

Including dynamic fishermen behaviour in a fisheries simulation model to assess the impact of environmental changes

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Background :

Since 2005, the Bay of Biscay pelagic fleet is experiencing a severe crisis following the closure of the anchovy fishery. This closure was adopted due to a serie of low biomass levels and poor spring recruitment in recent years. Anchovy in the Bay of Biscay are targeted by three distinct fleets: the French pelagic trawlers and purse seiners and the Spanish purse seiners.

Objectives :

In the current context of fisheries management simulation models are a useful tool to assess the evaluation of management scenarios. These models should include the key processes of the fishery system: stock dynamics, fleet dynamics, management implementation, and the interactions between these three elements.

To assess these questions, we first developped a Random Utility Model of fisher's choices to describe the effort allocation of the French pelagic trawlers and tested its capacity to predict the effort reallocation during the anchovy closure in 2005.

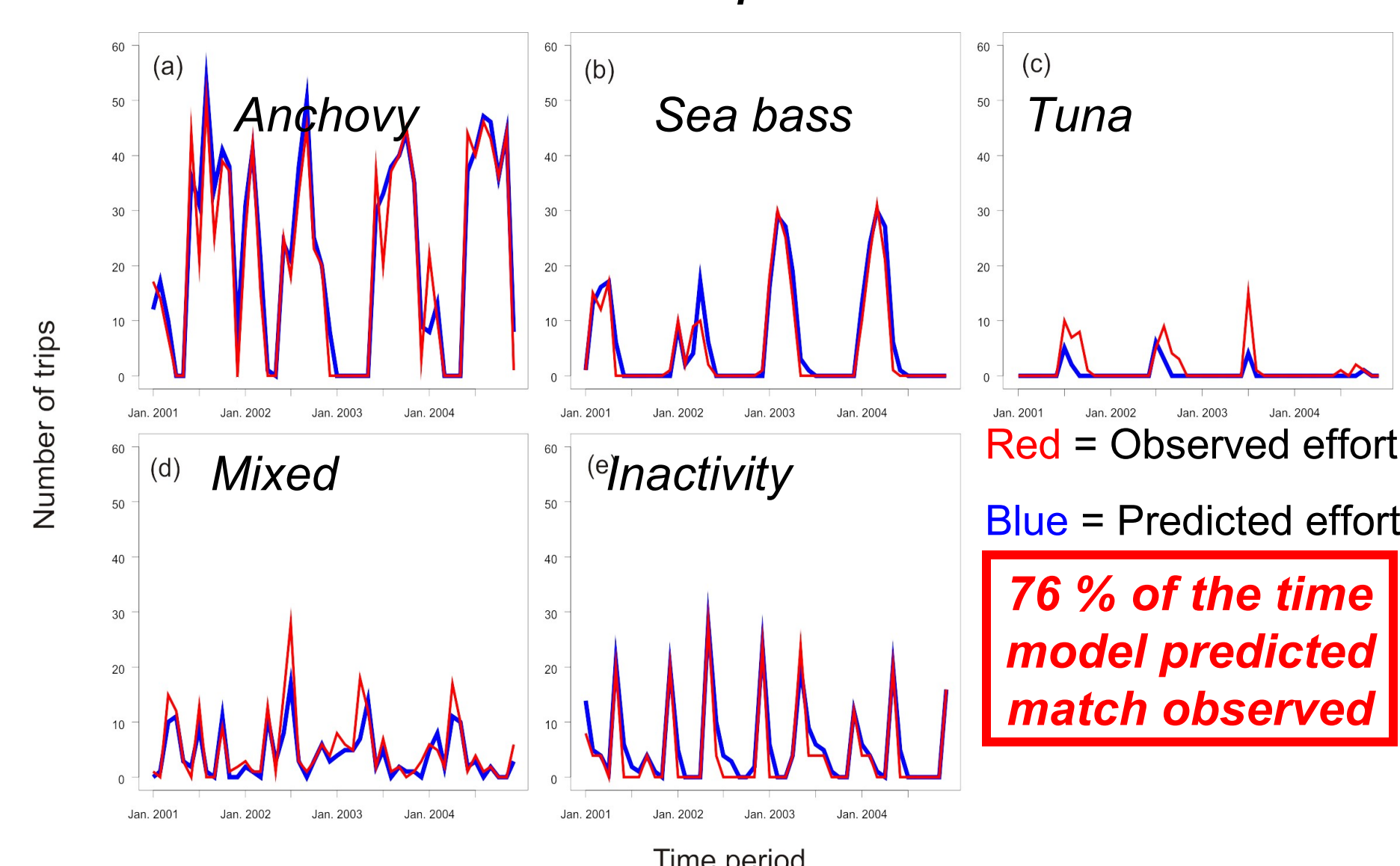
RUMs are now integrated in the generic and spatially explicit fishery simulation model ISIS-Fish to predict fishery response to alternative management options.



