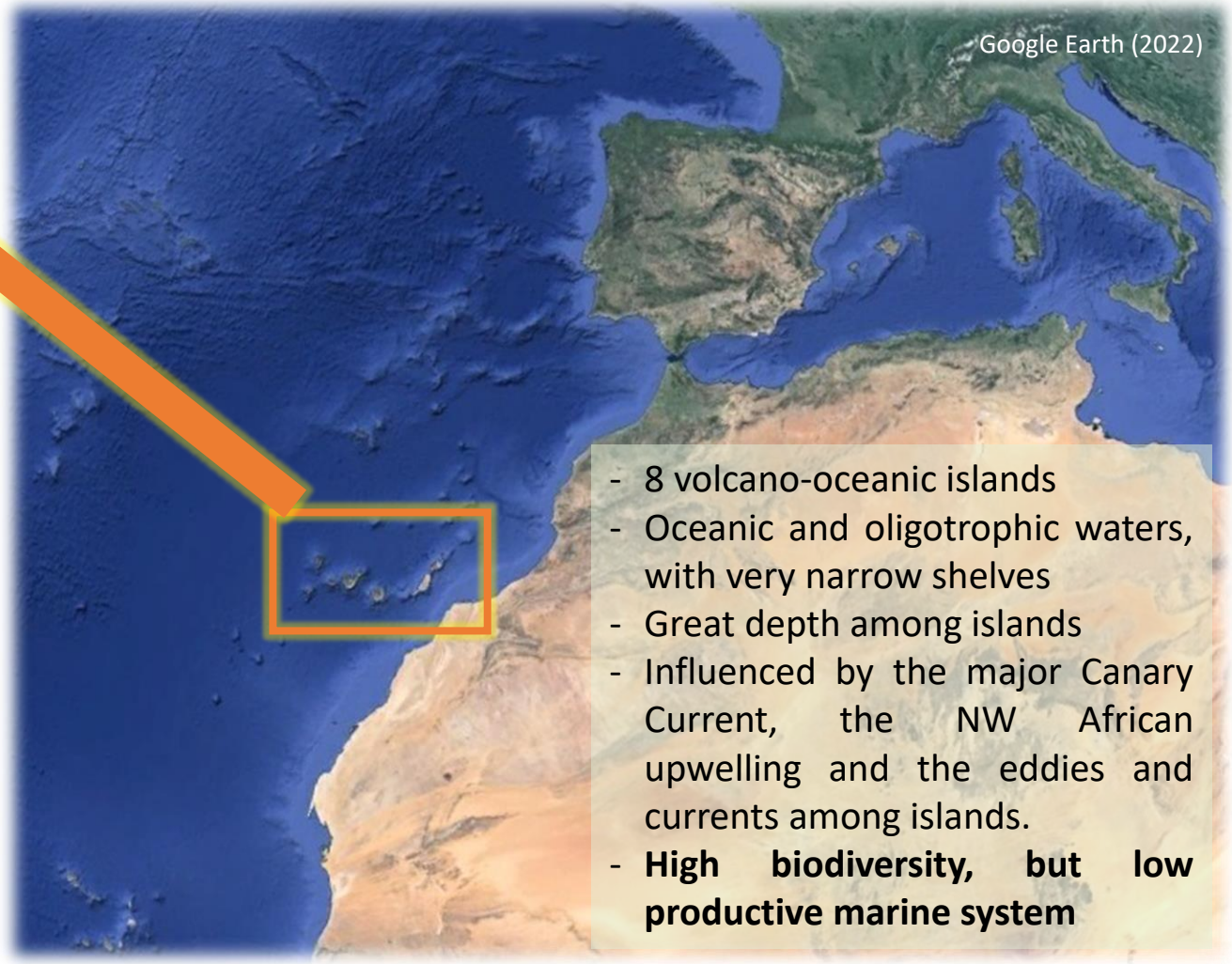
The Canary Islands context





https://www.gob-iocag.ulpgc.es/post/eddies-in-the-canary-islands-a-gaia-perspective



- 8 volcano-oceanic islands
- Oceanic and oligotrophic waters, with very narrow shelves
- Great depth among islands
- Influenced by the major Canary Current, the NW African upwelling and the eddies and currents among islands.
- **High biodiversity, but low productive marine system**

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The Canary artisanal fishery

- Artisanal fleet (>600 boats): multi-gear, multi-species, oportunistic and polyvalent.
- Three different *métiers* identified and monitored in the EU-DCF:
  - **LHP_LPF** Tuna pole and line fished with live-bait (68% Canary landings, monitoring launched in 2003)
  - **MIS_DES** Multigear directed to demersal species (14% Canary landings, monitoring launched in 2015)
  - **PS_SPF** Traíñas (18% Canary landings, monitoring launched in 2013)

