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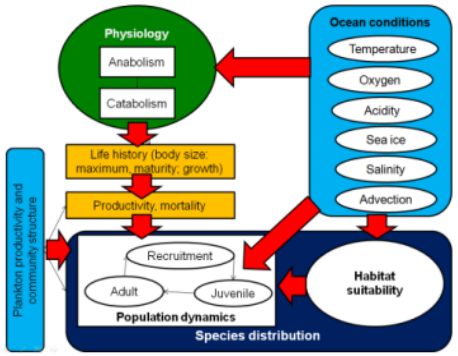
EU projects: changes in tropical tuna stocks because of climate change, and technological developments for mitigation and adaptation

Jose A. Fernandes (jfernandes@azti.es)

Fisheries projections under climate change

Species-based + size-spectrum model = species interactions

Latitudinal shifts 20% slower when considering species interactions (Fernandes et al., 2013)



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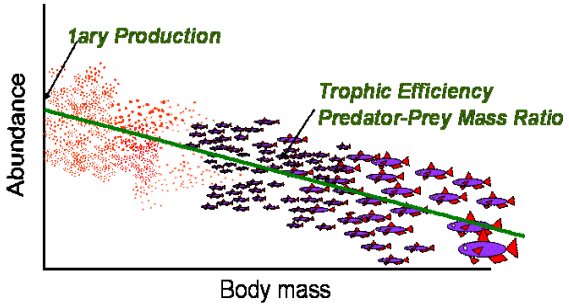

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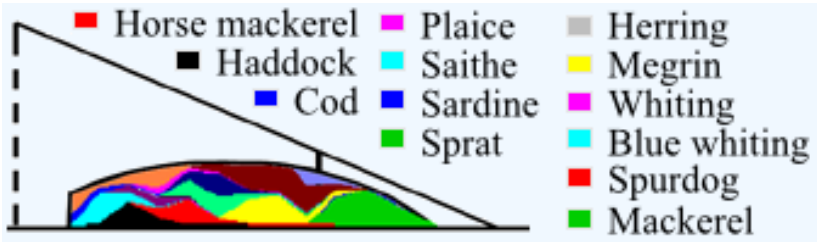

