



Conditioning of OMs and preliminary evaluation of MPs for Indian Ocean yellowfin

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Source code:

<https://github.com/flr/FLBEIA>

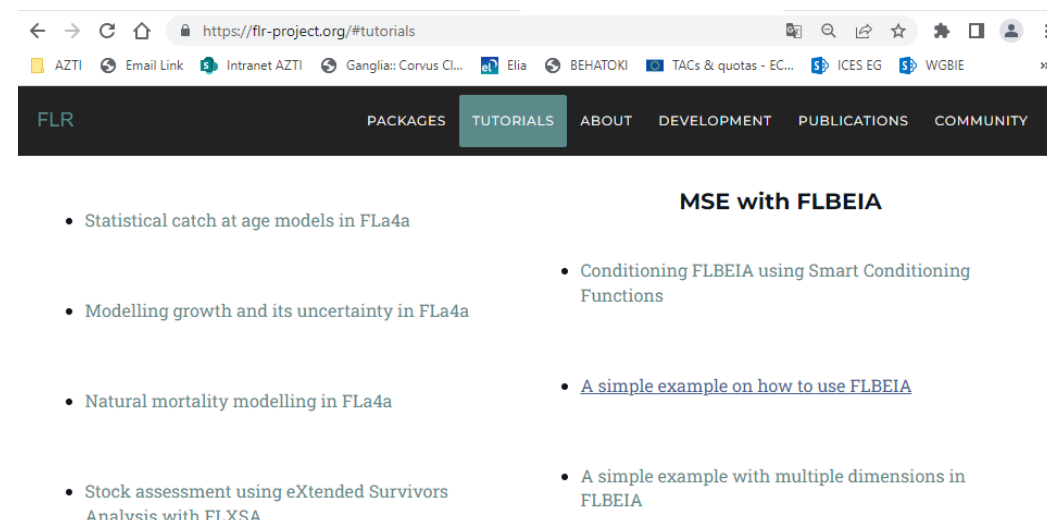
Documentation:

- <https://www.flr-project.org/>,
- https://github.com/flr/FLBEIA/blob/master/vignettes/FLBEIA_manual.pdf

FLBEIA: A simulation model to conduct Bio-Economic evaluation of fisheries management strategies



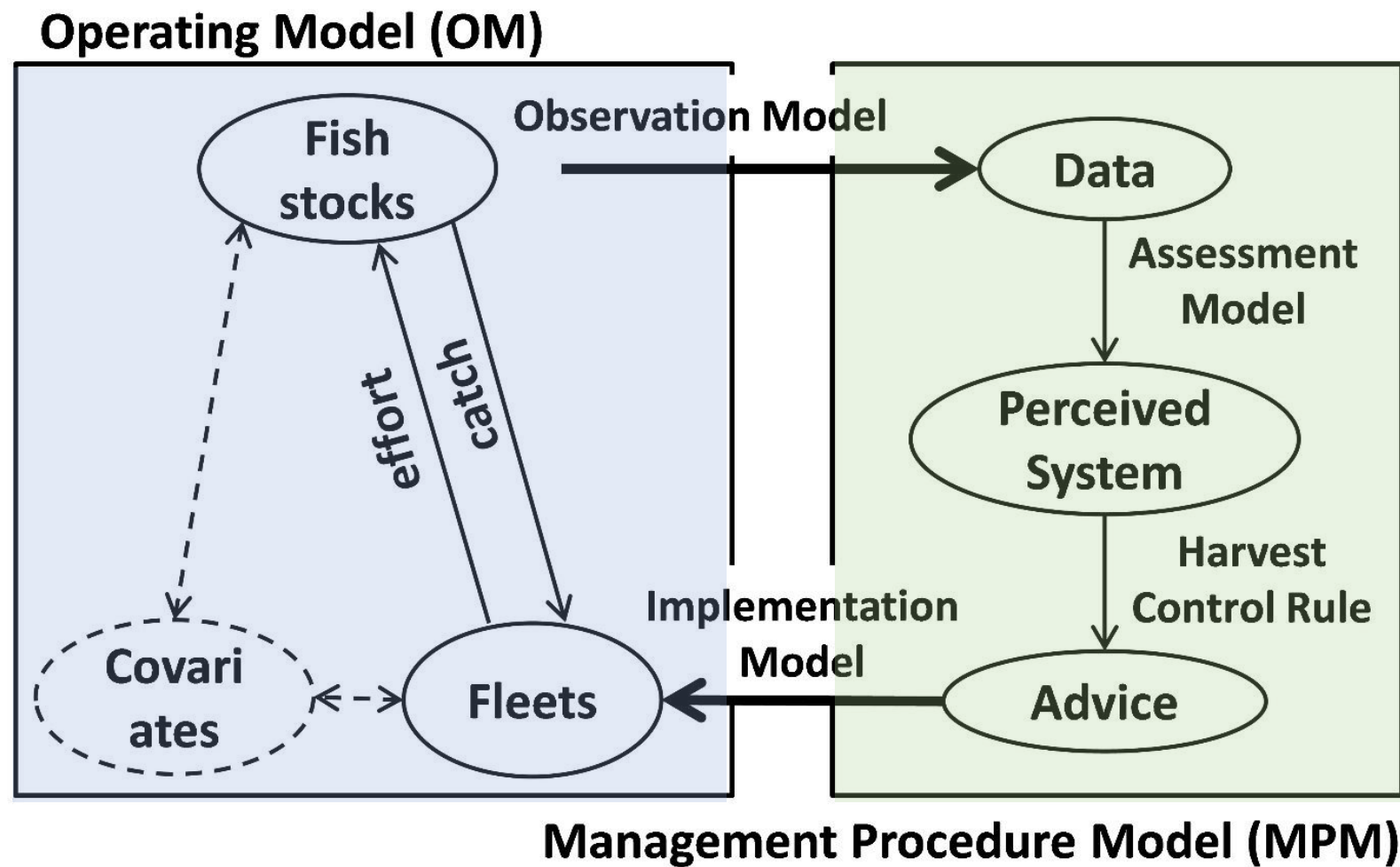
Dorleta Garcia ^{a,*}, Sonia Sánchez ^b, Raúl Pallezo ^a, Agurtzane Urtizberea ^b, Marga Andrés ^a



