

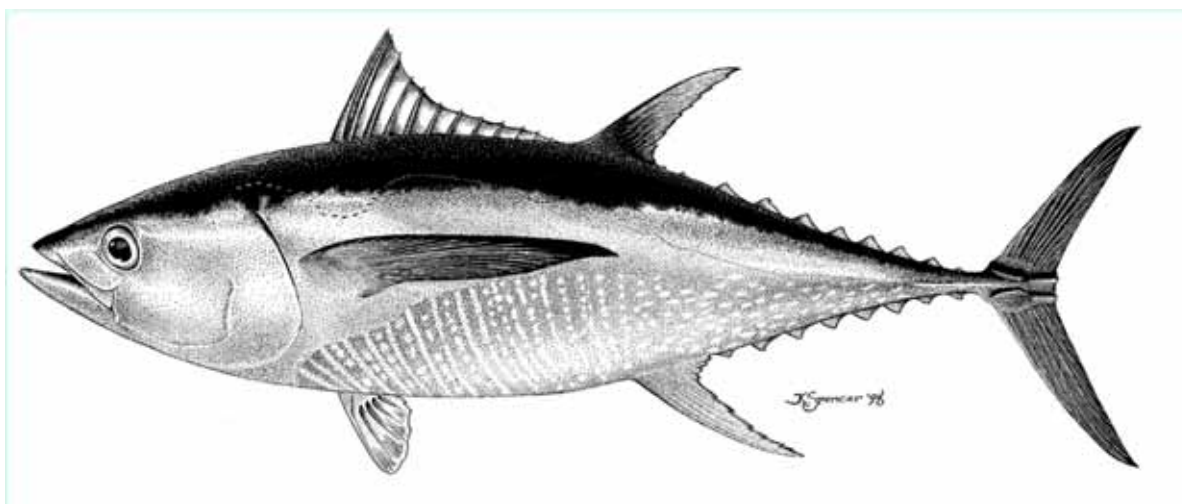
# STATUS OF YELLOWFIN TUNA IN THE EASTERN PACIFIC OCEAN IN 2013

UPDATE OF 2013 STOCK ASSESSMENT

Document SAC-05-07

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January 1975 – December 2013



5<sup>th</sup> Meeting of the Scientific Advisory Committee  
La Jolla, 12-16 May 2014



# Outline

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- Fishery data updates
- Stock assessment
  - Model assumptions
  - Results (fishing mortality, recruitment, biomasses)
  - Stock status (base case)
  - Stock-recruitment sensitivity analysis (steepness = 0.75)
  - Population projections (*status quo* and  $F_{MSY}$ )
- Summary conclusions





# New or updated data

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- Surface fisheries

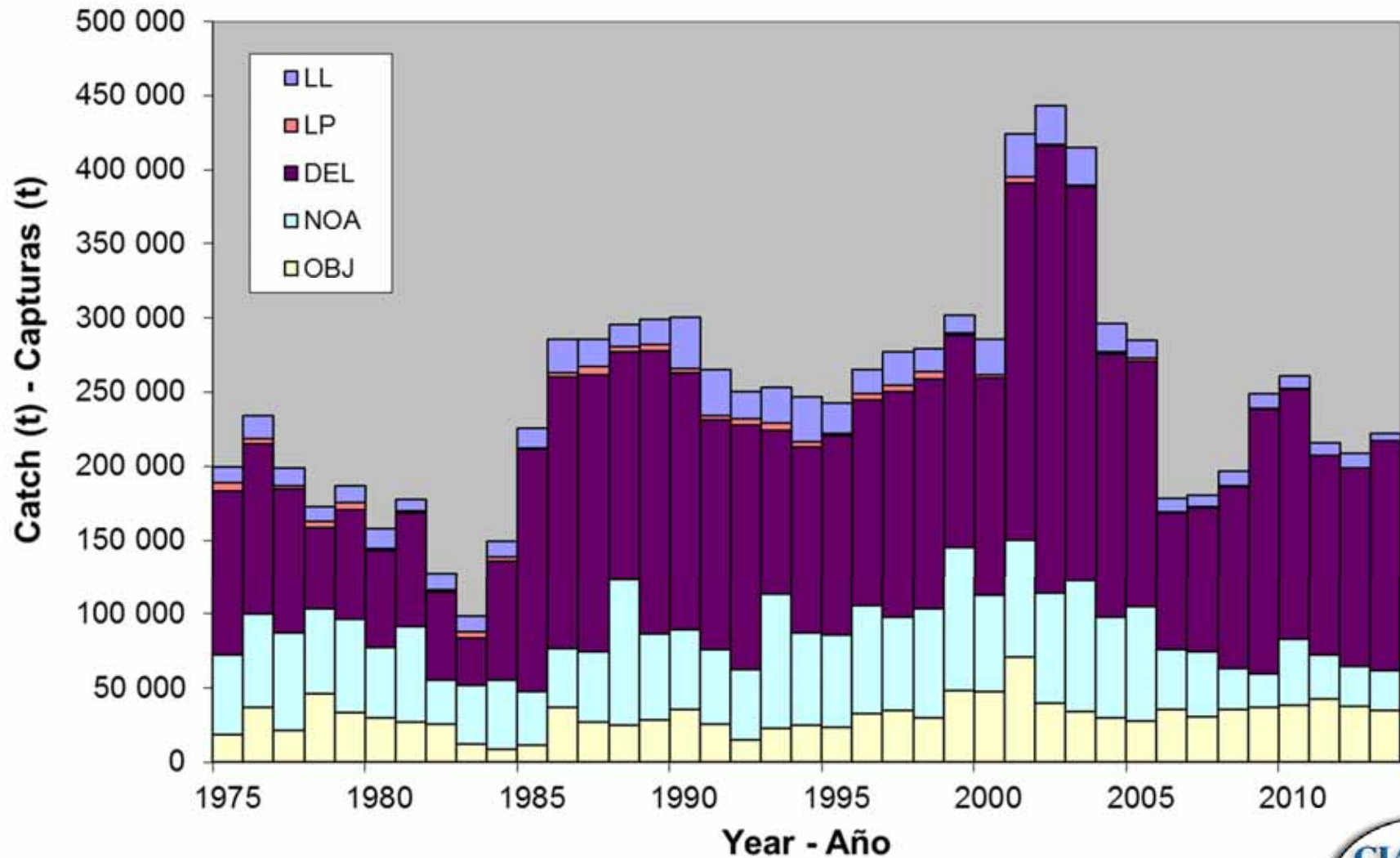
- Catch, CPUE and size-frequency recent data updated and new data for 2013.

- Longline fisheries

- New or updated longline catch data: China (2012), Chinese Taipei (2010-2012), Japan (2010-2012), Korea (2012), the United States (2011-2012), French Polynesia (2012), Vanuatu (2012) and other nations (2007-2013).
- Japanese longline catch data for 2013 are available from the monthly report statistics.
- New or updated CPUE data available for Japan (2010-2012).
- New or updated longline size-frequency for Japan (2011- 2012).



# Total catches





# Model assumptions

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2013 update assessment = same model as in SAC4

- Fishery definitions: 16 fisheries
- Data weighting: the CV of the southern LL fishery was fixed, others estimated (NOA, DEL)
- Growth: Richards curve with fixed parameters
- Natural mortality: sex-specific
- Modeling of catchability and selectivity:
  - Catchability coefficients for 5 CPUE time series are estimated (NOA-N, NOA-S, DEL-N, DEL-I, LL-S)
  - Selectivity curves for 11 of the 16 fisheries are estimated (F9 DEL-S mirrors F12 LL-S)
  - Logistic selectivity for LL-S and DEL-S, and dome-shape for other fisheries (except discards)





# YFT fishery definitions

Defined based on:

- *gear type* (purse seine, pole and line, and longline)
- *purse-seine set type* (sets on schools associated with floating objects, free schools, dolphin-associated schools)
- *area* (IATTC length-frequency sampling area or latitude)
- *discards*

**TABLE A.** Fisheries defined for the stock assessment of yellowfin tuna in the EPO. PS = purse seine; LP = pole and line; LL = longline; OBJ = floating objects; NOA = unassociated fish; DEL = dolphin. The sampling areas are shown in Figure A.

Fishery	Gear type	Set type	Region	Sampling areas
1	PS	OBJ	South	11-12
2	PS	OBJ	Central	7, 9
3	PS	OBJ	Inshore	5-6, 13
4	PS	OBJ	North	1-4, 8, 10
5	PS	NOA	North	1-4, 8, 10
6	PS	NOA	South	5-7, 9, 11-13
7	PS	DEL	North	2-3, 10
8	PS	DEL	Inshore	1, 4-6, 8, 13
9	PS	DEL	South	7, 9, 11-12
10	LP		All	1-13
11	LL		North	N of 15°N
12	LL		South	S of 15°N
Discard fisheries				
13	PS	OBJ	South	11-12
14	PS	OBJ	Central	7, 9
15	PS	OBJ	Inshore	5-6, 13
16	PS	OBJ	North	1-4, 8, 10

10 surface fisheries

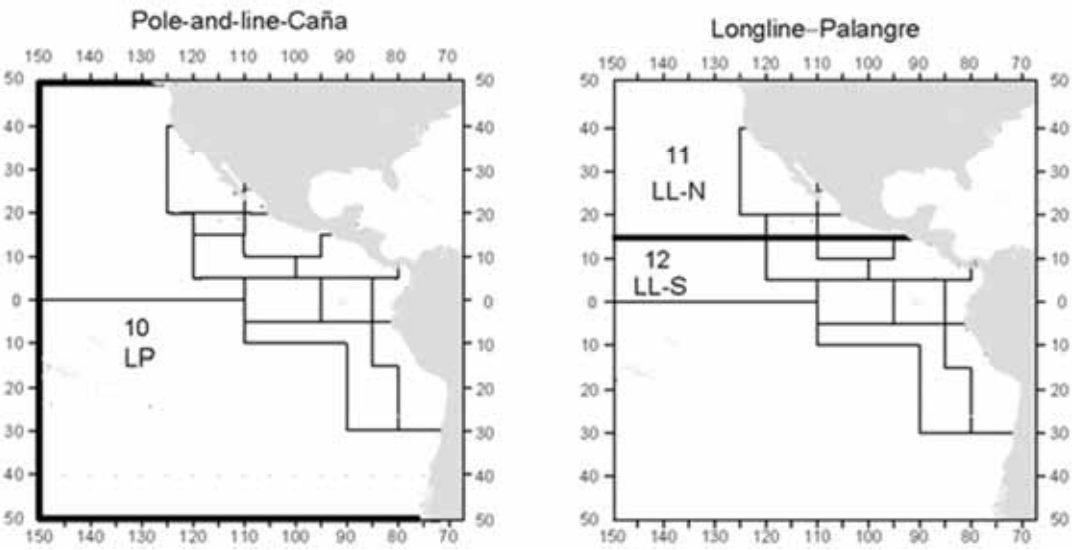
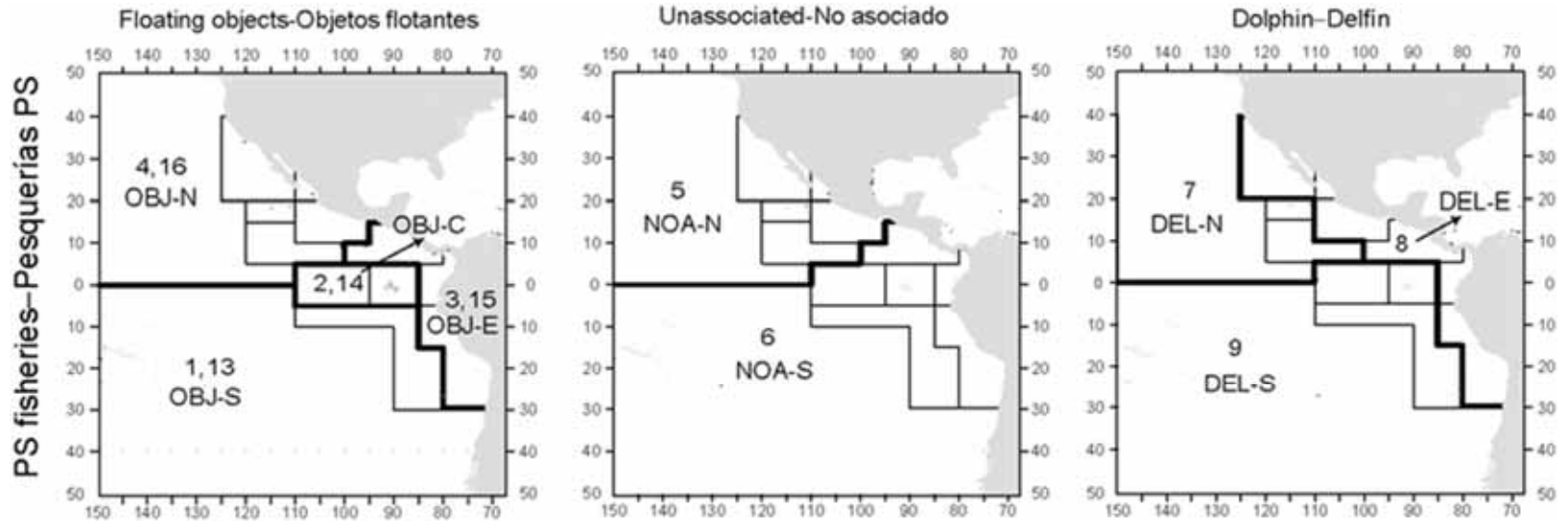
2 longline fisheries

