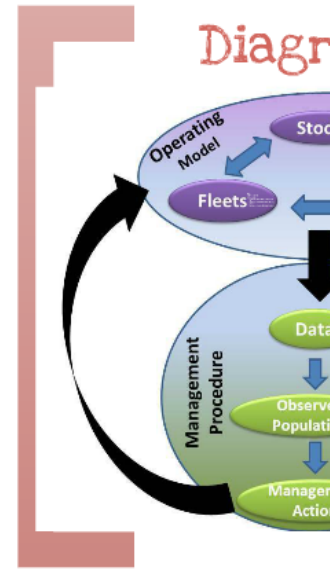
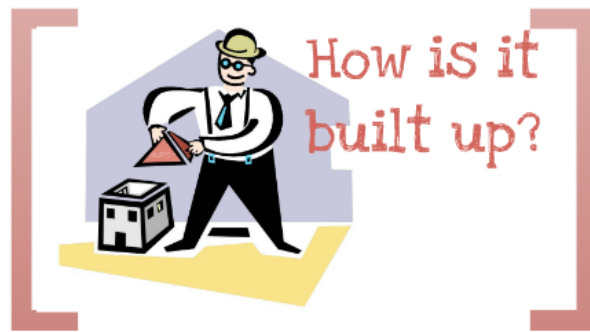




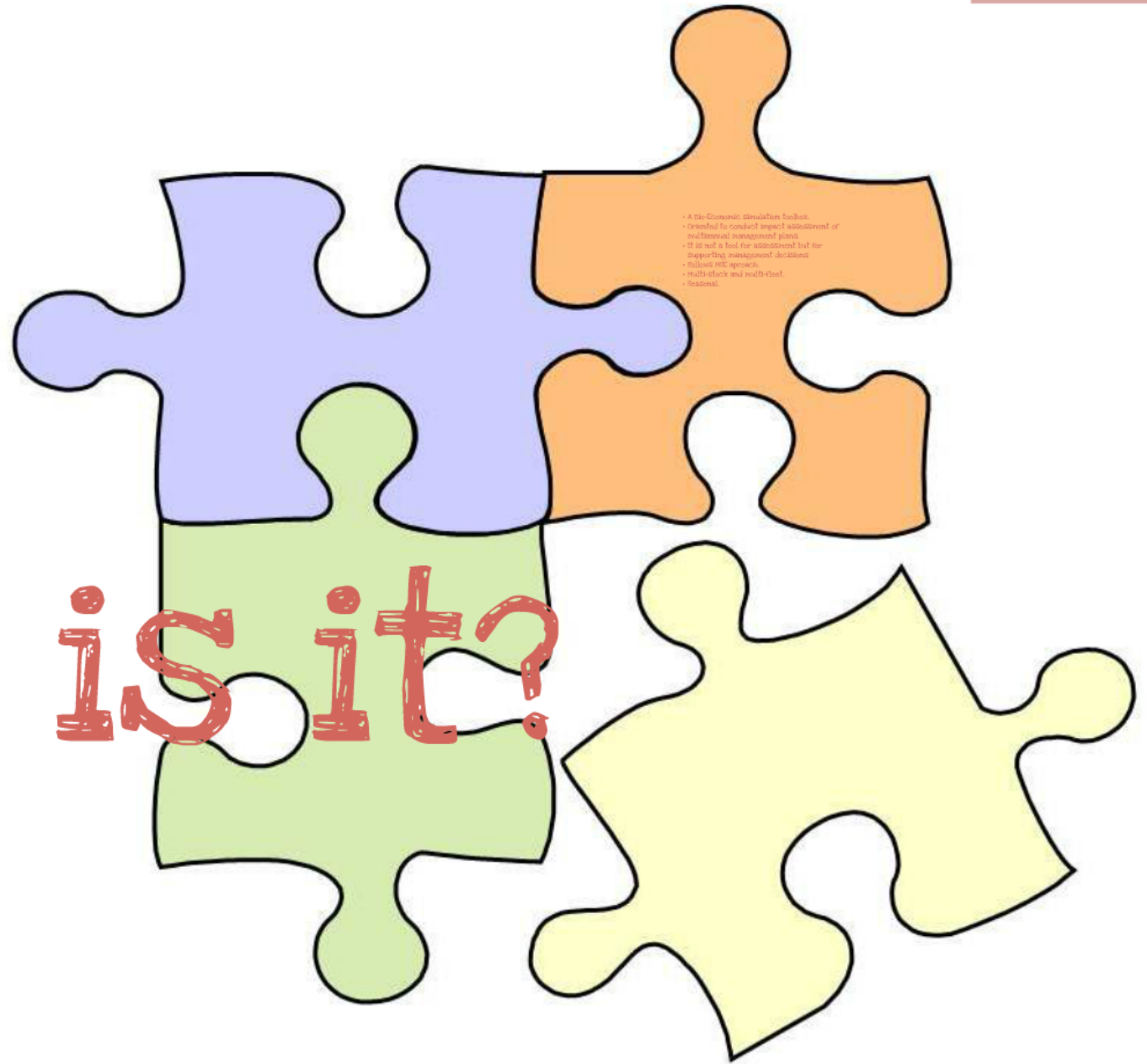
Just a new tool? it solves mixed fisheries mngmnt....?
Well, it helps to take management decisions...sound based.