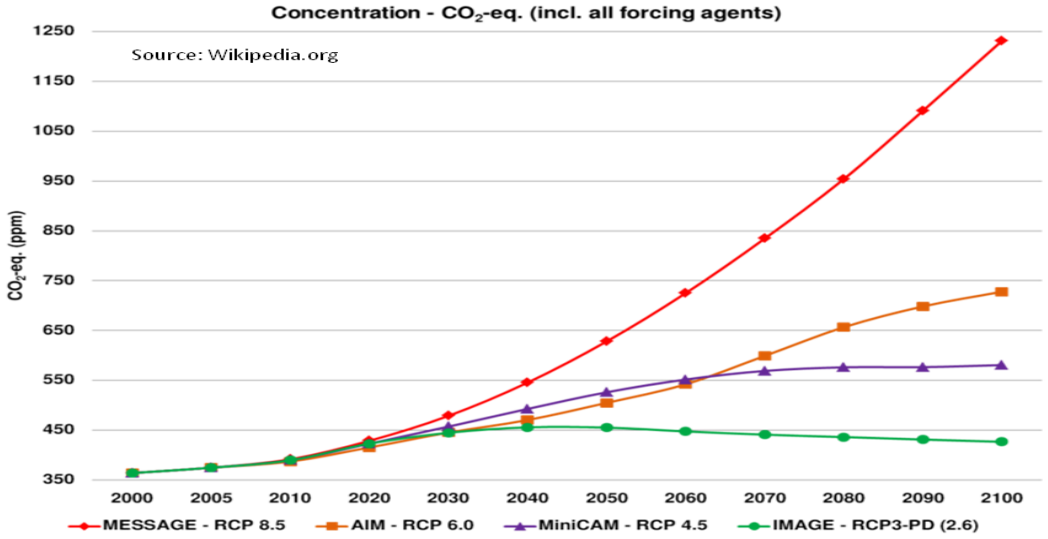

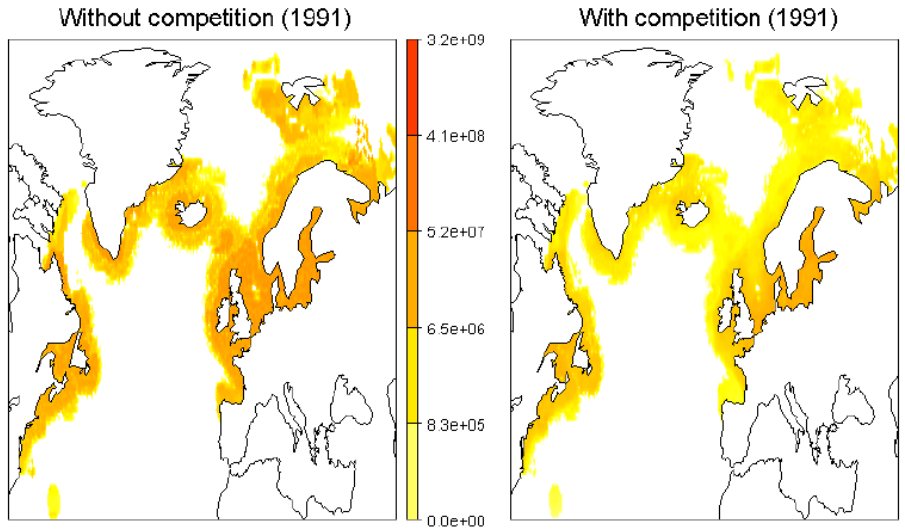

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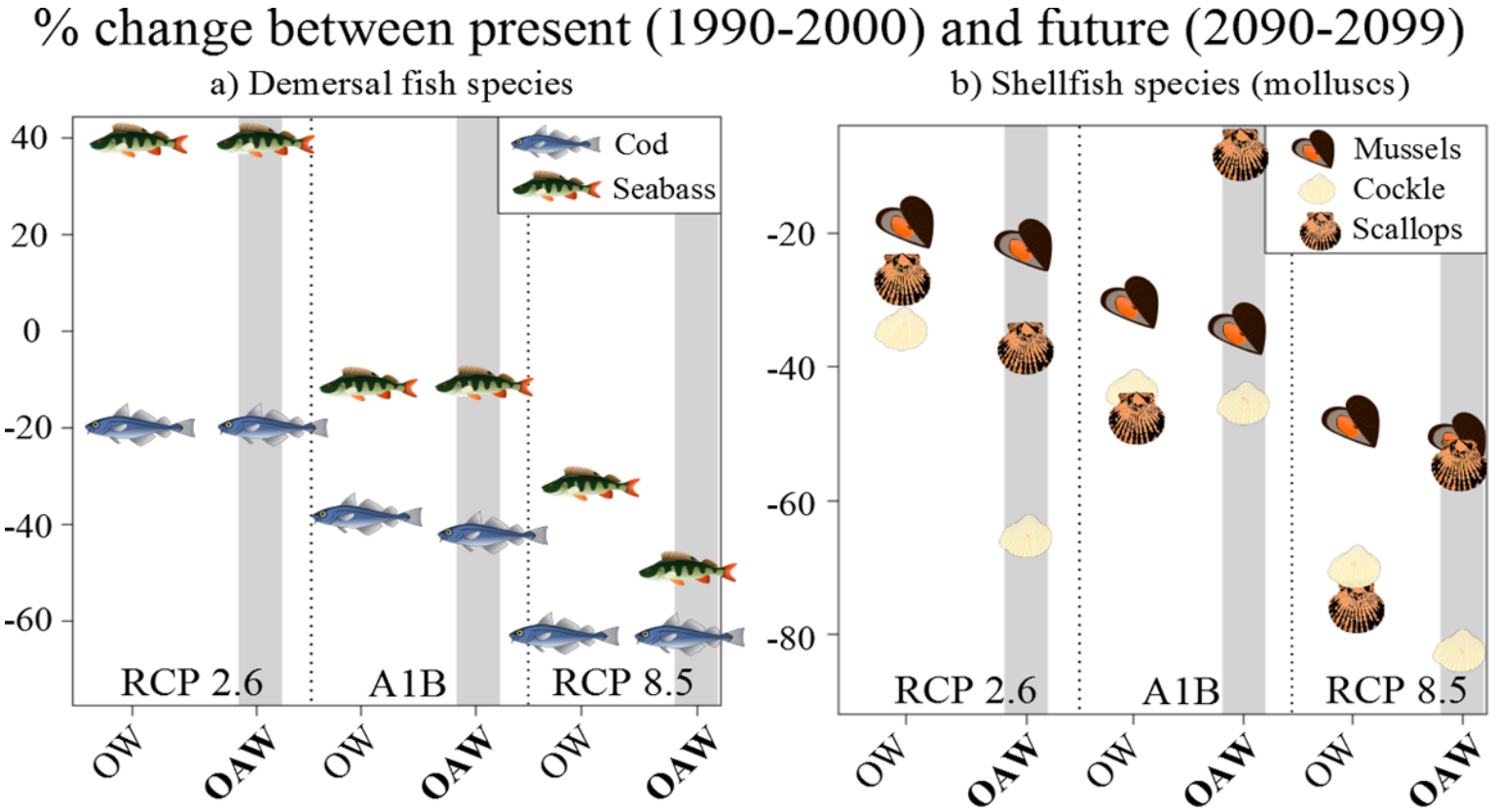
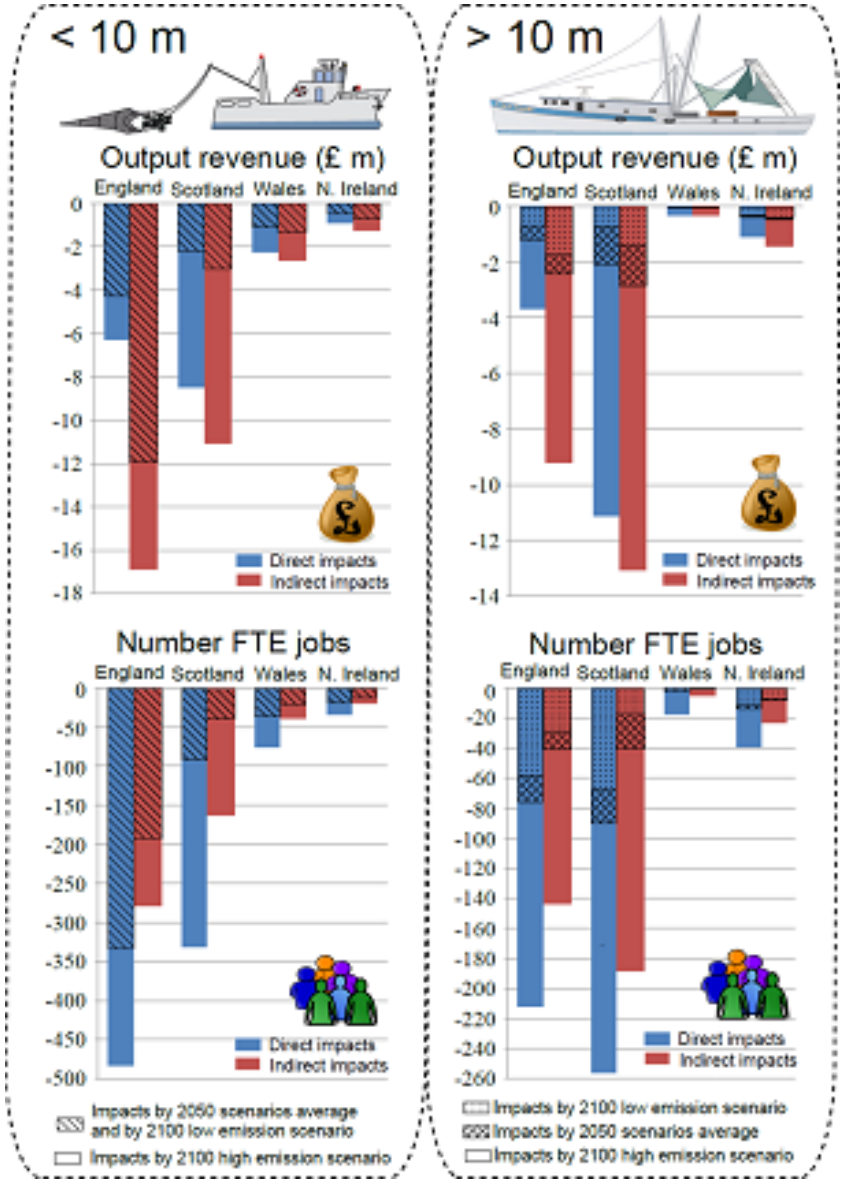
With ocean acidification experiments