4 discard fisheries





# YFT fishery definitions

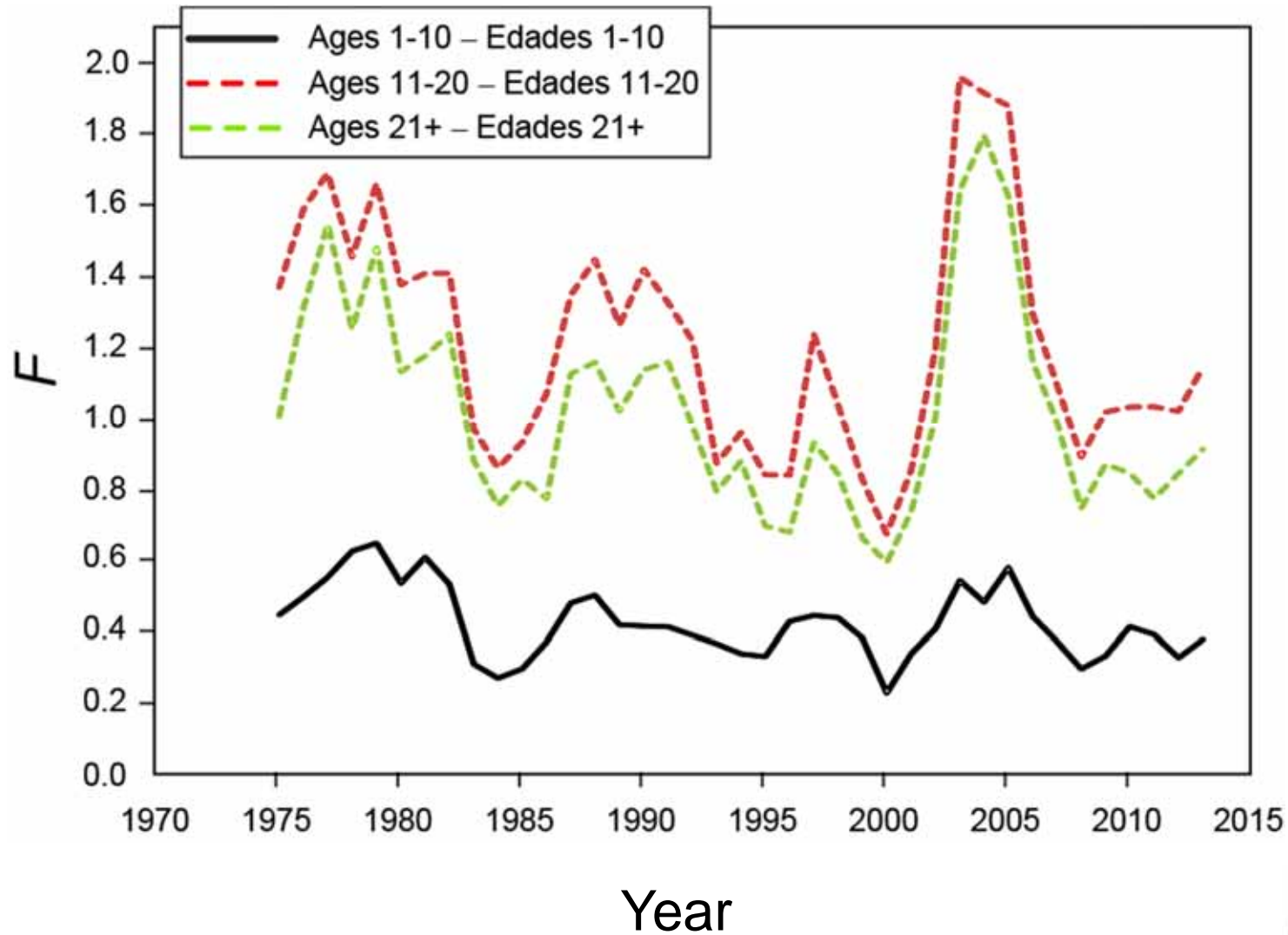


\_\_\_ IATTC length-frequency sampling areas  
 \_\_\_ fishery definition areas



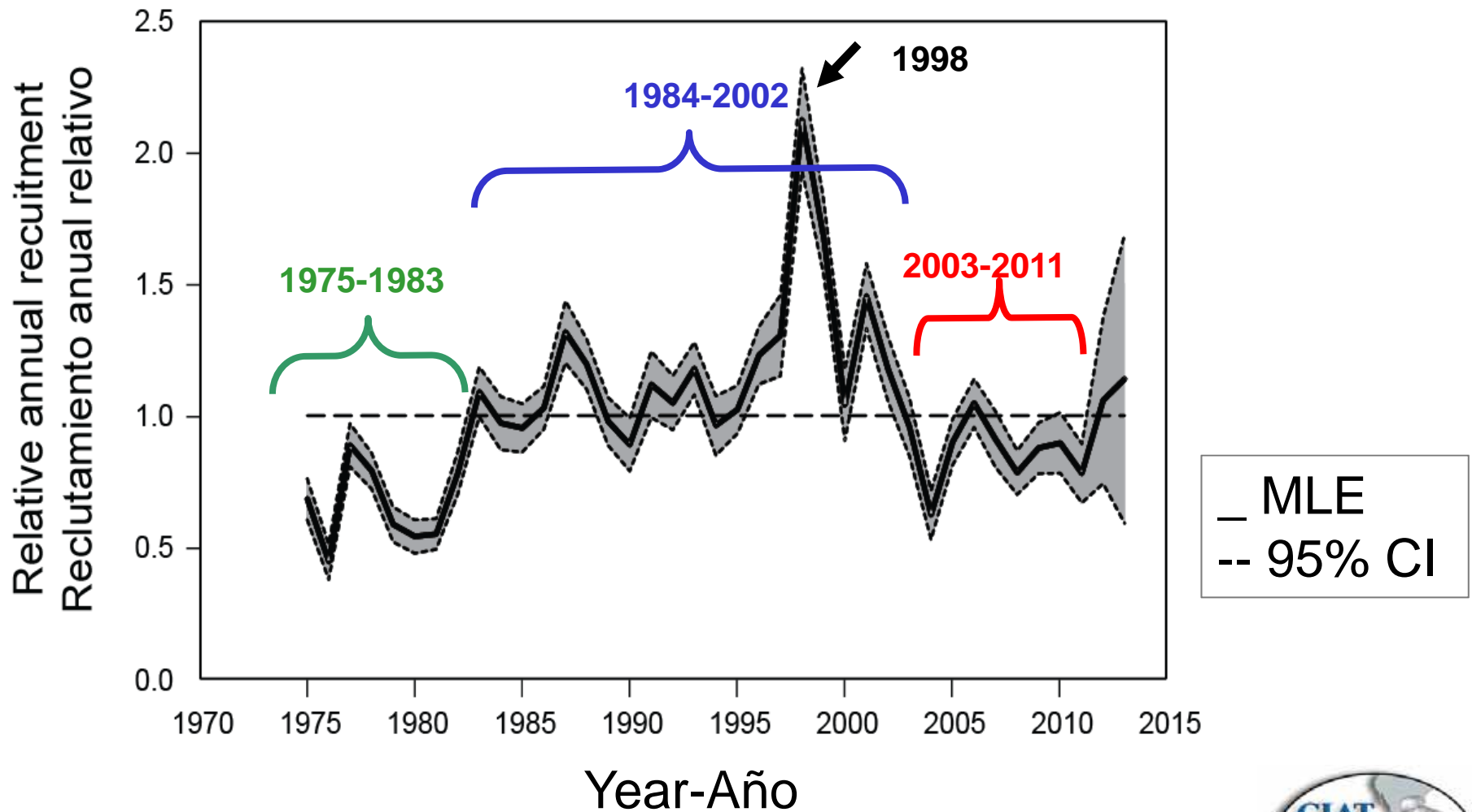


# Fishing mortality

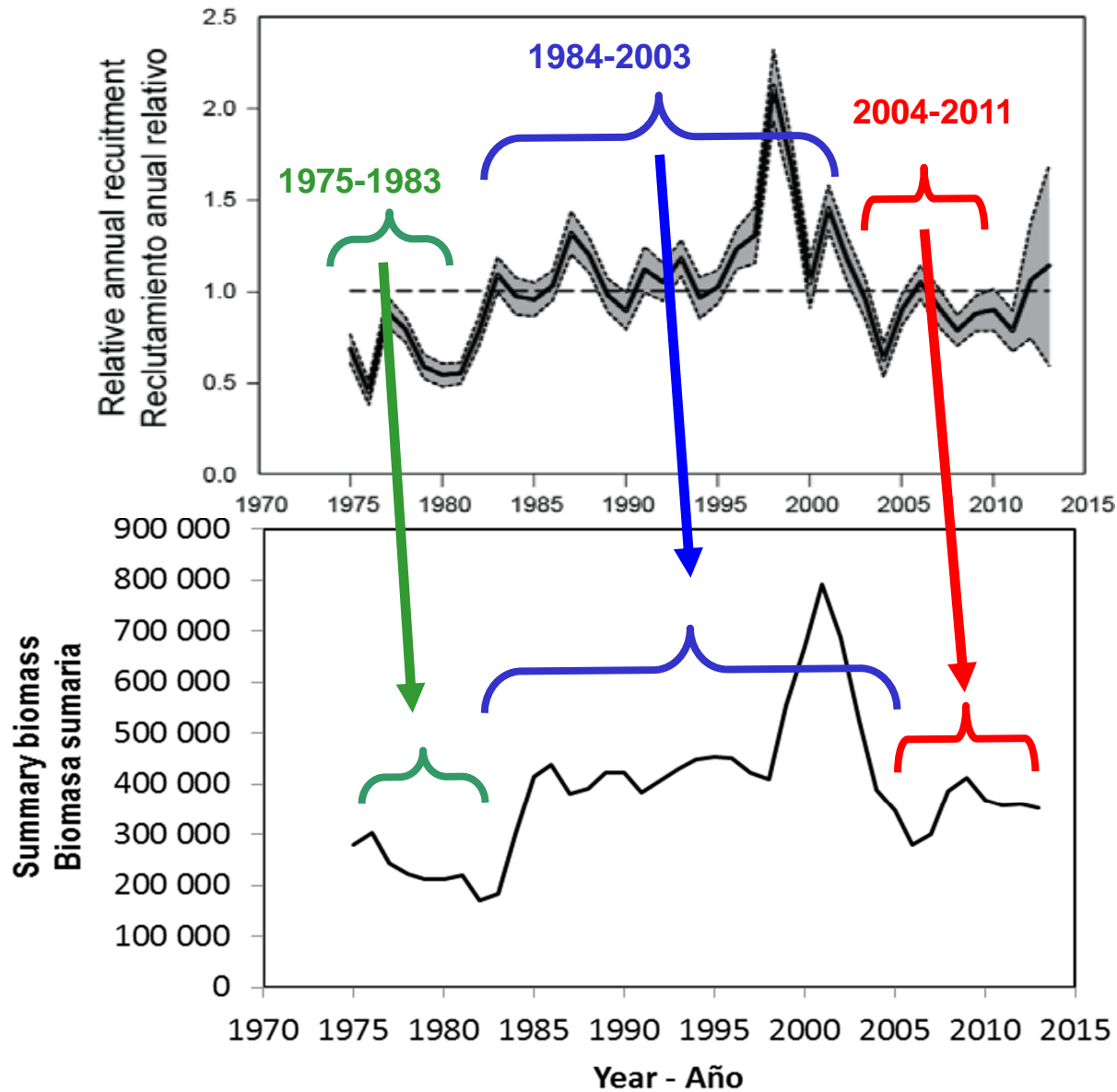




