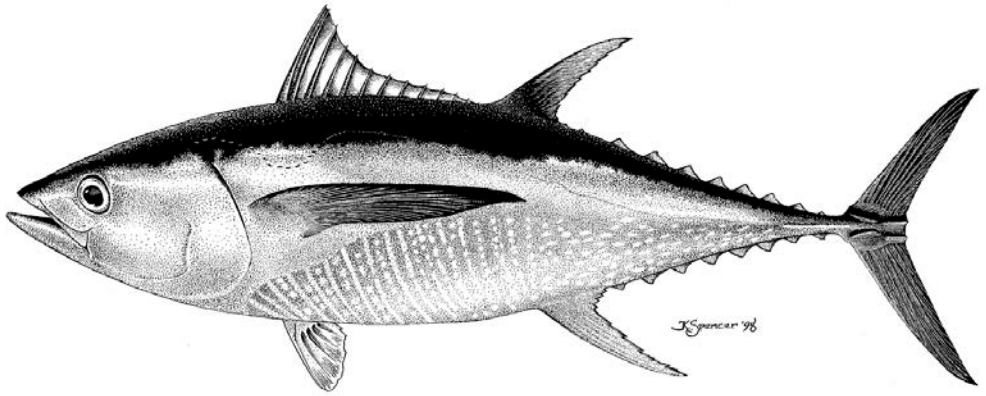
A review of historical EPO YFT stock assessment sensitivity analyses
(Doc YFT-01-08)

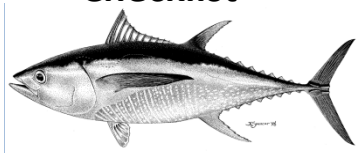
Mark Maunder and Alexandre Aires-da-Silva

External review of IATTC yellowfin tuna assessment

La Jolla, USA, 15-19 October, 2012



Checklist on main sensitivities



- Structural (model assumptions)
  - Steepness (h=0.75)
  - Growth: Average length of the older fish (L_2), estimate other growth parameters internally
  - Estimate natural mortality (M)
  - Selectivity: Change in OBJ selectivity starting in 2001 (C-00-08)
- Data (use and weighting)
  - Fitting to CPUE of DEL-N as main index of abundance
  - Excluding OBJ size-composition data from analysis
  - CPUE standardization method
  - Extra variance component of CPUE estimated
  - Species composition catch estimates
  - Iterative reweighting of the length-frequency sample size

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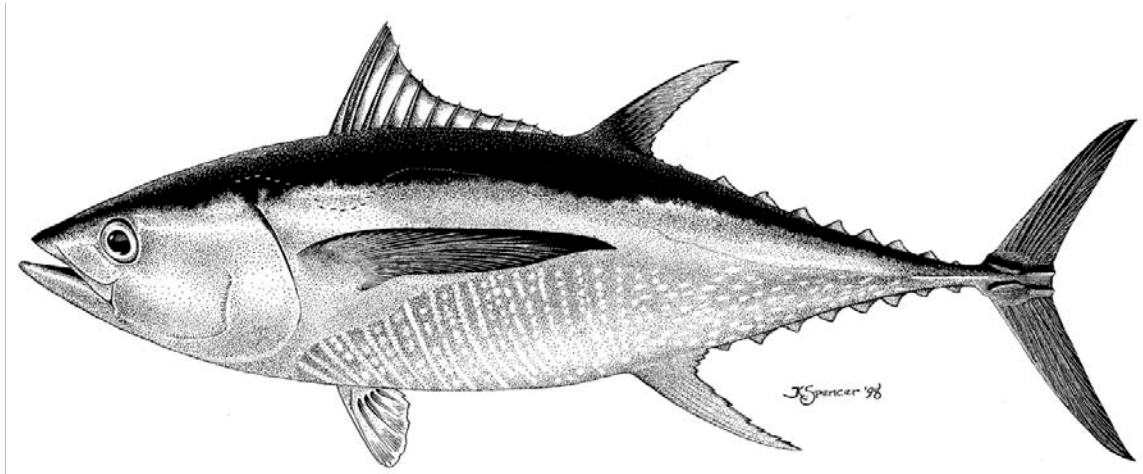


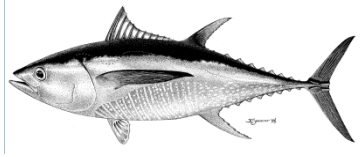
STRUCTURAL SENSITIVITIES

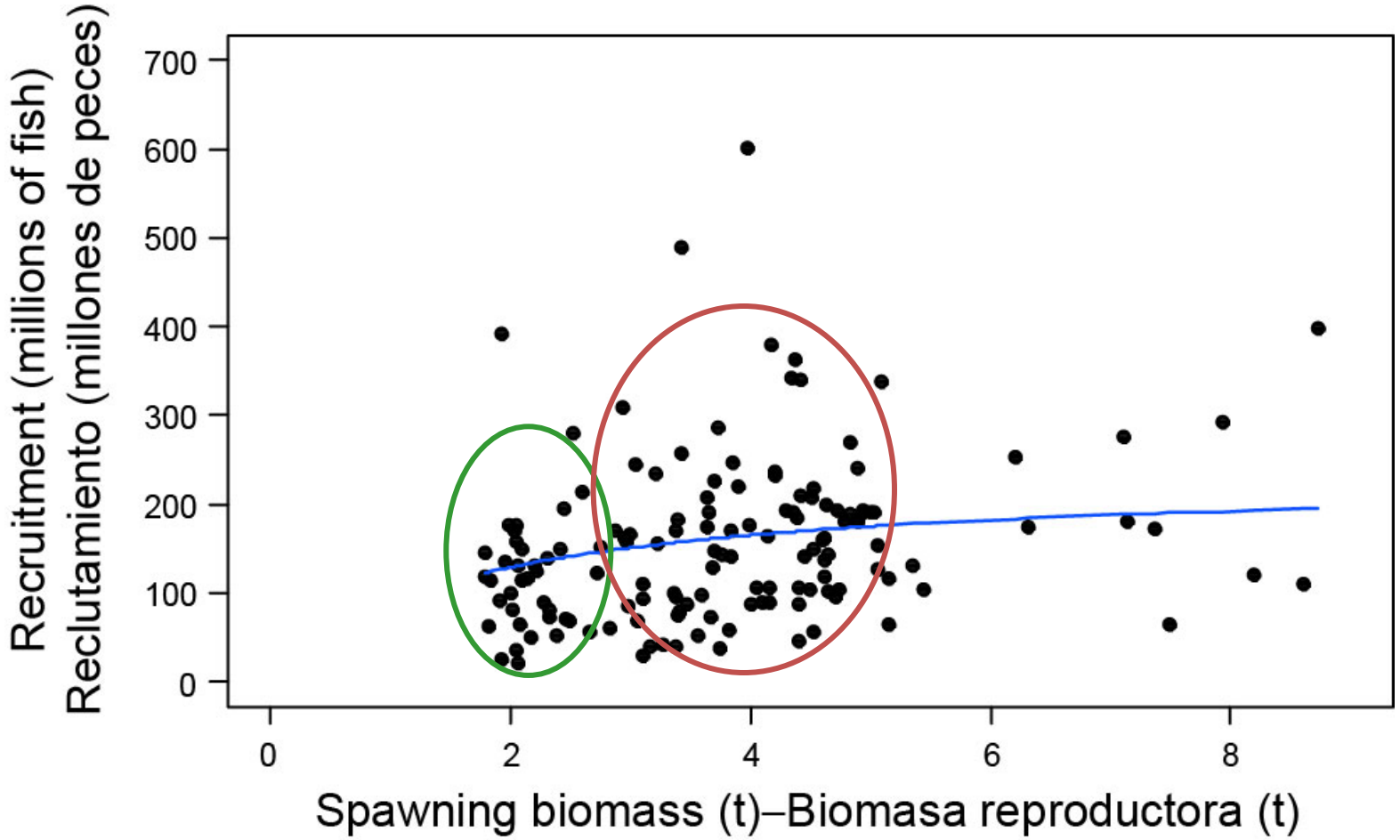
Steepness of S-R relationship

(*h*=0.75)

S-R relationship (*h*=0.75)

Sensitivities (*Steepness*)





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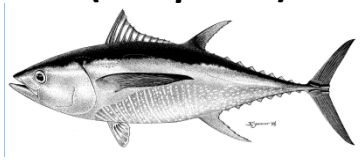
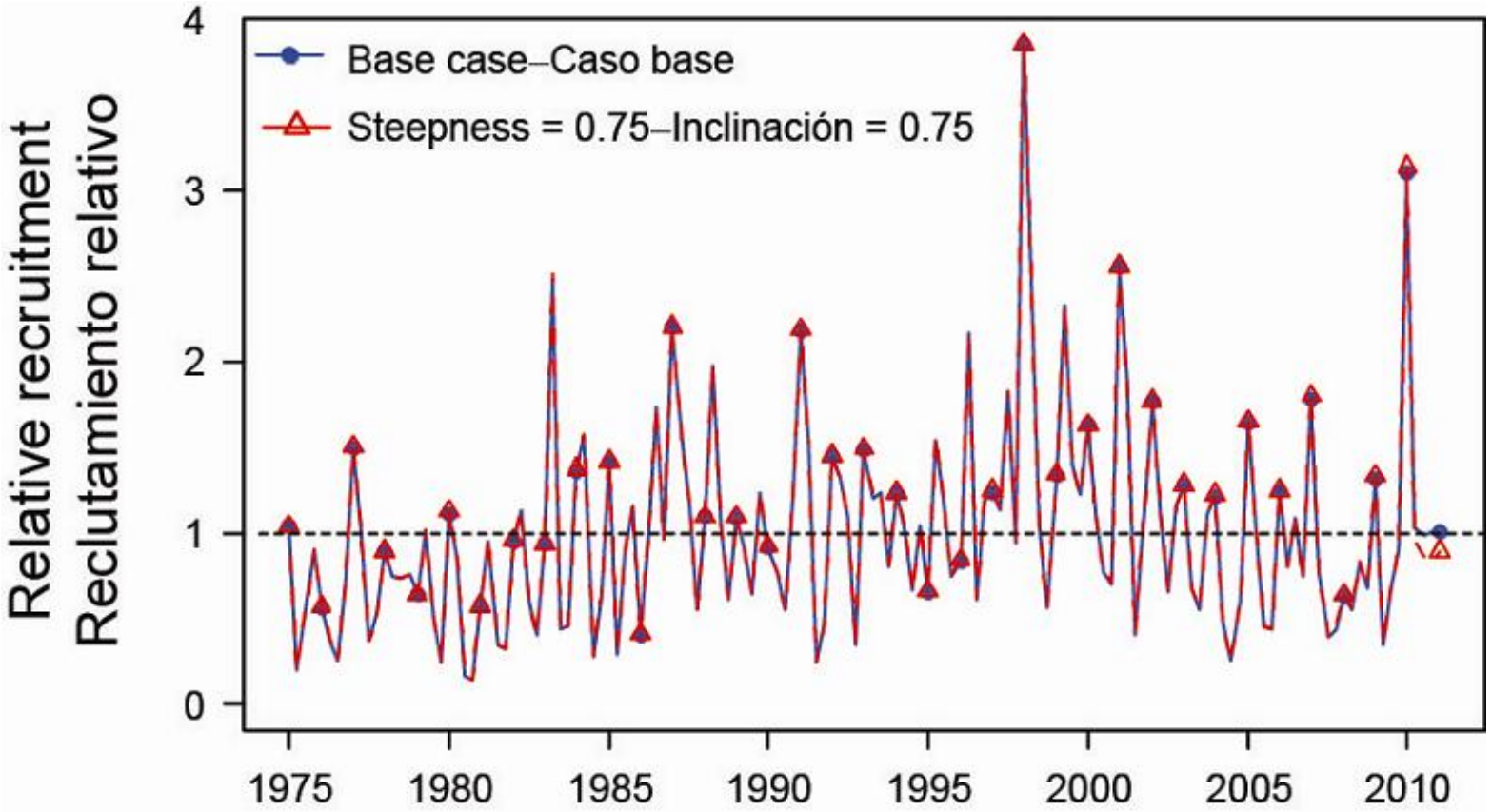
Recruitment

Sensitivities (*Steepness*)





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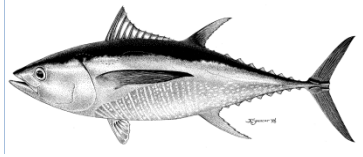
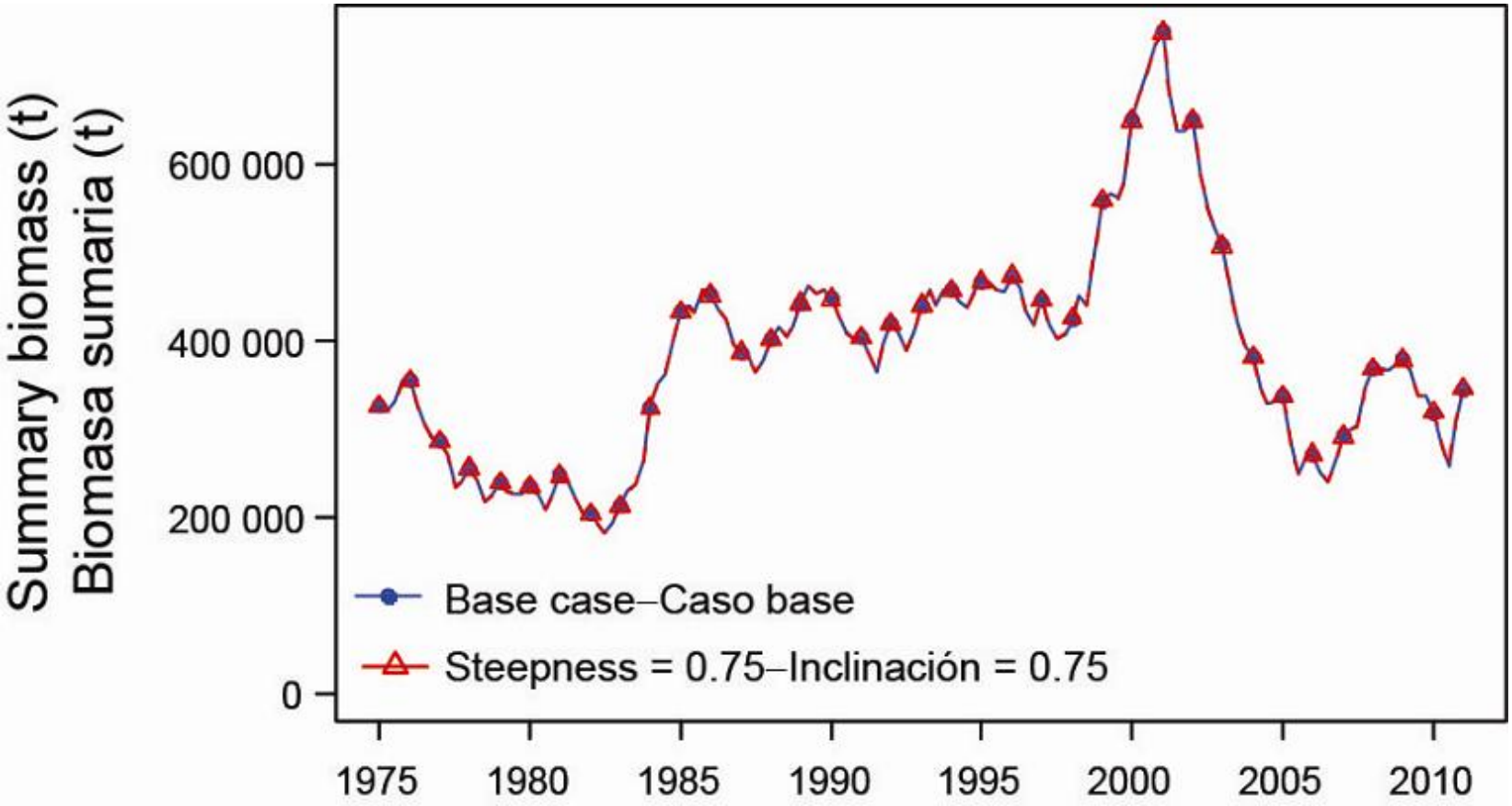
Summary biomass

