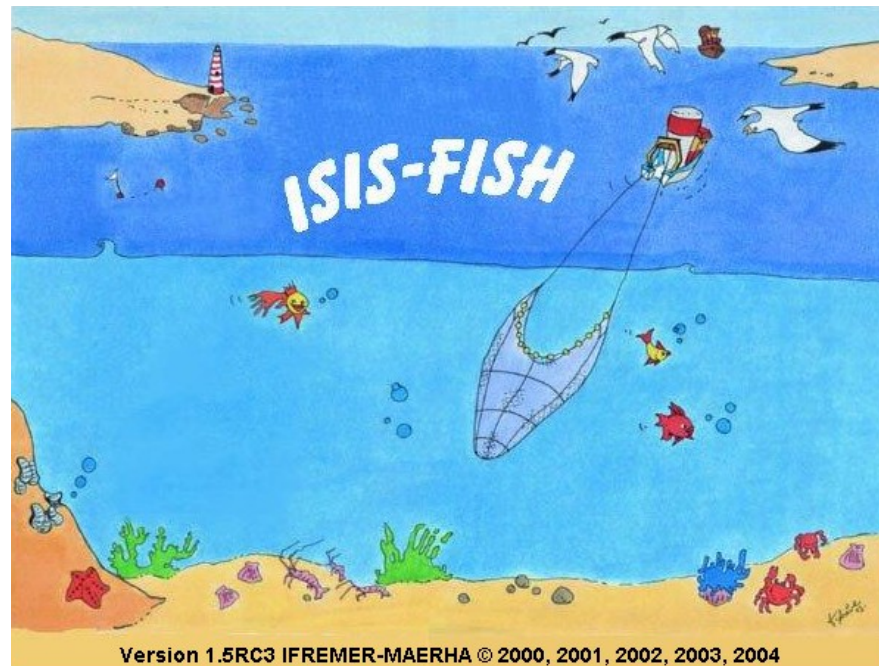
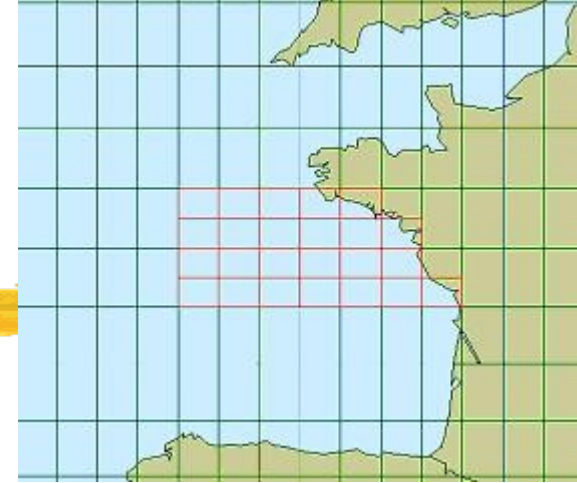


Assessing the impact of marine protected areas on the Hake-Nephrops fishery of the Bay of Biscay using ISIS-Fish



**Hilaire Drouineau - Stéphanie Mahévas - Dominique Pelletier -
Benoît Beliaeff**

IFREMER - Laboratoire MAERHA



Introduction

■ Context of the fishery

- TAC regulated
- alternative management (spatial, effort) : Which one?
- ISIS-Fish: simulation tool to test spatial and seasonal management measures for mixed fisheries

■ Approach

- Parameterisation of ISIS-Fish
- Sensitivity of the model to uncertain parameters
- Simulation study to quantify the impact of management measures