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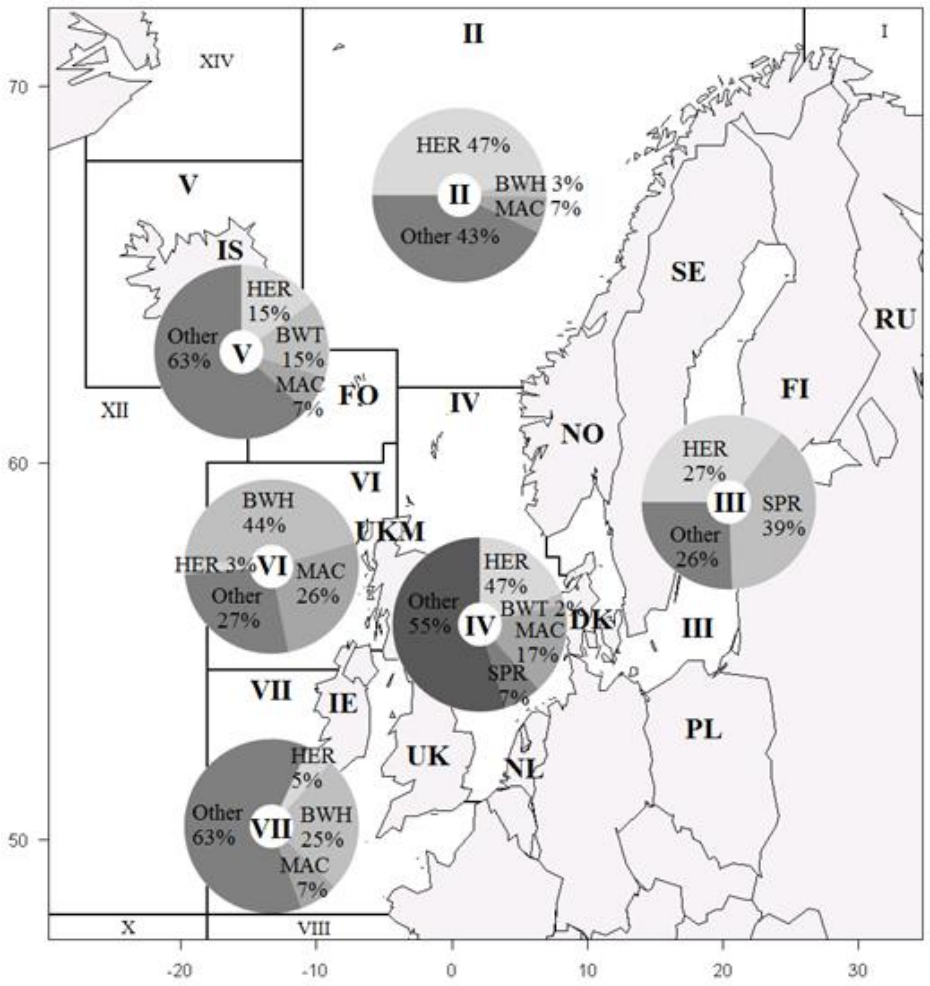
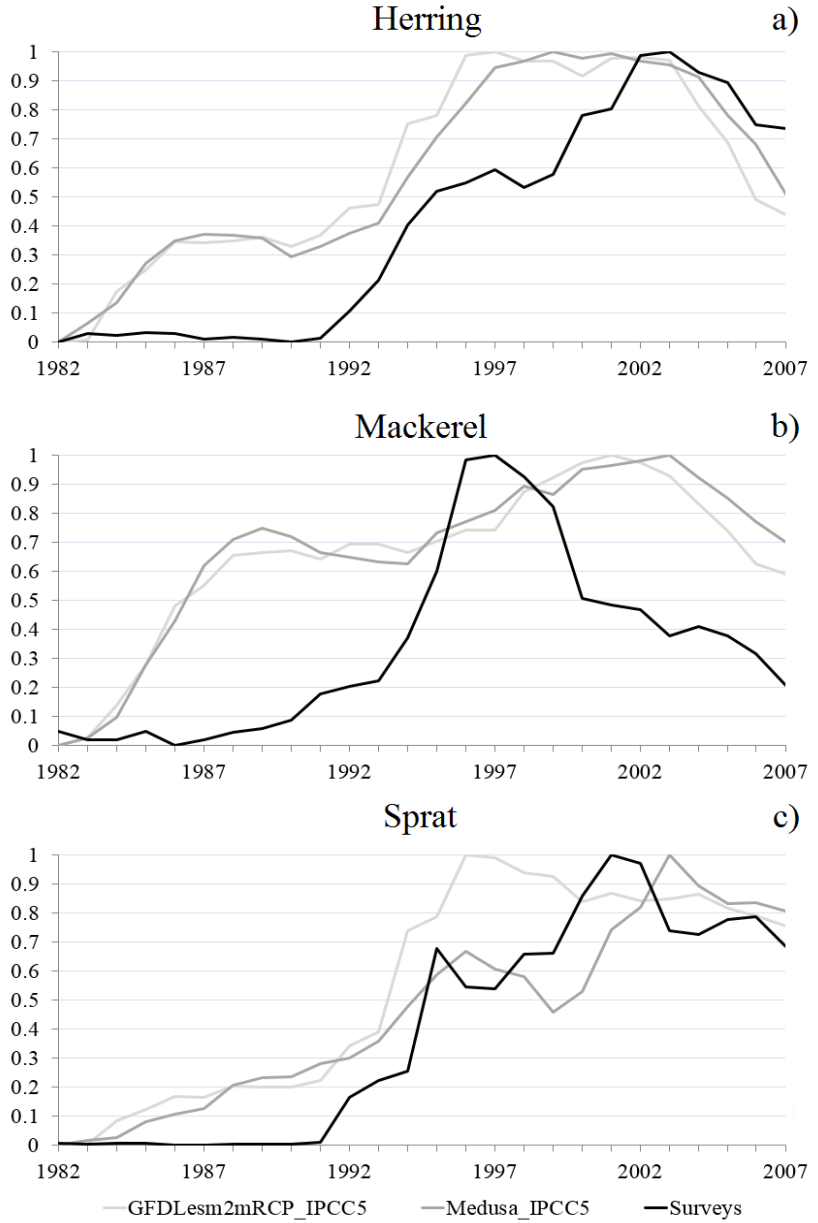
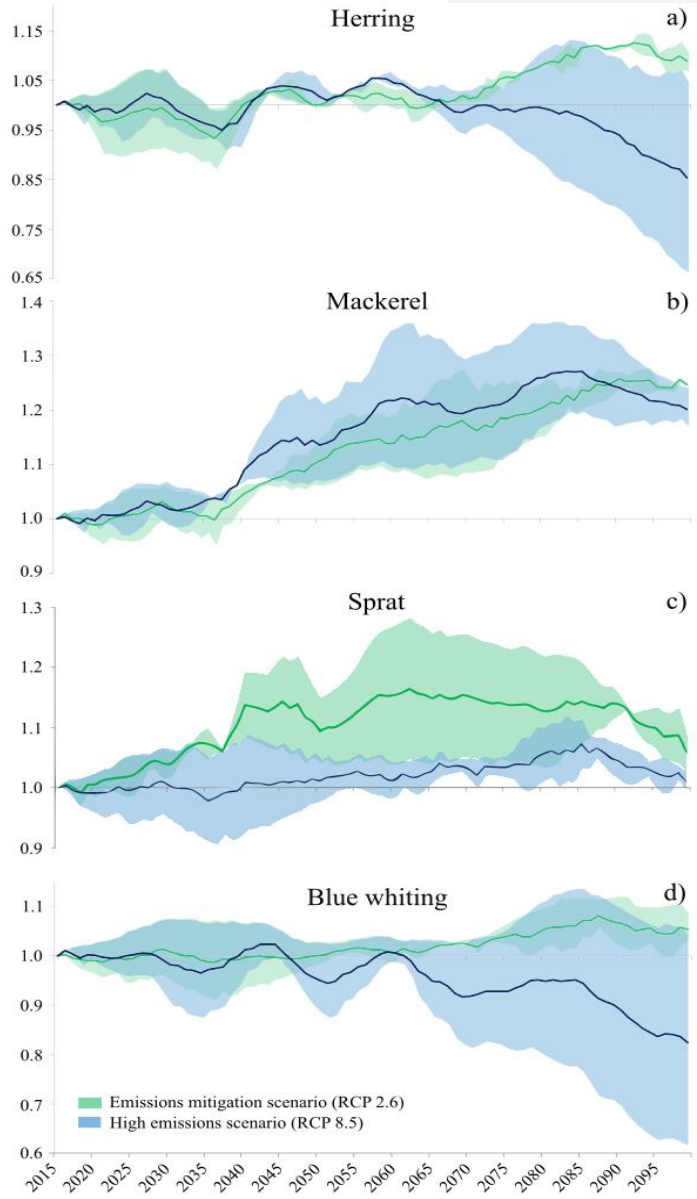
Projections of small pelagic species







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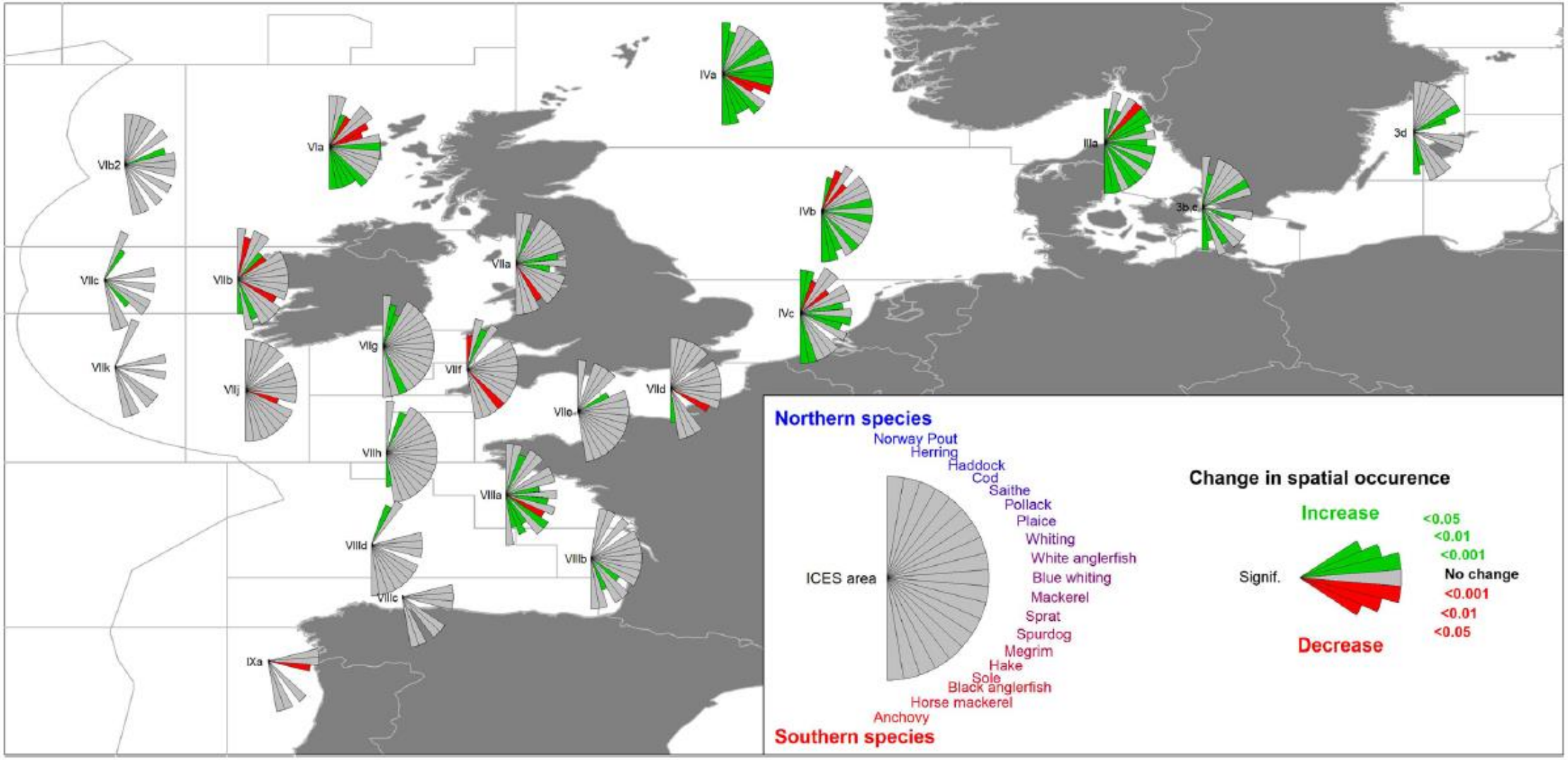
Evidences changes already happening