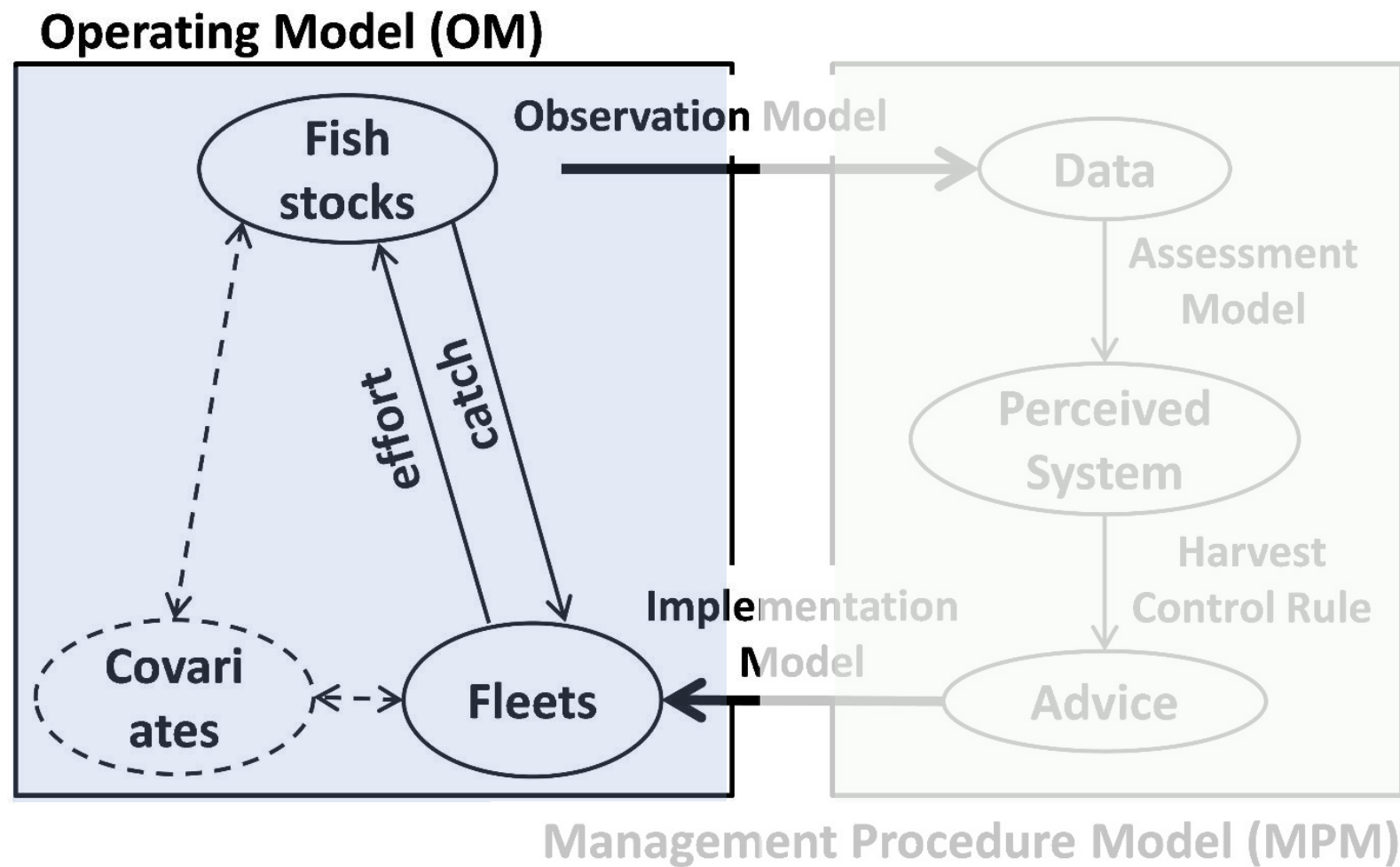
The screenshot shows the FLR project website with the URL <https://flr-project.org/#tutorials>. The navigation bar includes links for PACKAGES, TUTORIALS, ABOUT, DEVELOPMENT, PUBLICATIONS, and COMMUNITY. The main content area is titled "MSE with FLBEIA" and lists several topics:

- Statistical catch at age models in FL4a
- Modelling growth and its uncertainty in FL4a
- Natural mortality modelling in FL4a
- Stock assessment using eXtended Survivors Analysis with FLXSA
- Conditioning FLBEIA using Smart Conditioning Functions
- [A simple example on how to use FLBEIA](#)
- A simple example with multiple dimensions in FLBEIA

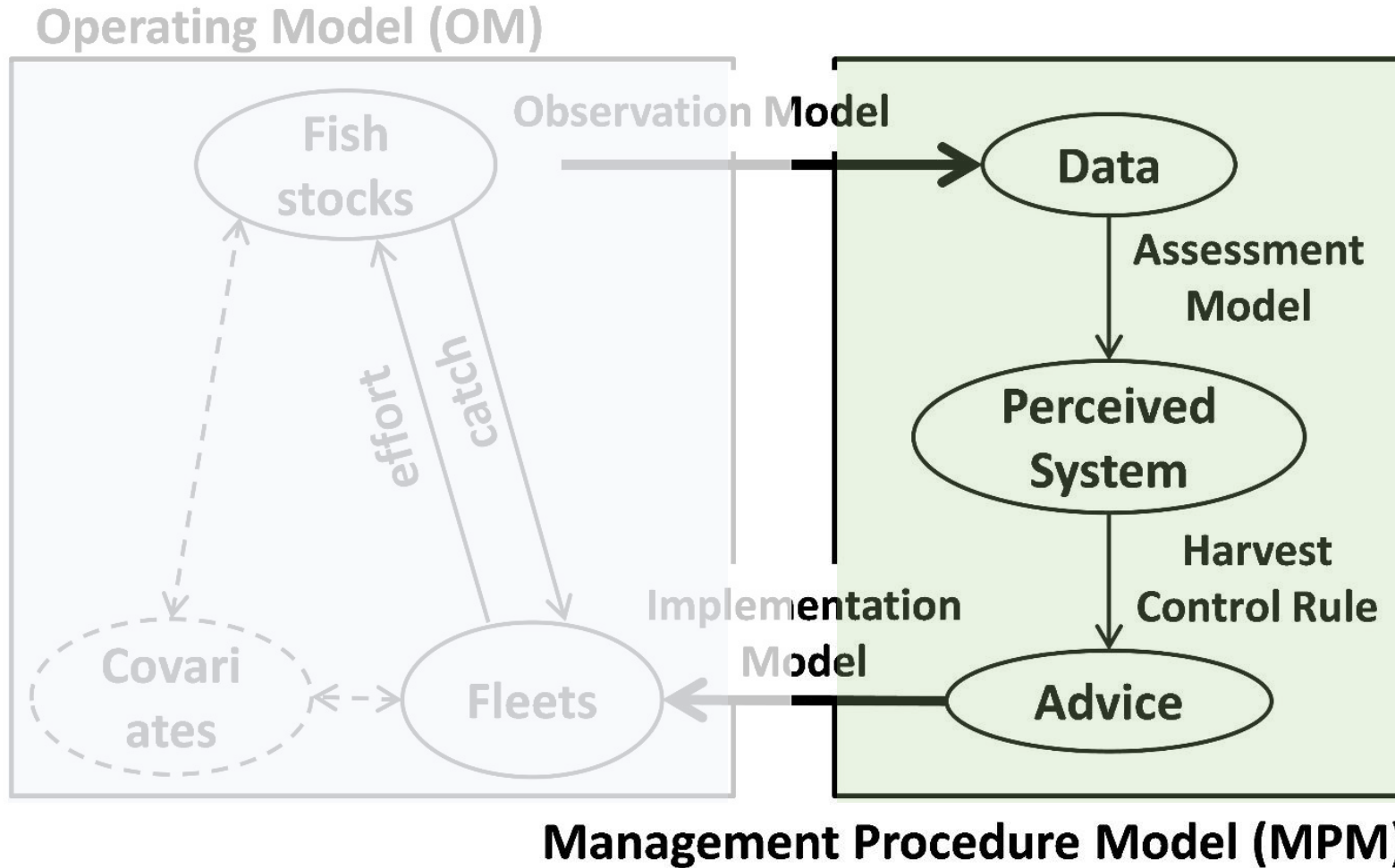
FLBEIA scheme



FLBEIA scheme



FLBEIA scheme



Uncertainty grid

Uncertainty grid

An initial reference set of OMs was developed based on the uncertainty grid of the assessment of YFT 2024.

