



8th International
Conference on
BIG DATA
& Data Science for Official Statistics

BILBAO 2024

Informing Climate Change and
Sustainable Development Policies
with Integrated Data

BILBAO. SPAIN | **10-14 JUNE 2024** | **#UNBigData2024**

The use of big data and remote sensing for biodiversity monitoring in marine ecosystems

AUTHOR Jose A. Fernandes, A. Anabitarte, I. Granado, M. Valle, G. Chust
ORGANIZATION AZTI, Basque Research and Technology Alliance (BRTA)

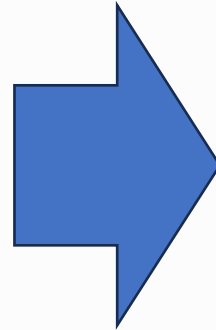
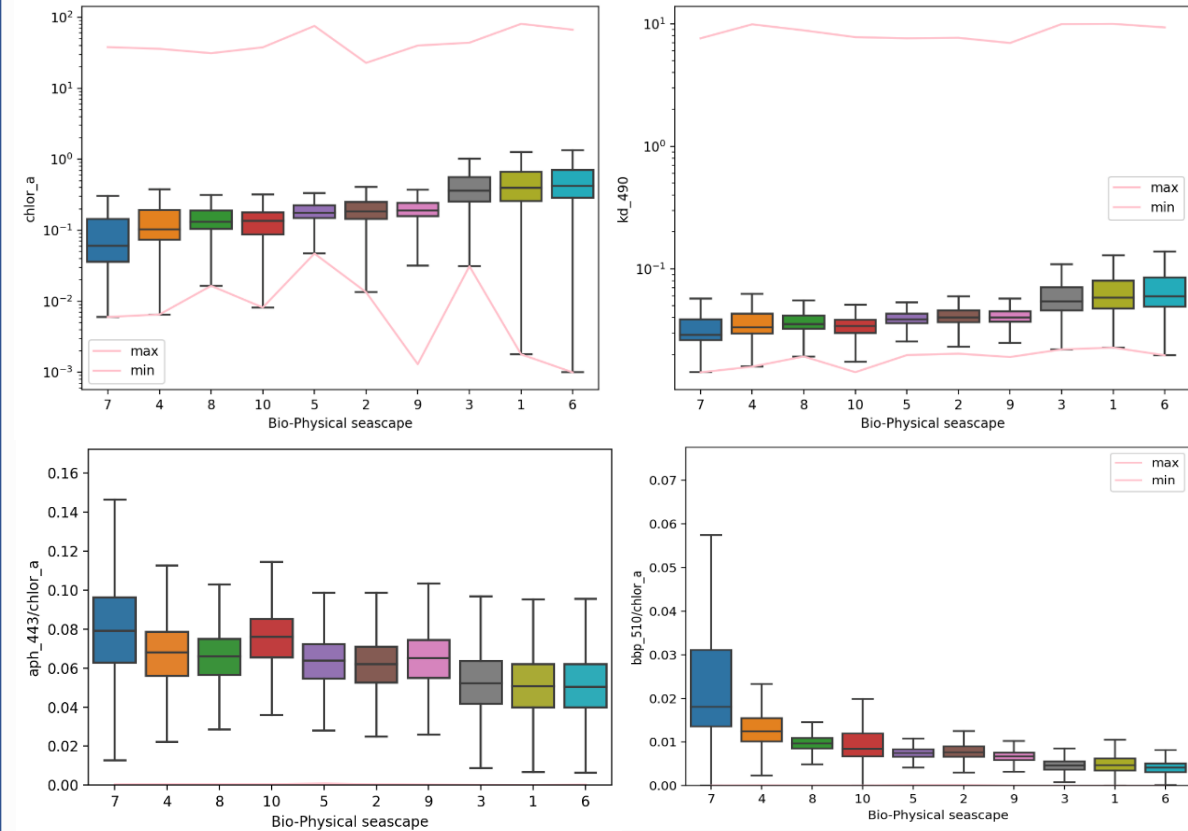


Protecting Areas in Atlantic Beyond National Jurisdiction Based on Seascapes and TradeOffs with Human Activities

Anabitarte, A., Astarloa, A., Galparsoro, I., Valle, M., Mateo, M., Chust, G., Galparsoro, I., Arrizabalaga, H., Eguíluz, V. M., Martínez, V., Fernández-Salvador, Jose A., A New Approach for Protecting Areas in Atlantic Beyond National Jurisdiction Based on Seascapes and TradeOffs with Human Activities

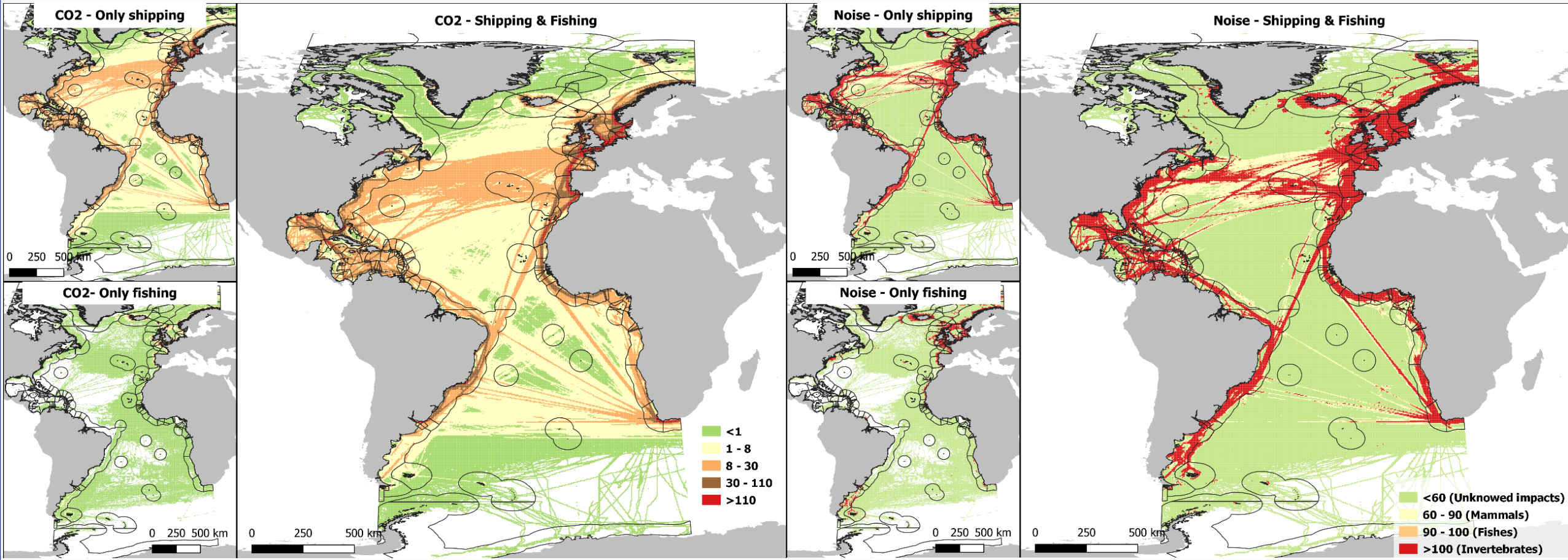
<http://dx.doi.org/10.2139/ssrn.4773737>