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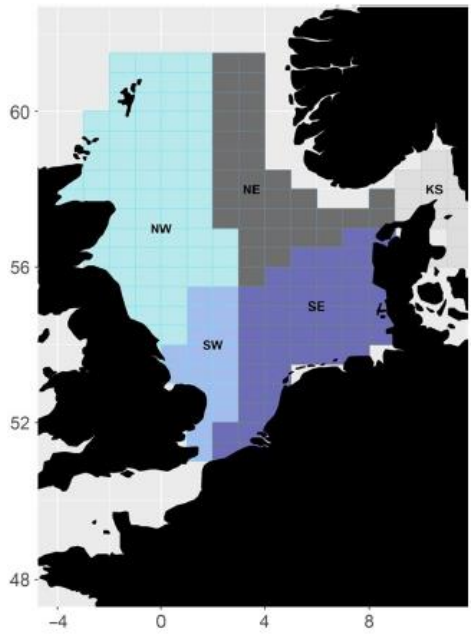
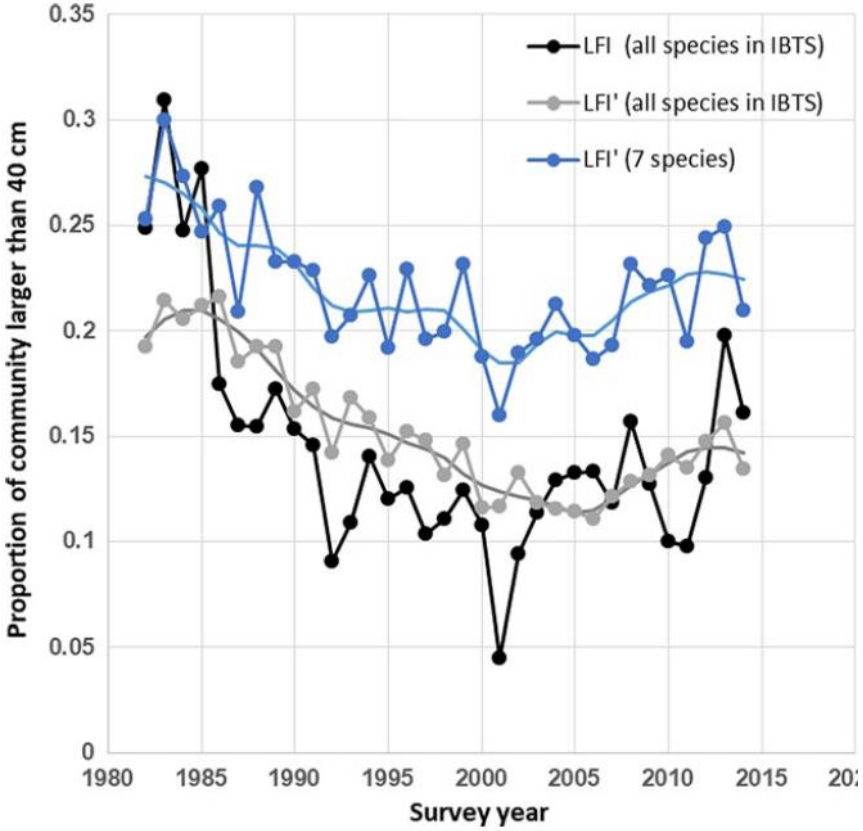
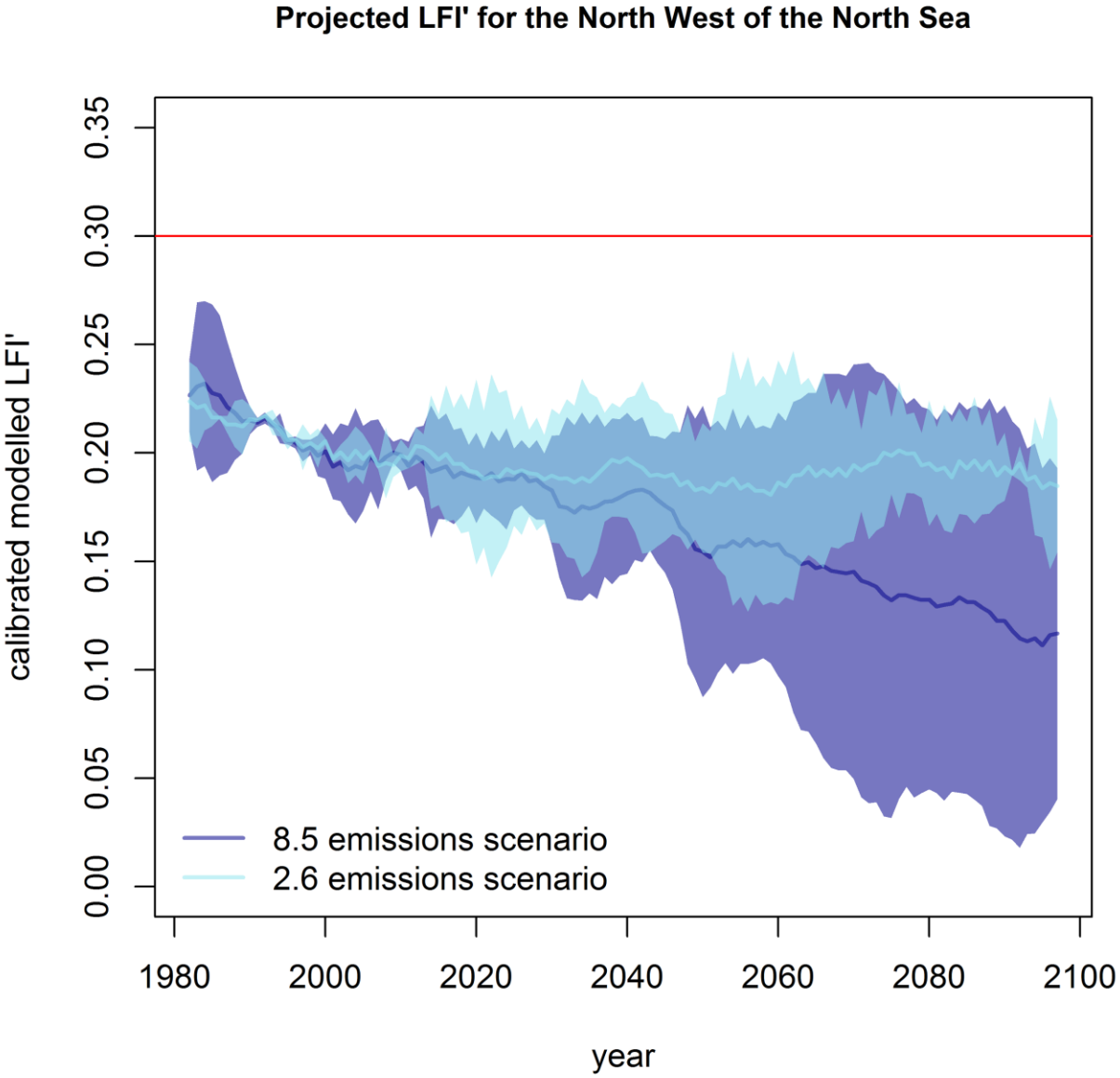
Projections of changes in sizes







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Tuna species

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869342.