Purse-seine fleet targeted species

Atlantic chub Mackerel - ***Scomber colias*** (Gmelin,1789)

Blue jack mackerel- ***Trachurus picturatus*** (Bowdich, 1825)

Round sardinella- ***Sardinella aurita*** (Valenciennes, 1847)

Sardine - ***Sardina pilchardus*** (Walbaum, 1792)

CECAF COPACE

FAO FIAT PANIS

FAO Working Group on the Assessment of Small Pelagic Fish off NW Africa
(included since 2015)

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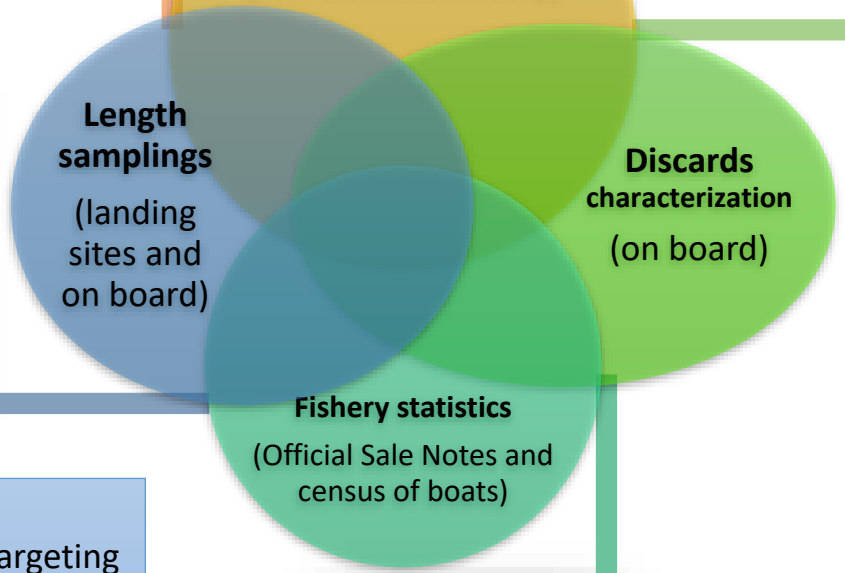
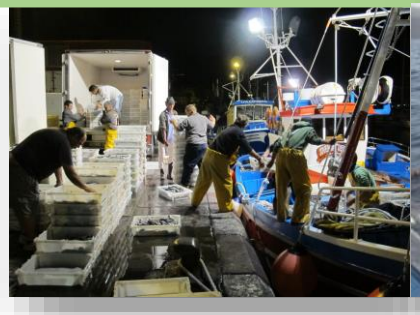
Monitoring system (EU-DCF)

Characterization of the fish populations:

- Biological data (LF, mean weight and age distribution of catches, sex-ratio, maturity) for the main SPF species targeted by *the artisanal purse seiners* in the Canary Islands: *Somber colias, Trachurus spp, Sardina pilchardus, Sardinella aurita*
- Data to assess the fisheries impact on marine ecosystems (i.e: discards, since 2017)
- Assessment of this stock status in the CECAF framework.





Characterisation of the fishery:

- Technical characteristics of the artisanal fleet targeting SPF
- Main landing and selling sites
- Landings and fishing effort analysis based on official 'sale notes' (available since 2007).

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Life history traits

Fishery behaviour and environmental effects

Reproductive biology of the blue jack mackerel, *Trachurus picturatus* (Bowdich, 1825), off the Canary Islands

By A. Jurado-Ruzafa and M. T. García Santamaría

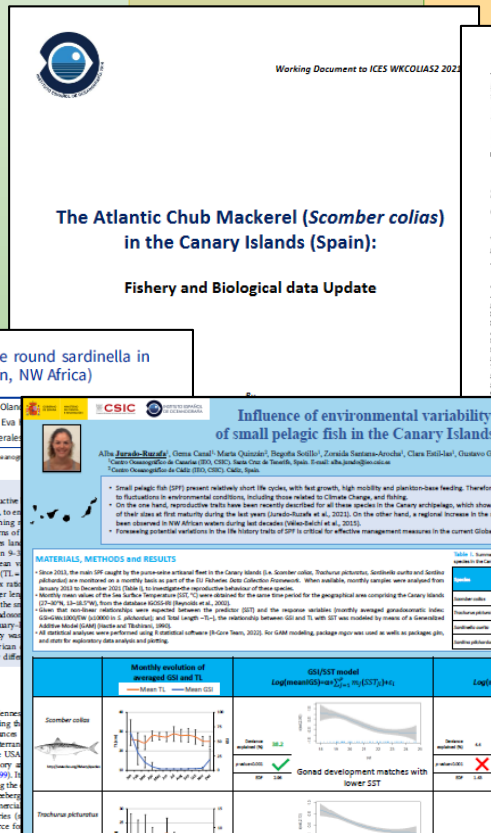
Instituto Español de Oceanografía, Centro Oceanográfico de Canarias, Santa Cruz de Tenerife, Islas Canarias, Spain