# Recruitment

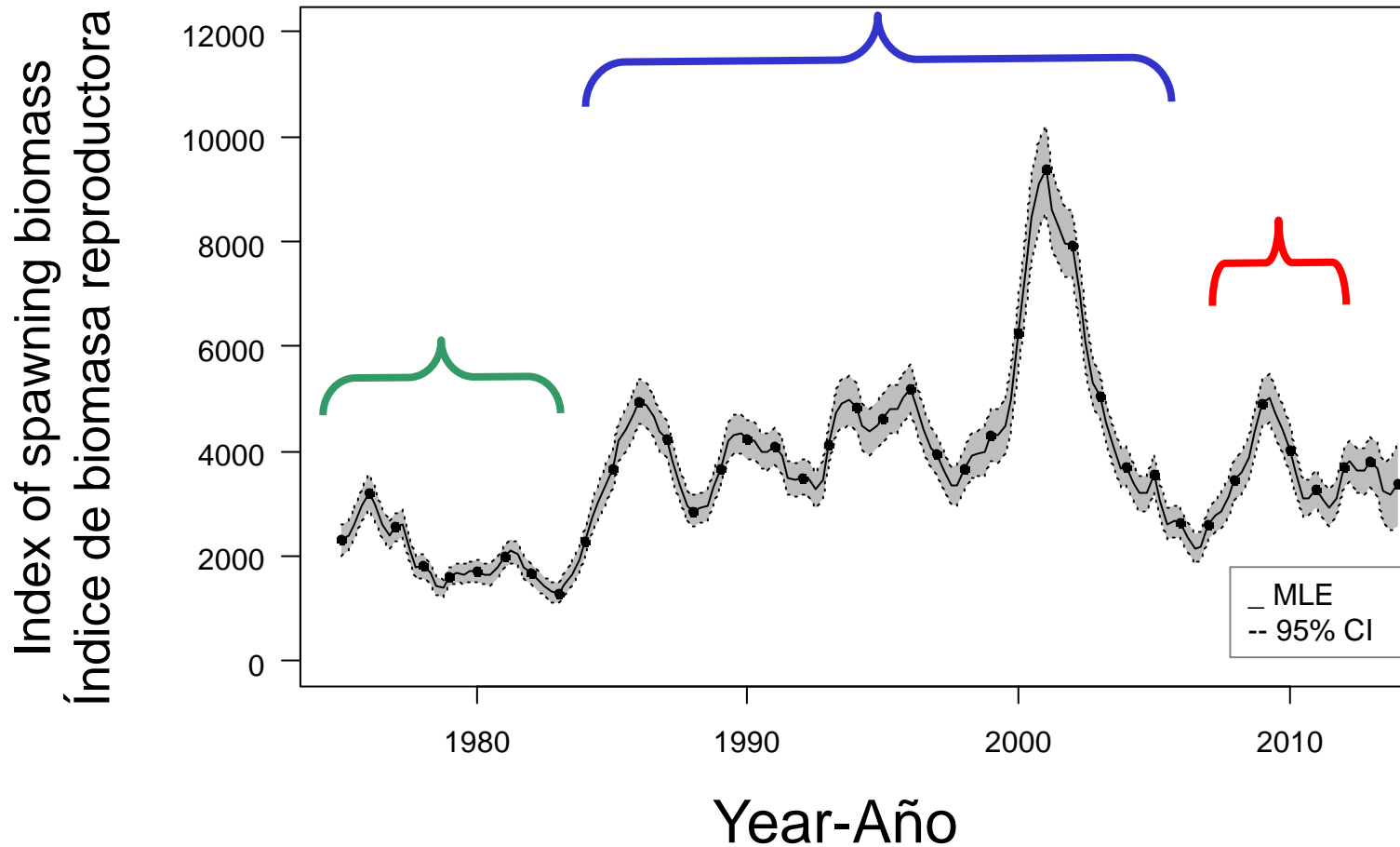


# Summary biomass



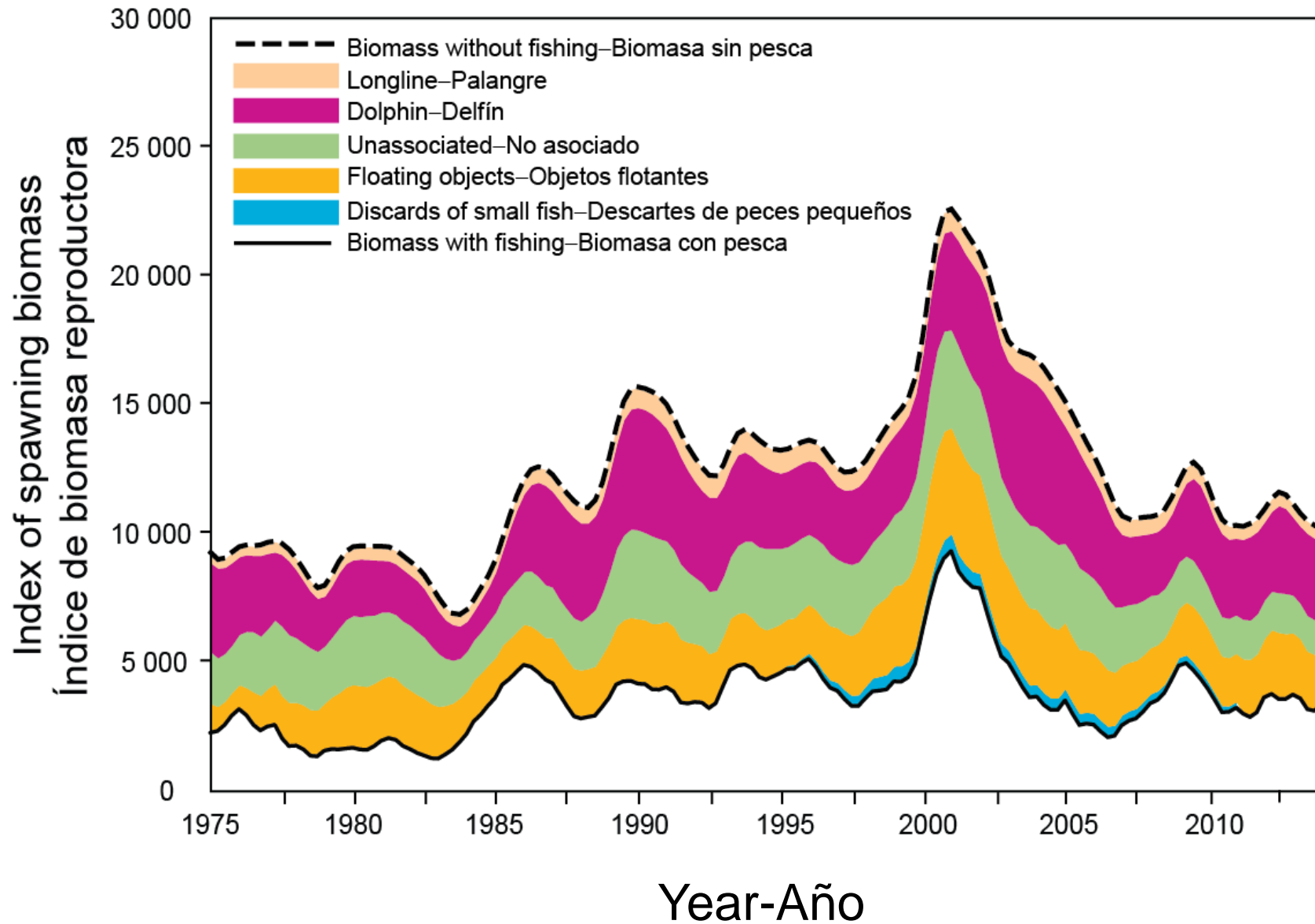
# Spawning biomass

Results - base case



# Fishery impact

Results - base case

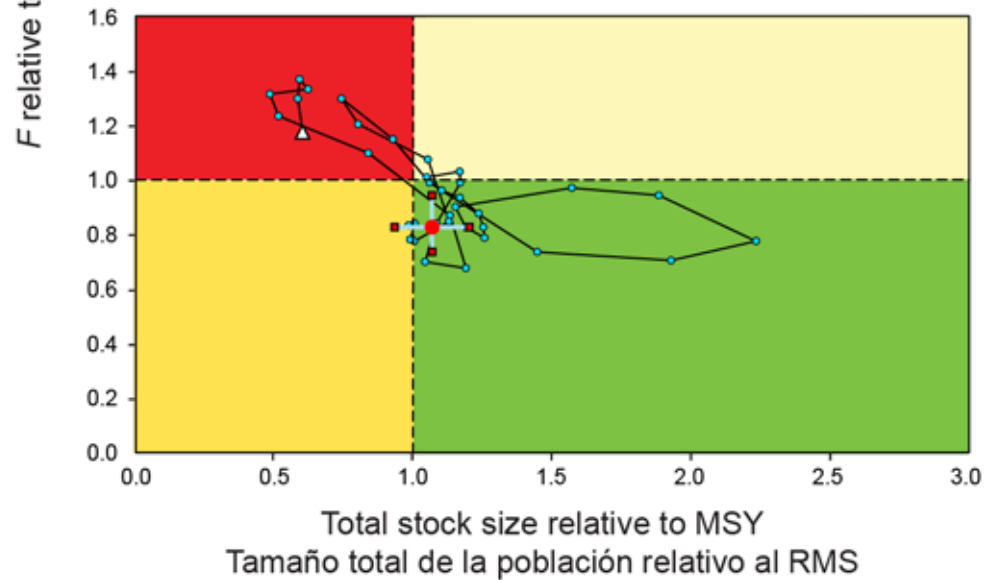
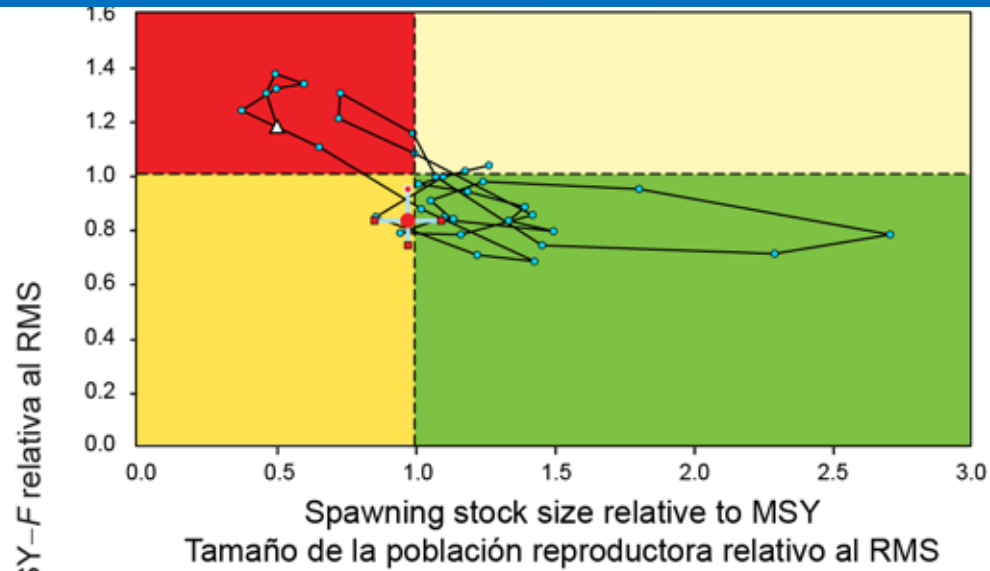


