

SAC GFCM Sub-Committee on Stock Assessment

Date*

28	September	2010
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Code*

MUT0610Fer

Authors*

Fernández, A. M.

Affiliation*

I. E. O. Centro Oceanográfico de Murcia

Species Scientific name*

1 Source: GFCM Priority Species

2 Source: -

3 Source: -

Geographical area*

Western Mediterranean

Geographical Sub-Area (GSA)*

06 - Northern Spain

Combination of GSAs

1

2

3

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet #0 Basic data on the assessment

Code: MUT0610Fer

Date*	28	Sep	2010	Authors*	Fernández, A. M.
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Species Scientific name*	Mullus barbatus - MUT	Species common name*	Red mullet
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Data Source

GSA*	06 - Northern Spain	Period of time*	1998-2009
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Description of the analysis

Type of data*	Size composition of commercial catches, official landings and CPUE	Data source*	IEO, Fishermen Associations, Regional Autonomous Governments
Method of assessment*	Tuned VPA (XSA) Y/R analysis (pseudocohort)	Software used*	Lowestoft (Darby and Flatman, 1994) VIT (Leonart & Salat, 1997)

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	---	---	---	2	1	1	1	---	1	1	---

Comments, bibliography, etc.

<p>Abella, A., Caddy, J.F., Serena, F. (1997). Do natural mortality and availability decline with age? An alternative yield paradigm for juvenile fisheries, illustrated by the hake <i>Merluccius merluccius</i> fishery in the Mediterranean. <i>Aquat. Liv. Res.</i>, 10: 257–269.</p> <p>Caddy, J.F. (1991). Death rates and time intervals: is there an alternative to the constant natural mortality axiom? <i>Rev. Fish. Biol. Fish.</i>, 2: 109–138.</p> <p>Carbonell, A. (1997) Discards of the western Mediterranean trawl fleets. Final Report Contract DGXIV-MED/94/027, 142 pp.</p> <p>Darby, C.D. and Flatman, S., (1994). Virtual Population Análisis: version 3.1 (Windows/DOS) user guide. Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft, nº 1, 85 pp.</p> <p>Demestre M., M. Sbrana, F. Álvarez and P. Sánchez (1997) Analysis of the interactions of fishing gear in <i>Mullus barbatus</i> fisheries of the Western Mediterranean. <i>J. Appl. Ichthyol.</i>, 13: 49-56.</p> <p>Leonart J. and J. Salat (1997) VIT: Software for fishery analysis. User´s manual. FAO Computerized Information Series (Fisheries). Nº 11. Rome, FAO, 105 pp.</p> <p>García-Rodríguez M. and Fernández A.M. .2005. Influencia de la geometría de la malla del copo en las captura,selectividad y rendimientos de algunas especies de peces comerciales en el Golfo de Alicante (SE de la península Ibérica). <i>Inf.Tec.Ins.Esp.Oceanogr.</i> 185.</p>
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Comments, bibliography, etc.

Lombarte A., L. Recasens, M. González and L. Gil de Sola (2000) Spatial segregation of two species of Mullidae (*Mullus surmuletus* and *M. barbatus*) in relation to habitat. *Mar. Ecol. Prog. Ser.*, 206: 239-249.

Martín P., P. Sartor and M. García-Rodríguez (1999) Exploitation patterns of the European hake *Merluccius merluccius*, red mullet *Mullus barbatus* and striped red mullet *Mullus surmuletus* in the western Mediterranean. *J. Appl. Ichthyol.*, 15: 24-28.

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet B Biology of the species

Code: MUT0610Fer

Biology	Somatic magnitude measured (LH, LC, etc)*			Total length	Units*	cm
	Sex	Fem	Mal	Both	Unsexed	
Maximum size observed					28.5 (1)	Reproduction season May-July
Size at first maturity					12.2 (2)	Reproduction areas Continental shelf (4)
Recruitment size					7.8 (3)	Nursery areas Coastal areas

Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L_{∞}				34.5 (5)	
	K				0.34	
	t_0				-0.143	
	Data source					
Length weight relationship	a				0.00624	
	b				3.1597	
	M				0.4 (6)	
	sex ratio (mal/fem)					

Comments

- (1) Size composition of trawl catches in GSA06.
- (2) From the Spanish DCR National Programme
- (3) García-Rodríguez, M. and Fernández, A.M .2005.
- (4) Lombarte, A.; L. Recasens; M. González and L. Gil de Sola (2000)
- (5) Growth parameters adopted in the SGMED-08-03 meeting.
- (6) Vector of M by size class calculated from Caddy (1991) equation using the PROBIOM Excel spreadsheet (Abella et al., 1997) and transformed to a M at age vector by VIT program:
- | | |
|------|------|
| Age | M |
| 0 | 0.99 |
| 1 | 0.46 |
| 2 | 0.30 |
| 3 | 0.24 |
| 4 | 0.21 |
| 5 | 0.20 |
| Mean | 0.40 |

