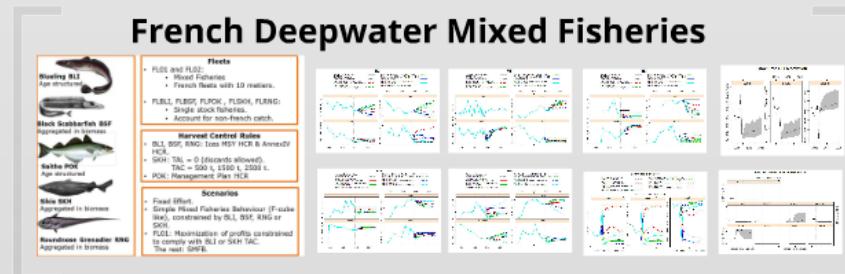
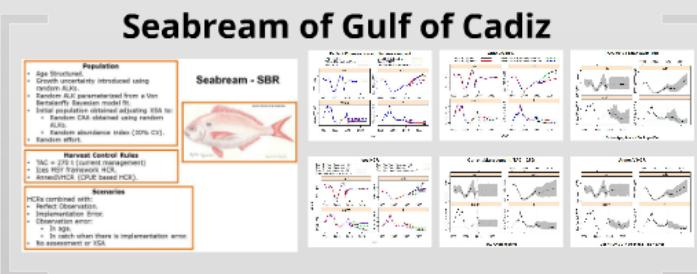
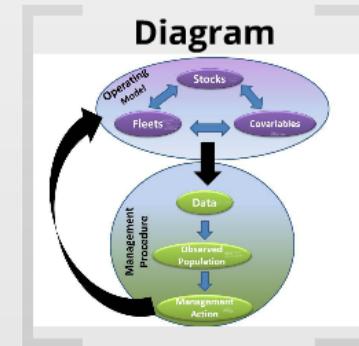
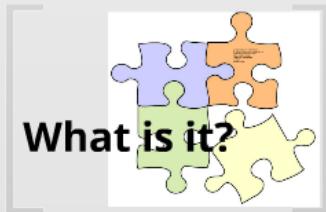
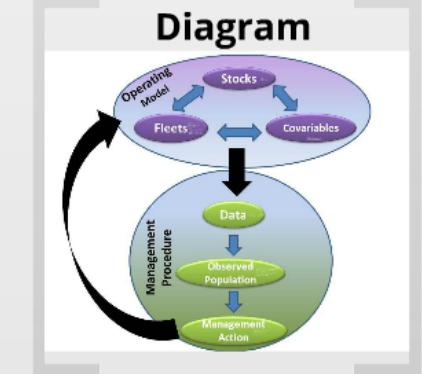


FLBEIA

Bio-Economic Impact Assessment

Dorleta Garcia, Raúl Prellezo, Sonia Sanchez, Guzman Diez





FLBEIA

Bio-Economic Impact Assessment

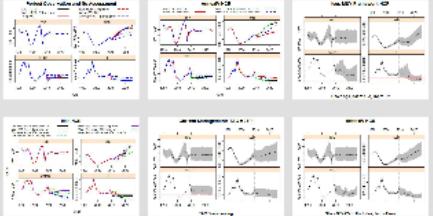
Dorleta Garcia, Raúl Prellezo, Sonia Sanchez, Guzman Diez



Seabream of Gulf of Cadiz

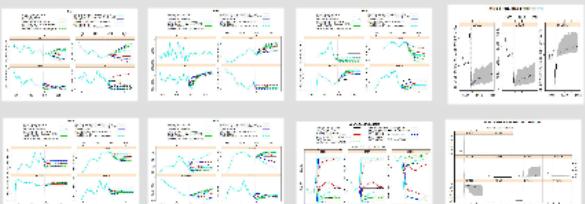
- Population**
 - Age structure
 - Growth uncertainty introduced using random effects
 - Random AAC parameterized from a von Bertalanffy Bayesian model fit.
 - Implementation of a bio-economic XSA to:
 - Random CAA obtained using random AAC
 - Random abundance index (30% CV).
 - Random effort.
- Harvest Control Rules**
 - TAC = Total Allowable Catch
 - (Eco) MEY framework (HCR)
 - AnnealHCR (COPUE based HCR)
- Scenarios**
 - HCRs combined with:
 - Perfect Observation
 - Perfect Prediction
 - Observation error:
 - In age
 - In effort when there is implementation error
 - No assessment or XSA

Seabream - SBR

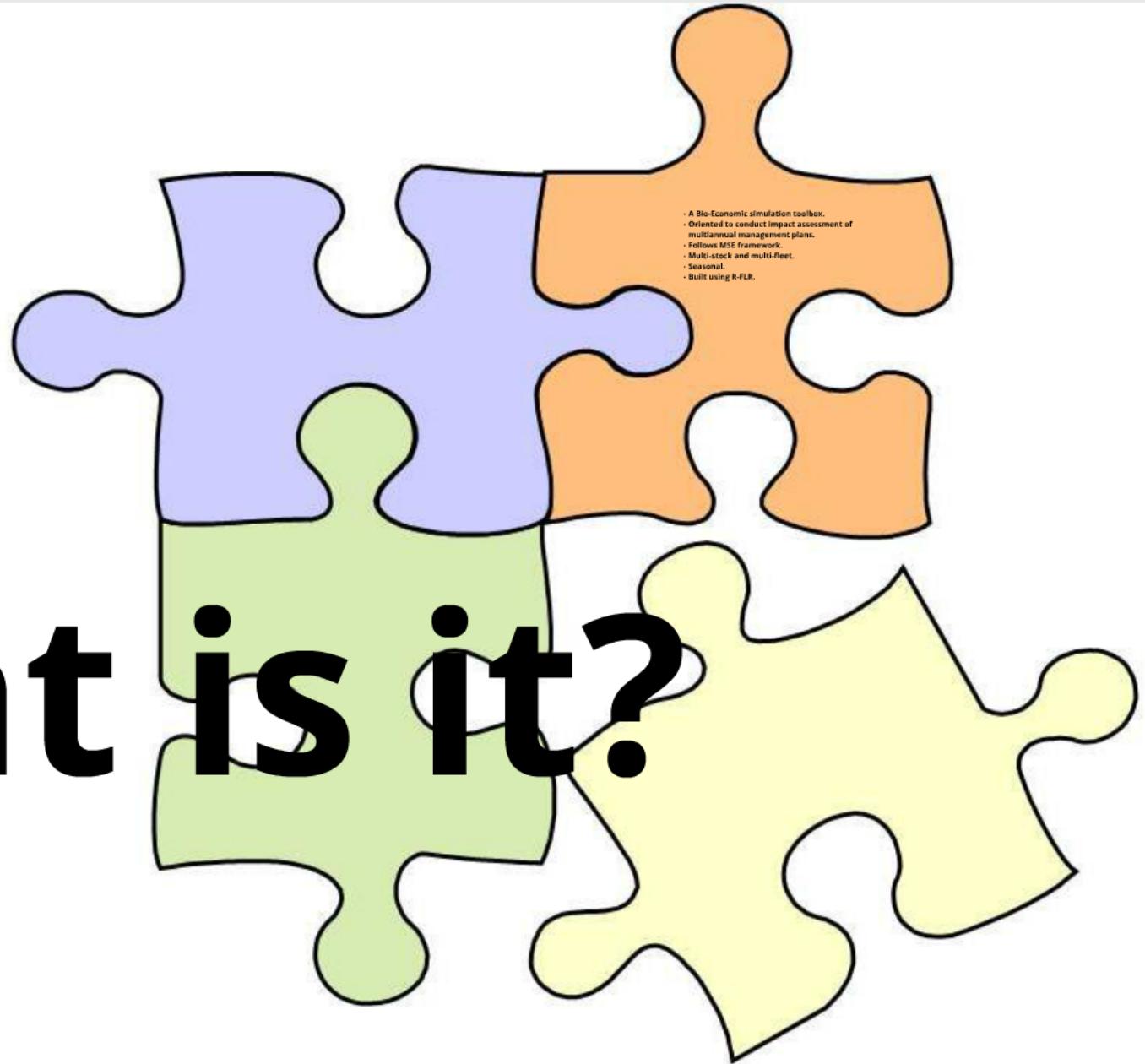


French Deepwater Mixed Fisheries

- Fishes**
 - BLJ: Bluestripe Lizardfish
 - BSB: Black Scabbardfish SSB Aggregated in biomass
 - SPO: Saithe POC Age structured
 - SGI: Skate SGI Aggregated in biomass
 - RNG: Roundnose Grenadier RNG Aggregated in biomass
- FLEETS**
 - Mixed Fisheries
 - French Fleet with 10 meters.
 - French fleet behaviour
 - Account for non-french catch.
- Harvest Control Rules**
 - BLJ, BSB, RNG: Ties HSY HCR & AnnexIV HCR
 - SGI: TAL = 0 (discards allowed)
 - TAC = 500 L, 1500 L, 2500 L
 - PON: Management Plan HCR
- Scenarios**
 - Fleet Effort
 - Simple Mixed Fisheries Behaviour (F-cube like), constrained by BLJ, BSB, RNG or SGI
 - FU1: Maximization of profits constrained to comply with BLJ or SGI TAC. The rest: SFRP.



What is it?



- A Bio-Economic simulation toolbox.
- Oriented to conduct impact assessment of multiannual management plans.
- Follows MSE framework.
- Multi-stock and multi-fleet.
- Seasonal.
- Built using R-FLR.



- Existing bio-oriented models tend to simplify economic part and the other way around.
- Biological models built on generally accepted models.
- Fleet dynamic models are very case specific, standard models are not available.

Motivation

- Existing bio-oriented models tend to simplify economic part and the other way around.
- Biological models built on generally accepted models.
- Fleet dynamic models are very case specific, standard models are not available.

How is it built up?

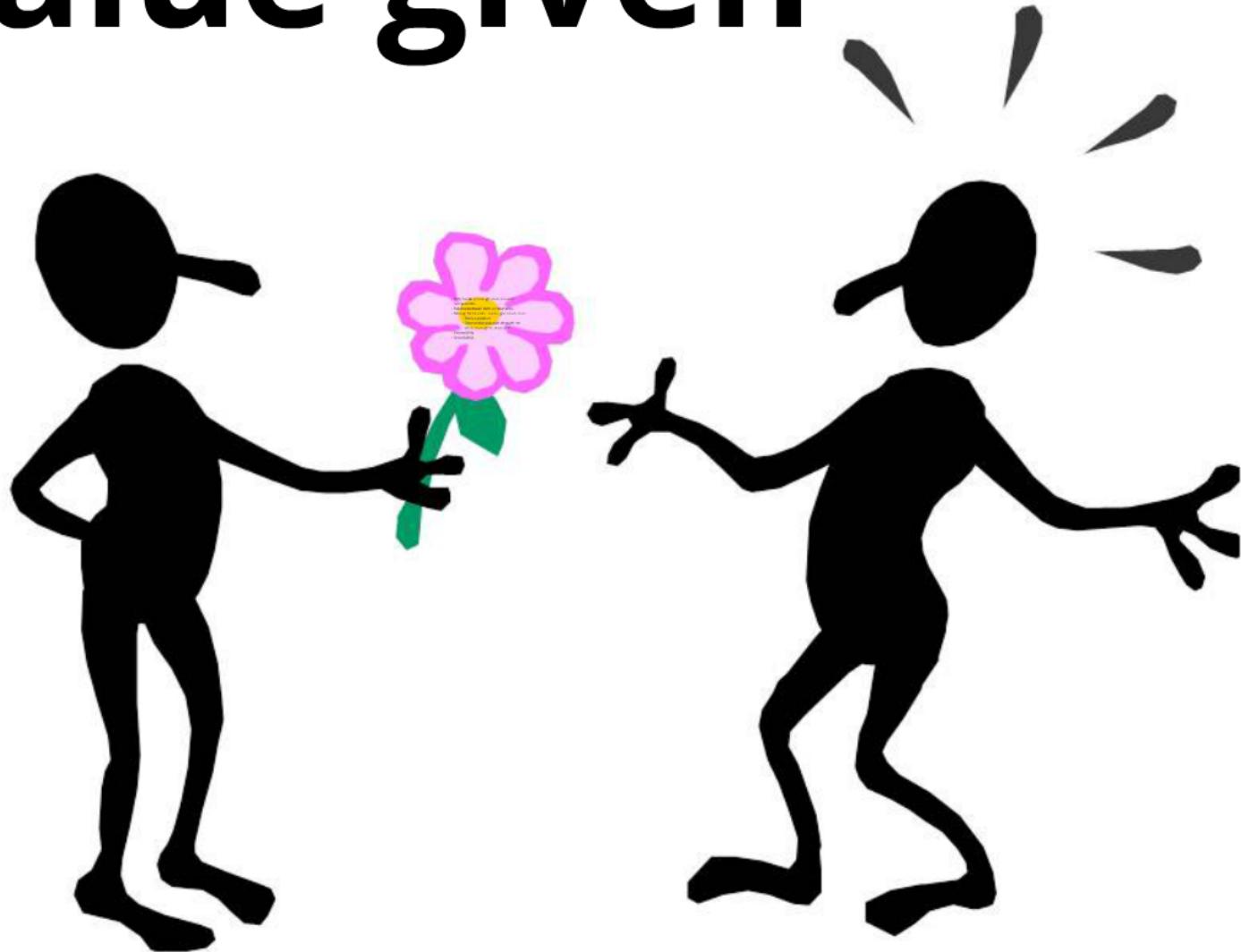


Composability:

**"A model is nothing more than the 'sum' of its parts,
which can be individually modelled
and then put together "**

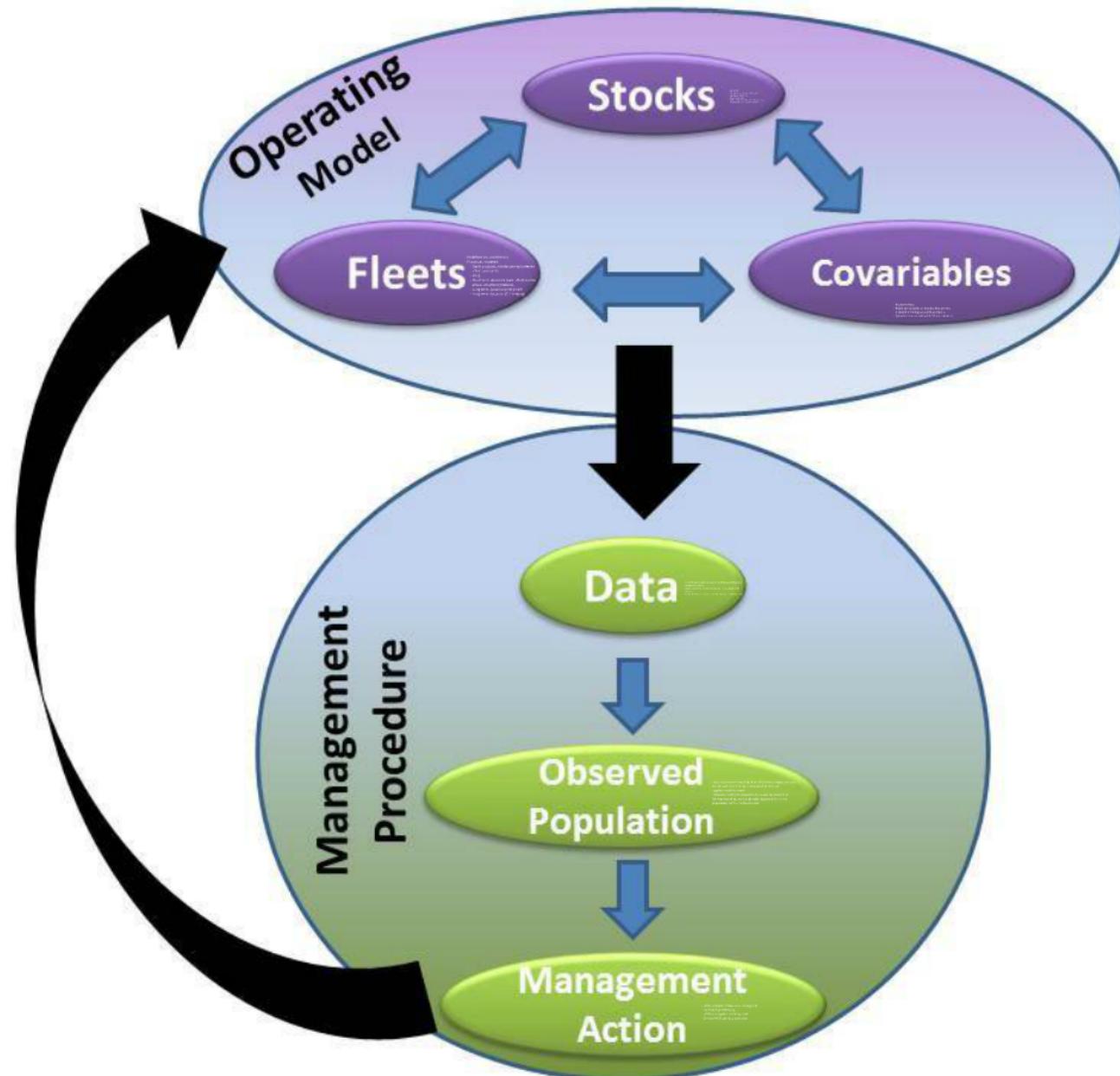
- The model has been constructed modularly.
- The fishery and management systems are defined as the "sum" of "small" processes.
- Several models available for each process.
- 2 kind of processes:
 - **Low level:** Stock recruitment, catch production function...
 - **High level:** Population growth, fleets' short term dynamics...
- There are functions at different levels that assemble the models at lower levels.

Value given



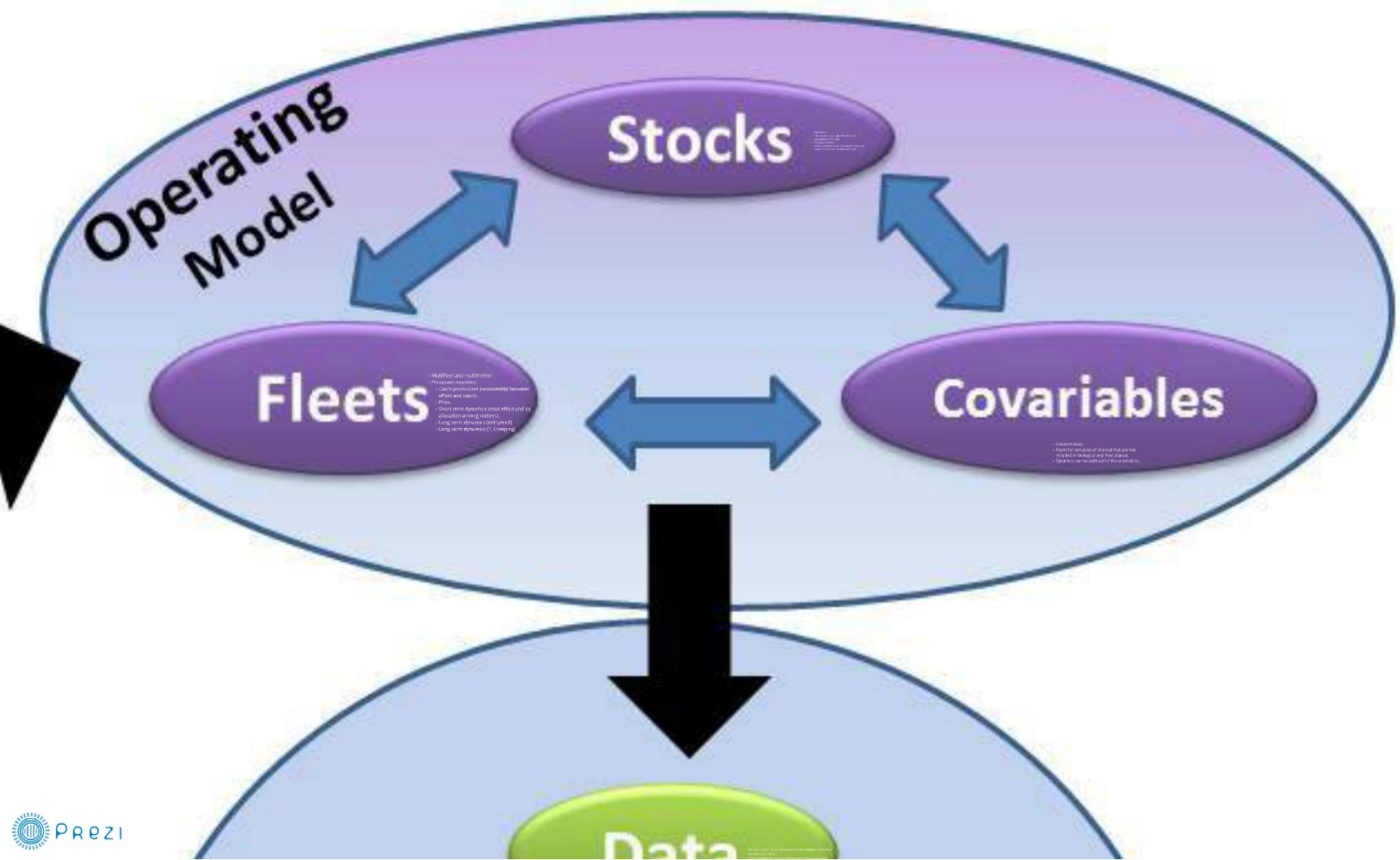
- Fully coupled: biologic and economic components.
- Balance between both components.
- Management advice can be given based on:
 - Real population.
 - Observed population through the whole management process
- Extensibility.
- Uncertainty.

Diagram



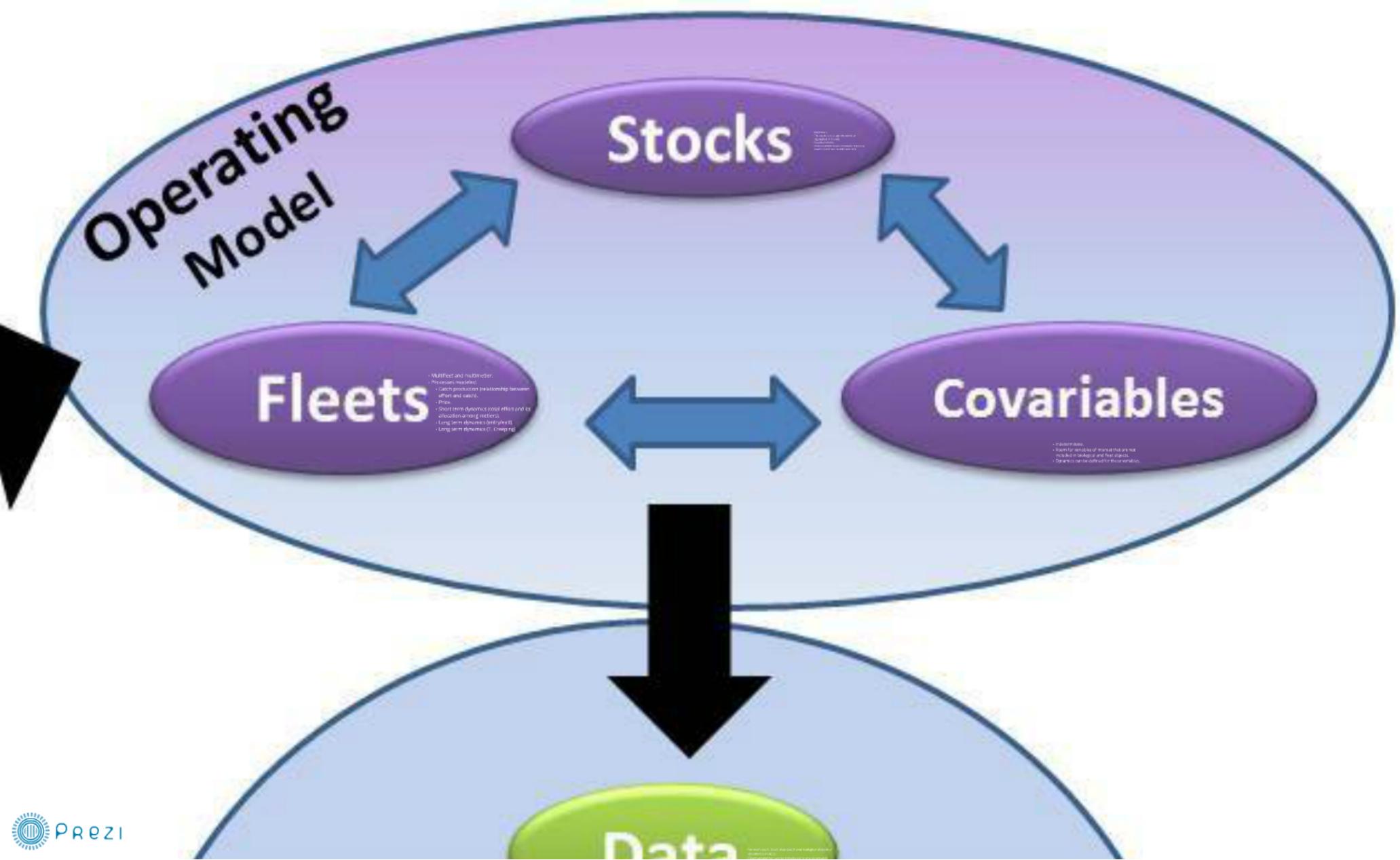
- Multi stock.
- The stocks can be age structured or aggregated in biomas.
- Seasonal cohorts.
- At the moment trophic interactions are not implemented but could be included.

