


Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

SKIPJACK TUNA IN THE EASTERN PACIFIC OCEAN, 2021: INTERIM ASSESSMENT

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Outline

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  - Growth estimation
  - Fishery definitions
  - Purse seine CPUE
- Stock assessment
  - Reference model assumptions
  - Sensitivity analyses
- Results
  - Reference model
  - Sensitivity analyses
  - Stock status
- Future research

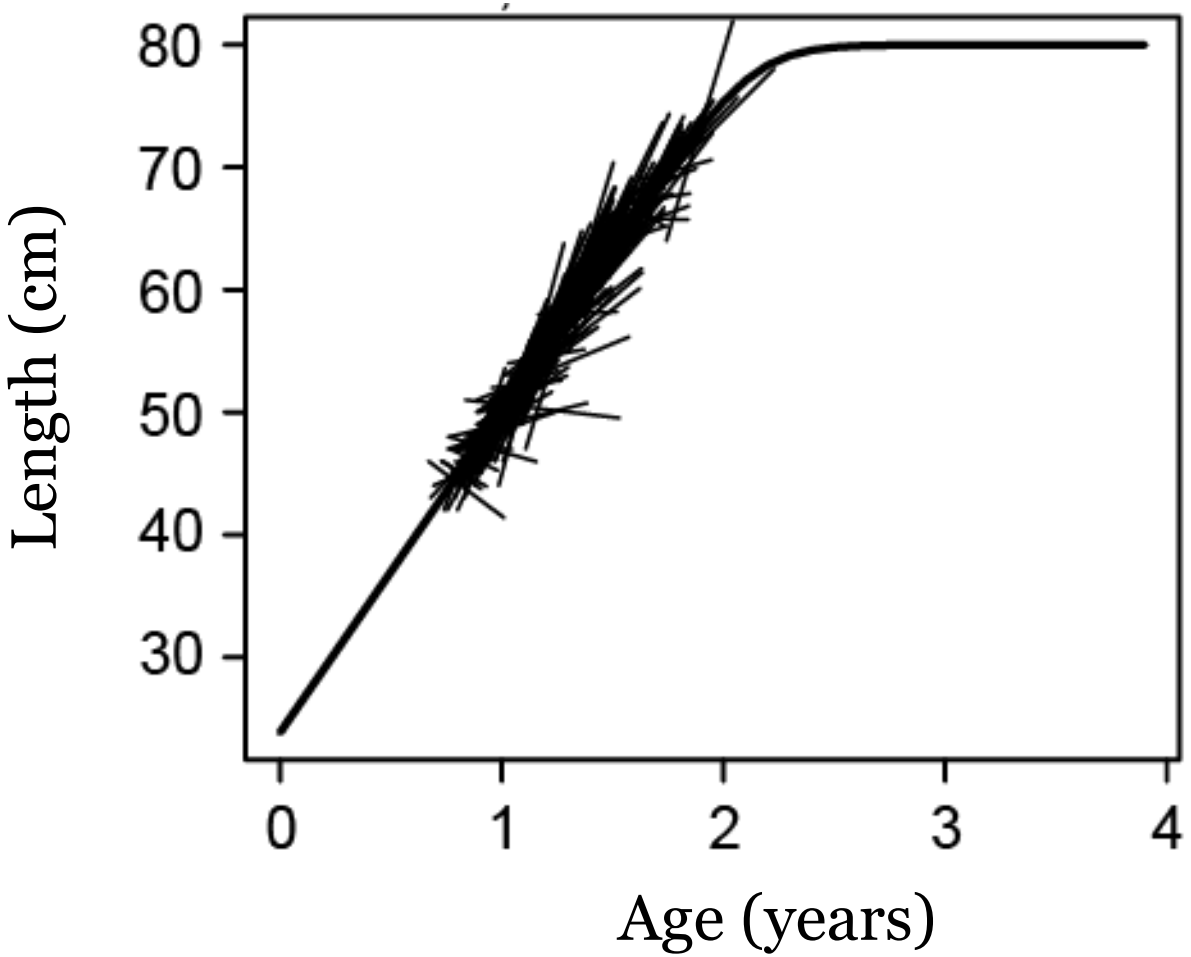
Motivation

- No reliable assessment for SKJ
  - Unknown if purse seine index is proportional to abundance
  - Unknown if purse seine selectivity is dome shape
  - No reliable aging data
- SPC uses longline data for skipjack
  - Provides estimates of dome shape selectivity
  - Possible index of abundance
- Echosounder buoy index
- Can do assessment without absolute age
  - New tagging data to estimate growth

Growth - SAC-13 INF-J

- Growth cessation model
- No age data
  - Assume 37 cm is age 2 quarters
- Not tagging data for large fish
  - Fix Linf at 78 cm based on peak of longline length composition
- Variation of length-at-age
  - Estimated using multiple methods
  - Too low
    - Modes in young ages
    - Does not fit longline length compoistion data
  - CV: 0 = 0.09; 20 = 0.06
  - CV a linear function of length