# Management quantities

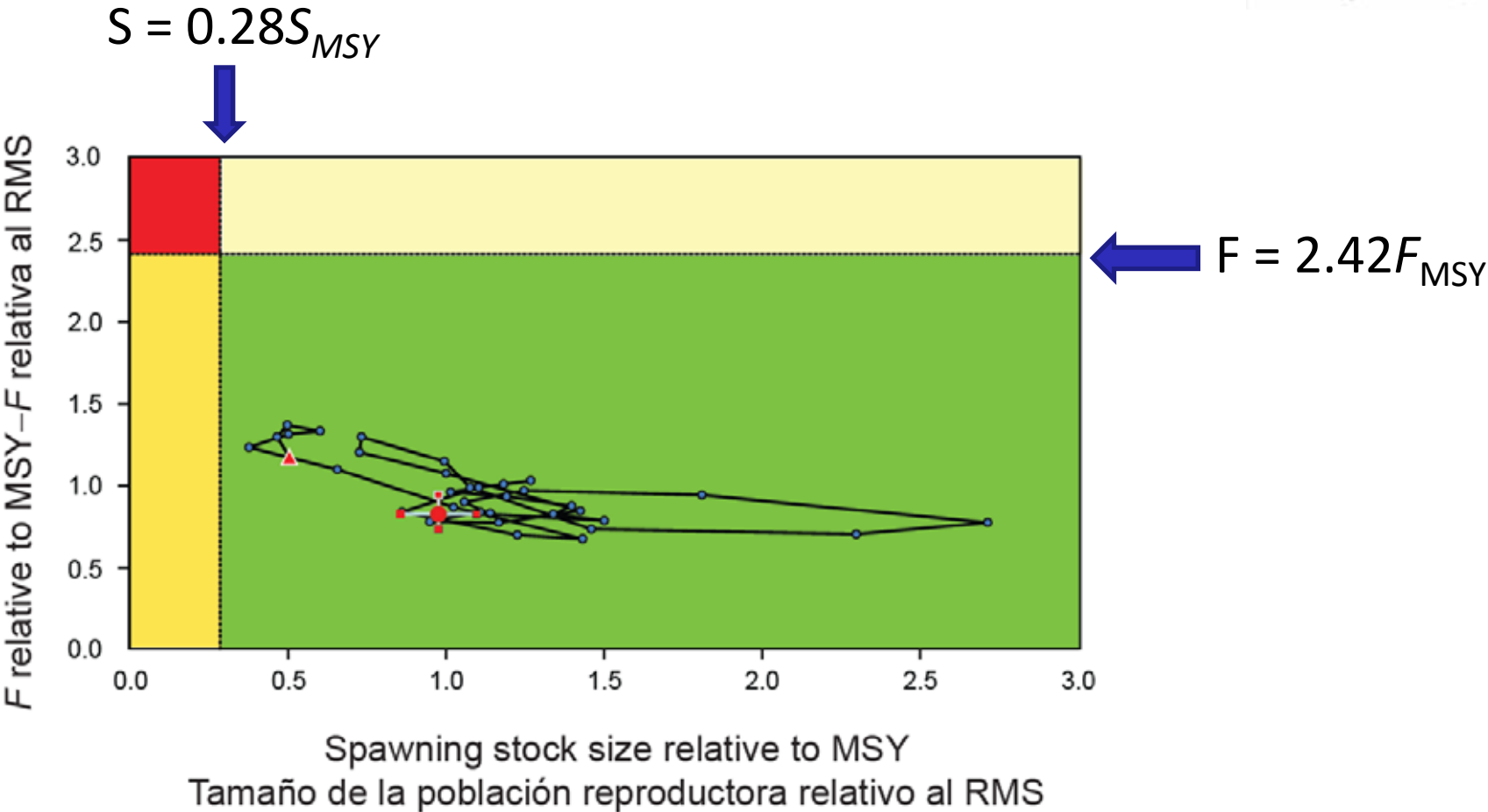


YFT	Base case Caso base
MSY-RMS	265,996
$B_{MSY} - B_{RMS}$	362,582
$S_{MSY} - S_{RMS}$	3,442
$B_{MSY}/B_0 - B_{RMS}/B_0$	0.32
$S_{MSY}/S_0 - S_{RMS}/S_0$	0.27
$C_{recent}/MSY - C_{recent}/RMS$	0.87
$B_{recent}/B_{MSY} - B_{recent}/B_{RMS}$	1.07
$S_{recent}/S_{MSY} - S_{recent}/S_{RMS}$	0.98
$F$ multiplier-Multiplicador de $F$	1.21

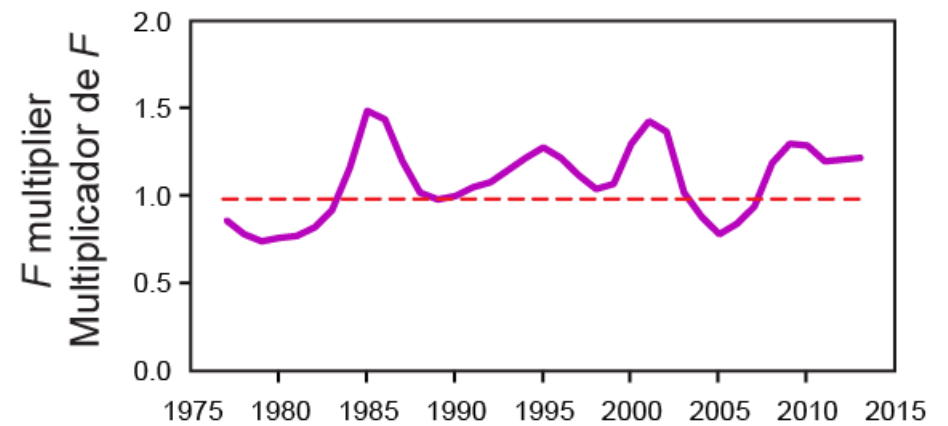
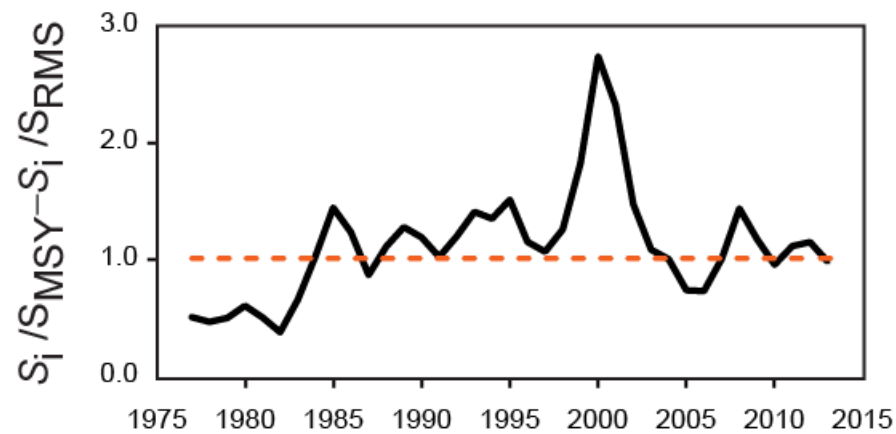
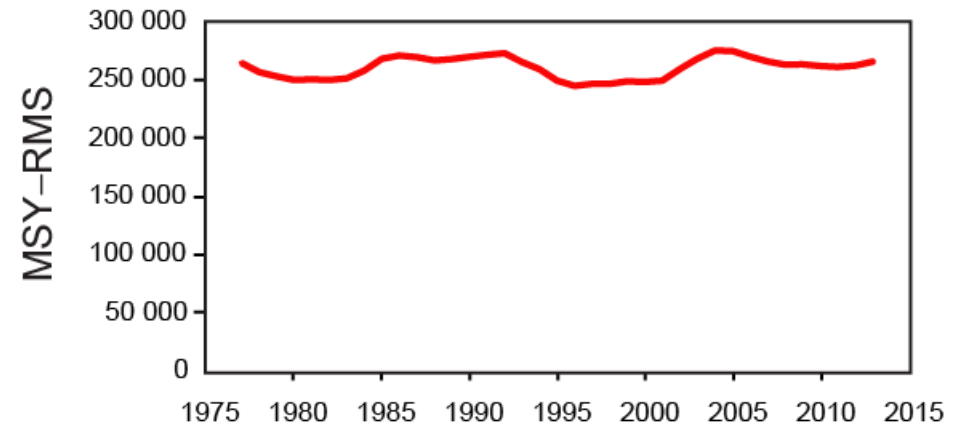
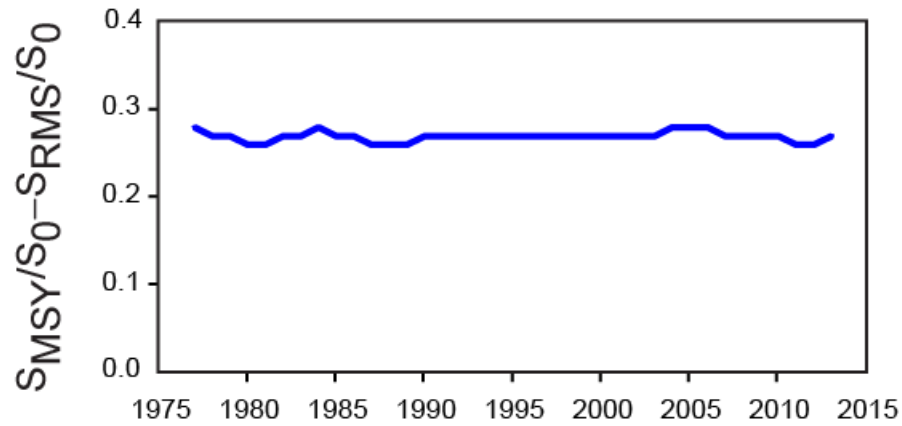
# Phase plots (targets)