Diagram



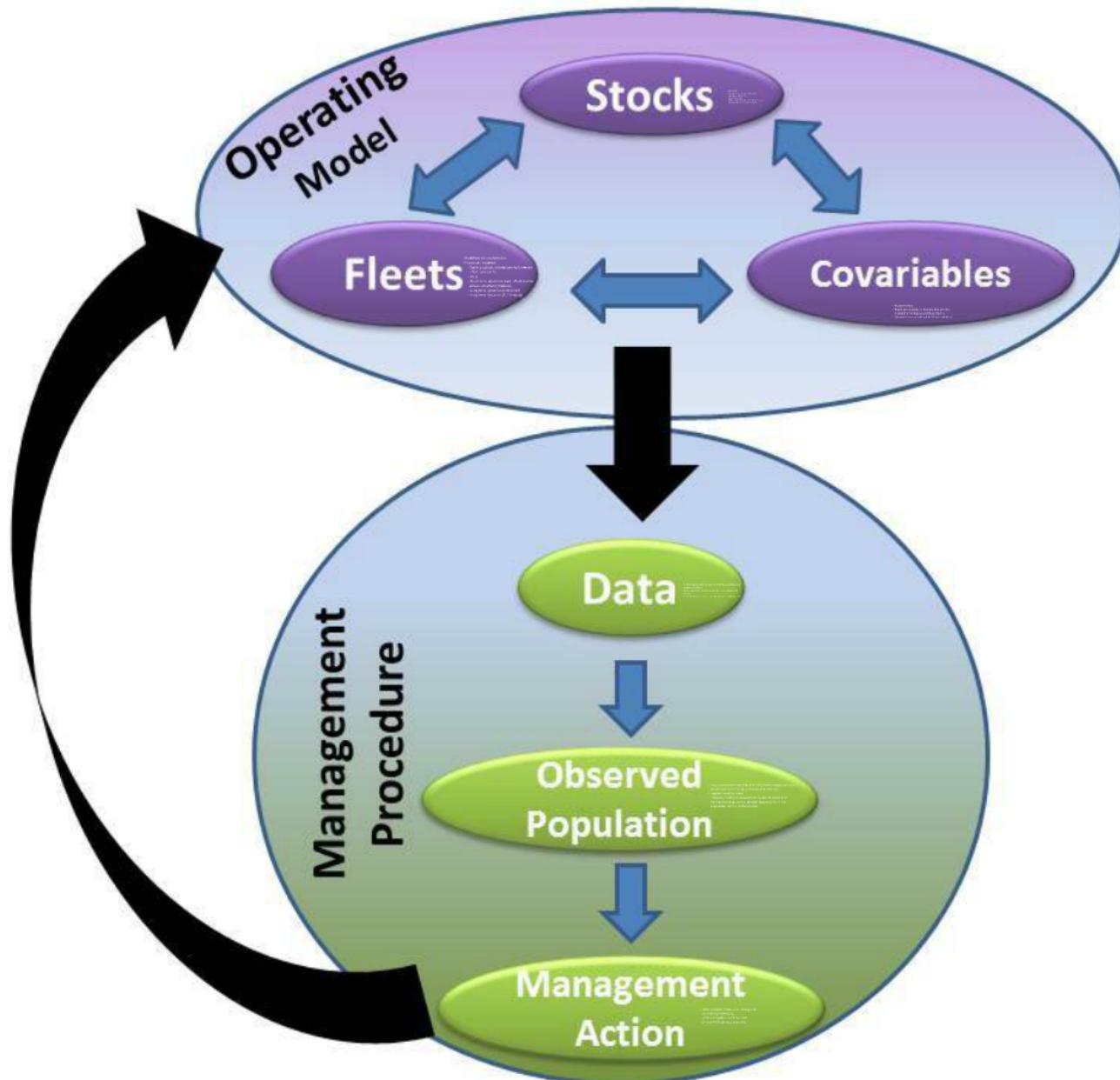
- Multifleet and multimetier.
- Processes modeled:
 - Catch production (relationship between effort and catch).
 - Price.
 - Short term dynamics (total effort and its allocation among metiers).
 - Long term dynamics (entry/exit).
 - Long term dynamics (T. Creeping)

Diagram



- Indeterminate.
- Room for variables of interest that are not included in biological and fleet objects.
- Dynamics can be defined for these variables.

Diagram



- For each stock: Stock data (catch and biological data) and abundance indices.
- Observation error can be introduced in any observable variable.
- Stocks and indices can be observed at age or biomass level.

Management Procedure

Data

The stock is fully assessed and managed based on the results of every assessment model and action can be determined at this time.

Observed Population

- Any assessment model built in ICES can use input data can be derived from the data simulated in the DM.
- Applications include:
- Instead of using an assessment model, biomass and fishing mortality can be directly assessed from the population with or without error.

Management Action

- ICES temporal estimates changes in catchabilityweeney.
- ICES are assessed stock by stock.
- General ICES already available.

- Any assessment model built in R/FLR which input data can be derived from the data simulated in the OM.
- Applied stock by stock.
- Instead of using an assessment model, biomass and fishing mortality, can be directly 'observed' from the population with or without error.

Management Procedure

Data

The stock is fully assessed and managed based on the results of every assessment model and action can be determined at this time.

Observed Population

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- Applications include:
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Management Action

- ICES temporal estimates changes in catchabilityweeney.
- ICES are assessed stock by stock.
- General ICES already available.

- HCRs, temporal closures, changes in catchability/selectivity....
- HCRs are applied stock by stock.
- Several HCRs already available.

Seabream of Gulf of Cadiz

Population

- Age Structured.
- Growth uncertainty introduced using random ALKs.
- Random ALK parameterized from a Von Bertalanffy Bayesian model fit.
- Initial population obtained adjusting XSA to:
 - Random CAA obtained using random ALKs.
 - Random abundance index (30% CV).
- Random effort.

Seabream - SBR



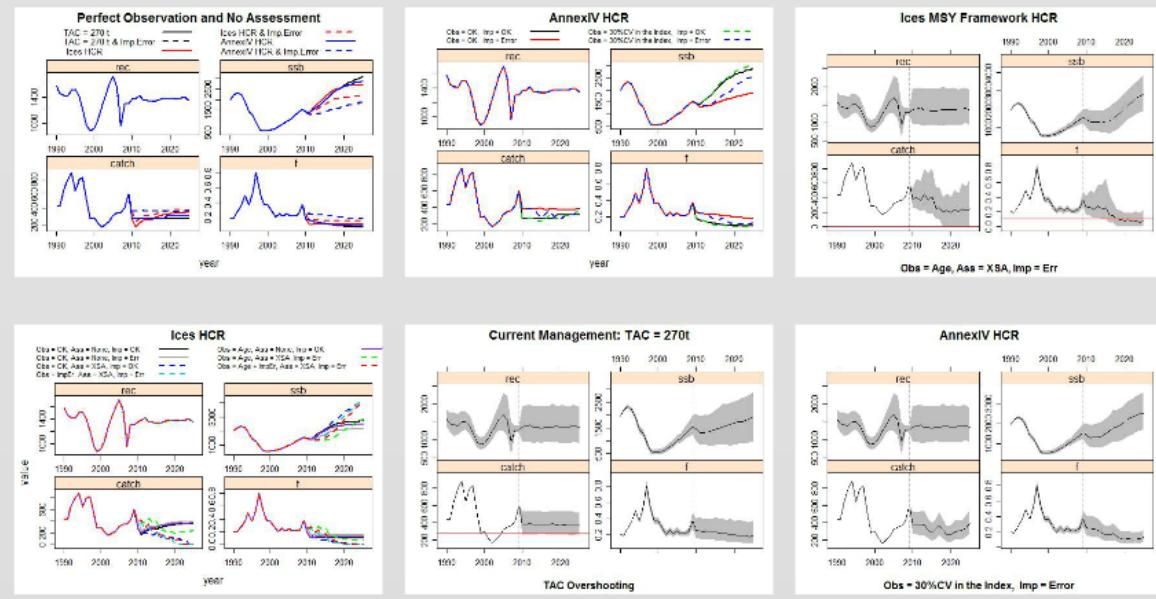
Harvest Control Rules

- TAC = 270 t (current management)
- Ices MSY framework HCR.
- AnnexIVHCR (CPUE based HCR).

Scenarios

HCRs combined with:

- Perfect Observation.
- Implementation Error.
- Observation error:
 - In age.
 - In catch when there is implementation error.
- No assessment or XSA



Assessment

Sonia Sanchez, Guzman Diez

French Deepwater Mixed Fisheries



Fleets

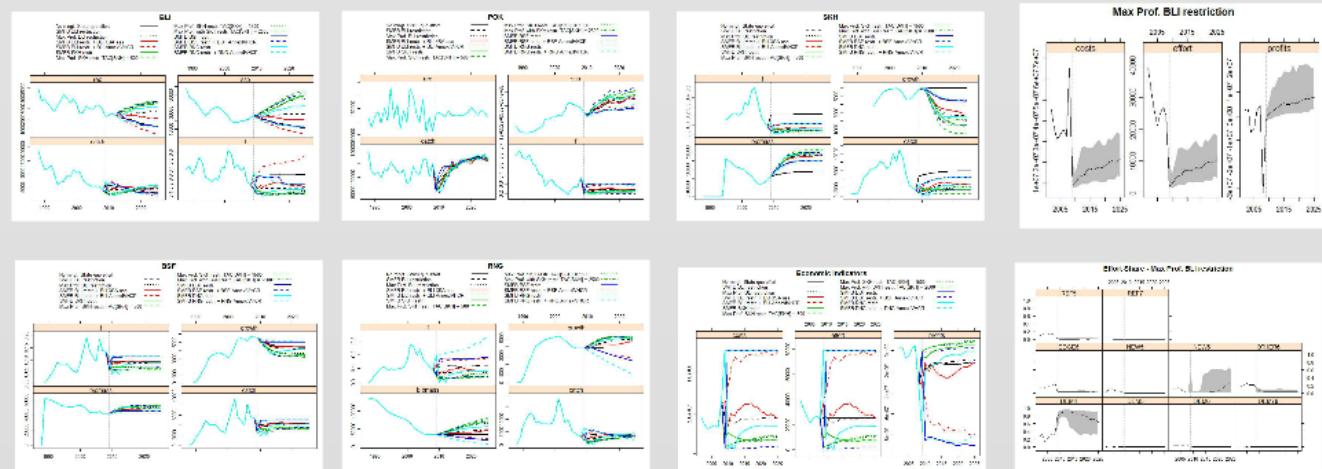
- FL01 and FL02:
 - Mixed Fisheries
 - French fleets with 10 metiers.
- FLBLI, FLBSF, FLPOK , FLSKH, FLRNG:
 - Single stock fisheries.
 - Account for non-french catch.

Harvest Control Rules

- BLI, BSF, RNG: Ices MSY HCR & AnnexIV HCR.
- SKH: TAL = 0 (discards allowed).
TAC = 500 t, 1500 t, 2500 t.
- POK: Management Plan HCR.

Scenarios

- Fixed Effort.
- Simple Mixed Fisheries Behaviour (F-cube like), constrained by BLI, BSF, RNG or SKH.
- FL01: Maximization of profits constrained to comply with BLI or SKH TAC.
The rest: SMFB.

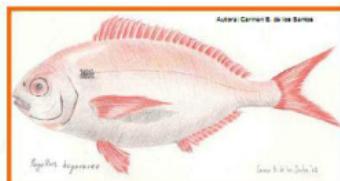


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Seabream - SBR



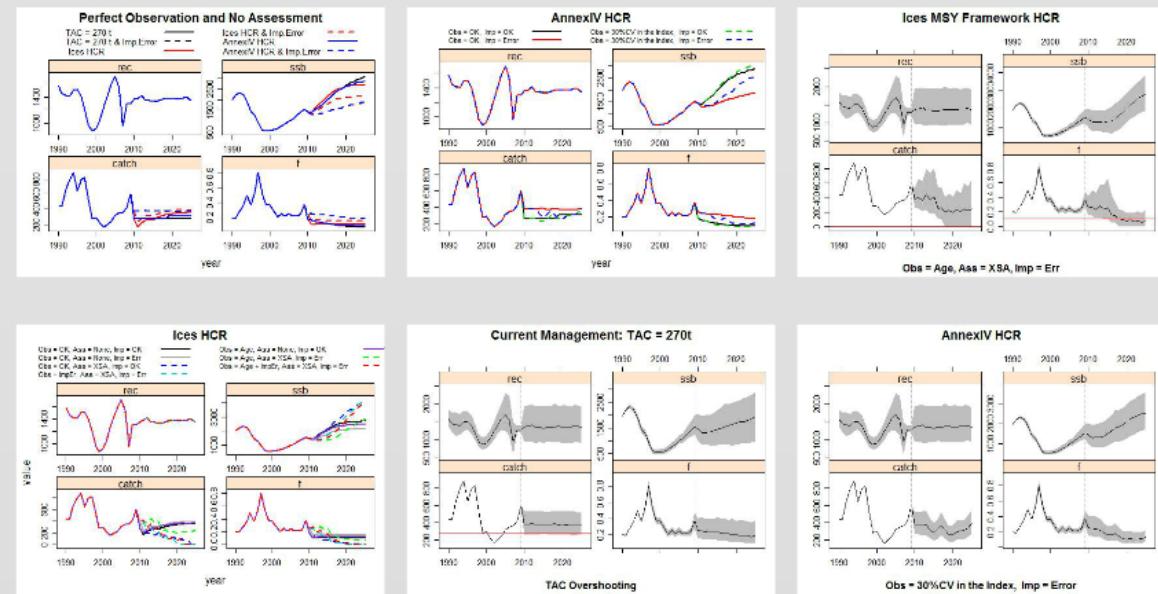
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Population

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 - Random CAA obtained using random ALKs.
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Harvest Control Rules

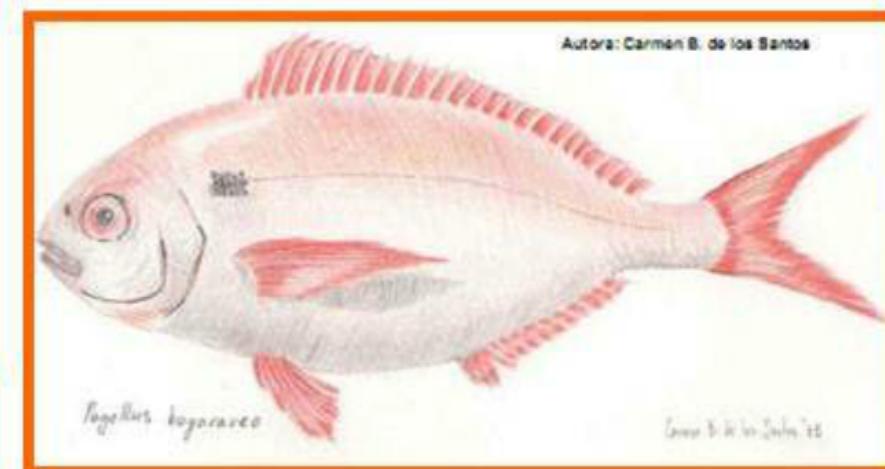
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Scenarios