Length–weight relationships of the most caught small pelagic fish from the Canary Islands (NE Atlantic, Spain)

Age, growth and natural mortality of blue jack mackerel *Trachurus picturatus* (Carangidae) from the Canary Islands, Spain (NW Africa)

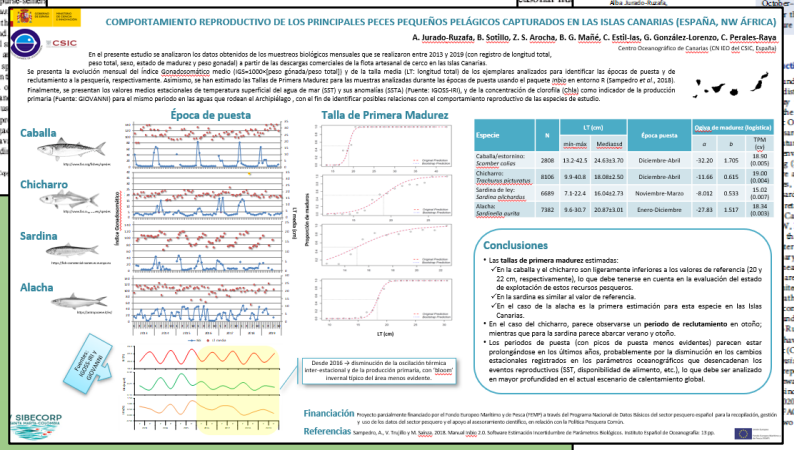
A Jurado-Ruzafa and MTG Santamaría

Reproductive traits of the round sardinella in the Canary Islands (Spain, NW Africa)



The Atlantic Chub Mackerel (*Scomber colias*) in the Canary Islands (Spain):

Fishery and Biological data Update



COMPORTAMIENTO REPRODUCTIVO DE LOS PRINCIPALES PECES PEQUEÑOS PELÁGICOS CAPTURADOS EN LAS ISLAS CANARIAS (ESPAÑA, NW ÁFRICA)

