



The a4a Initiative Simulation testing

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assessment for all (a4a)

*Long term objective - To have a group of **standard methods** that can be applied **rapidly** to a large number of stocks, **without requiring** a strong statistical technical background, but **making use** of the technical knowledge on the fisheries, stocks and ecosystem characteristics.*

Simulation:

- *Test how well the model rebuilds the truth under a range of conditions.*
- *Test “automatic mode”.*

[With R/FLR (methods, data structures, parallel computing, easy data analysis, repeatability)]

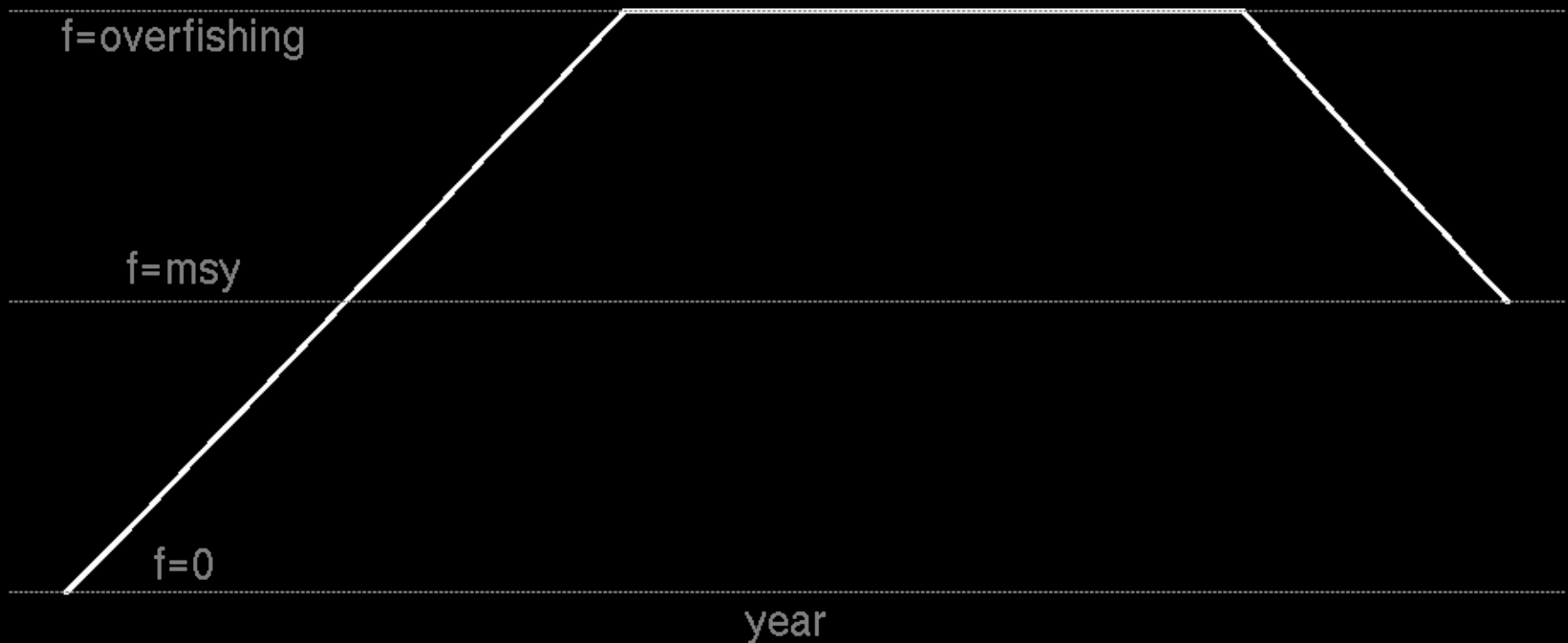
Approach:

- *Generate OMs based on biology and exploitation characteristics.*
- *Add observation error.*
- *Fit models.*
- *Compare with the simulated data.*

