Dealing with regional differences in data-richness: an exercise applied to chub mackerel in the Iberian Peninsula.

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Background

- Differences in data richness between regions of the same stock complicates fisheries advice

  - Sardine in the Celtic Seas, English Channel and Bay of Biscay

- Surplus production models (SPM) are one option in data-limited cases

  - require data with contrast

  - long time series

Approach

- Apply a SPM to a long time series of data of part of the stock

- Estimate parameters likely to be identical to those of the whole stock

  - intrinsic rate of population growth; r

  - initial biomass level; B1/K

- Use point estimates and standard deviation in priors of models fitted to a short time series/poorly contrasted data, of the whole stock

- Evaluate improvement of the precision of model parameters and retrospective behaviour

Case-study
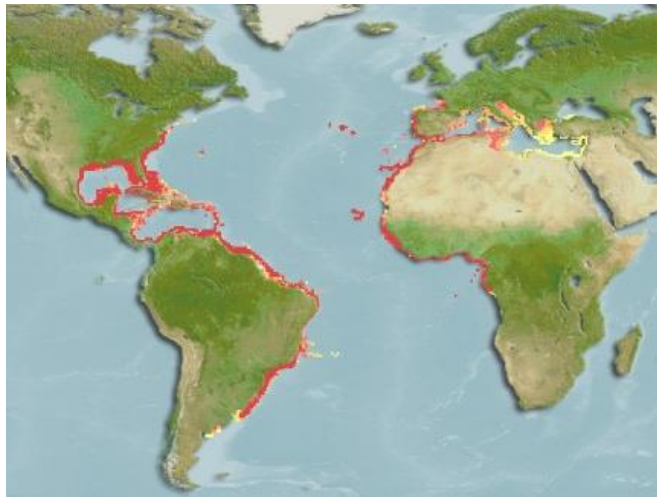
Changes in the abundance and spatial distribution of the Atlantic chub mackerel (*Scomber colias*) in the pelagic ecosystem and fisheries off Portugal

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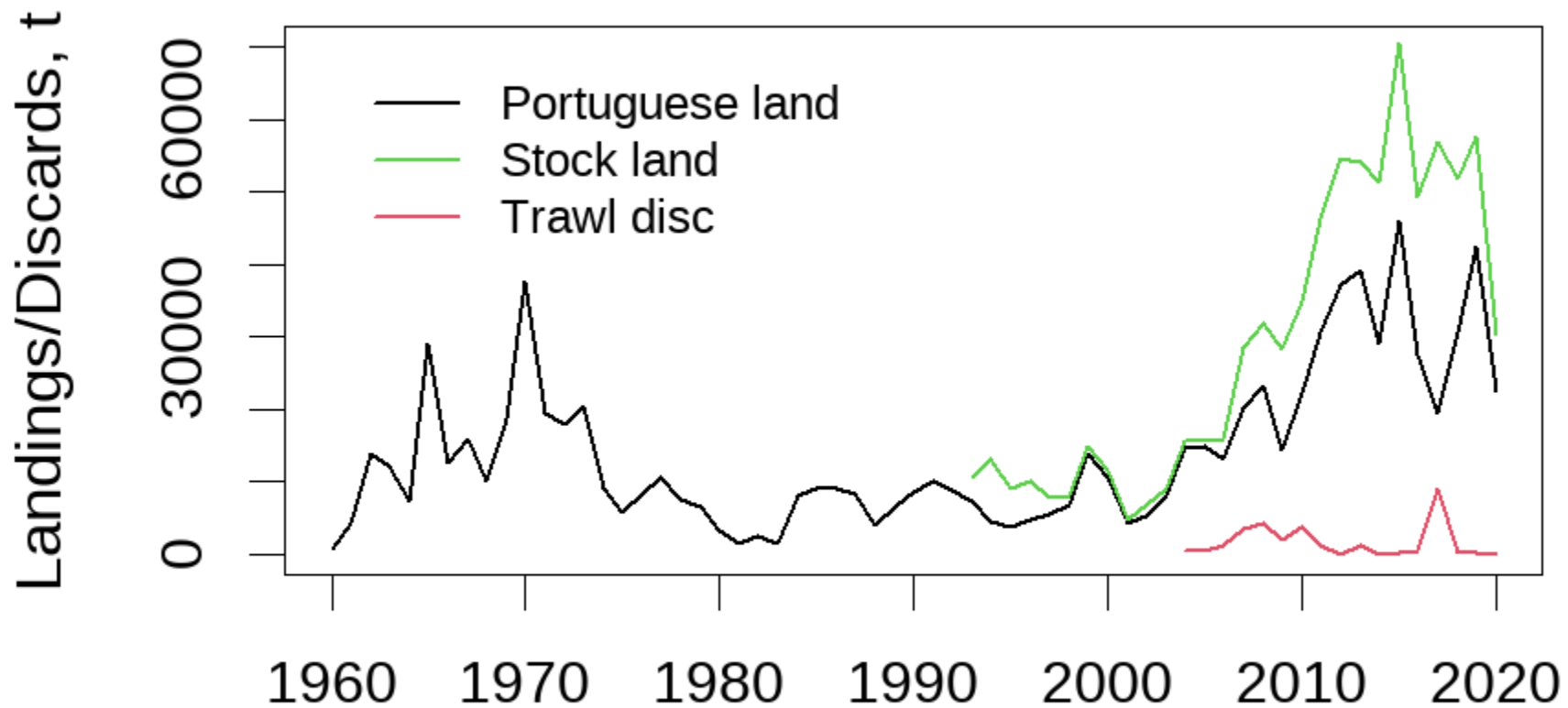[2] Independent consultant, Fjellveien 96, N-5019 Bergen, Norway.
[3] Institute of Marine Sciences, University of California, Santa Cruz, Earth and Marine Sciences Building, Rm A317, Santa Cruz, CA 95064, USA
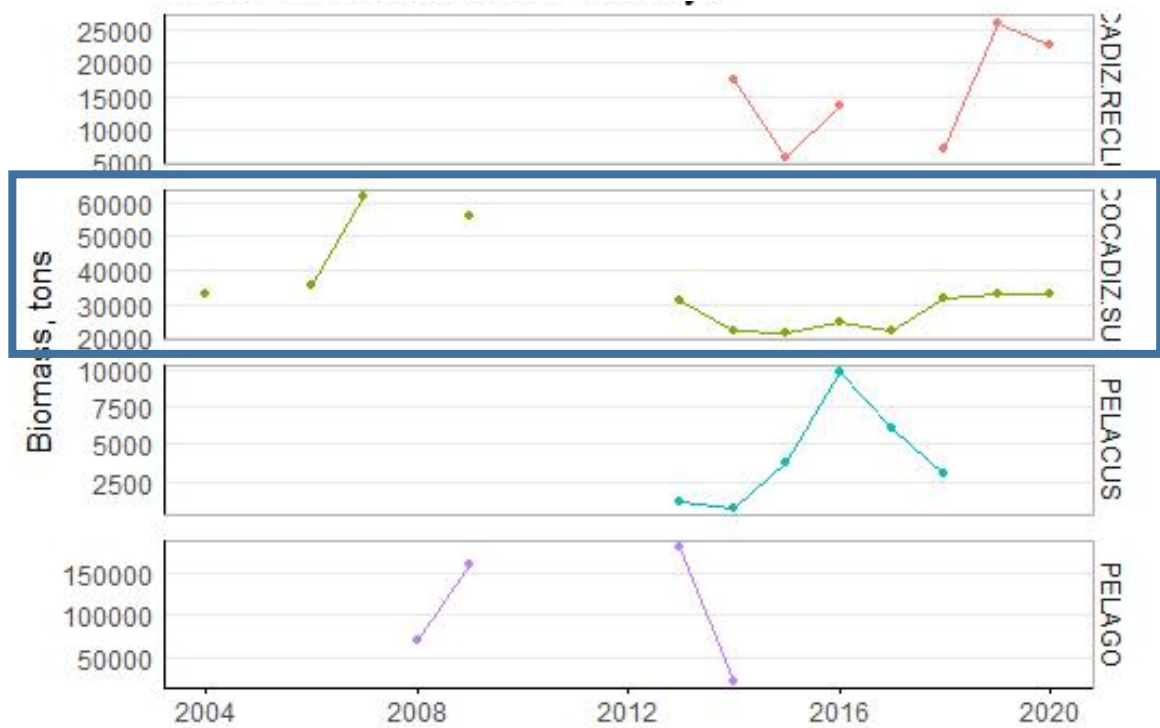*These authors contributed equally to this work
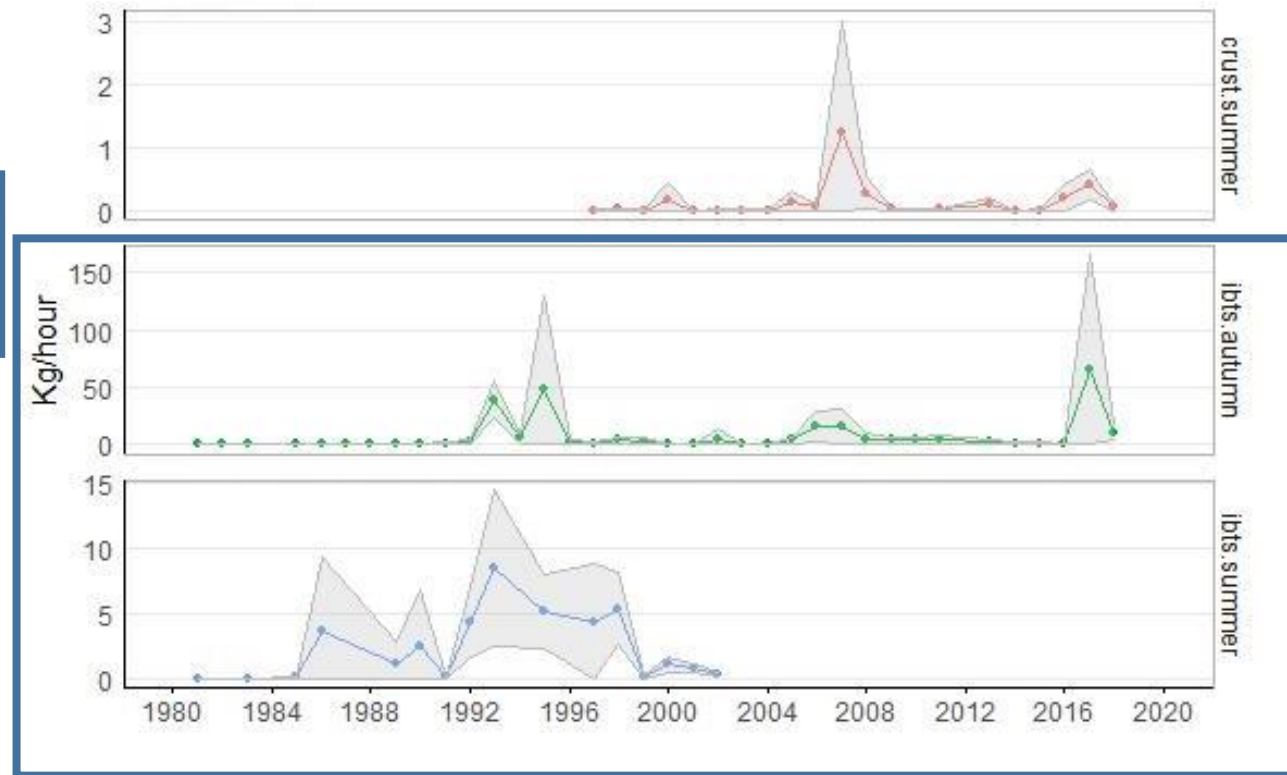