Sensitivities (*Steepness*)





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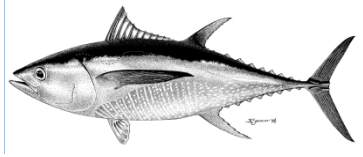
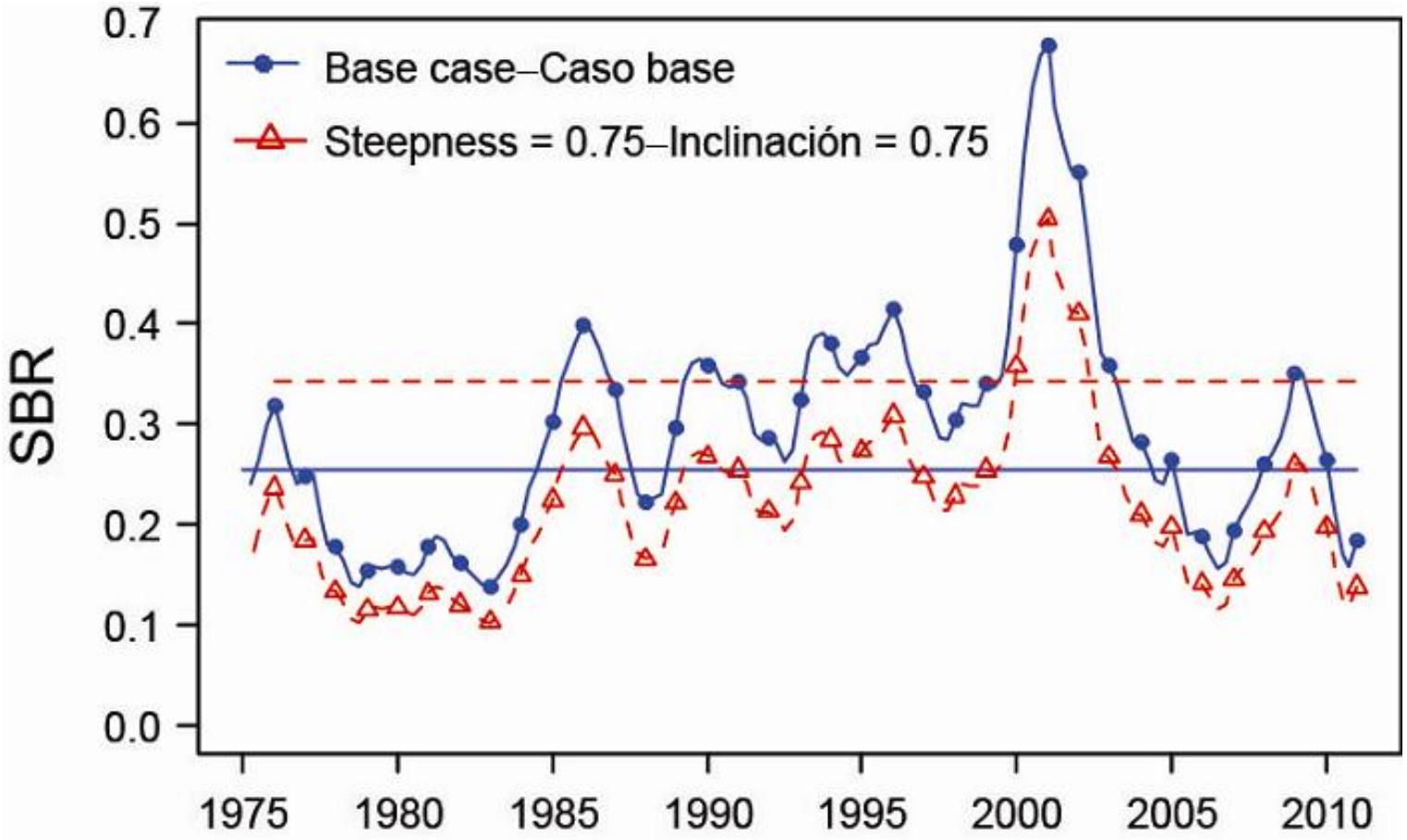
Spawning biomass ratio

Sensitivities (*Steepness*)





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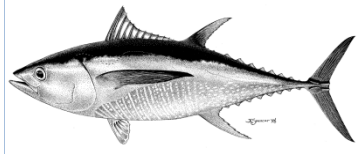
Management quantities

Sensitivities (*Steepness*)



	Basecase	h = 0.75	
MSY	262,857	291,790	↑
Bmsy	354,958	559,967	
Smsy	3,305	5,993	
Bmsy/B0	0.31	0.37	
Smsy/S0	0.26	0.35	↑
Crecent/AMSY	0.88	0.79	
Brecent/Bmsy	0.96	0.61	
Srecent/Smsy	0.71	0.39	↓
Fmultiplier	1.13	0.71	↓

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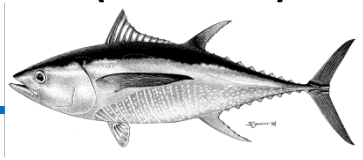
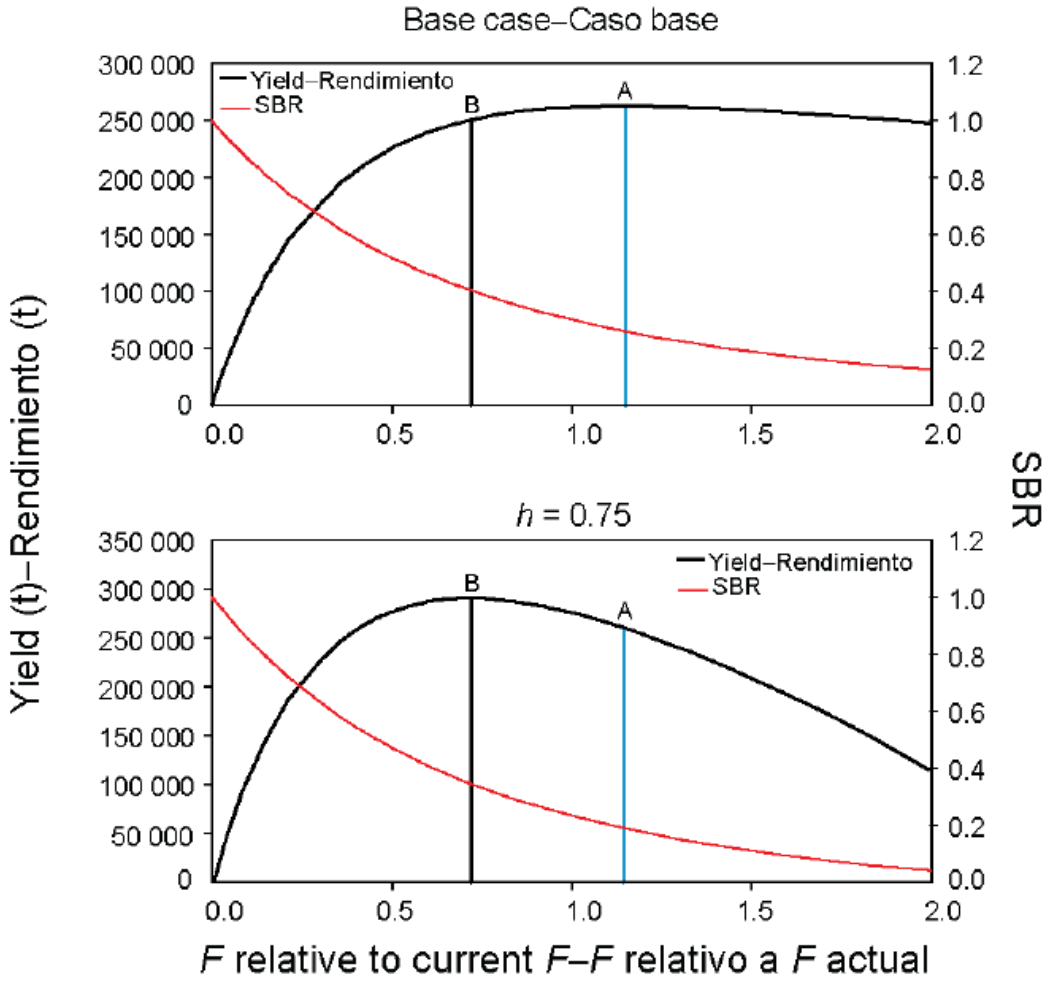
Yield

Stock status (base case)





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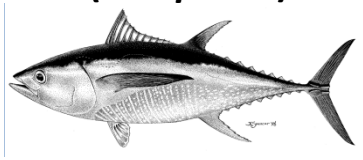
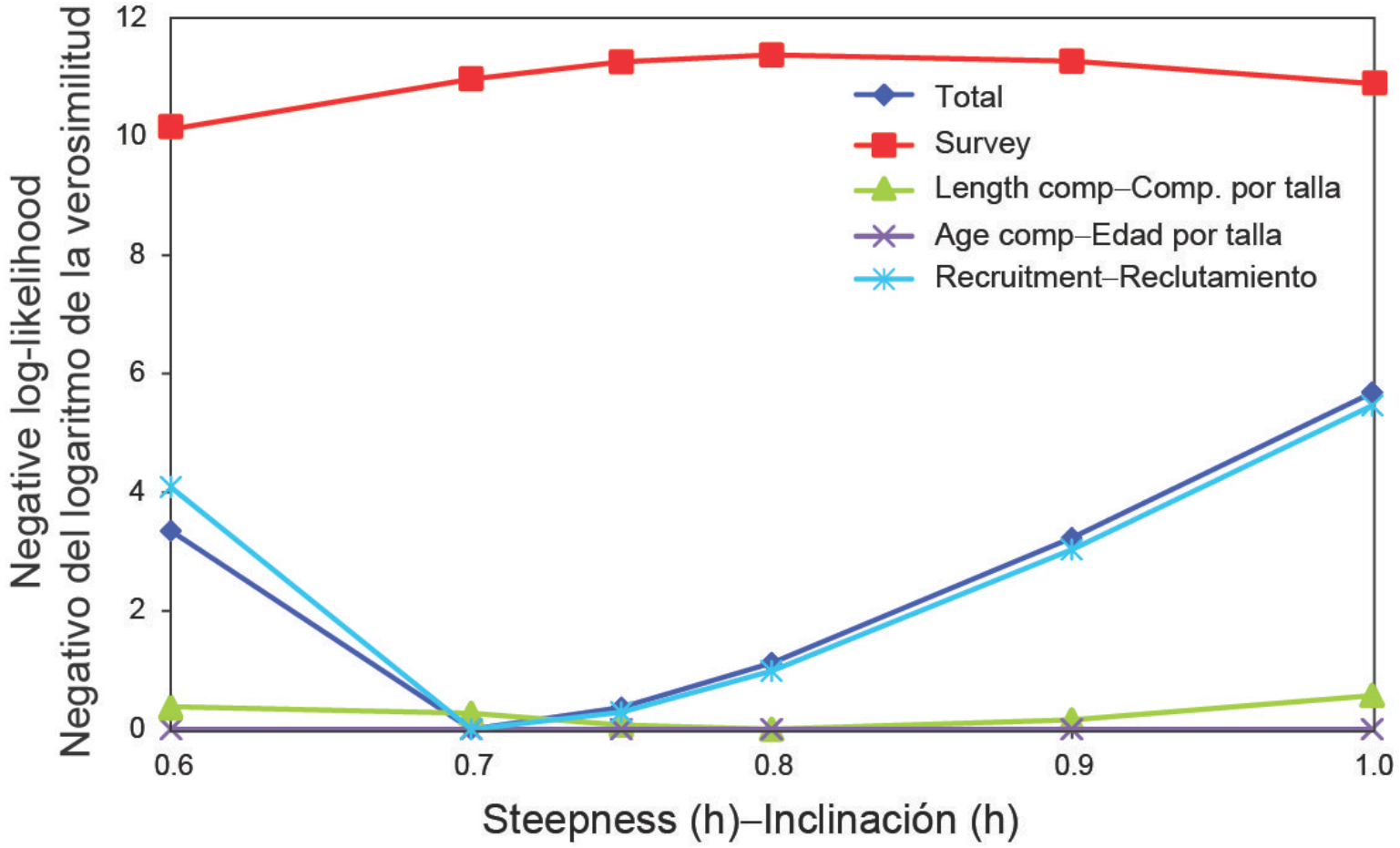
Likelihood profile on *h*

Sensitivities (*Steepness*)





