Combining Fleets and population dynamics

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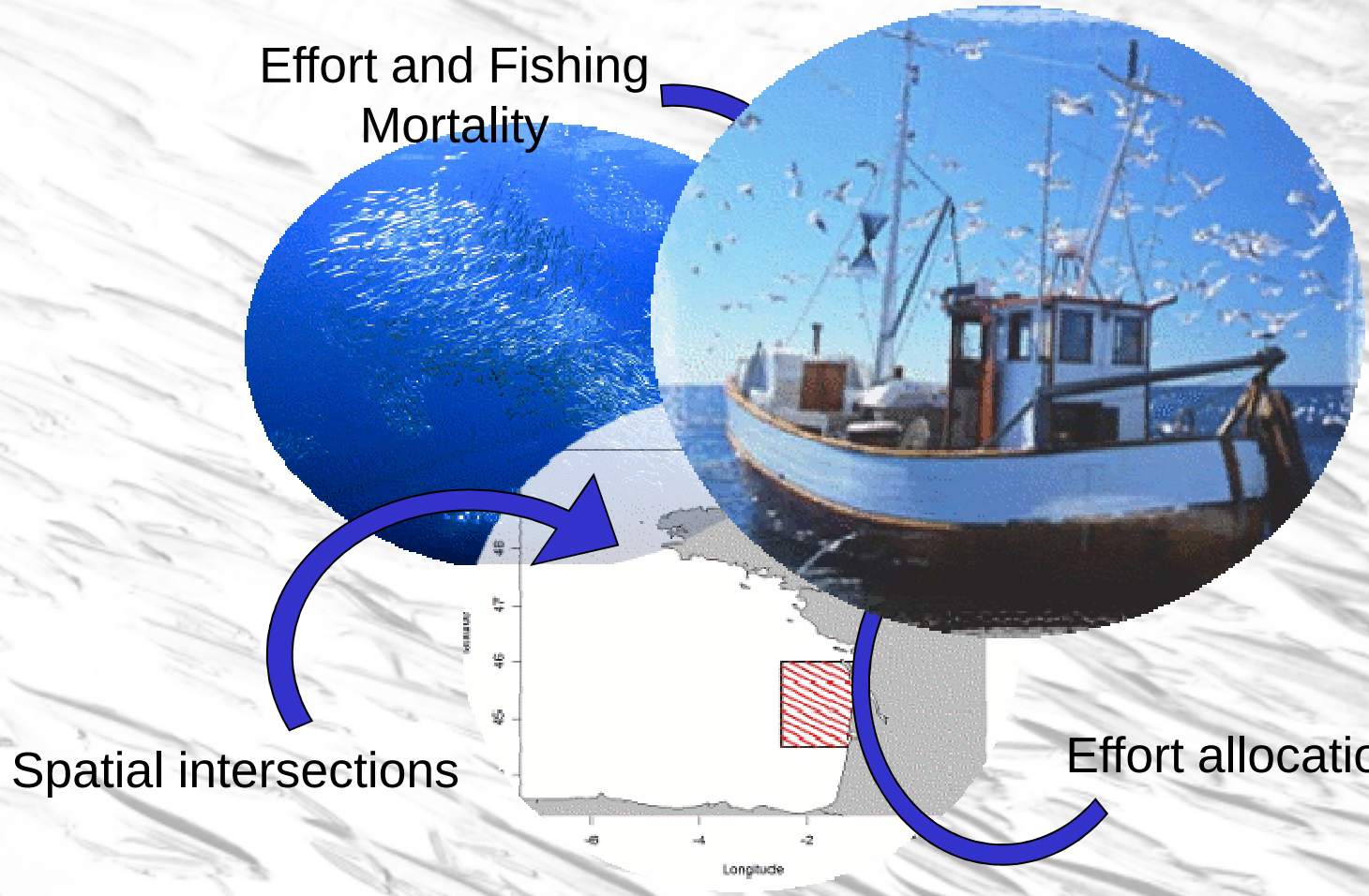
A complex system



A complex system with multiple interactions

Focus on Fishing behavior

Combining Fleets and population dynamics

- Can we reproduce the fleets and population dynamics over the period 2000 2004?
  - Using the mean effort allocation pattern
  - Using Random Utility Model
- Using ISIS-Fish to test management measures and assessing the impact of the fleet dynamic module in the evaluation of managemant strategies building on TAC and Marine Protected Areas