Scomber colias
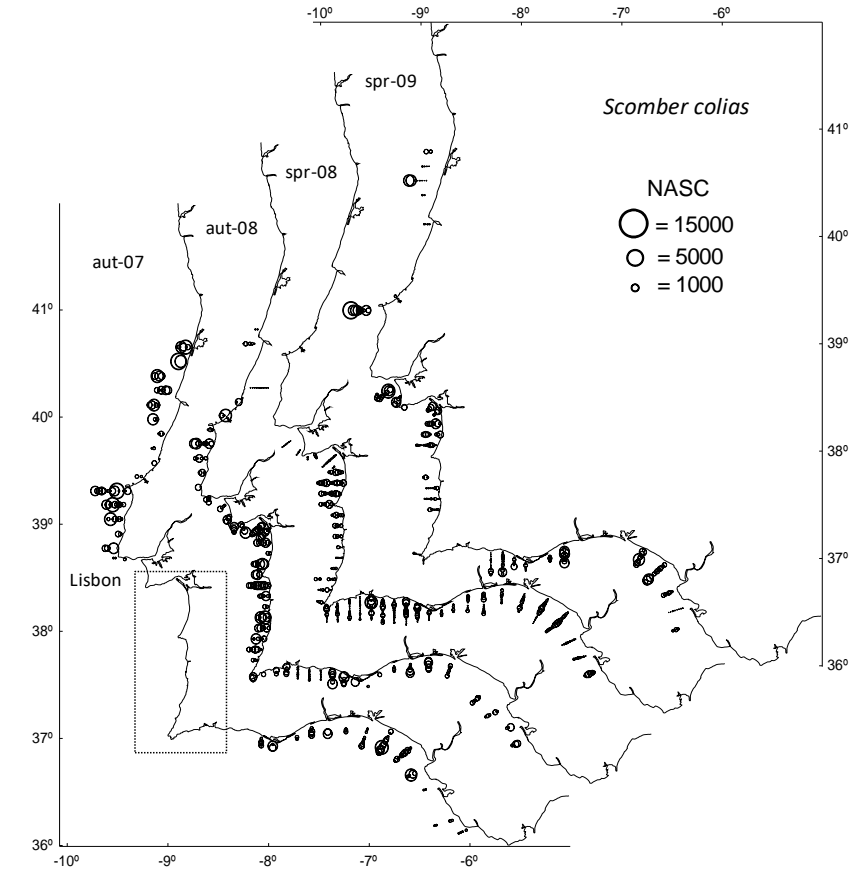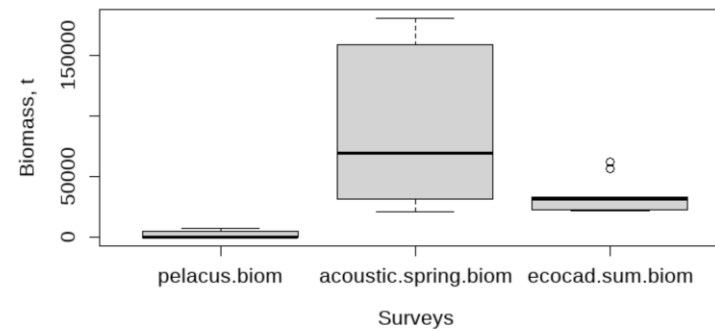
CATCHES

SURVEYS

ACOUSTIC

PORTUGUESE BOTTOM TRAWL (IBTS)

Model settings

- Indices and corresponding CVs standardized to mean 1

- CVs used as weigthing factors of IBTS indices

- Past catches downweighted in the long-term model

- Model with yearly time steps

- Time-varying productivity

  - Regime shift in 1995 👍

  - SST as a covariable of productivity 👎

- Exploitable biomass correction

Priors
- None
- Default: all, n, alfa&beta
- N only: Schaefer, Fox, "Thorson"
- r only
- B1/K (0.2, 0.5, 0.8)
- r and B1/K

Meta-analysis (Thorson et al 2012)
Shape parameter of the production curve for Perciforms
n = 1.064 (SD=0.59)