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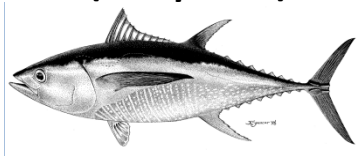
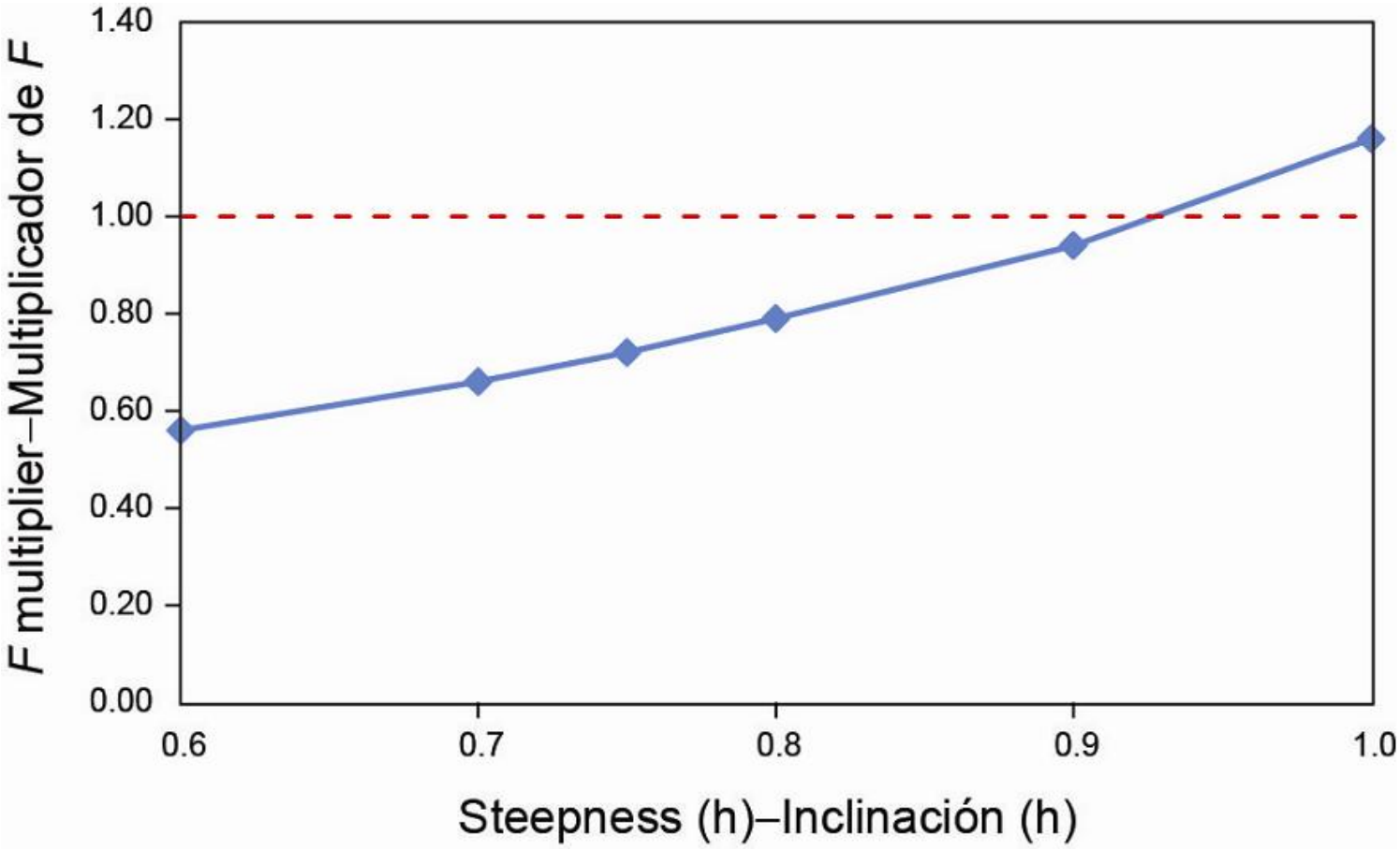
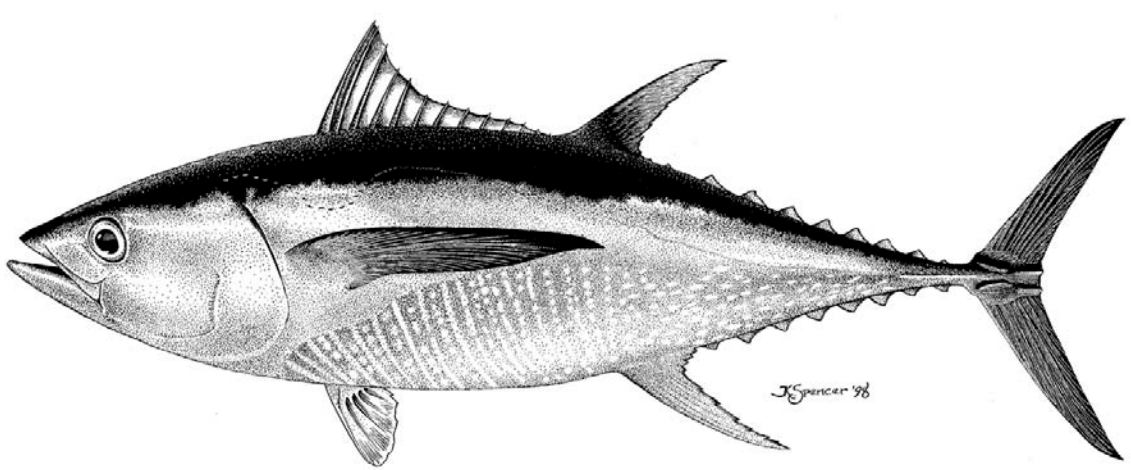
F multiplier and steepness

Sensitivities (*Steepness*)





SAR 12 (2012)

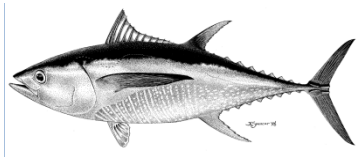


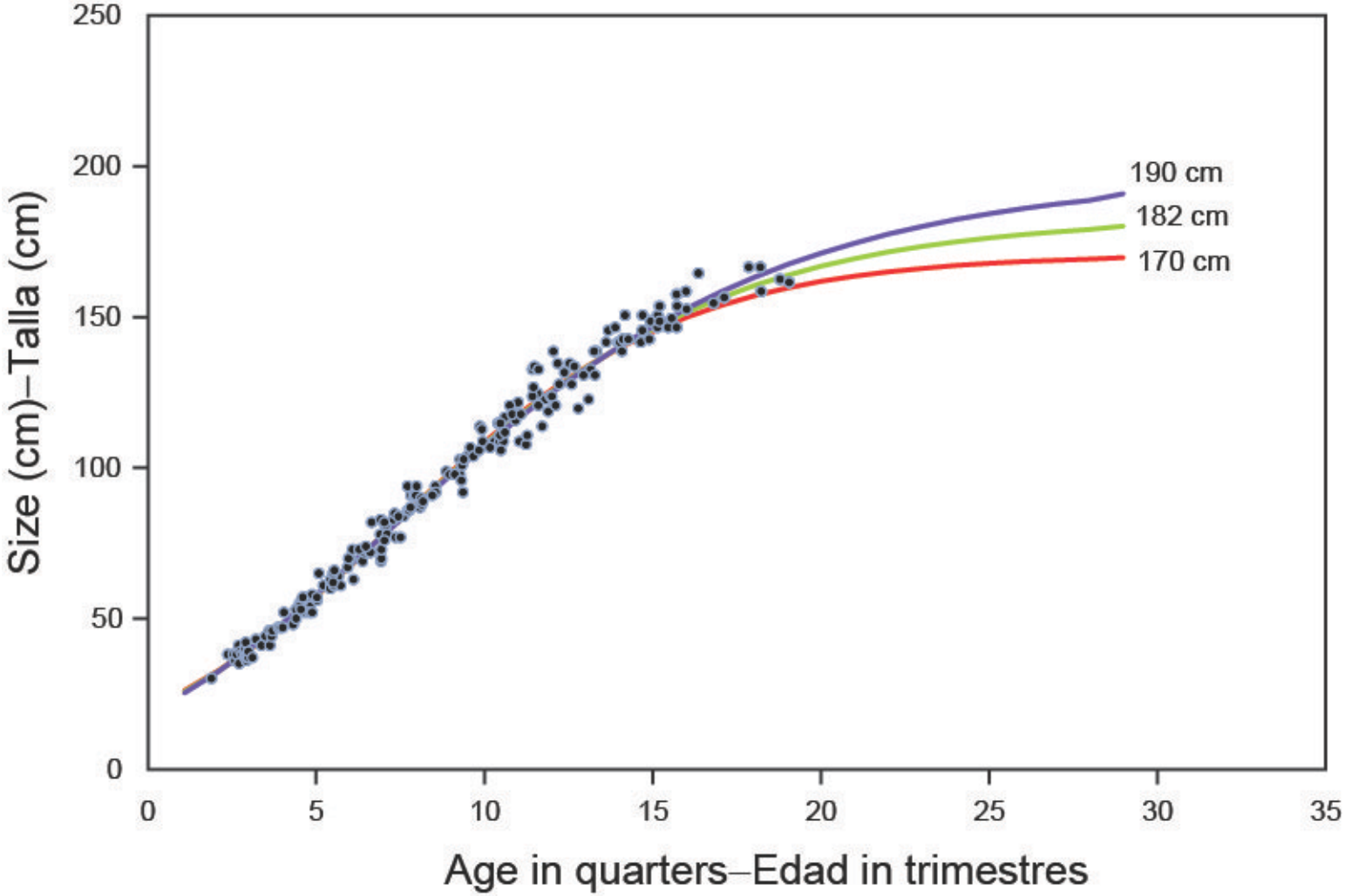
STRUCTURAL SENSITIVITIES

Growth sensitivity analyses

- Fixed values of the average size of oldest fish L_2

Fixed values of L_2

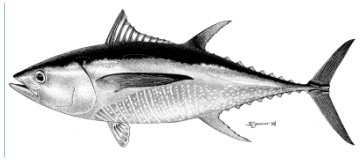


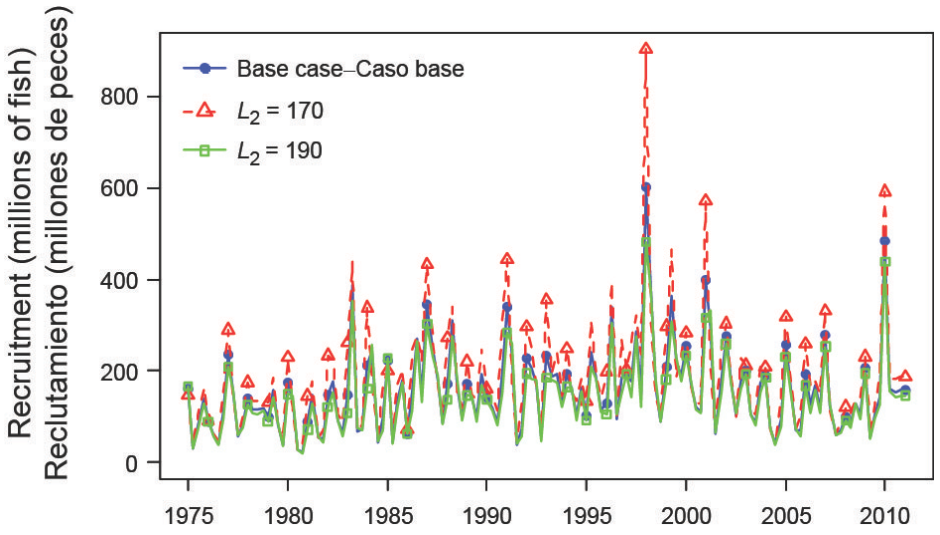


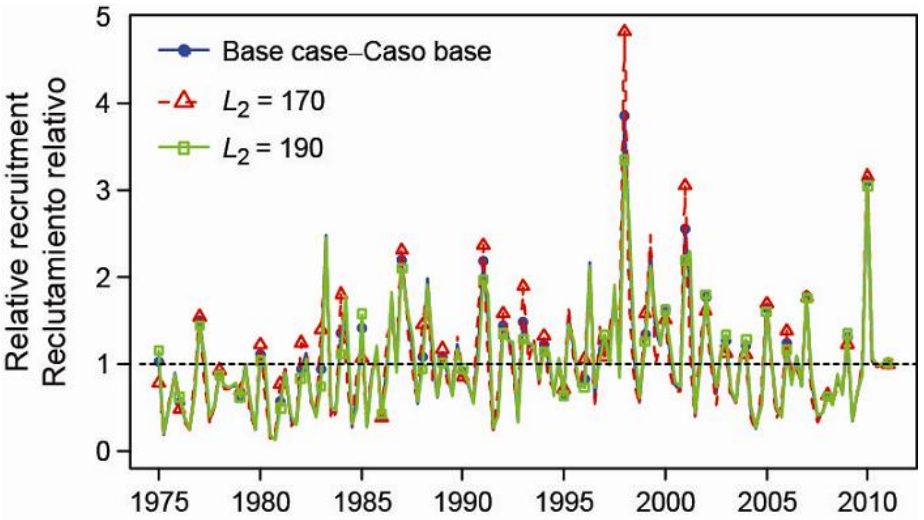
SAR 12 (2012)

Recruitment

Sensitivities (L_2)