Comments

Alternative analysis was also done using the following parameters:

Linf = 26.0; K = 0.41; t0 = -0.4 (SGMED-08-03 slow growth)

Age	M	From PROBIOM (M. barbatus assessment GSA7 2009, IFREMER-IEO)
0	0.64	
1	0.43	
2	0.27	
3	0.18	
4	0.15	
5	0.12	
6	0.10	
7	0.10	
Mean	0.25	

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet P1 General information about the fishery

Code: MUT0610Fer

Data source*	Size composition of trawl catches from IEO and Spa	Year (s)*	1998-2009
Data aggregation (by year, average figures between years, etc.)*	by year for XSA analysis and average 1998-2009 for Y/R analysis		

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	06	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	MUT
Operational Unit 2						
Operational Unit 3						
Operational Unit 4						
Operational Unit 5						

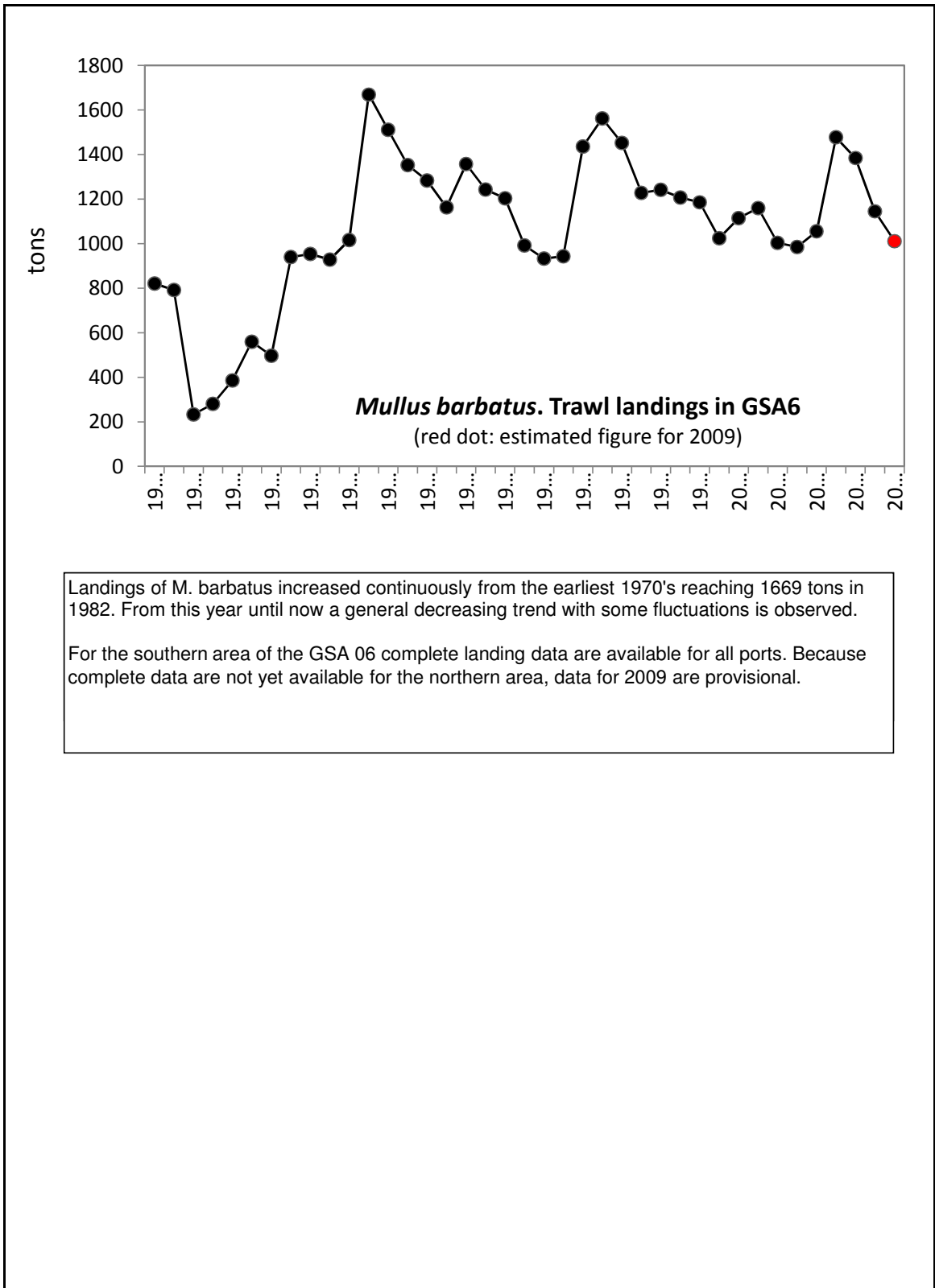
Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ESP 06 E 03 33 - MUT	723	Tons	1146	See sheet P2b	No		days fishing
Total	723		1146				