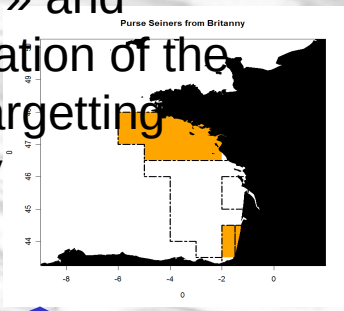
Combining fleet dynamics and population dynamics

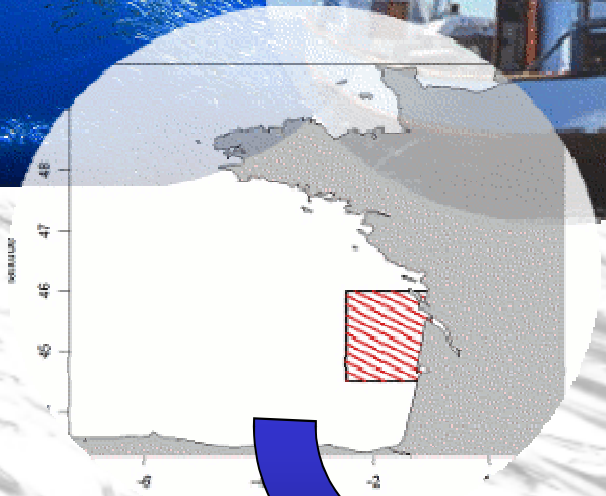
Effort allocation

1 population

=> Anchovy

Aggregation of the « others » and spatialisation of the métier targetting Anchovy





