Adaptation options for vessels highly dependent on a limited number of species under climate and political changes. Case of New Aquitaine (France) southern fleets

N. Caill-Milly[1], C. Carter[2], C. Kermorvant[3], M. Lissardy[1], N. Bru[3]

[1] Ifremer, LITTORAL, 1 Allée du Parc Montaury, 64600, Anglet, France ; [2] INRAE, UR ETTIS, Centre de Nouvelle Aquitaine, Cestas, France ; [3] Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, LMAP, Anglet, France
Nathalie.Caill.Milly@ifremer.fr; caitriona.carter@inrae.fr; claire.kermorvant@univ-pau.fr; Muriel.Lissardy@ifremer.fr; NoelleBru@univ-pau.fr

1. Introduction

The European Union has developed a consistent regulatory framework to ensure sustainability of the exploitation of natural resources in the Northeast Atlantic. This regulatory framework is now applied to marine ecosystems impacted by climate change. Climate change induces modifications in biological and physico-chemical parameters within water bodies. These will in turn have a greater or lesser impact on a species depending on its habitat requirements, life cycle characteristics and its trophic position. Changes in latitudinal distribution or depth and/or changes in abundance have already been identified, impacting human activities that depend on these resources. It is therefore necessary to develop legislation, particularly in terms of borders and access rights, while also considering political changes. These can be variable and the cause of socio-economic uncertainties and tensions over maritime activities in shared spaces.

=> This poster focuses on the impact of these changes for fishing fleets that are highly dependent on these resources and on the possible options for adaptation without forgetting to take into account the need for a new political framework in relation to Brexit.

2. Material and Methods

2.1. Marine resources exploited by vessels of the southern Bay of Biscay

A recent review of thirteen species of importance for New Aquitaine fishermen indicated that modifications impacting related stocks and seen through the climate change prism, are mainly related to temperature, marine productivity, river flow regimes and, more incidentally, current and swell regimes. Among these modifications, changes in biogeographical limits with northward movements are the best documented such as for European hake (*Merluccius merluccius*) and anglerfish (*Lophius piscatorius*, *Lophius budegassa*).

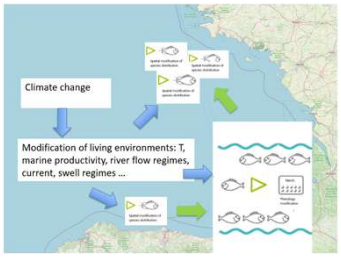
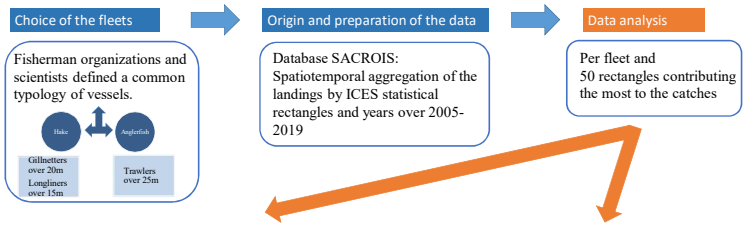


Figure 1: Summary of climate change effects on resources exploited by southern Bay of Biscay fleets.

2.2. From the choice of the fleets of interest to the data analysis

Among the New Aquitaine fishing vessels, three fleets are particularly dependent on hake and anglerfish: gillnetters over 20 m and longliners over 15 m for hake (95 % and 96 % of their incomes respectively); trawlers over 25 m for anglerfishes (53 % of their incomes).



Objectives	Methods/Visualization
Analysis of the evolution of the annual total catch per rectangle over the period: comparison of catches by year	Normalized principal components analysis -> correlation circle and plot of rectangles in the first factorial plane
Typology of rectangles having the same temporal profile (clustering of rectangles)	Hierarchical clustering on principal components (5) -> dendrogram
Zoomed-in analysis on the first paragon of each cluster	Graph of catch evolutions per fleet -> curves

Trends and spatial aspects were analyzed with respect to political considerations under two scenarii.