Fleet dynamic model simulating métiers choices using Random Utility Model (Model Fit) (Vermard et al. 2008)

Trip based model using as attributes a lagged percentage of the value per unit of effort of the main species caught, total value per unit of effort and inertia to change from one métier to another

Validation on observed trips

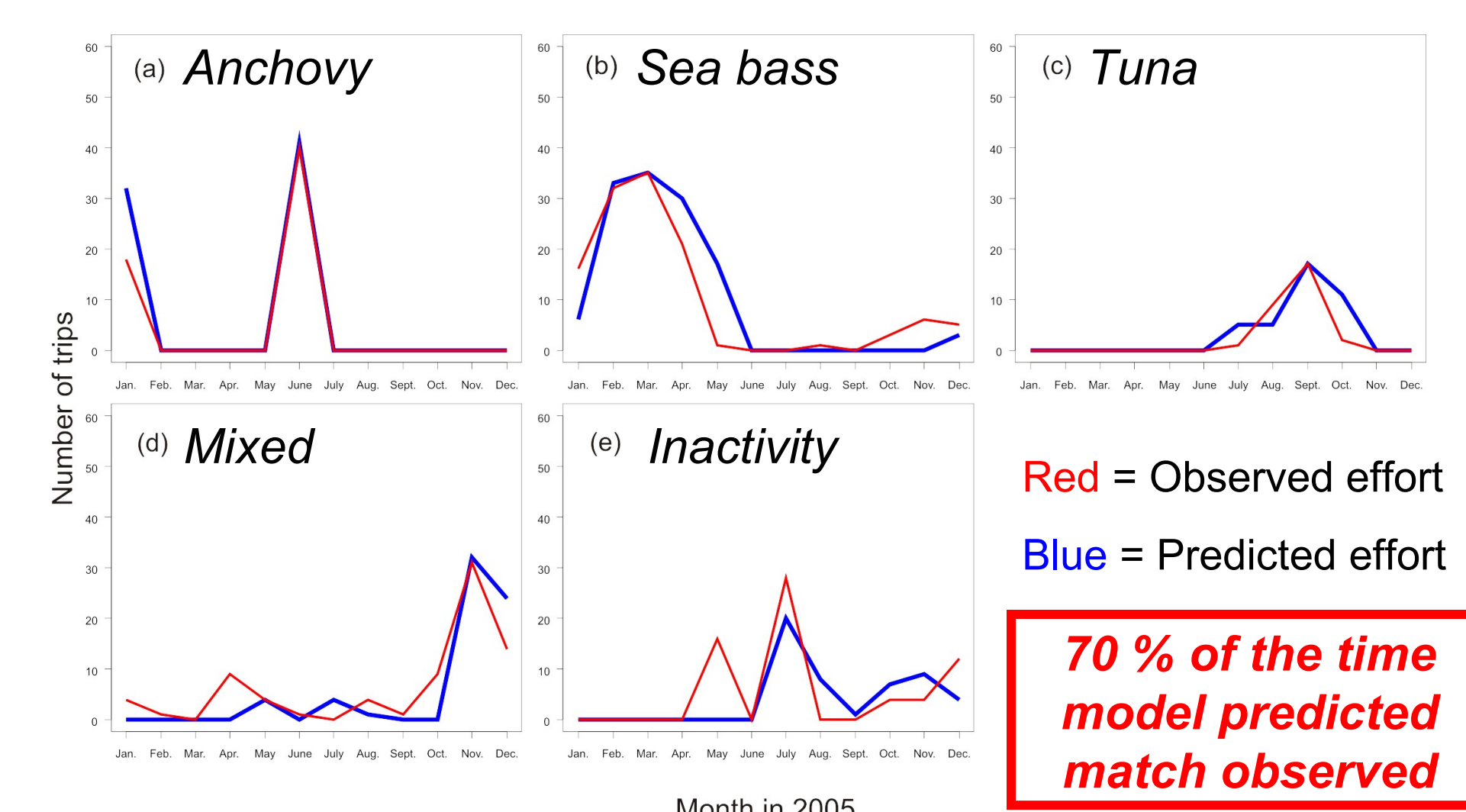


Comparison between predicted and observed number of trips per métier during the calibration period 2001-2004