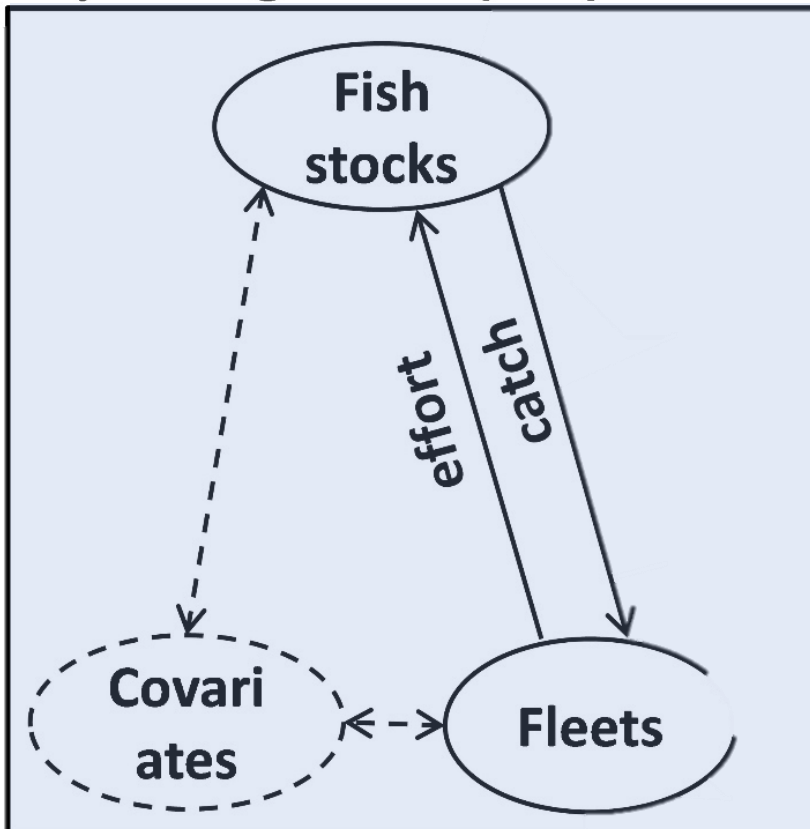
- **Differences on CPUE selectivity:** after the year 2000, larger fish are caught by the LL gear
- **Steepness:** 0.7, 0.8, 0.9
- **Effort creep:** Apply to the CPUE an effort creep of 0 and 0.5% per year.

Conditioning

Conditioning OM

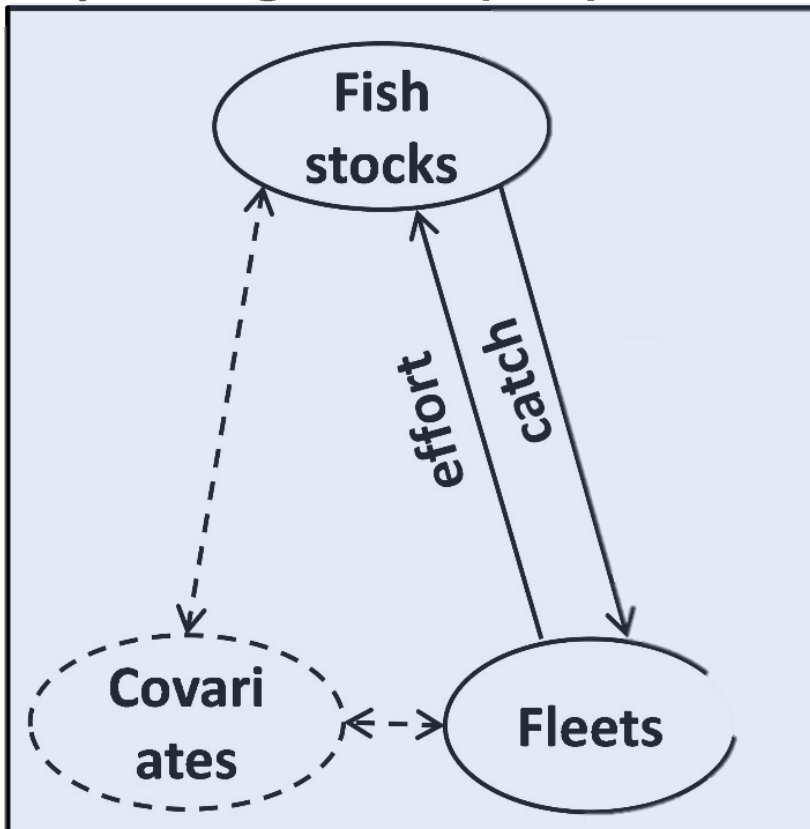
Biological OM

Operating Model (OM)



- Biological characteristics similar to ss3: number of individuals, weight, maturity, natural mortality.
- Age Structured Population Growth.
 - Exponential survival model.
 - Stock recruitment relationship the same as in ss3.

Operating Model (OM)



Fleets OM

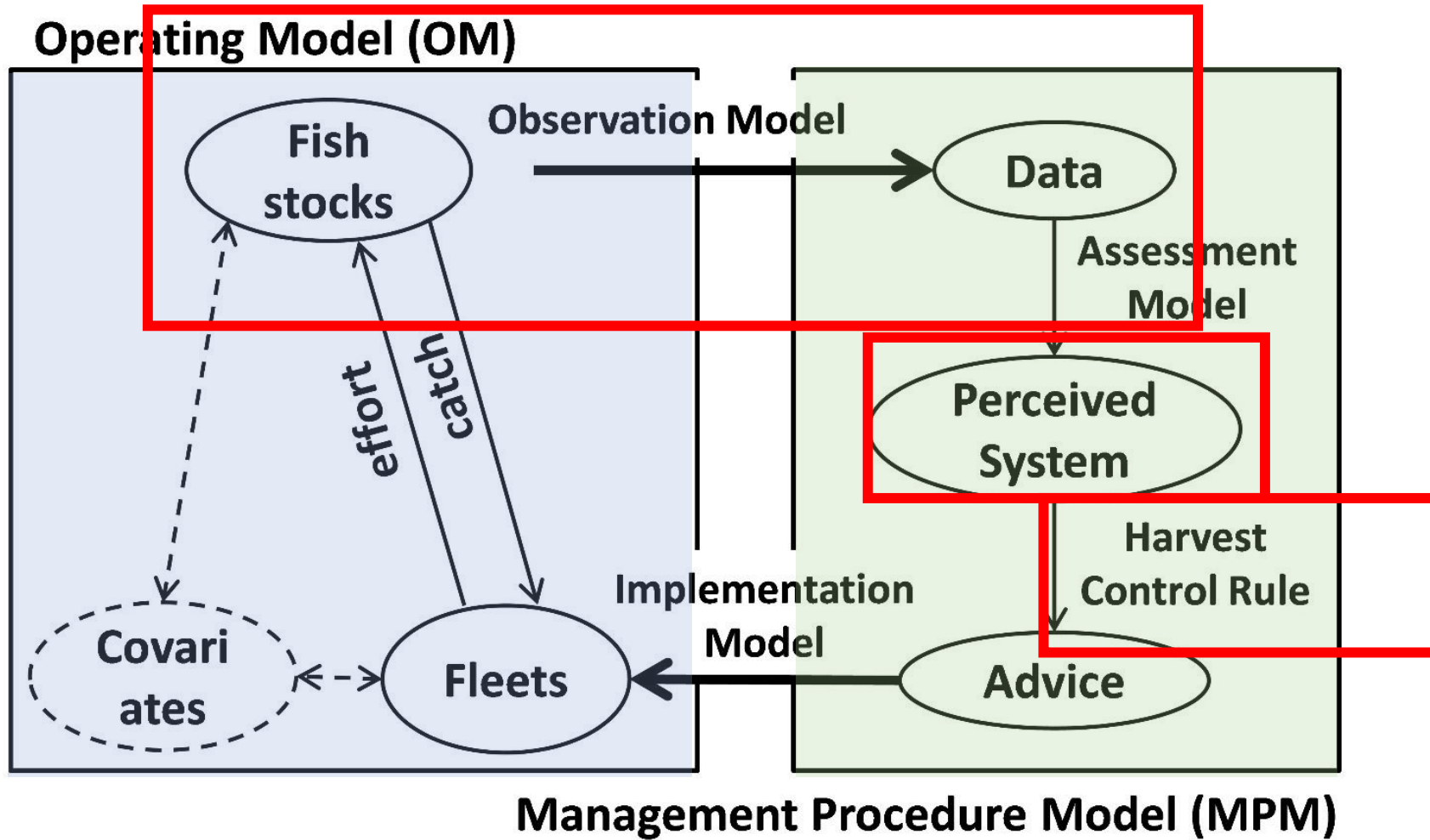
- The fleet structure simplified to the gear (no area):
 - BB, PS, LL, GI, HD, TR, FLL, OT
 - Fleets characteristics similar to ss3 (landings of number of individuals, weight , maturity, natural mortality
 - Catchability estimated from: Catch Model – Cobb Douglas equation