Use of satellite databased seascapes for high seas protection



Properties by bio-physical seascape, ordered by the median Chl-a concentration.

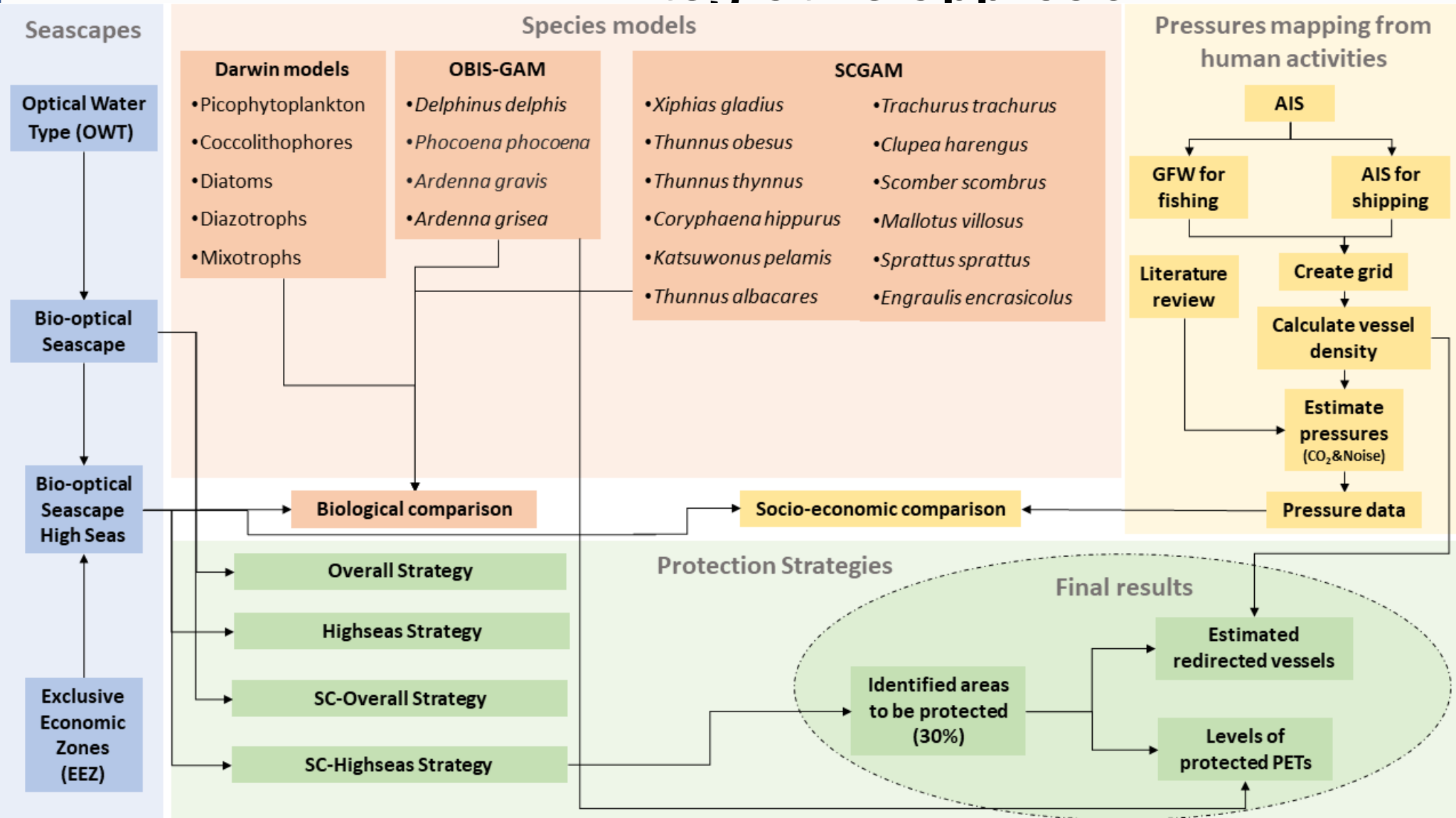
Seascapes in relation to human activities and pressures



Anabitarte, A., Astarloa, A., Garcia-Baron, I., Valle, M., Mateo, M., Chust, G., Galparsoro, I., Arrizabalaga, H., Eguíluz, V. M., Martinez-Vicente, V., Fernandes-Salvador, Jose A., A New Approach for Protecting Areas in Atlantic Beyond National Jurisdiction Based on Seascapes and Trade-Offs with Human Activities. <http://dx.doi.org/10.2139/ssrn.4773737>

