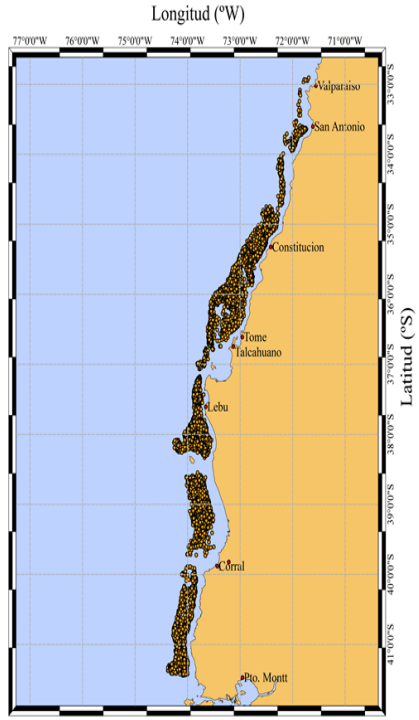
Stock assessment Chilean Hake in Stock Synthesis

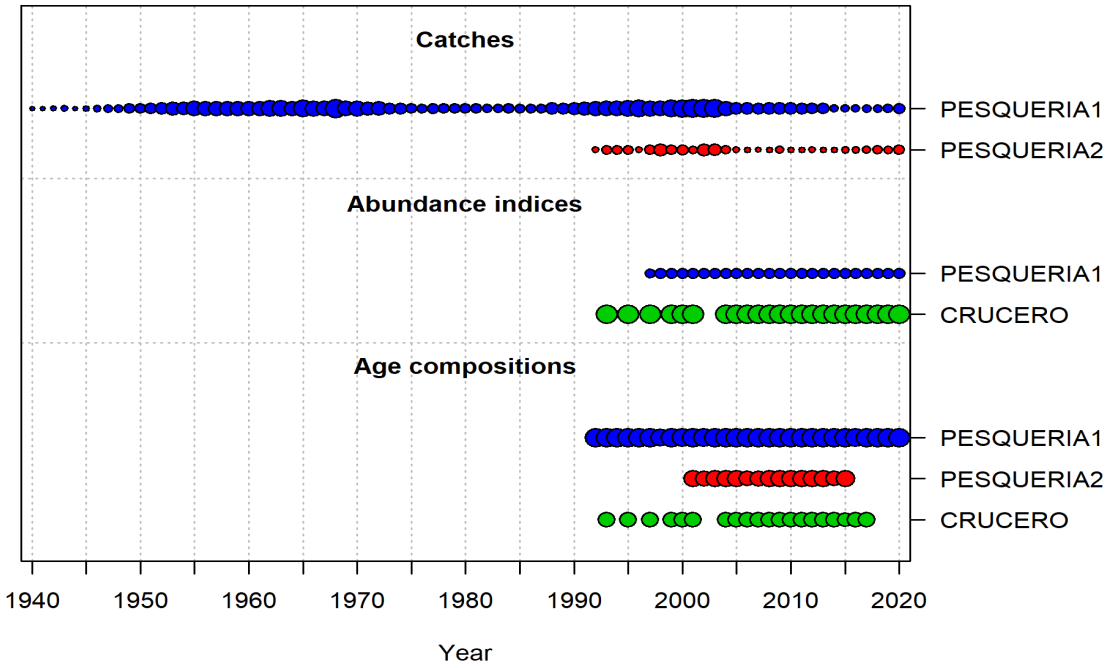
Background

a. Species: Chilean hake or Merluza Común (*Merluccius gayi gayi*)
b. Fishing Area: Chilean coast in Fishery Regions (33-41ºS)
c. Gear: Bottom trawl, gillnet and long-line
d. Distribution: On the continental shelf between 50 and 500 m depth and along the Chilean coast.
e. Exhibits a key trophic role in the central Chile ecosystem with consistent predation and prey role.



Information

There are official landing record from 1940 and recently estimates of illegal catches between 1992-2020. Furthermore, abundance and biomass from survey in august (spawning period). Catch at age composition is available to fishery and survey from 1992-1993. Also, there is discard but the serie is not available.