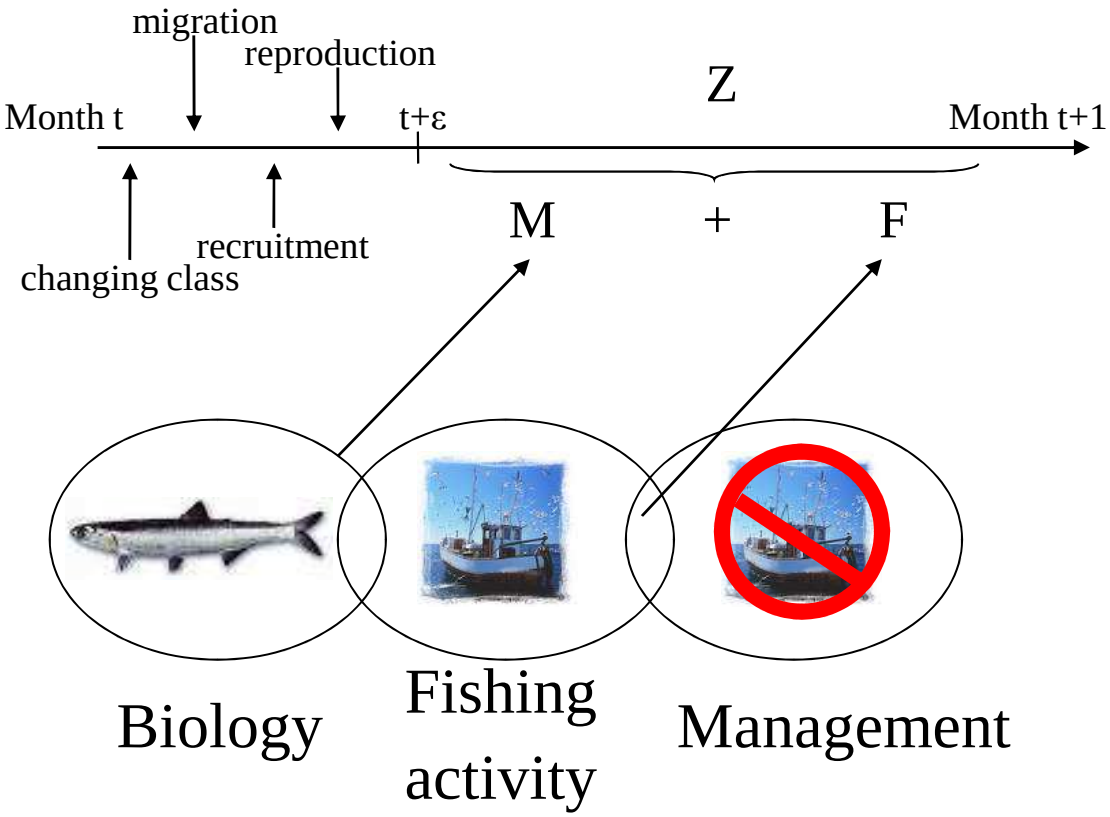
2 Management measures

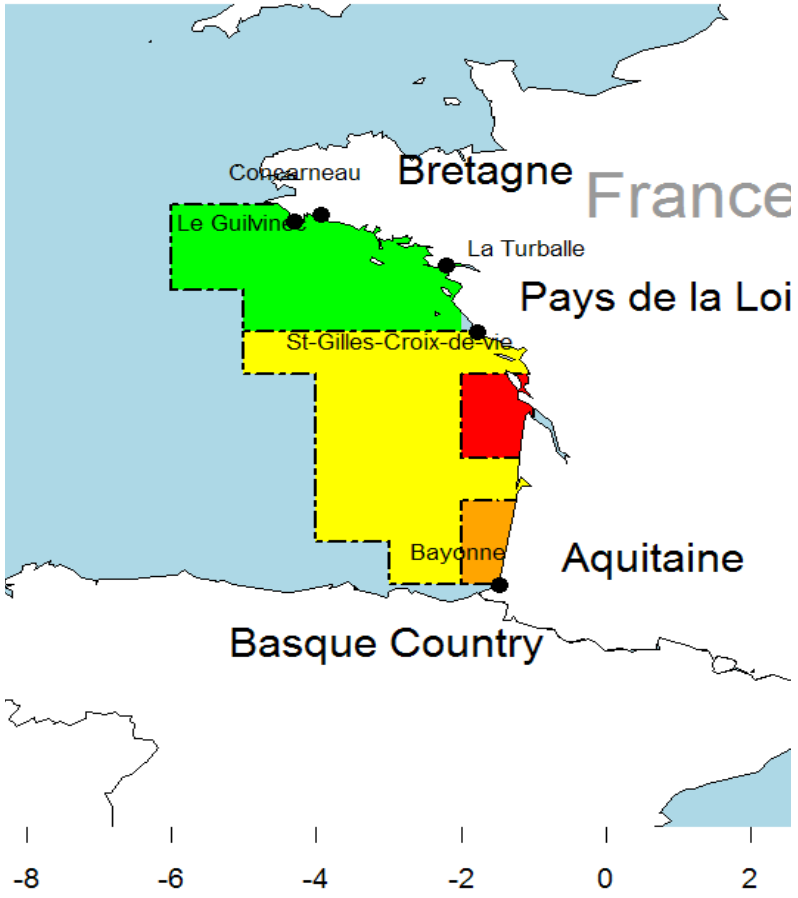
-Effort Reduction
-MPA (2)
In a context of TAC

ISIS-Fish simulation tool

1 model = 3 sub-models:

Seasonnally and spatially explicit





Combining fleet dynamics and population dynamics

Effort allocation

1)

STATIC EFFORT ALLOCATION

Constant per month

= average value during 2000-2004

Total Effort of each fleet (E)

p1 → Effort Métier 1

p2 → Effort Métier 2

p3 → Effort Métier 3

p4 → Effort Métier 4

2)

DYNAMIC EFFORT ALLOCATION

Proportions computed at each time step

Based on Effort previous year, Landed value on anchovy and other species last month (Spatialized)

Structure of the model

Random Utility Model

Probability choice $_i$ = f (Utility(Choice $_i$))

Utility = αi * TOTVPUE + γi * PERCLAGVPUE

High VPUE for the past trip may impact the probability of targetting the same species the next trip