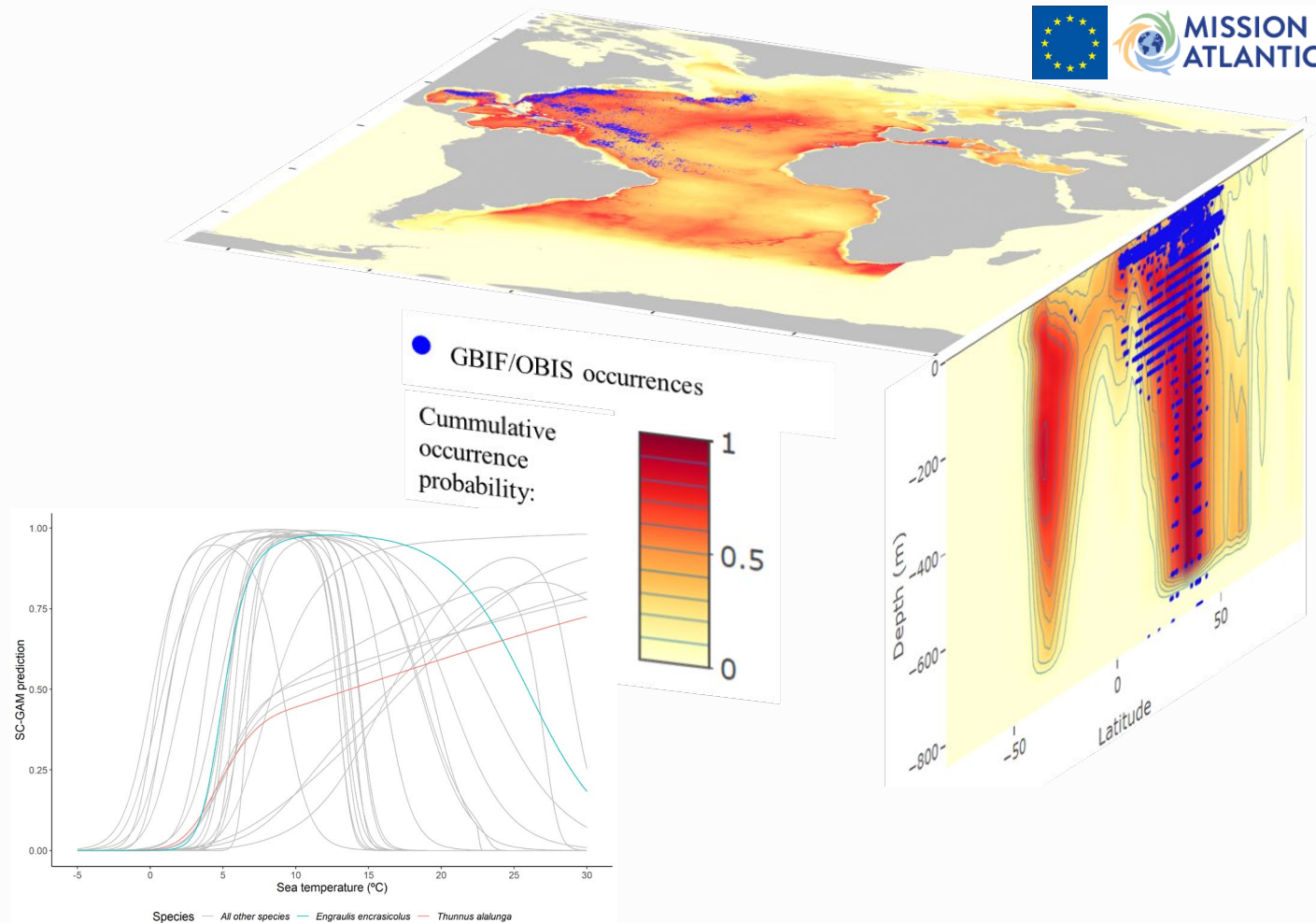
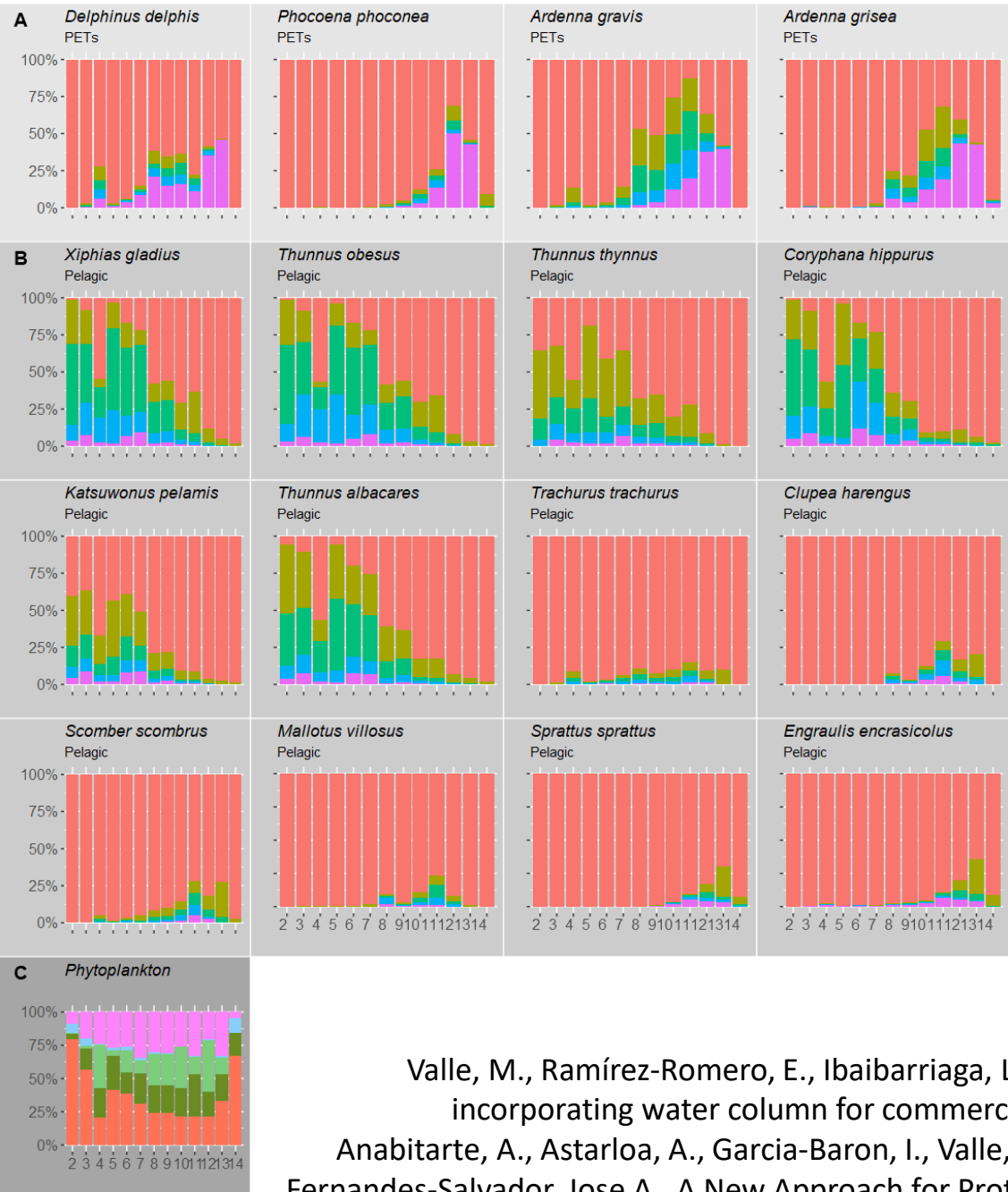