Legal minimum size	11 cm total length
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Comments

<p>Fleet (n° of boats) refers to the average number of trawlers fishing in GSA-06 between 1998-2009.</p> <p>Catch refers to the average trawl landings during the period 1998-2009.</p> <p>Discards are not significant (Carbonell, 1997).</p>
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Comments



Landings of *M. barbatus* increased continuously from the earliest 1970's reaching 1669 tons in 1982. From this year until now a general decreasing trend with some fluctuations is observed.

For the southern area of the GSA 06 complete landing data are available for all ports. Because complete data are not yet available for the northern area, data for 2009 are provisional.

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet P2a Fishery by Operational Unit

Code: MUT0610Fer

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Data source*	OpUnit 1*	ESP 06 E 03 33 - MUT
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Time series

Year*	1998	1999	2000	2001	2002	2003
Catch	1207	1185	1025	1115	1159	1004
Minimum size	5	5	6	5	5	6
Average size Lc	12.4	11.8	12.8	12.4	12.4	13.1
Maximum size	26	28	26	26	26	26
Fleet	810	797	774	760	757	738

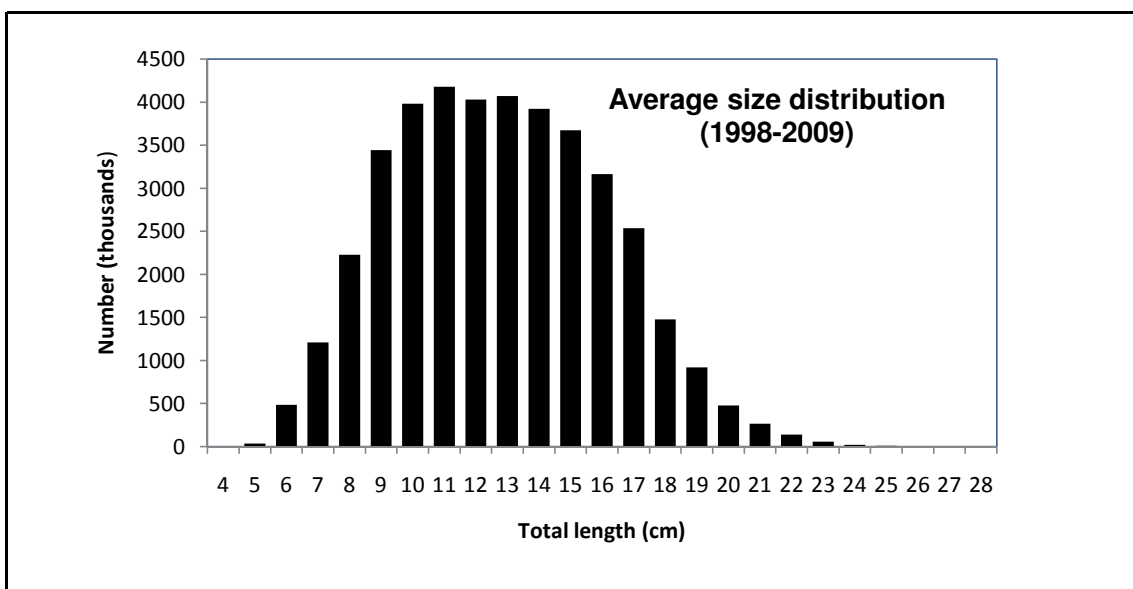
Year	2004	2005	2006	2007	2008	2009
Catch	985	1055	1477	1384	1145	1011
Minimum size	6	6	5	5	5	5
Average size Lc	12.8	12.8	13.2	12.4	13	14.7
Maximum size	26	27	28	28	27	27
Fleet	729	722	716	691	624	567