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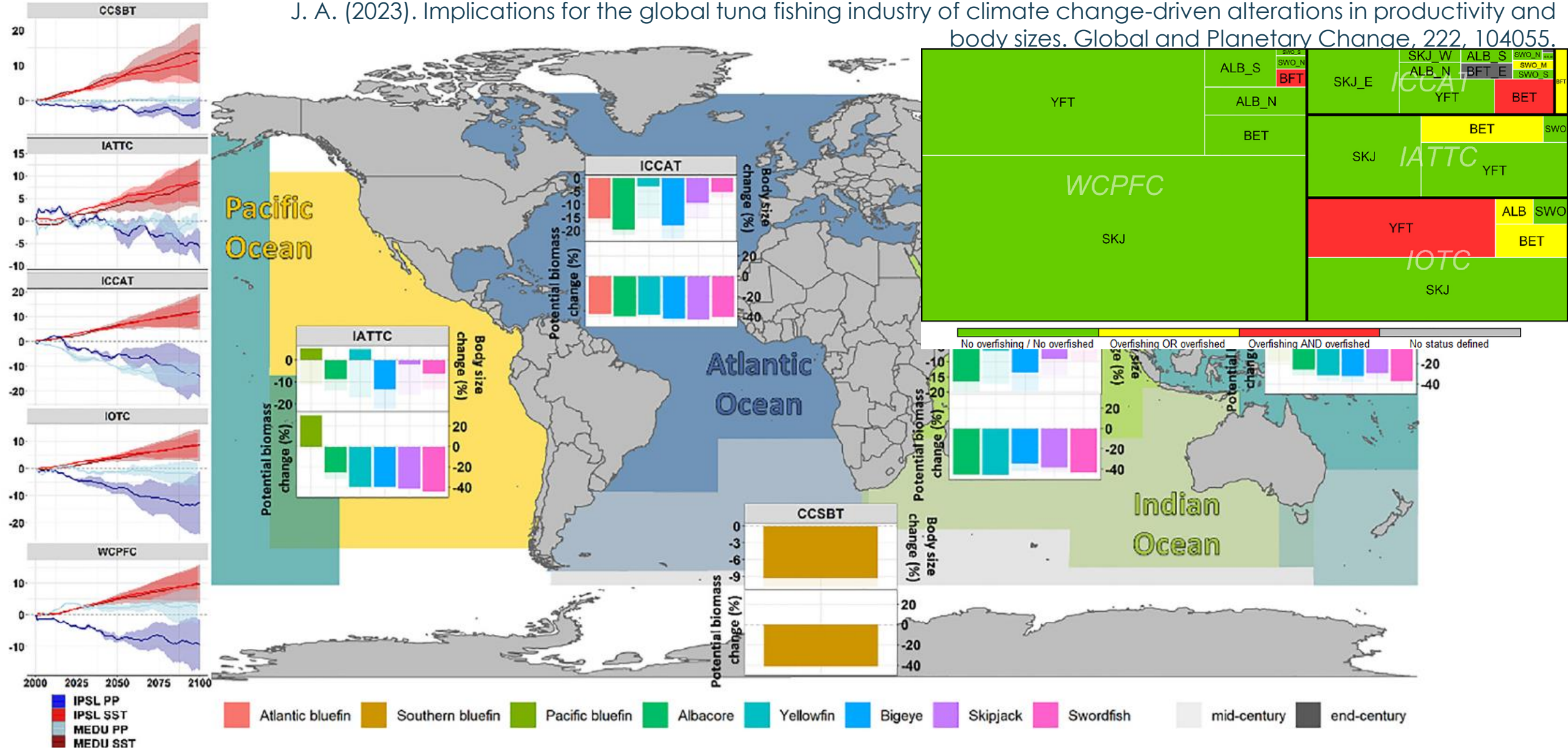
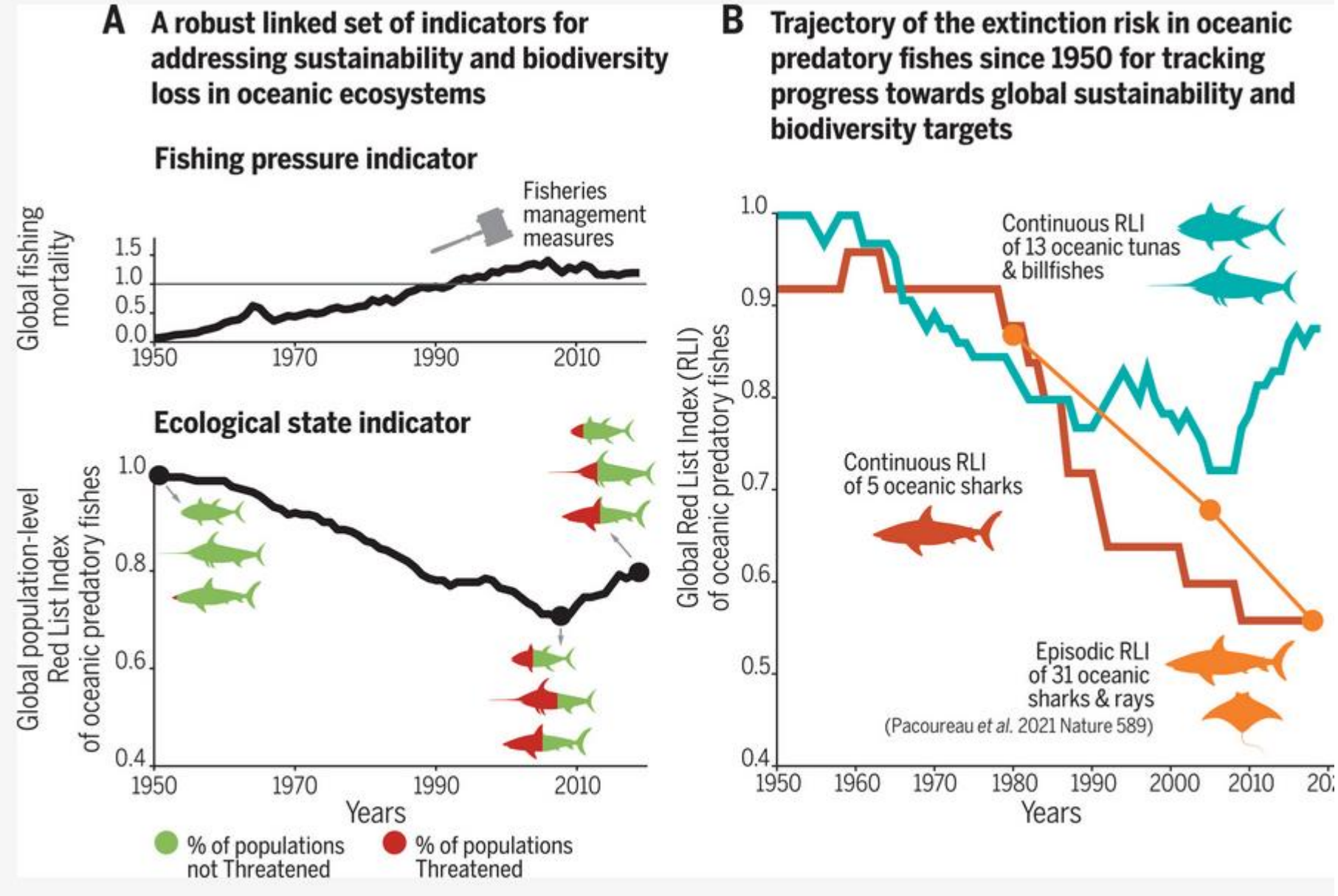