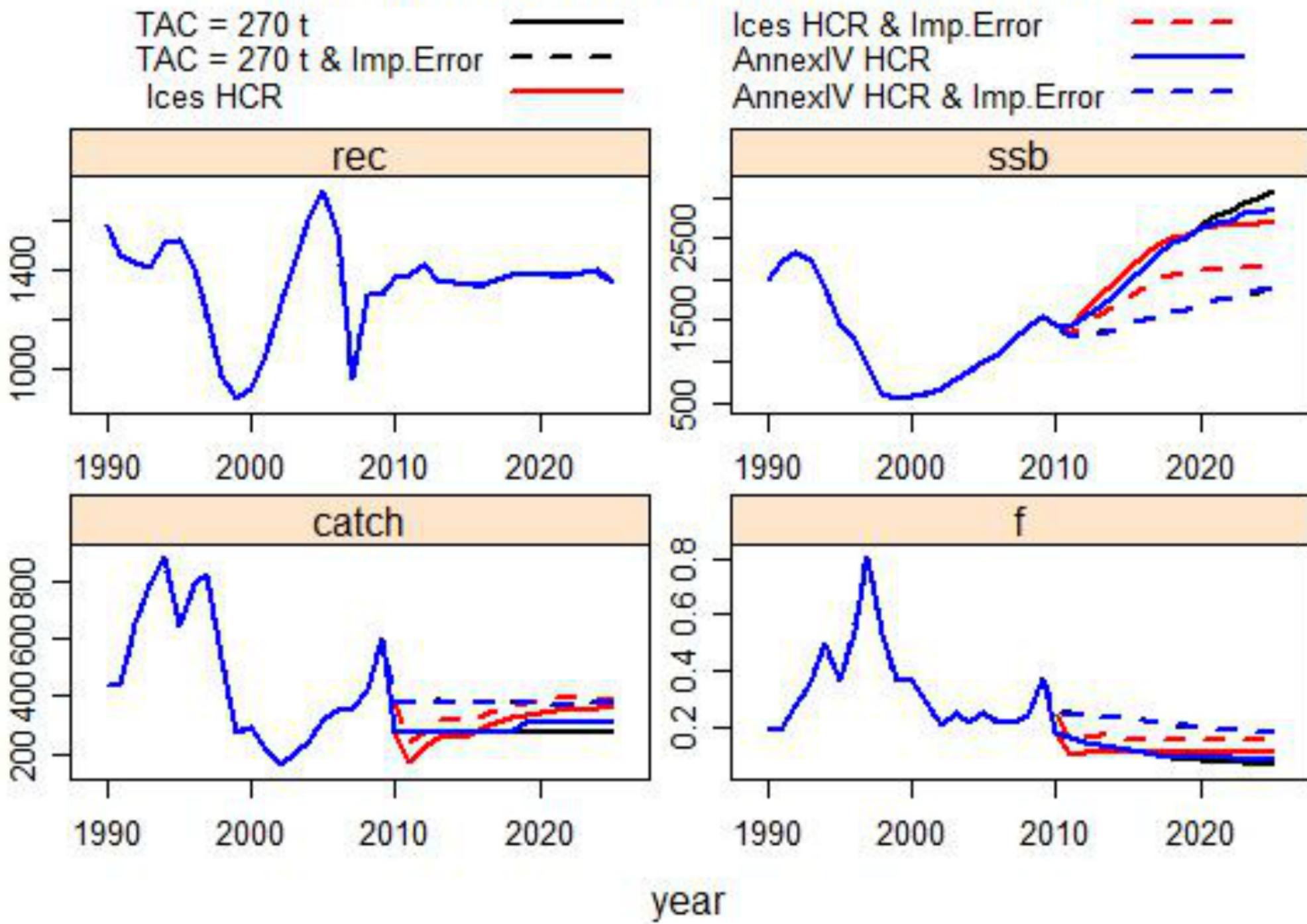
HCRs combined with:

- Perfect Observation.
- Implementation Error.
- Observation error:
 - In age.
 - In catch when there is implementation error.
- No assessment or XSA

Seabream - SBR



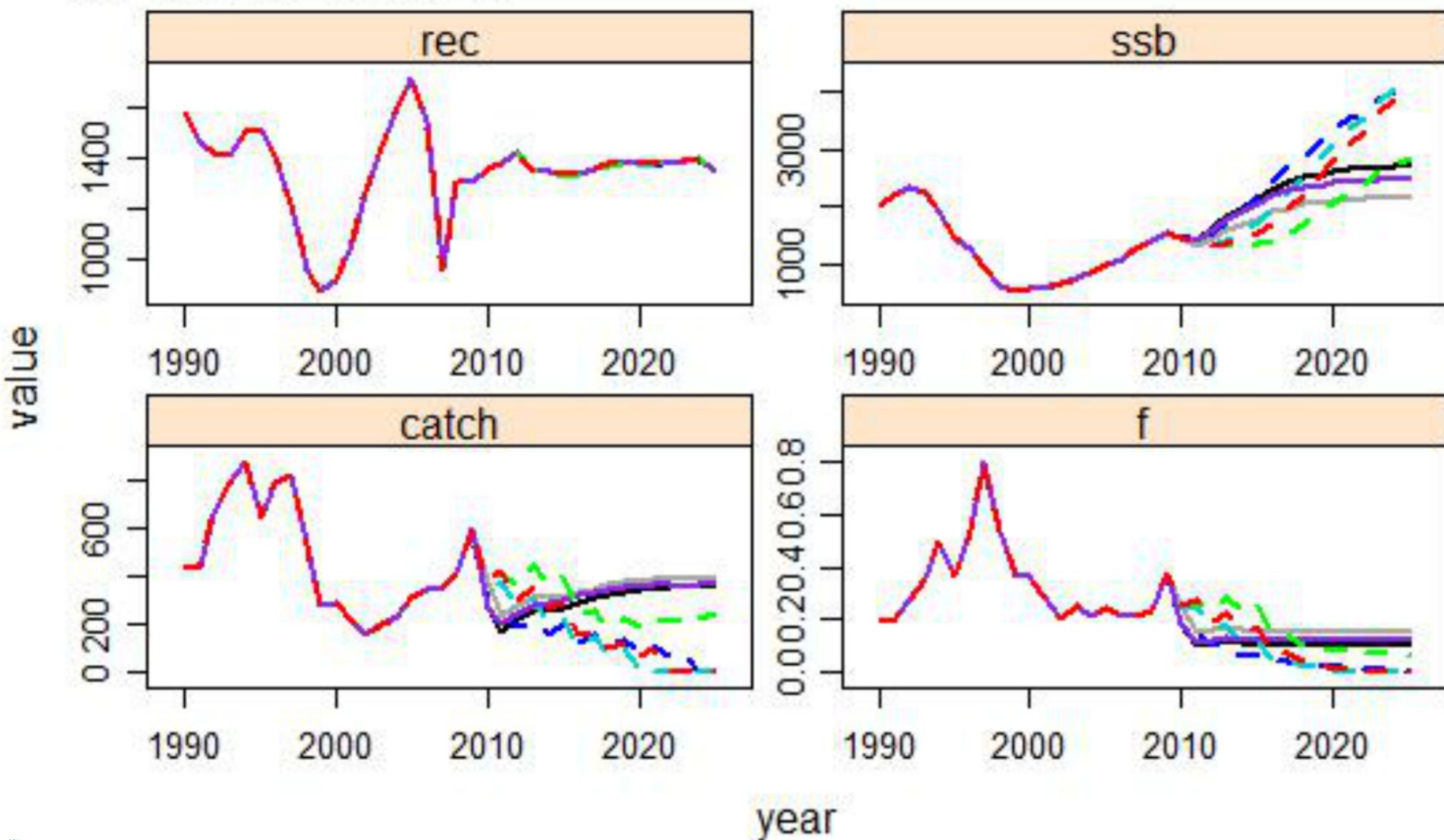
Perfect Observation and No Assessment



Ices HCR

Obs = OK, Ass = None, Imp = OK
Obs = OK, Ass = None, Imp = Err
Obs = OK, Ass = XSA, Imp = OK
Obs = ImpEr, Ass = XSA, Imp = Err

Obs = Age, Ass = None, Imp = OK
Obs = Age, Ass = XSA, Imp = Err
Obs = Age + ImpEr, Ass = XSA, Imp = Err

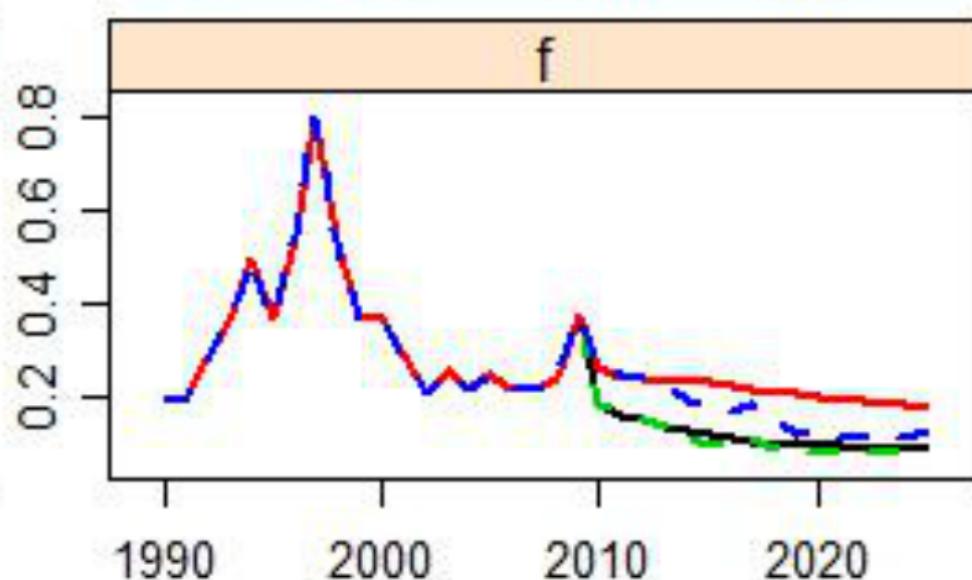
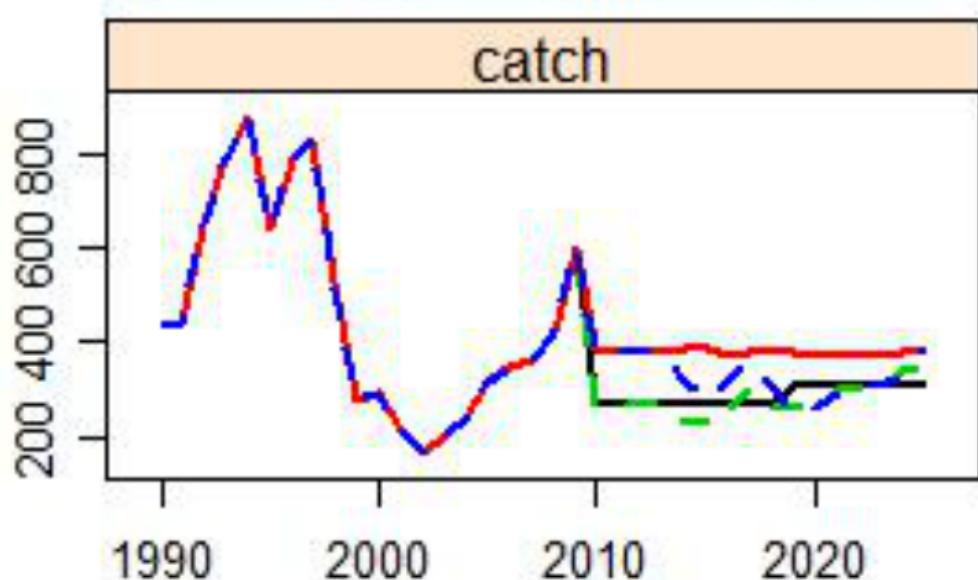
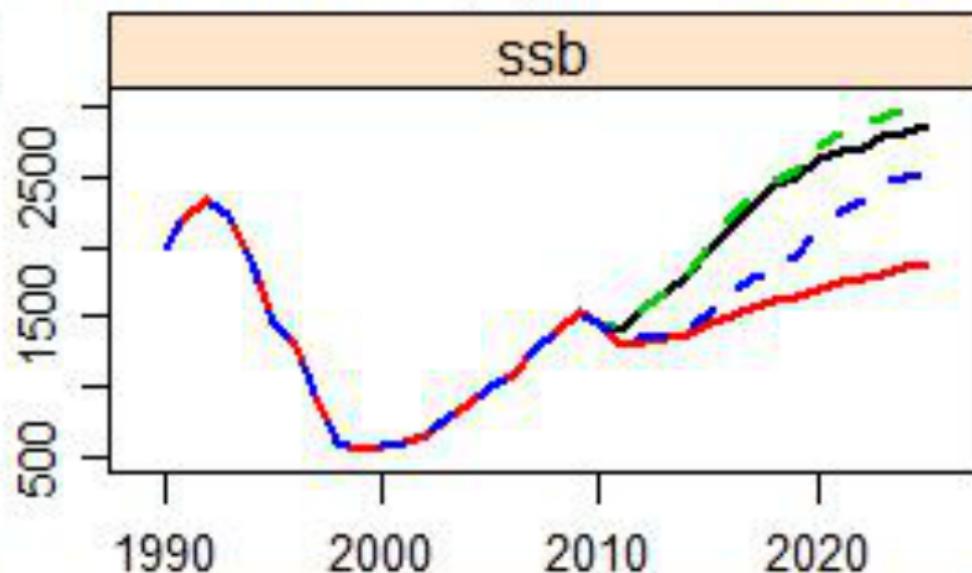
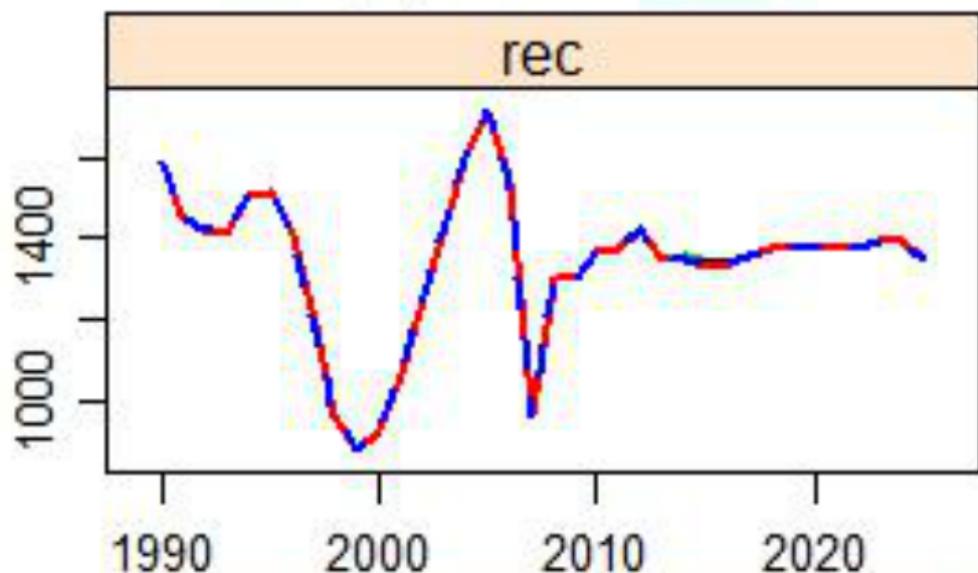