Results – Long-term

n

bkfrac

r

k

alpha1

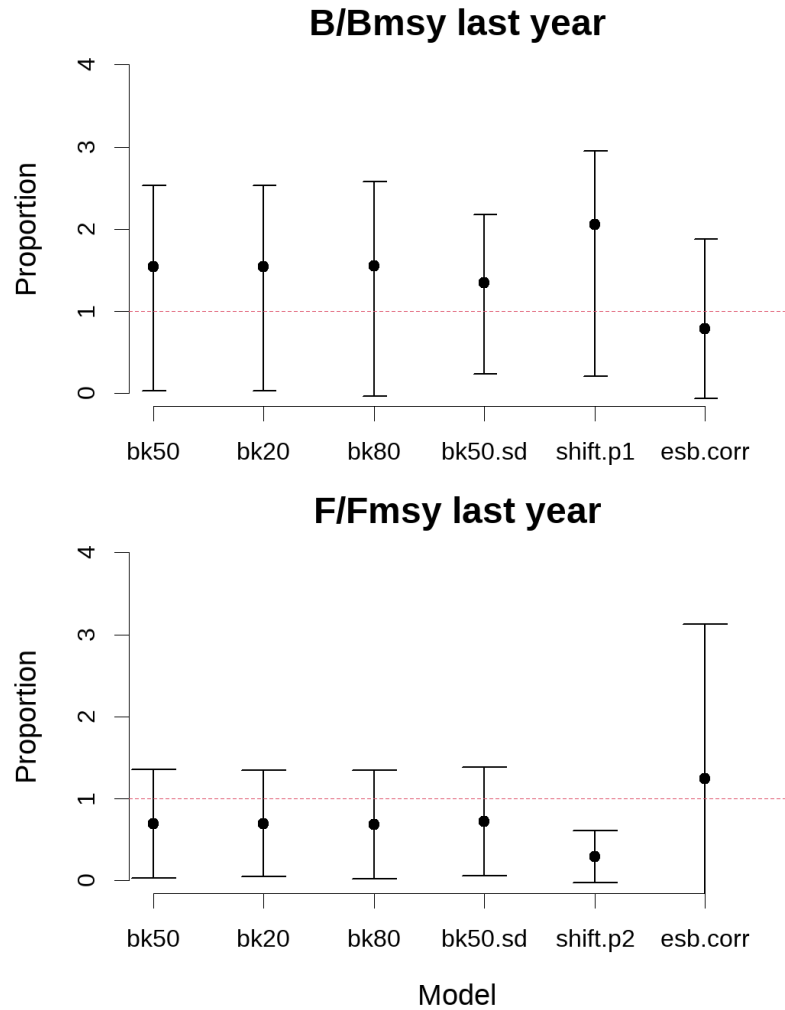**alpha3**
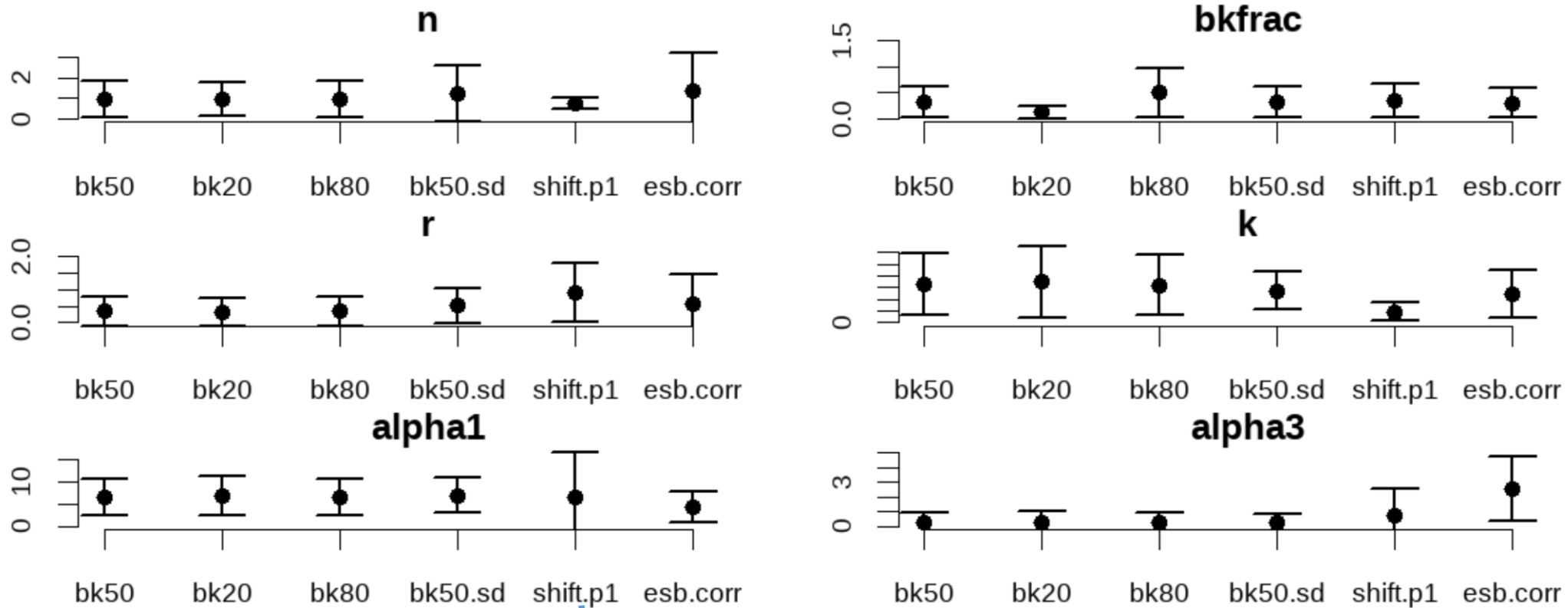
Initial biomass: B1/K

IBTS survey weighting

productivity shift in 1995

exploitable biomass correction

* point estimates ± 2 standard deviations

- Good candidate model: Thorson with prior on B1/K (0.5, SD=0.45)

- Low sensitivity to alternative assumptions

Results – Long-term

B/Bmsy last year

F/Fmsy last year

Mohn's Rho
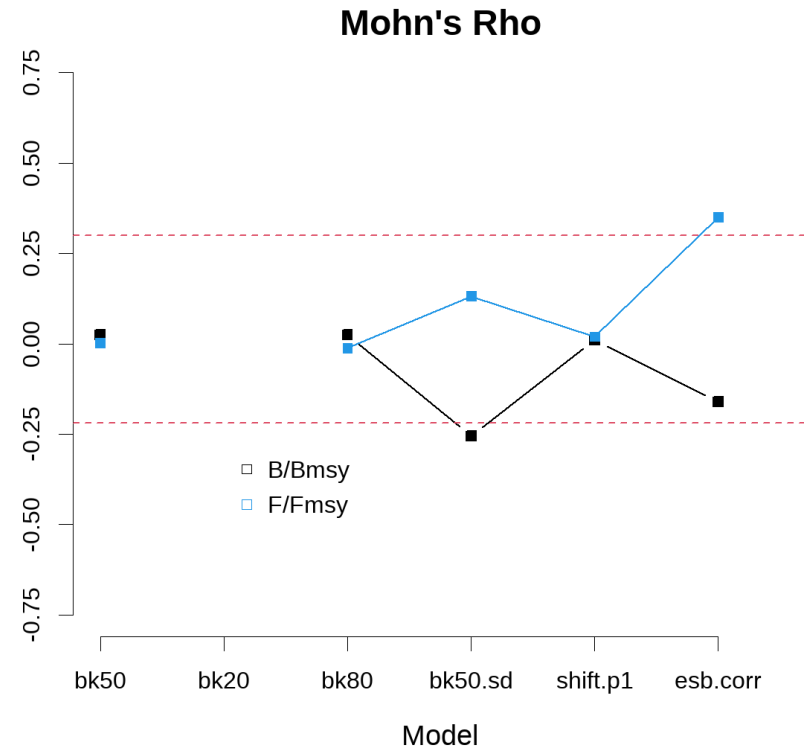
Model using IBTS surveys with biomass correction showed the poorest estimate and the worse restrospective pattern for F/Fmsy.