$$q_a = C_a / (N_a \times e^{-m_a/2})$$

$$C_a = q_a \times N_a^\alpha \times E_a^\beta \quad (\alpha = 1, \beta = 1)$$

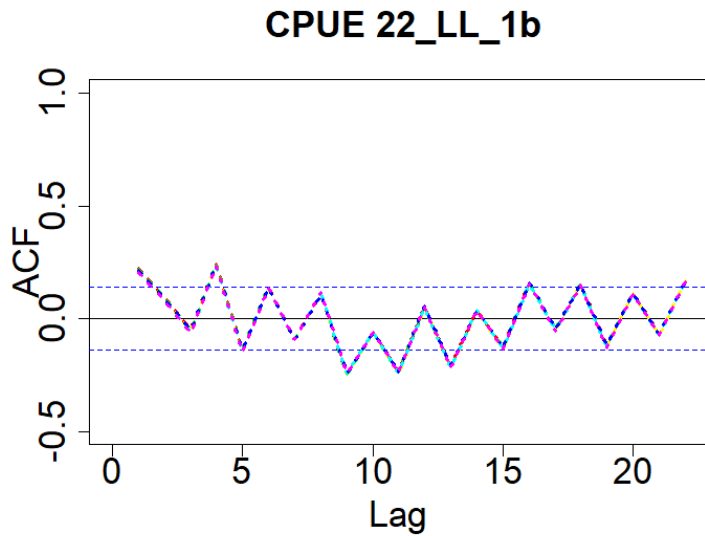
Observation error model

FLBEIA scheme

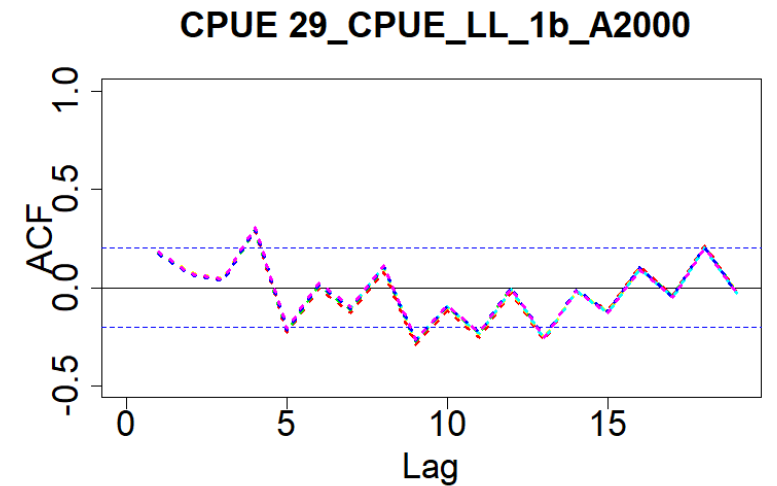
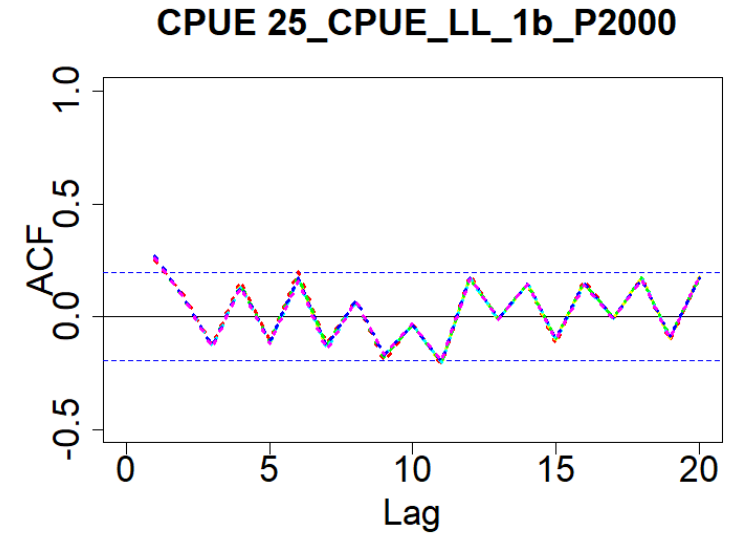


- Only the CPUE of region 1b is considered due to the higher biomass in that area and because the MP is not disaggregated by area.
- Autocorrelation analysis to the residuals obtained from the observed CPUE data and the fits to the CPUE data.
- In case of significant autocorrelation, then the error in the projection is simulated with autocorrelation.
- Simulated CPUE is estimated by applying the estimated errors to the vulnerable abundance (CPUE in numbers).