Selectivity

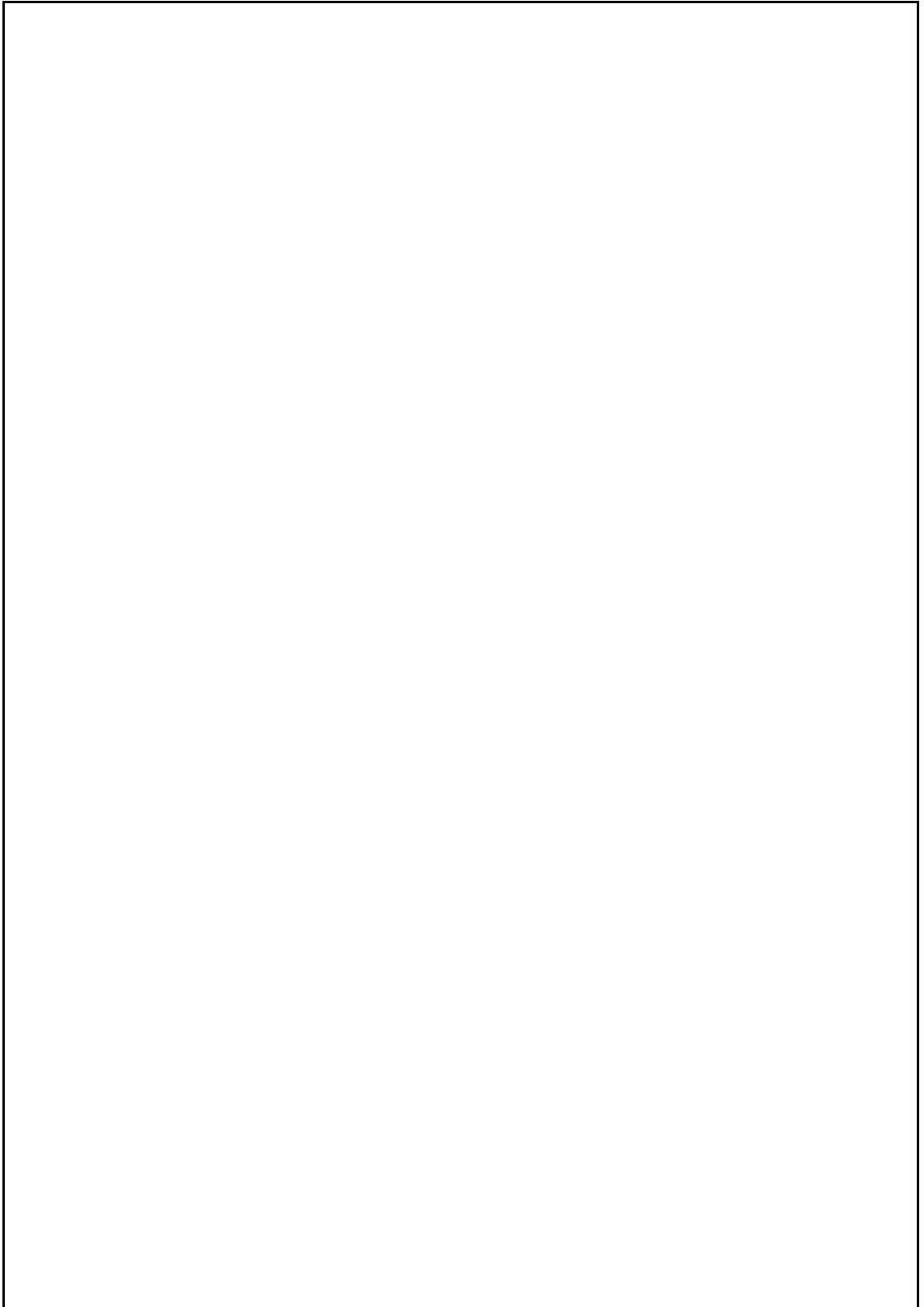
Remarks

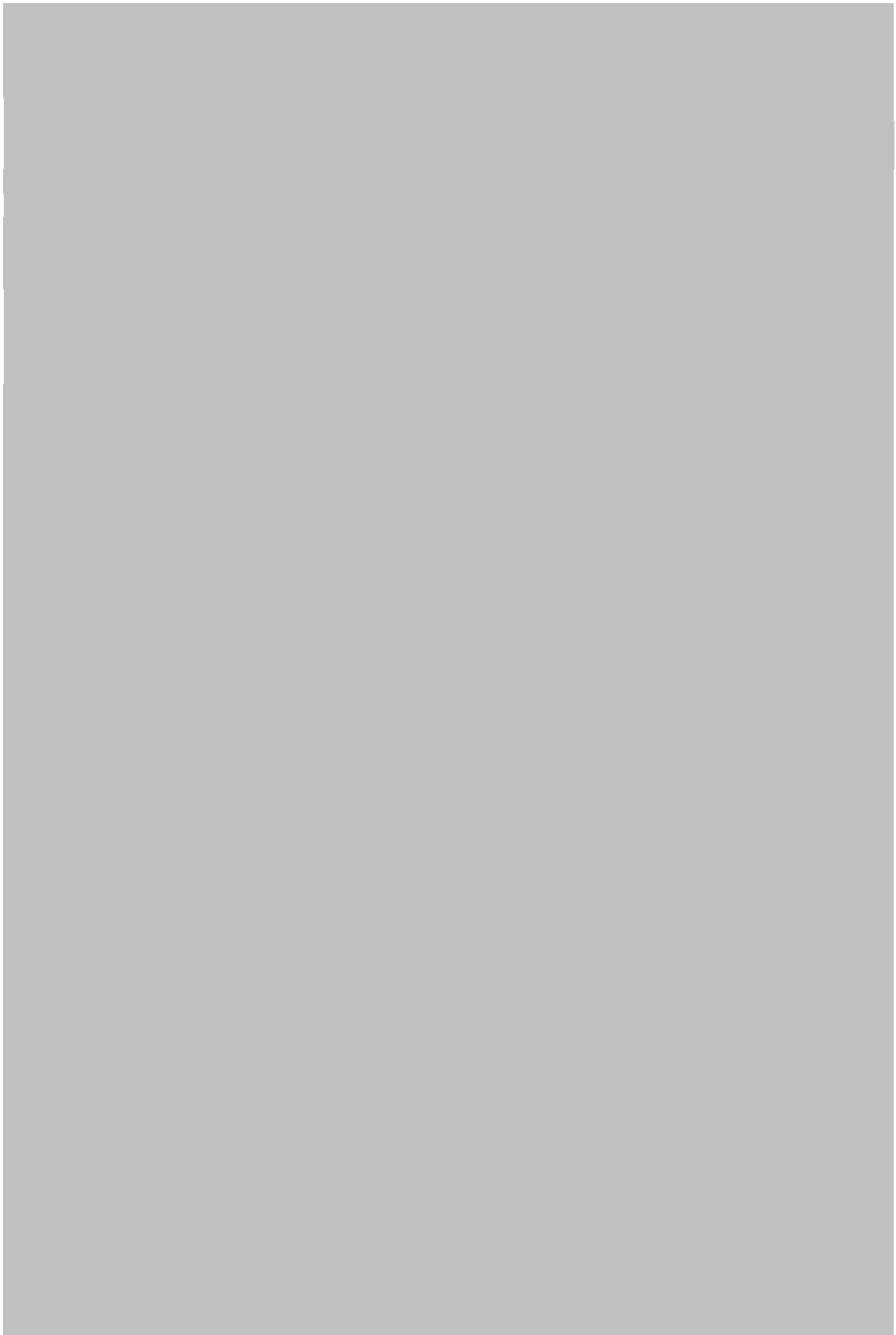
L25	6.9	Selectivity parameters for 40 mm diamond mesh in the cod-end (García-Rodríguez and Fernández, 2005).
L50	7.8	
L75	8.9	
Selection factor	1.95	