A. Jurado-Ruzafa, B. Sotillo, Z. S. Arocha, B. G. Mañé, C. Estil-las, G. González-Lorenzo, C. Perales-Raya

Época de puesta

Talla de Primera Madurez

Caballa

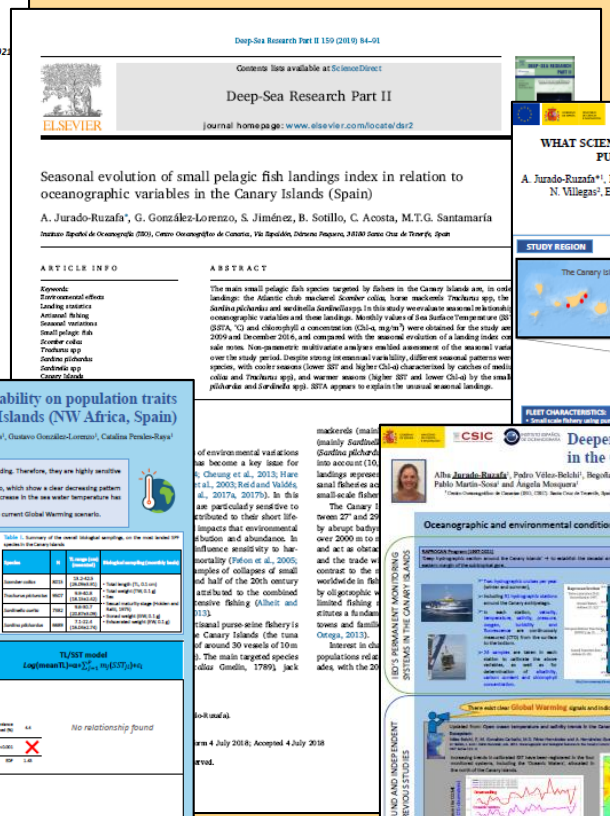
Chicharro

Sardina

Alacha

Conclusiones

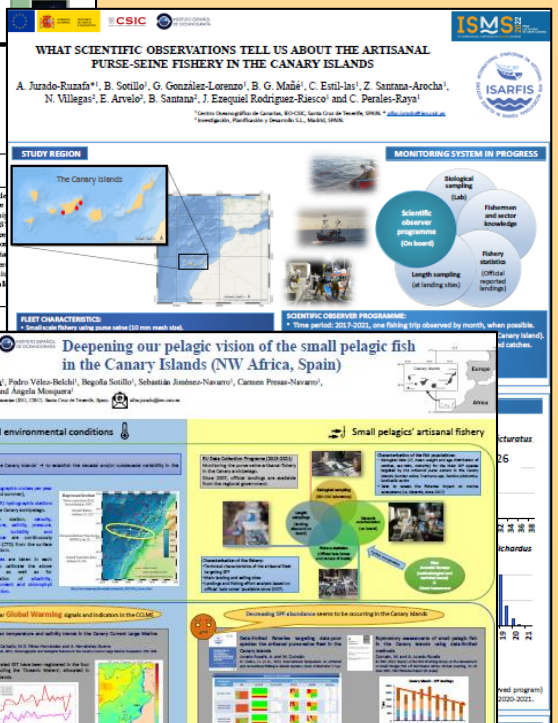
Influence of environmental variability on population traits of small pelagic fish in the Canary Islands (NW Africa, Spain)



Deep-Sea Research Part II

Seasonal evolution of small pelagic fish landings index in relation to oceanographic variables in the Canary Islands (Spain)

A. Jurado-Ruzafa*, G. González-Lorenzo, S. Jiménez, B. Sotillo, C. Acosta, M.T.G. Santamaría

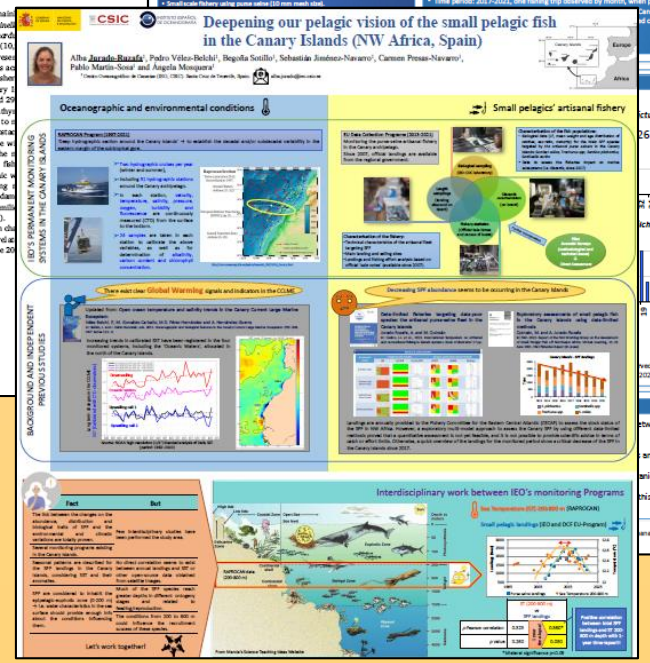


WHAT SCIENTIFIC OBSERVATIONS TELL US ABOUT THE ARTISANAL PURSE-SEINE FISHERY IN THE CANARY ISLANDS

A. Jurado-Ruzafa*, B. Sotillo, G. González-Lorenzo, B. G. Mañé, C. Estil-las, Z. Santana-Arocha, N. Villegas, E. Arvelo, B. Santana, J. Ezequiel Rodríguez-Riesco and C. Perales-Raya

STUDY REGION

MONITORING SYSTEM IN PROGRESS



Deepening our pelagic vision of the small pelagic fish in the Canary Islands (NW Africa, Spain)