# Limit reference points



# Time varying indicators





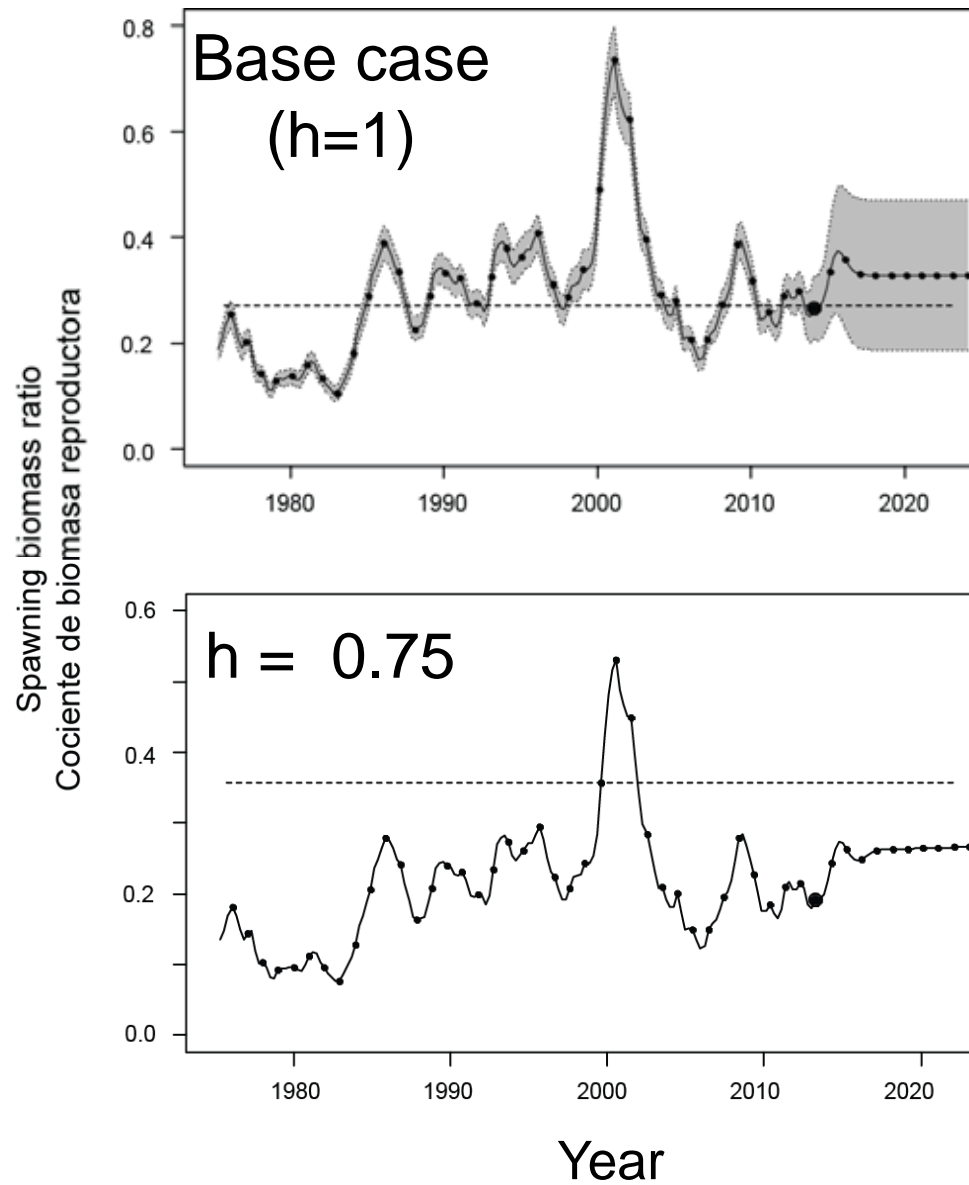
# Management quantities



YFT	Base case	$h = 0.75$
	Caso base	
MSY-RMS	265,996	306,515
$B_{MSY} - B_{RMS}$	362,582	584,135
$S_{MSY} - S_{RMS}$	3,442	6,321
$B_{MSY}/B_0 - B_{RMS}/B_0$	0.32	0.37
$S_{MSY}/S_0 - S_{RMS}/S_0$	0.27	0.35
$C_{recent}/MSY - C_{recent}/RMS$	0.87	0.75
$B_{recent}/B_{MSY} - B_{recent}/B_{RMS}$	1.07	0.67
$S_{recent}/S_{MSY} - S_{recent}/S_{RMS}$	0.98	0.54
$F$ multiplier-Multiplicador de $F$	1.21	0.77

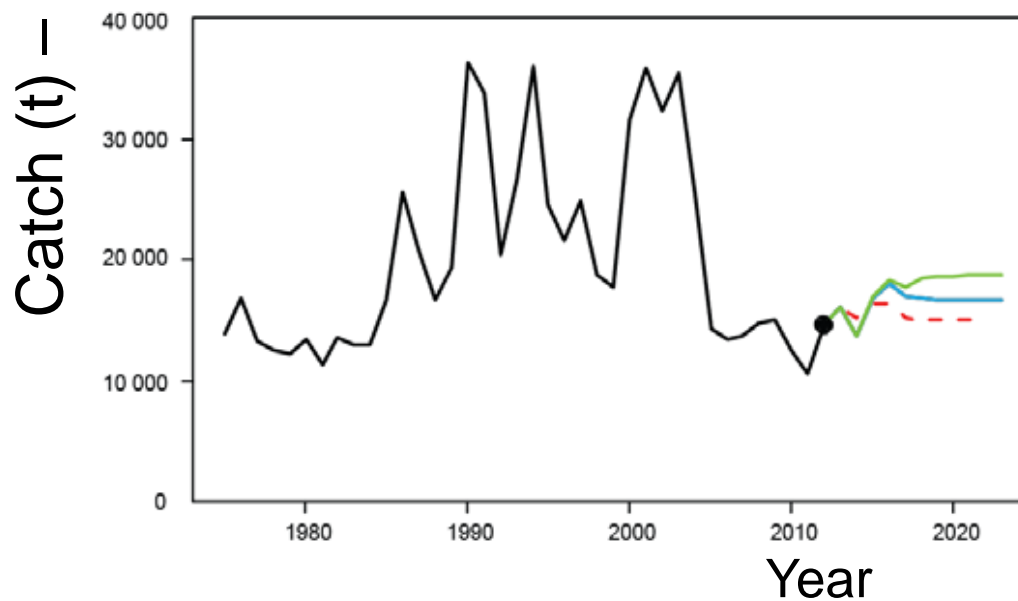
# Spawning Biomass Ratio (SBR)

Projections



Projections

# Projected catches – *Status quo* ( $F_{cur}$ )



- Base case-Caso base
- - -  $F_{MSY} - F_{RMS}$
- $h = 0.75$

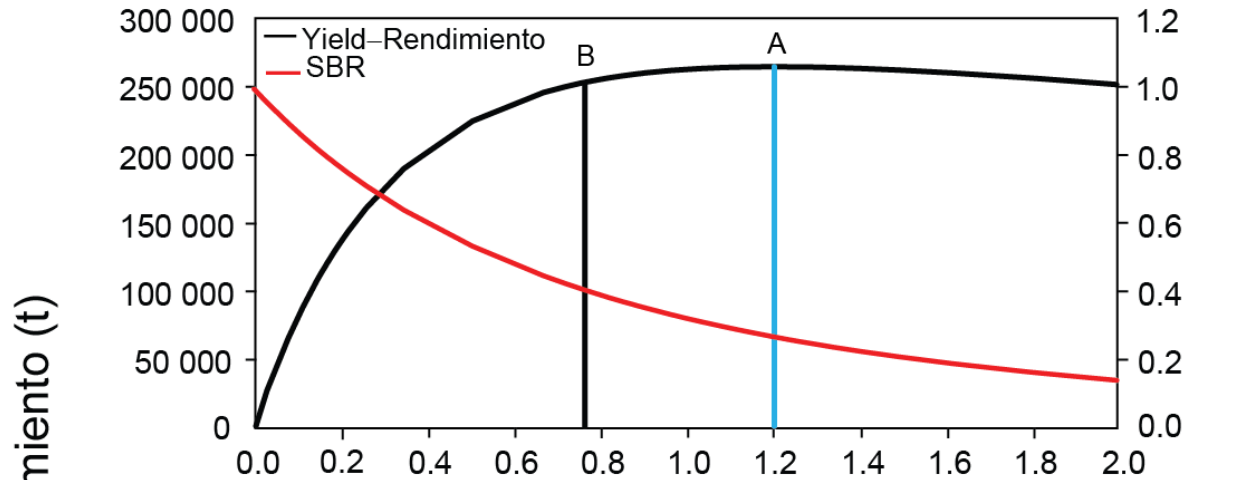


# Yield

Yield



Base case–Caso base

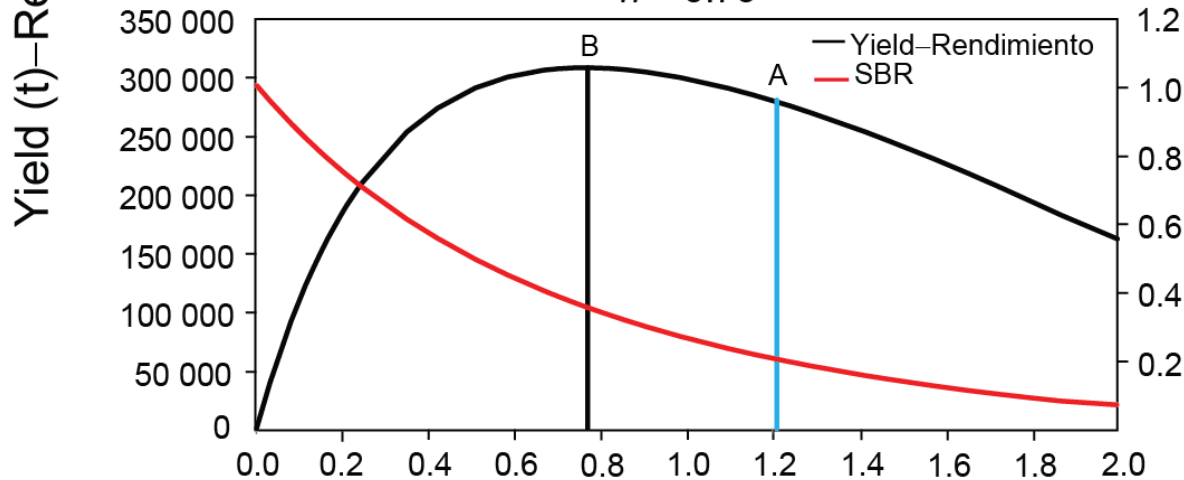


A- FMSY, base case

B - FMSY, h=0.75

SBR

$h = 0.75$



F relative to current F – F relativo a F actual

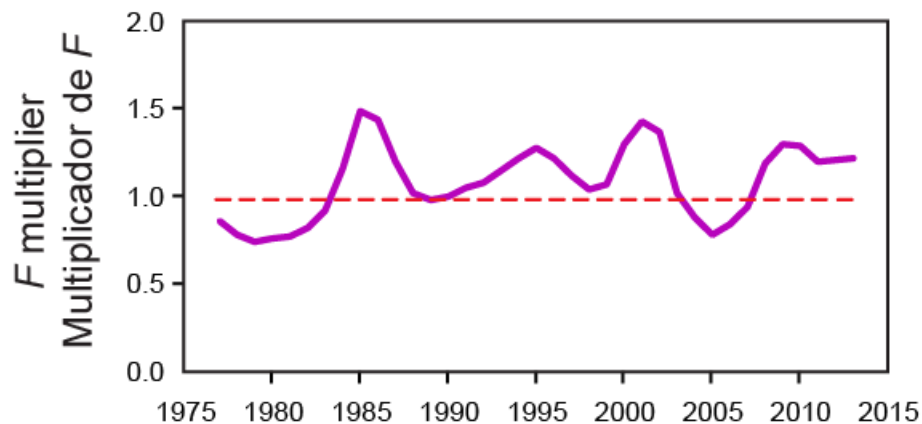




# Summary: key results

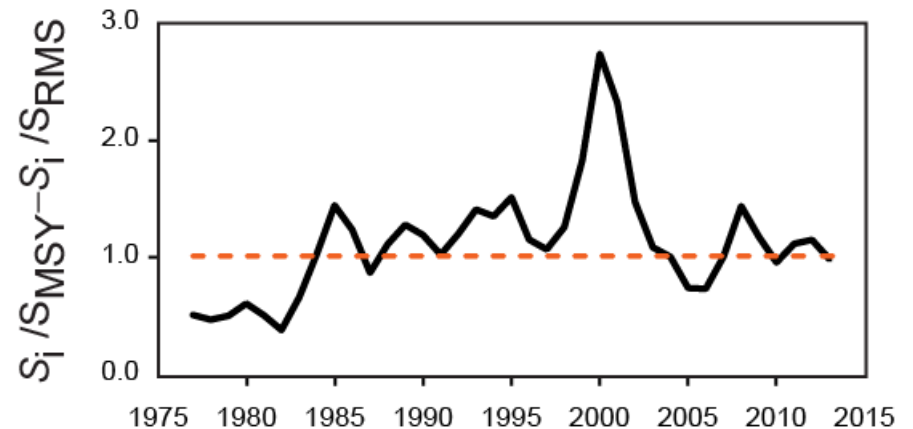
- The recent **fishing mortality** rates are estimated to be below those corresponding to the MSY