Prediction of effort reallocation by the fleet in response to the fishing ban in 2005 using RUMs coefficients (Vermard et al. 2008)

Simplified model of fleet dynamics, using the coefficient estimated in the previously described behavioral model.

The fishing ban from February to May and since July is modelled by a coefficient equal to 0 for the métier targeting anchovy.



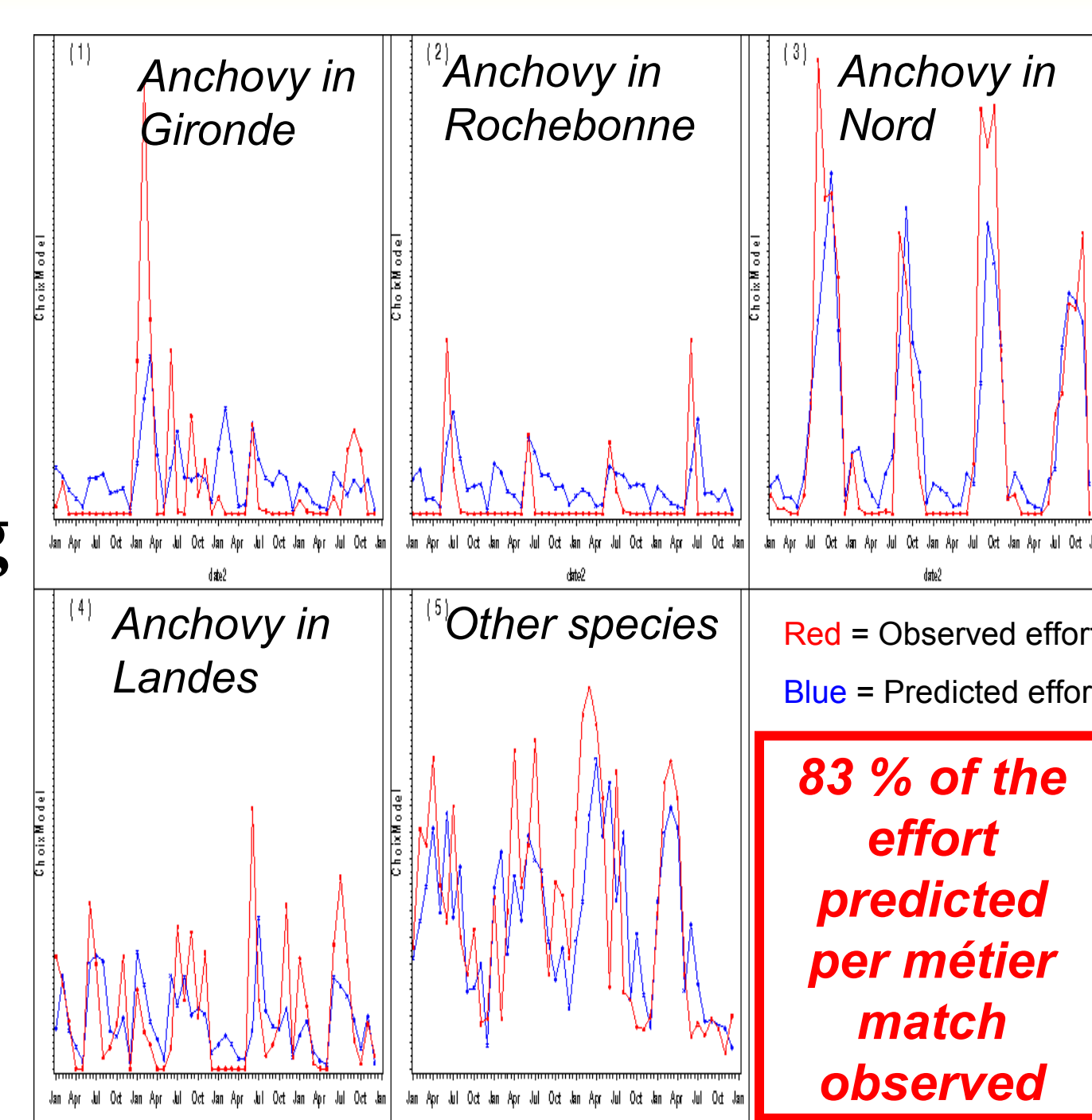
Comparison between predicted and observed number of trips per métier during the fishing ban (January to May and July to December 2005)