Oceanographic and environmental conditions

Small pelagics' artisanal fishery

Interdisciplinary work between IEO's monitoring Programs

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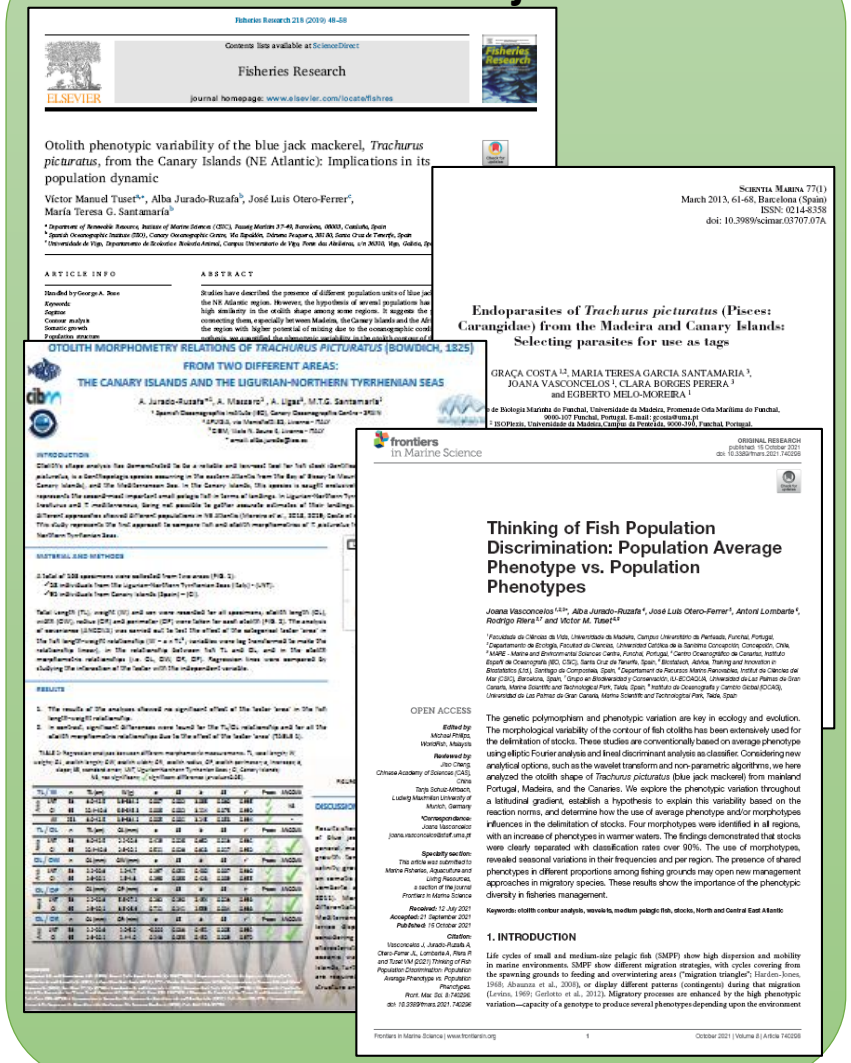
Population structure / species plasticity & Collaborative research

Atlantic chub mackerel

European sardine

Blue jack mackerel



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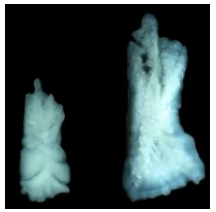
Biological and fishery data from commercial fleet











Data collation

Biological samplings:
- total length (TL, 0.1 cm)
- total weight (TW, 0.1 g)
- gutted weight (0.1 g)
- sex
- sexual maturity (general 5-stages SMS)
- gonadal weight (0.1 g)
- stomach repletion (4 categories)
- visceral fat (4 categories)
- *Sagitta* otoliths extraction and preservation

RIM and on-board observations: length frequencies

Life history traits

- Length frequencies
- LWRs
- Reproductive traits
- Growth parameters
- etc.

Mathematical assessment

Data-limited models

Length-based: LBB, LB-SPR, LCA/YR

Surplus production-based: Biodyn, SPiCT, CMSY, JABBA)

Fishery statistics (oficial sale-notes)

- Landings
- Fishing effort (non specific)
- LPUE (not standardized)