Results – Long-term

Chub mackerel relative fishing mortality

Chub mackerel relative biomass
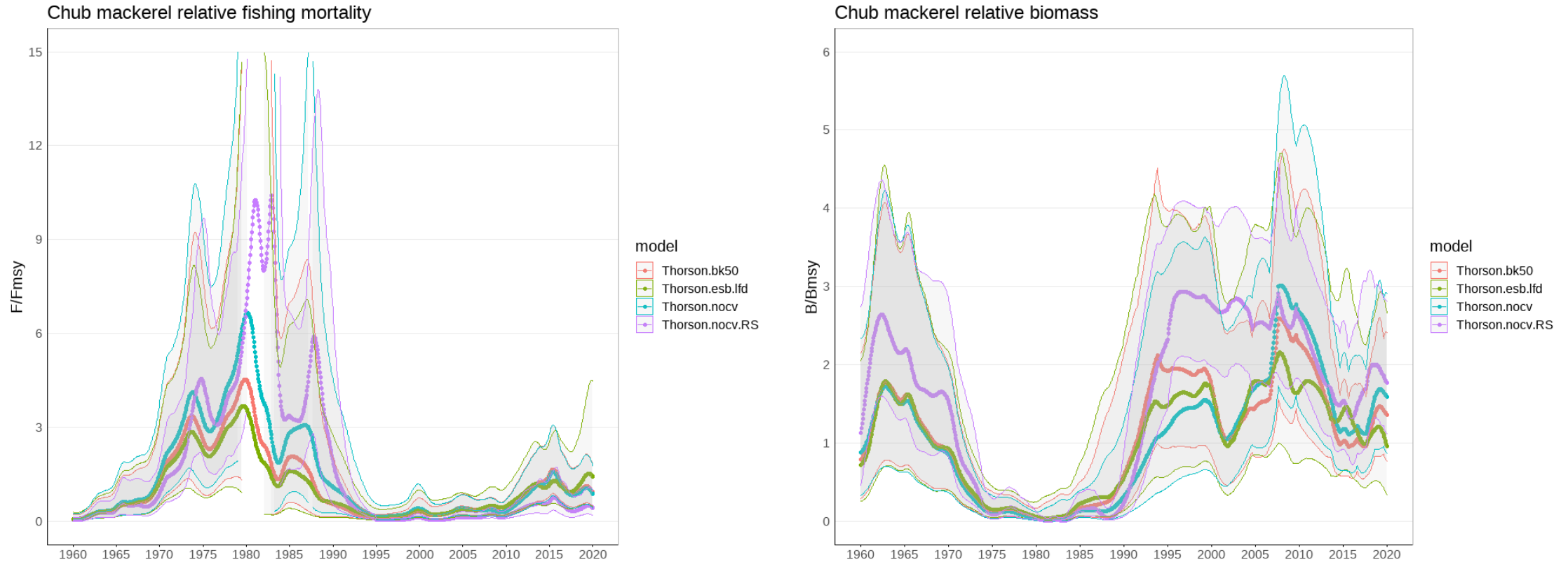
- Relative biomass and fishing mortality show similar long term trends

- Some differences since the early 1990s but confidence intervals overlap

- Generally good diagnostics and stability

Results –short term

Priors on B1/K and r taken from the Thorson model with prior on B1/K (mean=0.5, SD=0.45)

B1/K = B1993/K
Mean= 0.32 SD=0.44

r
Mean=0.34 SD=0.59

Results –short term
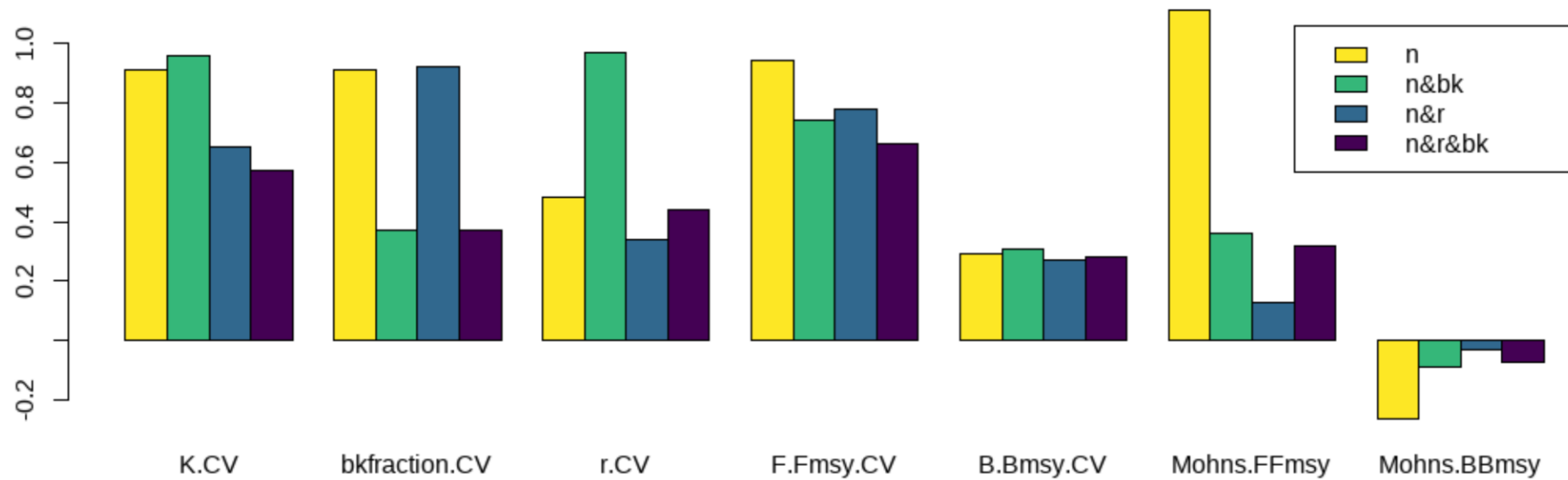
- Effect of priors on r and B1/K varied between models and parameters

- Fox models showed generally better performance

- Best model includes both r and B1/K prior assumptions

Results –short term
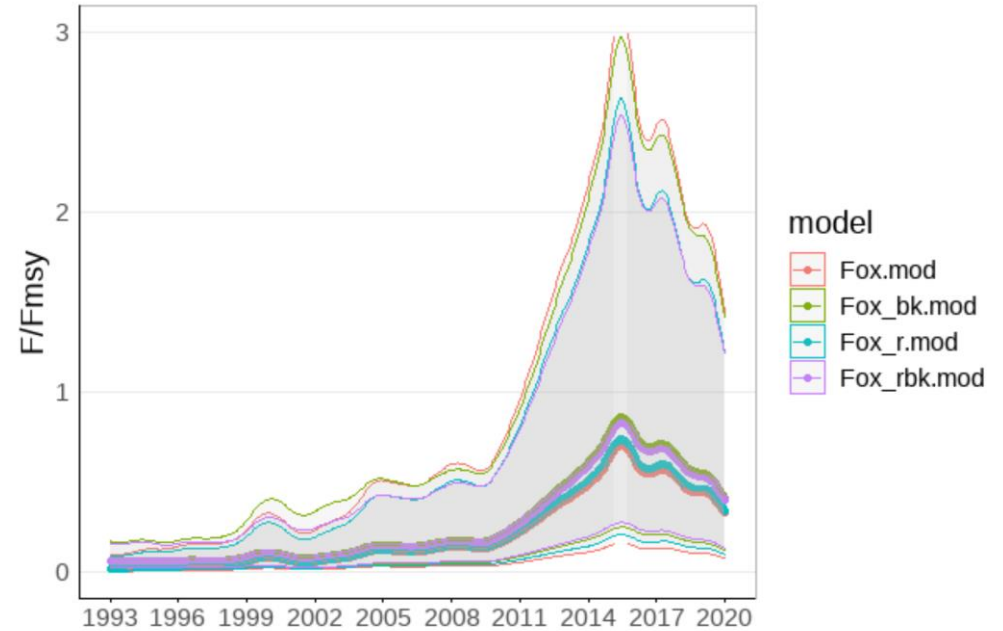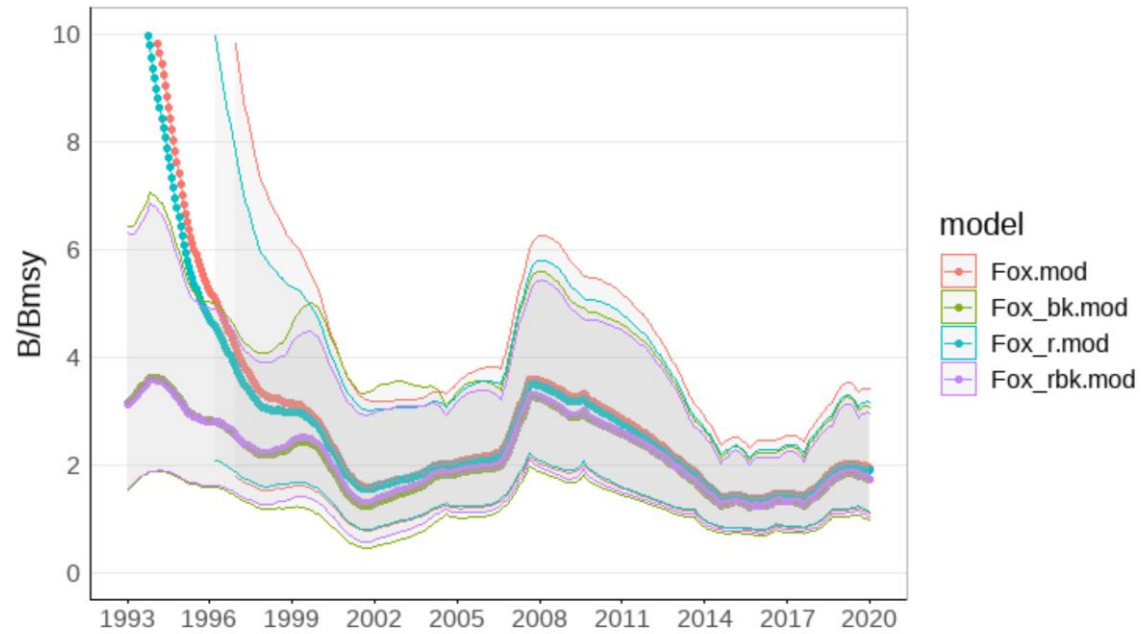
- The B1/K prior corrects the initial level of the stock to a realistic level
- High F/Fmsy uncertainty remains an issue