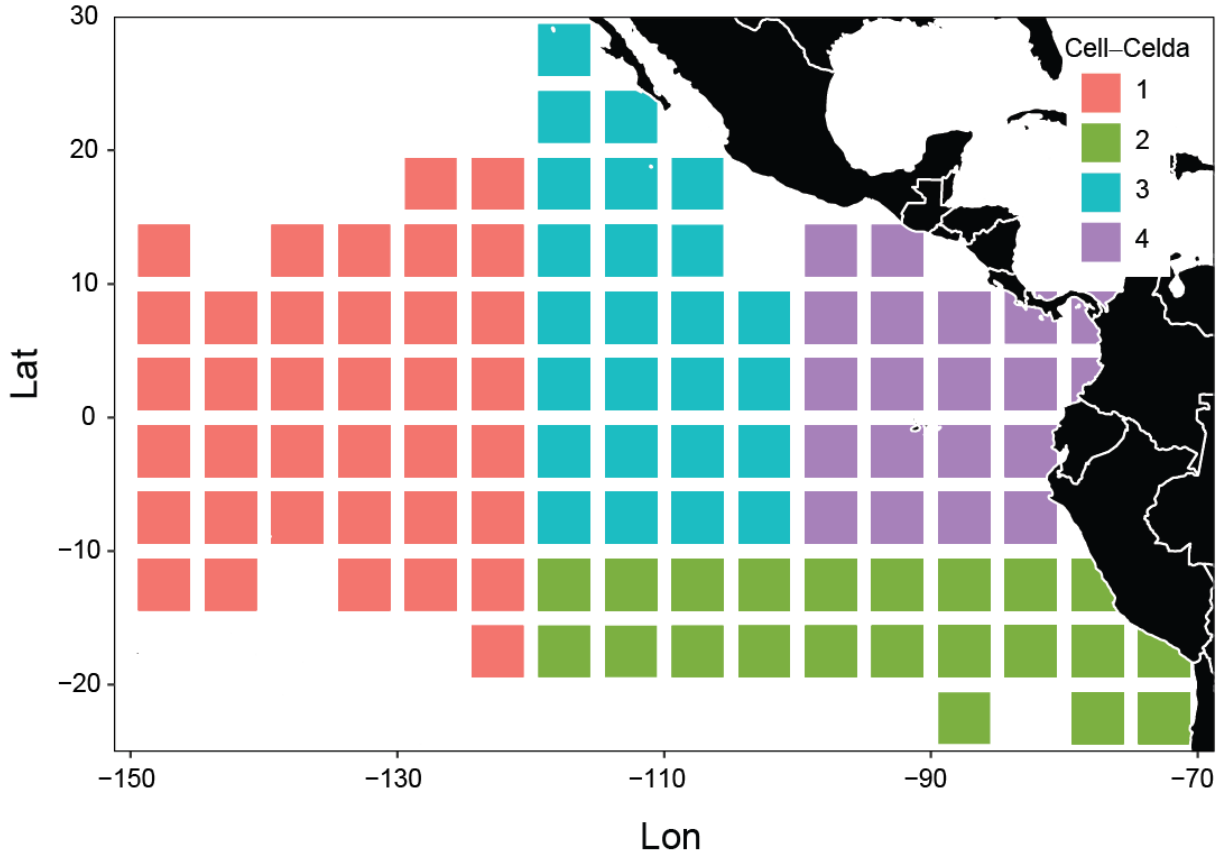
Growth – SAC-13 INF-J



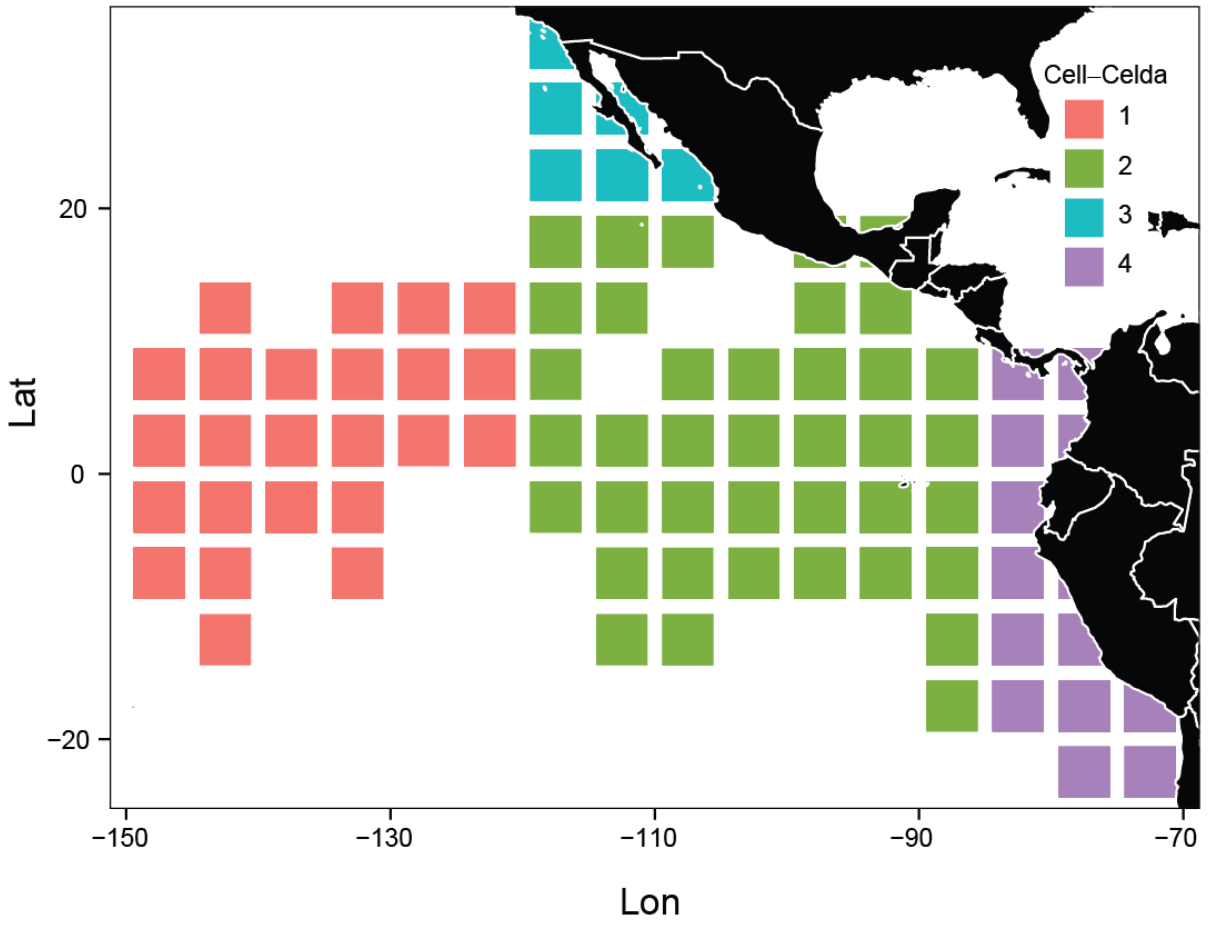
Fishery definitions – SAC-13 INF-I

- Analysis
  - Length-composition data from Class-6 purse-seine vessel
  - Floating objects (OBJ) and on unassociated schools (NOA)
  - Regression tree methods
  - Latitude, longitude, quarter, cyclic quarter, year
  - Divided by mean composition for year-quarter to reduce recruitment effect
  - Compromise between explaining data and number of fisheries
- Results
  - First split -120 for both set types
  - Other splits differ
  - 3 splits, 4 fishery

Fishery definitions: OBJ



Fishery definitions: NOA



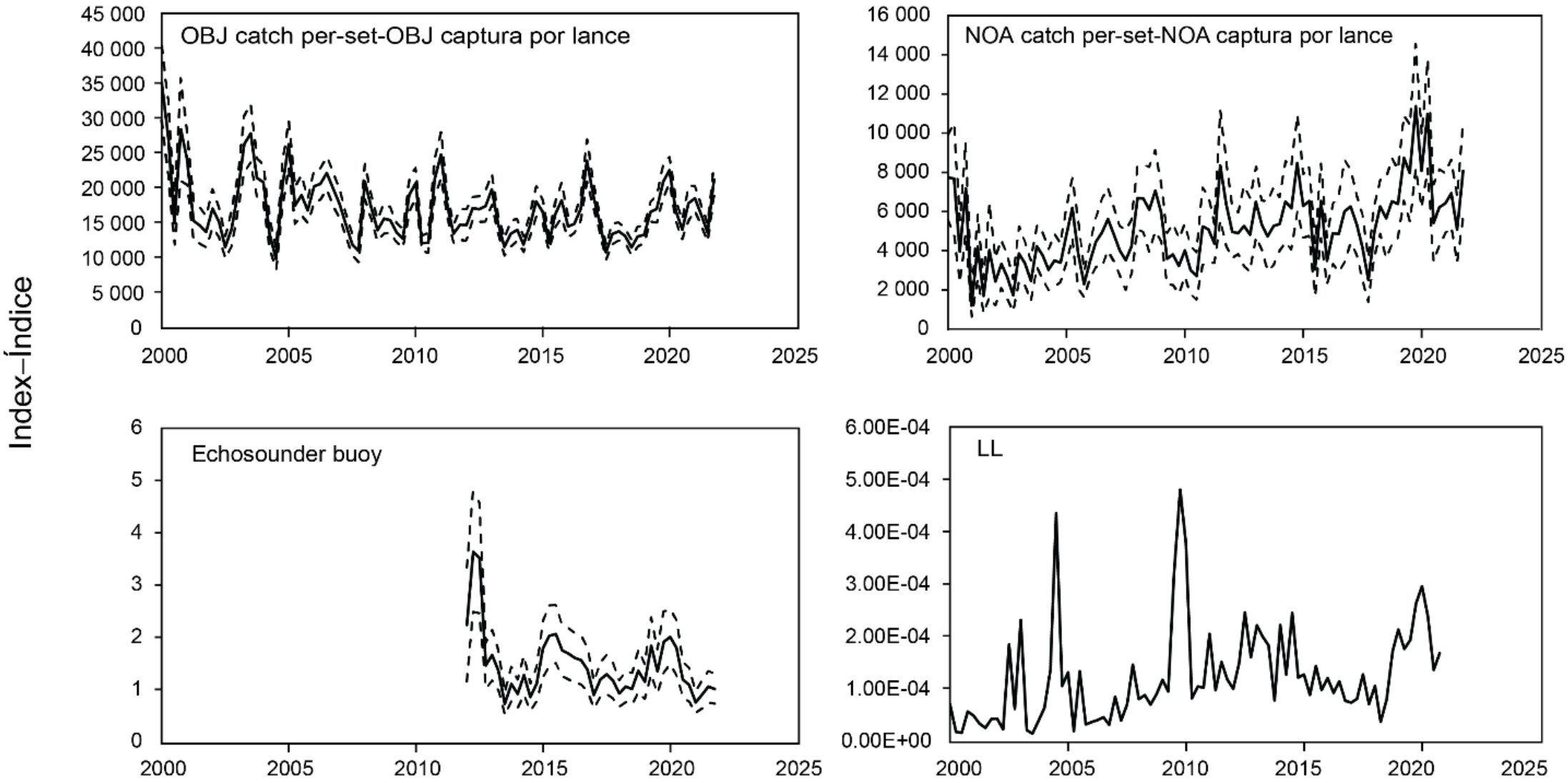
Fishery definitions – SAC-13 INF-I

- DEL
  - Low catch levels
  - Two areas: north and south of the equator
- LL
  - Low catch levels
  - One area: whole EPO