Time series: 2013-current

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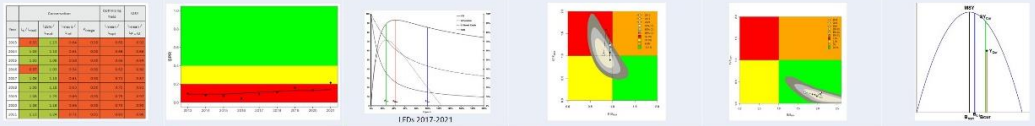
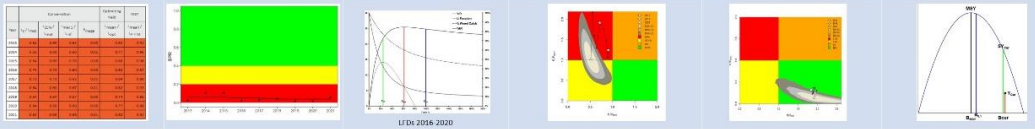
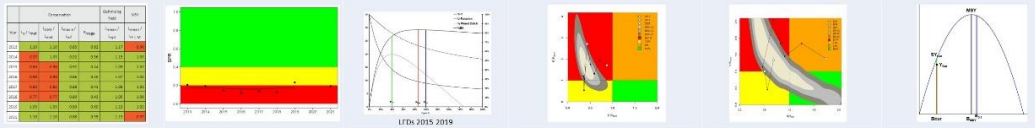
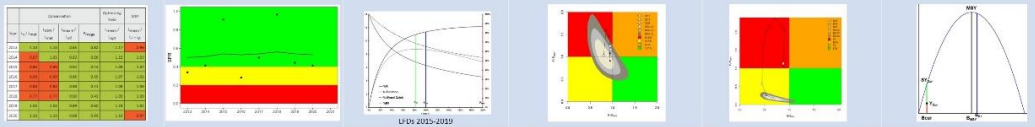
Current stock status assessment

Presented in V SIBECORP SANTA MARTA-COLOMBIA (2021)

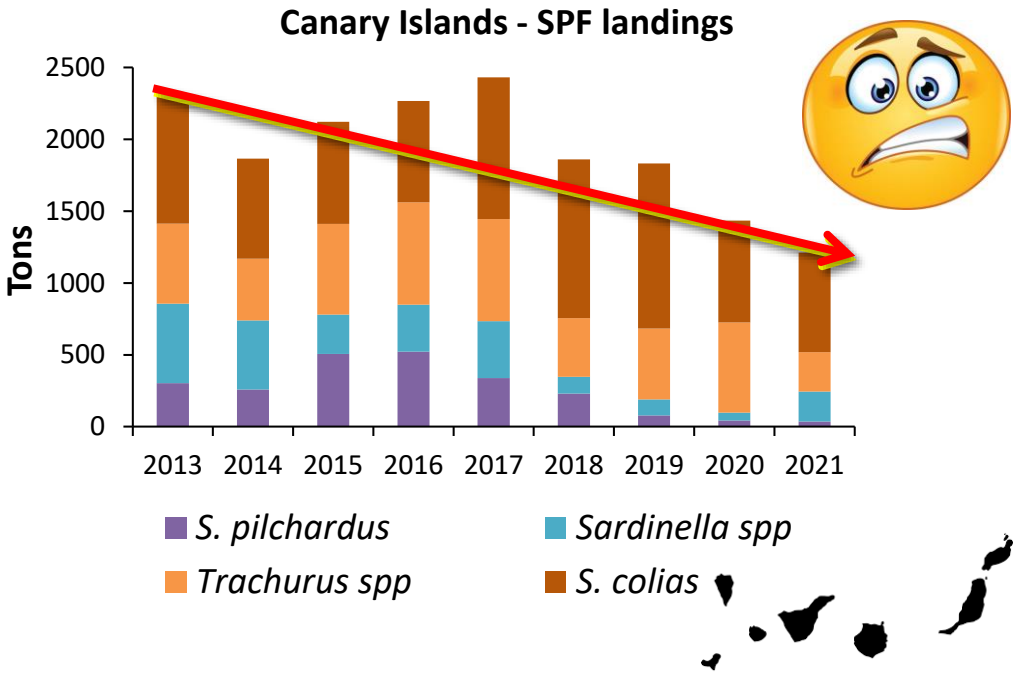
Presented in ISARFIS and CECAF COPACE FAO FIAT PANIS assessment WG (2022)

Species	Allowed catch size	LFM reference	Updated LFM
Scomber colias	20	20 (Lorenzo and Pajuelo, 1996)	**18.90**
Trachurus picturatus	15	22 (Jurado-Ruzafa and Santamaría, 2013)	**19.00**
Sardina pilchardus	11	15 (Méndez-Villamil et al., 1997)	15.02
Sardinella aurita	na	na	18.34

RESULTS & CONCLUSIONS

Assessment model	Length-based models			Surplus production-based models		
	LBI	LB-SPR	(LCA+)YPR	CMSY	JABBA	BioDyn
Scomber colias						
Trachurus spp (Mixed landings)						
Sardinella spp (Mixed landings)						
Sardina pilchardus						

- ✘ The exploratory multi-model approach to assess the small pelagic fish in the Canary Islands by using seven different data-limited methods proves that a quantitative assessment is not feasible yet .
- ✘ It is not possible to provide scientific advice in terms of catch or effort limits.