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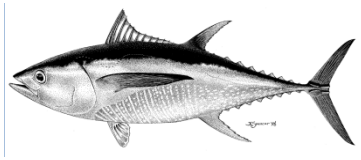
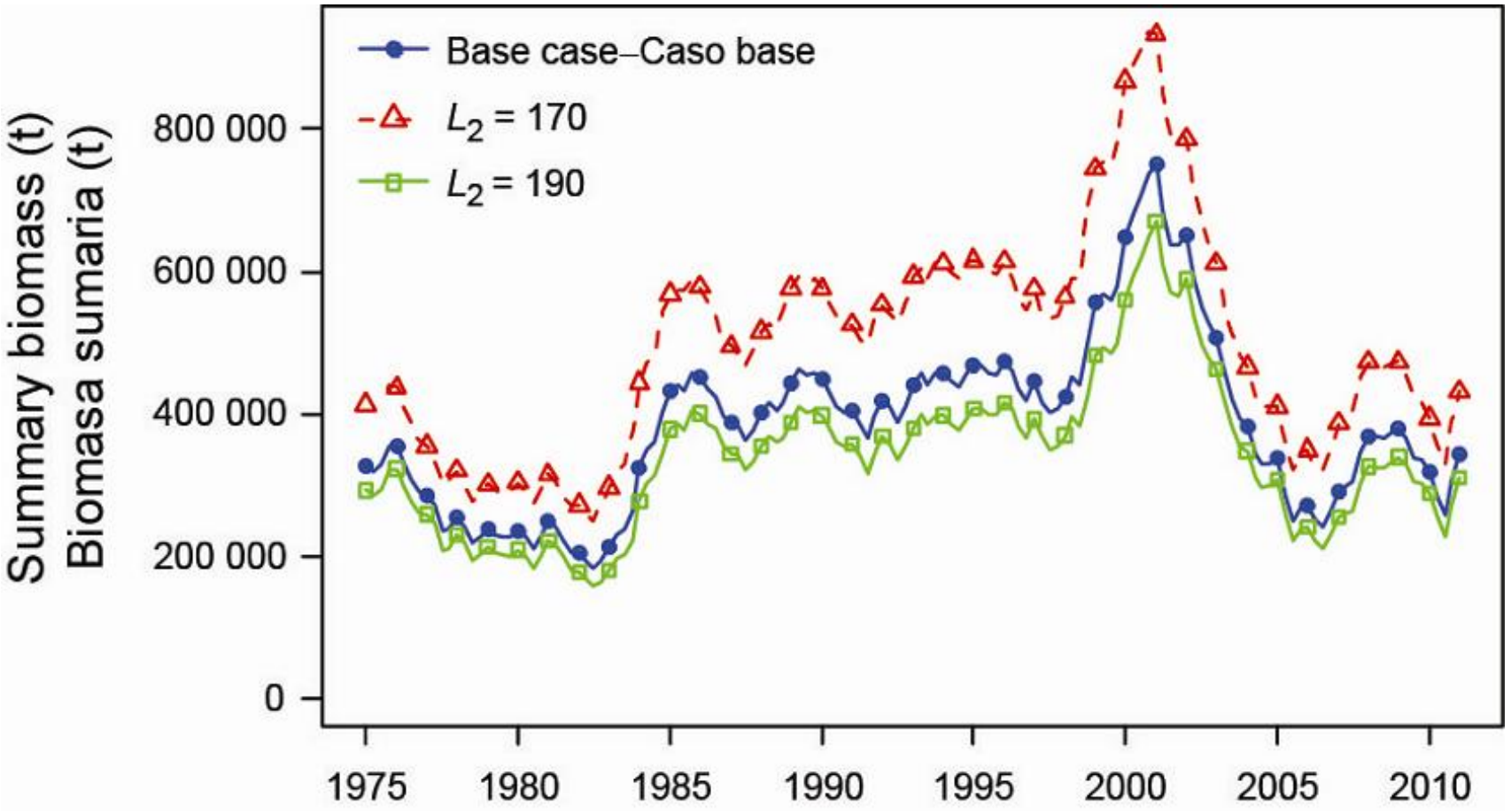
Summary biomass

Sensitivities (L_2)

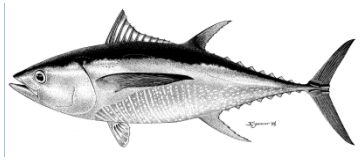


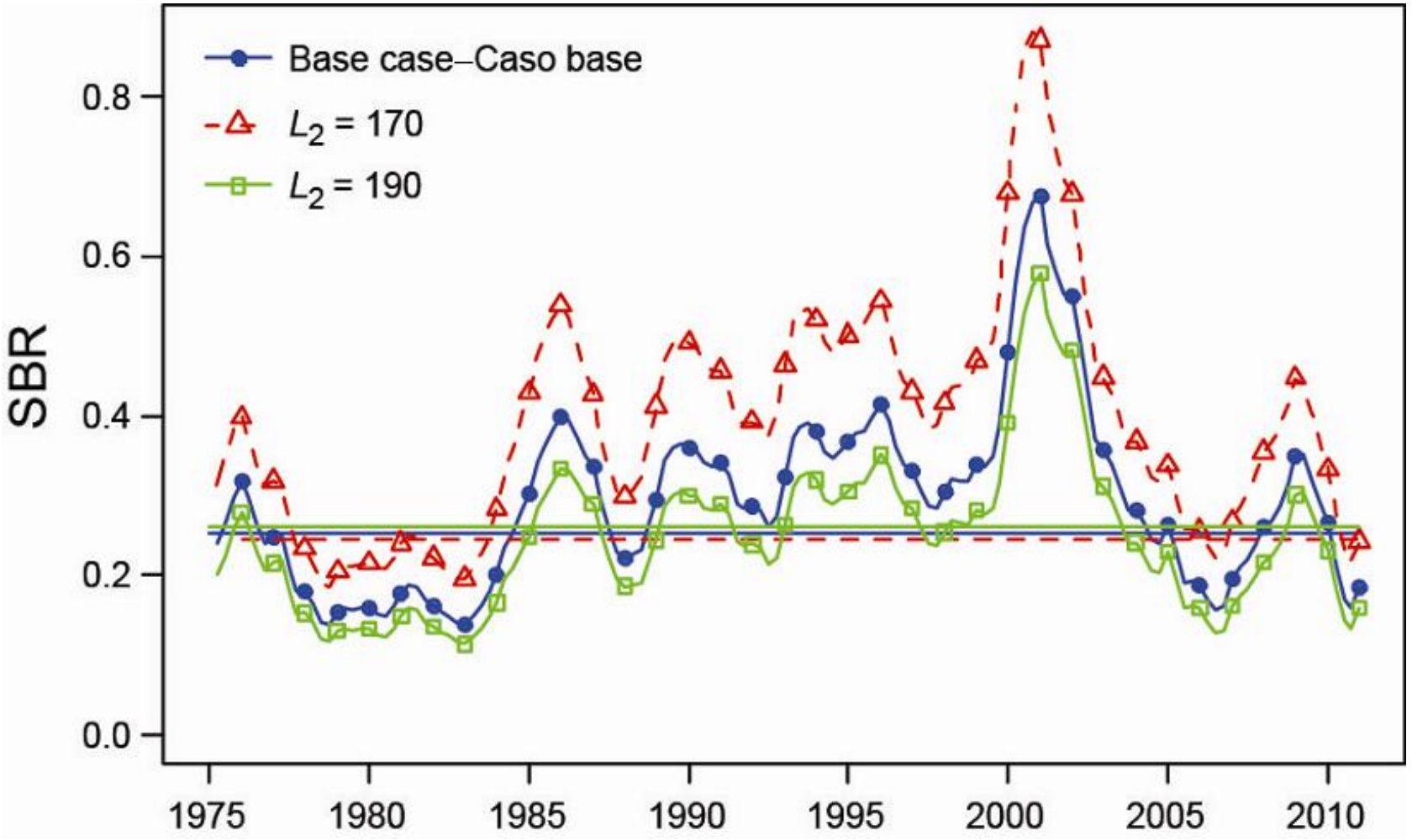


SAR 12 (2012)

Spawning biomass ratio

Sensitivities (L_2)

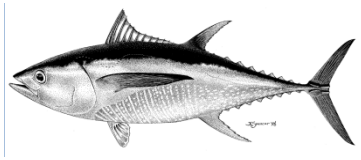




SAR 12 (2012)

Management quantities

Sensitivities (L_2)



		L2	
	Basecase	170 cm	190 cm
MSY	262,857	275,310	264,704
Bmsy	354,958	370,334	359,144
Smsy	3,305	3,777	3,169
Bmsy/B0	0.31	0.31	0.31
Smsy/S0	0.26	0.24	0.27
Crecent/AMSY	0.88	0.84	0.87
Brecent/Bmsy	0.96	1.20	0.85
Srecent/Smsy	0.71	1.03	0.59
Fmultiplier	1.13	1.65	0.94

L_2

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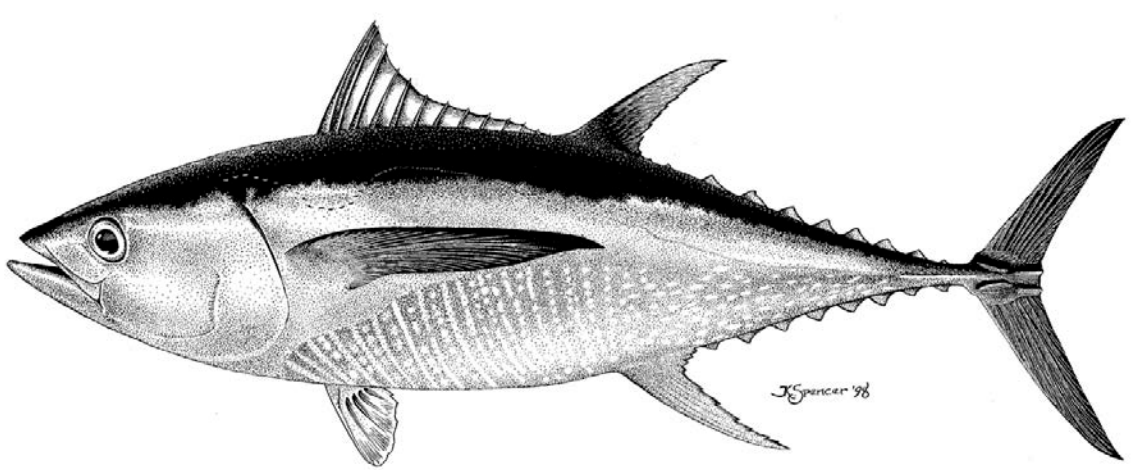
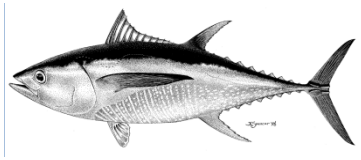


STRUCTURAL SENSITIVITIES

Natural mortality

- Estimate natural mortality for adult females and males



Fit to sex ratio data

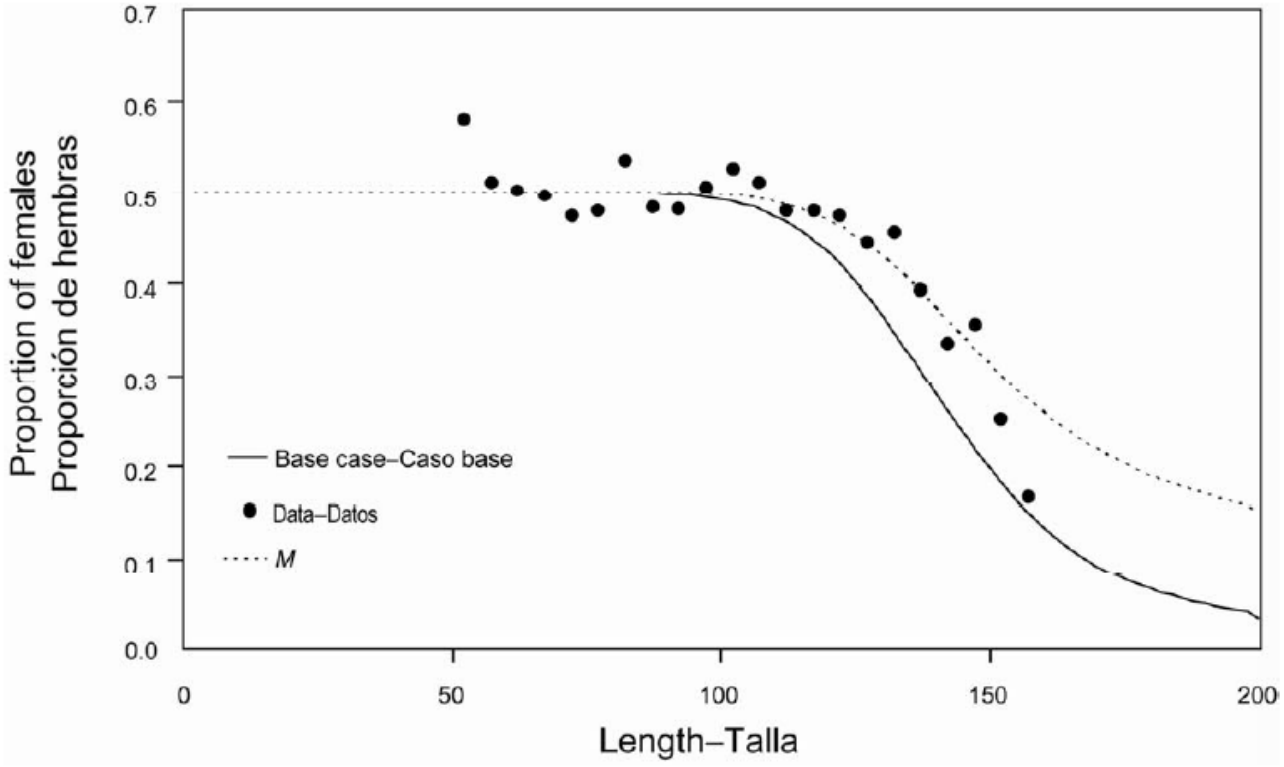
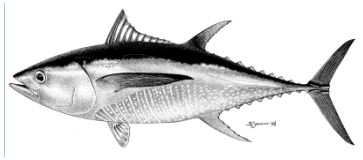


FIGURE C.5. Fit to the sex ratio information for the base case and the sensitivity analysis that estimates natural mortality.