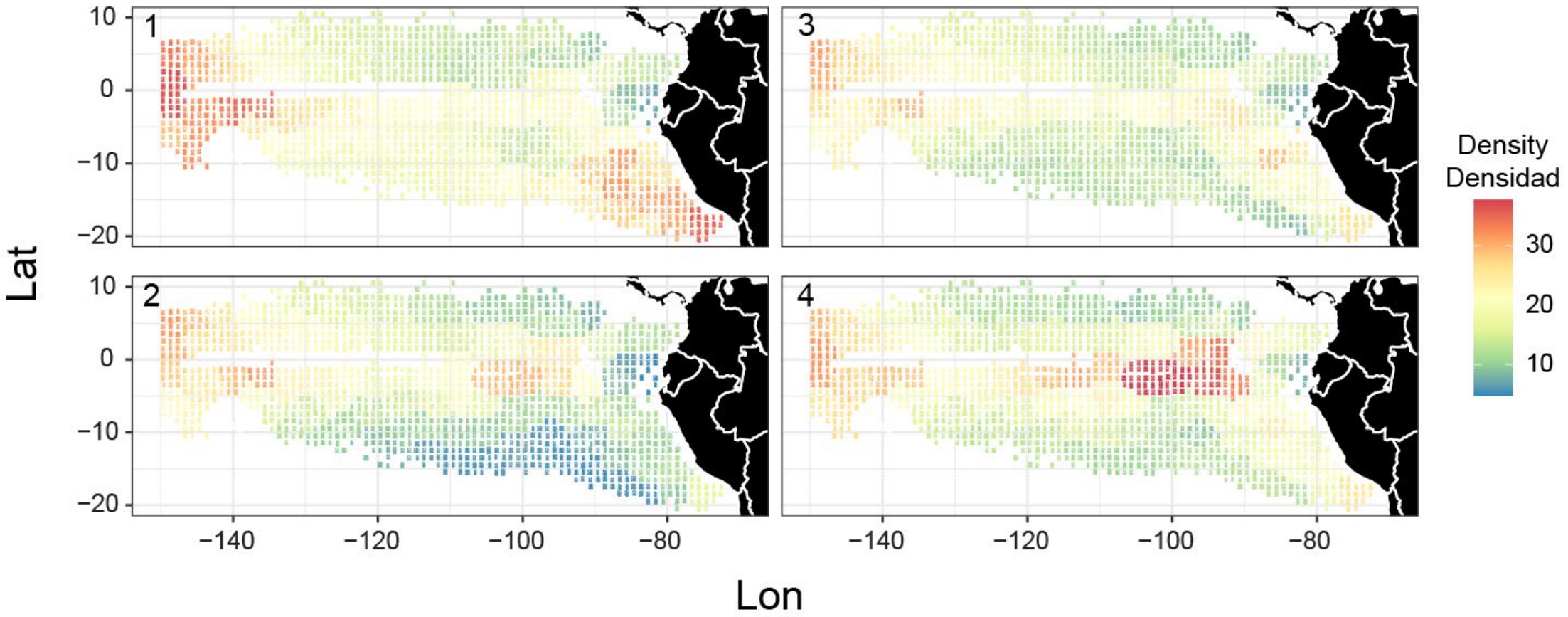
Indices of abundance

- Purse seine catch-per-set - SAC-13 INF-K
  - Can’t separate set types
  - No good measure of searching
  - OBJ and NOA
  - Spatio-temporal model
- Longline
  - Catch in number of fish per hook
  - Total catch divided by total number of hooks in a year-quarter
- Echosounder buoys - FAD-06-03
  - Signal from satellite-linked GPS tracking echosounder buoys used in the purse-seine OBJ fishery
  - Provide a single biomass value without discriminating species or size composition of the fish
  - Useh fishery data on catch species composition and average size, to obtain the skipjack index

Indices of abundance



Indices of abundance: OBJ catch-per-set



Reference model assumptions

- Single stock in the whole EPO
- Quarterly time step
- Longline selectivity is asymptotic, purse-seine selectivity is dome-shaped, modelled with splines
- Natural mortality based on Hampton (2000) and constant after a length of 65 cm.
- The asymptotic length is 78 cm.
- The age at 37 cm is 2 quarters.
- The CV of the length at age is a linear function of length and for age zero fish is 0.09 and for age 20 quarters is 0.06.
- Recruitment is independent of stock size
- Recruitment standard deviation of 0.6.
- Uses the longline and the echosounder buoy-based indices of relative
- Length compositions for the purse-seine OBJ index are used for the echosounder buoy index
- Index CVs average 0.2
- Length composition data OBJ/NOA = No. Wells; DEL =0.1 x No. Wells; LL = 0.1 x No fish

Sensitivity analyses

a) Lower asymptotic length. The asymptotic length is set at 73 cm.

b) Higher asymptotic length. The asymptotic length is set at 83 cm.

c) Lower variation of length at age. The CV for variation at the asymptotic length is fixed at 0.05.

d) Higher variation of length at age. The CV for variation at the asymptotic length is fixed at 0.07.

e) Including the improved estimates of catch for 2020 and 2021.

f) Excluding the echosounder buoy index of abundance.

g) No longline index of abundance.

h) Inclusion of the purse-seine OBJ catch-per-set index.

i) Inclusion of the purse seine NOA catch-per-set index.

j) NOA asymptotic selectivity.

k) OBJ asymptotic selectivity.

l) Eastern assessment: east of -120

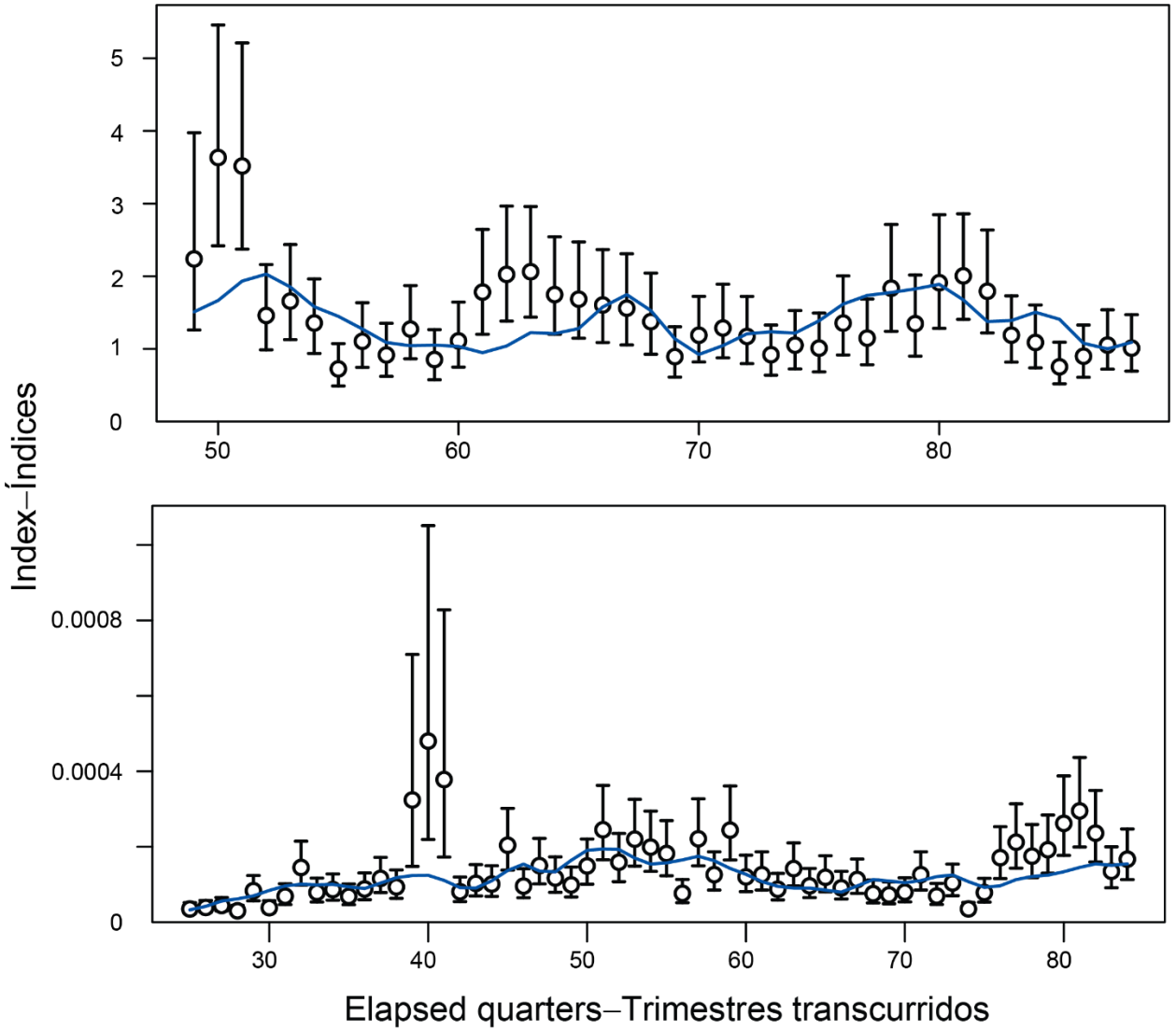
m) High natural mortality for old fish.

n) High fishing mortality for old individuals. The asymptotic length is fixed at 70 cm.