Improved management as mitigation measure with tuna



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Global wild fish production

FISHERIES & MARINE ECOSYSTEM
FISH-MIP
MODEL INTERCOMPARISON PROJECT

PNAS

Global ensemble projections reveal trophic amplification of ocean biomass declines with climate change

Heike K. Lotze[a,1], Derek P. Tittensor[a,b], Andre
Eric D. Galbraith[d,e], Manuel Barange[f], Nicolas
Matthias Büchner[l], Catherine M. Bulman[m], Da
Elizabeth A. Fulton[j,m], Simon Jennings[r,s,t], Mir
Ricardo Oliveros-Ramos[x], Tilla Roy[i,y], José A. I
Jeroen Steenbeek[p], Charles A. Stock[q], Philipp

nature climate change
ARTICLES
https://doi.org/10.1038/s41558-021-01173-9
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Next-generation ensemble projections reveal higher climate risks for marine ecosystems

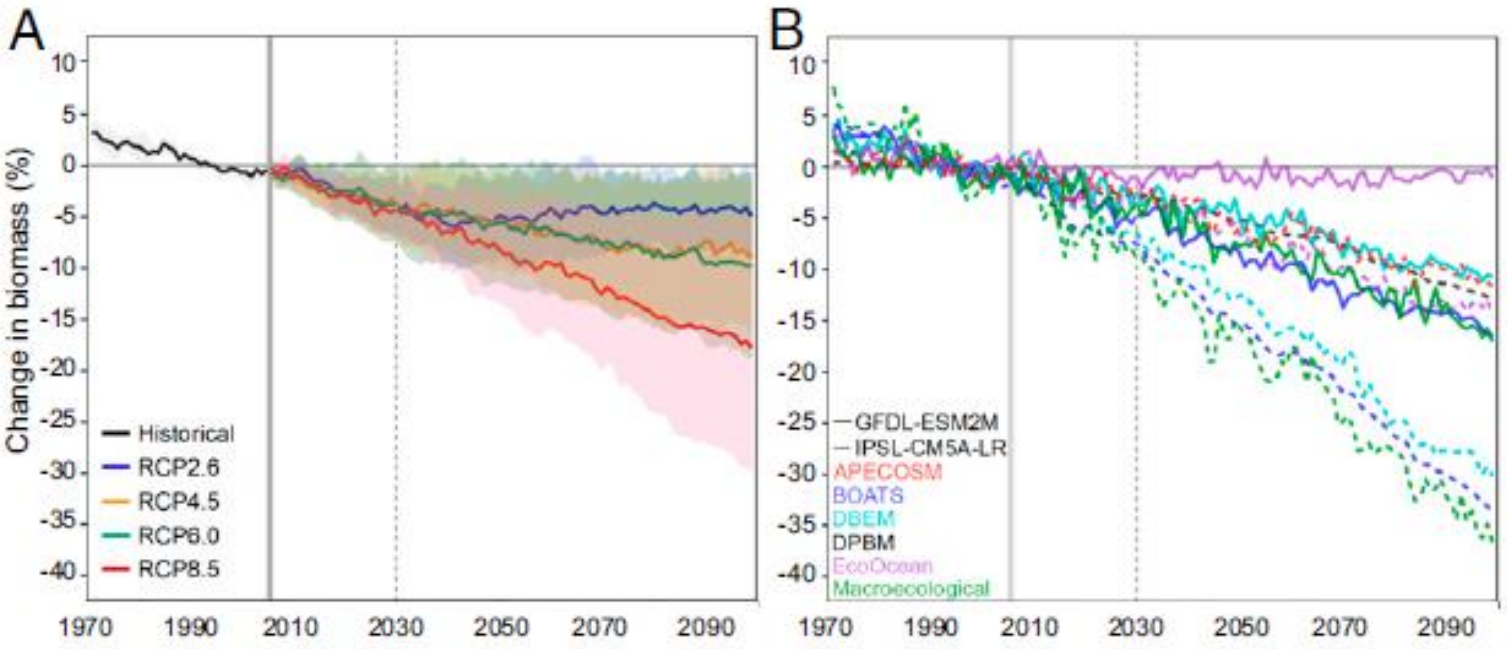
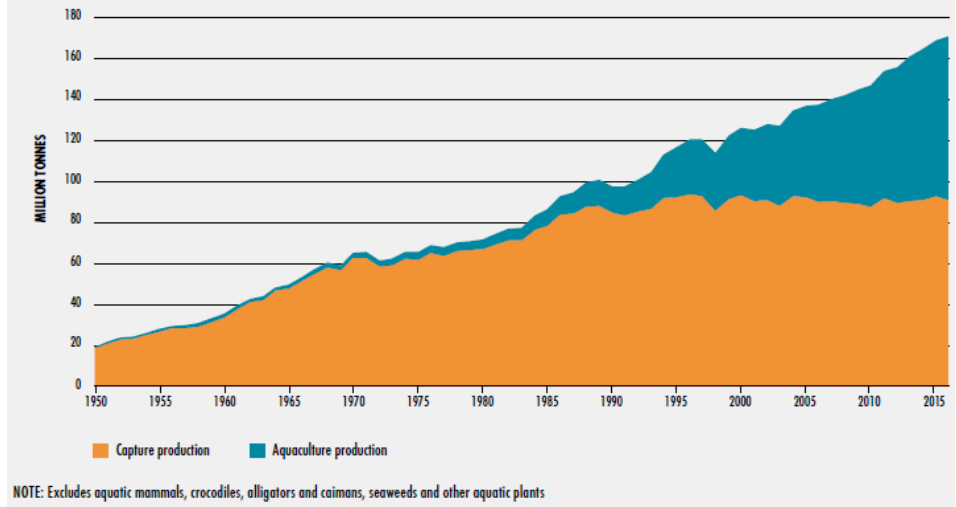


FIGURE 1
WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants

Global fuel use and capacity/effort

nature climate change

Article | Published: 02 April 2018

Fuel use and greenhouse gas emissions of world fisheries

Robert W. R. Parker, Julia L. Blanchard, Caleb Gardner, Bridget S. Green, Klaas Hartmann, Peter H. Tyedmers & Reg A. Watson

Nature Climate Change **8**, 333–337 (2018) | Download Citation

1594 Accesses | **23** Citations | **540** Altmetric | Metrics »

Abstract

Food production is responsible for a quarter of anthropogenic greenhouse gas (GHG) emissions globally. Marine fisheries are typically excluded from global assessments of GHGs or are generalized based on a limited number of case studies. Here we quantify fuel inputs and GHG emissions for the global fishing fleet from 1990–2011 and compare emissions from fisheries to those from agriculture and livestock production. We estimate that fisheries consumed 40 billion litres of fuel in 2011 and generated a total of 179 million tonnes of CO_2-equivalent GHGs (4% of global food production). Emissions from the global fishing industry grew by 28% between 1990 and 2011, with little coinciding increase in production (average emissions per tonne landed grew by 21%). Growth in emissions was driven primarily by increased harvests from fuel-intensive crustacean fisheries. The environmental benefit of low-carbon fisheries could be further realized if a greater proportion of

FISH and FISHERIES

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Original Article

Global fishing capacity and fishing effort from 1950 to 2012

Justin D Bell, Reg A Watson, Yimin Ye

First published: 19 September 2016 | https://doi.org/10.1111/faf.12187 | Cited by: 23