Catch profile in value of the past trip may impact the choice of next trip

2 Steps approach

Fitting the RUM on a past period (2000-2004) and simulating dynamics

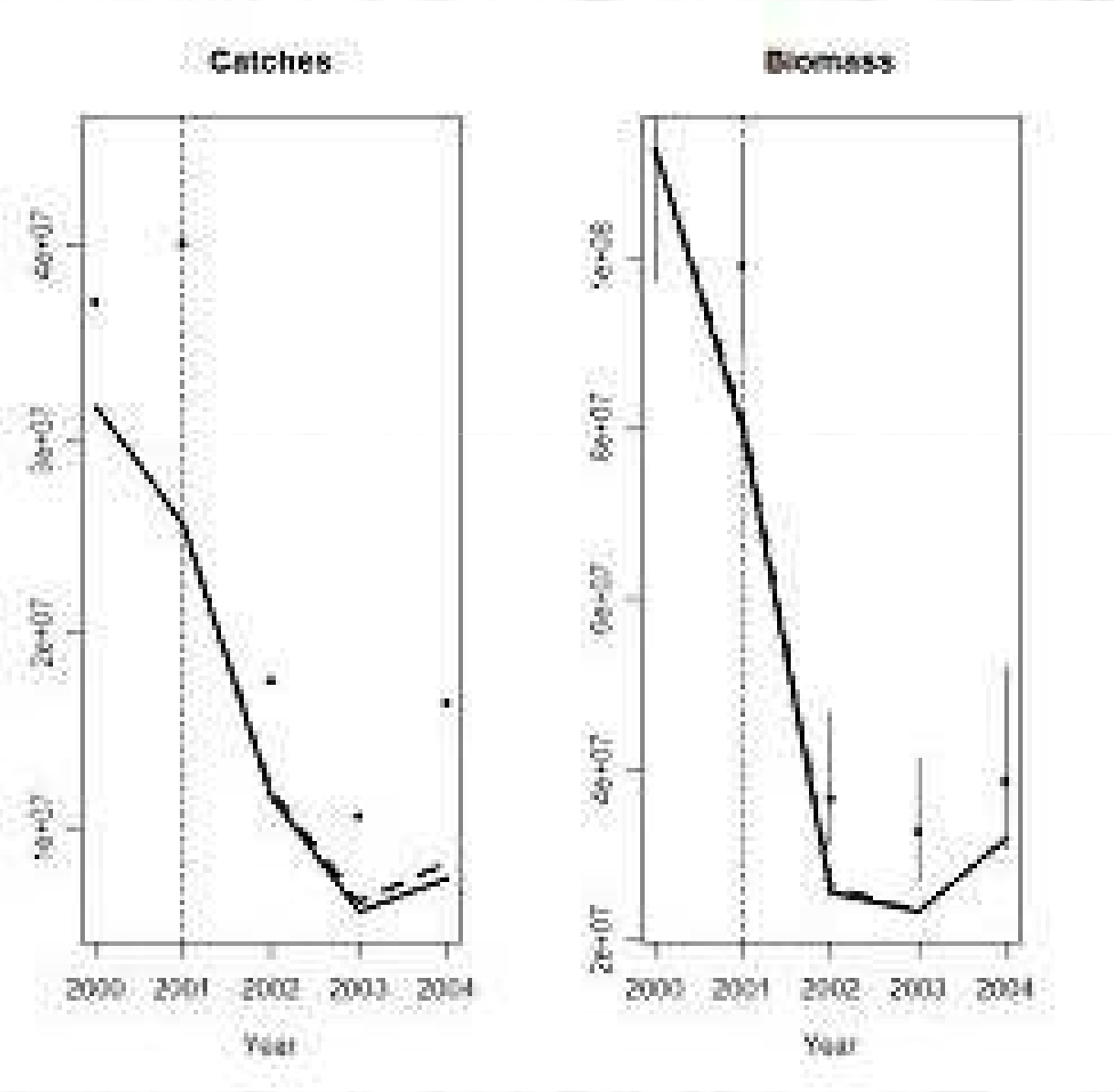
To assess the model's reliability

Simulate new management measures

To assess the impact of dynamics hypotheses on the management measures efficiency