Reference model: Fit to indices of abundance

Echosounder buoys

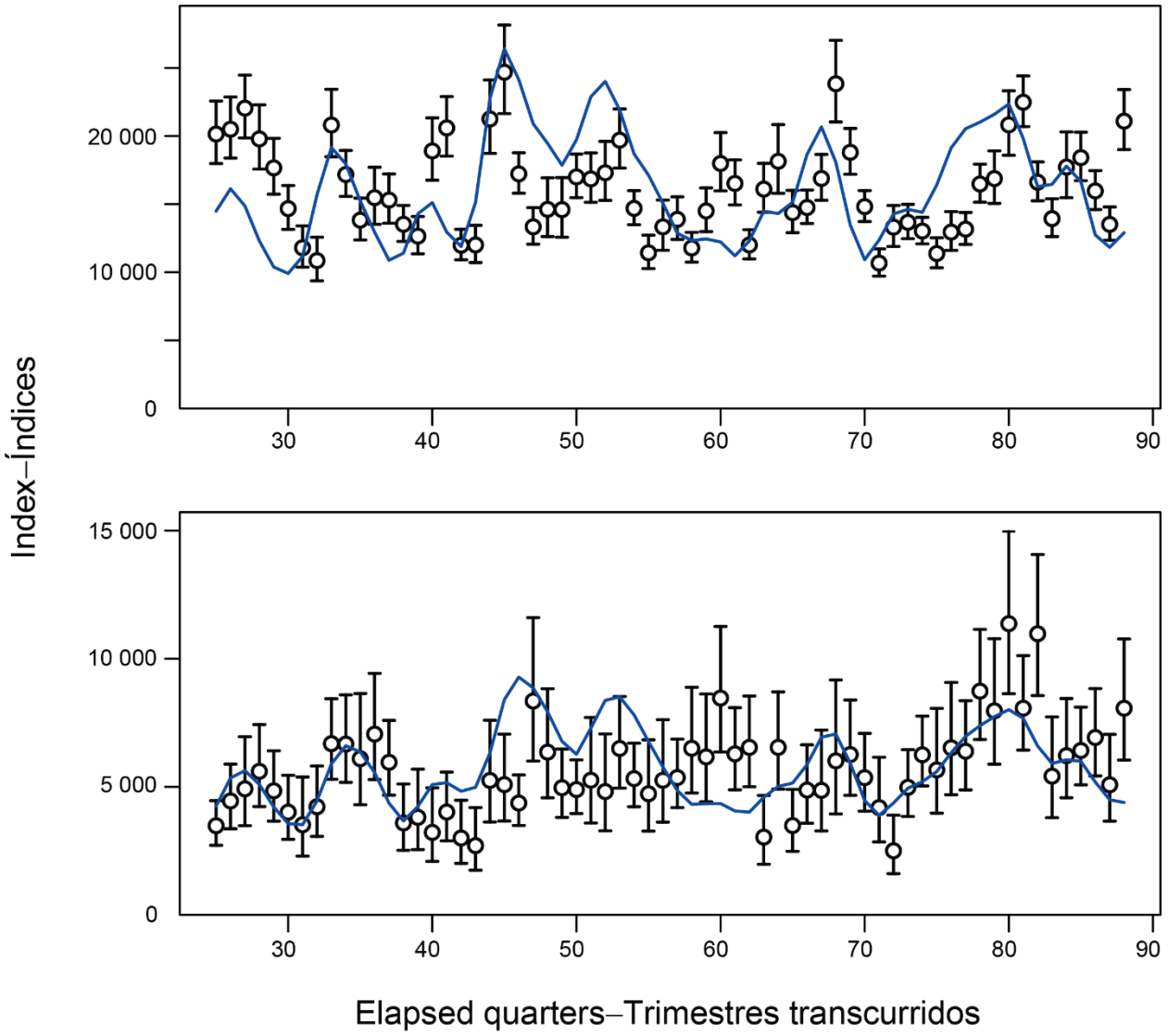
Longline



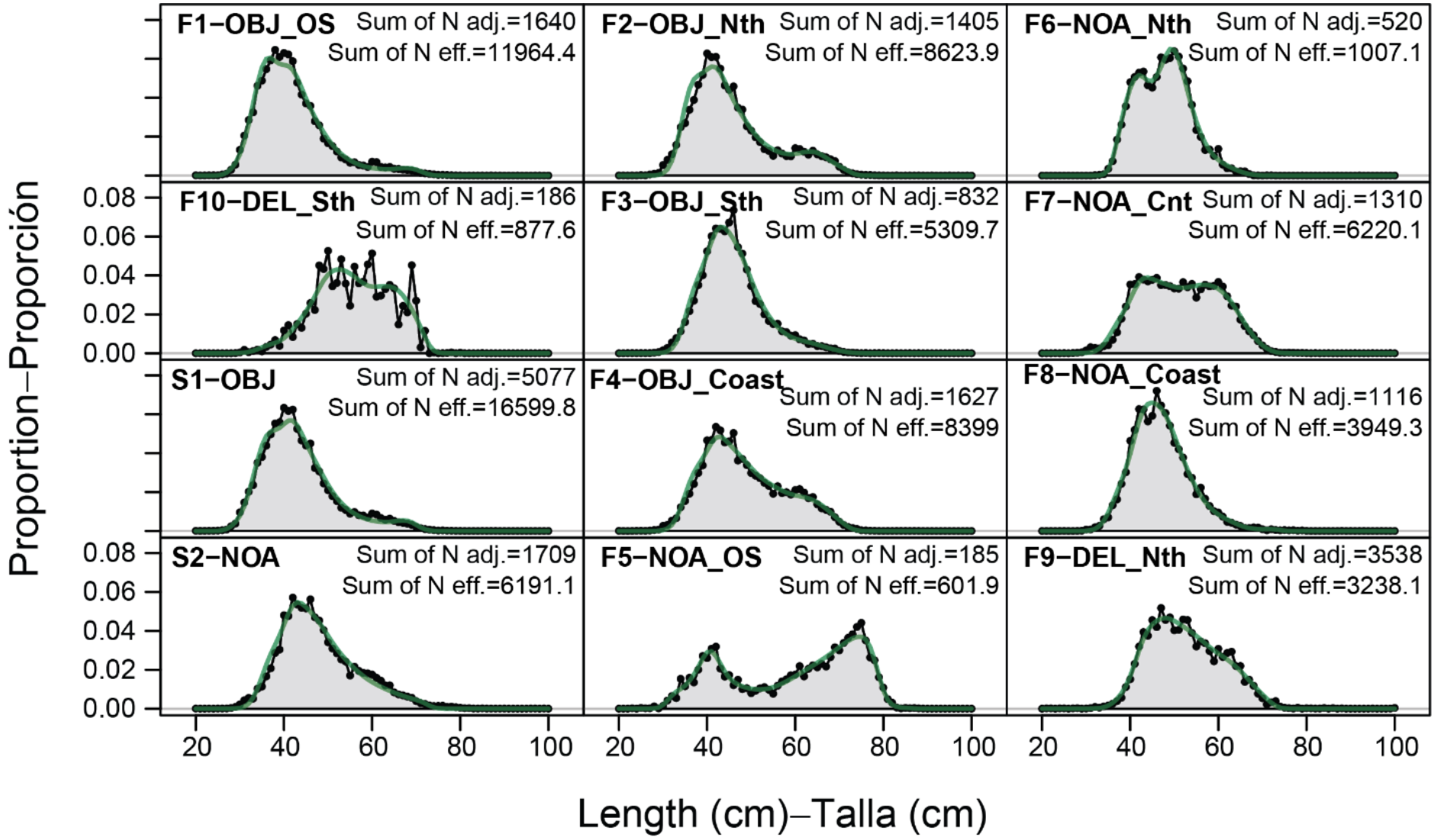
Reference model: Fit to indices of abundance