3. Results

3.1. Spatial distributions of the clusters (beginning)

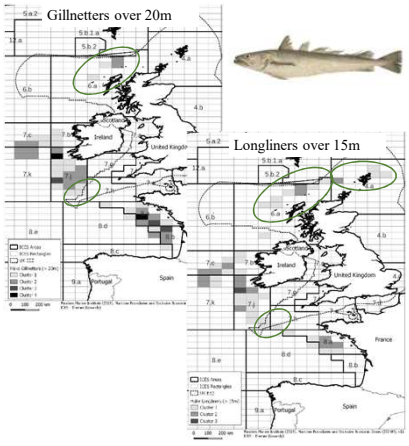


Figure 2: spatial distribution of clusters regarding gillnetters over 20 m (left) and longliners over 15 m (right) with identification of areas included in waters under UK jurisdiction following Brexit.

Spatial patterns are not clearly visible except that the continental slopes are mostly characterized by the lower catch levels for the different years.

Clusters	Fleets	Rectangle characteristics	Locations
Cluster 1	Gillnetters Longliners	Catches lower each year compared to the average	Great Sole Bank (north and centre) and on the continental shelf of South Brittany and South Bay of Biscay fishing grounds
Cluster 2	Gillnetters	Catches above average between 2005 and 2011	
	Longliners	Higher catches for years 2005, 2007-2012 and 2019	
Cluster 3	Gillnetters	Above average catches have been observed since 2014	
	Longliners	Very high catches from 2012 to 2018.	
Cluster 4	Gillnetters	Two rectangles with very high catches from 2005 to 2017	

=> The ICES areas with catches intersecting with the new exclusive economic zones of the UK are 6a and to a less extend 7j for gillnetters and 6a, 4a and to a less extend 7j and 7h for longliners.

3.1. Spatial distributions of the clusters (continued)

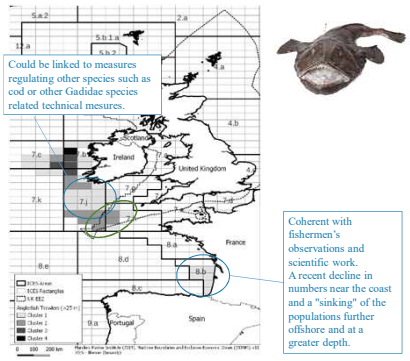


Figure 3: spatial distribution of clusters regarding trawlers over 25 m with identification of areas included in waters under British jurisdiction following the Brexit.

Spatial patterns are highlighted.

Clusters	Rectangle characteristics	Locations
Cluster 1	Catches under the average for each year of the studied period except 2006	Middle of Great Sole Bank, to the west of Porcupine Bank and to the north, close to the coast in the west of Ireland and in the south Biscay
Cluster 2	Catches above averages for years 2011, 2012, 2015, 2017 and 2019.	Mainly to the south and to the north of Great Sole Bank
Cluster 3	Catches at very high levels for years 2007 to 2019 for cluster 3 and for years 2005-2012 and 2016-2019 for cluster 4	Between the west of Ireland and Porcupine Bank and to the north of Great Sole Bank
Cluster 4		

=> The ICES areas with catches intersecting with the new exclusive economic zones of the UK are 7j, 7h and 7g.

3.2. Regulatory, market and political considerations under two scenarii

Two scenarii have been examined at this stage: vessels continue fishing the same species (scenario 1) or they alter their practices and fish new species (scenario 2).
Under scenario 1, EU and Brexit rules and organizations determine access to fishing stocks/areas in an unstable political situation. In addition, regulatory considerations relating to landings differ between EU and UK (traceability, customs). For scenario 2, new financial mechanisms are required to support fishers' adaptation. As production and markets interconnect, new political work is also needed to create new markets (local or global), which could be collectivized (for example via professional organizations, local fishermen's associations, etc.). Under both scenarii, the challenge is to ensure equitable and sustainable fisheries management.