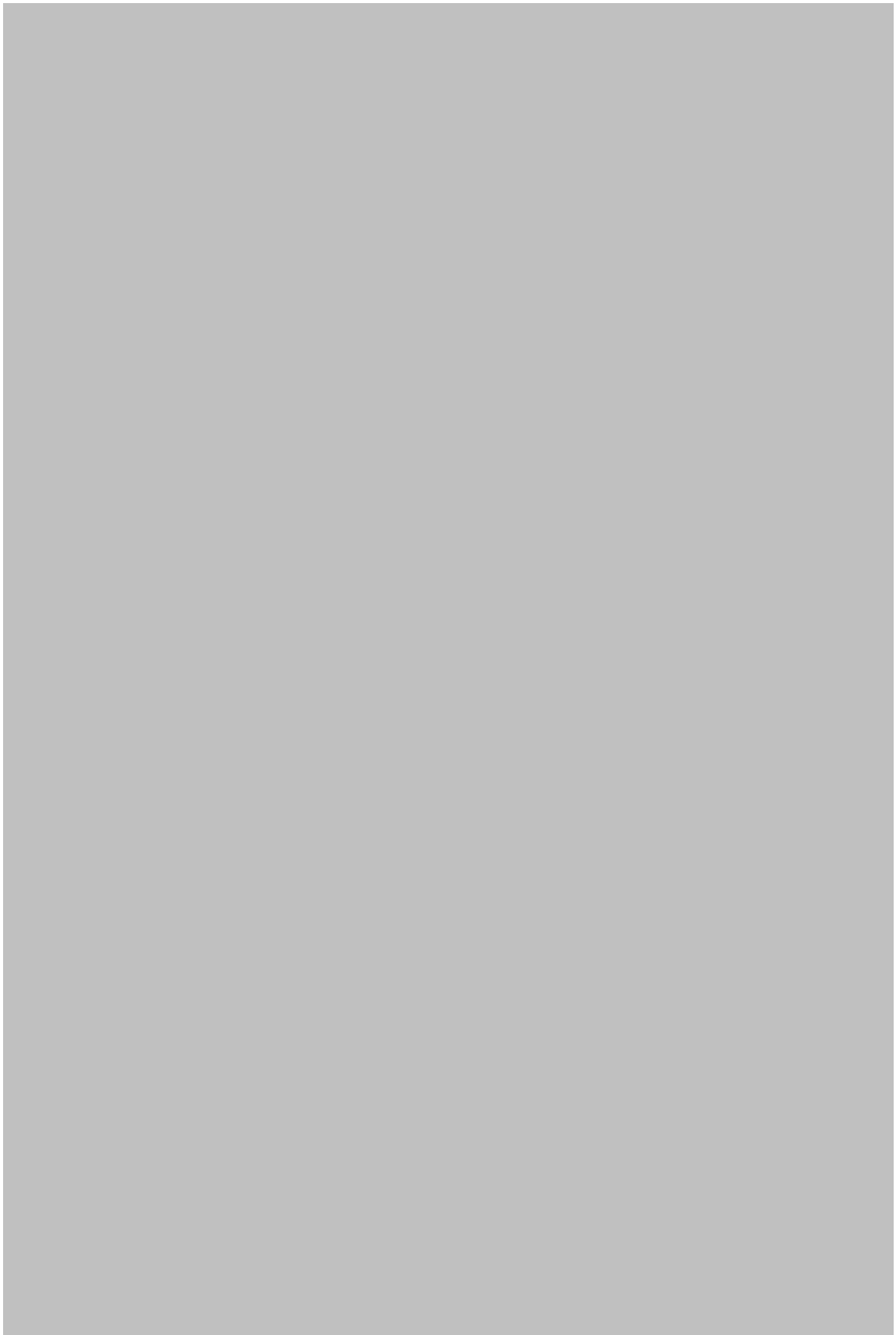
Structure by size or age

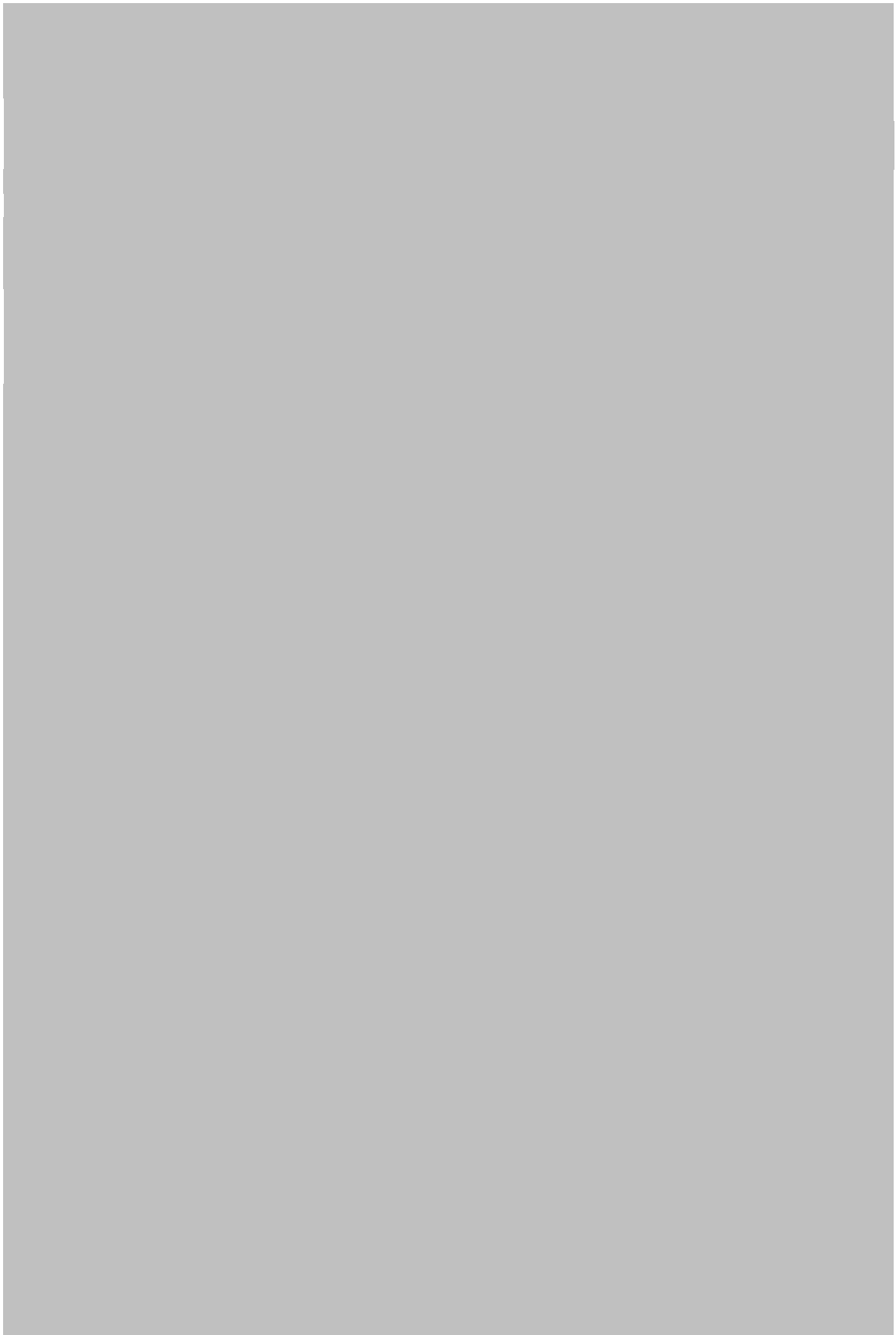


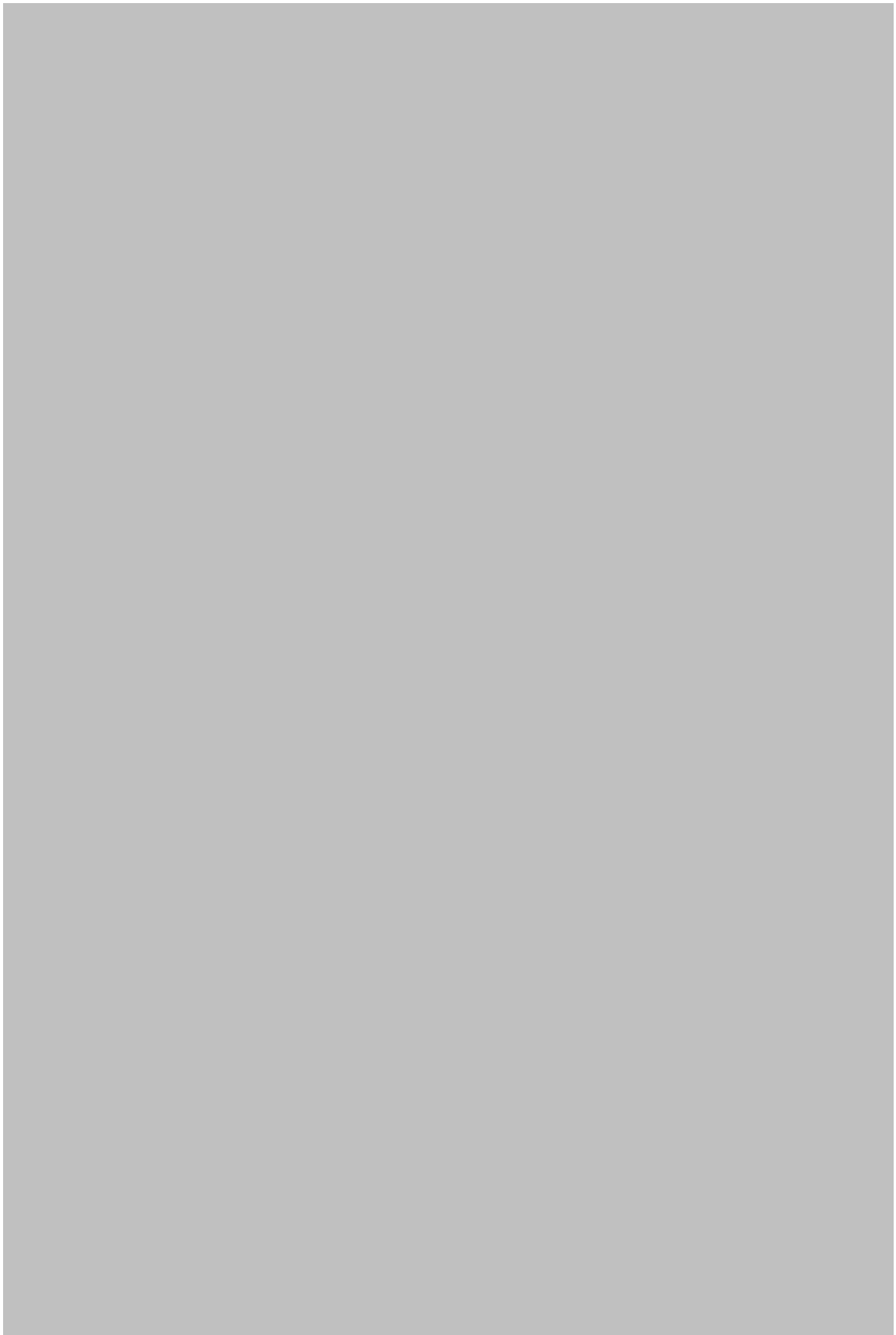