Just a new tool? it solves mixed fisheries mngmnt....?
Well, it helps to take management decisions...sound based.

What is it?



- A five-dimensional simulation toolset
- Designed to conduct impact assessment of multimodal management plans
- It is not a tool for assessment but for supporting management decisions
- Follows VEC approach
- Multi-stake and multi-thrust
- Iterative

- A Bio-Economic Simulation toolbox.
- Oriented to conduct impact assessment of multiannual management plans.
- It is not a tool for assessment but for supporting management decisions
- Follows MSE approach.
- Multi-stock and multi-fleet.
- Seasonal.



• To create a digital and virtual world
• To build a digital world where people
interact and be inspired by the power of
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Motivation

- To couple biological and economical models
- To built a flexible model where Specific submodels can be replaced by new ones if necessary. (f.e. fleet's effort dynamics, stock recruitment...)
- To incorporate fleet/metiers dynamic models (models to describe mixed-fisheries (Fcube like, profit maximization).
- To fully incorporate the economic part (Short term (effort dynamics) and long term (capital dynamics and technological creep).

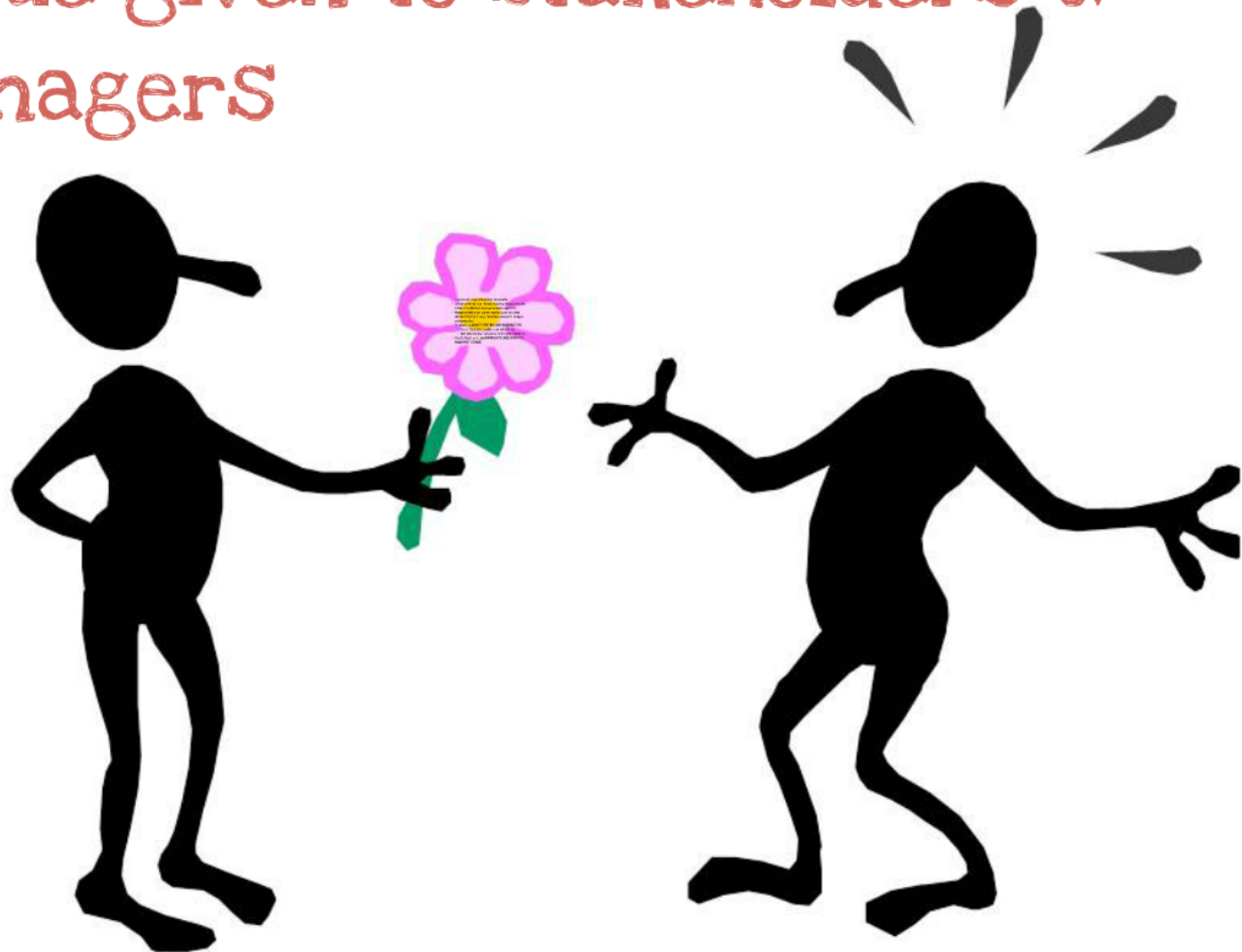
How is it
built up?