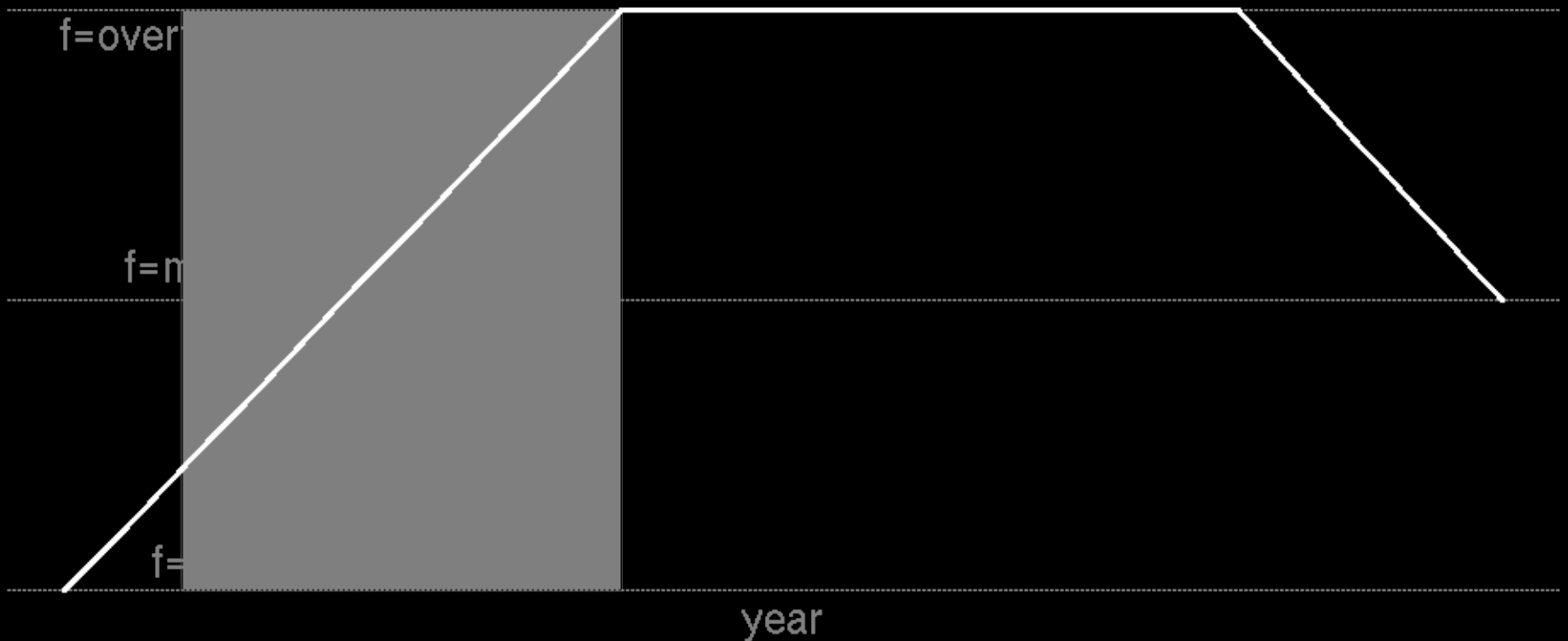
Algorithm step 01 – get life history parameters

- *webscrap fishbase for life history parameters **[a, b, L_{inf}, K, T₀, L₅₀, a₅₀]***
- *two S/R models beverton & holt or ricker with two steepness values 0.6 or 0.8.*
- *build coherent population dynamics under no-exploitation*
- *1053 species*