Scenarios: CPUE selectivity
not divided

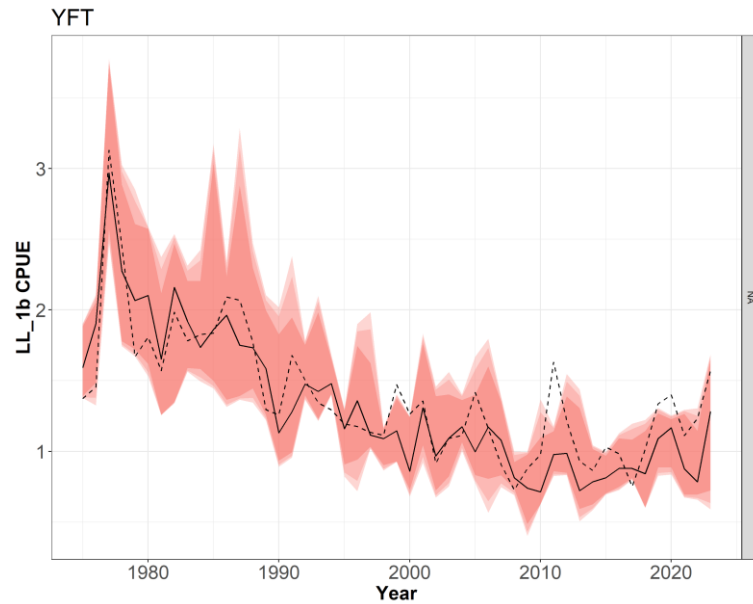


Scenarios: CPUE selectivity
divided in 2000

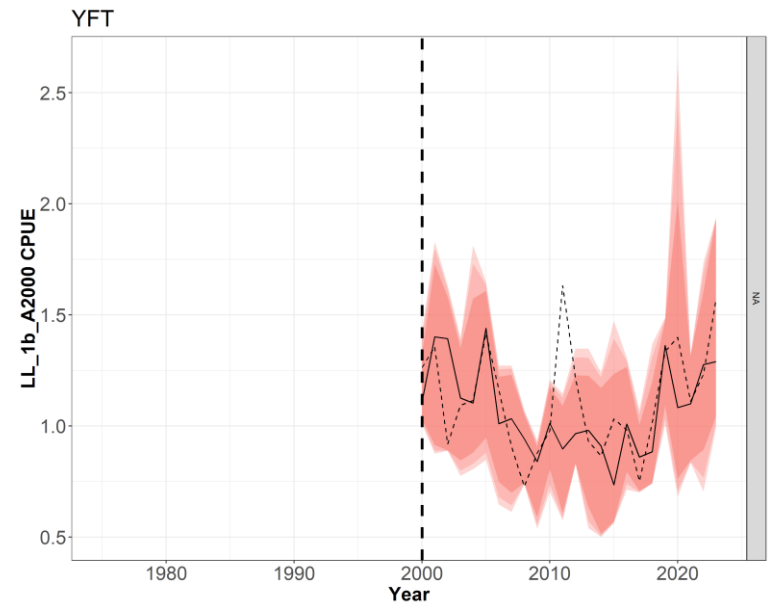
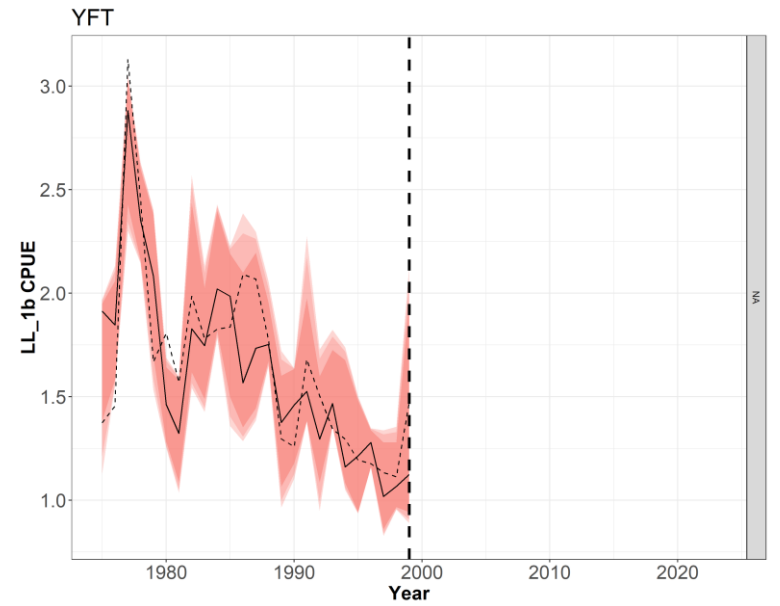


SCENARIO	RHO	SIGMA
One CPUE all time series	0.21	0.24
Two CPUE -Previous 2000	0.26	0.19
Two CPUE -after 2000	0.18	0.25

Scenarios: CPUE selectivity not divided

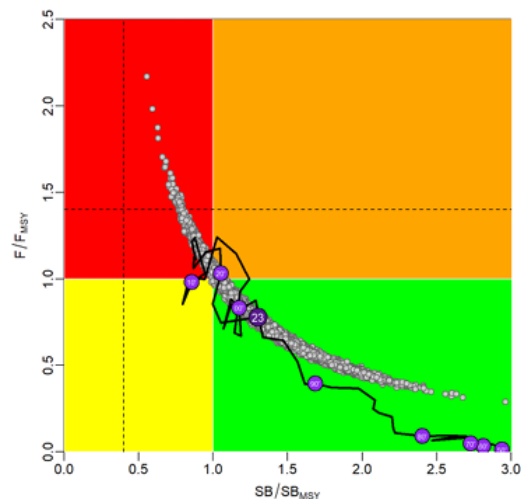


Scenarios: CPUE selectivity divided in 2000



Stock status estimator in the MP:

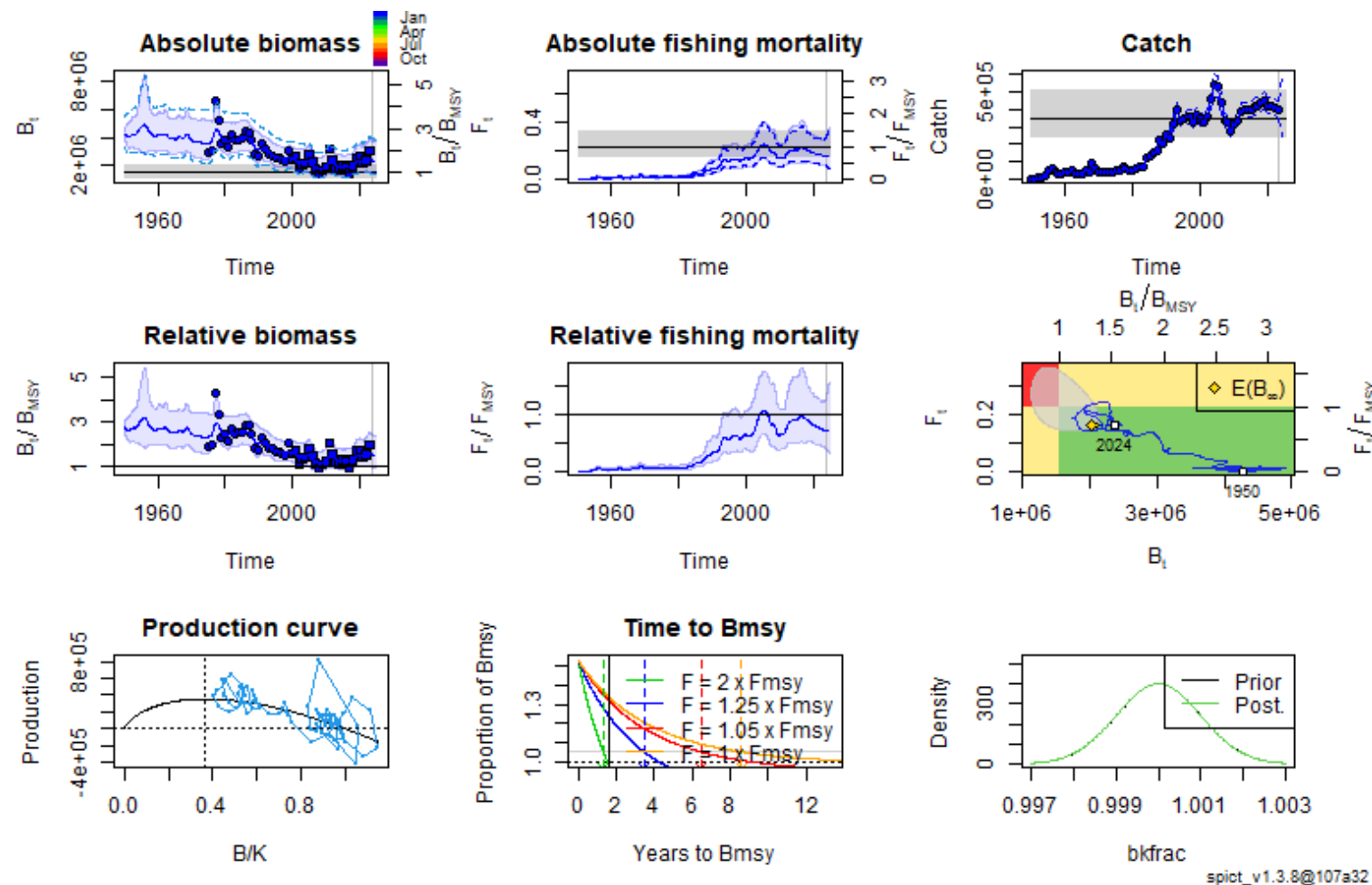
SPiCT



WPTT 26-YFT stock trajectory
from the model grid

Inputs Spict model:

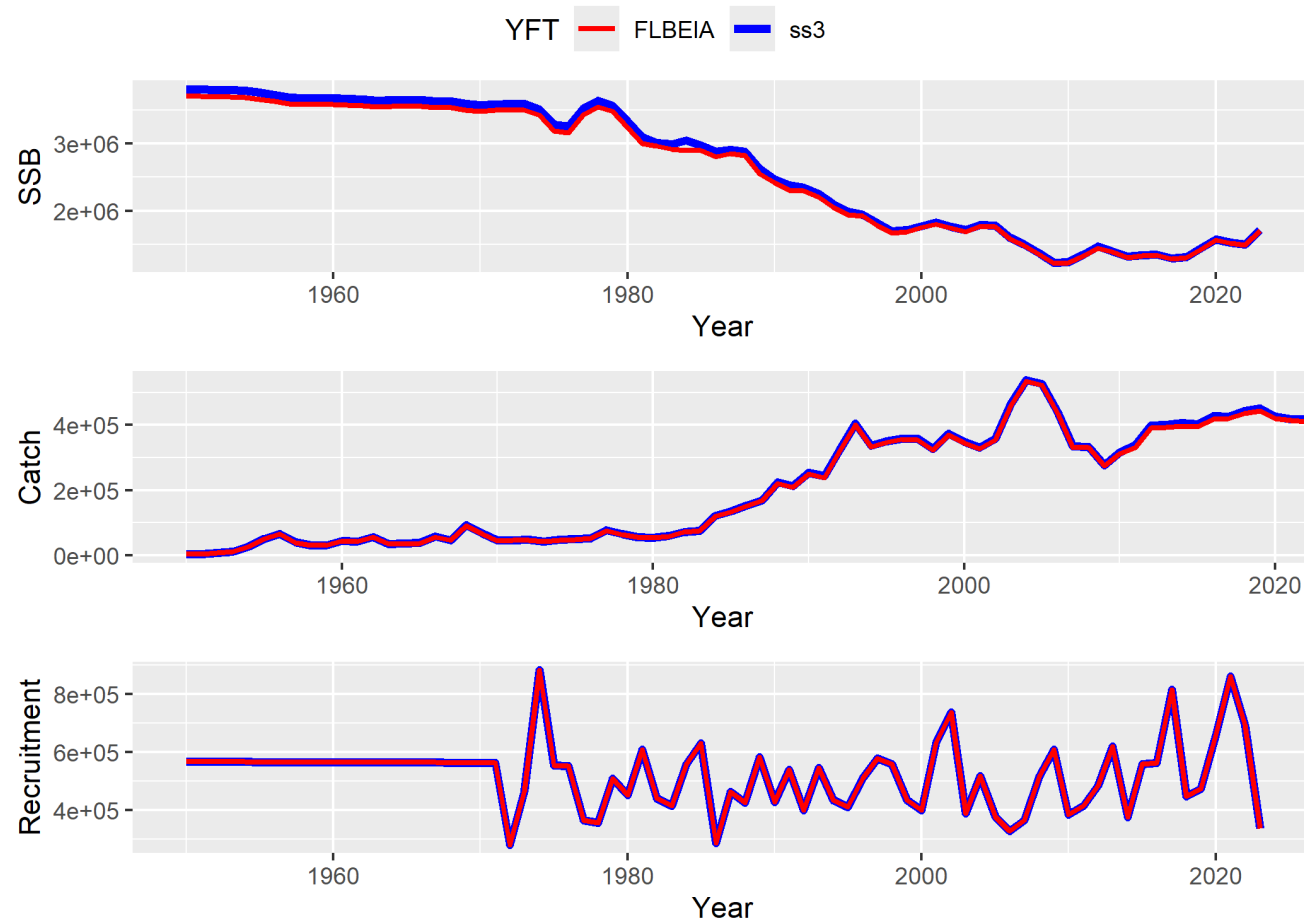
- Catches
- Joint LL CPUE divided
in 2 periods (in 2000)



Priors:
 $\log bkfrac = \log(1)$
 $\log r = \log(0.12)$
 $\log K = \log(3.25e6)$ (Virgin biomass Average: 3.5e6)
 $\log n = \log(1)$

COMPARISON

COMPARISON FLBEIA AND SS3

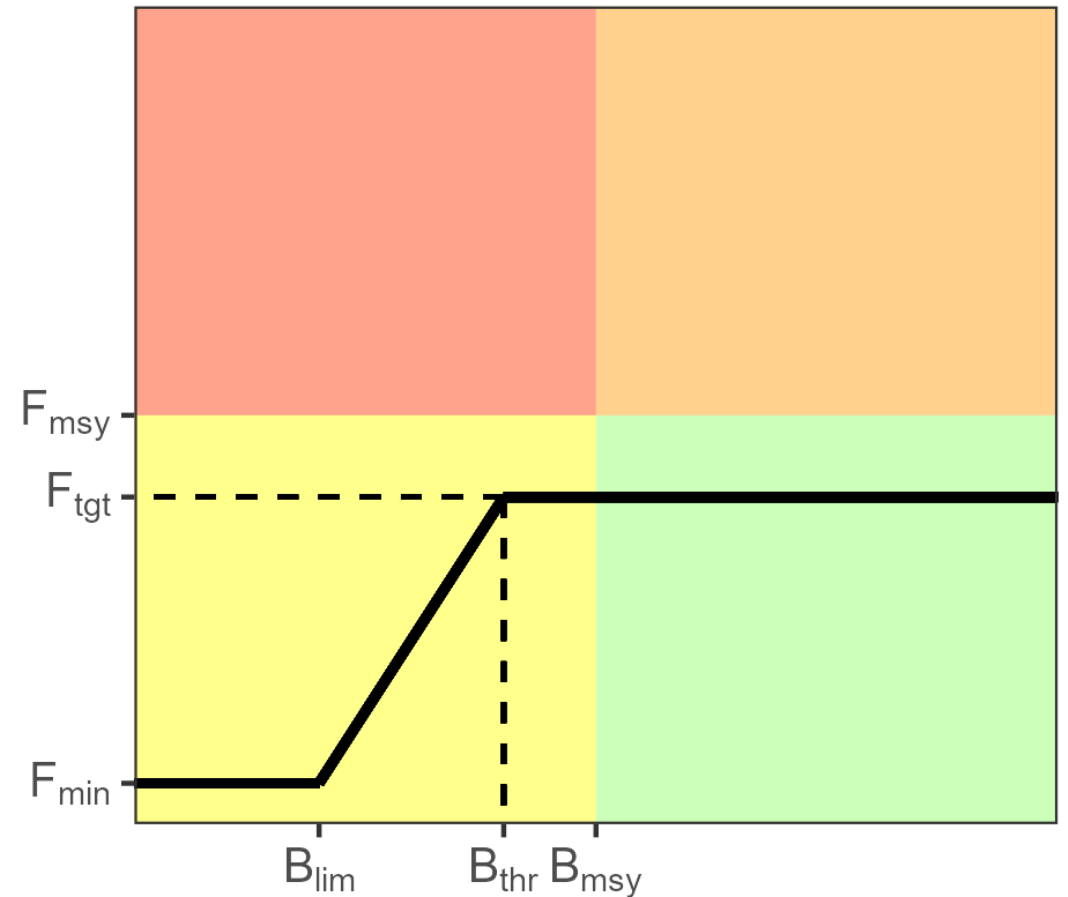


CANDIDATE HCRs

- TAC advice every 3 years.
- Model based, hockey stick shape, HCR (example to the right).