Spatialisation and monthly time scale RUMs for integration in ISIS-Fish

In ISIS-Fish (Mahévas and Pelletier 2004, Pelletier and Mahévas 2005), time step is the month and métiers are defined according to species targeted and areas of practice. The structure of the RUM is thus modified to predict the monthly proportion of effort on each métier (species*area).

Attributes are the percentage of effort per métier the month m-1 and m-12 (habits last month and last year same month) and the mean Value per Unit of Effort per species (Anchovy and « Other species ») per métier the month m-1.

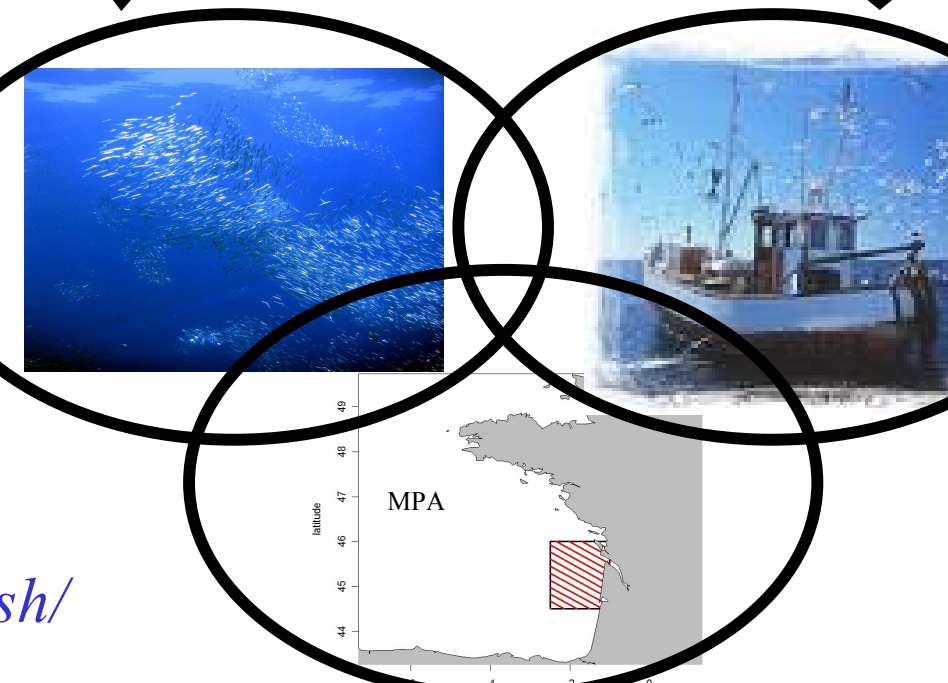
RUM fitting



Comparison between predicted and observed number of trips per métier during the calibration period 2001-2004

Anchovy population dynamics (Lehuta et al., submitted)