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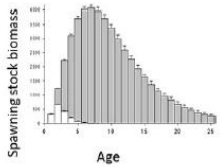
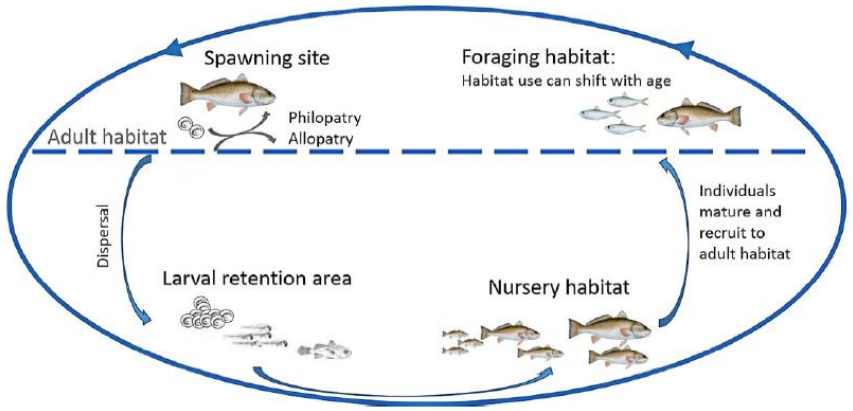
Workshop 6: Small Pelagic Fish Reproductive Resilience

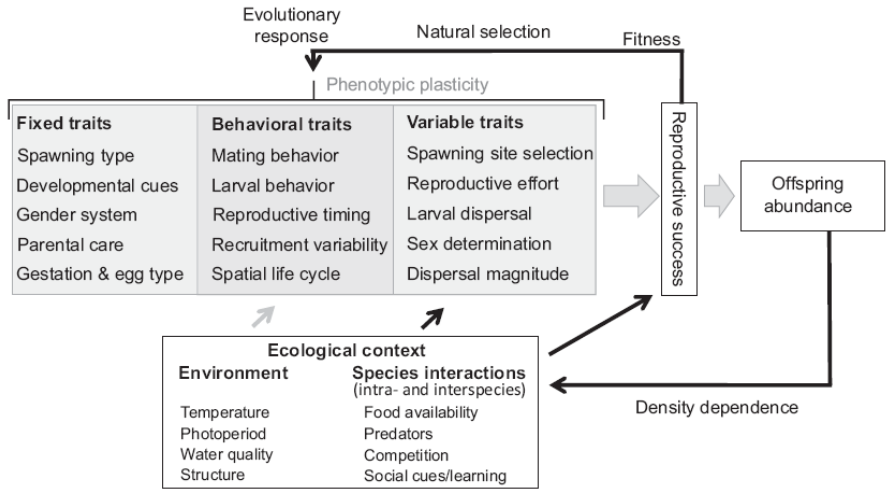
Background: REPRODUCTIVE RESILIENCE PARADIGM

Management context:
Harvest control rules=conserve some portion of mature females
(reproductive potential based on spawning stock biomass as a proxy)



Ecological context:
Reproductive success=an individual's offspring survive to reproductive age
(affected by genetics, habitat, environmental factors, predation, and food availability)





From Lowerre-Barbieri *et al.* (2017)

Reproductive potential is commonly based on spawning stock biomass (SSB) but, in many marine species, spatial components of the life cycle may be more important to reproductive success.

W6 final aim: To operationalize the use of the ***reproductive resilience paradigm*** to inform management.

W6 departure hypotheses:

1. The ***reproductive resilience paradigm*** takes an eco-evolutionary perspective to identify species-specific traits in spawner-recruit systems that drive reproductive success and consequently resilience to fishing pressure.
2. Reproductive success is tightly coupled with **adult abundance** and **fecundity** in many terrestrial animals and, in exploited marine fish, **where and when fish spawn**, and consequent **dispersal dynamics**, may have a greater impact.

W6-detected needs for the scientific side:

To move beyond the intrinsic population growth equation to understand drivers of transgenerational productivity requires **scientific dialogue across fields** including **fisheries ecologists**, **geneticists**, **early life biologists** and stock **assessment scientists**.

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Our aim

To achieve the knowledge to be able to know the actual state of these stocks, in order to provide the best scientific advice **to protect our environment and the marine resources.**

The ***reproductive resilience*** of these species should be further understood

Pending work in reproductive characterization:

- Microscopic validation of the maturity stages assignments
- Estimation of fecundity and reproductive potential
- Egg and larval development
- Spawning locations
- Larval dispersal and connectivity
- Spatio-temporal analyses
- etc.