Chub mackerel, sardine , SST
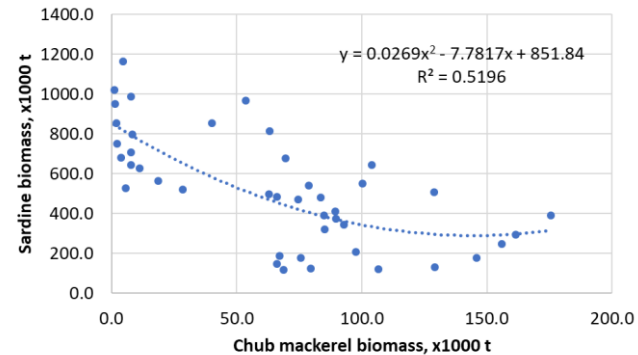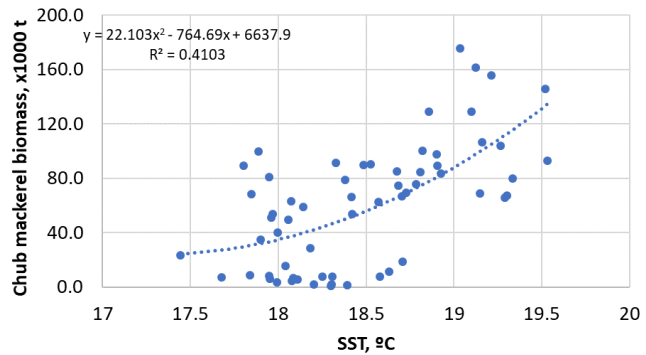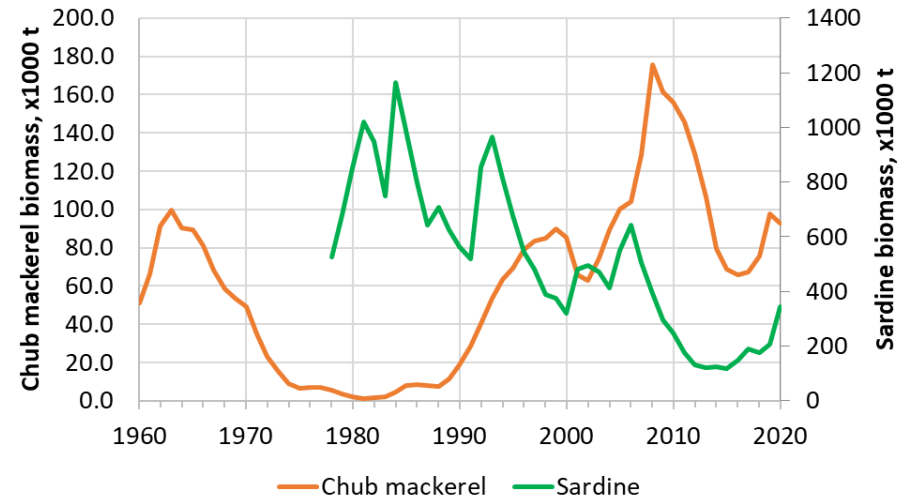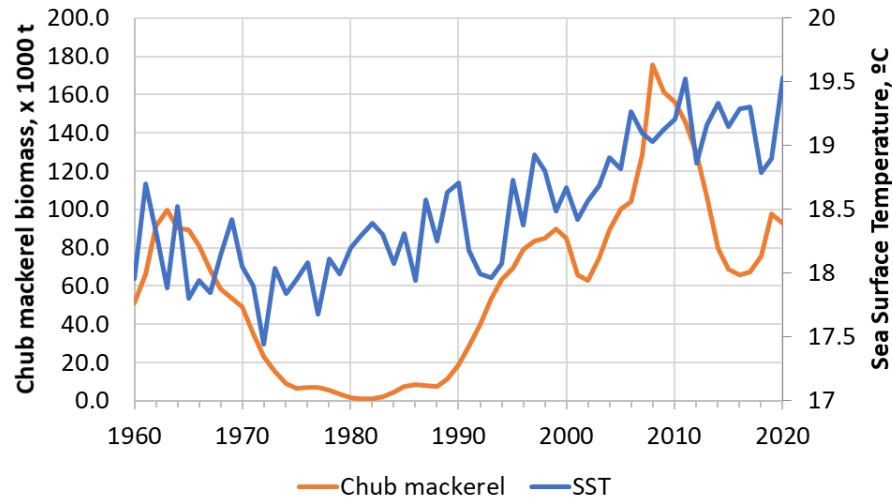
SST obtained from the data set iCOADS (https://icoads.noaa.gov/products.html)

Discussion

- Stock unit assumption

- Long-term catches: uncertainty, bias

- Derivation of priors

- SPICT assumptions
  - exploitable biomass
  - catches vs landings
  - constant catchability

- Prior on B1/K
  - Lead to realistic estimates of B1/K
  - Generally improved parameter CVs (except for r and K) and retrospective patterns
  - Non-normal residuals of IBTS autumn

- Prior on r:
  - Generally improved parameter CVs (except for B1/K) and retrospective patterns.