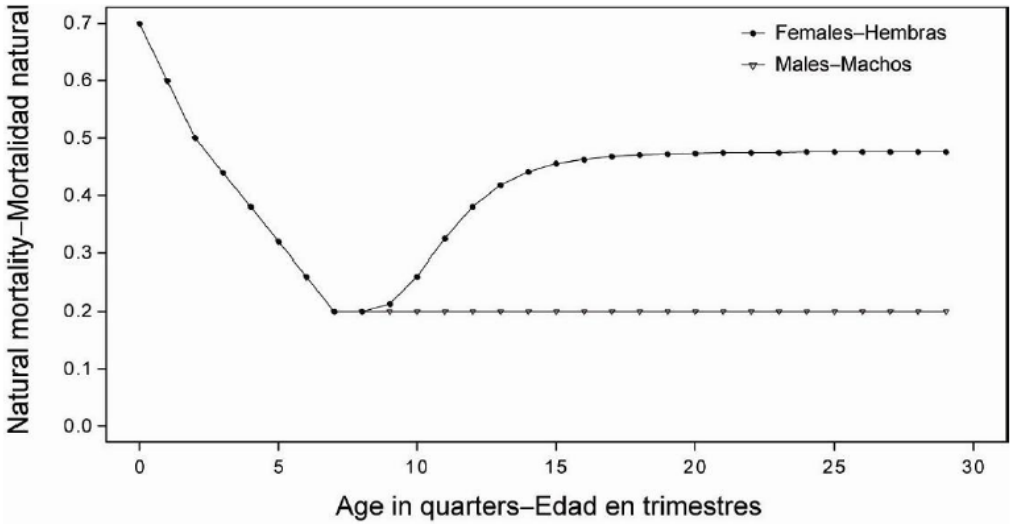
FIGURA C.5. Ajuste a la información de proporción de sexos del caso base y del análisis de sensibilidad que estima la mortalidad natural

SAR 10 (2010)

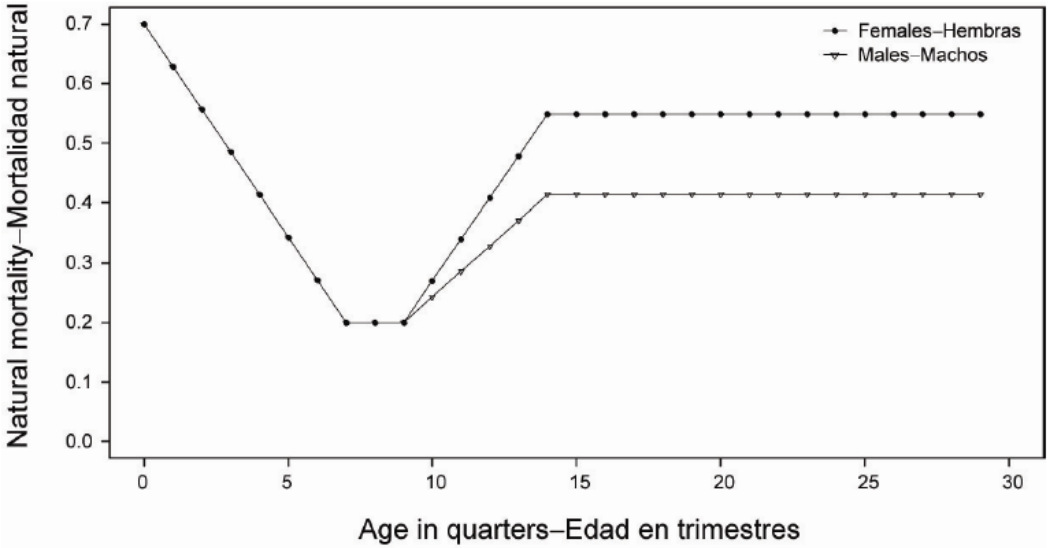


M schedulle

Fixed
(base case)



Est. adult M
(sensitivity)



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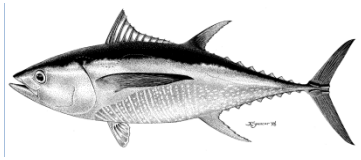
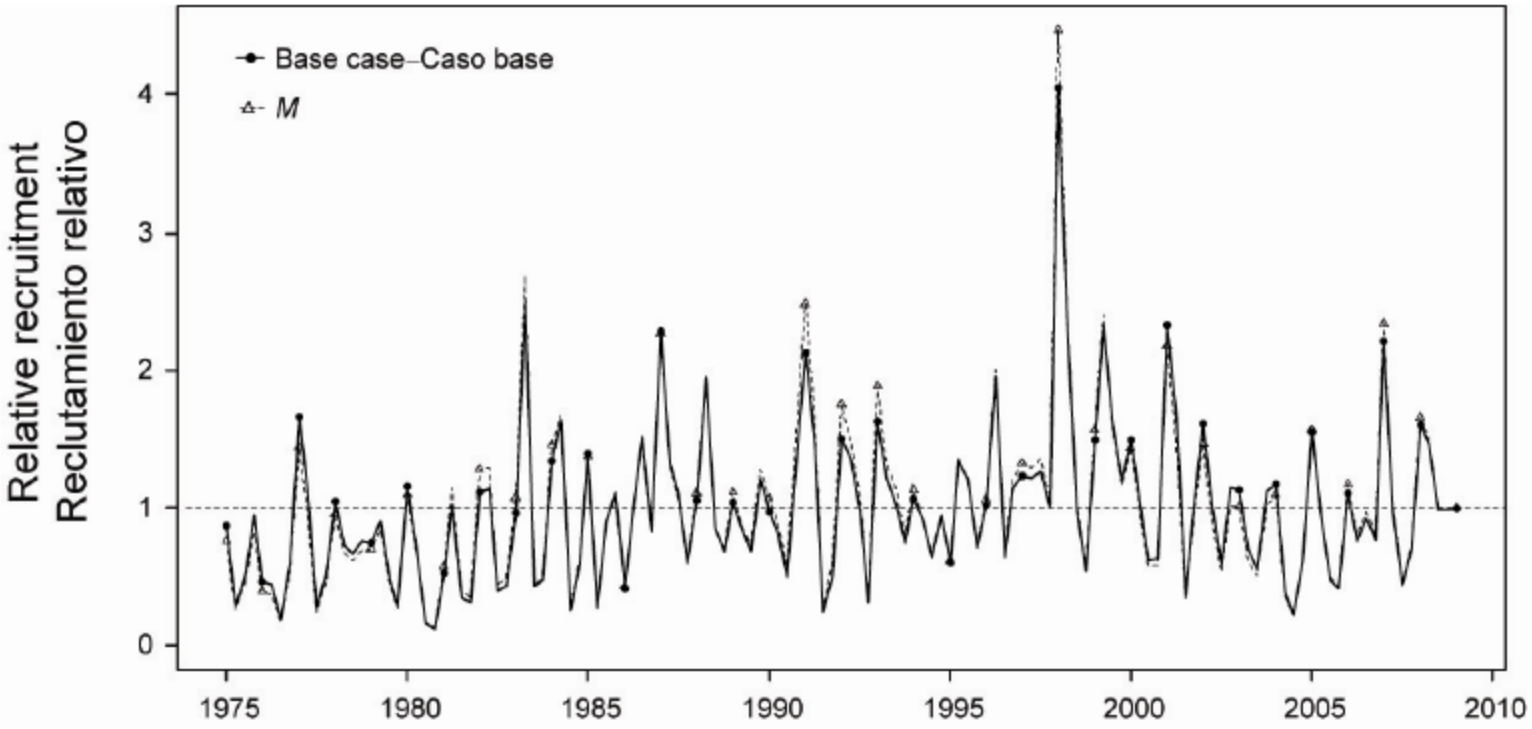
Recruitment

Sensitivities (*M*)

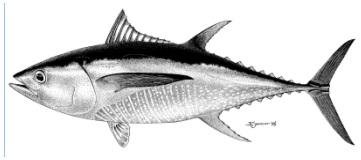


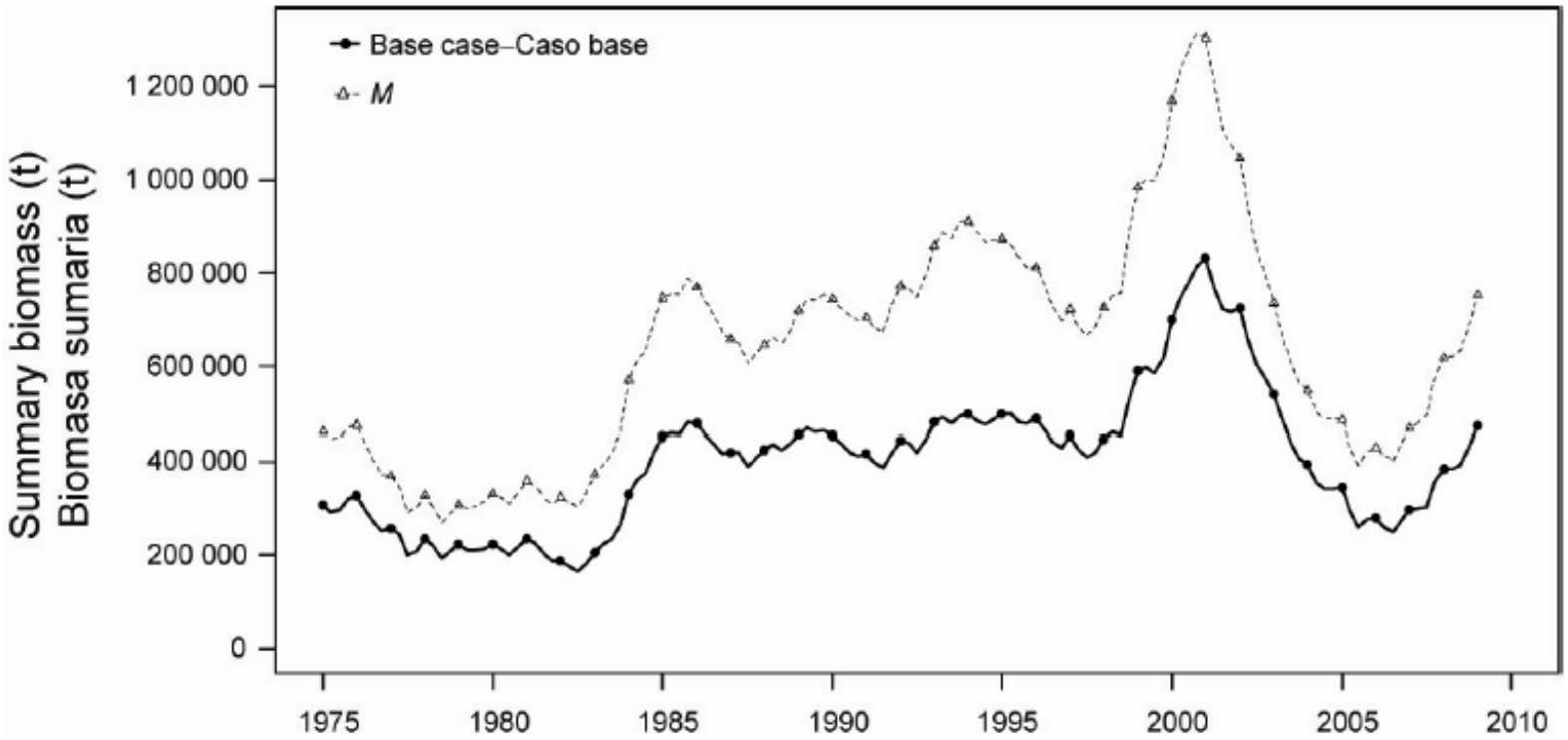


SAR 10 (2010)

Summary biomass

Sensitivities (*M*)





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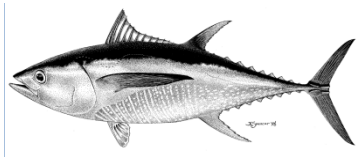
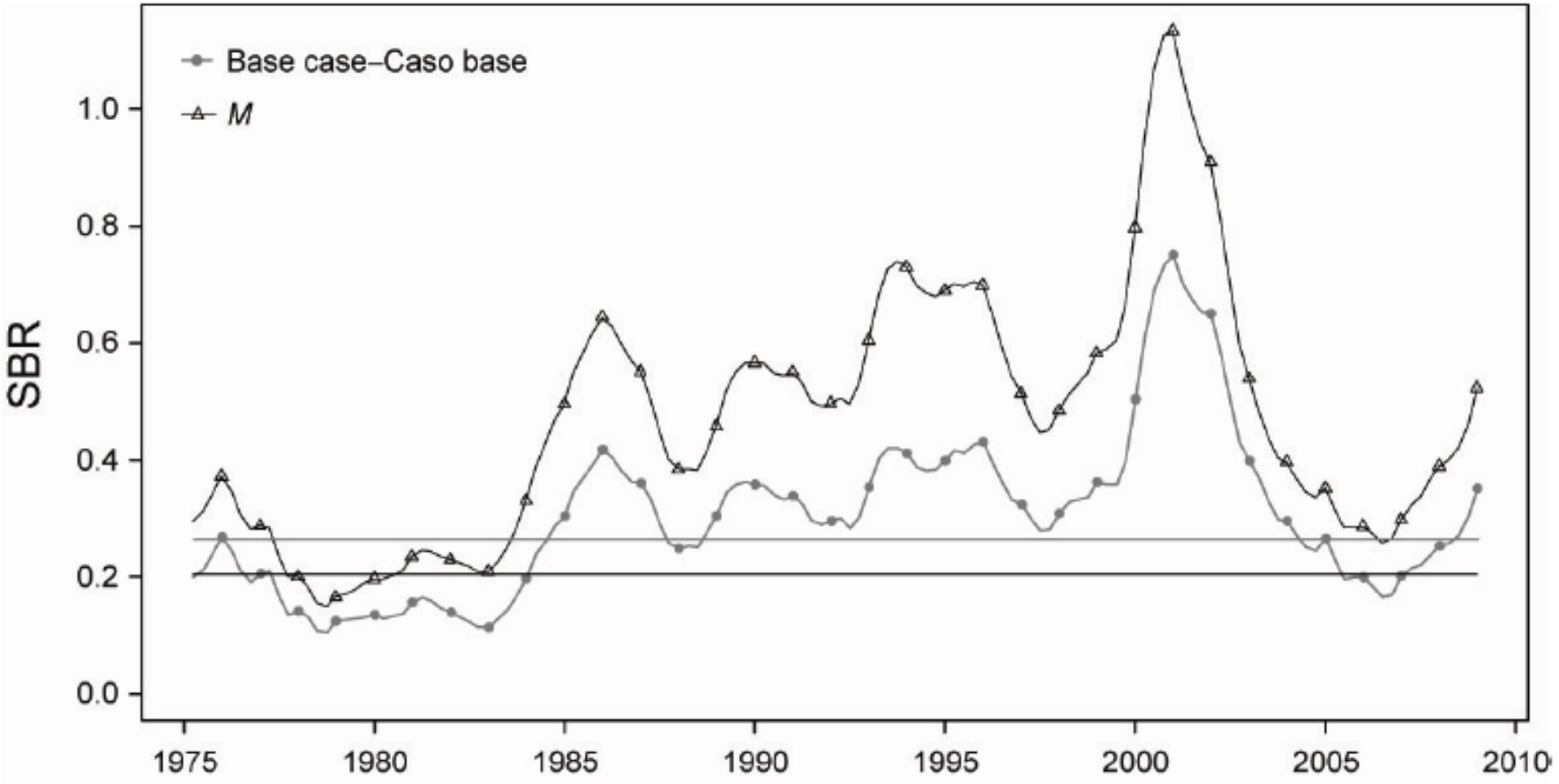
Spawning biomass ratio

Sensitivities (*M*)

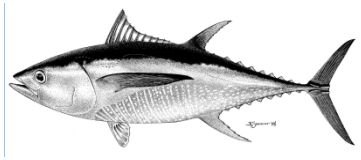




SAR 10 (2010)