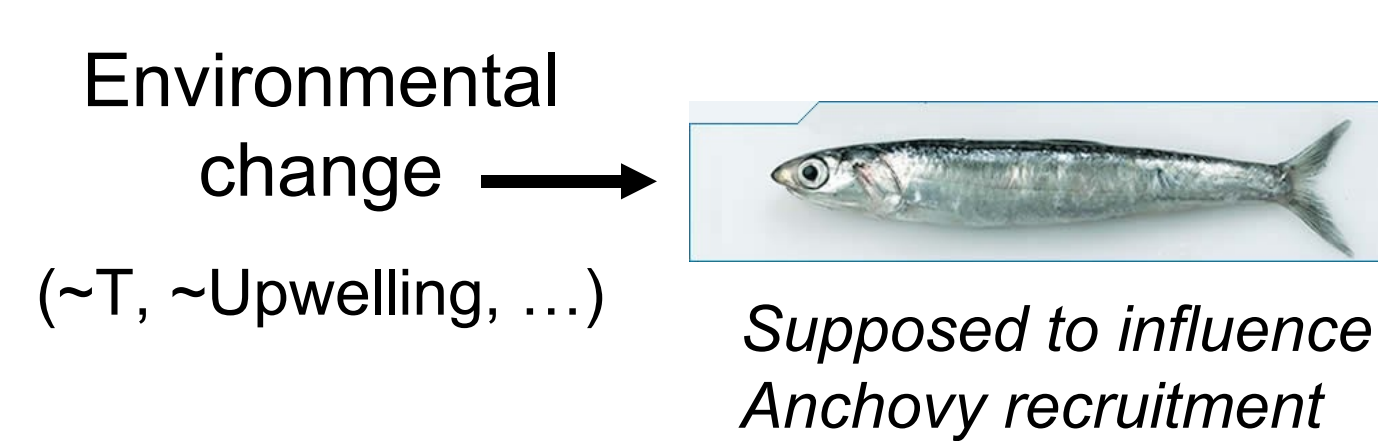
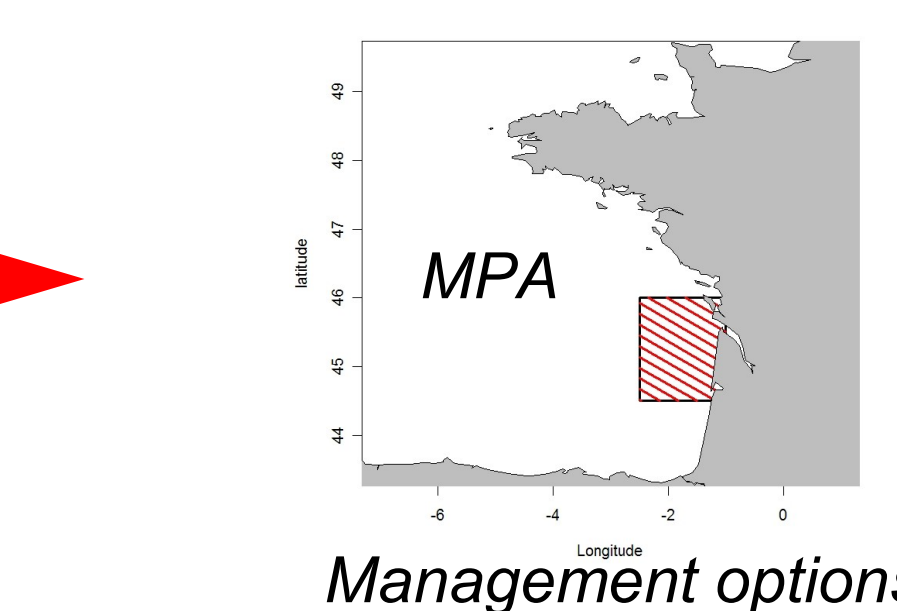
ISIS-Fish
Anchovy fishery application



<http://www.ifremer.fr/isis-fish/>

Perspectives

The aim is to obtain a realistic modelling of fishermen adaptive response to spatial management options under various environmental scenarios to enable management assessment.



References

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- Mahévas, S. and Pelletier, D. 2004. ISIS-Fish, a generic and spatially-explicit simulation tool for evaluating the impact of management measures on fisheries dynamics. *Ecol. Model.* 171: 65-84.
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