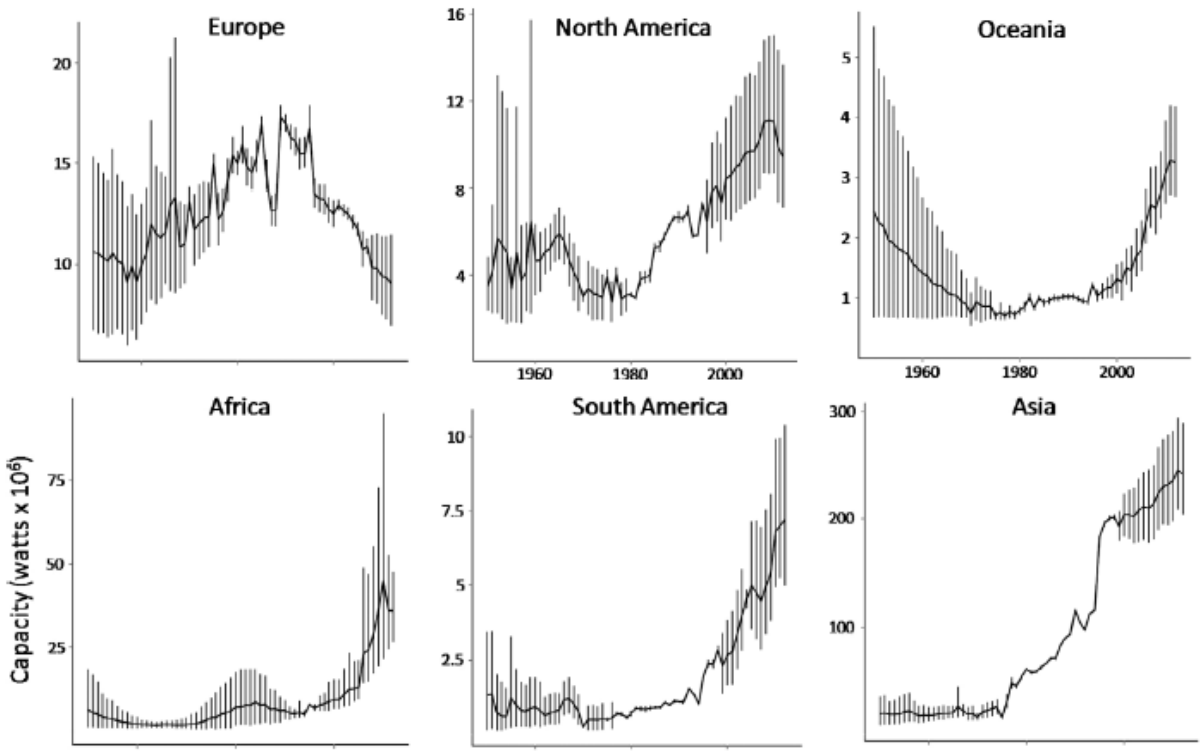

Figure 2 Regional fishing capacity from 1950 to 2012. Error bars represent 95% confidence intervals.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869342.

Proyecto SusTunTech

Consortium

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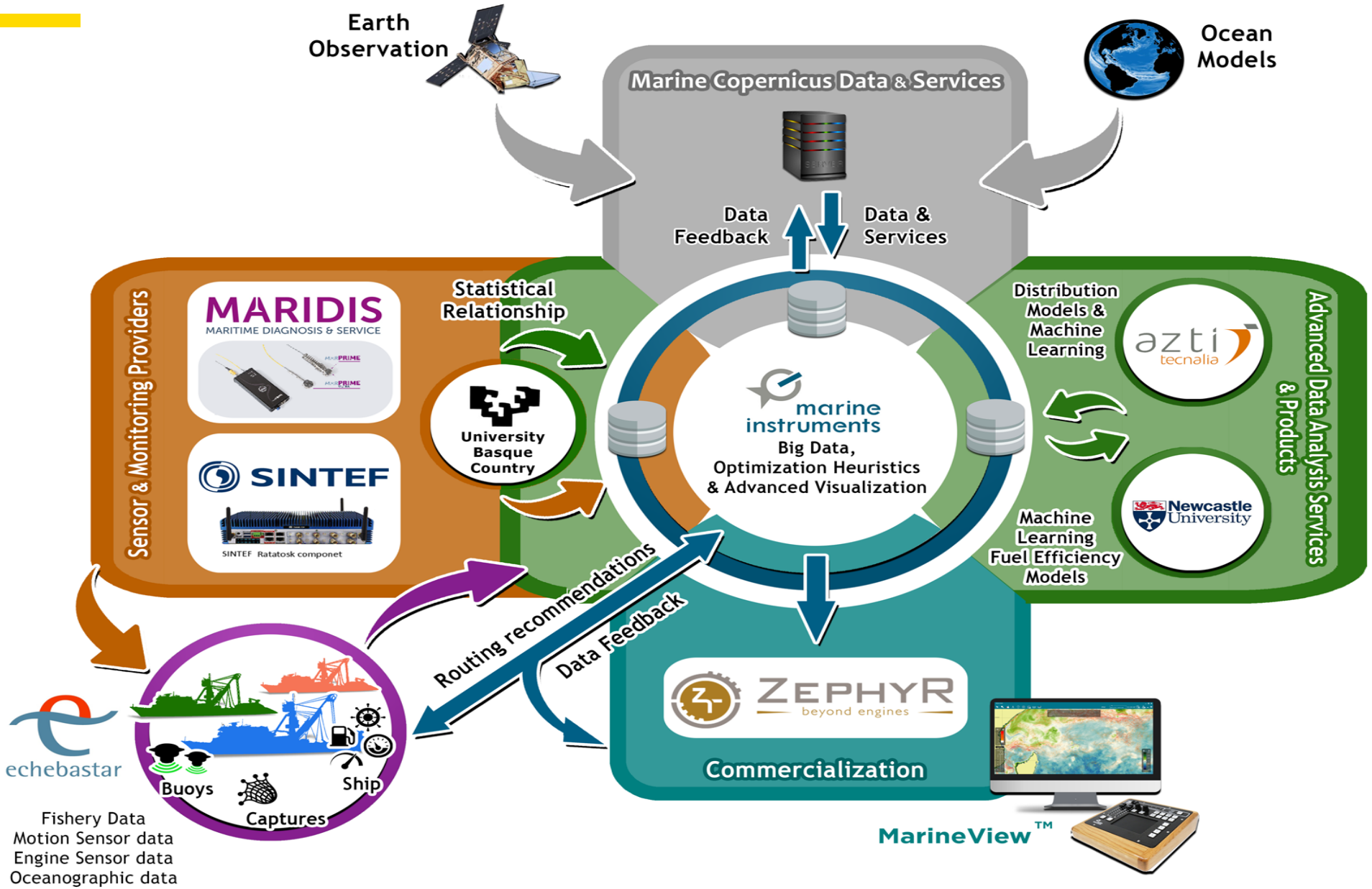

Vessel digitalization

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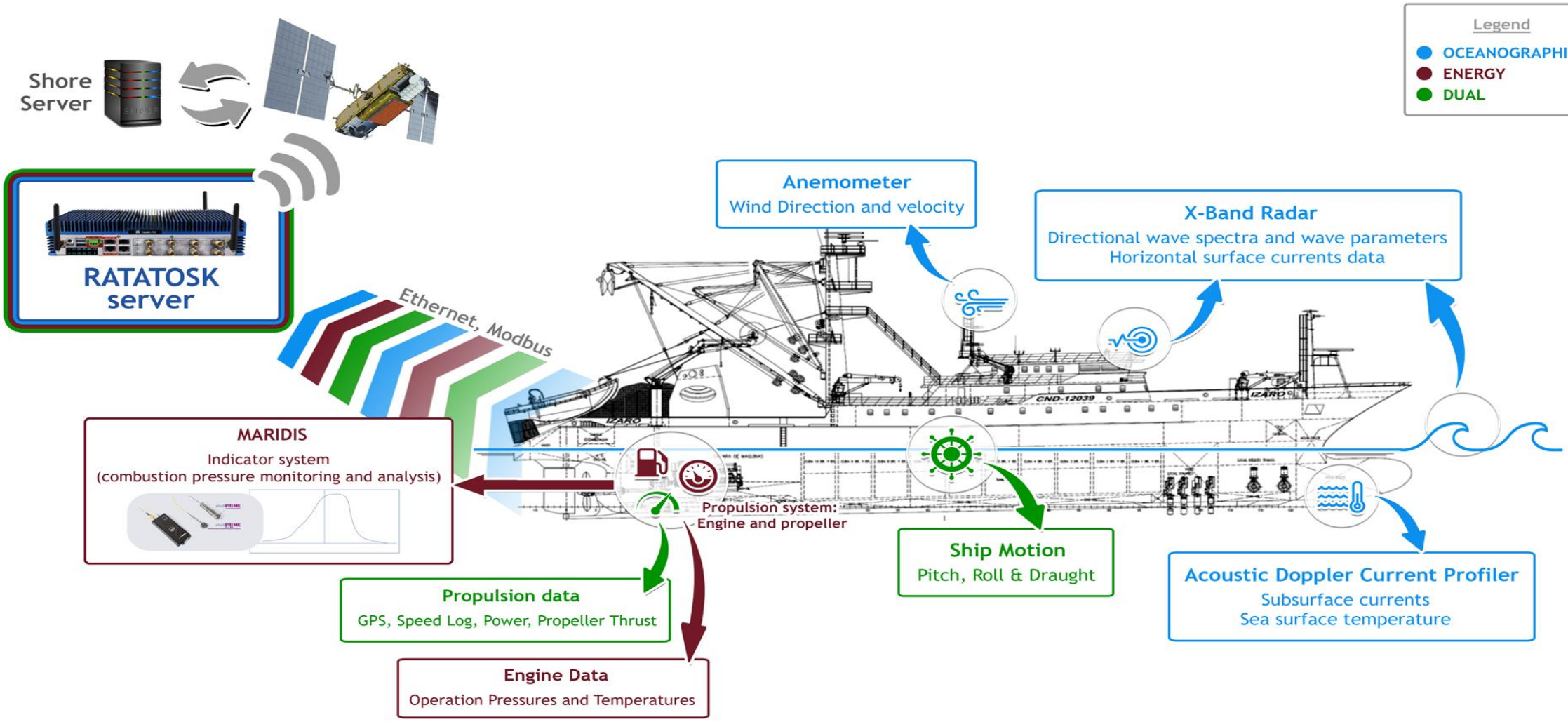