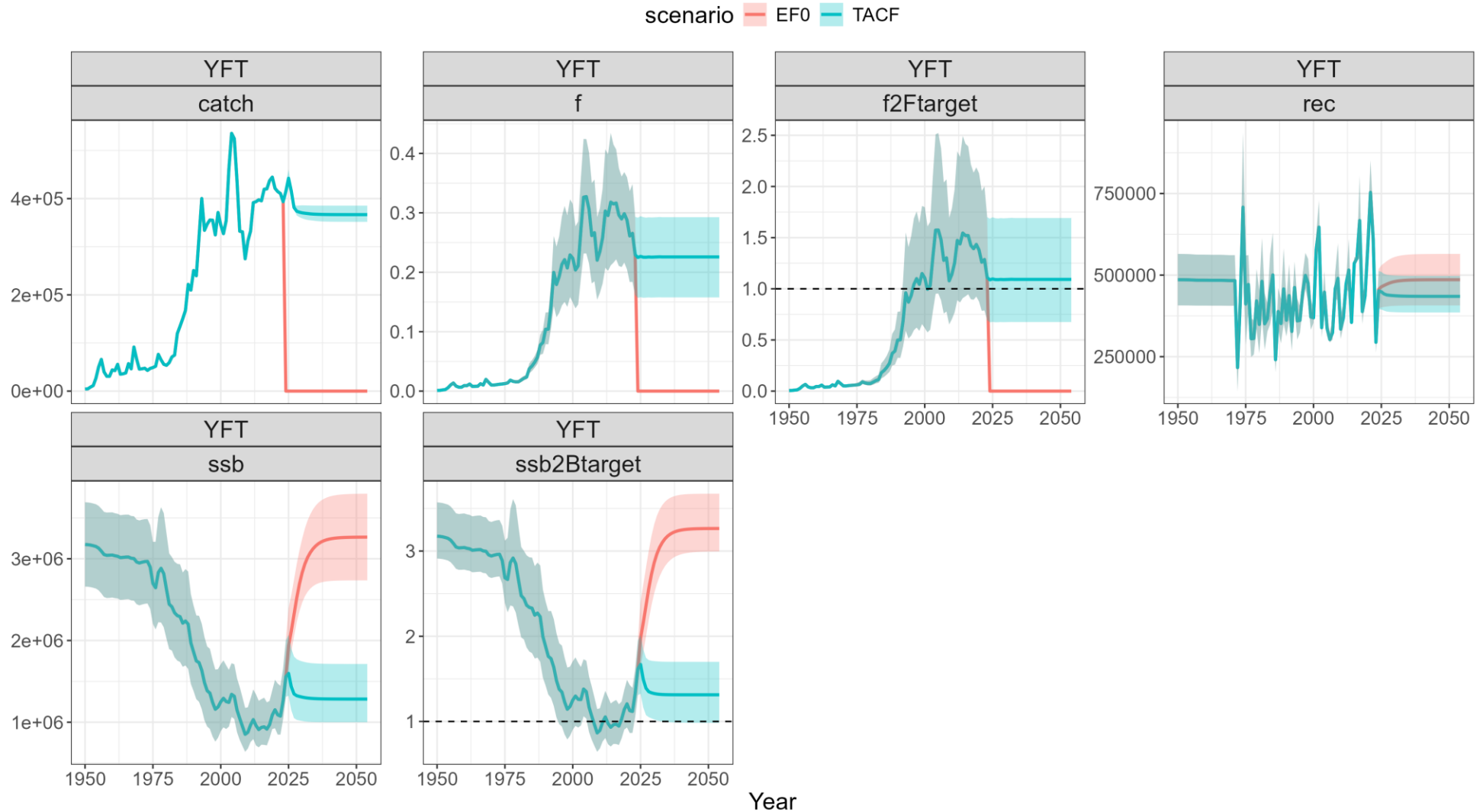
Constraints :

- $TAC_{adv,y+1} \leq TAC_{max}$
- Maximum increase between TAC advices
- Maximum decrease between TAC advices