Scenario 1

In EU waters	In UK waters
Ecosystem approaches French fishers have a voice over access to stocks/areas in domestic fisheries' management committees and in EU marine region Advisory Councils (ACs).	Temporary access (UK-EU Trade and Cooperation Agreement: TCA) (2020) based on quotas and historic track records for non-quota species (2012-2016) 90% of French licenses have been authorized (including 53 vessels registered in Bayonne). A new Specialized Committee on Fisheries (SCF) has been created (Article 508 TCA) to ensure sustainable co-management of stocks. Formal, 'old fashioned' intergovernmental style committee (30 EU & 45 UK officials) likely to generate UK-EU 'stand-offs' (and trade-offs) over access and stock management

Scenario 2

In EU waters	In UK waters
CFP norm of relative stability determining quotas and access (as well as national regulations) = rigidity and barriers to access for newcomers Fleets cannot 'just change' to catch the fish now in their waters: fleet adaptation requires technical flexibility or acquisition of appropriate vessels/gear, as well as new skills for skippers.	
	An alternative zonal attachment mechanism might seem appealing (this was a UK proposal), but does not solve all problems for just and sustainable management of mobile stocks.
Additionally, current co-habitation agreements which regulate different professions fishing a common stock (using different gears) might need revision.	

4. Discussion/Conclusion

- Preliminary analysis with choice to work on catches of three fleets to understand future changes in enterprise strategy and governance.
- Potential future spatial issues were identified (UK EEZ, distribution of quotas by area). They differ between hake and anglerfish.
- Regulatory adaptation requirements were considered under two scenarii.
- It would be interesting to continue this work focusing on the vessel level and incorporating other species.
- More globally, this work complements another (the VentsEtMarées project) on the impact of weather conditions on fishing activity. The latter focused on the smallest vessels. Both aim to understand the vulnerability of fishing companies altering their practices following climate change.

Selected references
AcclimaTerra, Le Treut, H. (dir), 2018. Anticiper les changements climatiques en Nouvelle-Aquitaine. Pour agir dans les territoires. Éditions Région Nouvelle-Aquitaine, 488 pp.
Branders, K., 2010. Impacts of climate changes on fisheries. Journal of Marine Systems 79(3): 389-402. doi: 10.1016/j.jmarsys.2008.12.015
Gallet, F., Ducommun-Rigole, L., Caill-Milly, N., Lesueur, M., Gueguen, A., Lissardy, M., Morandeau, G. and Le Grand, C., 2019. Étude du poids socio-économique de la filière pêche dans le quartier maritime de Bayonne. Rapport final du projet EPOSE (Étude du POids Socio-Economique de la filière pêche dans le quartier maritime de Bayonne). CIDPMEM64-40/Ifremer/Agrocampus Ouest/CRPMEM Nouvelle-Aquitaine, 56 pages.
Gormley et al, 2015 Adaptive management, international co-operation and planning for marine conservation hotspots in a changing climate, Marine Policy, 53: 54-66.
Mahévas, S., Trenkel, V., Doray, M., Peyronnet, A. Hake catchability by the French trawler fleet in the Bay of Biscay: estimating technical and biological components, ICES Journal of Marine Science (2011), 68(1), 107–118. doi:10.1093/icesjms/fsq140.
Mateo, M., Pawlowski, L. and Robert, M., 2016. Highly mixed fisheries: fine-scale spatial patterns in retained catches of French fisheries in the Celtic sea. ICES Journal of Marine Science 74: 91–101. doi:10.1093/icesjms/fsw129.
Perry, AL., Low, PJ., Ellis, JR., Reynolds, JD., 2005. Climate change and distribution shifts in marine fishes. Science 308(5730). 1912-1915. doi: 10.1126/science.1111322
Rijnsdorp, AD., Peck, MA., Engelhard, GH., Möllmann, C. and Pinnegar, JK., 2009. Resolving the effect of climate change on fish populations. ICES Journal of Marine Science, 66:1570–1583.
Stewart, B. D., Williams, C., Barnes, R., Walmsley, S. F., & Carpenter, G. (2022). The Brexit deal and UK fisheries—has reality matched the rhetoric?. Maritime Studies, 21(1), 1-17.

This work area is supported by the Regional Scientific Committee on Climate Change (in https://www.acclimaterra.fr) and the Regional Research Network Futurs-ACT (Anticipating the evolution of climate change in the territories) (https://futurs-act.fr/).