Integrative approach



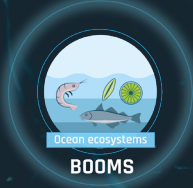
Anabitarte, A., Astarloa, A., Garcia-Baron, I., Valle, M., Mateo, M., Chust, G., Galparsoro, I., Arrizabalaga, H., Eguíluz, V. M., Martinez-Vicente, V., Fernandes-Salvador, Jose A., A New Approach for Protecting Areas in Atlantic Beyond National Jurisdiction Based on Seascapes and Trade-Offs with Human Activities.

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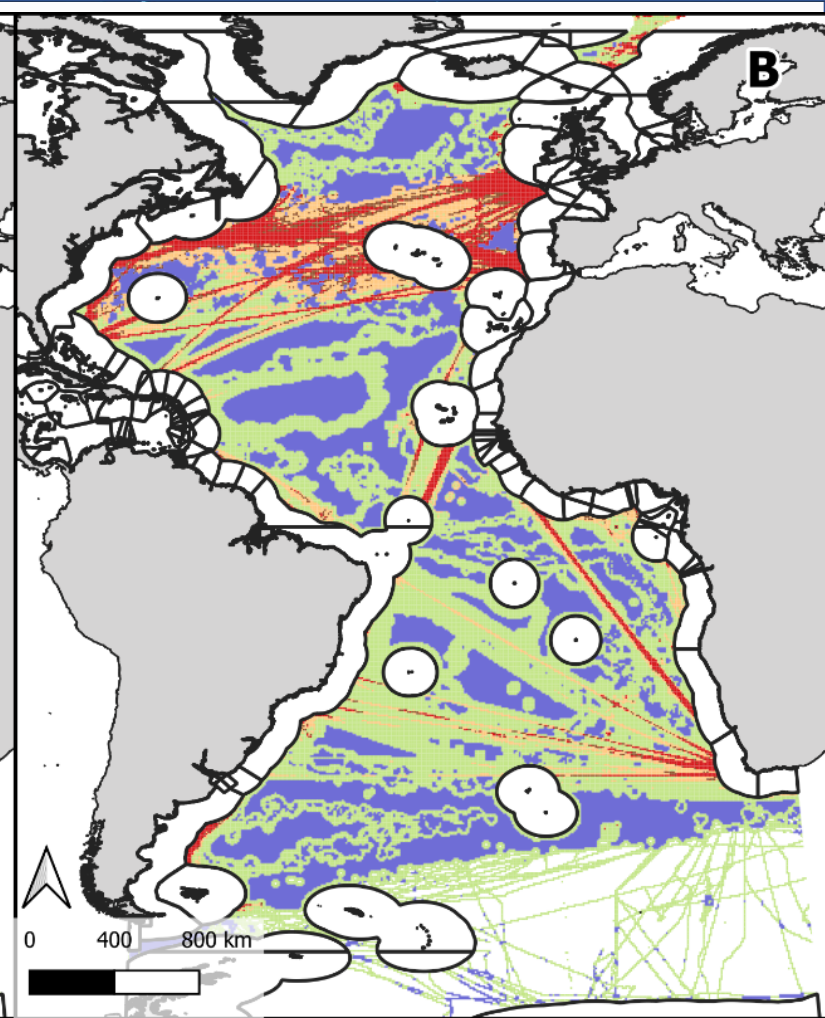
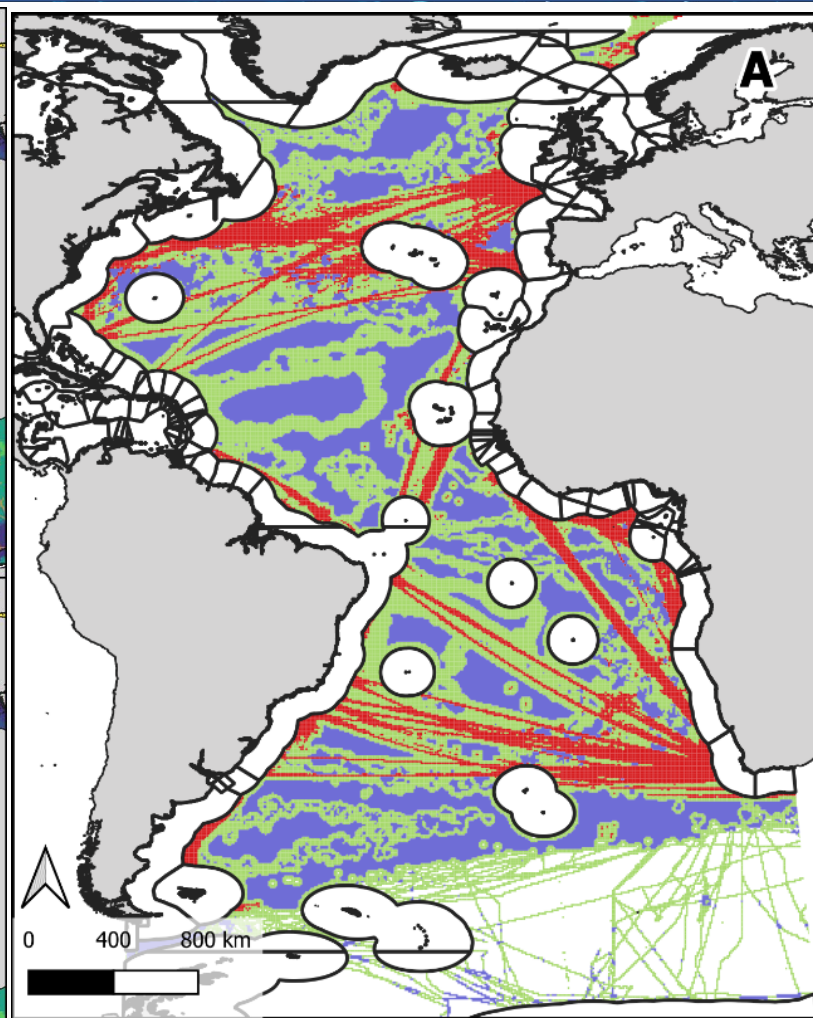
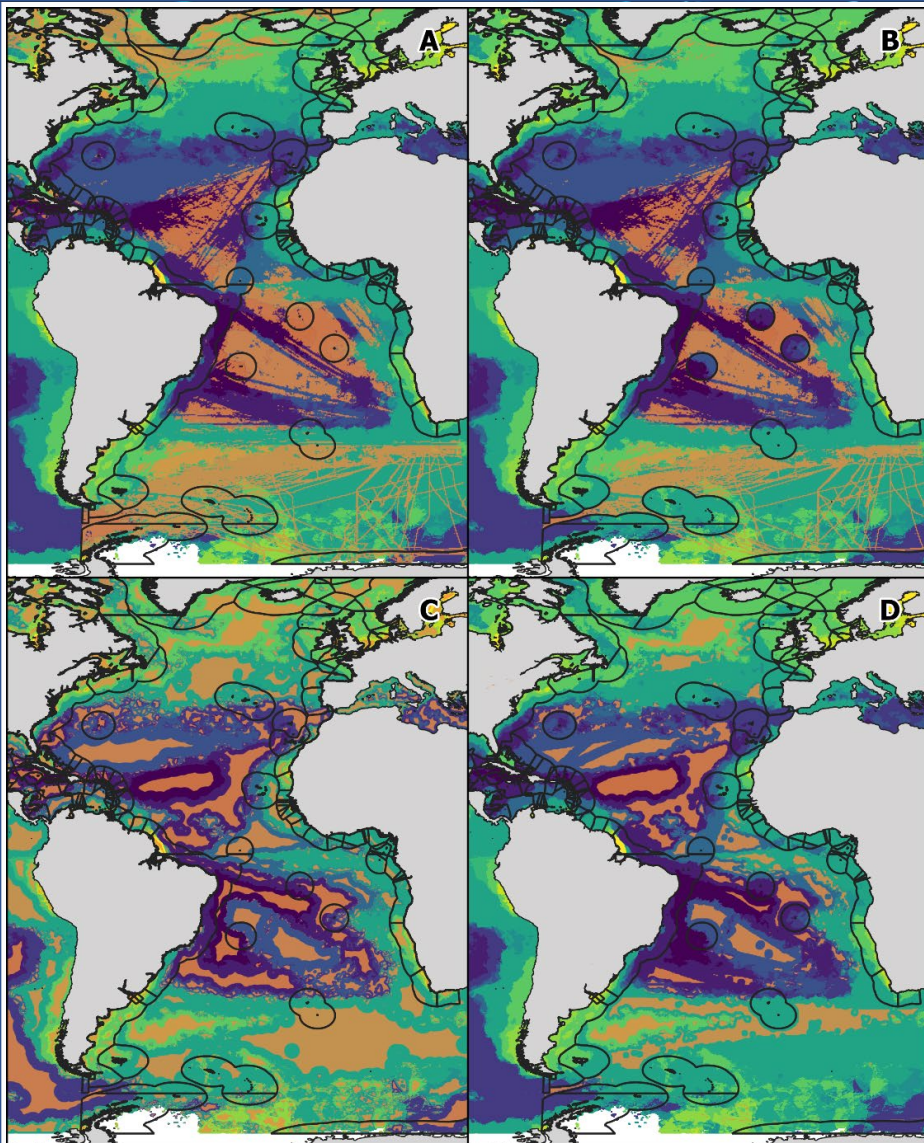
Valle, M., Ramírez-Romero, E., Ibaibarriaga, L., Citores, L., Fernandes-Salvador, J. A., & Chust, G. (2024). Pan-Atlantic 3D distribution model incorporating water column for commercial fish. *Ecological Modelling*, 490, 110632. <https://doi.org/10.1016/j.ecolmodel.2024.110632>