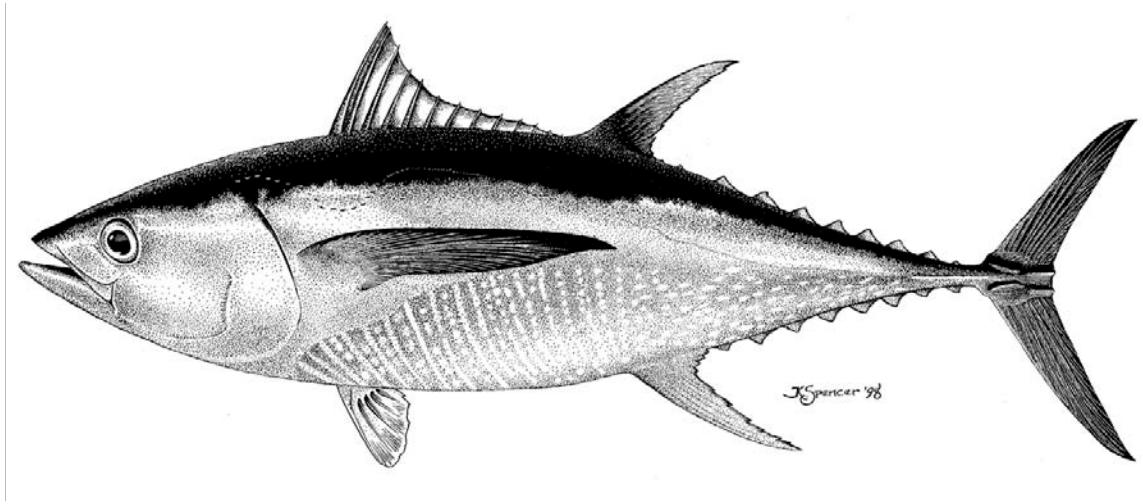
Management quantities

Sensitivities (*M*)



	Base case Caso base	Natural mortality Mortalidad natural
MSY–RMS	273,159	327,475
$B_{MSY} - B_{RMS}$	372,909	395,803
$S_{MSY} - S_{RMS}$	3,522	3,259
$C_{recent}/MSY - C_{recent}/RMS$	0.75	0.62
$B_{recent}/B_{MSY} - B_{recent}/B_{RMS}$	1.27	1.9
$S_{recent}/S_{MSY} - S_{recent}/S_{RMS}$	1.32	2.56
$S_{MSY}/S_{F=0} - S_{RMS}/S_{F=0}$	0.27	0.2
F multiplier—Multiplicador de *F*	1.09	2.27

SAR 10 (2010)

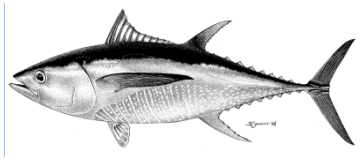


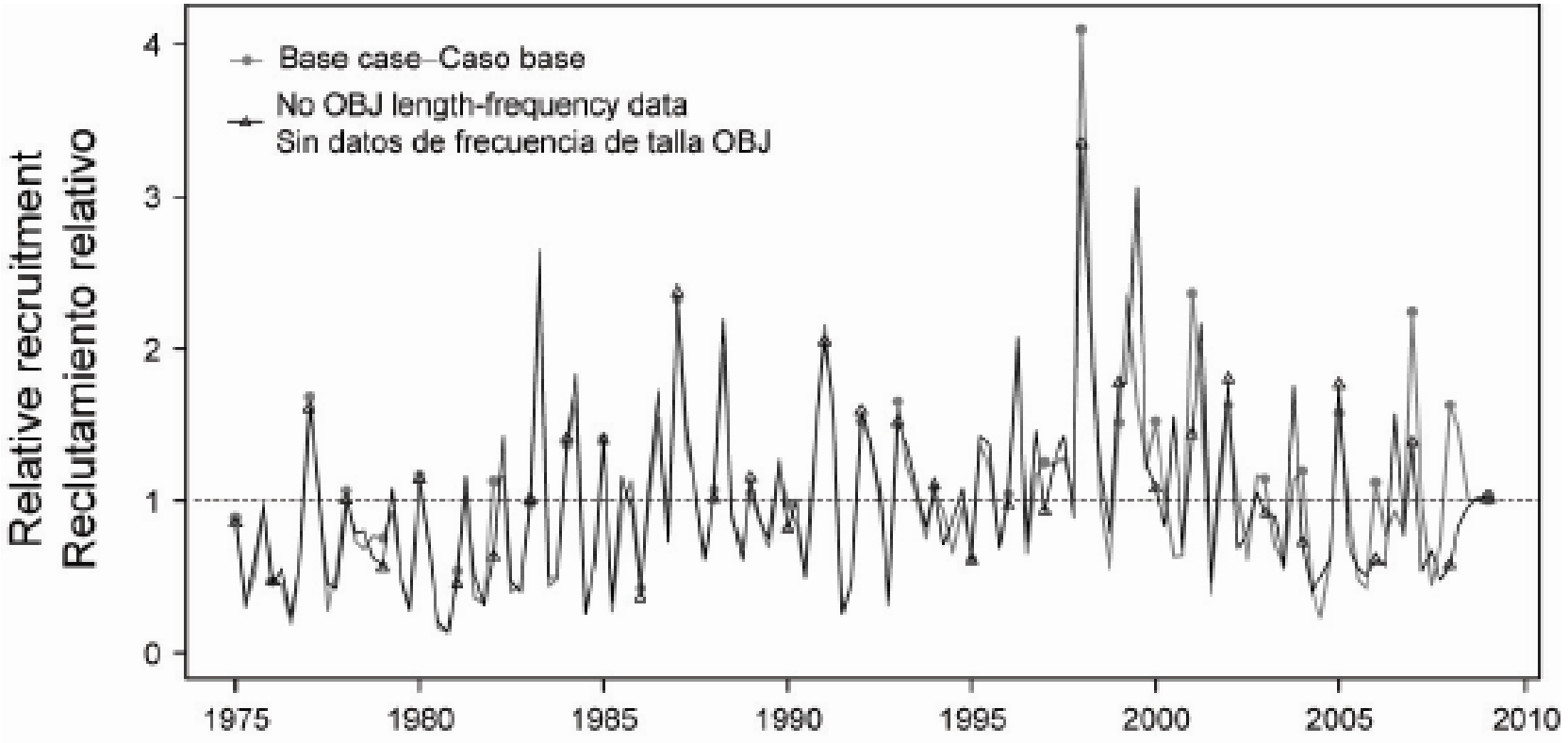
DATA SENSITIVITIES

Exclusion of OBJ length-composition data from the assessment

Recruitment

Sensitivities (drop OBJ)

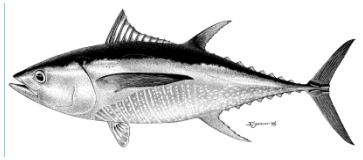


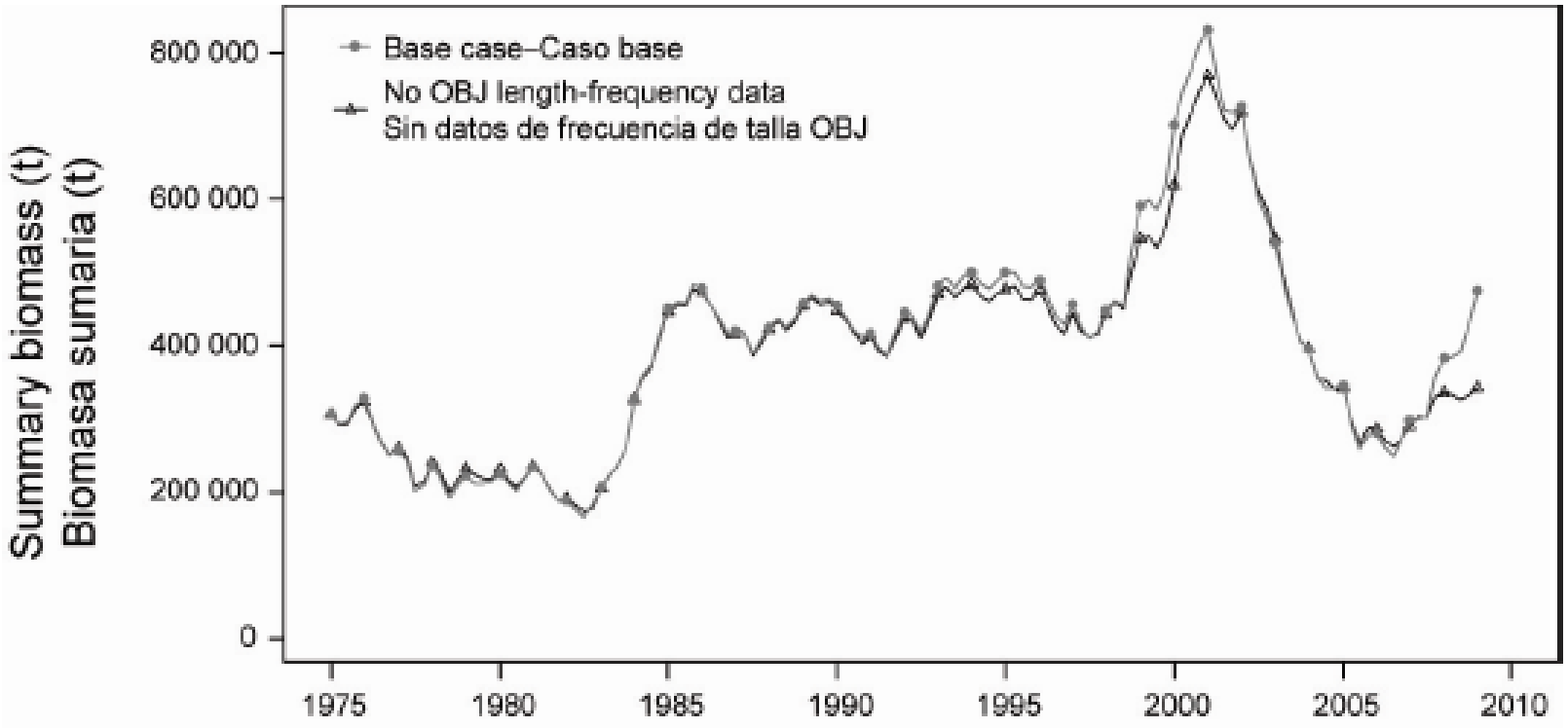


SAR 10 (2010)

Summary biomass

Sensitivities (drop OBJ)

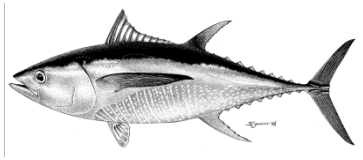


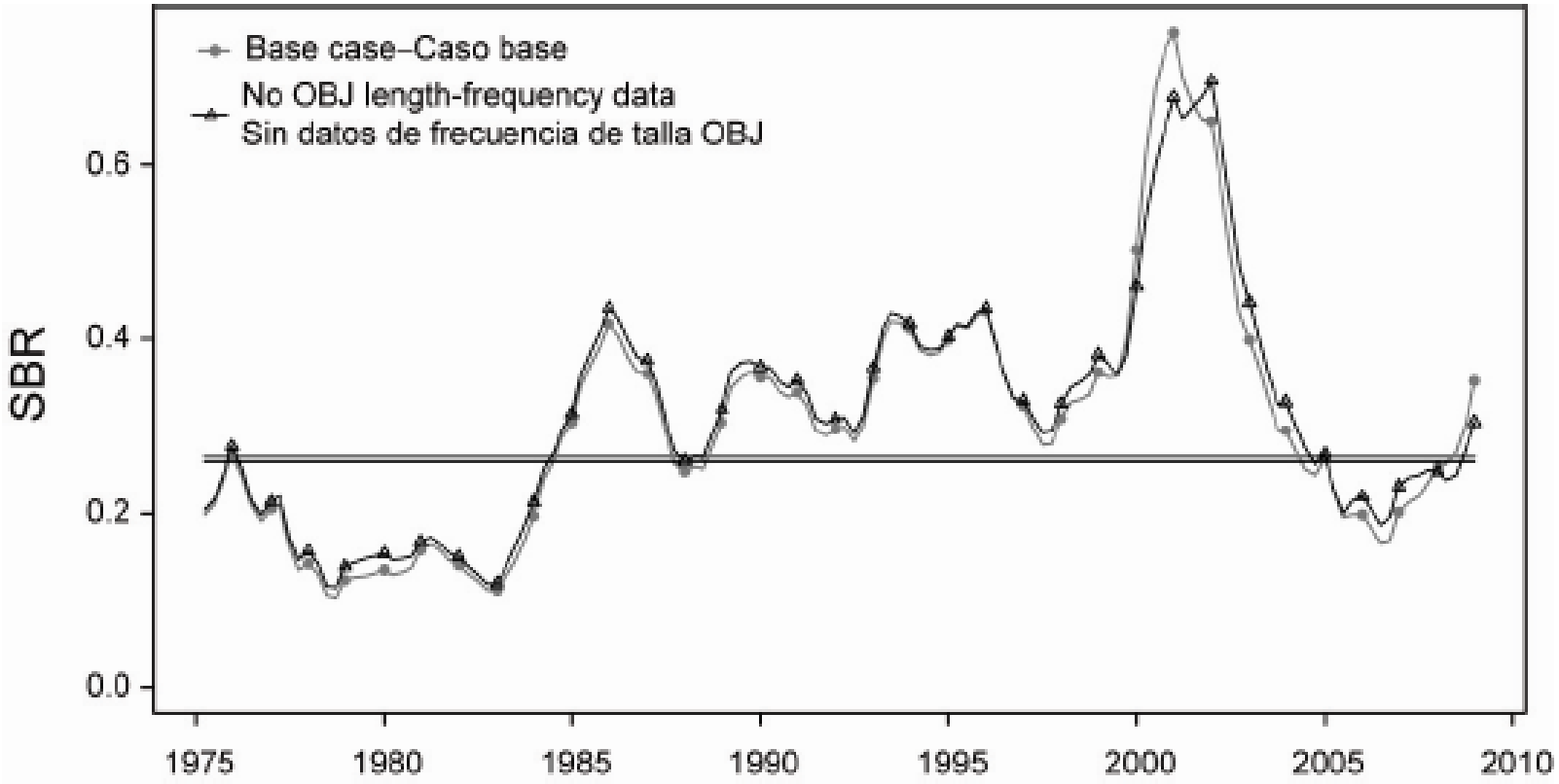


SAR 10 (2010)

Spawning biomass ratio

Sensitivities (drop OBJ)