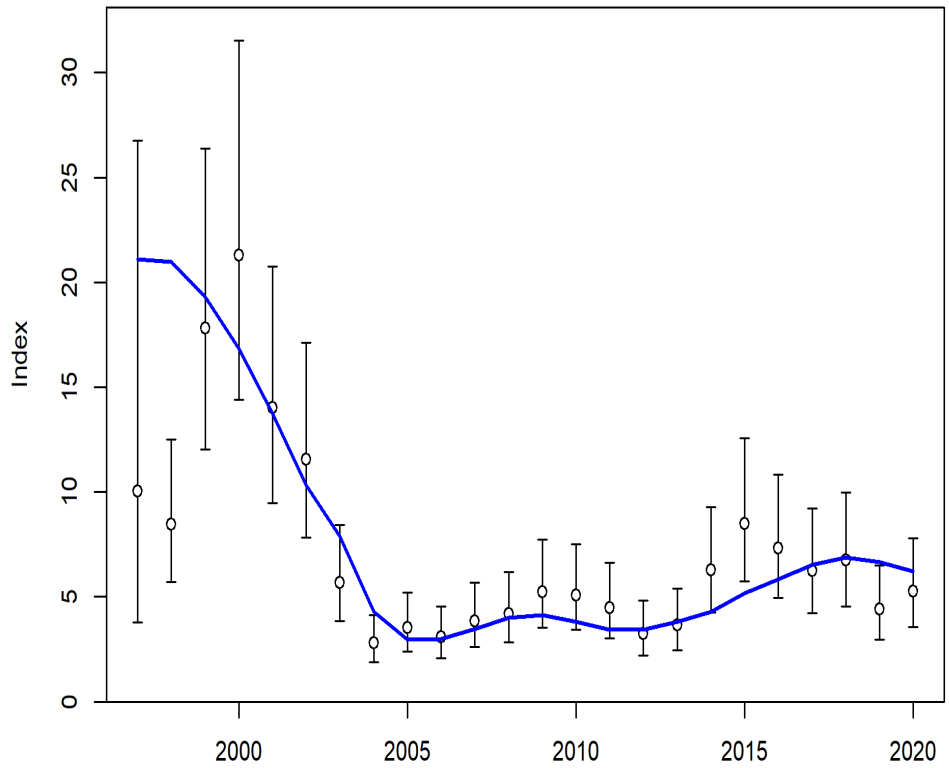
Activities

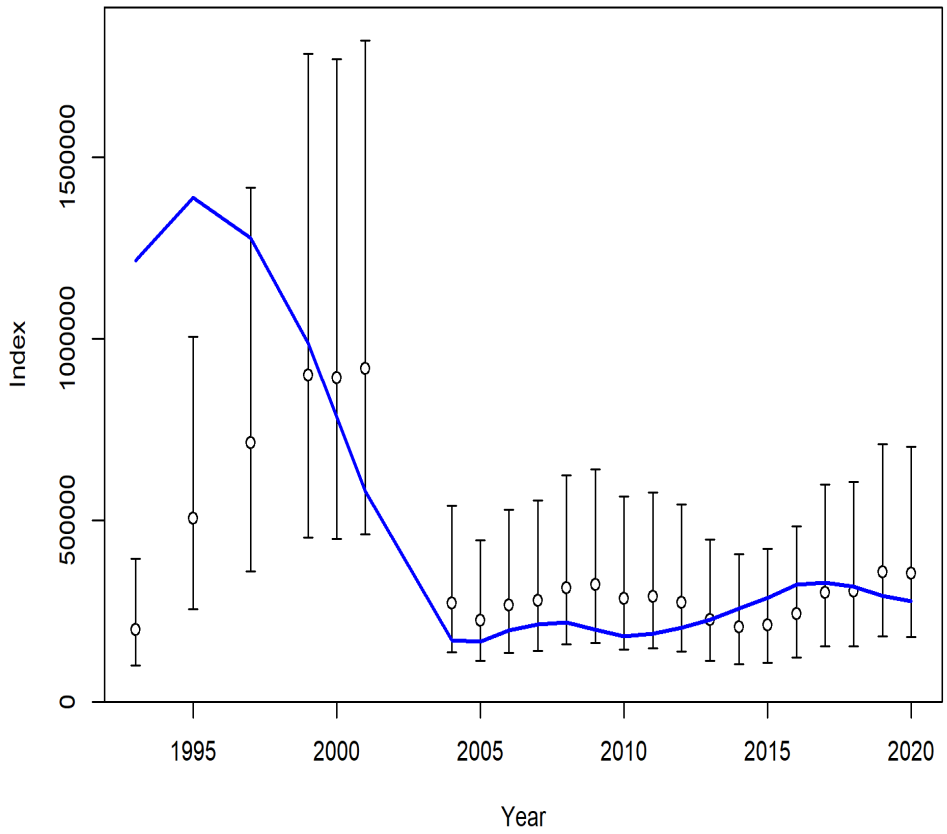
a. Model construction incorporates two fleets, catches, age-composition (fleets and survey) and biomass acoustic survey.
b. Structure data file to SS.
c. Structure control file.
d. Solve problems following examples, manual_SS, lectures and specially echoinput file.
e. Review different options to recruitment, include blocks to selectivity.
f. Generate output and summary to explore a first base model.
g. Review data weighting options.
h. Include bias correction SR.
i. Explore diagnostic options (i.e. retrospective analysis).

Ecosystem considerations

Index fit

In the model, we consider the index from the acoustic survey and catch rate index. There is a poor fit at the beginning of the series, this situation is similar to regular stock assessment from the institute. The trend in biomass, abundance and fishing mortality are consistent with the result of assessment developed but with an improvement in the shape to the fit.