AnnexIV HCR

Obs = OK, Imp = OK
Obs = OK, Imp = Error

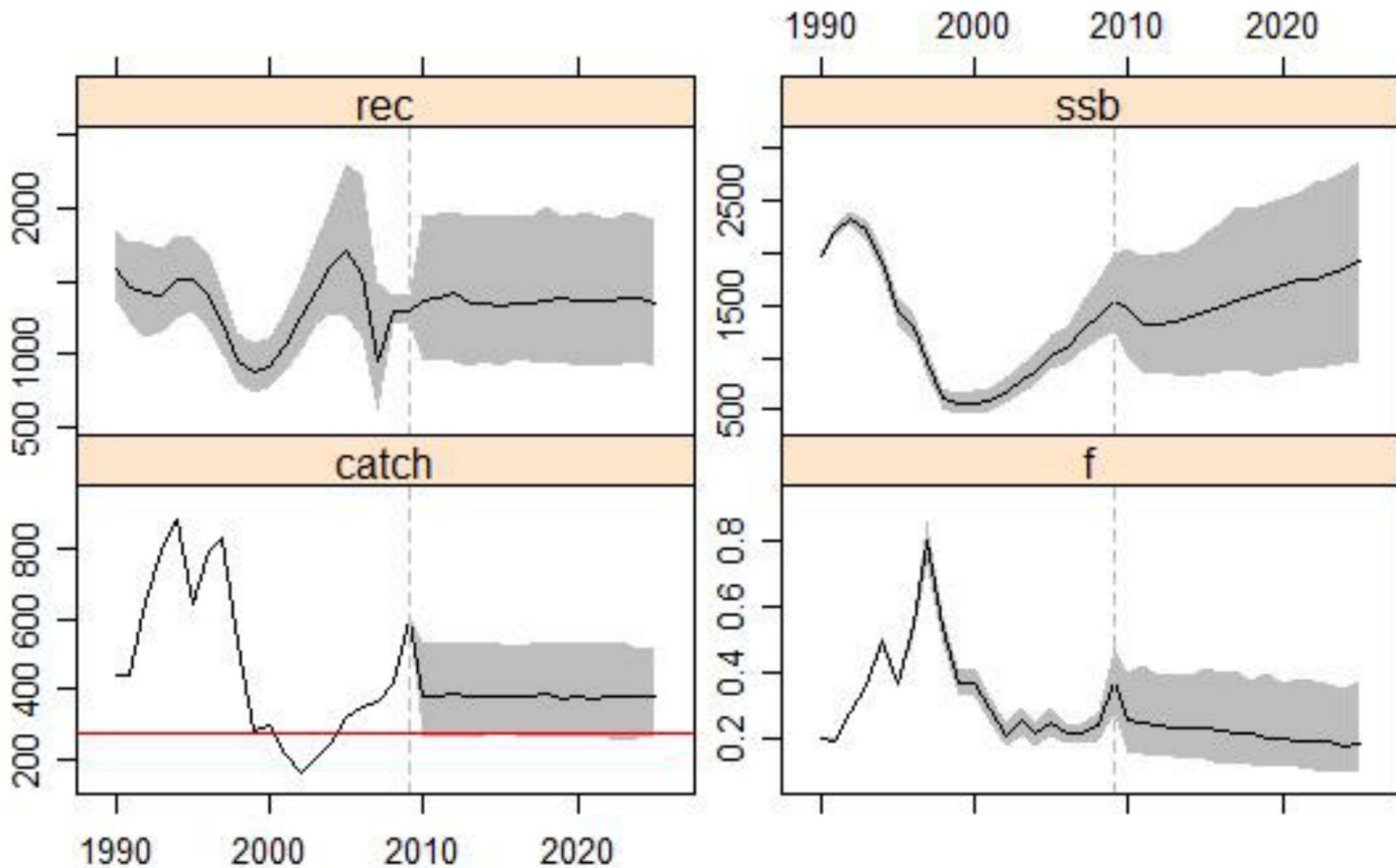


Obs = 30%CV in the Index, Imp = OK
Obs = 30%CV in the Index, Imp = Error



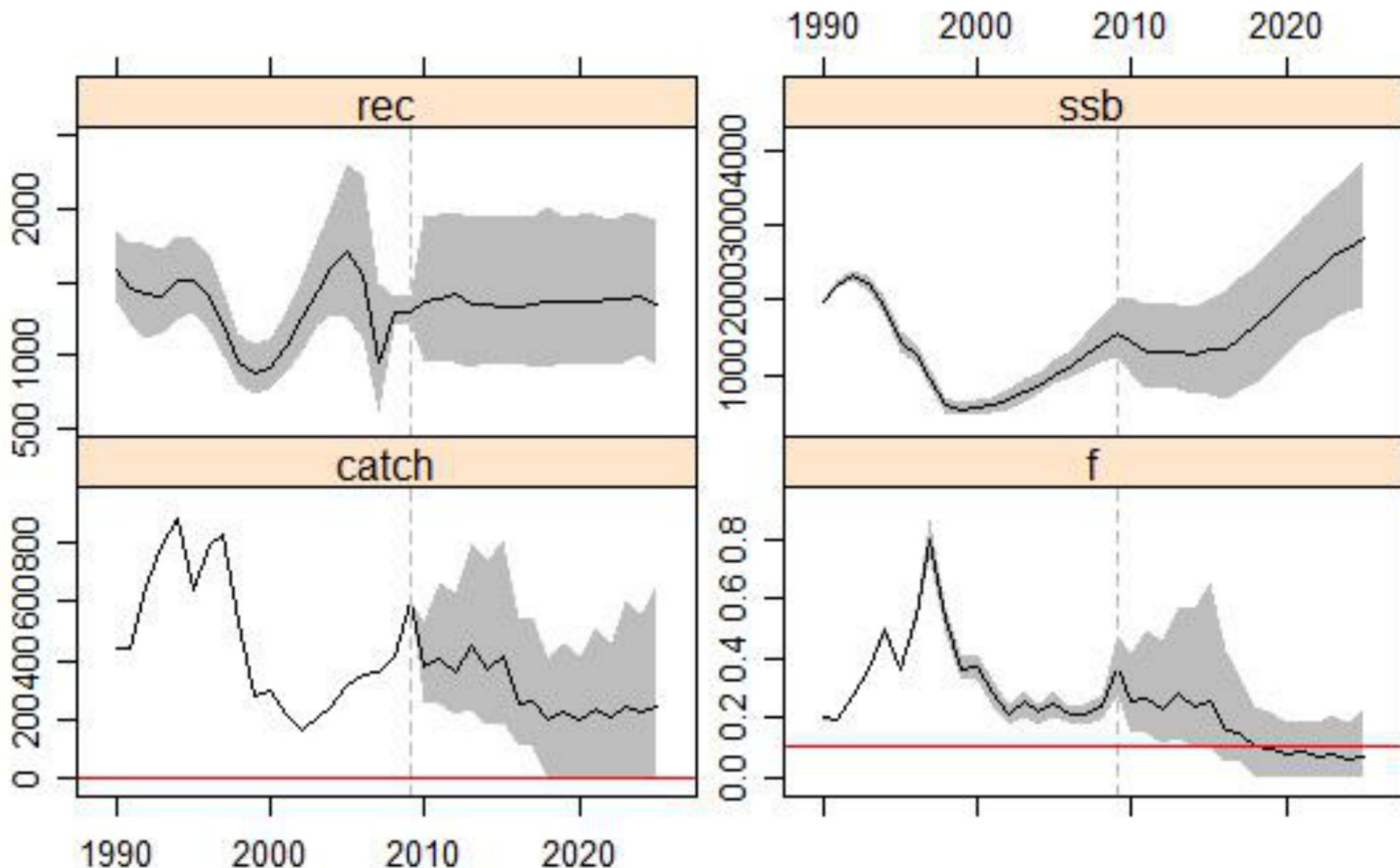
year

Current Management: TAC = 270t



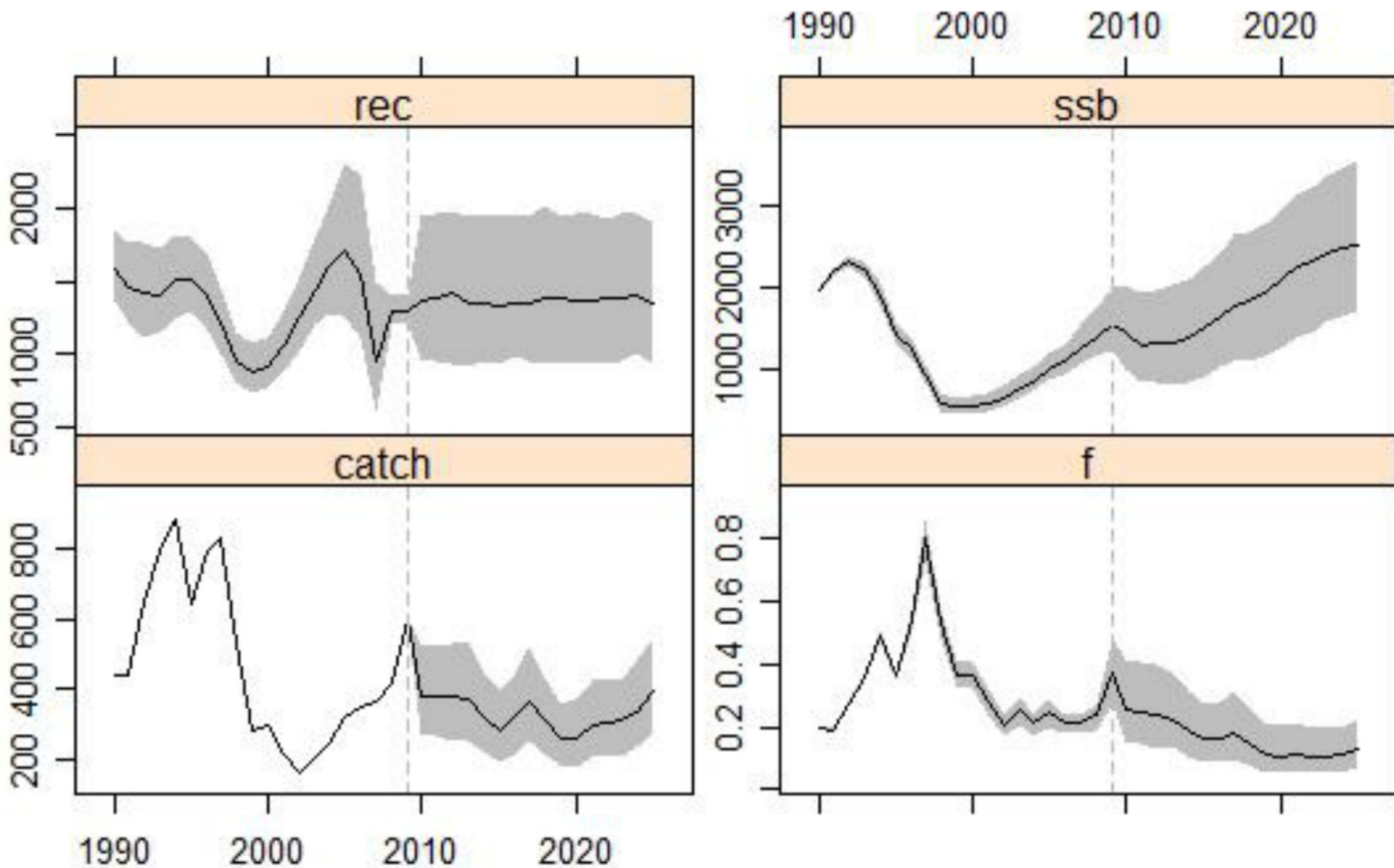
TAC Overshooting

Ices MSY Framework HCR



Obs = Age, Ass = XSA, Imp = Err

AnnexIV HCR



Obs = 30%CV in the Index, Imp = Error

Assessment

Sonia Sanchez, Guzman Diez

French Deepwater Mixed Fisheries



Fleets

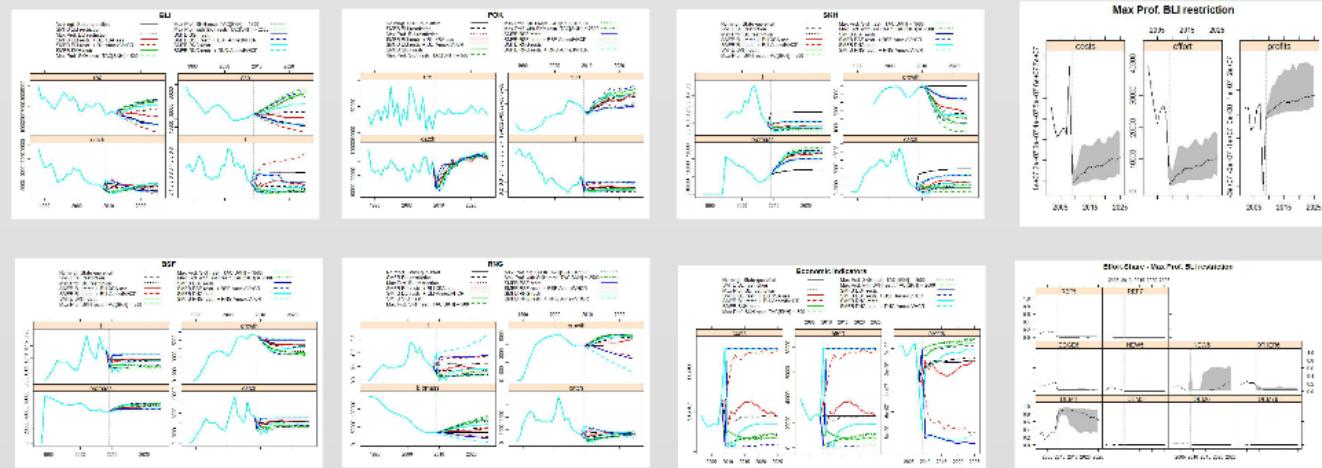
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- FLBLI, FLBSF, FLPOK , FLSKH, FLRNG:
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 - Account for non-french catch.

Harvest Control Rules

- BLI, BSF, RNG: Ices MSY HCR & AnnexIV HCR.
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TAC = 500 t, 1500 t, 2500 t.
- POK: Management Plan HCR.

Scenarios

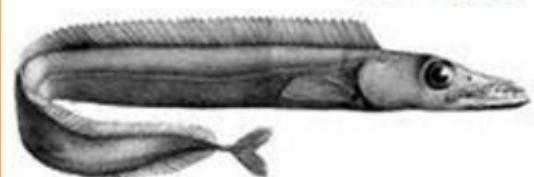
- Fixed Effort.
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- FL01: Maximization of profits constrained to comply with BLI or SKH TAC.