- $(F_{\text{recent}} < F_{\text{MSY}})$



- The recent levels of **spawning biomass** are estimated to be slightly below those corresponding to the MSY

- $(S_{\text{recent}} < S_{\text{MSY}})$



# Plausible Sensitivities and Uncertainties

- lessons from previous assessments

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- Results are more **pessimistic** with:
  - The inclusion of a stock-recruitment relationship
  - Higher values of the average size of the oldest fish ( $L_2 > 182$  cm)
  - Lower rates of adult natural mortality ( $M$ )
- Results are more **optimistic** with:
  - Lower values of the average size of the oldest fish ( $L_2 < 182$  cm)
  - Higher rates of adult natural mortality ( $M$ )
  - Fitting to CPUE DEL-N as main index of abundance ( $S_{\text{recent}} > S_{\text{MSY}}$ )

Thank you

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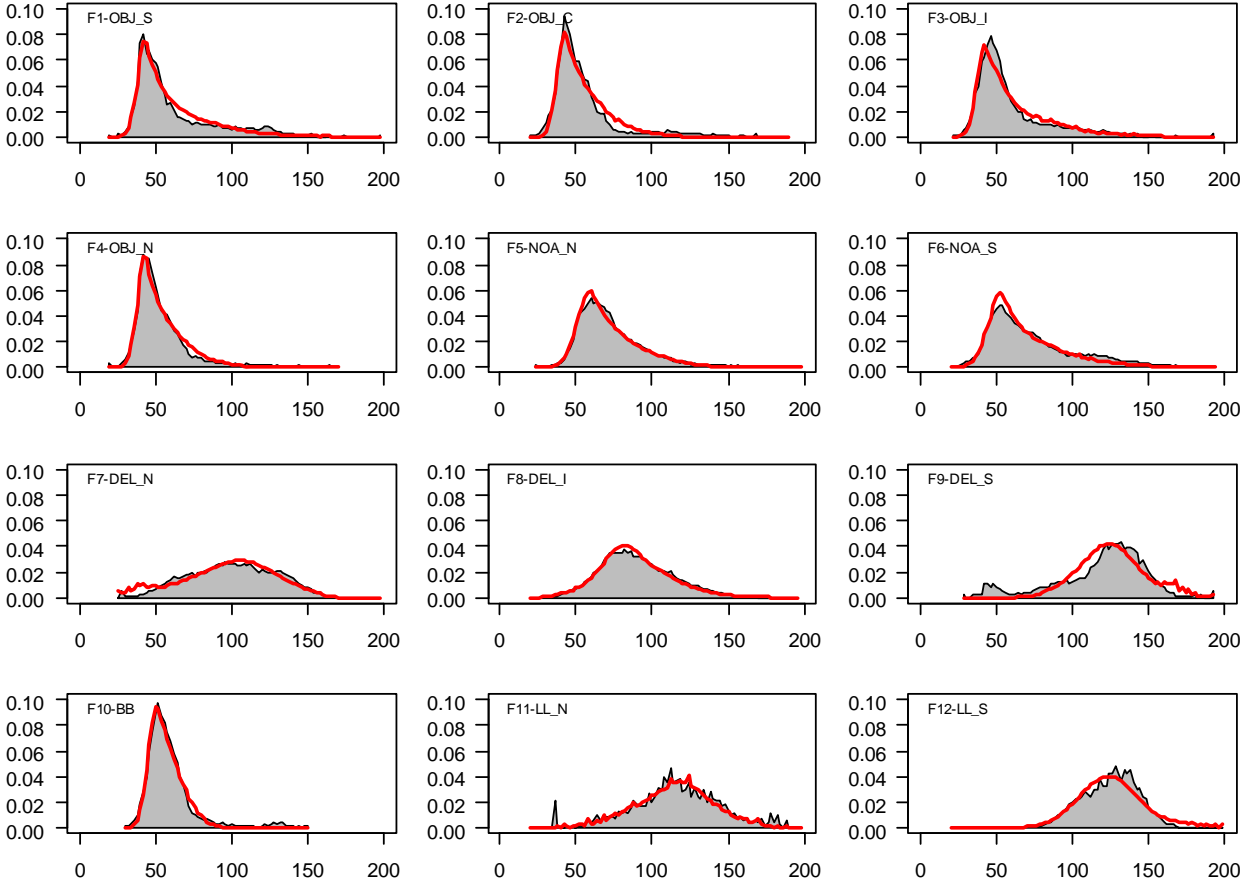
**Extra slides**



# Average fits to size comps.



Proportion of the catch - Proporción de la captura

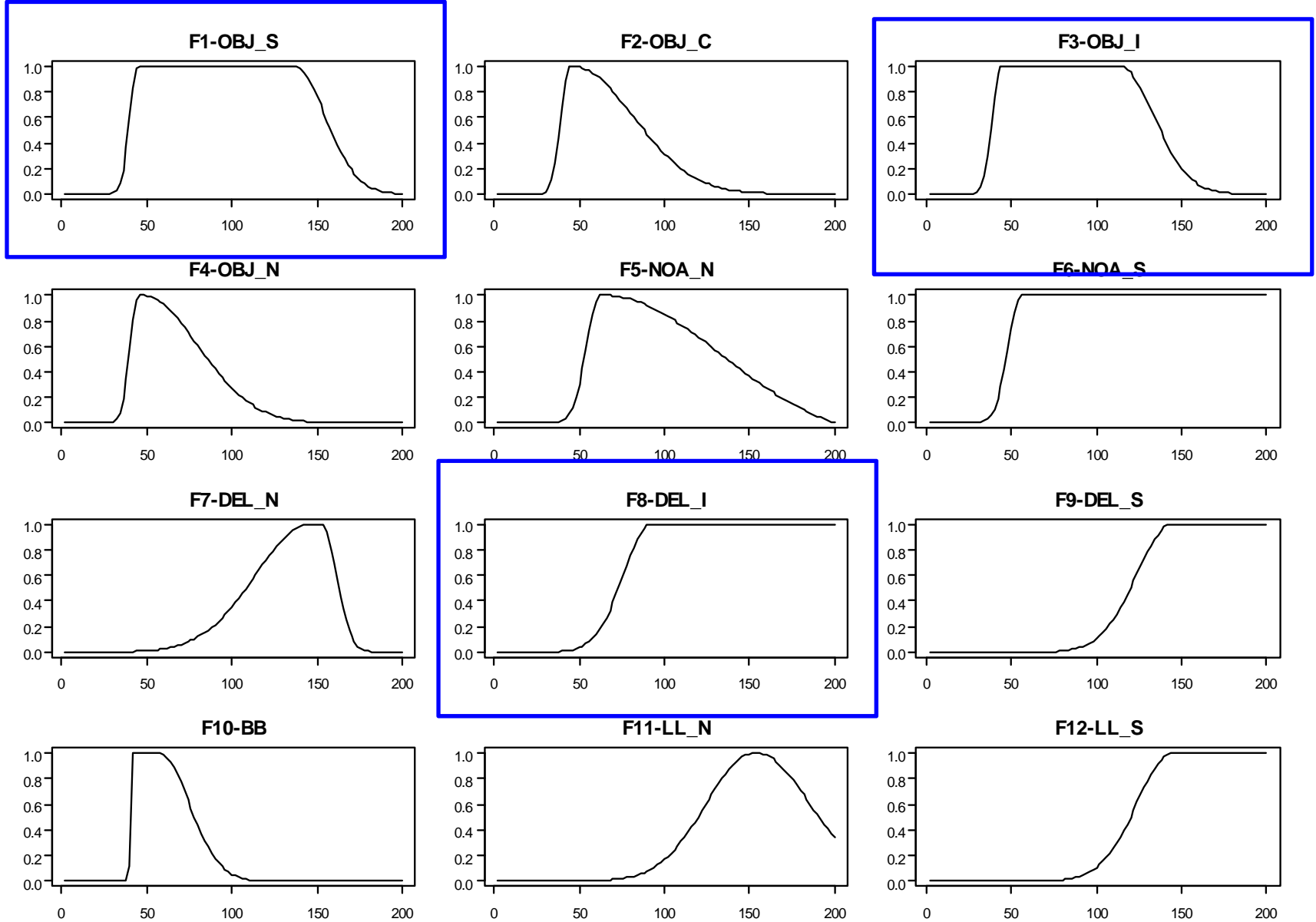


Length (cm)- Talla (cm)