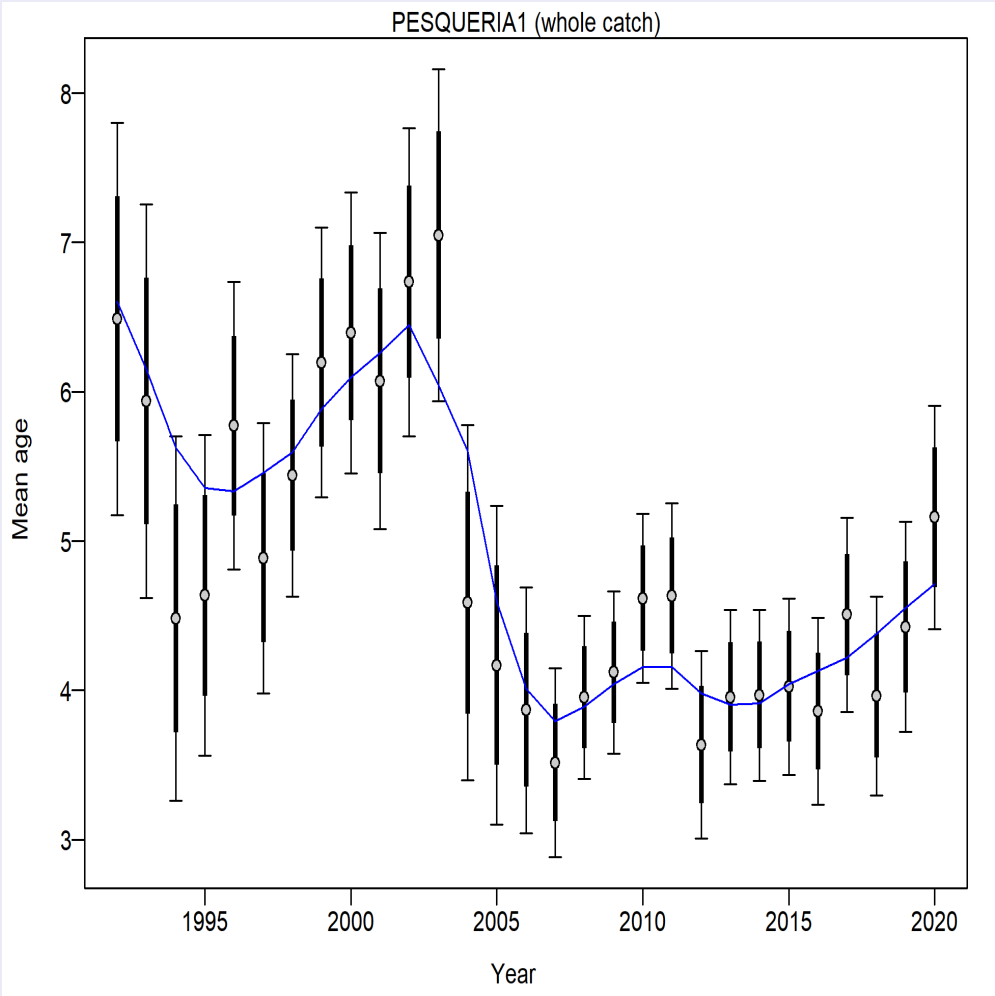



Index
0
500000
1000000
1500000
1995
2000
2005
2010
2015
2020
Year

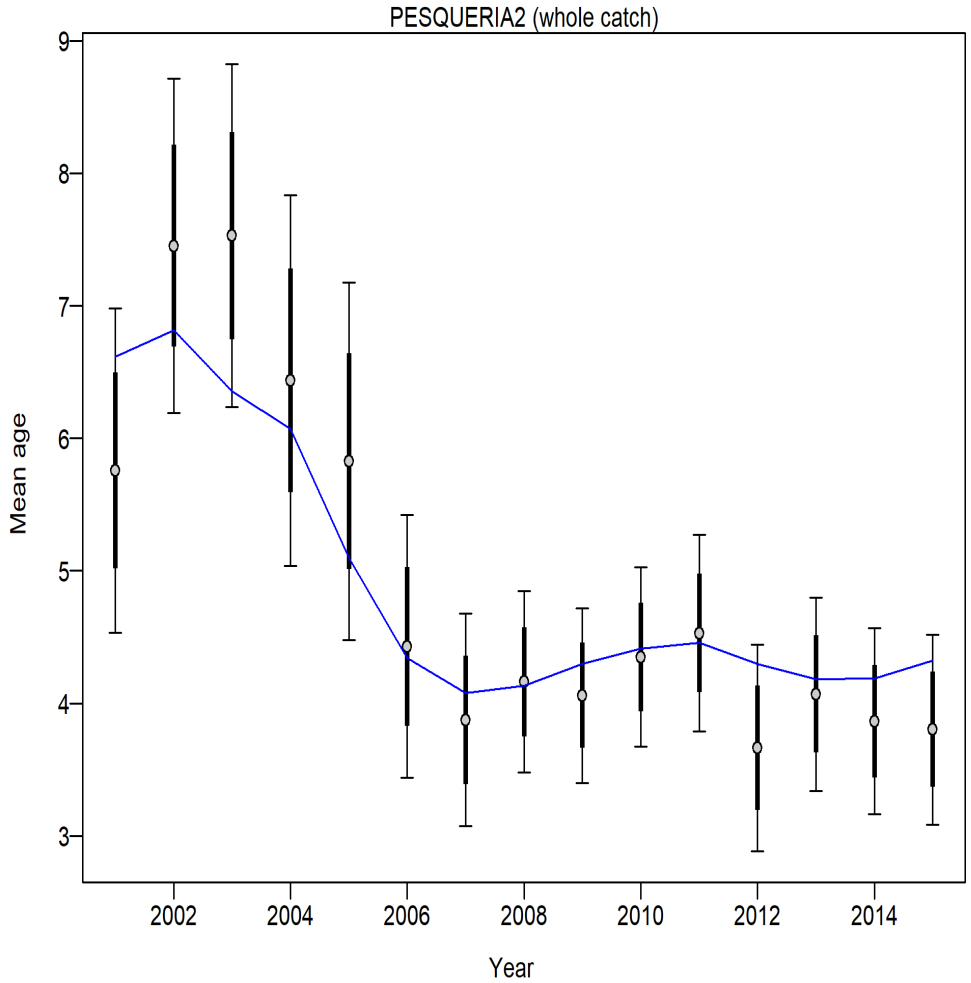
Age composition

The age composition fit to different fleets and survey shows