- **Using both priors resulted in a substantial improvement of the model**

- **Thank you very much !**

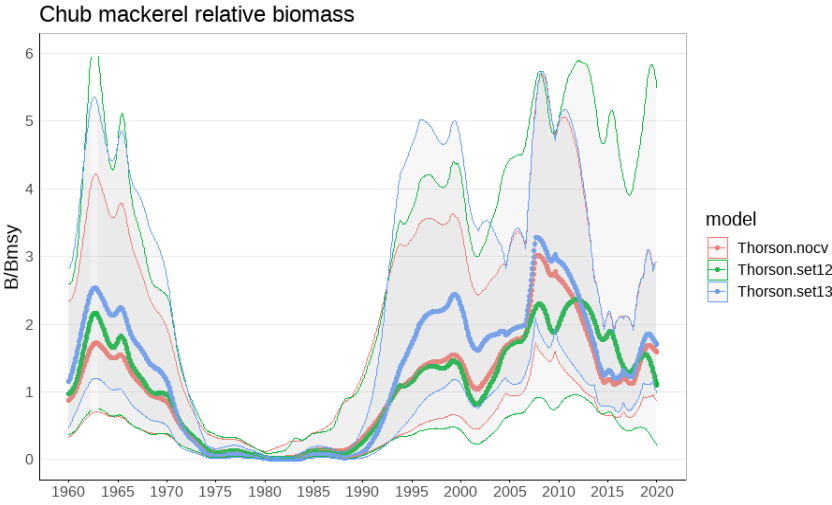# Acknowledgements

EXTRA SLIDES

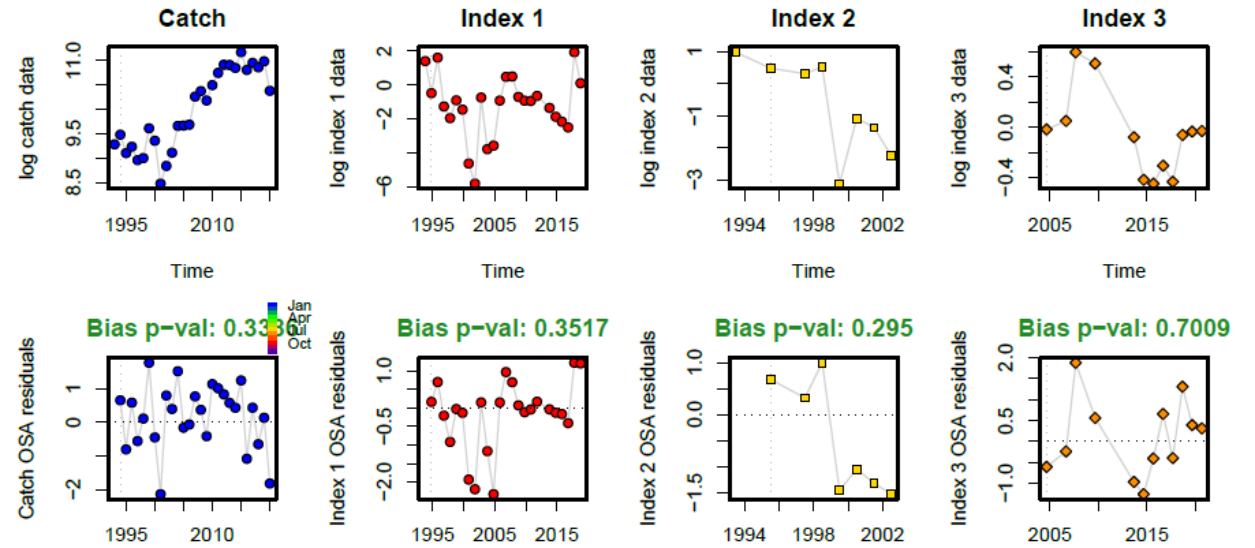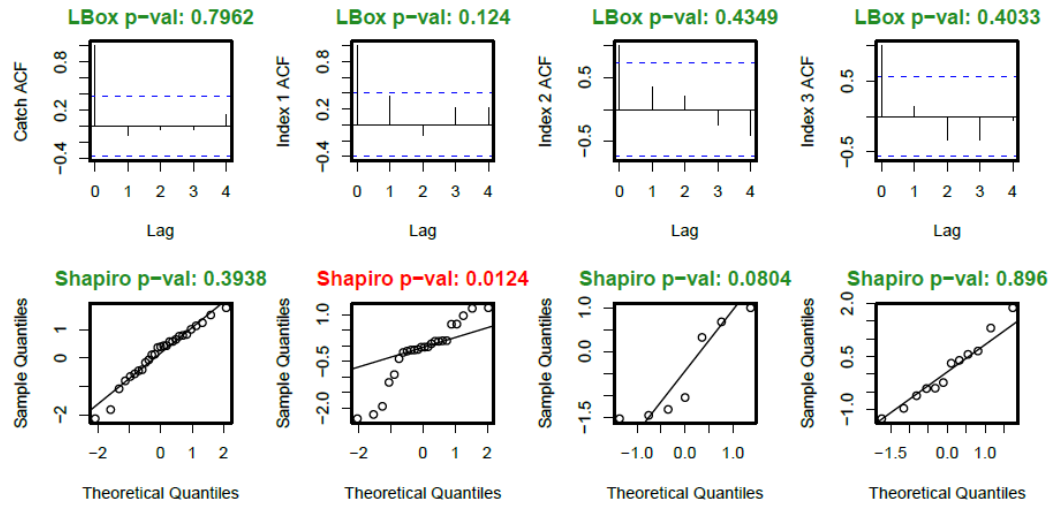**Diagnostics of the Long-term PT final model (Thorson.bk50)**
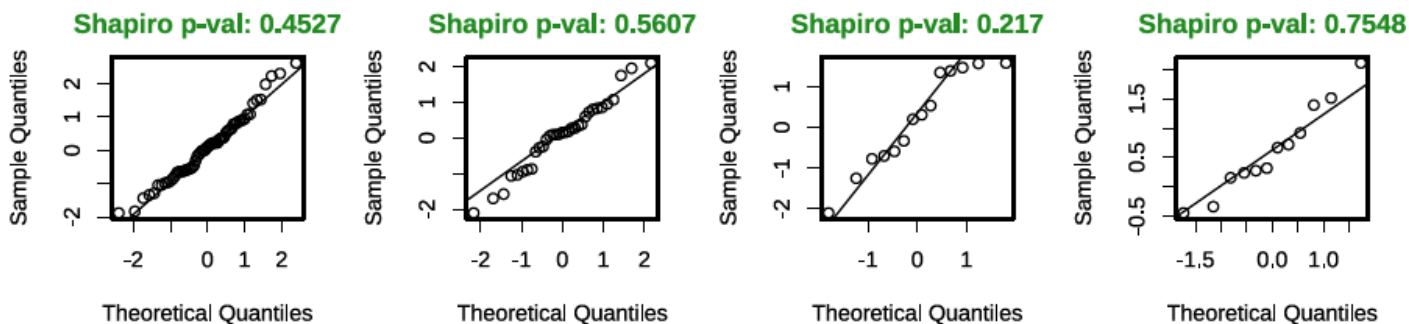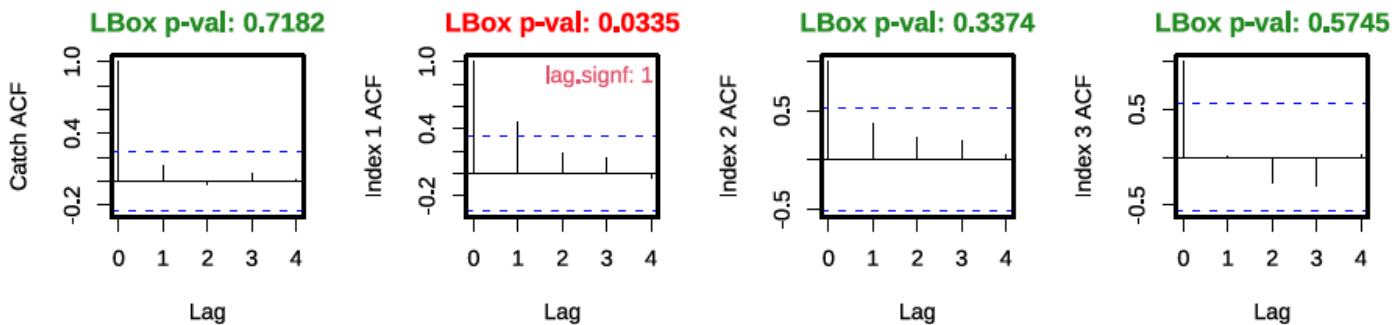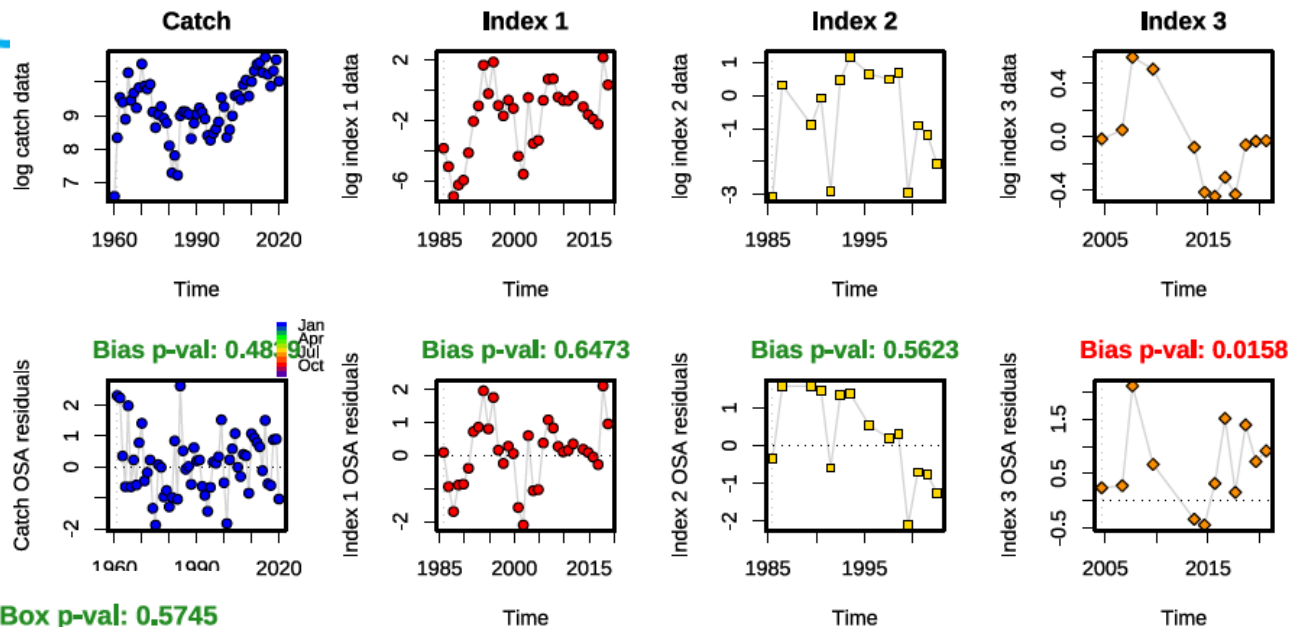