11

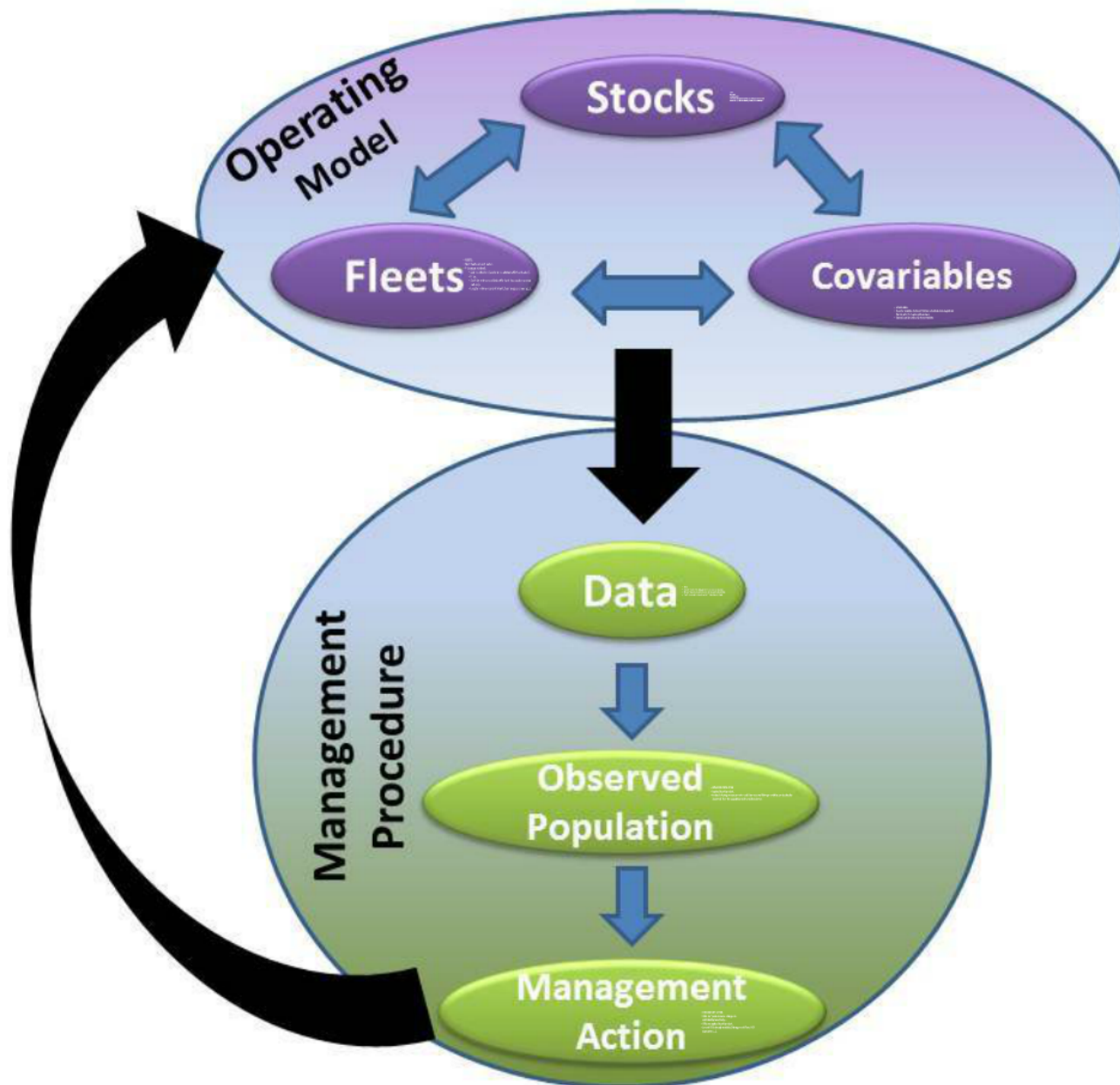
- The model has been constructed modularly.
- The fishery and management systems are defined as the "Sum" of "Small" processes.
- Several models available for each process.