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BOOMS Biodiversity in the Open Ocean Mapping, Monitoring and Modelling

PML | Plymouth Marine Laboratory



EEZ
 Protected areas (SC - Highseas)
 Low traffic density areas
 High traffic density areas

Redistributed noise (dB)
 <60 (Unknown impacts)
 60 - 90 (Mammals)
 Protected areas (SC-Highseas)
 90 - 100 (Fishes)
 >100 (Invertebrates)
 EEZ

0 500 1,000 km
 Protected area
 EEZ
 Seascapes: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14



Tradeoffs of impacts on human activities and pressures

S	Shipping				Fishing			Mammal		Seabird	
	Pass.	Cargo	Tank.	Other	Pelag.	Bott.	Pass.	Dolphin	Porpoise	Great shearwater	Sooty shearwater
2	0.3	0.3	0.4	0.8	0	0	0	NA	NA	NA	NA
3	0.4	1.1	0.9	0.9	1.3	0	0	0	NA	0	NA
4	1.1	2	1.6	1	1.1	0	0	0	NA	0	NA
5	0.8	1.3	0.9	0.7	0.4	0	0	0	NA	0	NA
6	0.1	0.4	0.4	0.3	1.3	0	0	0	NA	0	NA
7	0.1	0.4	0.3	0.2	0.4	0	0	0	NA	0	NA
8	0.1	0.6	0.4	0.4	0.8	0.1	0	13.12	NA	11.06	10.04
9	0.6	1.4	1	0.8	1.6	0.1	0	1.16	NA	12.68	16.05
10	0.1	0.2	0.2	0.2	0.2	0.1	0	18.7	NA	29.08	12.17
11	0.3	0.4	0.3	0.4	0.3	0.1	0	0	0	36.04	6.64
12	0	0	0	0	0	0	0	NA	NA	NA	NA
13	0	0	0	0	0	0	0	NA	NA	NA	NA
14	0	0	0	0	0	0	0	NA	NA	NA	NA
Σ	4	8.1	6.5	5.6	7.5	0.3	0	32.98	0	88.86	44.9

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Marine Climate Change Observatories

Chust, G., Villarino, E., McLean, M., Mieszowska, N., Baccetti, L., Bulleri, F., ... & Lindegren, M. (2024). Crossbasin and cross taxa patterns of marine community tropicalization and deborealization in warming European seas. *Nature Communications*, 15(1), 2126.