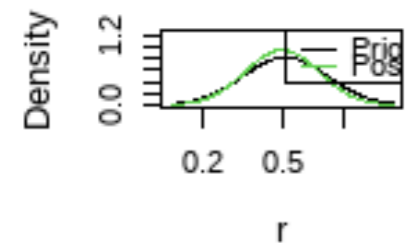# Results of the Long-term PT final model (Thorson.bk50)
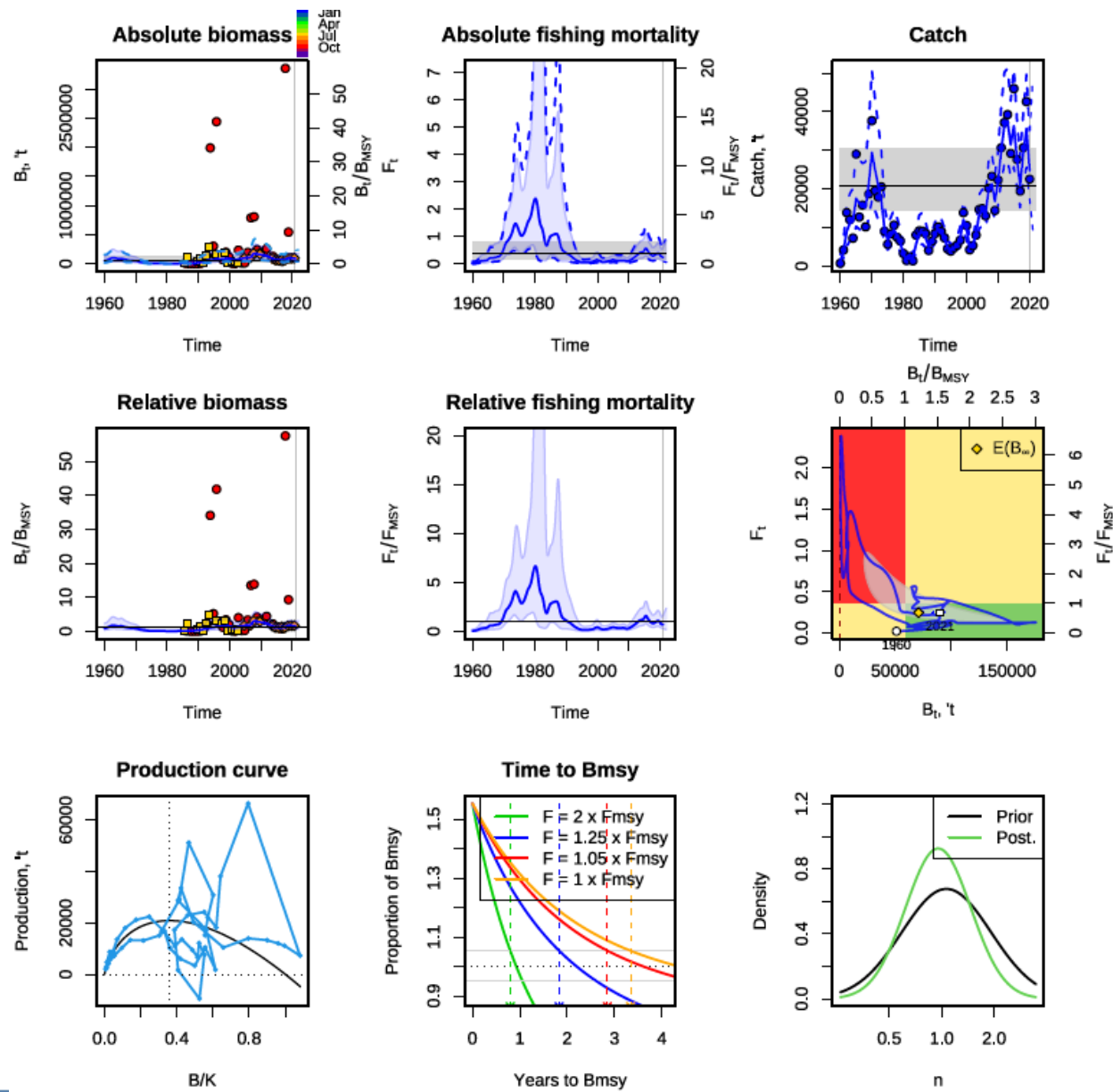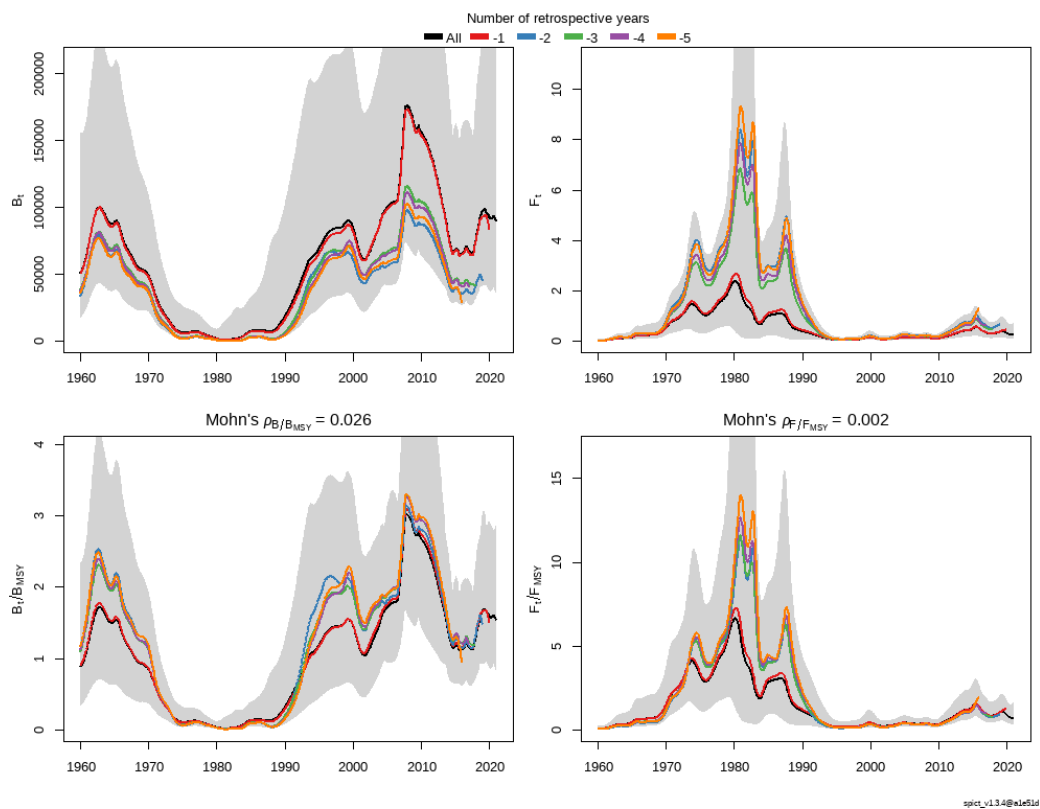
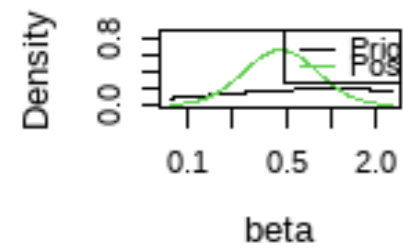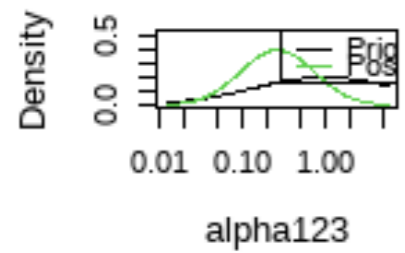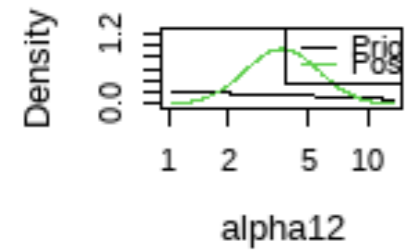Sensitivity to different data sets