OBJ catch-per-set

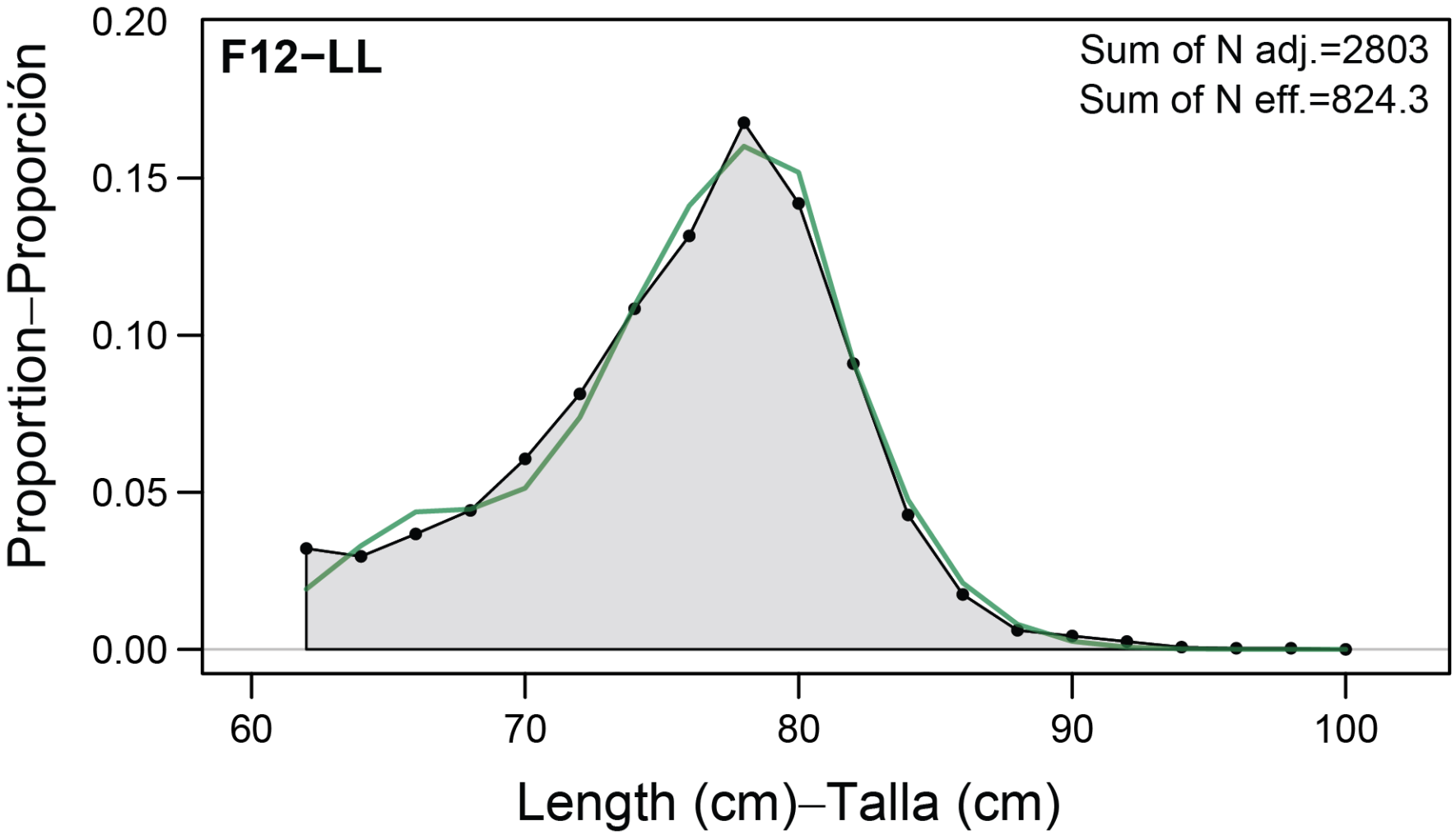
NOA catch-per-set



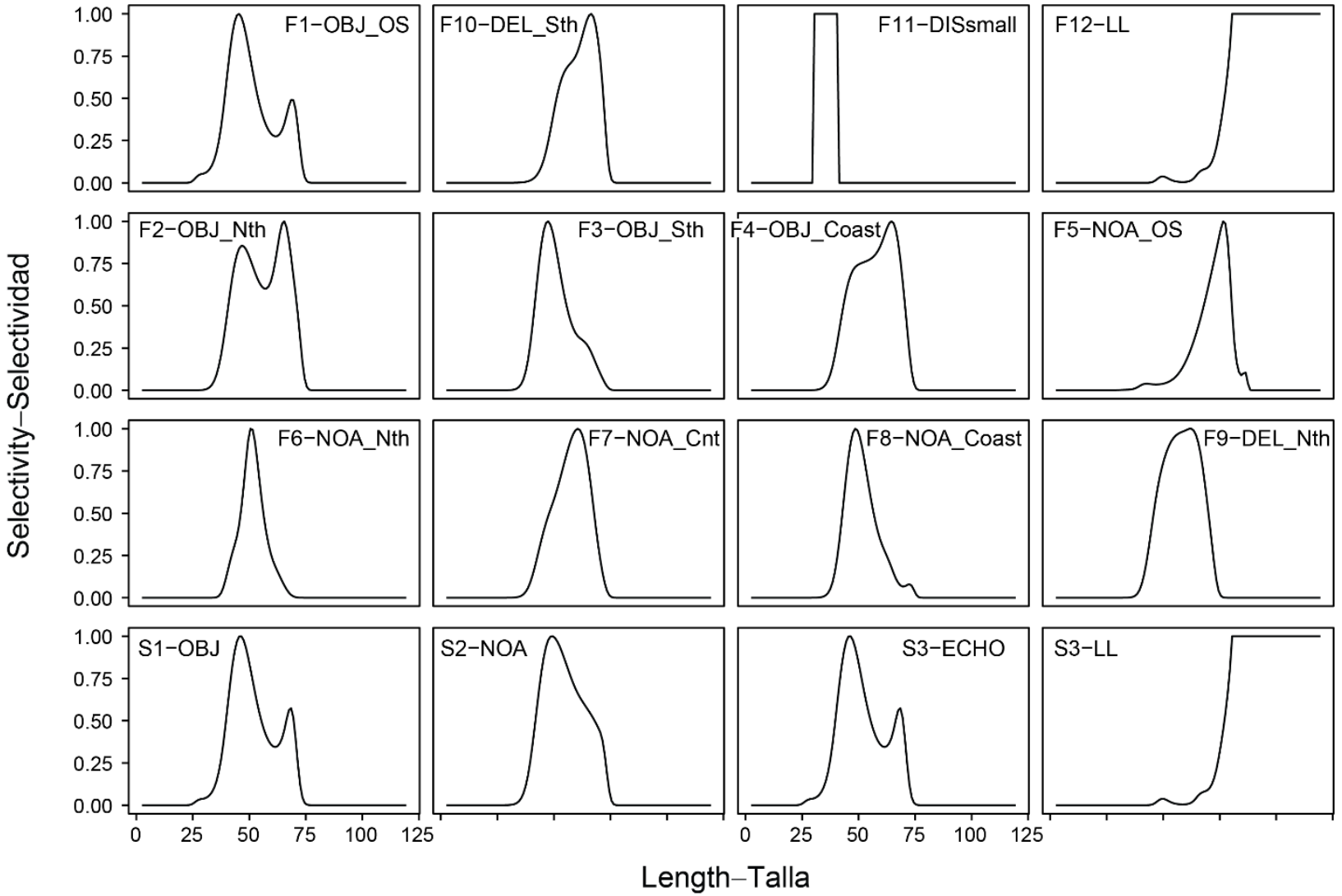
Reference model: Fit to length composition