Combining fleet dynamics and population dynamics

1/ Assess the model's reliability



2 Steps approach

Fitting the RUM on a past period (2000-2004) and simulating dynamics

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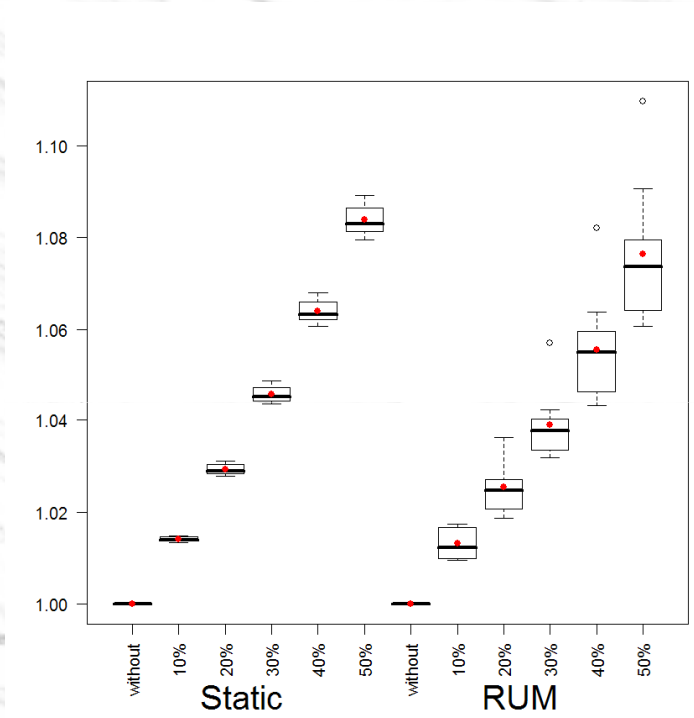
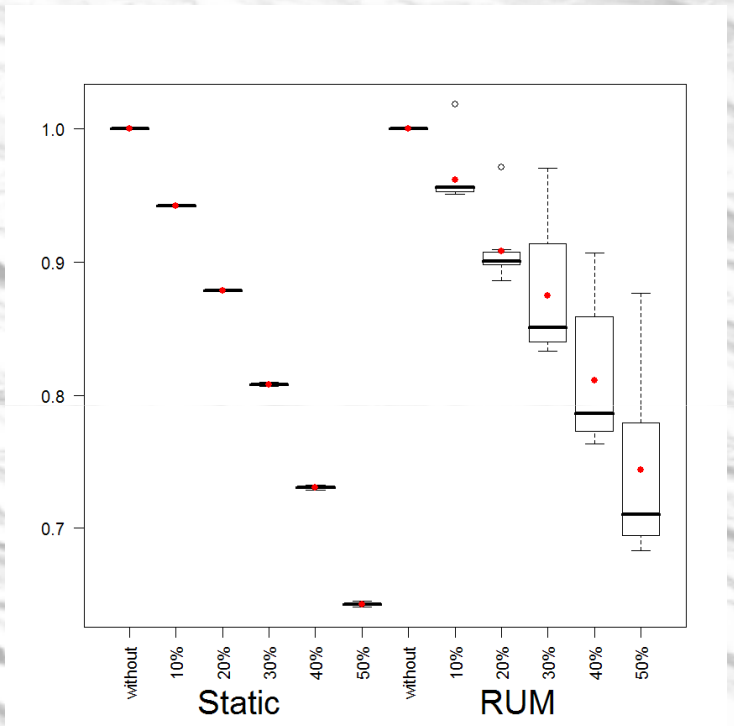
2/ Management measure efficiency: Total Effort Reduction