Taboada, F. G., Chust, G., Santos Moco-roa, M., Aldanondo, N., Fontán, A., Cotano, U., ... & Ibaibarriaga, L. (2024). Shrinking body size of European anchovy in the Bay of Biscay. *Global Change Biology* 30(1), e17047.

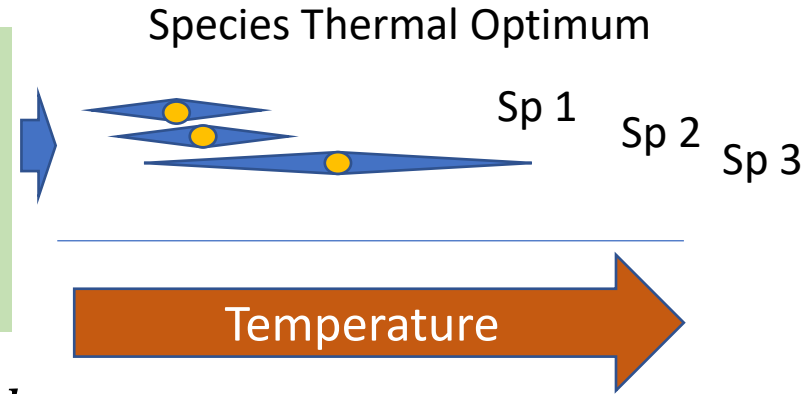
Erauskin-Extramiana, M., Chust, G., Arrizabalaga, H., Cheung, W. W., Santiago, J., Merino, G., & Fernandes Salvador, J. A. (2023). Implications for the global tuna fishing industry of climate change driven alterations in productivity and body sizes. *Global and Planetary Change*, 222, 104055.

Chust, G., González, M., Fontán, A., Revilla, M., Alvarez, P., Santos, M., ... & Uriarte (2012). Climate shifts and biodiversity redistribution in the Bay of Biscay. *Science of the Total Environment*, 803, 149622.



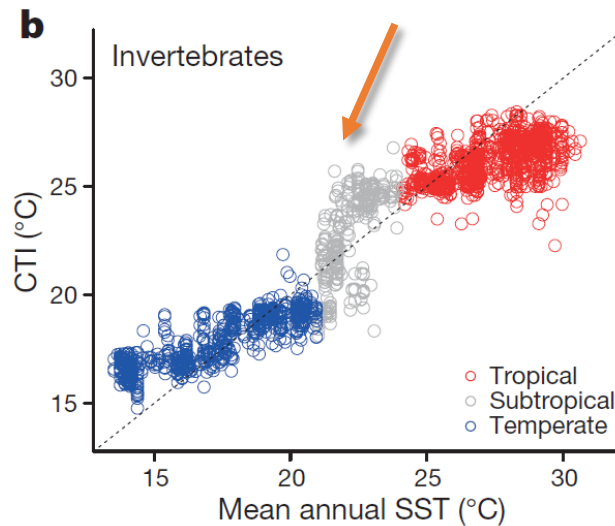
The community temperature index (CTI): a measure of the average thermal affinity of ecological communities, weighted by the relative abundance

- Experiments
- References
- Satellite
- OBIS, GBIF databases



$$CTI = \sum_{s=1}^n Temp.pref_s \times Relative.Abundance_s$$

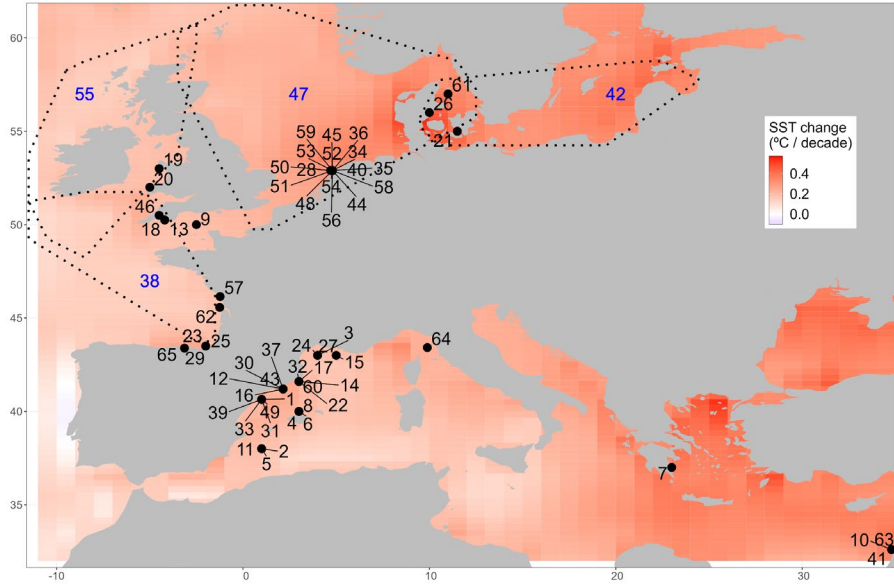
where the number of species in the community is n and each species (s) has a temperature preference and a relative abundance (the species' abundance divided by the abundances of all species) in the community