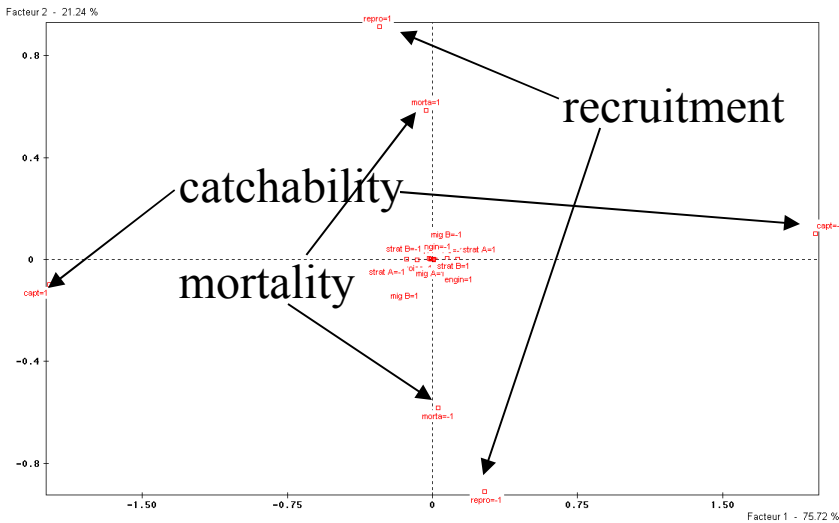
Parametrisation of ISIS-fish for Bay of Biscay Nephrops-Hake

- ISIS-Fish: single stock dynamics with technical interactions
- Parameters values:
 - Literature : => biological parameters + selectivity
 - Data analysis : log-books, market sampling, fishers interviews
 - => fishing activity parameters

Sensitivity analysis of ISIS-Fish

- Identification of uncertain parameters
- Level of uncertainty : Min, Max
- Experimental design of simulations :
 - fractional factorial design - group screening
 - Nb of factors : 106 => Nb of groups : 9
 - 128 simulations
- Output variables:
 - Abundance in last year (year 10)
 - 5 final years cumulated catch (in numbers)
 - catch in last year
- Analysis : PCA and ANOVA

Sensitivity analysis of ISIS-Fish



	Recruitment	Mortality	Catchability
Abundance Hake	1.6	1.3	0.8
Abundance Lobster	1.2	1.2	0.5
Catches last 5 years Hake	1.6	1.4	6.6
Catches last 5 years Lobster	1.2	1.3	5.7

- No significant interactions
- catchability: most sensitive parameter
- Improve the methodology
- Be cautious with the results

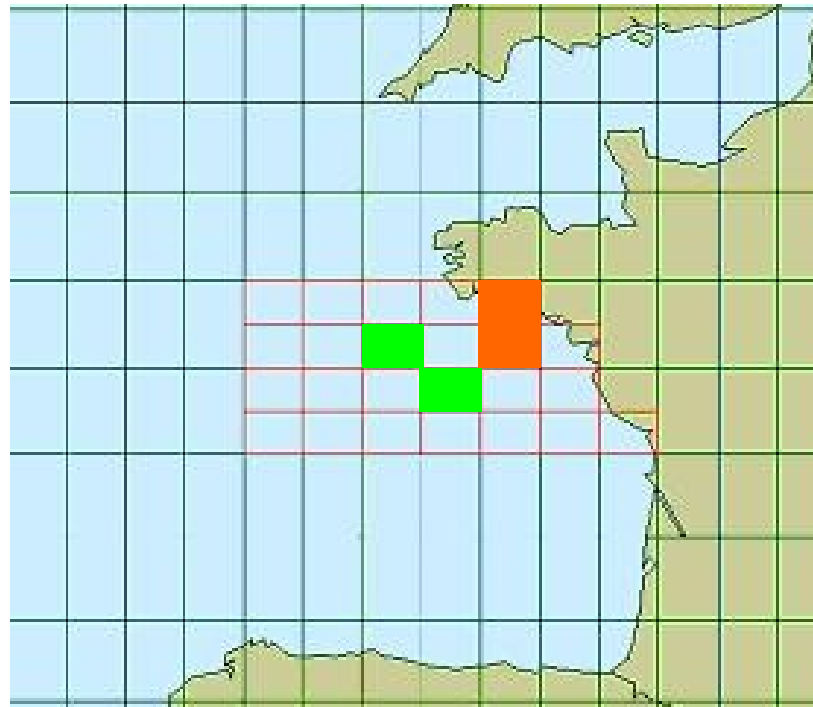
Impact of management measures:

Management measures tested (1)

- MPAs (design : size (2), season (3), gears (2))
 - nursery area
 - spawning area
 - none
- Reaction: allocate effort to remaining area

MPA spawning

1 rectangle



MPA spawning

2 rectangles

Impact of management measures:

Management measures tested (2)

■ TACs

- constant
- variable
- none

Reaction if target species, change métier, otherwise discard

■ Gear changes

- mesh size increase (70 to 100 mm),
- introduce selective device
- none

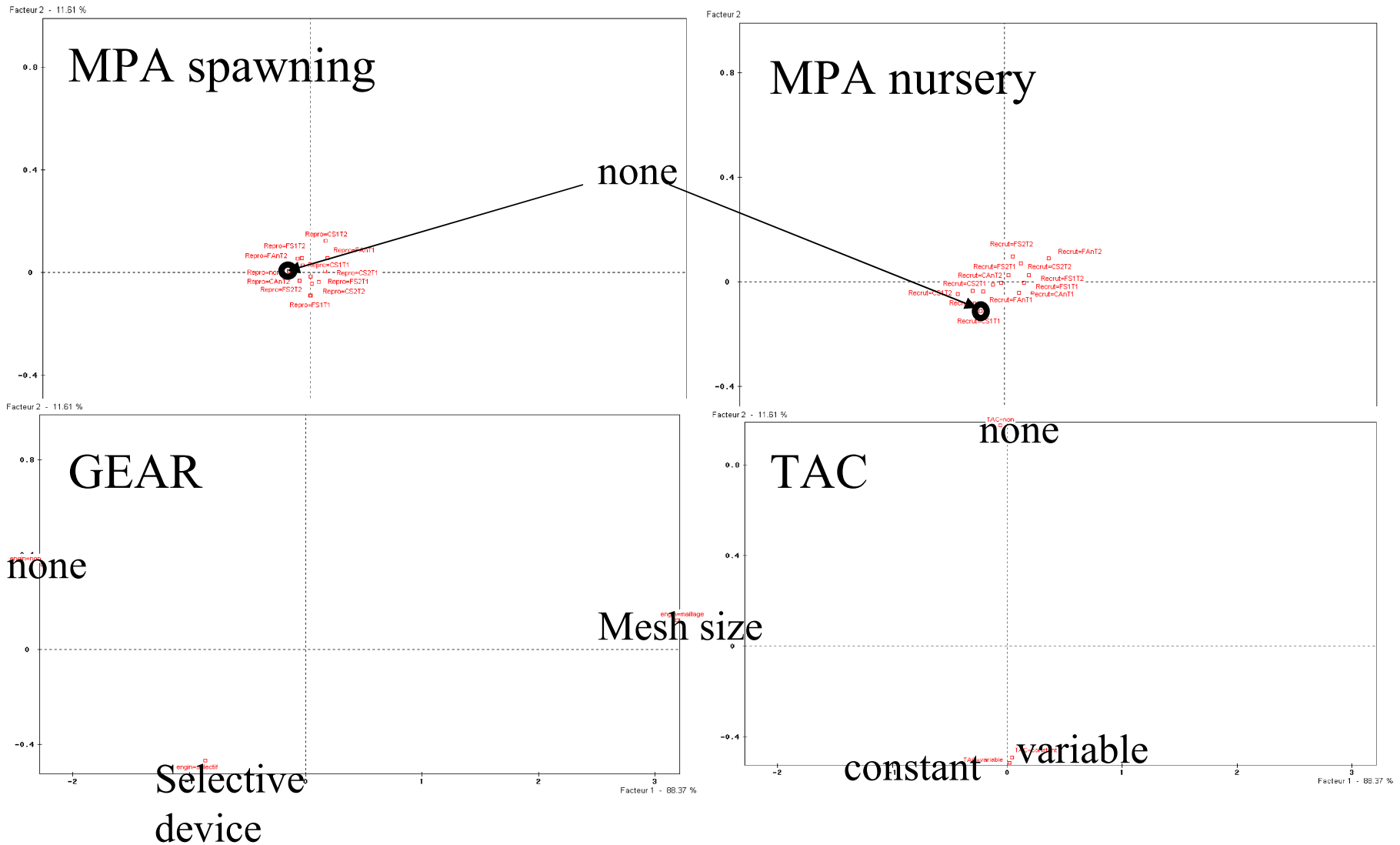
Reaction: respect regulation

Impact of management measures: *Methods*

- Output variables Y:
 - Abundance in last year (year 10)
 - 5 final years cumulated catch (in numbers)
 - catch in last year
- Management measures: D-optimal simulation design
- Analysis methods:
 - PCA
 - ANOVA : $\log(Y) = \text{Measure} + \text{interactions}$