FADs use can help to reduce fuel consumption?

- FADs can help to reduce emissions

- But, they can also lead to longer routes (emissions)if fishers perceive potential higher catches.

Búsqueda de pescado es donde va el mayor consumo de fuel

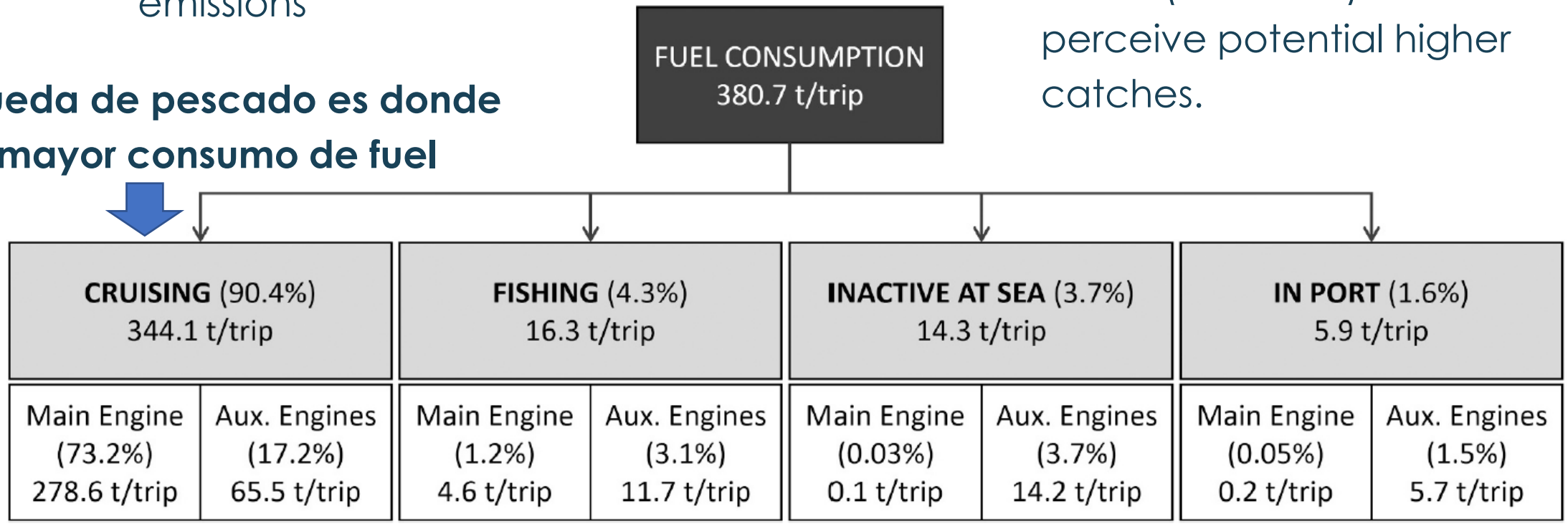

Fig. 3. Energy pattern of Vessel A, including fuel consumption in cruising, fishing, inactivity at sea and in port: values are presented in total, and per engine type.

Basurko, O. C., Gabiña, G., Lopez, J., Granado, I., Murua, H., **Fernandes, J. A.**, ... & Uriondo, Z. (2022). Fuel consumption of free-swimming school versus FAD strategies in tropical tuna purse seine fishing. Fisheries Research, 245, 106139.

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SusTunTech

Route decision support systems

Small-scale coastal fleet

Large-scale pelagic fleet

ENVIRONMENTAL LAYER

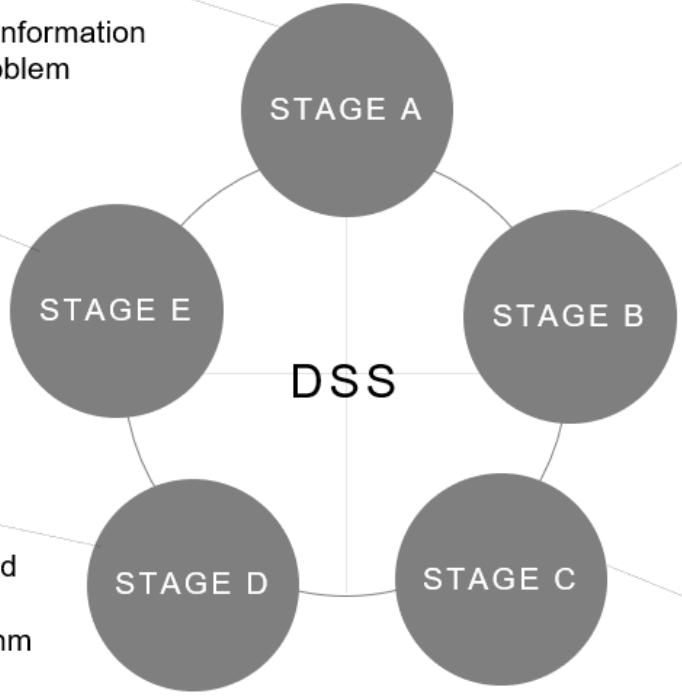
Provides the metocean information needed to model the problem

DECISION LAYER

It is the graphical component that interacts with the final user by selecting the final route.

ROUTING LAYER

This layer is the core of the DSS and according to the objectives, constraints and optimization algorithm the optimal route is computed



SHIP MODELLING LAYER

Predicts the ship performance under different weather conditions

FISHERIES LAYER

Provides the fisheries data, such as the target specie distribution, management regulations etc.

Large-scale demersal fleet

Distant-water fleet

Granado, I., Hernando, L., Galparsoro, I., Gabiña, G., Groba, C., Prellezo, R., & **Fernandes, J. A.** (2021). Towards a framework for fishing route optimization decision support systems: Review of the state-of-the-art and challenges. Journal of Cleaner Production, 320, 128661.

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High captures probability maps for adaptation to distribution shifts

Goikoetxea, N,, Goienetxea, I., Goñi, N., Granado, I., Ibaibarriaga, L., Iñaki Quincoces, Ruiz, J., Murua, H., Fernandes-Salvador, J.A. (2022). Machine learning aiding sustainable tuna purse seine fishery in contributing towards reduced CO2 emission and bycatch. Ecological Informatics. Under major review.

Reduce bycatch risk

Route optimization to mitigate emissions and reduce fuel costs

Granado, I., Hernando, L., Galparsoro, I., Gabiña, G., Groba, C., Prellezo, R., & Fernandes, J. A. (2021). Towards a framework for fishing route optimization decision support systems: Review of the state-of-the-art and challenges. Journal of Cleaner Production, 320, 128661.

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Thank you

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Any question?