Value given to Stakeholders & Managers



- Fully coupled: biologic and economic components.
- Considers wider technical interactions, taking into account spatial and technical effects across a species assemblage (ICES)
- Management advice can be given based on scenarios already defined (ICES, UE) or through interactive process with managers and stakeholders
- It is extensible (ALMOST EVERYTHING CAN BE INCORPORATED!!!!)
 - Trophic interactions (predator-prey relationships).
 - New models to describe fleet short and long term dynamics.
- Uncertainty can be included (IMPORTANT TO CONSIDER RISK IN THE MANAGEMENT DECISIONS)

Diagram



Management Procedure

Data

• Data is the information that is collected and used to make decisions.
• Data can be collected in many ways, such as through surveys, interviews, and observations.
• Data can be used to identify trends, patterns, and relationships between variables.

**Observed
Population**

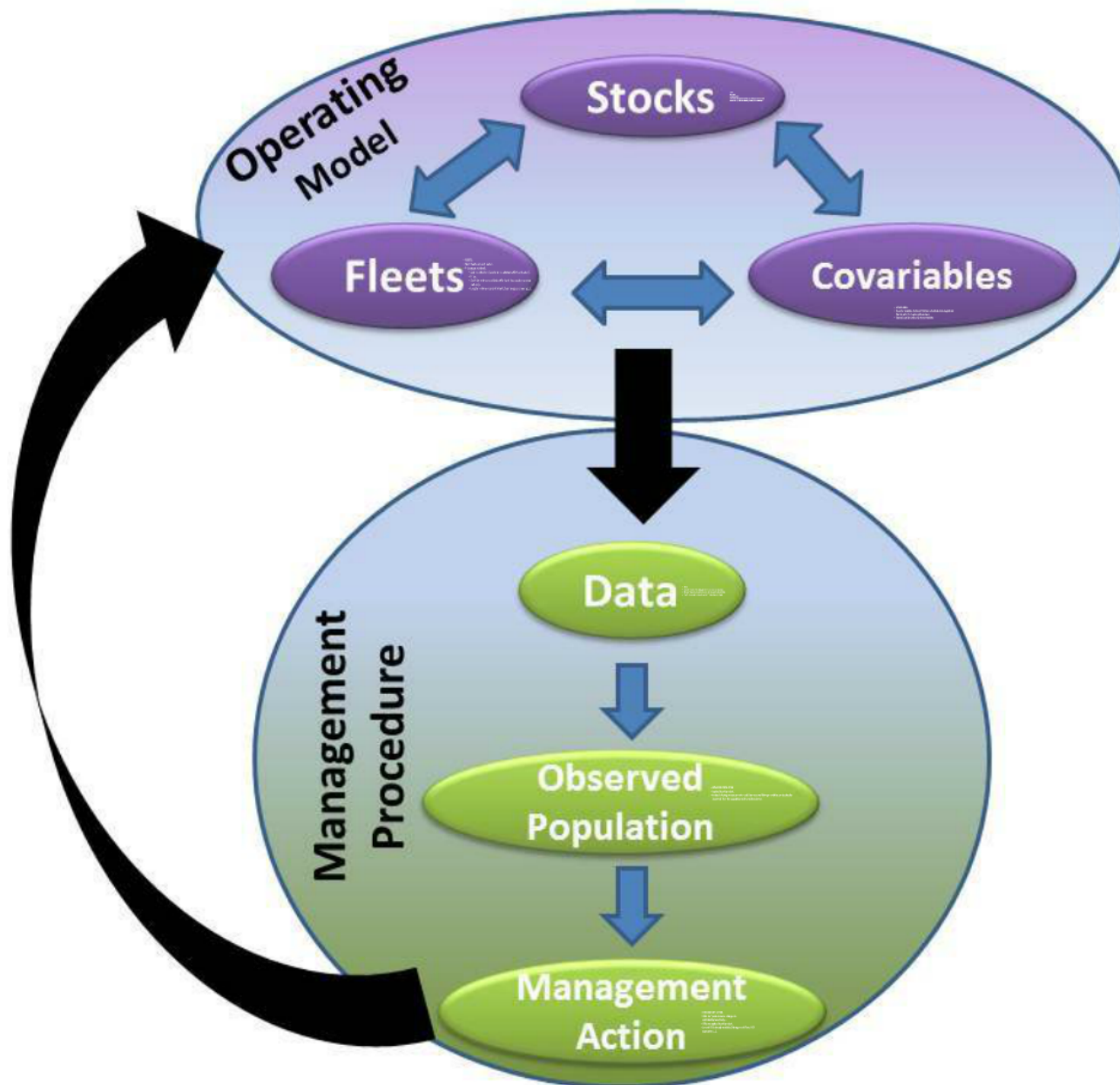
• Observed population is the group of individuals that are being studied.
• Observed population can be defined by a set of characteristics, such as age, gender, and location.
• Observed population can be used to make inferences about the larger population.