acceptable performance with the exception in period 2002-2004 when the composition of age in the population present changes with low presence of adults.

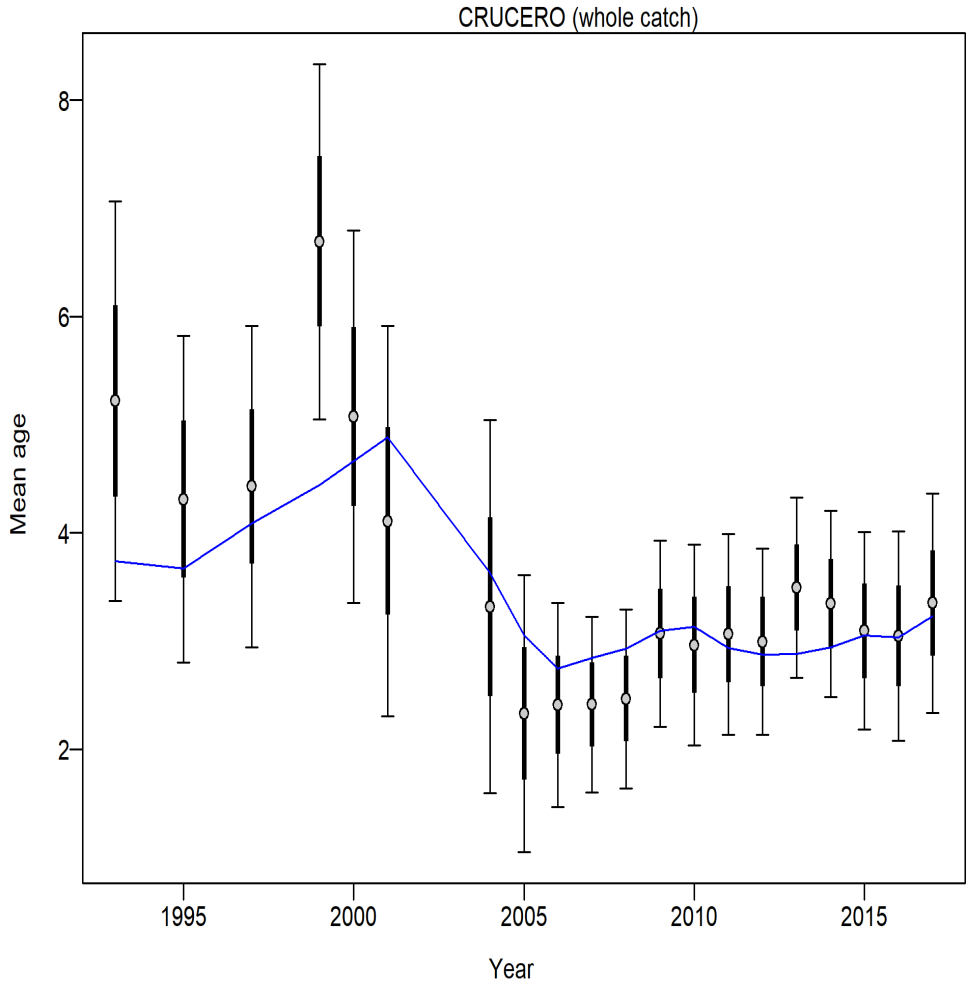
Fleet 1 (official)



Fleet 2 (not reported)