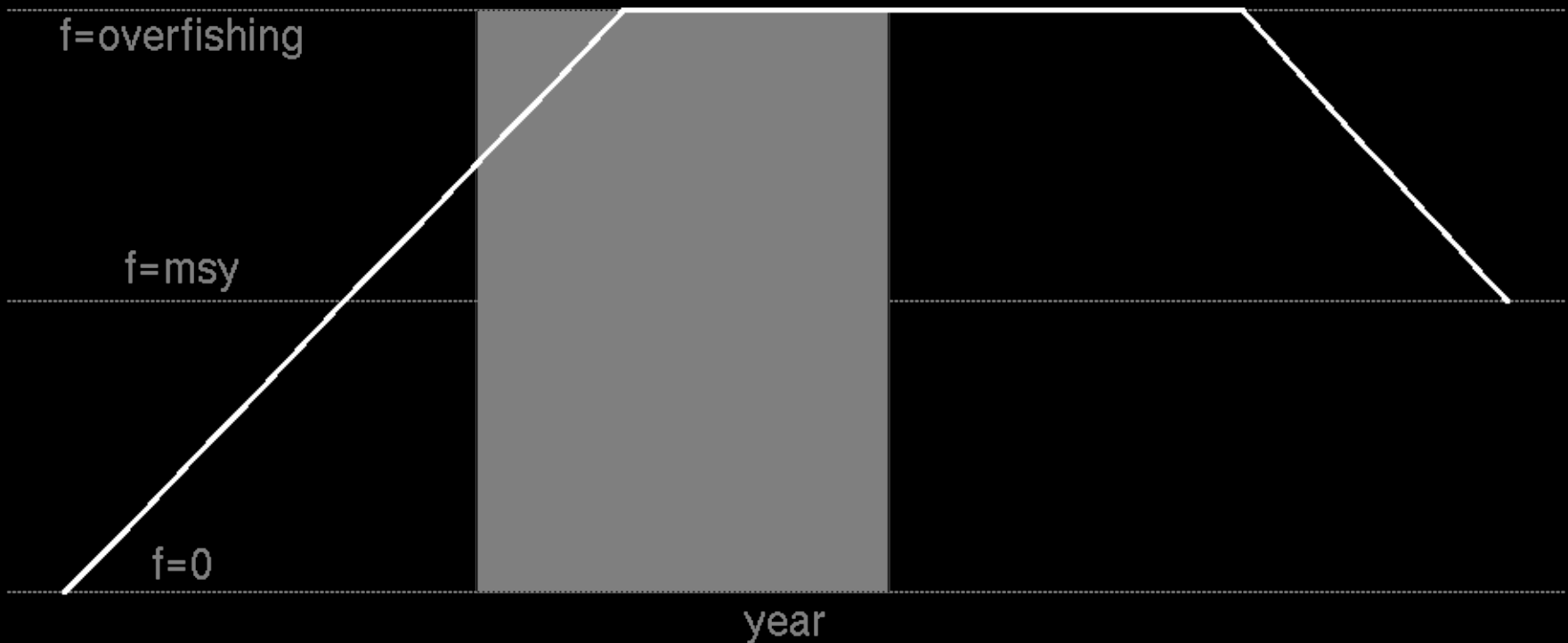
Algorithm step 02 - simulate exploitation