# Estimated selectivity curves SAC 5

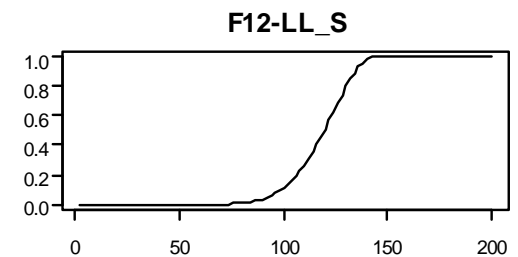
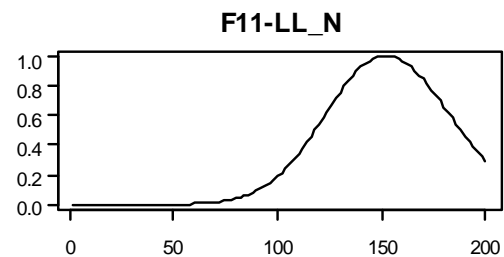
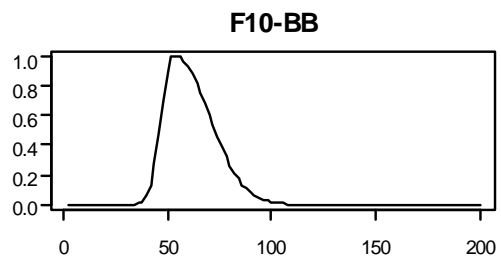
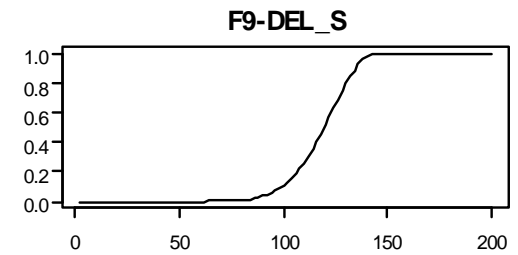
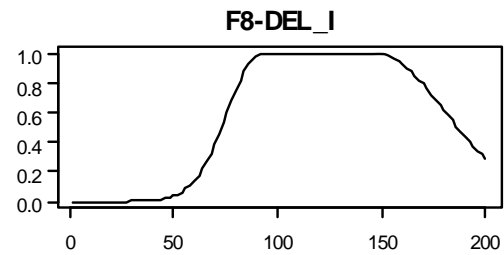
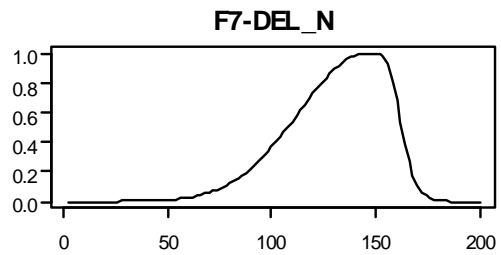
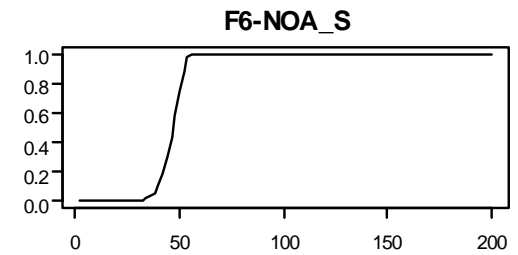
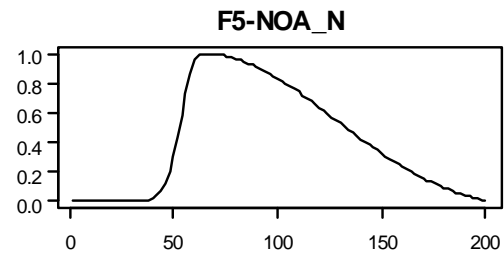
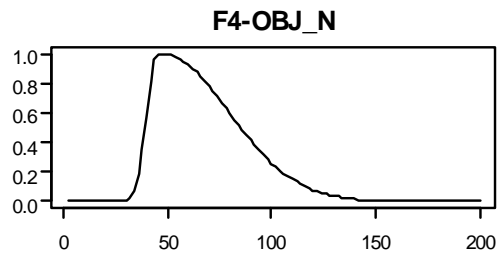
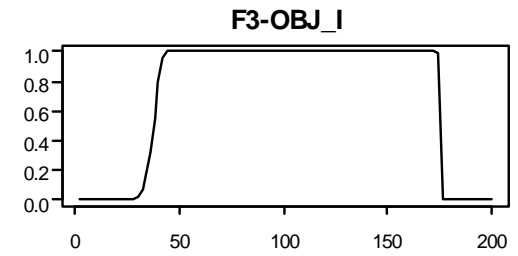
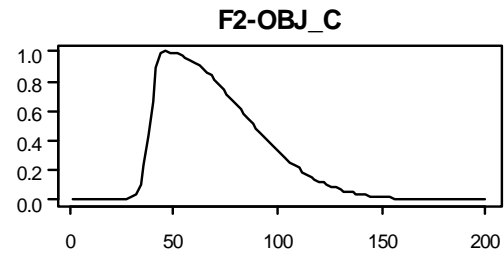
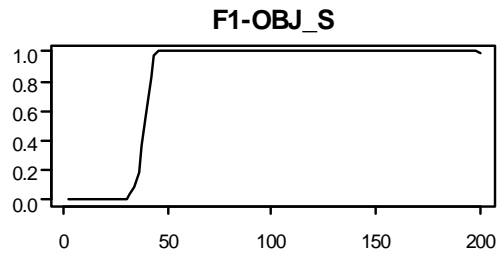
Selectivity and retention - Selectividad e retencion



Length (cm)-Talla (cm)

# SAC 4

Selectivity and retention - Selectividad e retencion

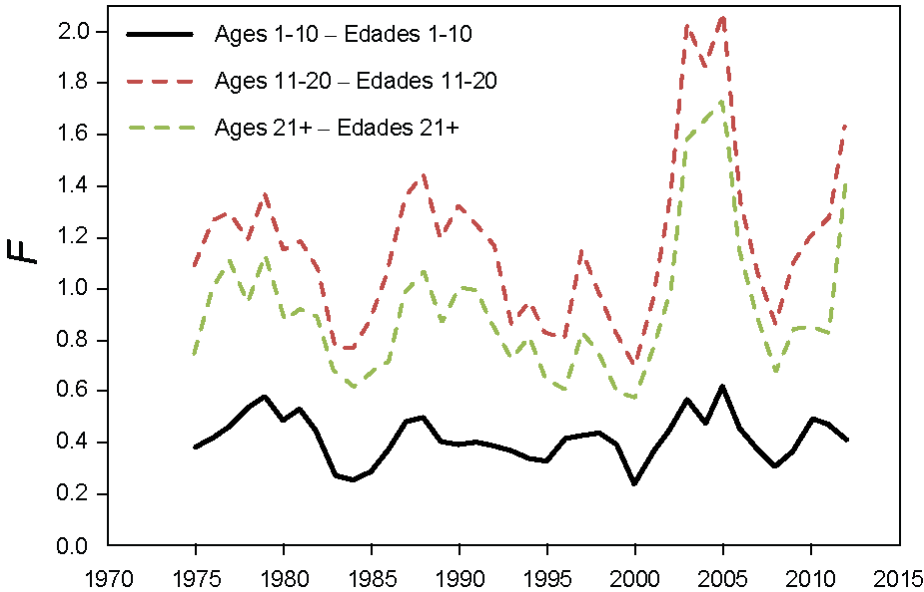


Length (cm)-Talla (cm)

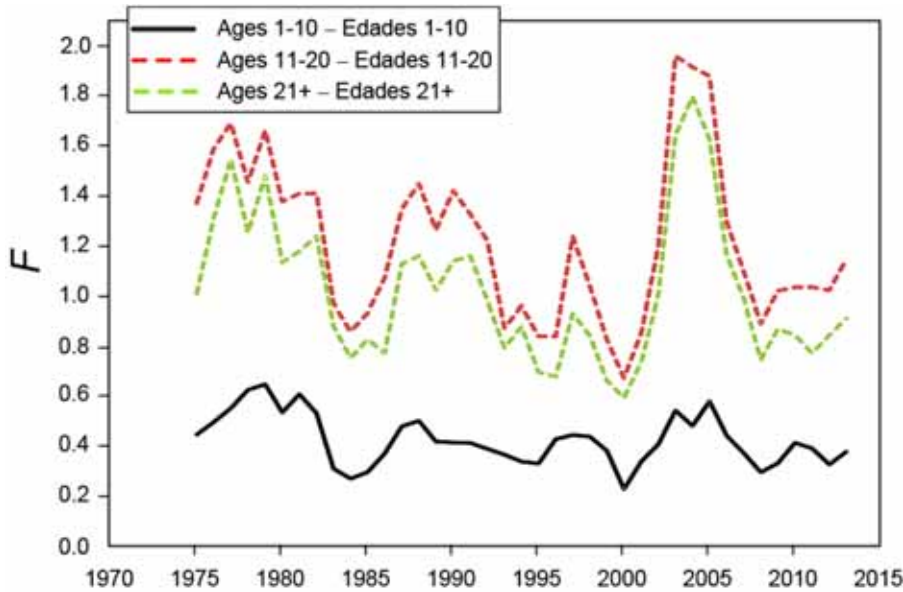
# Fishing mortality



### SAC4



### SAC5



Year

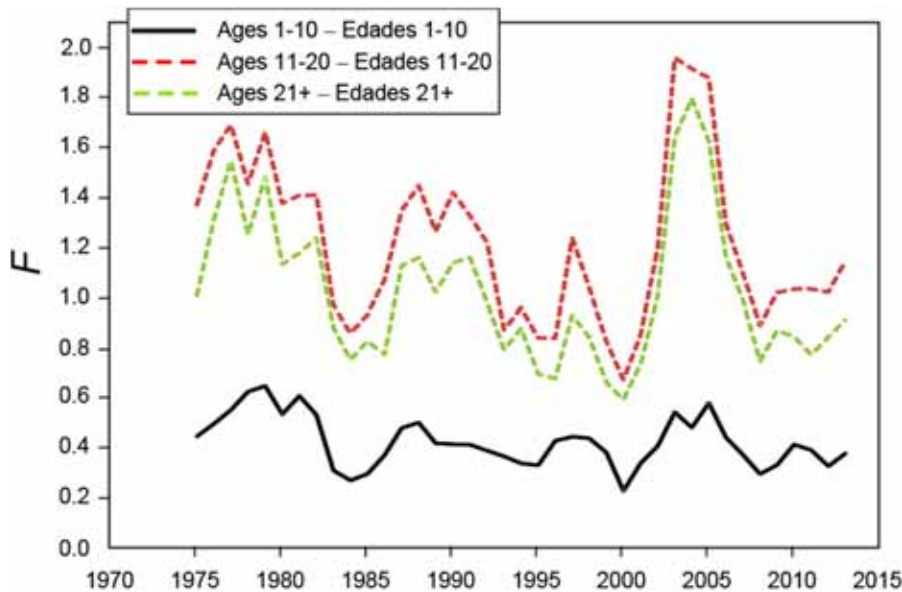


# Fishing mortality

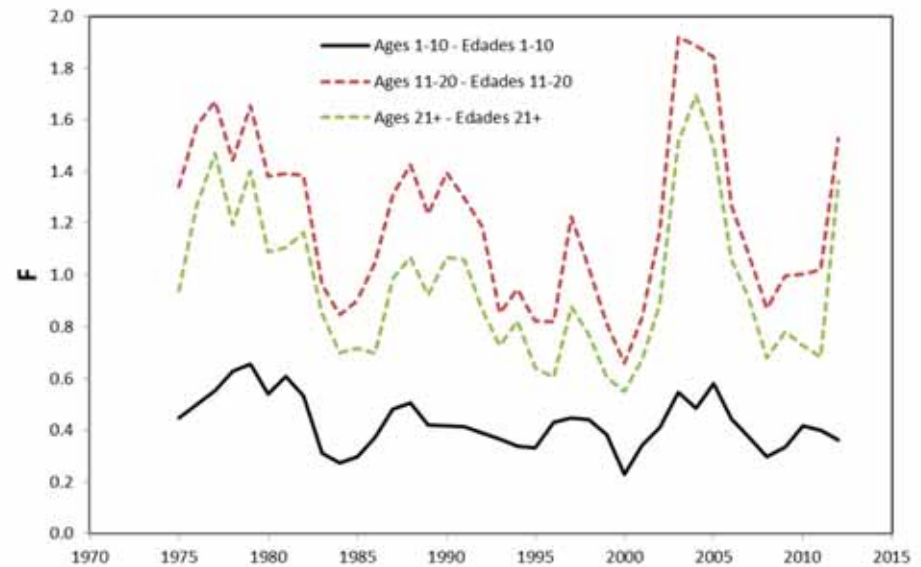


Effect of the 2013 PS  
size-composition data on the results

With (SAC5 base case)