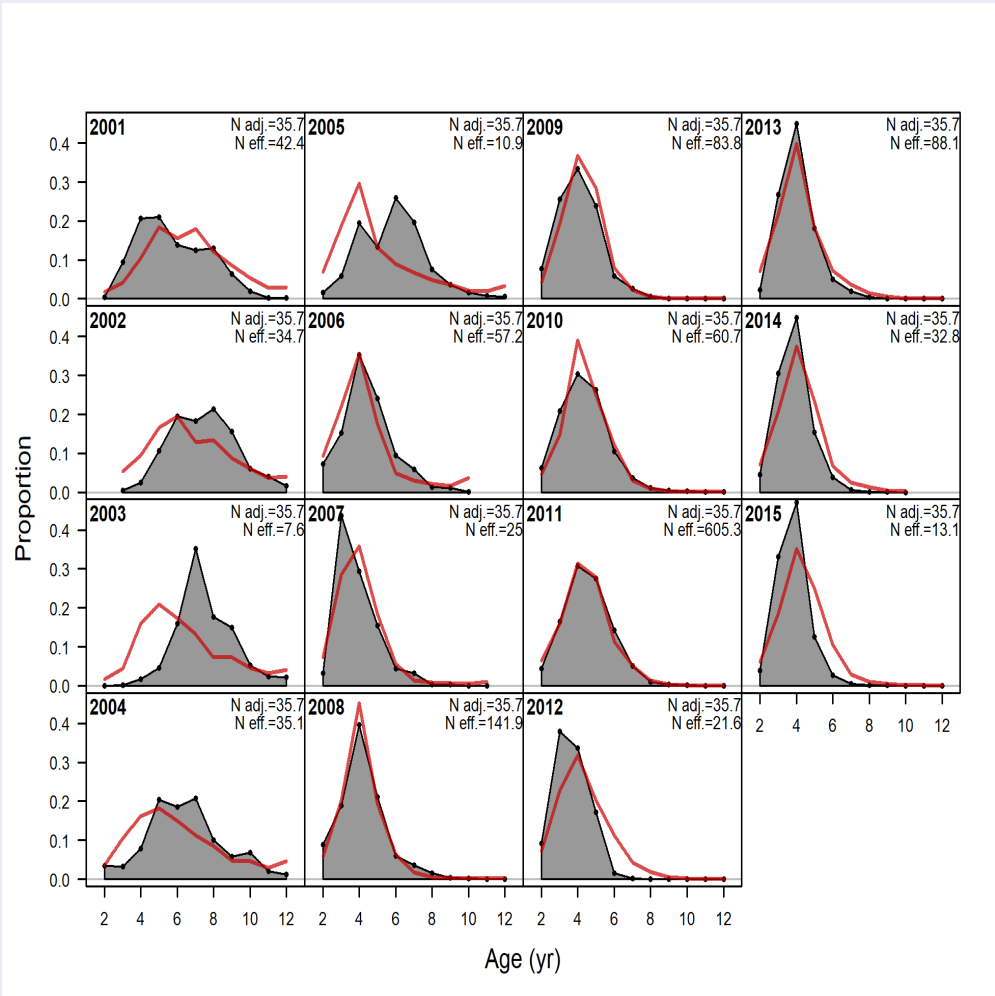


Survey

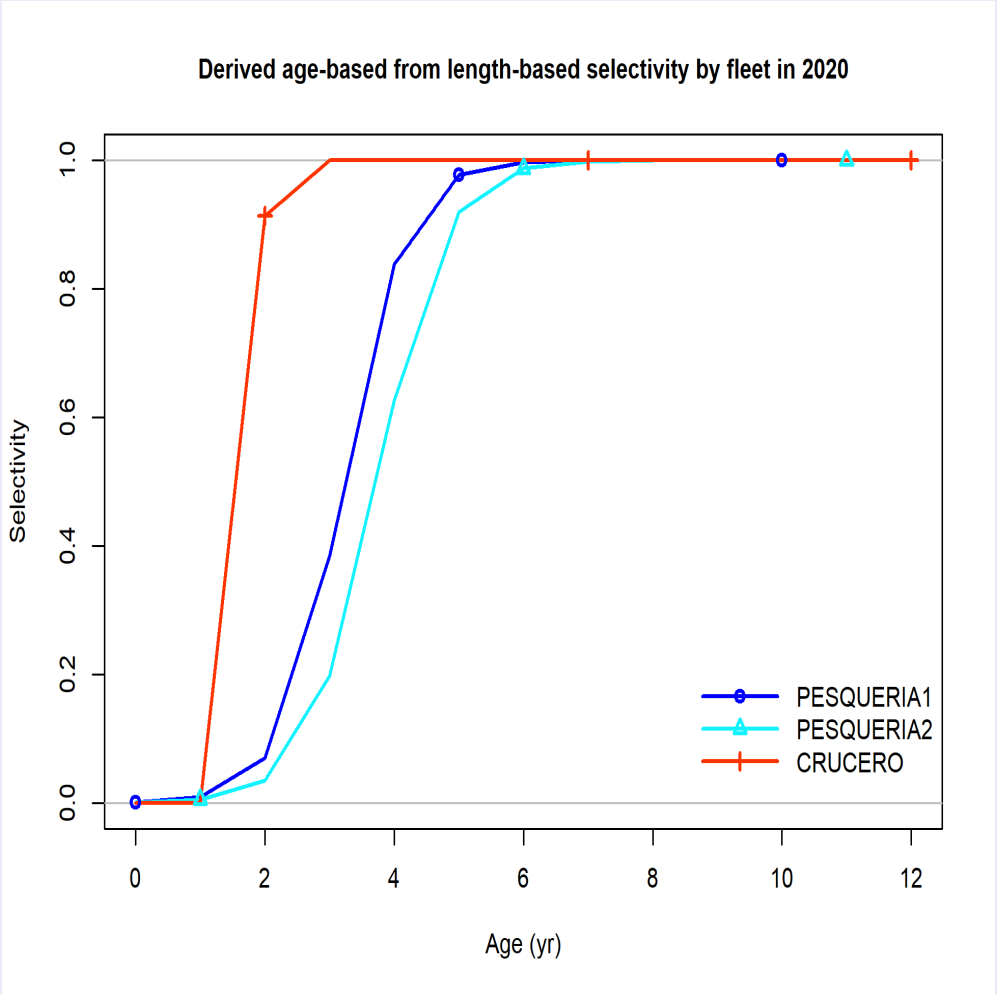

CRUCERO (whole catch)
Mean age
8
6
4
2
1995
2000
2005
2010
2015
Year

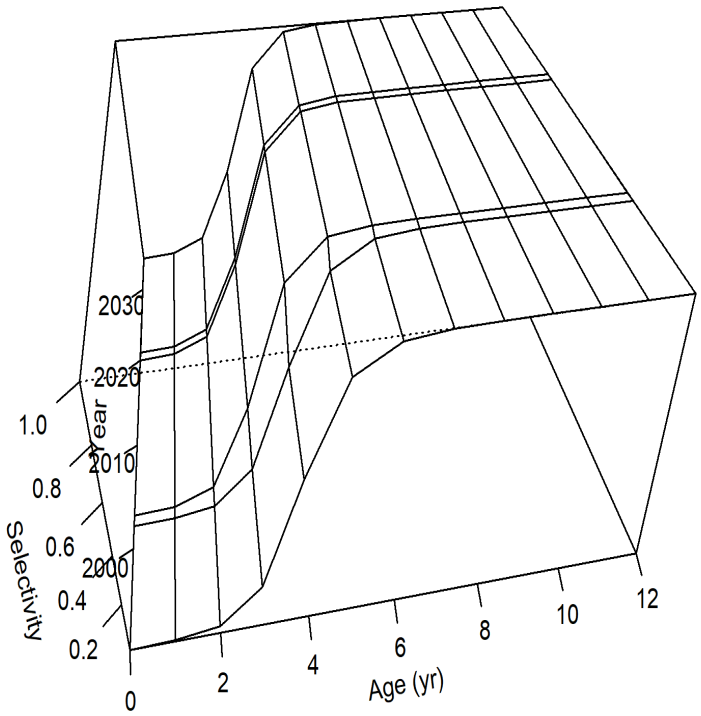
CAA

Survey fit

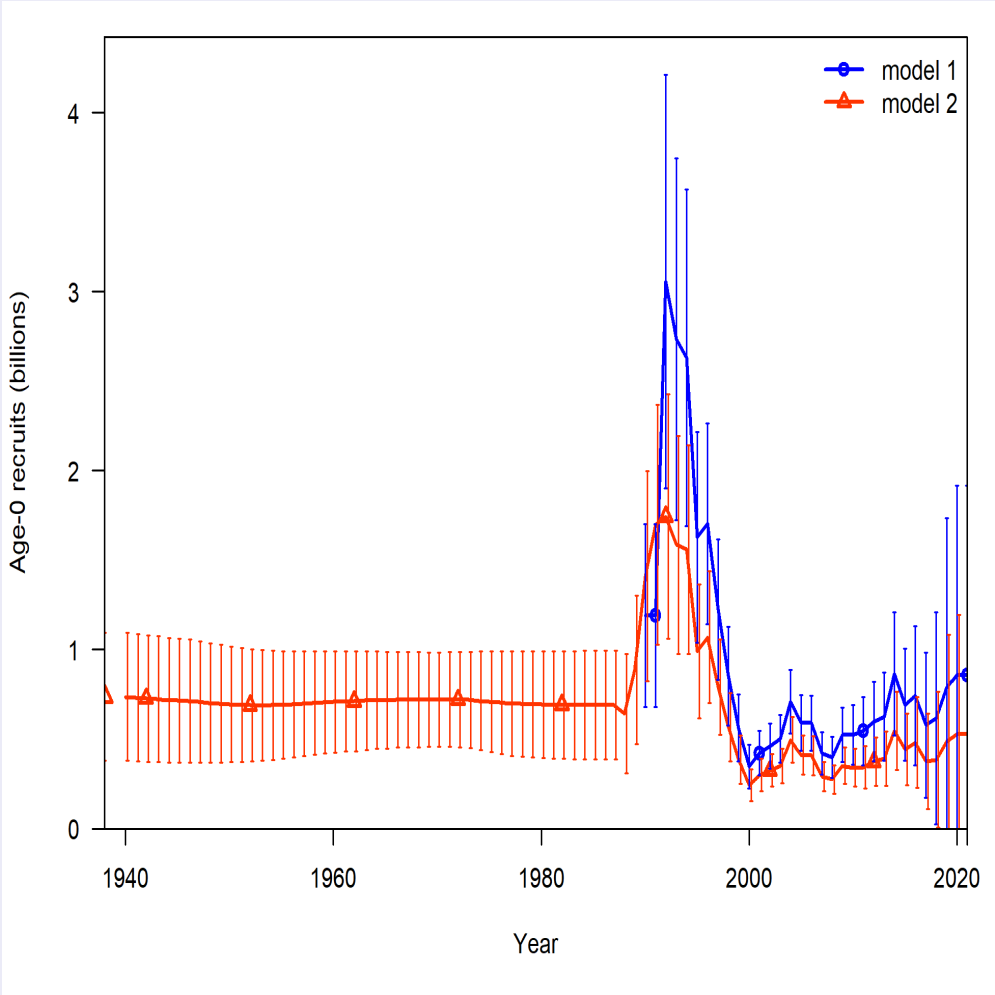


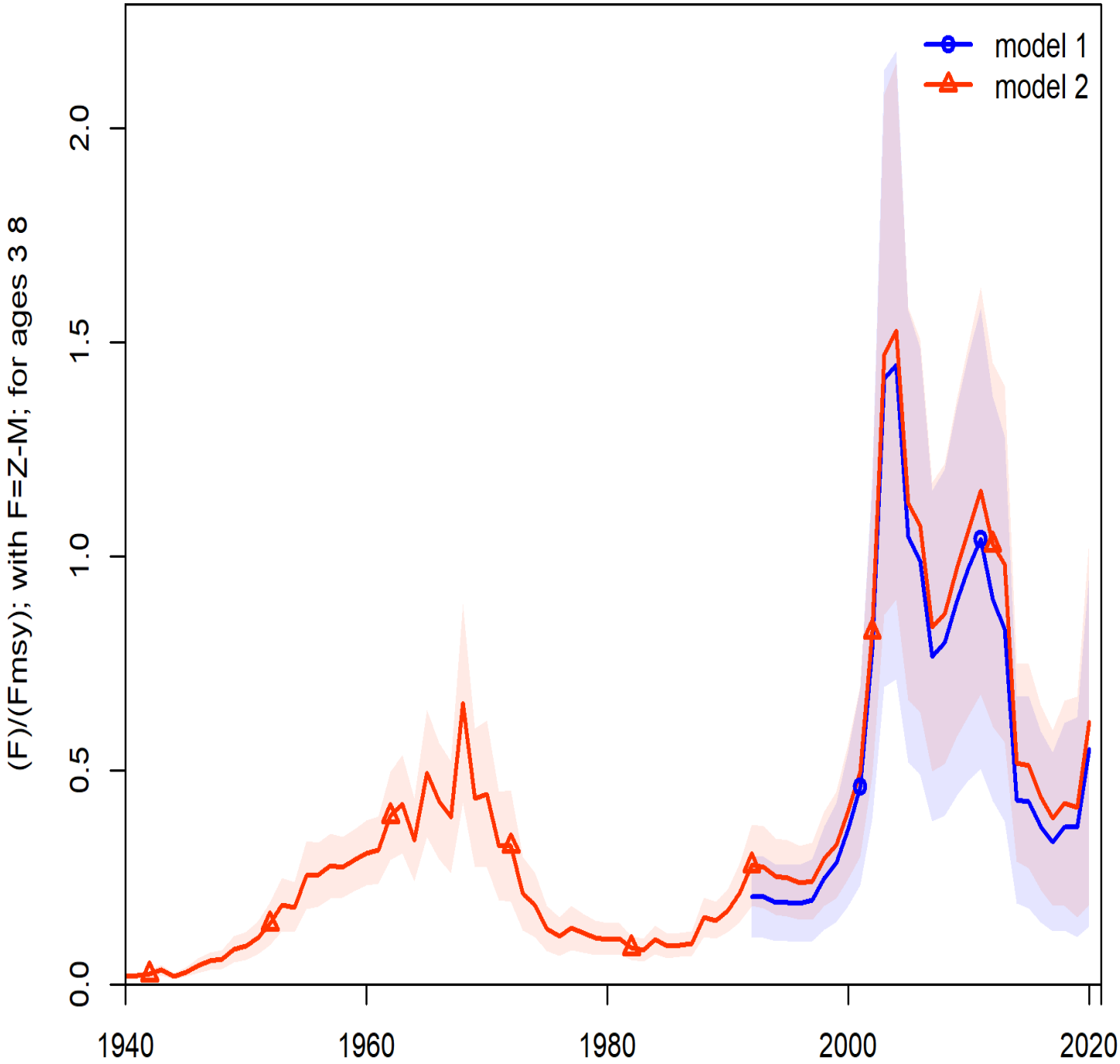
Selectivity by fleets and block



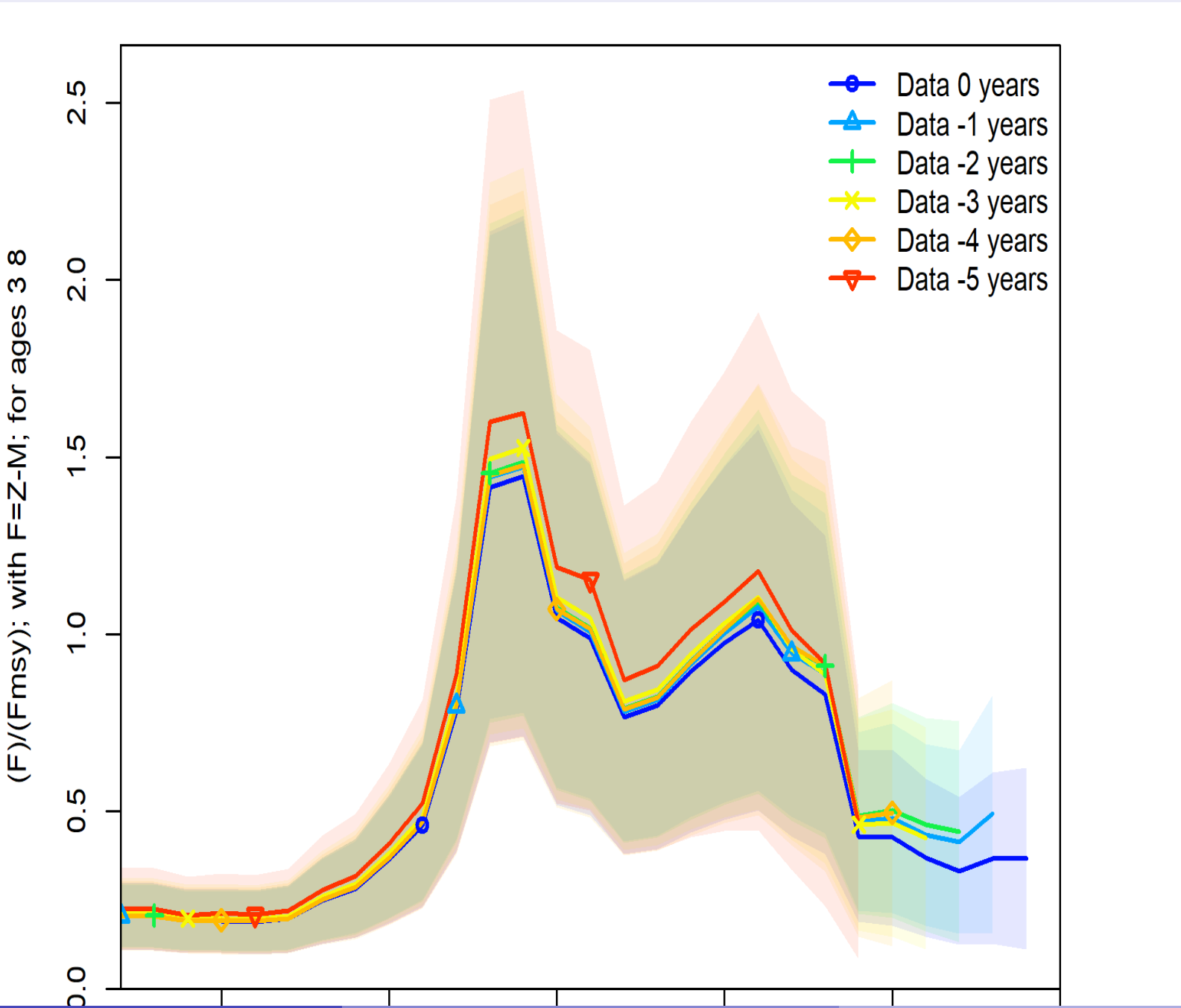