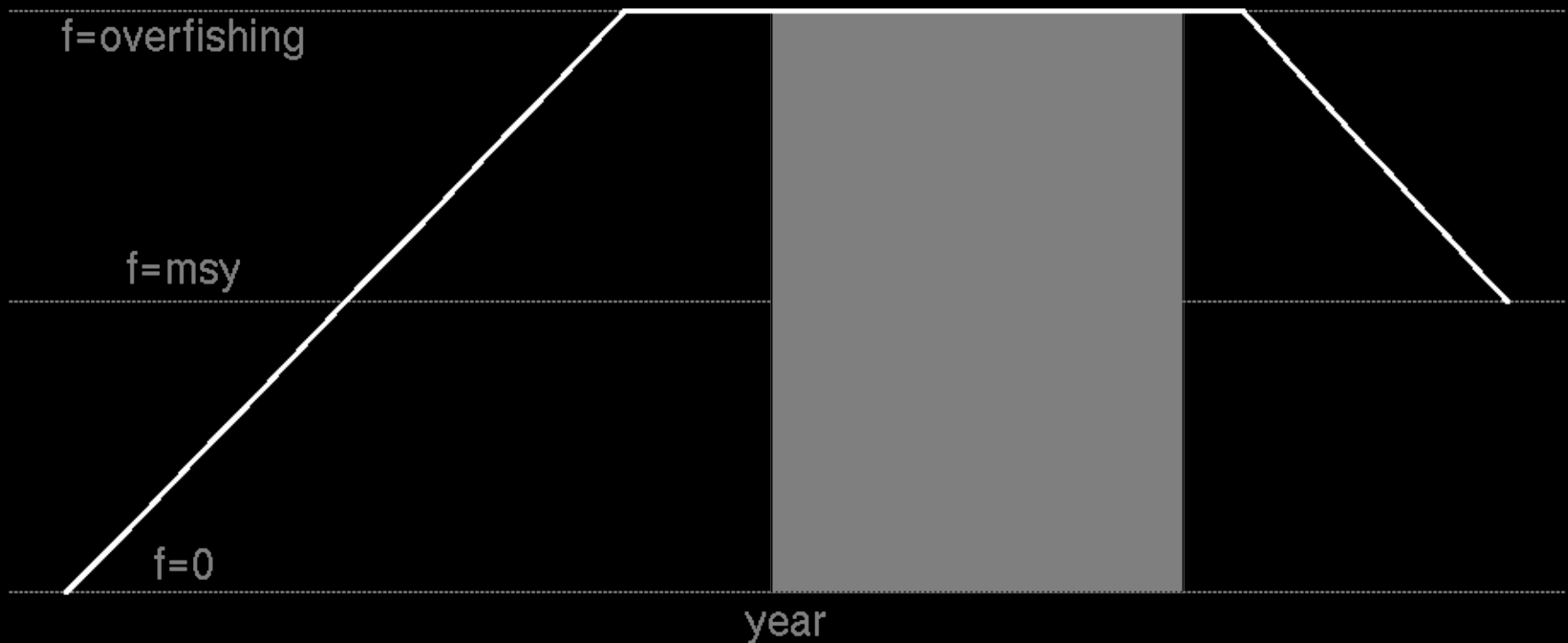
Algorithm step 02 - simulate exploitation



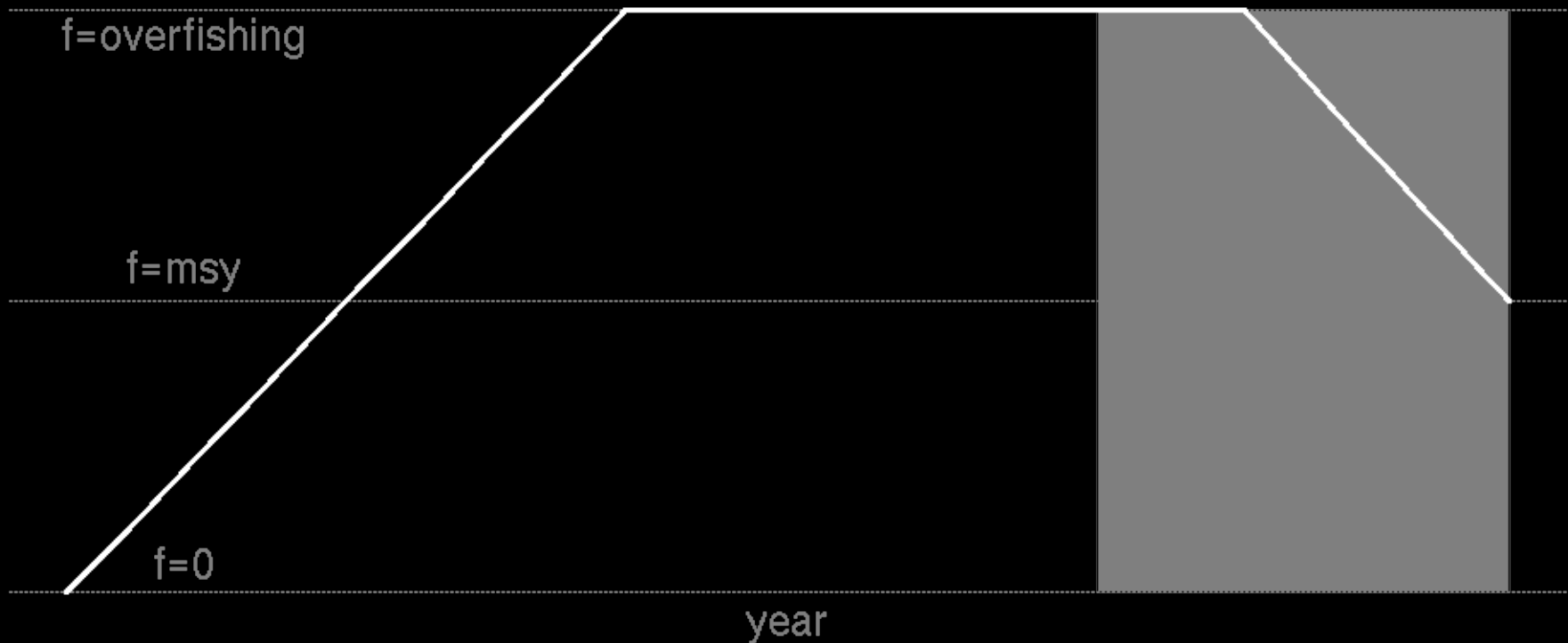
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(0) full series