**Management
Action**

• Management action is the decision that is made based on the data and the observed population.
• Management action can be used to change the behavior of the observed population.
• Management action can be used to improve the quality of life for the observed population.

- MANAGEMENT ACTION:
- HCRs, temporal closures, changes in catchability/selectivity....
- HCRs are applied stock by stock.
- Several HCRs already available (Management Plans, MSY approaches....).

Diagram



One useful example where FLBEIA has been successfully applied.

DEEPFISHMAN (VII FP): French Deep water Mixed Fisheries

French Deepwater Mixed Fisheries



- Fleets**
 - FL01 and FL02:
 - Mixed Fisheries
 - French fleets with 18 meters.
 - FL01, FL02, FL03, FL04, FL05, FL06:
 - Single stock fisheries.
 - Account for non-french catch.
- Harvest Control Rules**
 - BLI, BPF, RNG: low MSY HCR.
 - SKH TAC = 3 (classical effort).
 - TAC = 500 t, TAC = 2500t.
 - POK: Management Plan HCR
- Scenarios**
 - Fixed Effort.
 - Simple Mixed Fisheries Behaviour (F-cube law): FL01 and FL02 constrained by BLI or SKH, the rest by the stock they catch.
 - FL01: Reoptimization of profits constrained to comply with BLI or SKH TAC.
 - The rest: SMFB.

Mix species, multigear, taking into account all countries exploiting the stock, HCR as defined in KES stock by stock ... different scenarios in relation to fleets short term dynamics (effort allocation) are used.

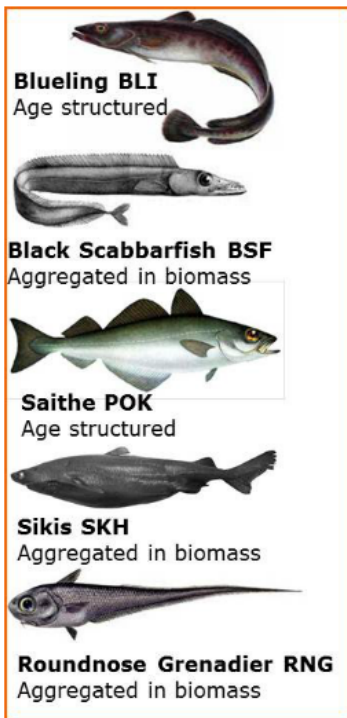
¹⁰ Fixed effort, profit maximization...

Risk has been taken into account (presentation of results is on median) and precautionary reference points (precautionary boundaries) have been included in the HCRs.

When comparing scenarios is easy to highlight main trade-offs

Fisheries

French Deepwater Mixed Fisheries



Fleets

- FL01 and FL02:
 - Mixed Fisheries
 - French fleets with 10 meters.
- FLBLI, FLBSF, FLPOK, FLSKH, FLRNG:
 - Single stock fisheries.
 - Account for non-french catch.

Harvest Control Rules

- BLI, BSF, RNG: Ices MSY HCR.
- SKH: TAL = 0 (discards allowed), TAC = 500 t, TAC = 2500t.
- POK: Management Plan HCR

Scenarios

- Fixed Effort.
- Simple Mixed Fisheries Behaviour (F-cube like). FL01 and FL02 constrained by BLI or SKH, the rest by the stock they catch.
- FL01: Maximization of profits constrained to comply with BLI or SKH TAC. The rest: SMFB.

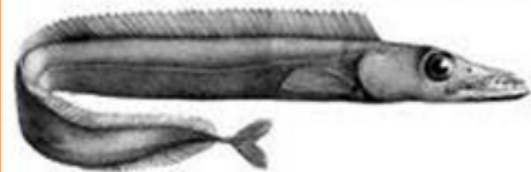
Mix species, multigear, taking into account all countries exploiting the stock, HCR as defined in ICES stock by stock ... different scenarios in relation to fleets short term dynamics (effort allocation) are used:
* Fixed effort, profit maximization...

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When comparing scenarios is easy to highlight main trade-offs



Blueling BLI
Age structured



Black Scabbardfish BSF
Aggregated in biomass



Saithe POK
Age structured



Sikis SKH
Aggregated in biomass



Roundnose Grenadier RNG
Aggregated in biomass

Fleets

- FL01 and FL02:
 - Mixed Fisheries
 - French fleets with 10 metiers.
- FLBLI, FLBSF, FLPOK, FLSKH, FLRNG:
 - Single stock fisheries.
 - Account for non-french catch.