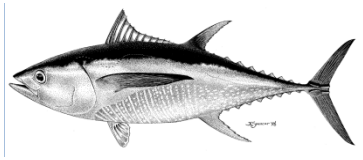




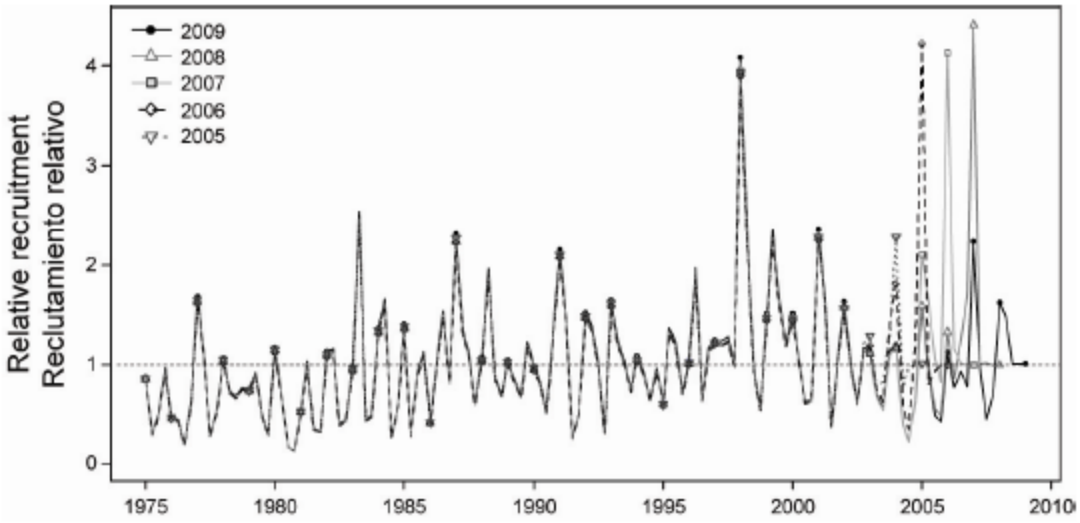
SAR 10 (2010)

Retrospective pattern

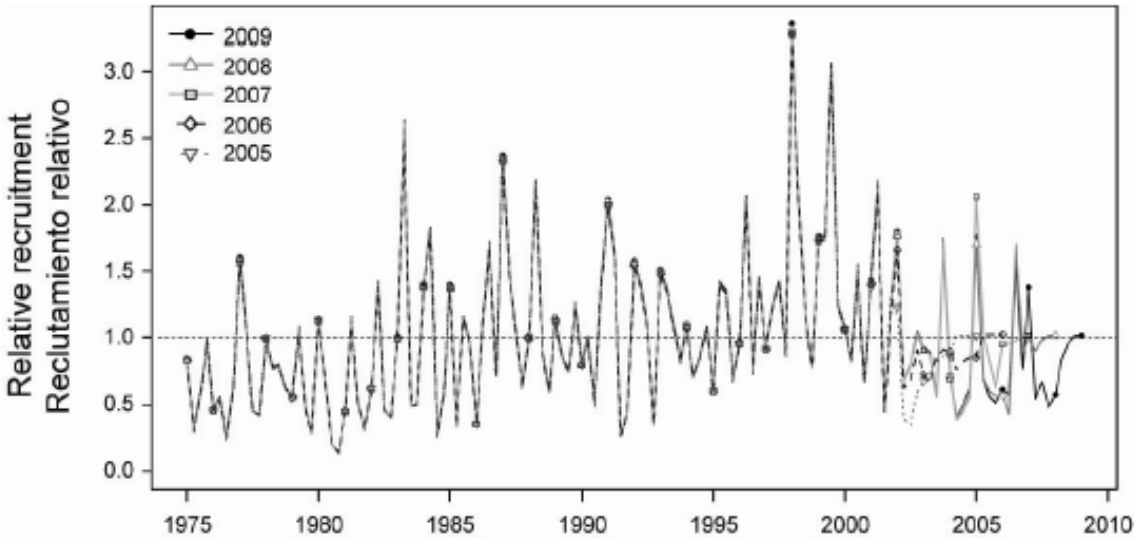
Sensitivities (drop OBJ)



Base case



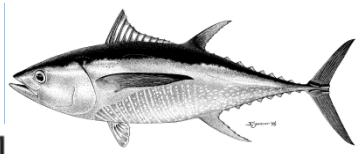
No OBJ



SAR 10 (2010)

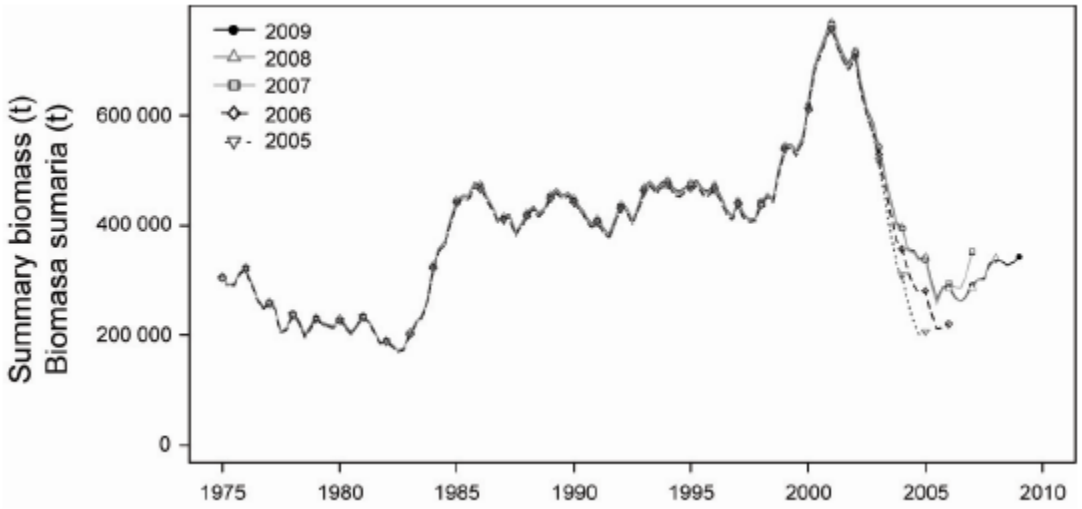
Retrospective pattern

Sensitivities (drop OBJ)



Base case

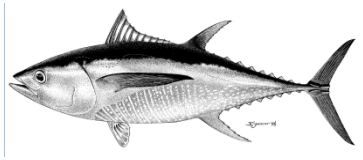
No OBJ



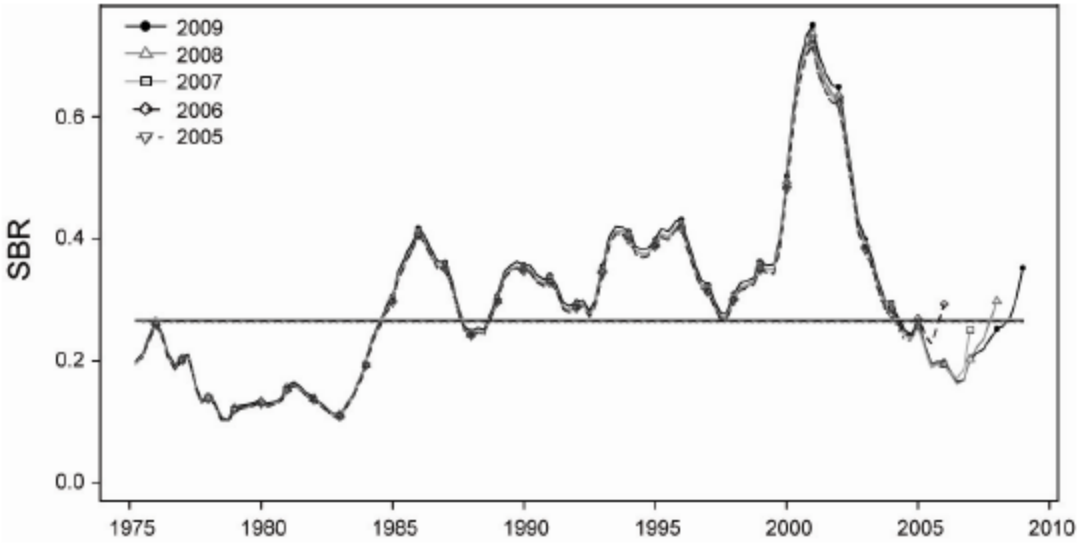
SAR 10 (2010)

Retrospective pattern

Sensitivities (drop OBJ)



Base case



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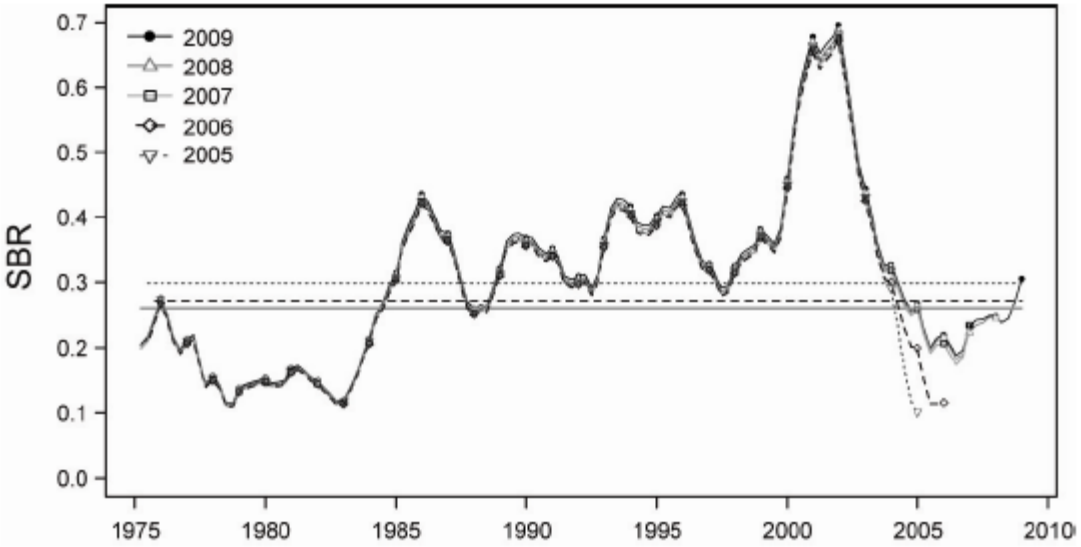

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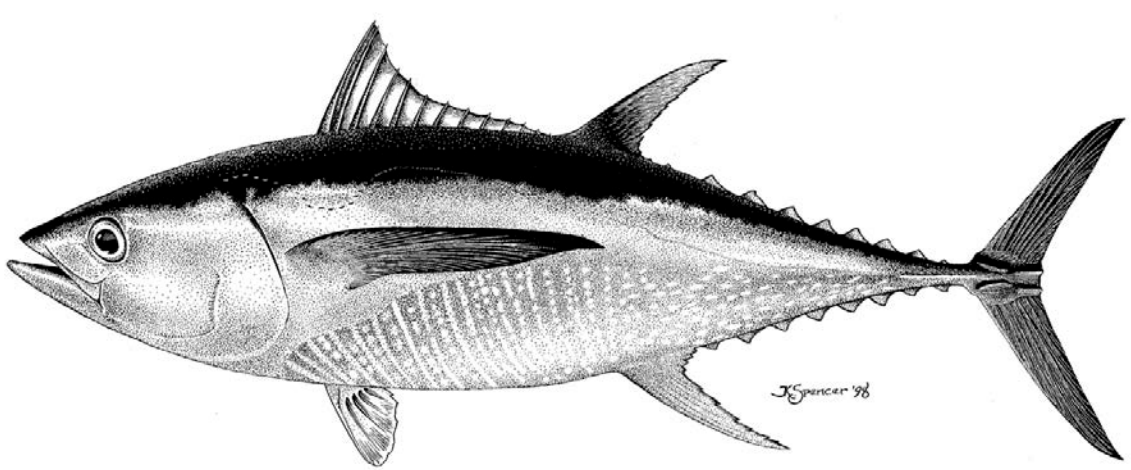


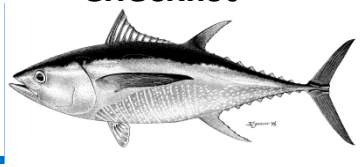
Other sensitivities

DOCUMENT YFT-01-08

A REVIEW OF HISTORICAL EPO YFT STOCK ASSESSMENT SENSITIVITY ANALYSES

Mark N. Maunder and Alexandre Aires-da-Silva

Checklist on main sensitivities



SAR	Assessment Year	Model	Reference	Sensitivities	Change in S/S_{MSY}	Change in Fmultiplier
1	2000	ASCALA	Maunder and Watters (2001) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR1_yelllowfin_ENG.pdf	None		
2	2001	ASCALA	Maunder and Watters (2002) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR2_yellowfin_ENG.pdf	h=0.75		
3	2002	ASCALA	Maunder (2002) http://www.iattc.org/PDFFiles/SAR3_YFT_ENG.pdf	h=0.75		
4	2003	ASCALA	Maunder and Harley (2004) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR4_YFT_ENG.pdf	a) h=0.7 b) Iterative reweighting of the length-frequency sample size c) Species-composition catch estimates d) Selectivity smoothness penalty weights used in previous assessments.	-21% -17% -2% -2%	-26% 13% 0% -2%
5	2004	ASCALA	Maunder and Harley (2005) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR5%20_YFT_ENG.pdf	h=0.75		
6	2005	ASCALA	Hoyle and Maunder (2006) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR6-YFT-ENG.pdf	h=0.75		

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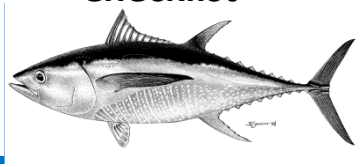
Checklist on main sensitivities

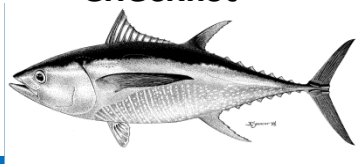


SAR	Assessment Year	Model	Reference	Sensitivities	Change in S/S_{MSY}	Change in Fmultiplier

7	2006	ASCALA	Hoyle and Maunder (2007) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR7-YFT-ENG.pdf	a) h=0.75;
				b) Linf = 170 cm
				c) Linf = 200 cm;
				d) Delta-lognormal standardized CPUE;
					-27%
					2%
					1%
					Small
						-33%
						2%
						2%
						Small

8	2007	ASCALA	Maunder (2008) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR8-YFT-ENG.pdf	h=0.75;		
9	2008	ASCALA	Maunder (2009) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR9-YFT-ENG.pdf	h=0.75;		
10	2009	SS3	Maunder and Aires-da-Silva (2010) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR10a-YFT-ENG.pdf	a) h=0.75; b) CPUE sds estimated; c) M for mature females and for mature males estimated and data on sex ratio included; d) Penalized age-specific parameters used for some selectivities; e) The maximum length is fixed at 175 cm, and the remaining three parameters of the Richards growth equation are estimated. The model is fit to age data from otoliths conditioned on length. f) Excluding the size-composition data for the floating-object fisheries from the analysis g) Change in selectivity for the floating-object fisheries	-46% -12% 94% -39% 26% Small Small	-38% -3% 108% -38% 28% Small Small