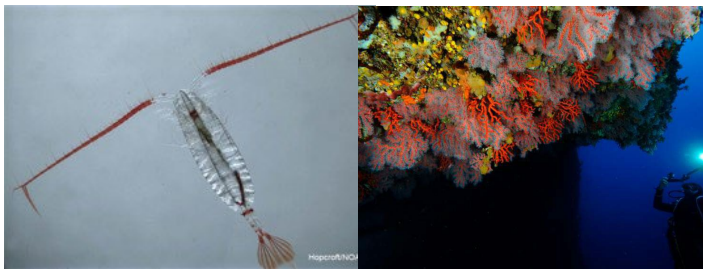
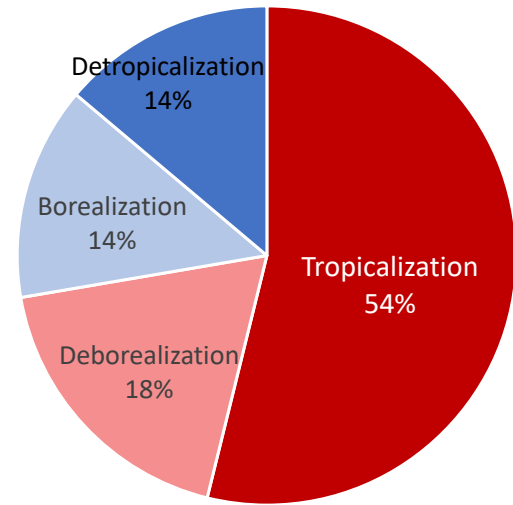
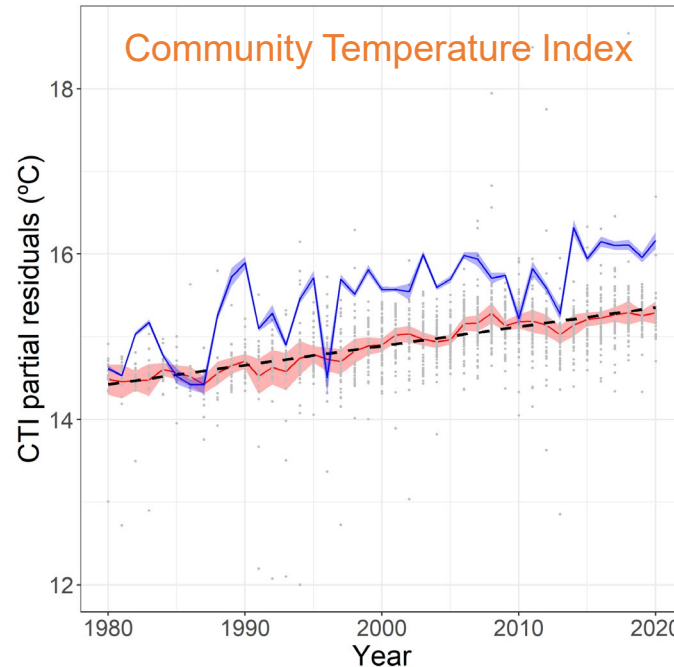
Thermal biases in relation to local environmental temperatures

Devictor et al. 2008. *Proc Roy Soc B: Bio Sci* **275**:2743-2748.

Stuart-Smith et al. 2015 *Nature*



- 65 series temporales de Biodiversidad (1980-2022)
- 1817 species
- Zooplancton, bentos, invertebrados pelagicos y demersales
- 418 especies de peces (pelágicos, demersales, estuaricos)



Chust, G., Villarino, E., McLean, M., Mieszkowska, N., Benedetti-Cecchi, L., Bulleri, F., ... & Lindegren, M. (2024). Cross-basin and cross-taxa patterns of marine community tropicalization and deborealization in warming European seas. *Nature Communications*, 15(1), 2126.

nature communications

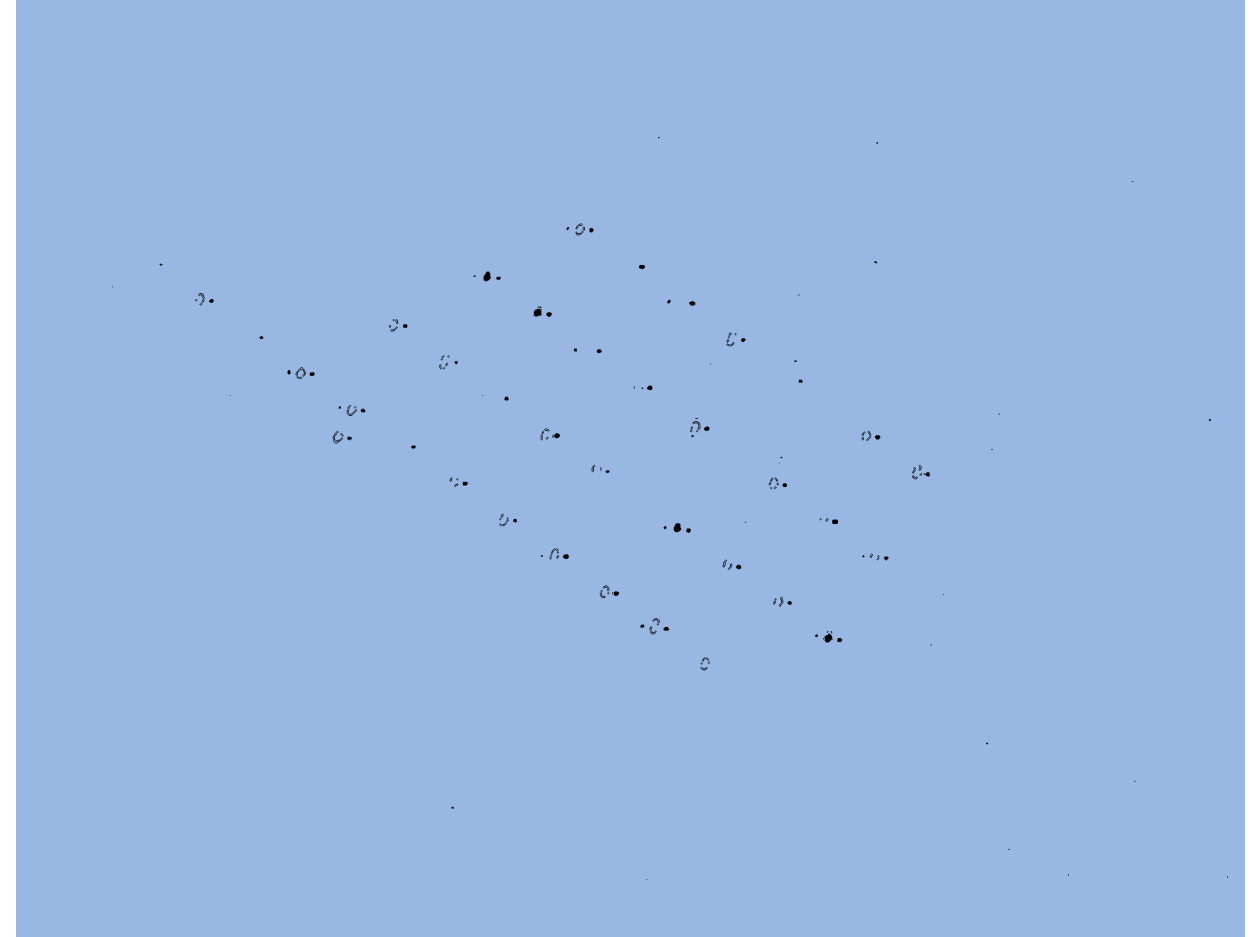
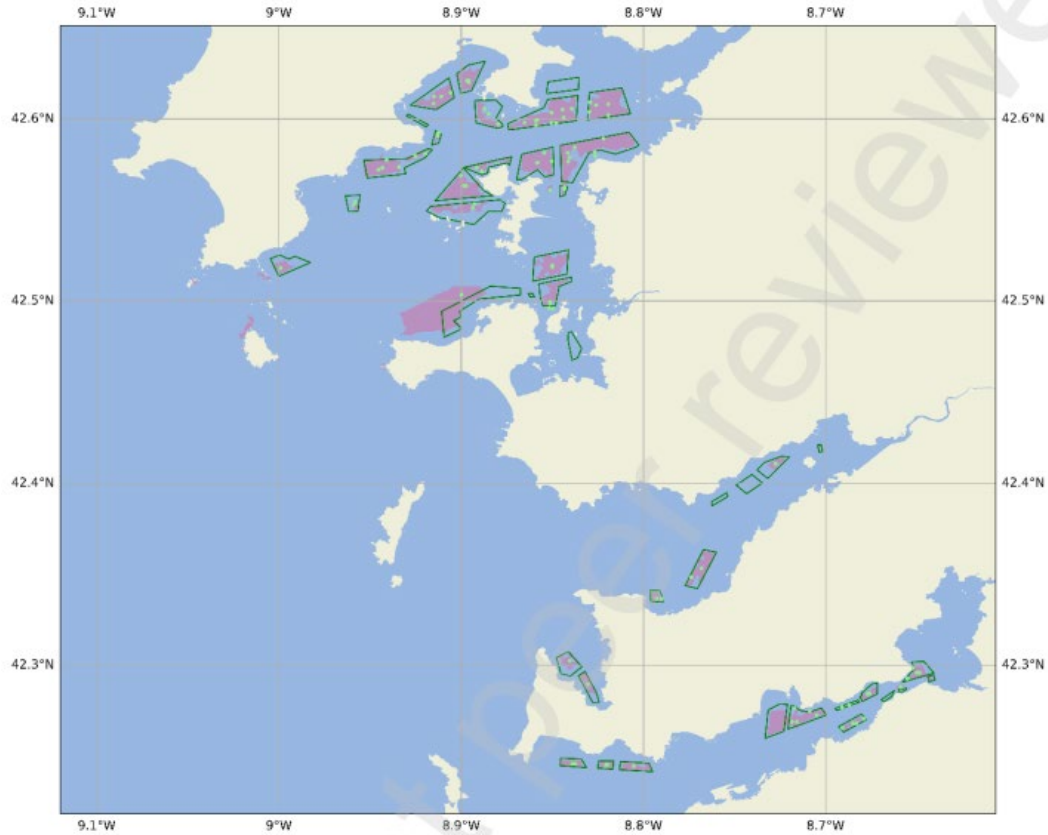
Article <https://doi.org/10.1038/s41467-024-46526-y>