Harvest Control Rules

- BLI, BSF, RNG: Ices MSY HCR.
- SKH: $TAL = 0$ (discards allowed),
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Scenarios

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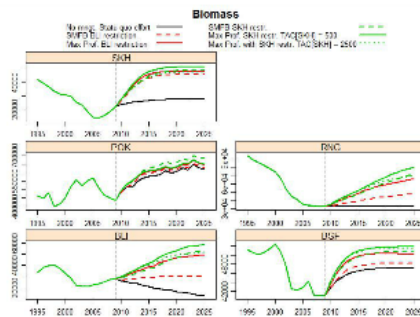
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When comparing scenarios is easy to highlight main trade -offs

which results can be expected ...



Biomass for each of the stocks in the long term under different scenarios:

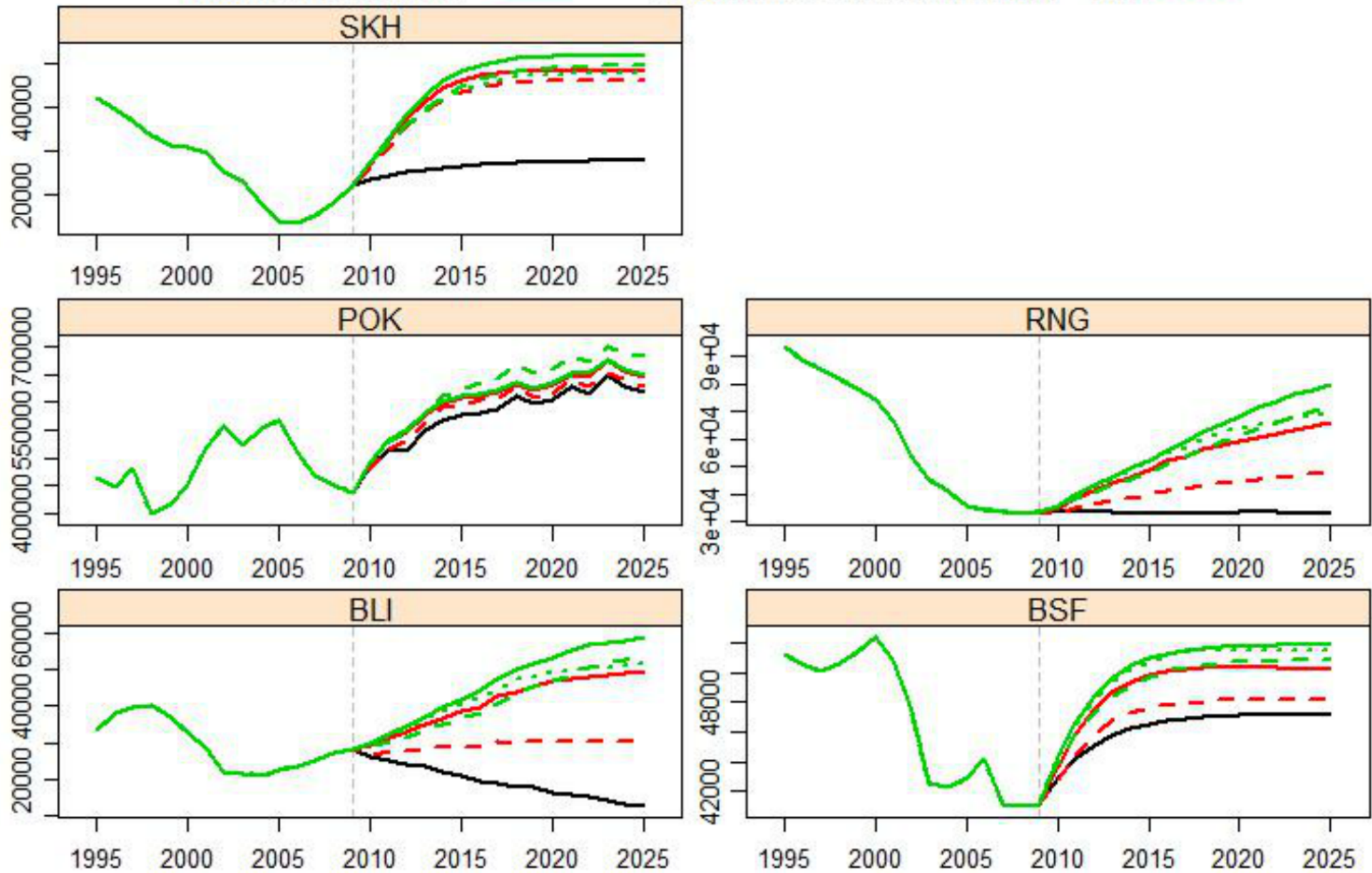
1. Best scenario: Highest biomass are obtained in scenario res SKH, specially for scenarios where profits are maximised and 500 t.