Chub mackerel relative biomass
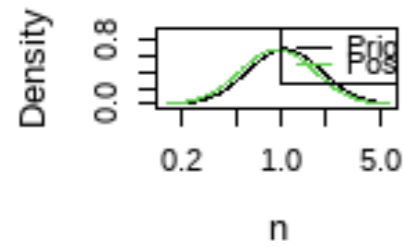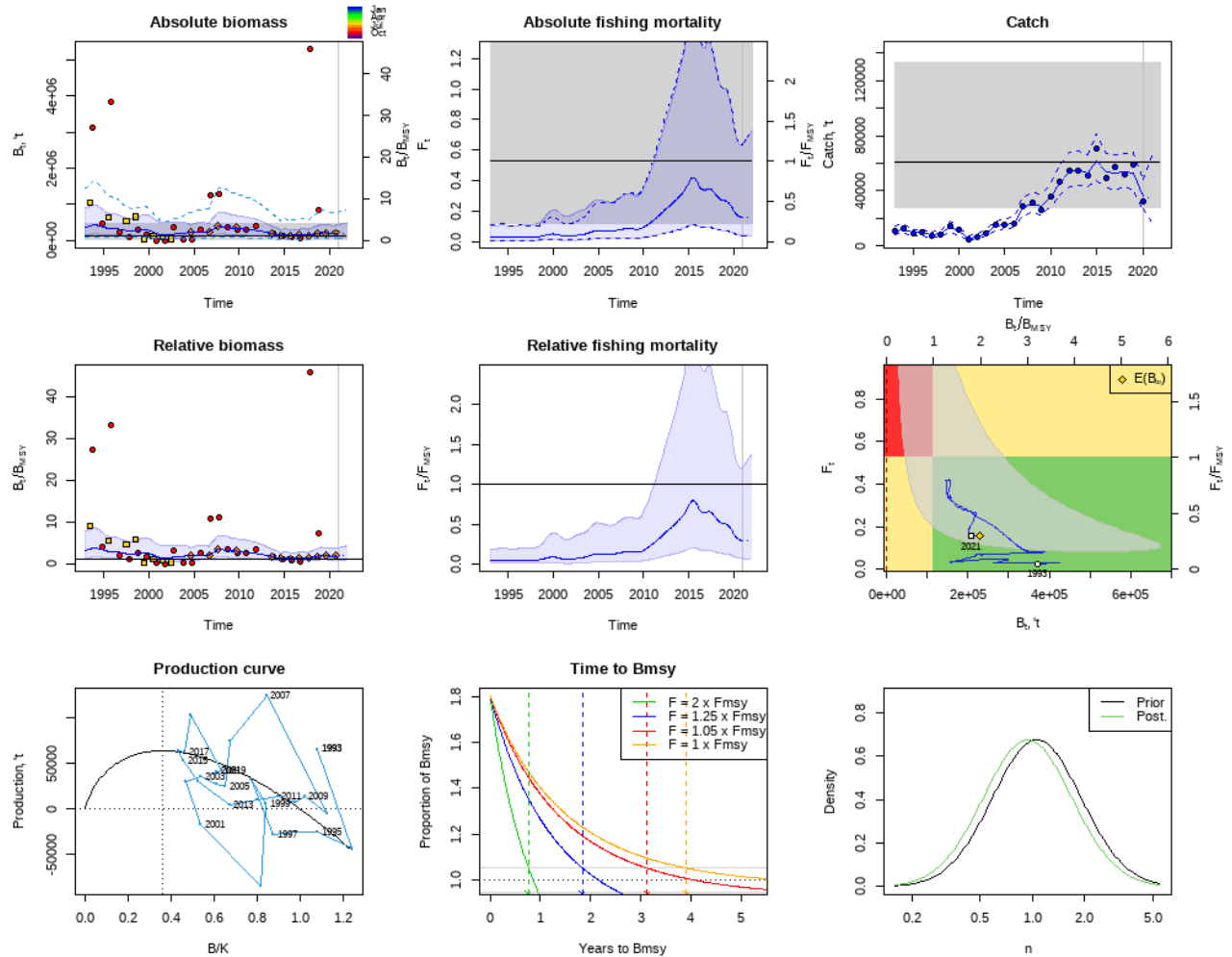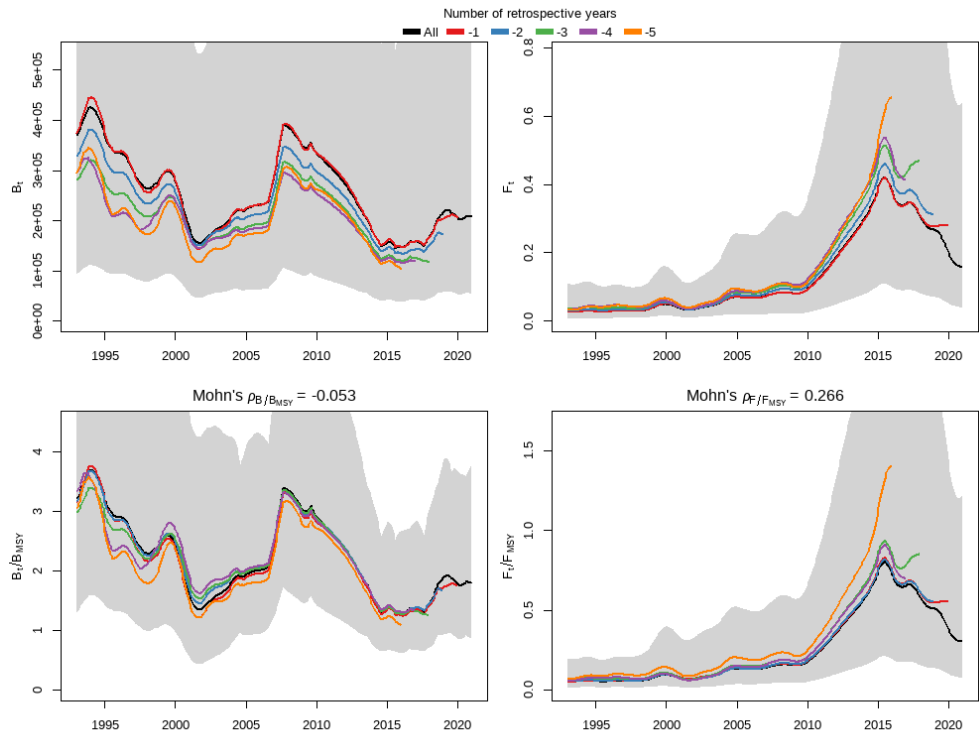
Diagnostics of the short-term final model (Thorson.rbk)

Priors and posteriors of the Thorson rbk model for the Iberian Peninsula
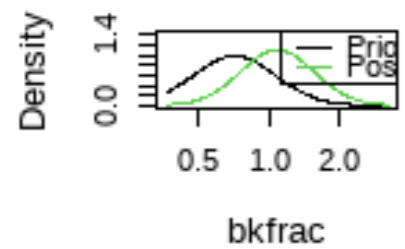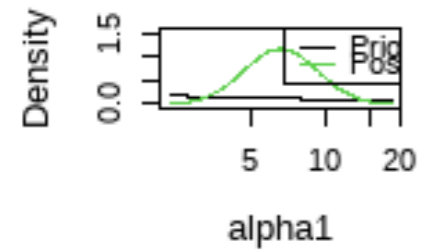
Results of the Long-term PT final model (Thorson.rbk)

Exploitable stock biomass

IBTS-aut vs landings mean length compositions

IBTS-aut vs landings length compositions