The rest: SMFB.





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:
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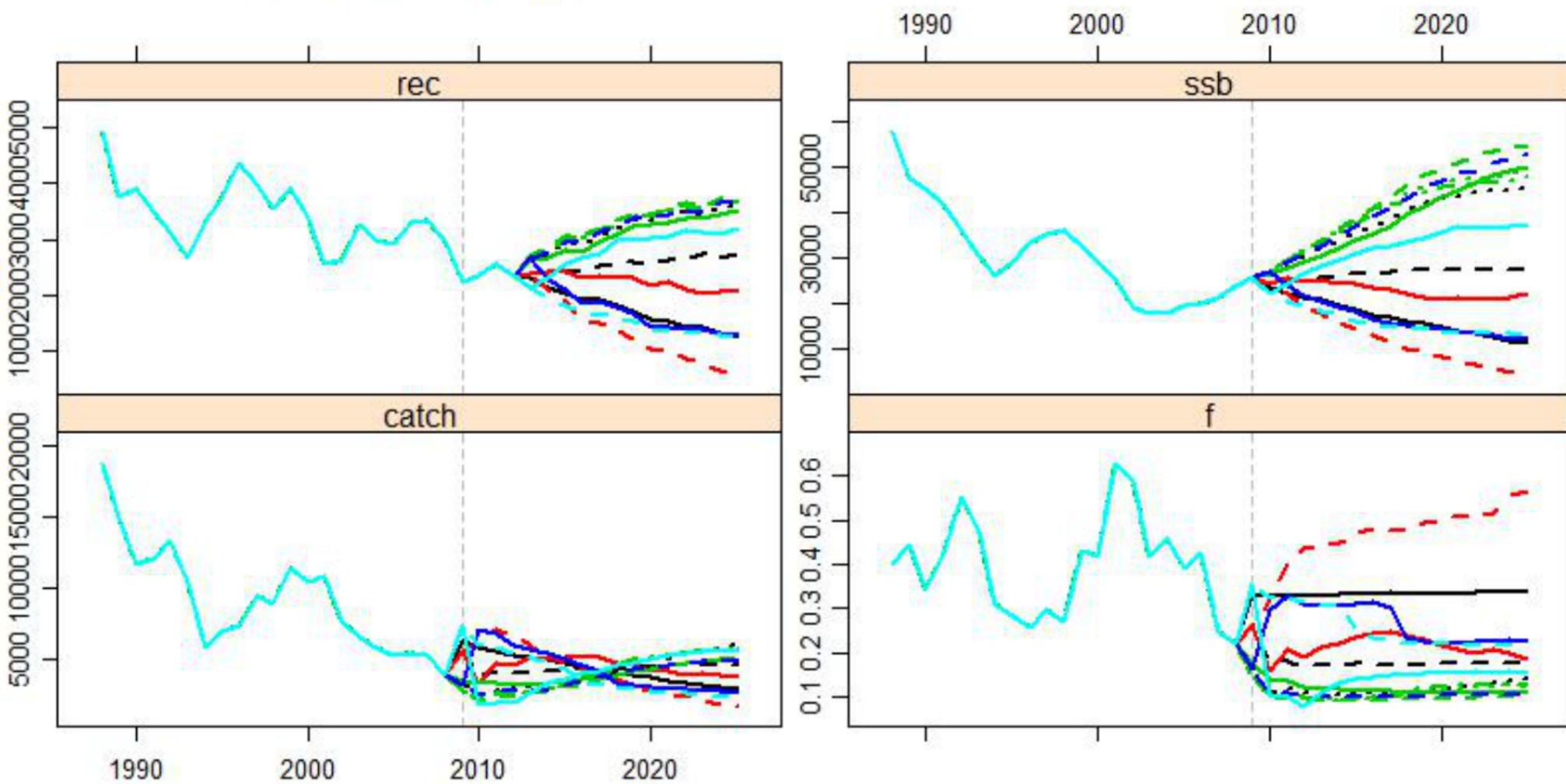
Scenarios

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- Simple Mixed Fisheries Behaviour (F-cube like), constrained by BLI, BSF, RNG or SKH.
- FL01: Maximization of profits constrained to comply with BLI or SKH TAC.
The rest: SMFB.

BLI

No mngrt. Statu quo effort
SMFB BLI restriction
Max Prof. BLI restriction
SMFB BLI restr. + BLI XSA ass
SMFB BLI restr. + BLI AnnexIVHCR
SMFB SKH restr.
Max Prof. SKH restr. TAC[SKH] = 500

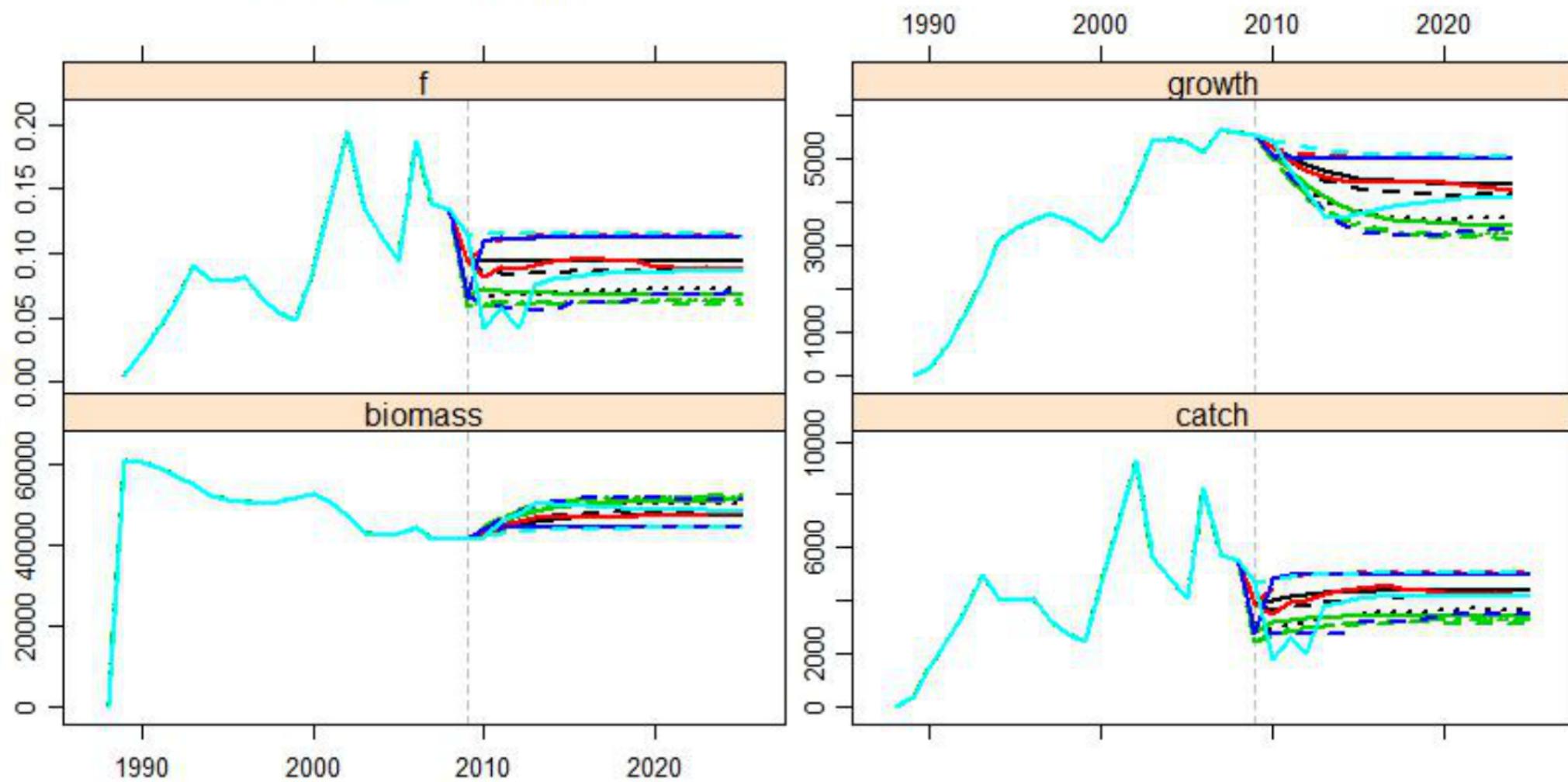
Max Prof. SKH restr. TAC[SKH] = 1500
Max Prof. with SKH restr. TAC[SKH] = 2500
SMFB BSF restr.
SMFB BSF restr. + BSF AnnexIVHCR
SMFB RNG restr.
SMFB RNG restr. + RNG AnnexIVHCR



BSF

No mngrt. Statu quo effort
 SMFB BLI restriction
 Max Prof. BLI restriction
 SMFB BLI restr. + BLI XSA ass
 SMFB BLI restr. + BLI AnnexIVHCR
 SMFB SKH restr.
 Max Prof. SKH restr. TAC[SKH] = 500