(i) "development"

(ii) "development plus over-exploitation"

(iii) "over-exploitation"

(iv) "recovery"

Algorithm step 02 - simulate exploitation

The exploitation pattern was:

*Full exploited age: 0.7 or $1 * a50$*

Shape: flat, double normal, “logistic”

Algorithm step 03 - add observation error

- *in abundance indices*
catchability constant or increase 5% year
independent lognormal errors $cv = 0.2$ or 0.5
- *in catch in numbers at age*
independent lognormal errors $cv = 0.1$ or 0.3

Algorithm step 04 – fit assessment models

A total of 30 assessment models were built by combining 3 distinct fisheries models, 5 distinct catchability models and 2 distinct stock recruitment models.

For each simulation one combination was randomly chosen to be used in the model.

Algorithm step 04 – fit assessment models

submodel	code	formula
fishery	fm1	$\sim \text{factor}(\text{age}) + \text{factor}(\text{year})$
fishery	fm2	$\sim \text{bs}(\text{age}, 4) + \text{bs}(\text{year}, 10)$
fishery	fm3	$\sim \text{te}(\text{age}, \text{year}, \text{bs} = \text{c}(\text{"tp"}, \text{"tp"}), k = \text{c}(4, 15))$
catchability	qm0	~ 1
catchability	qm1	$\sim \text{age}$
catchability	qm2	$\sim \text{factor}(\text{age})$
catchability	qm3	$\sim \text{bs}(\text{age}, 4)$
catchability	qm4	$\sim \text{bs}(\text{age}, 4) + \text{bs}(\text{year}, 15)$
recruitment	rm1	$\sim \text{factor}(\text{year})$
recruitment	rm2	$\sim \text{bs}(\text{year}, 15)$

Algorithm step 05 – compute statistics

Relative bias and mean square error
SSB, F, C, q, R

Finally:

Scenarios = 224

Species = 1053

Exploitation trajectories = 5

Total runs = 1.15 million

Results:

At this point it was clear we couldn't analyse the results in a conventional way.