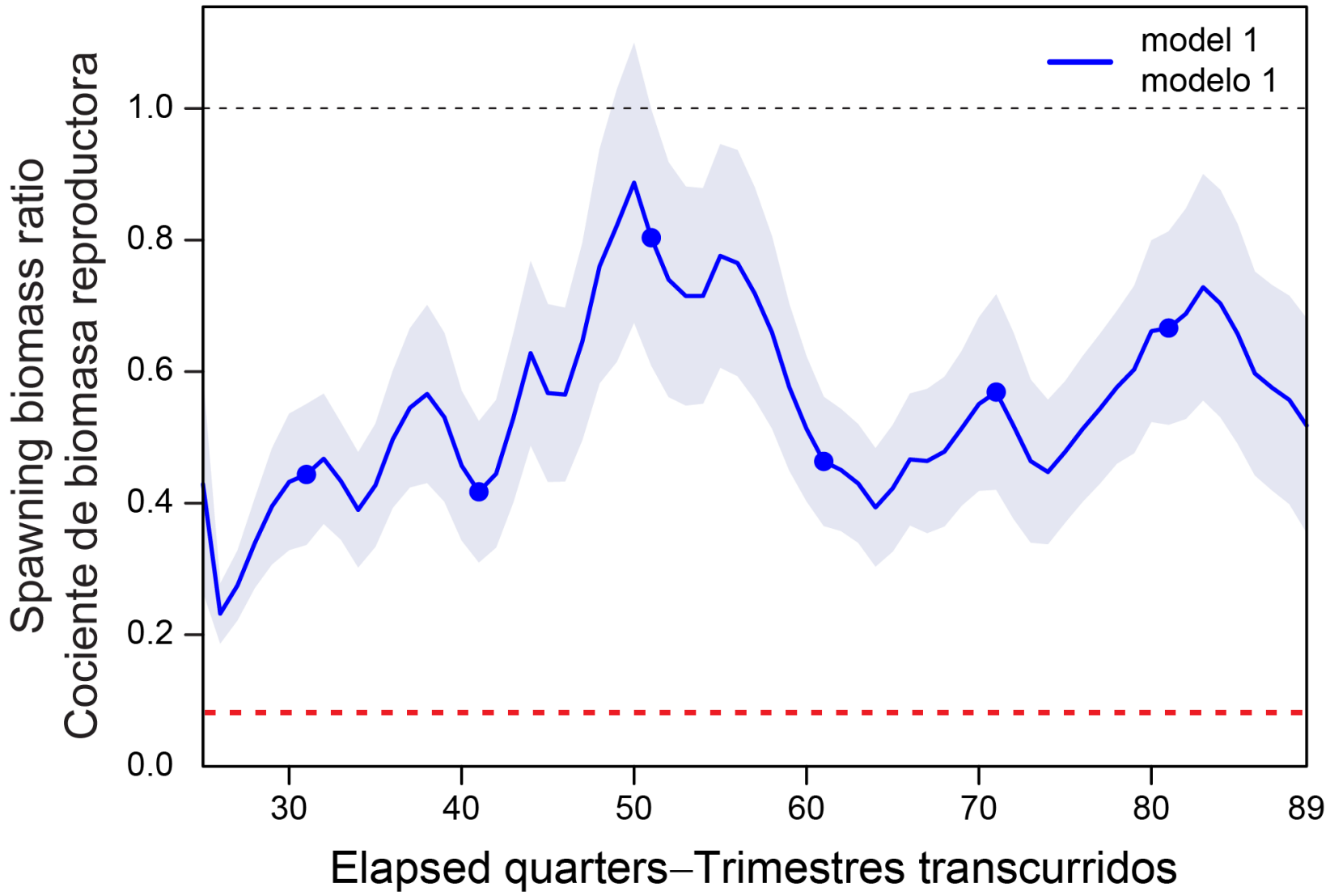
Reference model: Fit to length composition



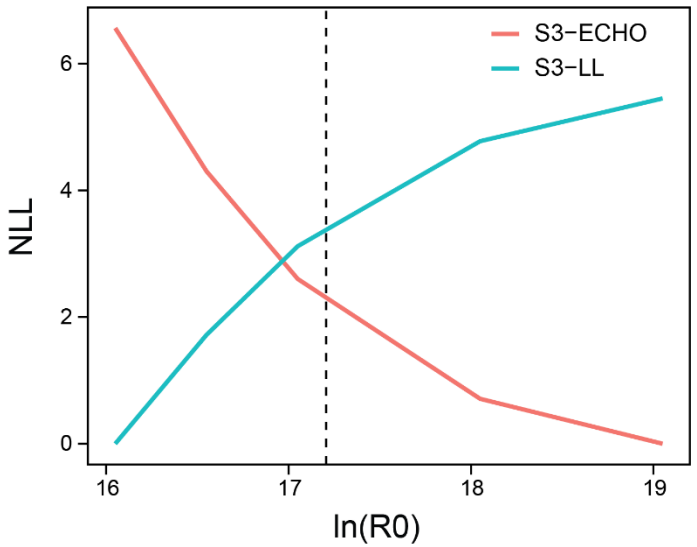
Reference model: Fit to indices of abundance

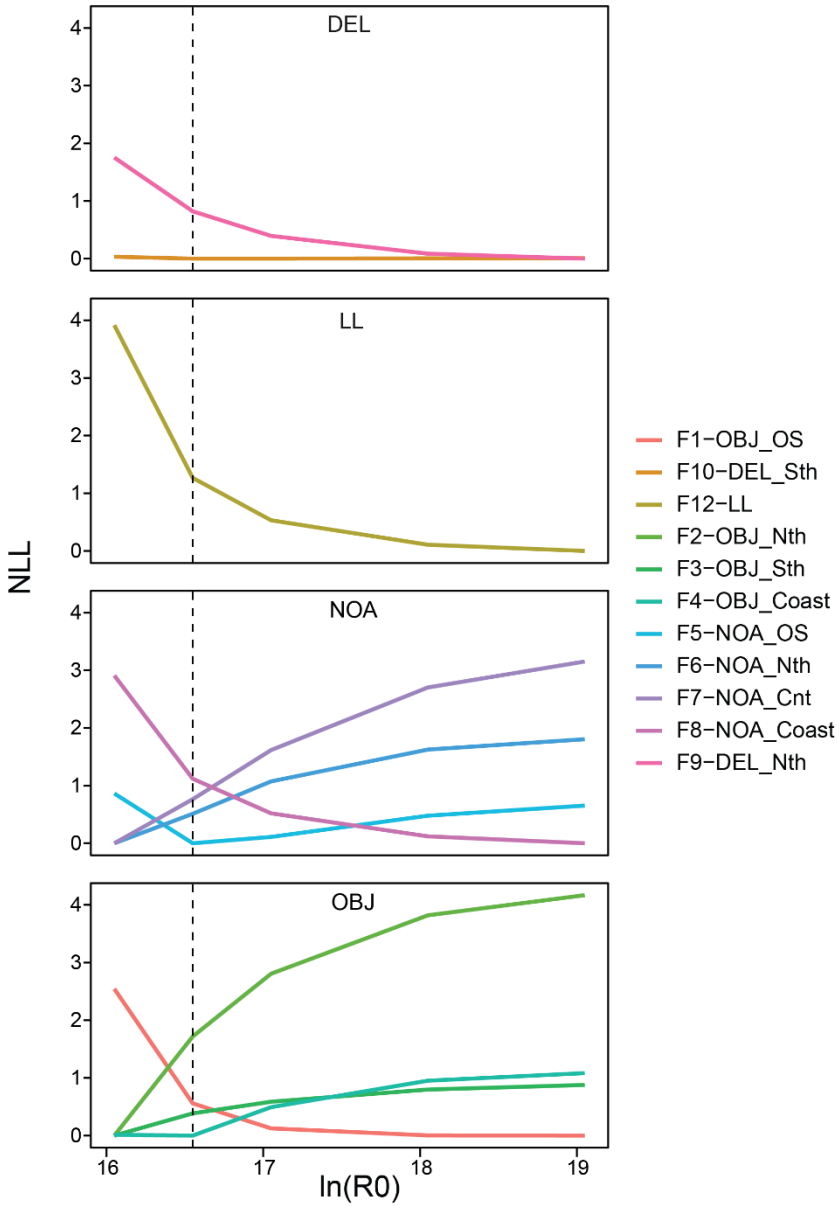


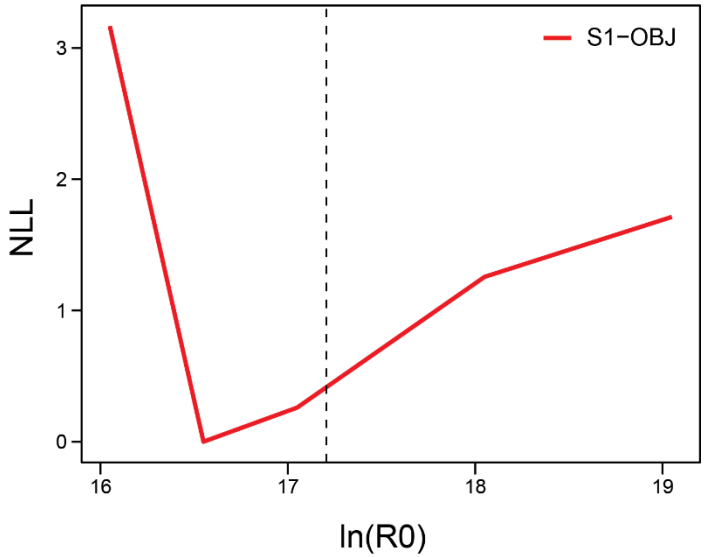
Reference model: Spawning biomass ratio (SBR)