Checklist on main sensitivities



SAR	Assessment Year	Model	Reference	Sensitivities	Change in S/S_{MSY}	Change in Fmultiplier
				starting in 2001 due to Resolution C-00-08, which prohibited the discarding of yellowfin tuna resulting from sorting by size		
11	2010	SS3	Maunder and Aires-da-Silva (2011) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR-11-YFT-ENG.pdf	h=0.75		
12	2011	SS3	Aires-da-Silva and Maunder (2012) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR-12-YFTENG.pdf	a) h=0.75 b) L2 is fixed 170 cm c) L2 is fixed at 190 cm. d) Fitting to the CPUE of the northern dolphin-associated fishery as the main index of abundance, rather than the CPUE of the southern longline fishery. For this purpose, the CV fixed at 0.2, and the CVs of other fisheries are estimated.	-45% 45% -17% 38%	-37% 46% -17% 14%
13	2012	SS3	Aires-da-Silva and Maunder (2012) http://www.iattc.org/PDFFiles2/StockAssessmentReports/SAR-12-YFTENG.pdf	h=0.75		

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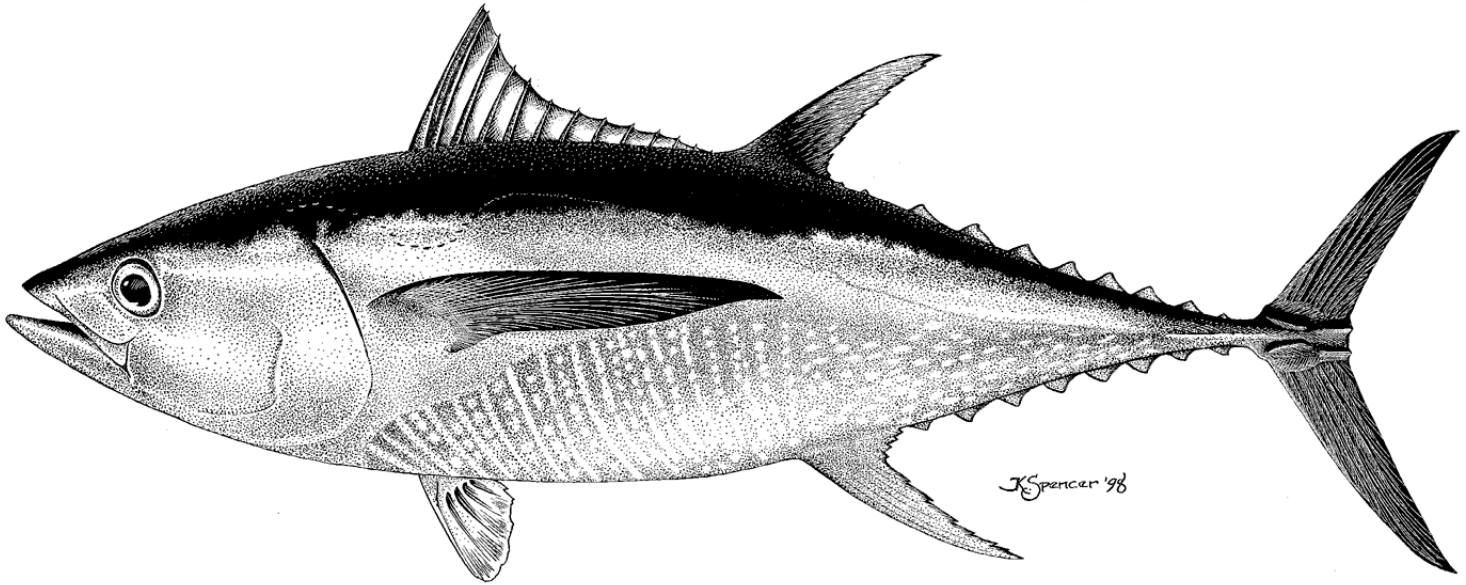
Questions?



Iterative reweighting of LF

Sensitivities
(I. reweight)

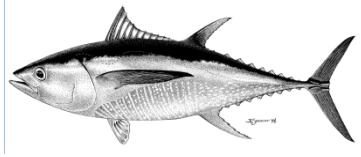


TABLE B.1. The average length-frequency sample size for yellowfin tuna for each fishery for the base case assessment and the sensitivity analysis using the iterative reweighting. The average scaling factor for the iterative reweighting is also given.

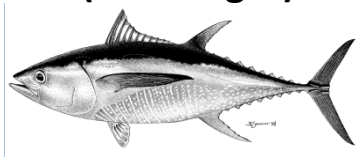
TABLA B.1. El tamaño de muestra de frecuencia de talla medio para atún aleta amarilla para cada pesquería en la evaluación de caso base y la análisis de sensibilidad usando reponderación iterativa. Se presenta también el factor de escala medio para la reponderación iterativa.

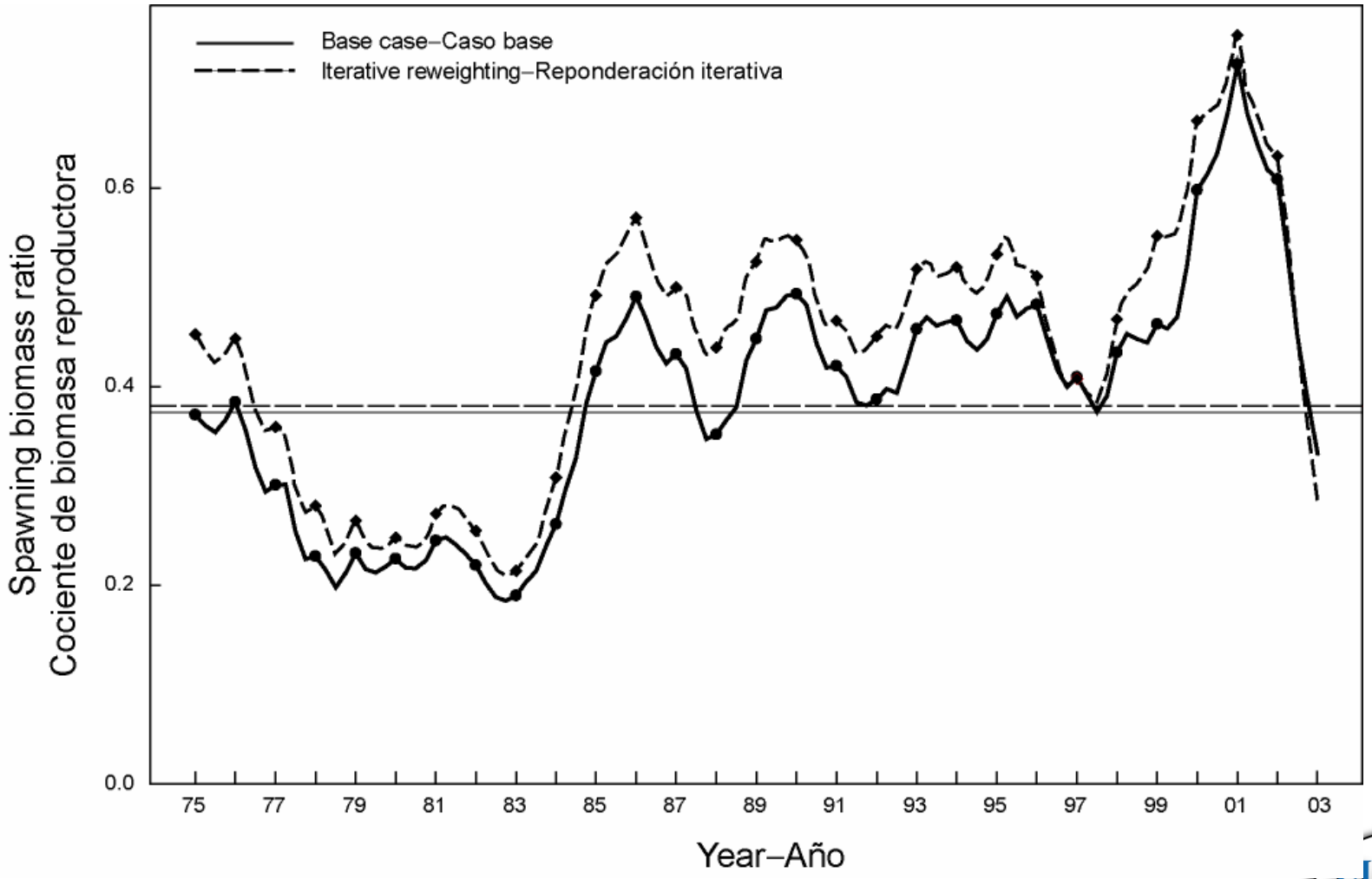
Fishery Pesquería	Base case Caso base	Reweighted Reponderado	Scaling factor Factor de escala
1	8.38	41.39	8.72
2	5.54	39.28	14.11
3	12.95	51.77	5.53
4	8.56	63.04	10.64
5	28.68	147.61	6.13
6	21.84	85.80	5.57
7	35.31	287.96	11.08
8	32.59	247.72	9.23
9	8.45	115.36	17.55
10	11.98	76.99	9.24
11	4.06	150.10	88.10
12	35.31	314.03	15.48

SAR 4 (2004)

Spawning biomass ratio

Sensitivities (I. reweight)

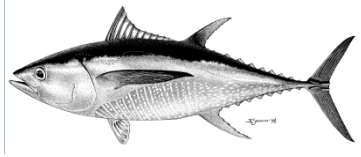


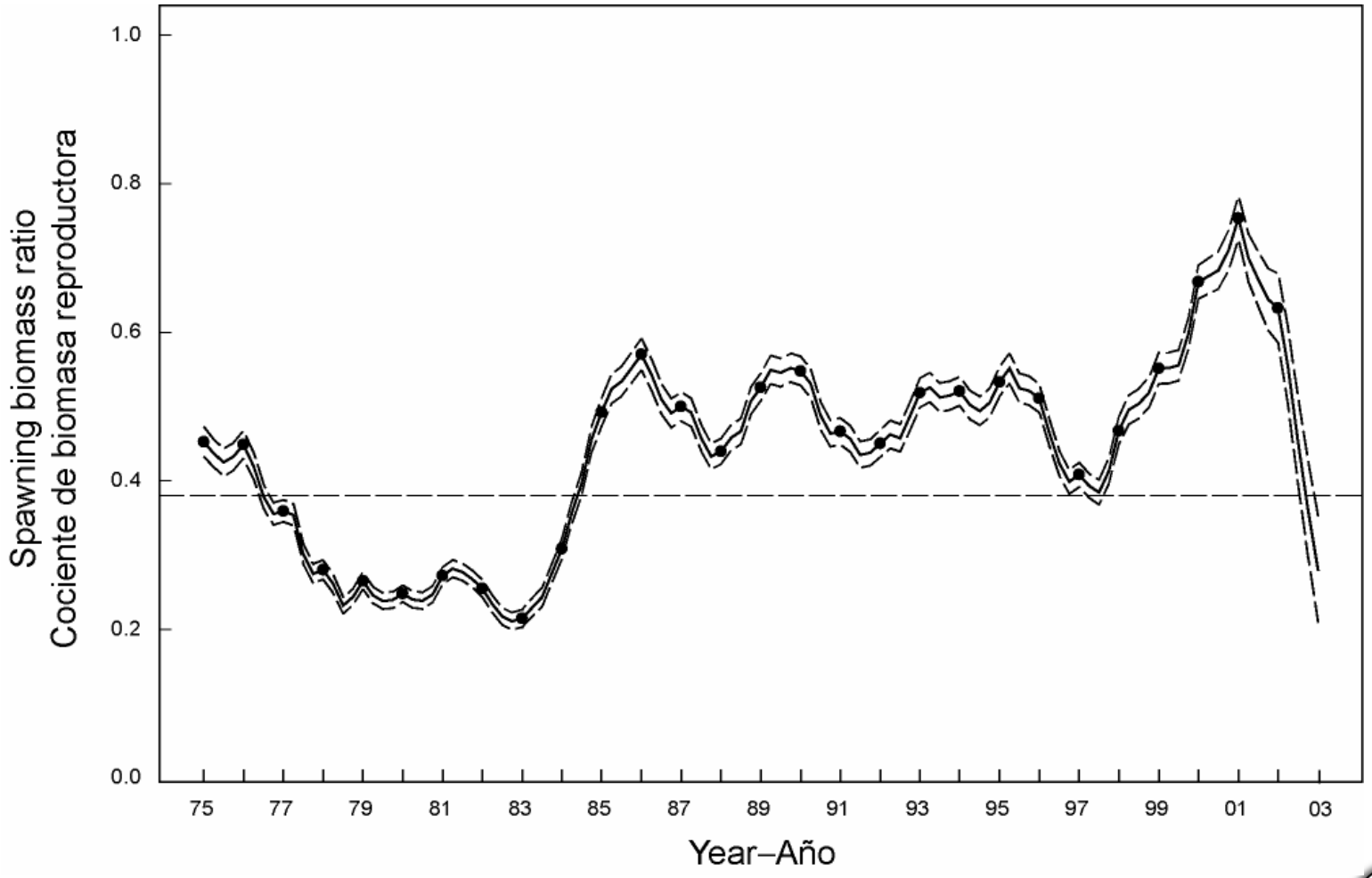


SAR 4 (2004)

Spawning biomass ratio

Sensitivities (I. reweight)

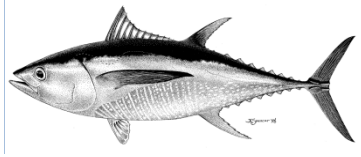




SAR 4 (2004)

Management quantities

Sensitivities (I. reweight)



	Base case	Iterative reweighting
	Caso base	Reponderación iterativa
AMSY–RMSP	254,723	250,750
B_{ms2} –B_{rm2}	381,775	377,686
S_{ms2}—S_{rm2}	6,010	5,990
C_{2002}/AMSY—C_{2002}/RMSP	1.72	1.76
B_{2003}/B_{AMSY} –B_{2003}/B_{RMSP}	0.89	0.74
S_{2003}/S_{AMSY} –S_{2003}/S_{RMSP}	0.89	0.74
$S_{AMSY}/S_{F=0}$ –$S_{RMSP}/S_{F=0}$	0.37	0.38
F multiplier—Multiplicador de F	1.20	1.36

SAR 4 (2004)