CHECK RUNS

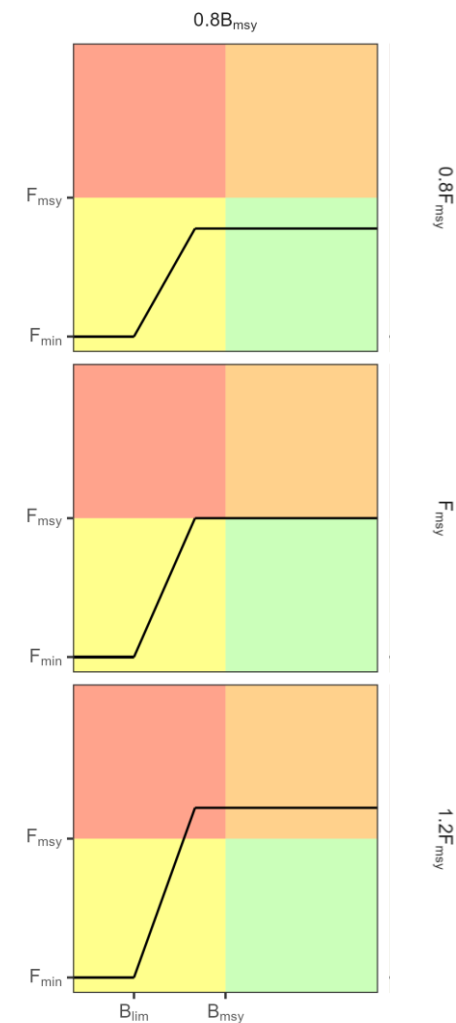
Results: Effort 0 and recent effort



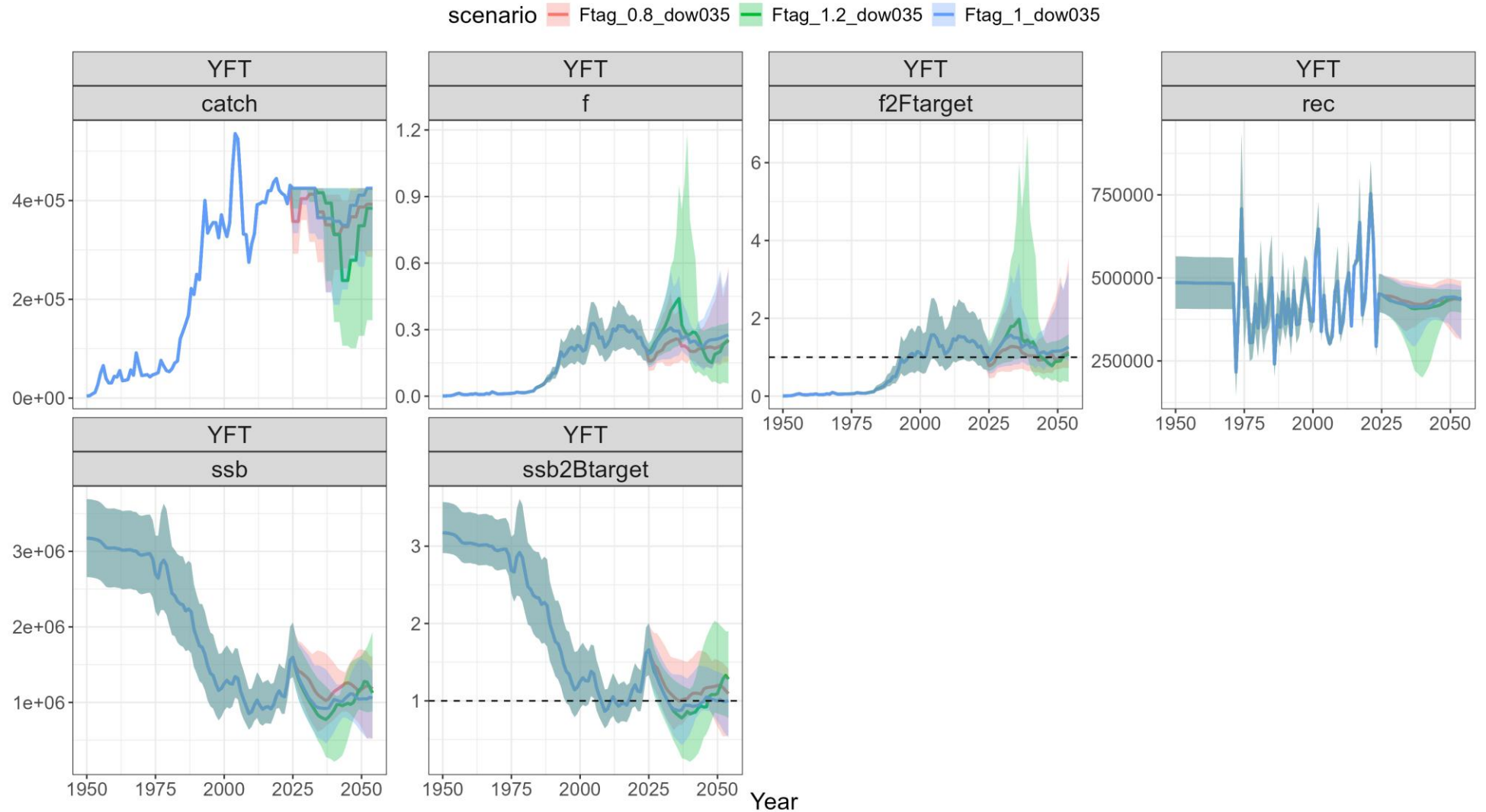
SIMULATIONS

Candidate MPs (HCRs)

Scenarios	F _{target}	B _{trigger}	Max Increase (%)	Max Decrease (%)	MAX TAC
s1	$0.8 \times F_{MSY}$	$0.8 \times B_{MSY}$	25	35	425 000 T
s2	$0.8 \times F_{MSY}$	$0.8 \times B_{MSY}$	25	35	425 000 T
s3	$0.8 \times F_{MSY}$	$0.8 \times B_{MSY}$	25	35	425 000 T
s4	$0.8 \times F_{MSY}$	$0.8 \times B_{MSY}$	25	25	450 000 T

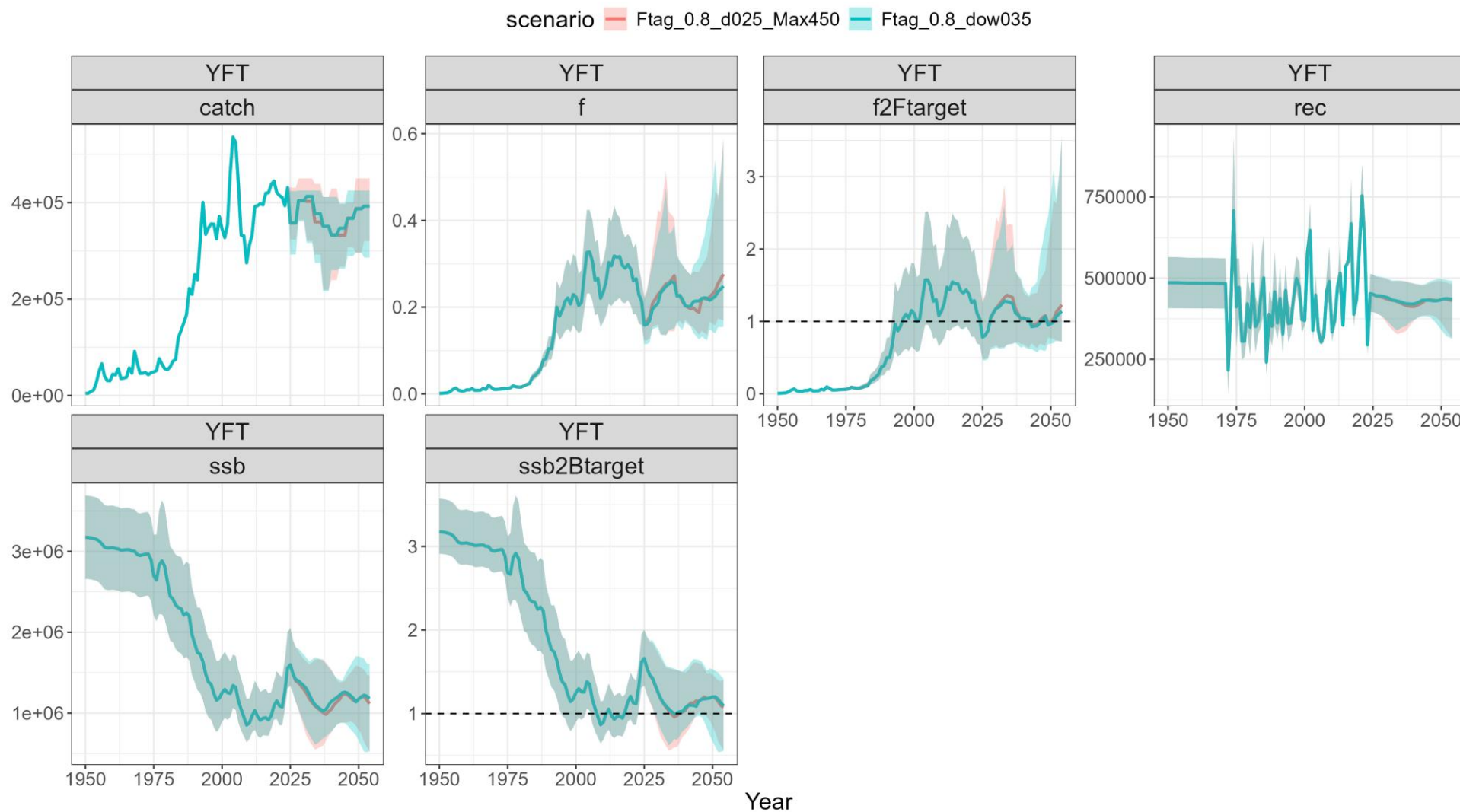


Candidate MPs (HCRs): Ftg 0.8, 1 and 1.2



The continuous line is the median and the shadow 90% CI

Candidate MPs (HCRs):Ftg 0.8



DISCUSSION

Discussion

- Other factors that could be considered in the uncertainty grid of the OM?
- Model based assumptions: Maximum catch, TAC variability.
- Simulations under Robustness Test : changes in R_0 and σ_R ?
- Next steps: development of empirical HCRs.



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THANK YOU VERY MUCH!