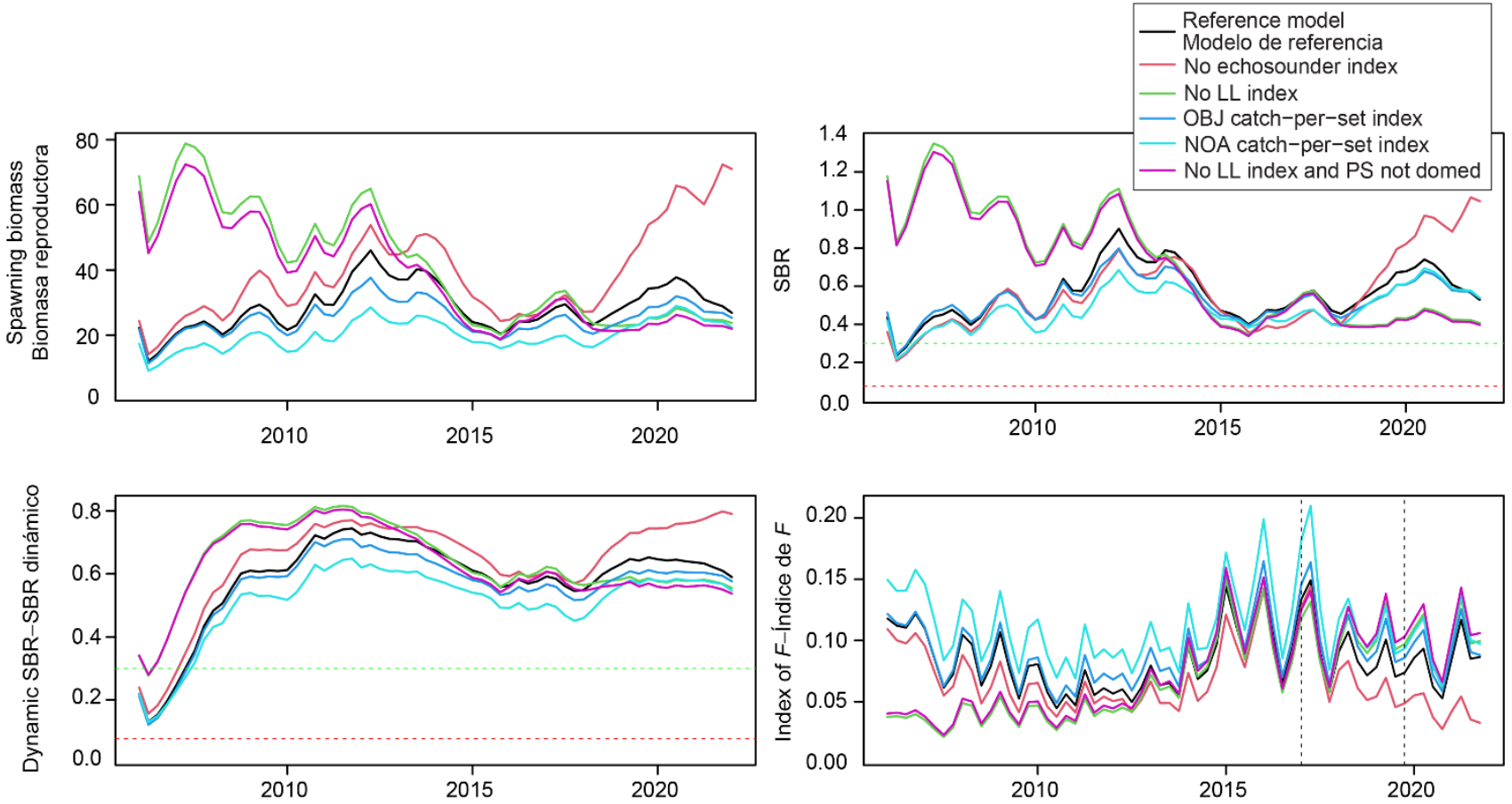
Reference model: R0 likelihood profile







Sensitivity analysis: Data



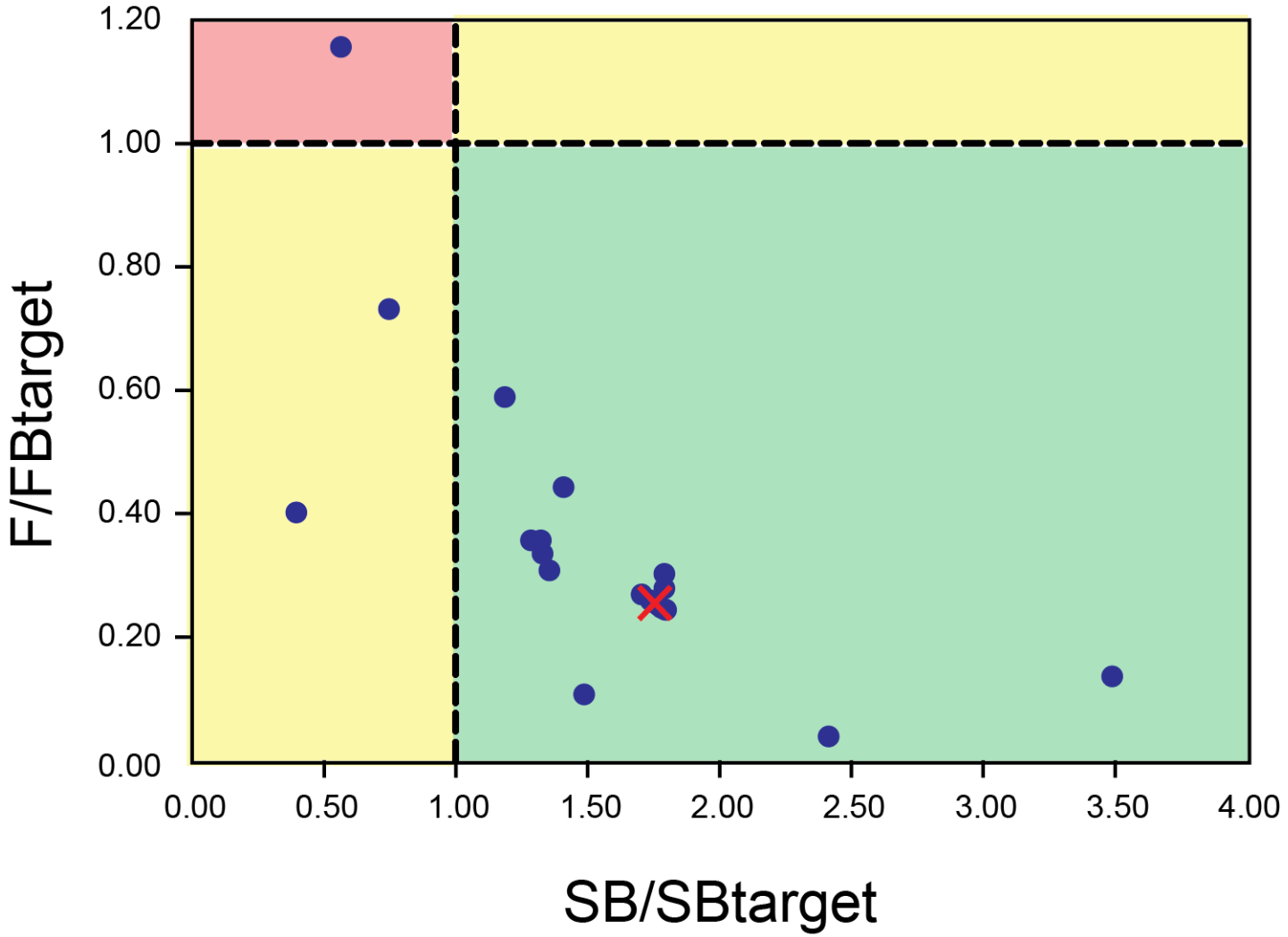
Sensitivity analysis: Asymptotic selectivity