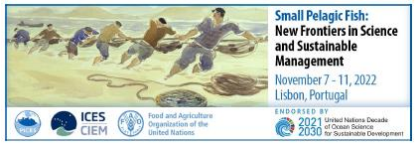
Needs:

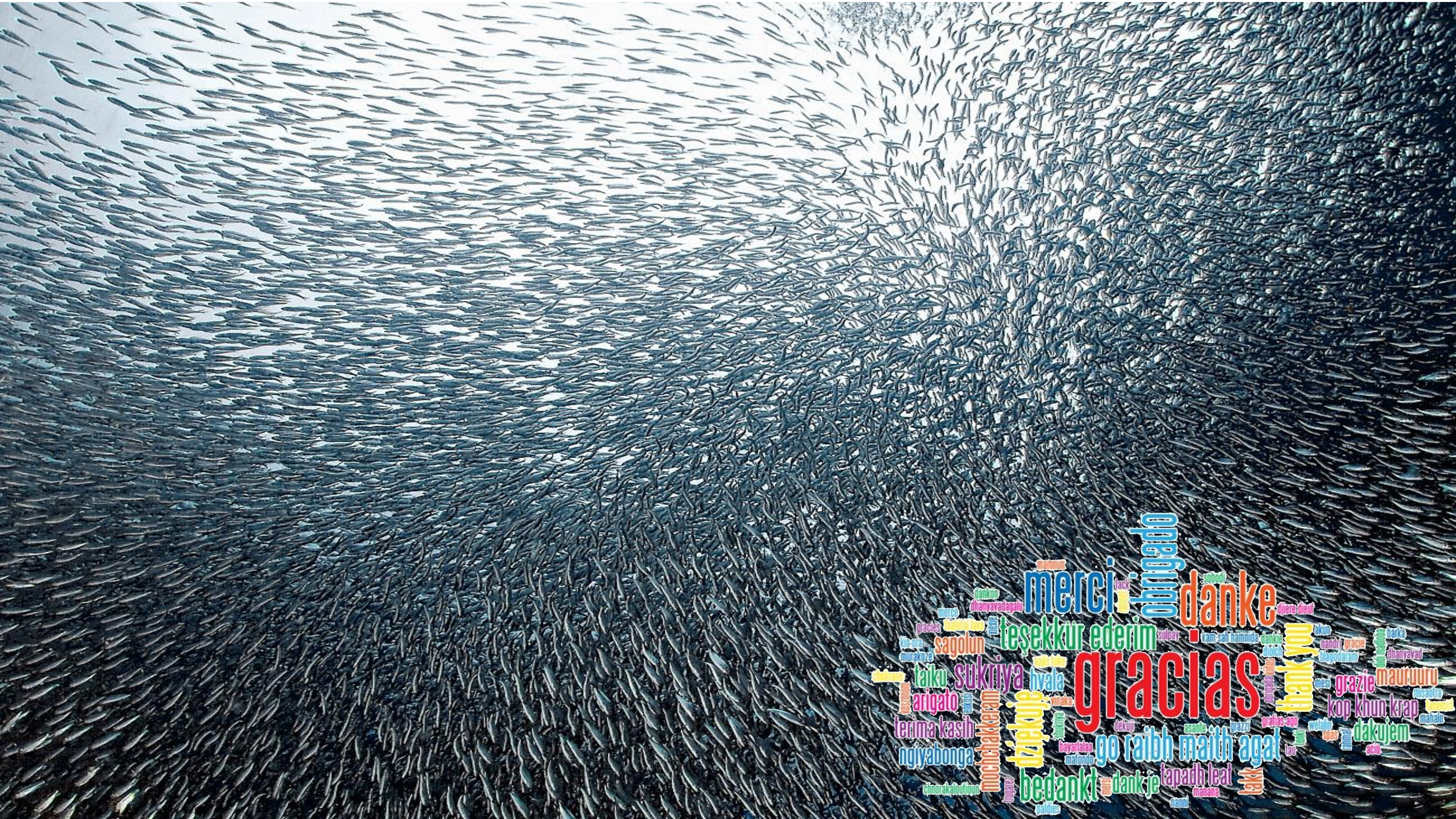
- To obtain fishery independent abundance/biomass estimations
- To keep the monitoring system
- Improvements in the First sale-notes reporting
- Fishing effort stardardization to estimate reliable specific CPUEs
- To better understand the environmental drivers impacting these species
- **Collaborative approaches including broader interdisciplinary and geographic perspectives**

But also:

- Trained staff
- Funds and materials
- Time to analyse data

Comments and suggestions are more than welcome

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bedankt
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