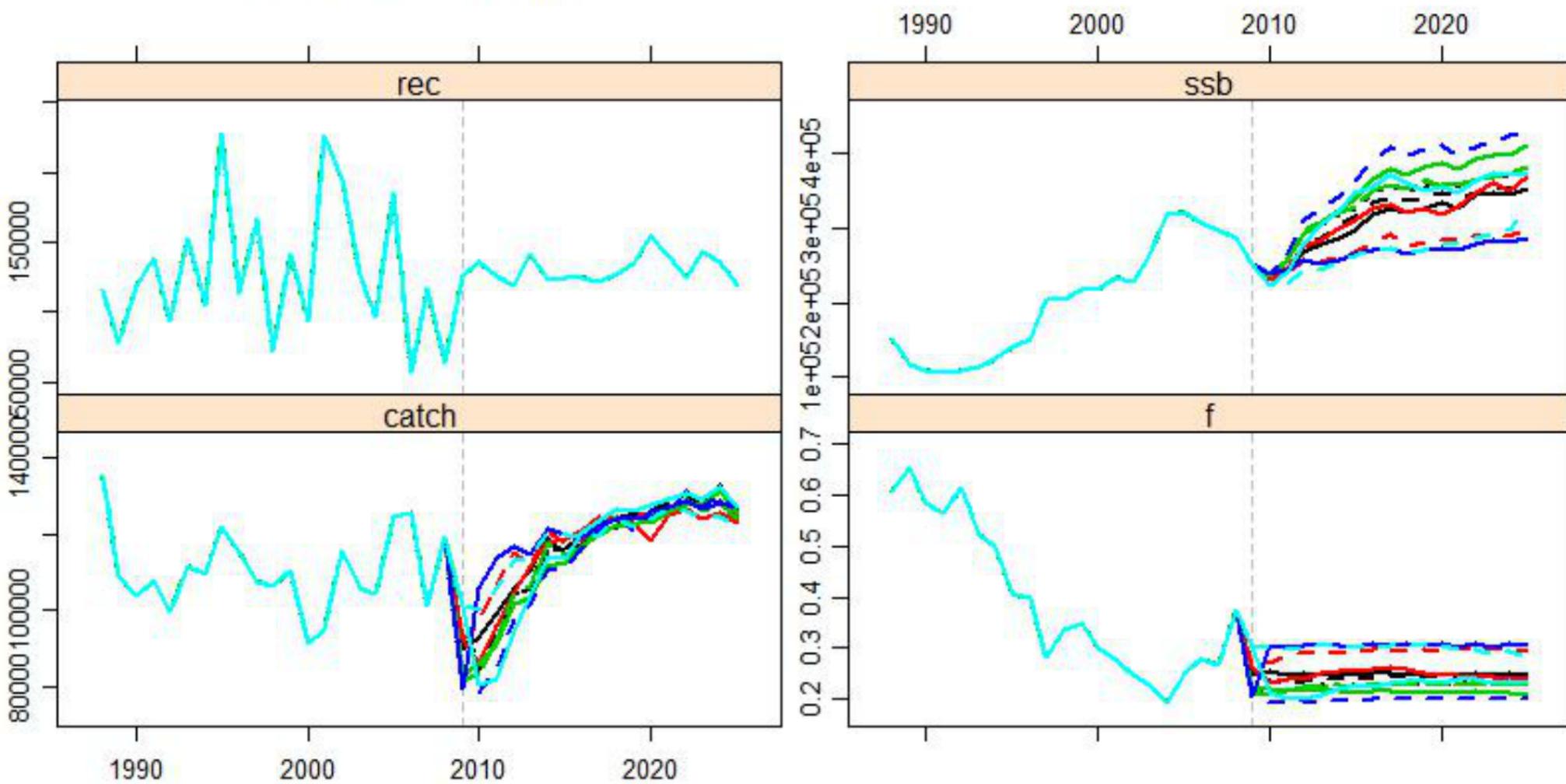
Max Prof. SKH restr. TAC[SKH] = 1500
 Max Prof. with SKH restr. TAC[SKH] = 2500
 SMFB BSF restr.
 SMFB BSF restr. + BSF AnnexIVHCR
 SMFB RNG restr.
 SMFB RNG restr. + RNG AnnexIVHCR



POK

No mngrt. Statu quo effort
 SMFB BLI restriction
 Max Prof. BLI restriction
 SMFB BLI restr. + BLI XSA ass
 SMFB BLI restr. + BLI AnnexIVHCR
 SMFB SKH restr.
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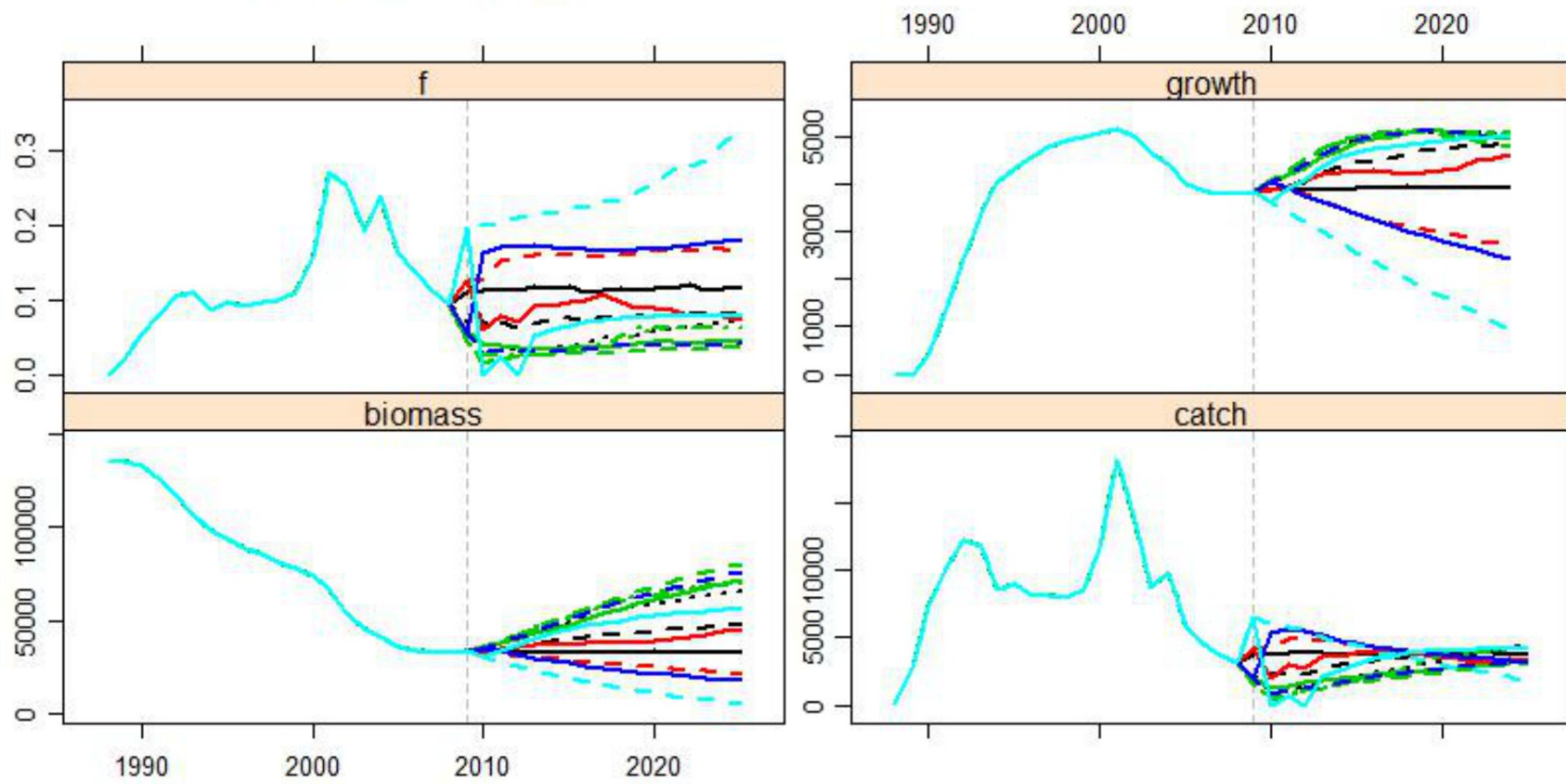
Max Prof. SKH restr. TAC[SKH] = 1500
 Max Prof. with SKH restr. TAC[SKH] = 2500
 SMFB BSF restr.
 SMFB BSF restr. + BSF AnnexIVHCR
 SMFB RNG restr.
 SMFB RNG restr. + RNG AnnexIVHCR



RNG

No mngrt. Statu quo effort
 SMFB BLI restriction
 Max Prof. BLI restriction
 SMFB BLI restr. + BLI XSA ass
 SMFB BLI restr. + BLI AnnexIVHCR
 SMFB SKH restr.
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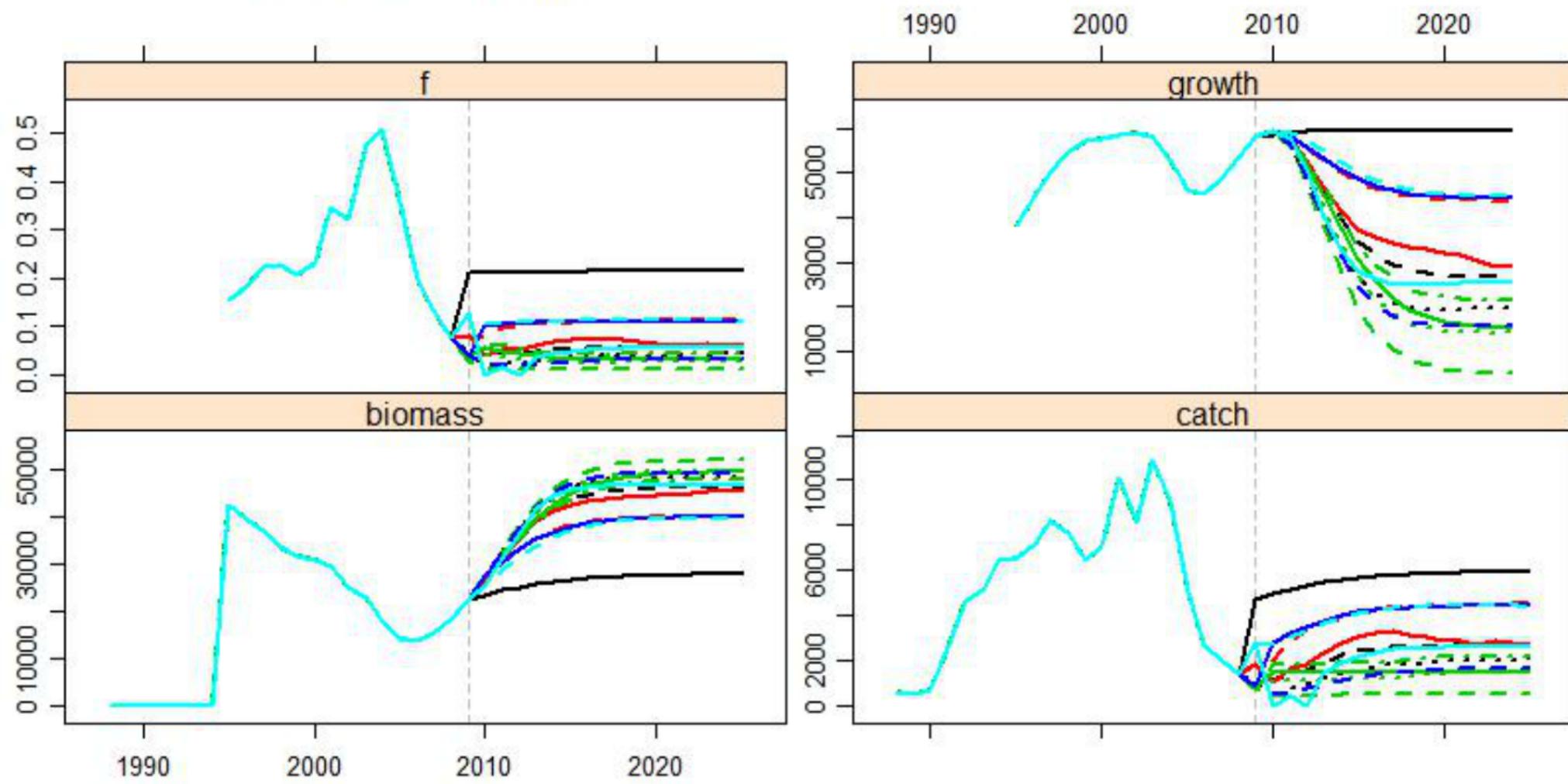
Max Prof. SKH restr. TAC[SKH] = 1500
 Max Prof. with SKH restr. TAC[SKH] = 2500
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 SMFB BSF restr. + BSF AnnexIVHCR
 SMFB RNG restr.
 SMFB RNG restr. + RNG AnnexIVHCR



SKH

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 Max Prof. BLI restriction
 SMFB BLI restr. + BLI XSA ass
 SMFB BLI restr. + BLI AnnexIVHCR
 SMFB SKH restr.
 Max Prof. SKH restr. TAC[SKH] = 500