Gain in biomass compared with no Effort reduction



Gain in catches compared with no Effort reduction

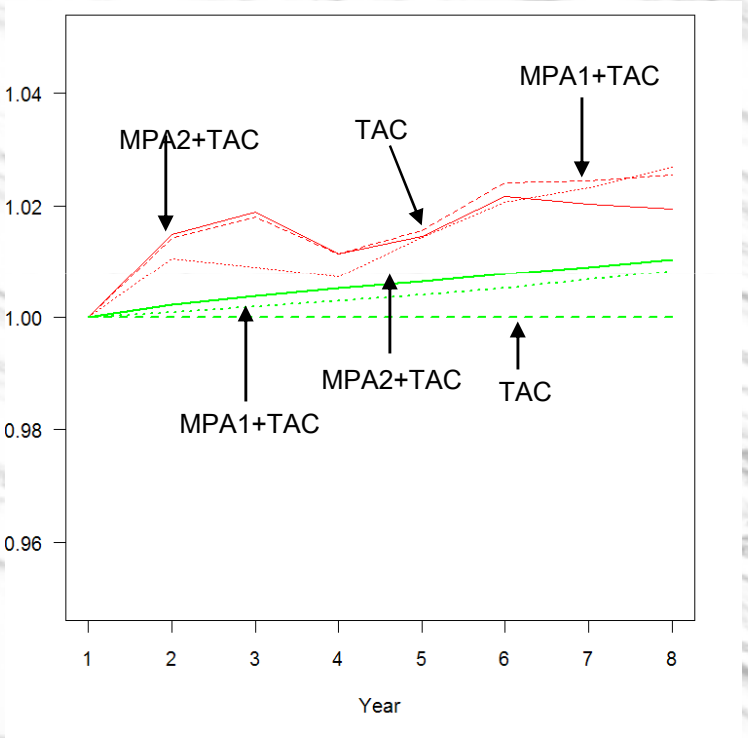


Taking into account fleets dynamics leads to more pessimistic forecasts

Combining fleet dynamics and population dynamics

2/ Management measure efficiency: Spatial management measures

Gain in biomass compared with no MPA static effort allocation

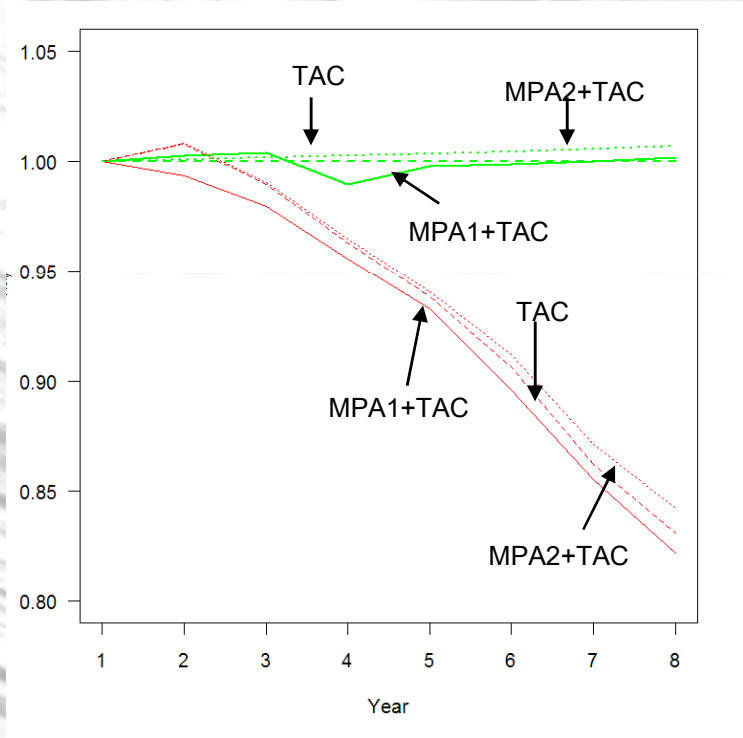


Fish migration in January

Green=Static effort allocation

Red=Dynamic effort allocation

Gain in biomass compared with no MPA static effort allocation



Fish migration in April

Conclusion

- Implementation of a dynamic model of effort allocation on top of a model of stock dynamics
  - Impact of the dynamics hypotheses
  - Importance of describing the system's dynamics
- Groundtruth results against observations

- Improving the spatial distribution knowledge of the anchovy's distribution

Confirm the importance of system's dynamics in the Management Scenario Evaluation


Thank you for your attention!

- **Modelling the « other » species** (Sardine, Sea Bass and Tuna)
- Better description of the fishery and interactions
- Impact of management on Mixed fisheries
- BUT: Are biological data available?

  Dynamics of these species impacted by « other » fleets

- **Taking costs into account in the RUM**
- Profit maximization
- BUT: Data are in general not available at the scale of the trip to characterise costs associated to each métiers

➢ Using the VMS to approximate fuel costs and weight economic attractivity by travelled distance (Fuel cost for pelagic trawlers ~31% of gross revenue)

Conclusions

- RUM allows for:

→ Describing fishing behavior

→ Predicting changes in fishing behavior the first year of the anchovy closure

- Assess the impact of fleets dynamics on exploited populations using Operational Models that combine fleets and populations dynamics

Confirm the importance of including fisher' responses in the assessment of the potential impact of fishing bans