Stock status: Biomass target

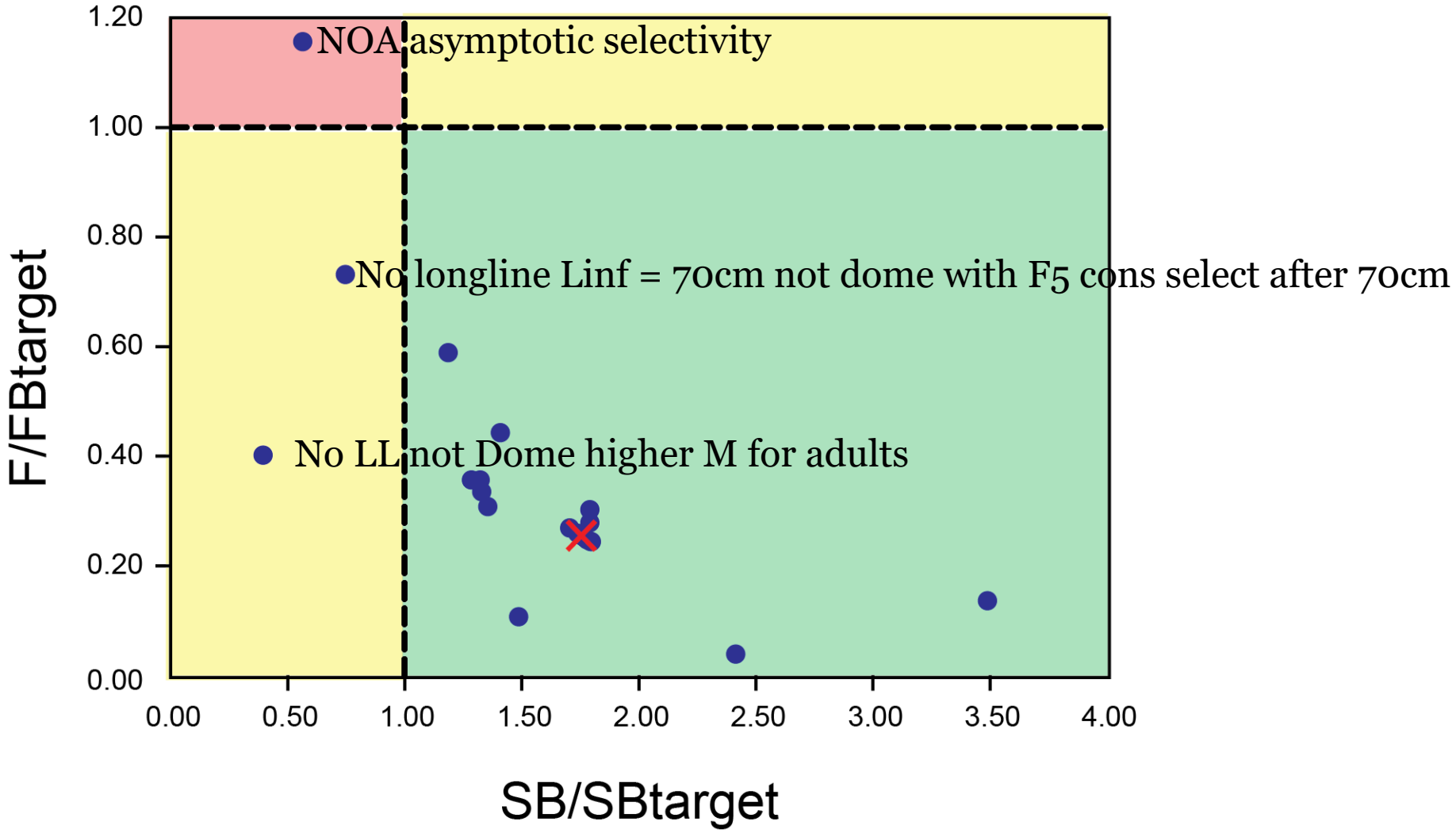
Btarget = 0.3

Steepness (h)	Bigeye	Yellowfin
1.0	0.20 – 0.24	0.23 – 0.32
0.9	0.25 – 0.27	0.28 – 0.35
0.8	0.28 – 0.30	0.32 – 0.37
0.7	0.31 – 0.32	0.35 – 0.40

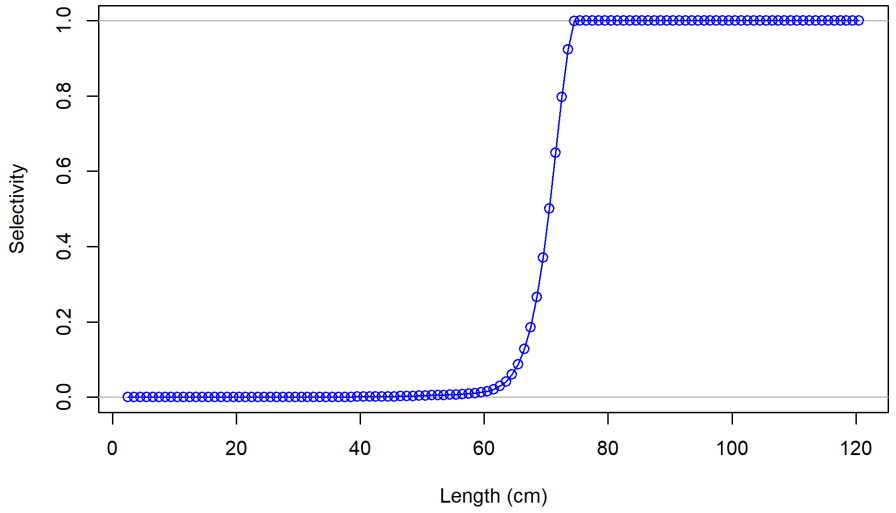
Stock status

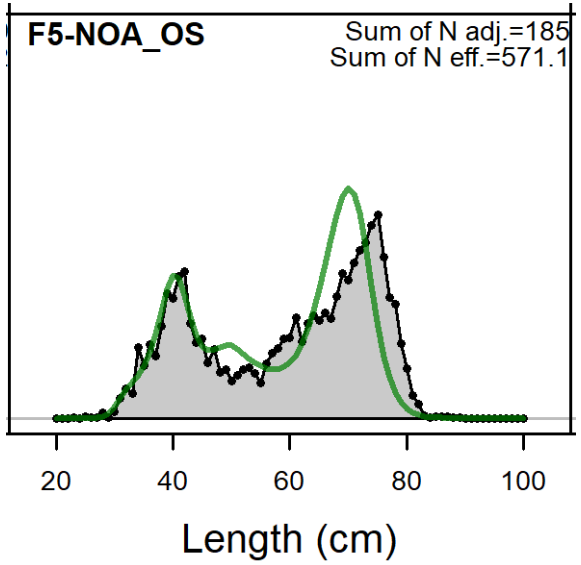


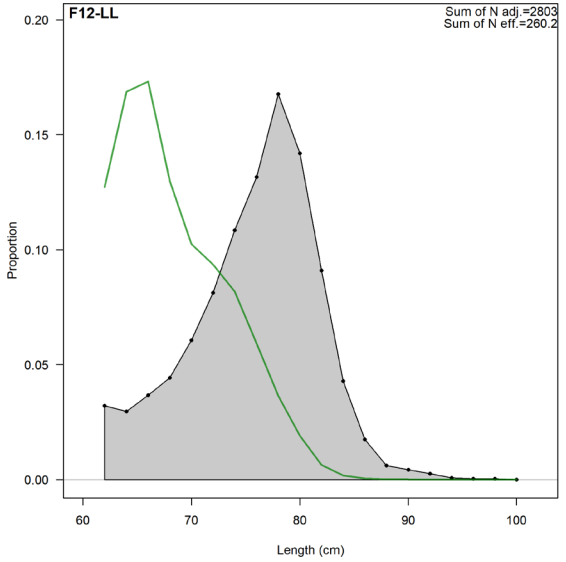
Stock status



Stock status: NOA asymptotic







N parameters are on or within 1% of min-max bound: 10; check results, variance may be suspect

Summary

- An assessment for skipjack was developed
- Longline data and an echosounder buoy based index of abundance were included
- The assessment is like those used to provide management advice for bigeye and yellowfin
- The length composition data from the longline fishery suggest that the purse seine fisheries have done-shape selectivities
- Sensitives to the assumptions were conducted
- The conclusion that the skipjack stock is healthy is generally robust to data usage and model assumptions

Future research

- Benchmark assessment in 2023
- Analyze tagging data and integrate it into assessment and management advice (SAC-13-08)
- Improve model
  - Investigations on stock structure and further evaluation of the eastern model
  - Refine the fishery definitions to remove bimodal and other undesirable length-composition distributions and selectivities
  - Investigate alternative selectivity patterns to avoid bimodal and other undesirable selectivity patterns
  - Consider the possibility of changes in selectivity as indicated by the catch curve analysis
  - Adjusting the length-composition data for shrinkage
  - Using the offshore OBJ length-composition data for the echosounder buoy index of abundance
  - Improve the estimates of natural mortality using the tagging data and other available information
  - Spatio-temporal modelling of the longline CPUE and composition data

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Questions