Without



Year

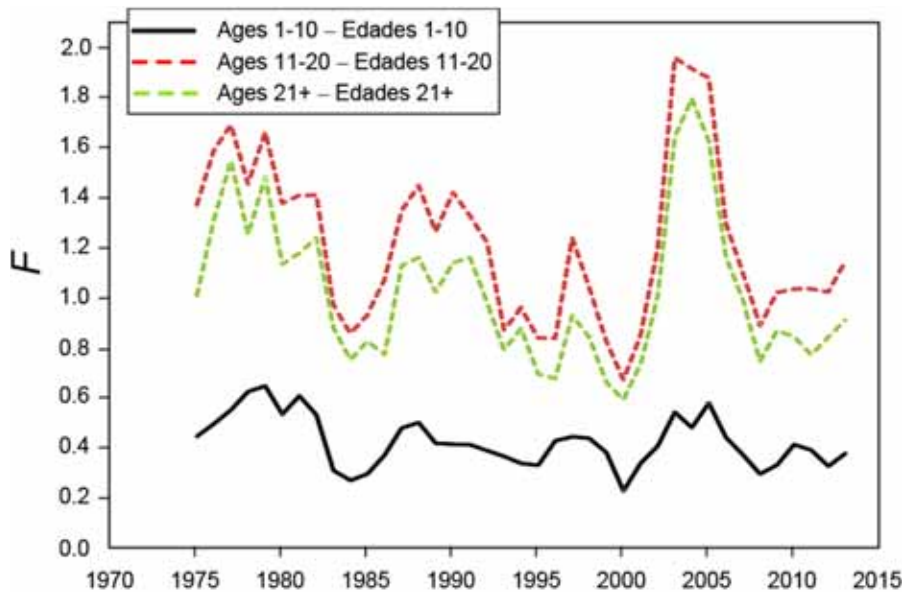


# Fishing mortality

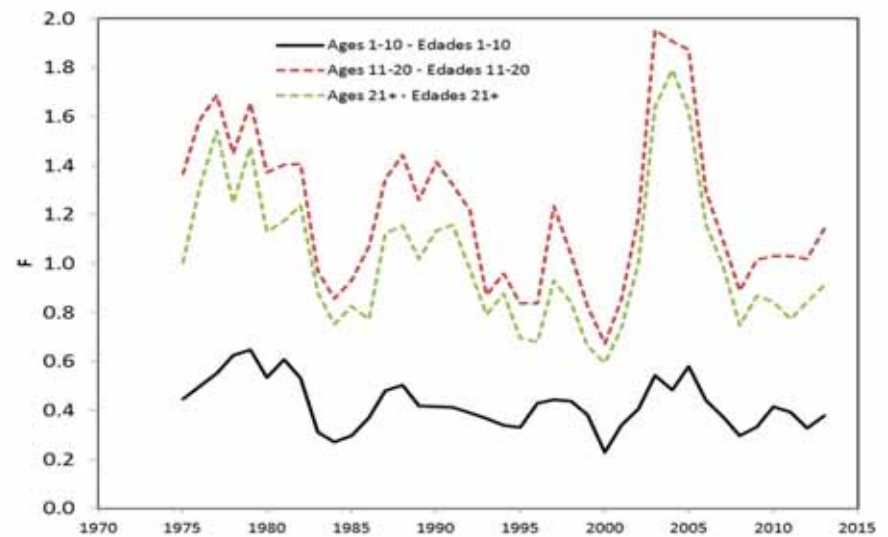


## Effect of the 2013 PS CPUE data on the assessment results

With (SAC5 base case)

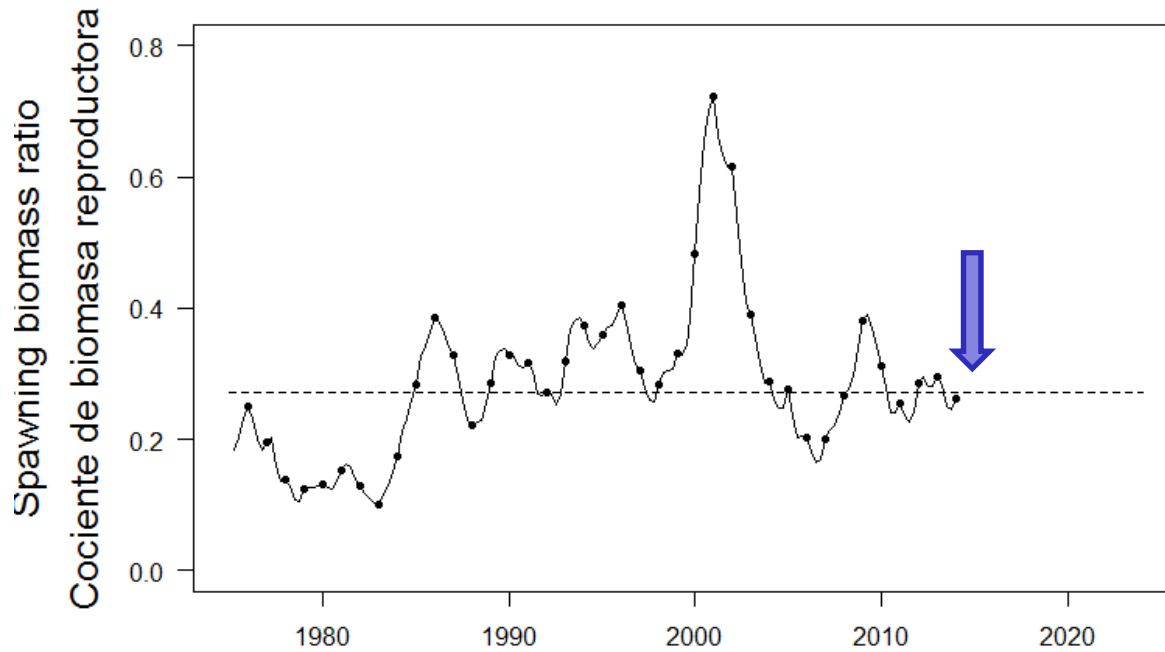


Without



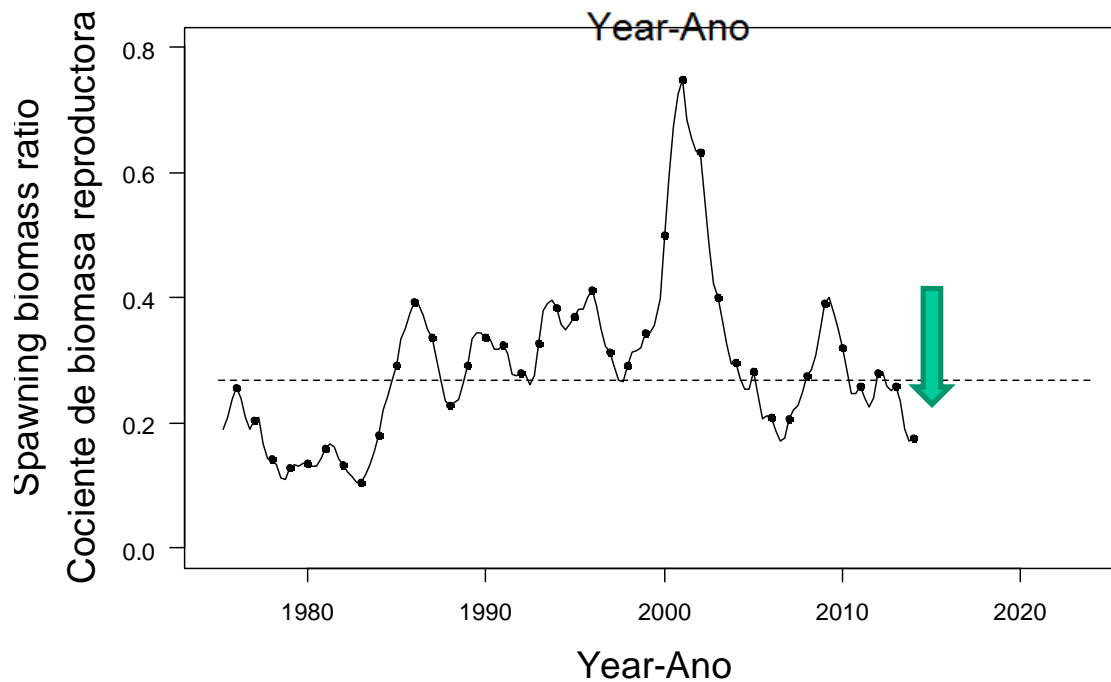
Year





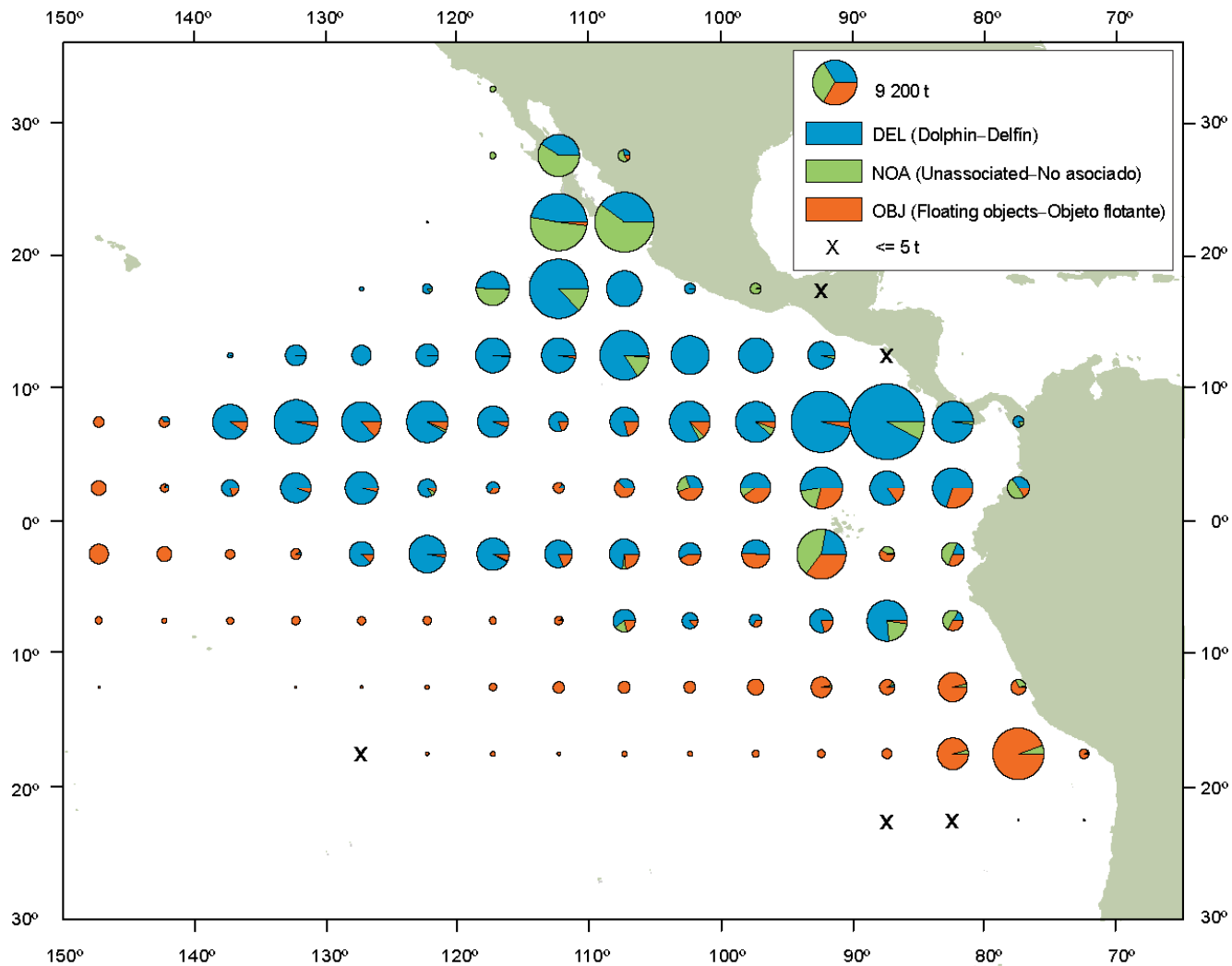
Results are more optimistic when fitting to 2013 PS cpue without the new LL cpue

$$F_{\text{mult}} = 1.24$$



Results are less optimistic when fitting to the new LL cpue without the 2013 PS cpue

$$F_{\text{mult}} = 1.05$$



## Annual distribution of the purse-seine catches of yellowfin, by set type, 2013.

The sizes of the circles are proportional to the amounts of yellowfin caught in those 5° by 5° areas. Source:SAC-05-06