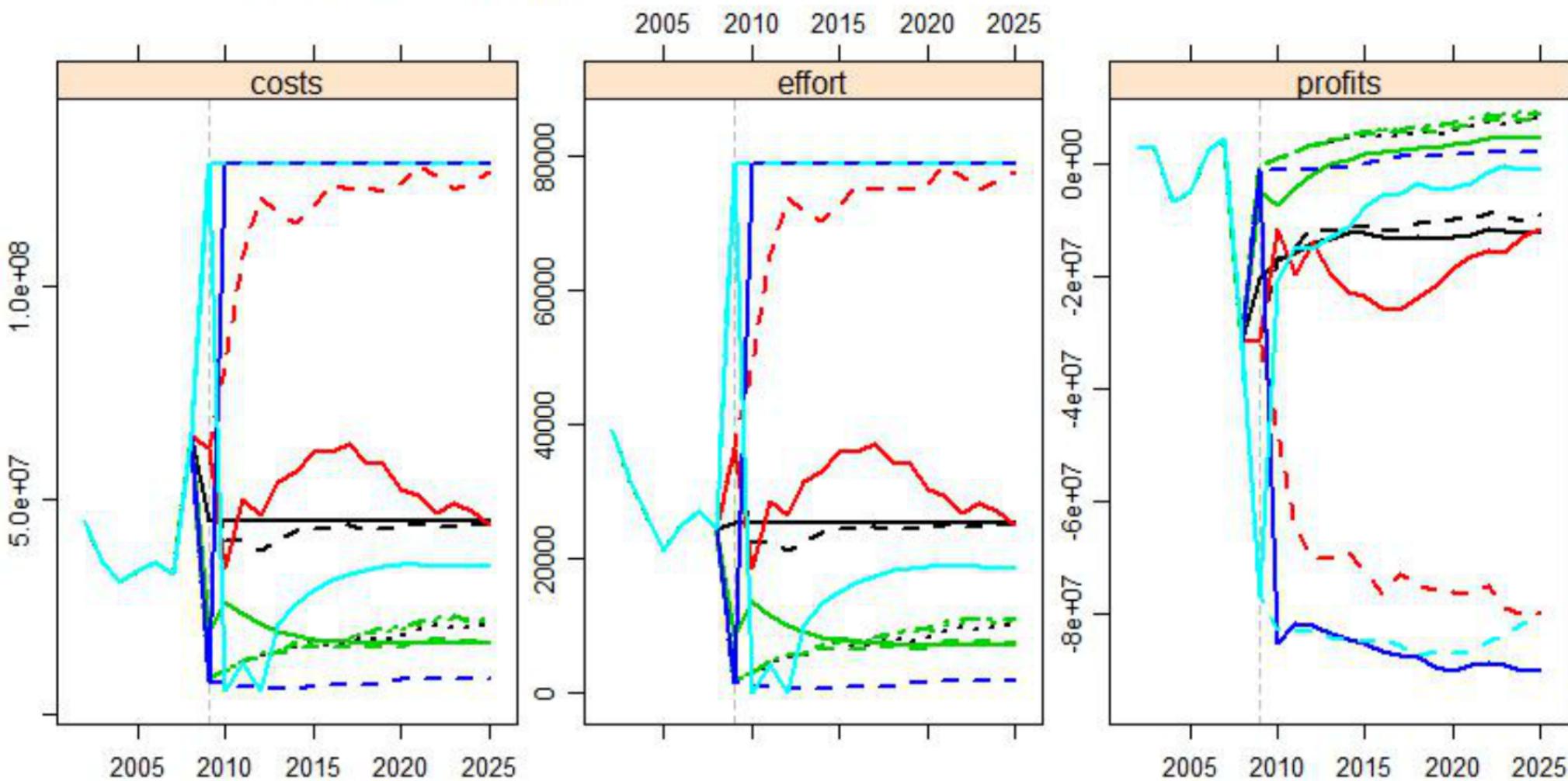
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 SMFB BSF restr.
 SMFB BSF restr. + BSF AnnexIVHCR
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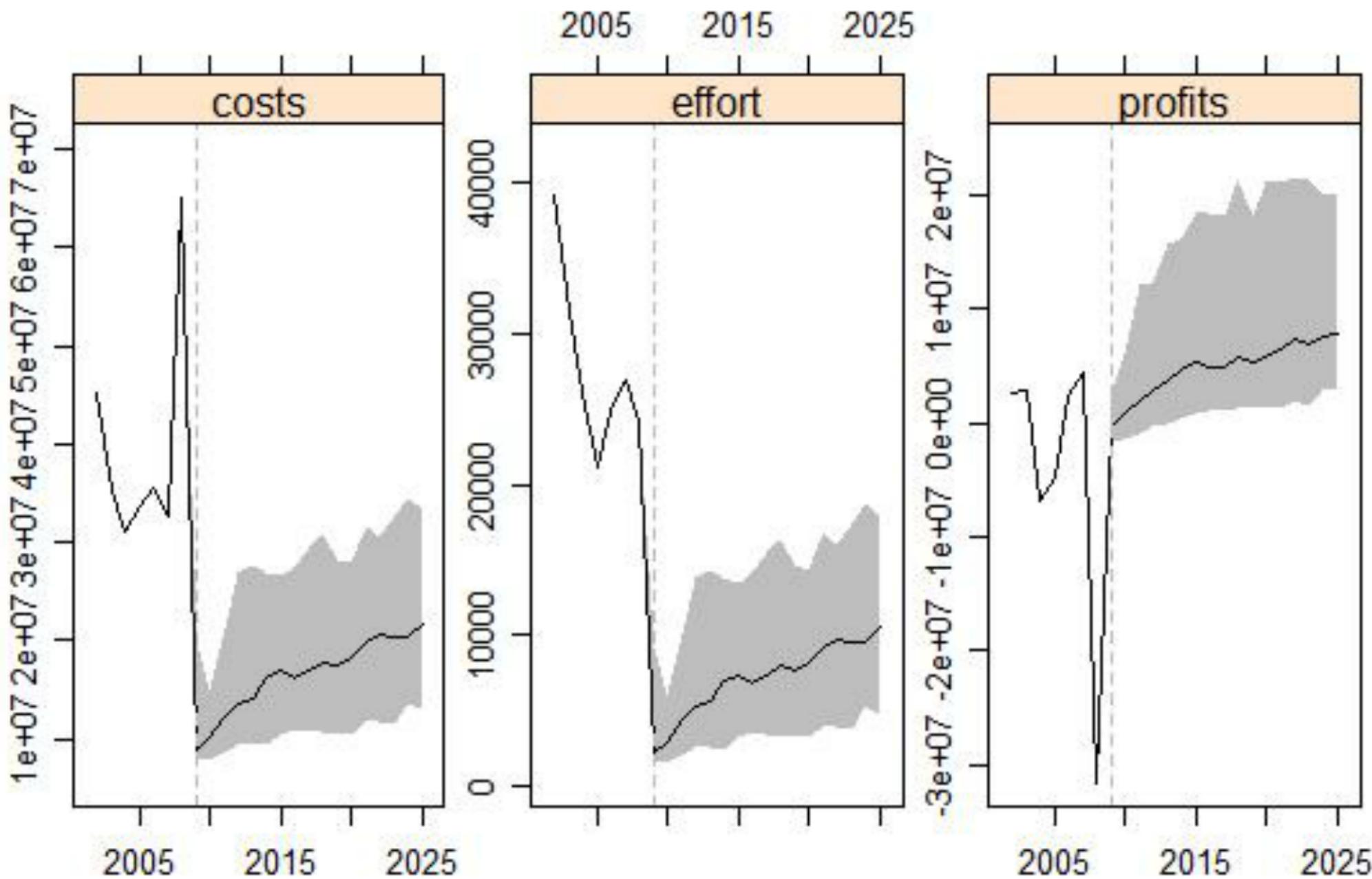
Economic Indicators

No mngrt. Statu quo effort
 SMFB BLI restriction
 Max Prof. BLI restriction
 SMFB BLI restr. + BLI XSA ass
 SMFB BLI restr. + BLI AnnexIVHCR
 SMFB SKH restr.
 Max Prof. SKH restr. TAC[SKH] = 500

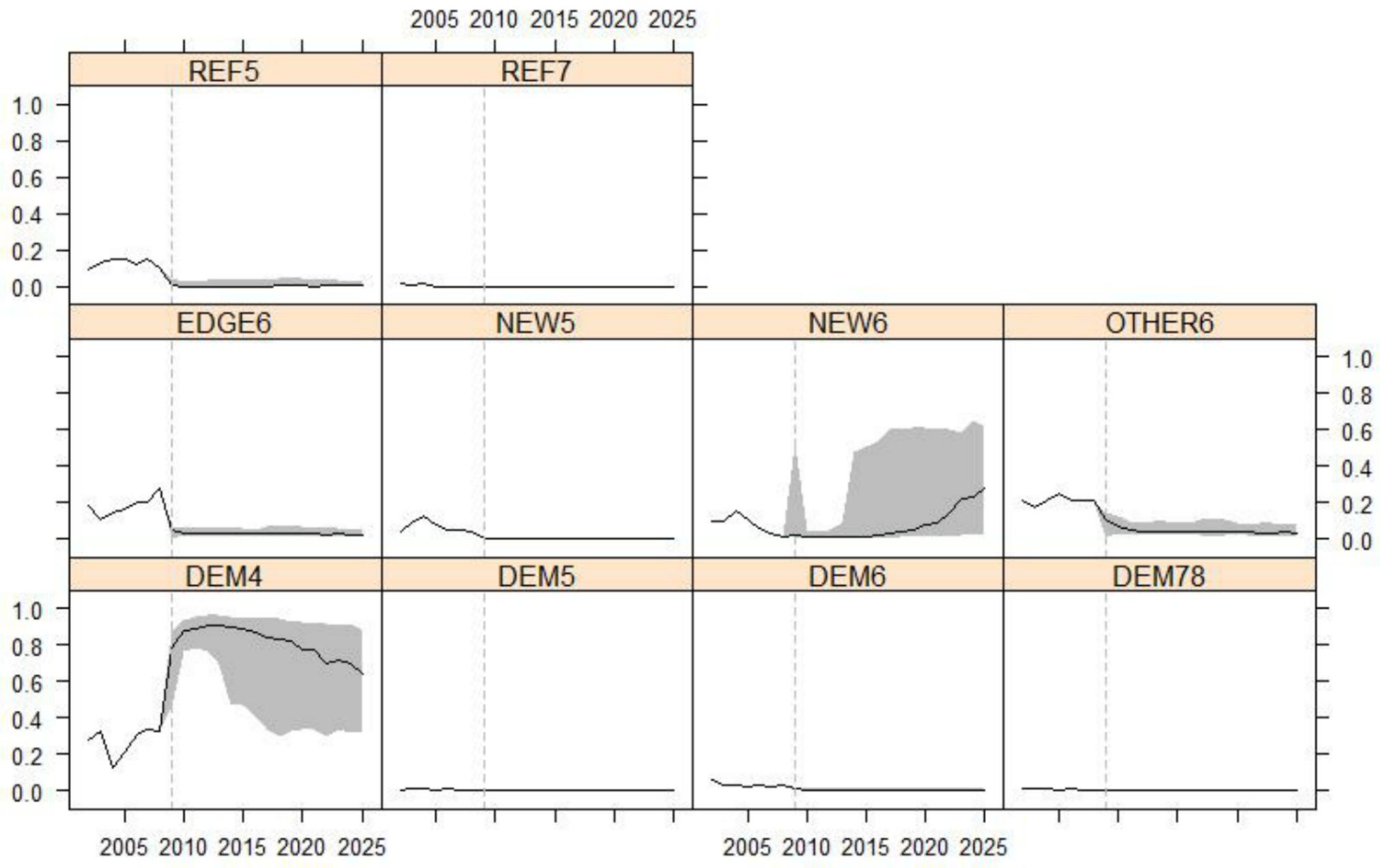
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 Max Prof. with SKH restr. TAC[SKH] = 2500
 SMFB BSF restr.
 SMFB BSF restr. + BSF AnnexIVHCR
 SMFB RNG restr.
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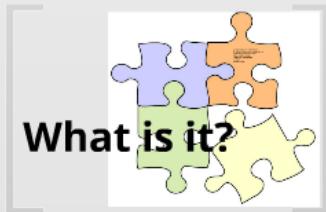
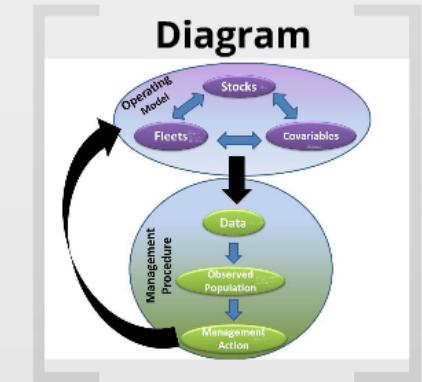
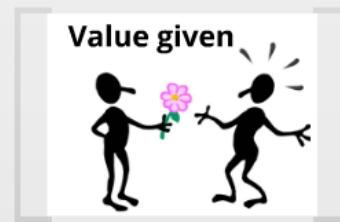


Max Prof. BLI restriction



Effort Share - Max Prof. BLI restriction





FLBEIA

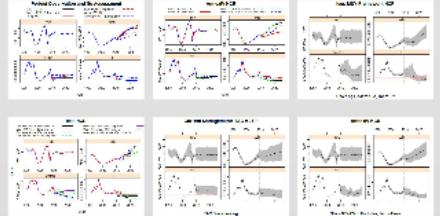
Bio-Economic Impact Assessment

Dorleta Garcia, Raúl Prellezo, Sonia Sanchez, Guzman Diez



Seabream of Gulf of Cadiz

- Population**
 - Age structure
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 - Random AIC parameterized from a von Bertalanffy Bayesian model fit.
 - Implementation of the existing XSA to:
 - Random CAA obtained using random effect
 - Random abundance index (30% CV).
 - Random effort.
- Harvest Control Rules**
 - TAC = Total Allowable Catch
 - (Code = Management Code)
 - AnnealXSA (COPUE based HCR).
- Scenarios**
 - HCRs combined with XSA
 - Perfect Observation
 - Perfect Implementation
 - Observation error:
 - In age
 - In abundance when there is implementation error.
 - No assessment or XSA



French Deepwater Mixed Fisheries

- Fleets**
 - BLJ: Mixed Fisheries
 - French Fleet with 10 meters.
 - FR: French fisheries
 - FL01, FL02, FL03, FL04, FL05, FL06, FL07, FL08, FL09, FL10: Non-french fisheries
 - Account for non-french catch.
- Harvest Control Rules**
 - BLJ, BSF, RNG: Ties HSY HCR & AnnexIV HCR
 - SKH: TAC = 0 (discounts allowed).
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 - FL01: Maximization of profits constrained to comply with BLJ or SKH TAC.
 - The rest: XSA's.