Website:

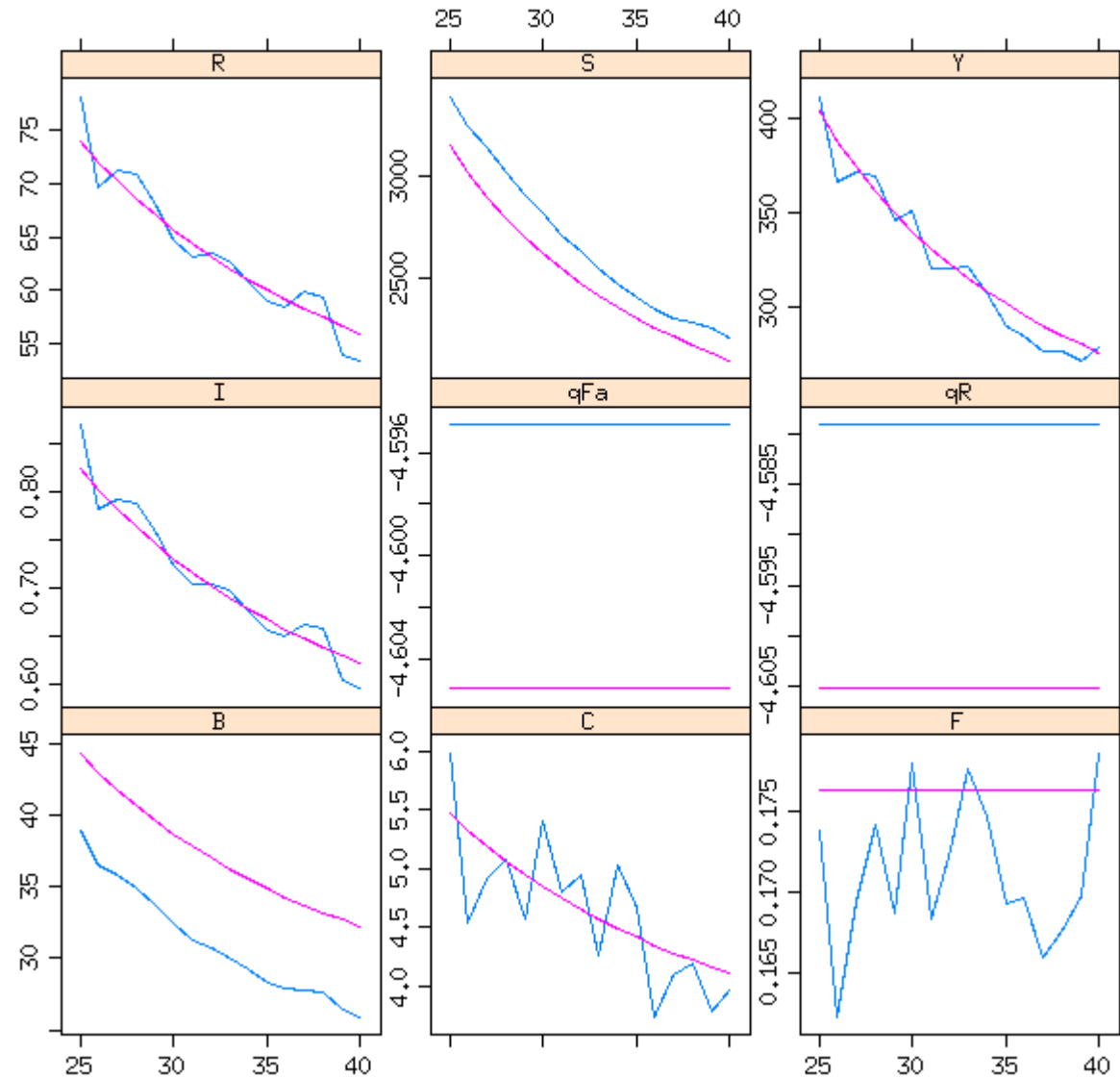
The website stores, shows and shares the results of the model tests.

<https://fishreg.jrc.ec.europa.eu/web/a4a/simulation-testing>

Fishbase stocks^(*)



Testing, 1,2 ...



Conclusions:

The simulations allowed us to test

- The model capacity to replicate the underlying trends.*
- The “automatic mode”.*
- “Publish” the results.*

Further discussion for the WK.

What do we want to test ?

Rebuild the underlying processes ?

Predict next year catches ?

Inform a harvest control rule ?

Further discussion for the WK.

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