Cross-basin and cross-taxa patterns of marine community tropicalization and deborealization in warming European seas

Human activities and pressures mapping from SAR images

Lekunberri, X., Ballesteros, B., Berman, J. D., Argandoña, C., Carreras, I., & Fernández-Salvador, J. A.
Automatic Mapping of Aquaculture Activity in the Atlantic Ocean.
<http://dx.doi.org/10.2139/ssrn.4665486>

And work in progress ...



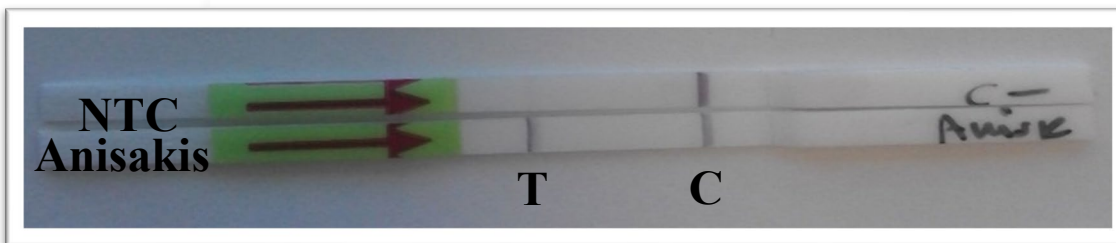
Lekunberri, X., Ballester-Berman, J. D., Arganda-Carreras, I., Fernandes-Salvador, Jose A., Automatic Mapping of Aquaculture Activity in the Atlantic Ocean. <http://dx.doi.org/10.2139/ssrn.4665486>

Windfarms



Three main research topics from AZTI:

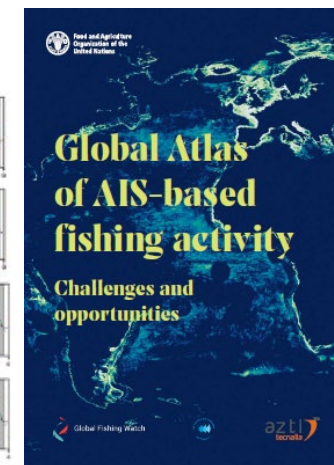
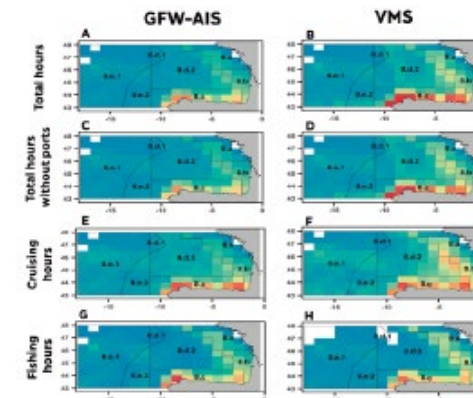
- Rapid DNA analysis (together with DAQua)



- Standards (fisheries FLUX) under FAIR, CARE and TRUST principles for fish data reporting (not only catches, ships of opportunity)

UN/FLUX 

- Unreported, unregulated and illegal fishing





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The use of big data and remote sensing for biodiversity monitoring in marine ecosystems

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