Measure={MPA (13), TAC (3), gear (3)}

Impact of management measures: Results



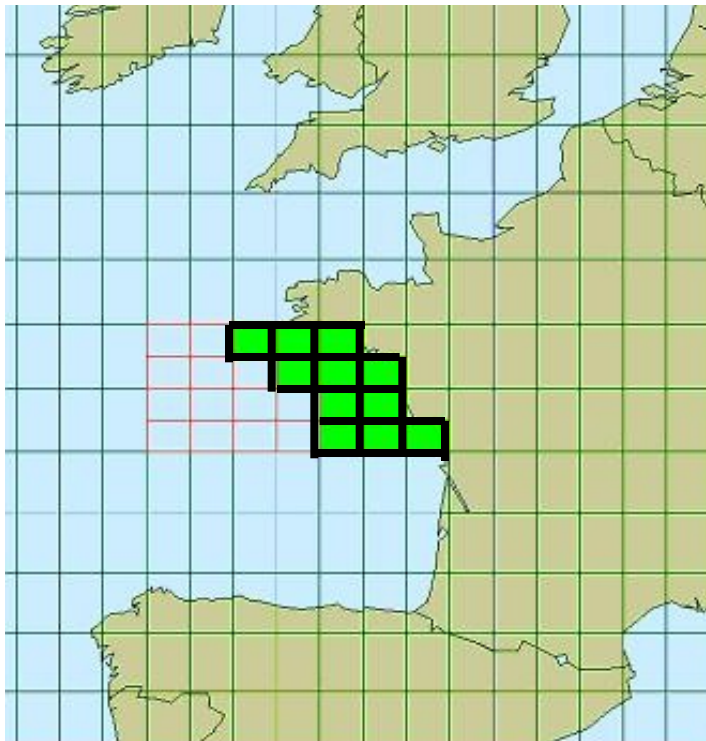
Impact of management measures:

Results



- Efficient measures
 - Increase mesh size
 - ↗ catches in weight
 - Twin trawl banned from the region
 - ↗ abundance
 - TAC: pluri-specific approach
 - ↗ lobster abundance
 - ↘ hake abundance
- MPA: limited effect

Impact of management measures: *Comparison of hypotheses*



- Homogeneous population densities
- No dispersion of Nephrops between rectangles
- MPA : efficient management measure
 - ↗ lobster abundance 6 and 12%

Conclusion



- ISIS-Fish :
 - Integration of knowledge
 - Experimental design of simulations
- Sensitive to catchability parameter: new methods to reduce uncertainty
- Relevant reglementations
 - gear restrictions
 - MPA : a solution
 - pluri-specific TAC approach