2. Worst scenario: Status quo, The higher effort is used. For a biomass decrease or do not increase as much as for the other

Biomass

No mngt. Statu quo effort —
 SMFB BLI restriction - - -
 Max Prof. BLI restriction —

SMFB SKH restr. - - -
 Max Prof. SKH restr. TAC[SKH] = 500 —
 Max Prof. with SKH restr. TAC[SKH] = 2500 ····



Results can be expected ...



Biomass for each of the stocks in the long term under different scenarios

1. Best scenario: Highest biomass are obtained in scenario restricted by SKH, specially for scenarios where profits are maximised and SKH is TAL: 500 t.

2. Worst scenario: Status quo, The higher effort is used. For all stock biomass decrease or do not increase as much as for the other scenarios

Economic indicator for each stock by scenario in the long term:

1. Worst scenario: No management and



Economic indicator for each stock by scenario in the long term:

1. Worst scenario: No management and status quo effort. Cost decrease by remain the highest, effort is high and profits are the lowest.
2. Other scenarios: an important decrease in effort & cost is translated into higher profits

Economic Indicators

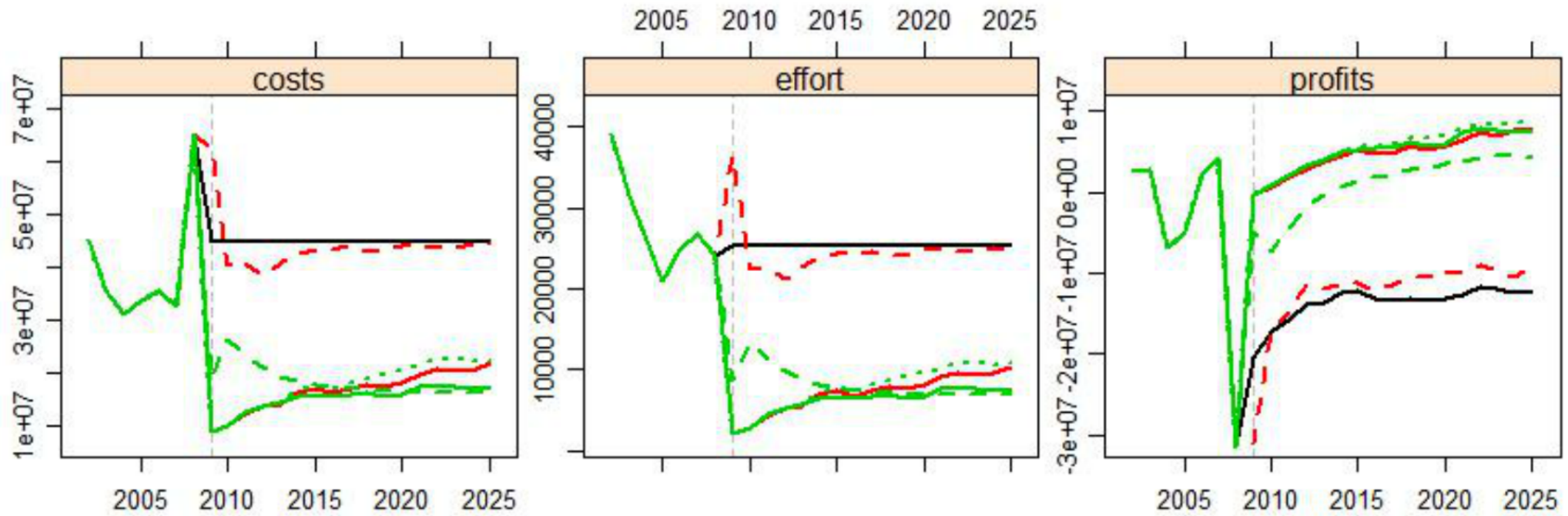
No mngt. Statu quo effort
SMFB BLI restriction
Max Prof. BLI restriction



SMFB SKH restr.