Time-varying selectivity for PESQUERIA1
Selectivity
1.0
0.8
0.6
0.4
0.2
Year
2030
2020
2010
2000
0
2
4
6
8
10
12
Age (yr)

Time series comparisons model 1 and 2




model 1
model 2
(F)/(Fmsy); with F=Z-M; for ages 3 8
0.0
0.5
1.0
1.5
2.0
1940
1960
1980
2000
2020

Retrospective analysis



Learned lesson

1. SS presents extensive capabilities to build different stock assessment.
2. Develop much necessary analysis of diagnostic in a friendly environment.i.e. data weighting, retrospective.
3. Excellent tools to review output by plots and tables with the use of r4ss.
4. Is necessary the use of control version program i.e. github.
5. We need to continue learning about SS and methods incorporating. i.e. read Manual, view examples, training.

Tables

	Label	model1	model2
1	TOTAL_like	342.90	301.78
2	Survey_like	53.98	24.86
3	Age_comp_like	273.39	262.42
4	Parm_priors_like	1.42	1.56
5	Recr_Virgin_billions	1.36	0.74
6	SR_LN(R0)	14.13	13.51
7	SR_RkrPower_steep	0.63	0.82
8	NatM_p_1_Fem_GP_1	0.30	0.21
9	L_at_Amax_Fem_GP_1	65.00	65.00
10	VonBert_K_Fem_GP_1	0.15	0.15
11	SSB_Virgin_thousand_mt	1772.99	1793.26
12	Bratio_2017	0.87	0.58
13	SPRratio_2016	0.56	0.90