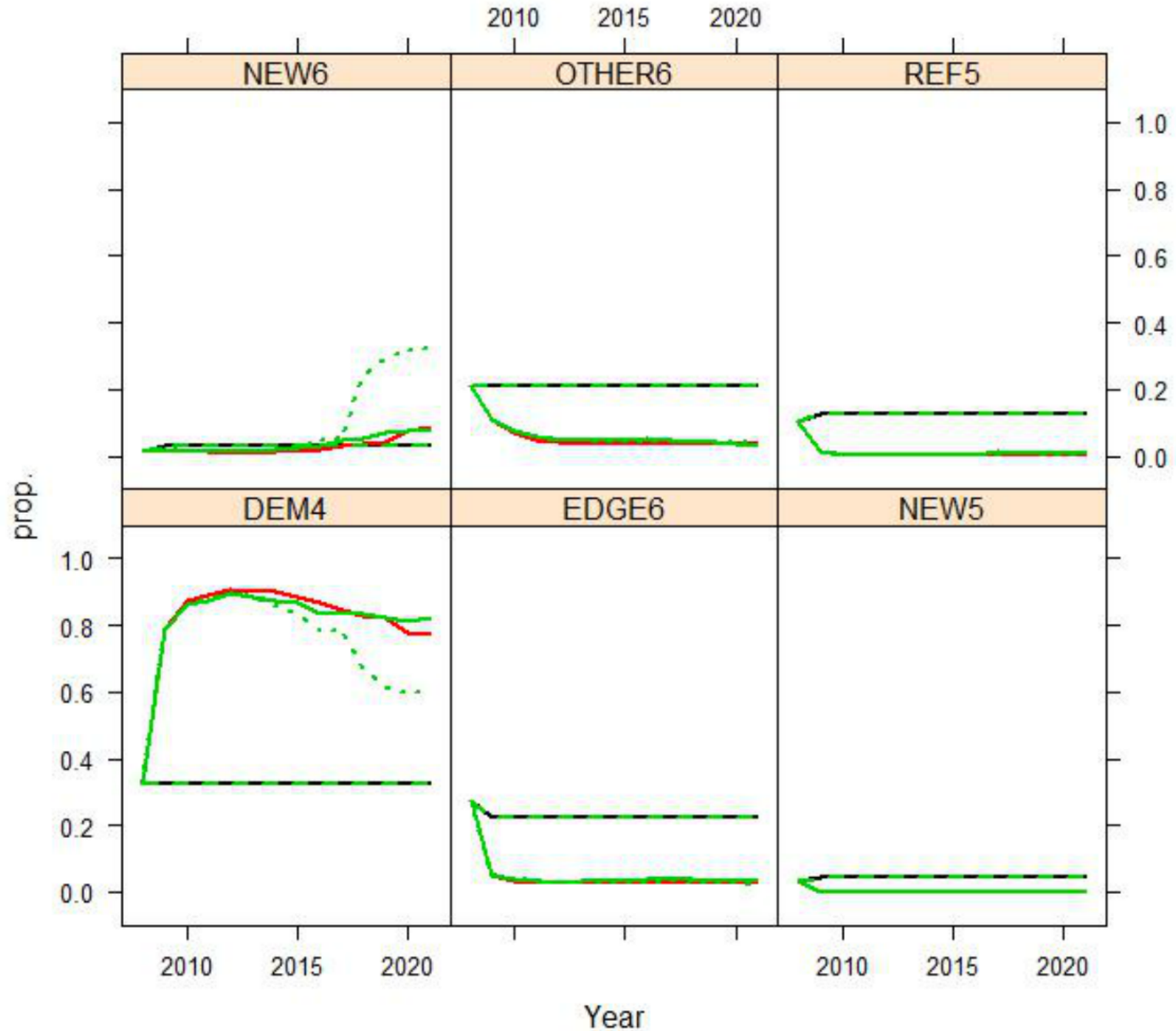
Max Prof. SKH restr. TAC[SKH] = 500

Max Prof. with SKH restr. TAC[SKH] = 2500



FL01 - Effort share along metiers

No mngt. Statu quo effort ———
 SMFB BLI restriction - - -
 Max Prof. BLI restriction ———
 SMFB SKH restr. - - -
 Max Prof. SKH restr. TAC[SKH] = 500 ———
 Max Prof. with SKH restr. TAC[SKH] = 2500



Fleet dynamics:

Metier effort allocation changes along time depending on the scenario chosen. Some metiers disappear and others take more relevance.

When profit maximization is used the allocation along metiers changes which means that theoretically the actual allocation (that used in fixed effort and Fcube like approach) is not the most economically efficient.

Utility for managers:

- A step forward in mixed fisheries and EBFM. Mixed fisheries is, by itself, a step forward in EBFM (apart of that, environmental variables could be included in the covariables OM)
- Incorporates economic (and social, if needed) indicators
- It facilitates comparison between management strategies (temporal closures, technical changes (catchability), area closures (implicitly)...).
- Incorporates uncertainty: important to take into account risk assessment (risky or conservative decisions)

Fisheries are complex systems

In the recent years, and driven by the Ecosystem approach, the urgent need of management advice based and directed to the actual activity of the mixed fisheries has already become a reality.

We hope AZTI can help in this process.

Thanks !
azti
tecnalia