Structure by size or age

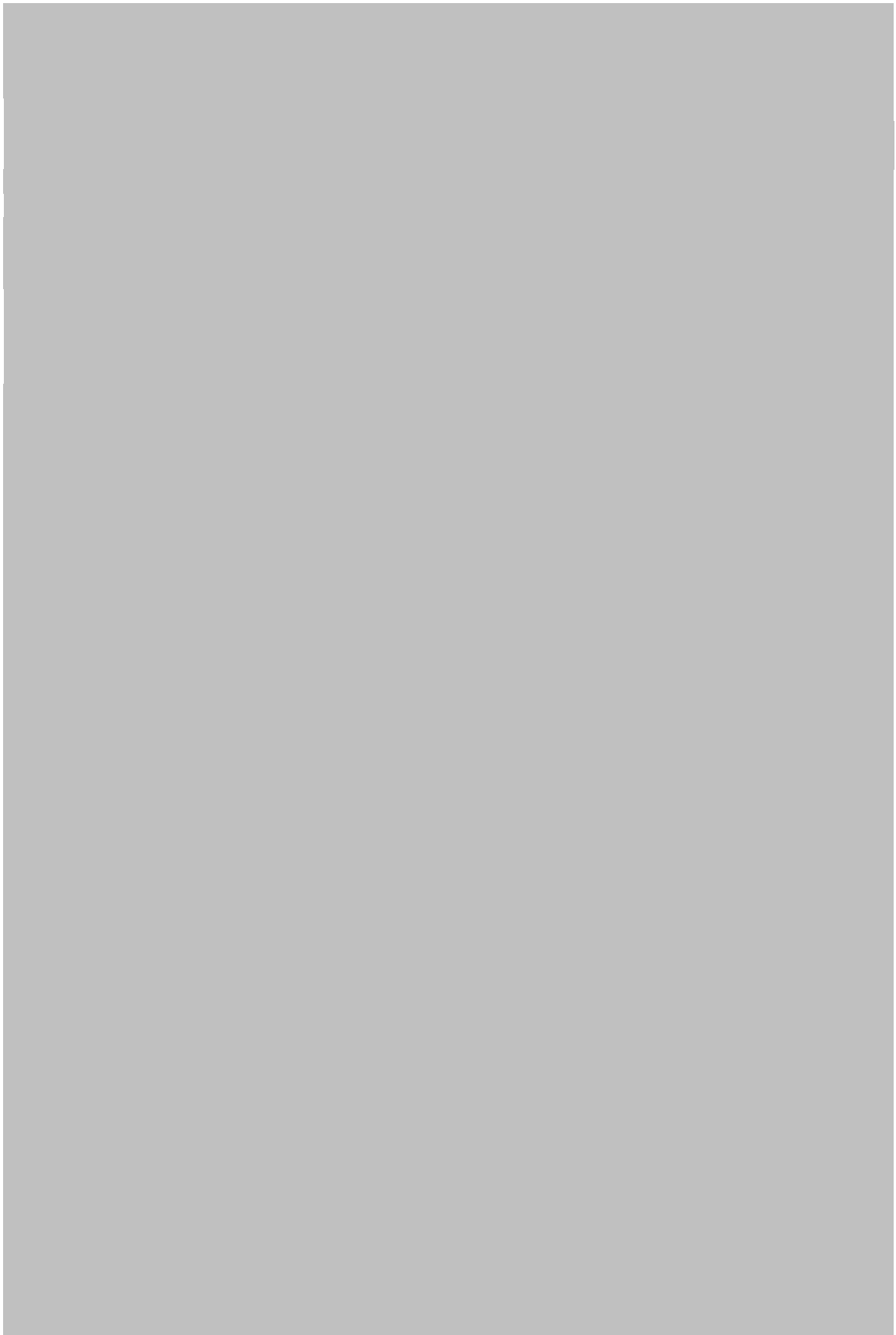
A large, empty rectangular box with a thin black border, occupying most of the page. It is intended for a drawing or diagram related to the section header 'Structure by size or age'.

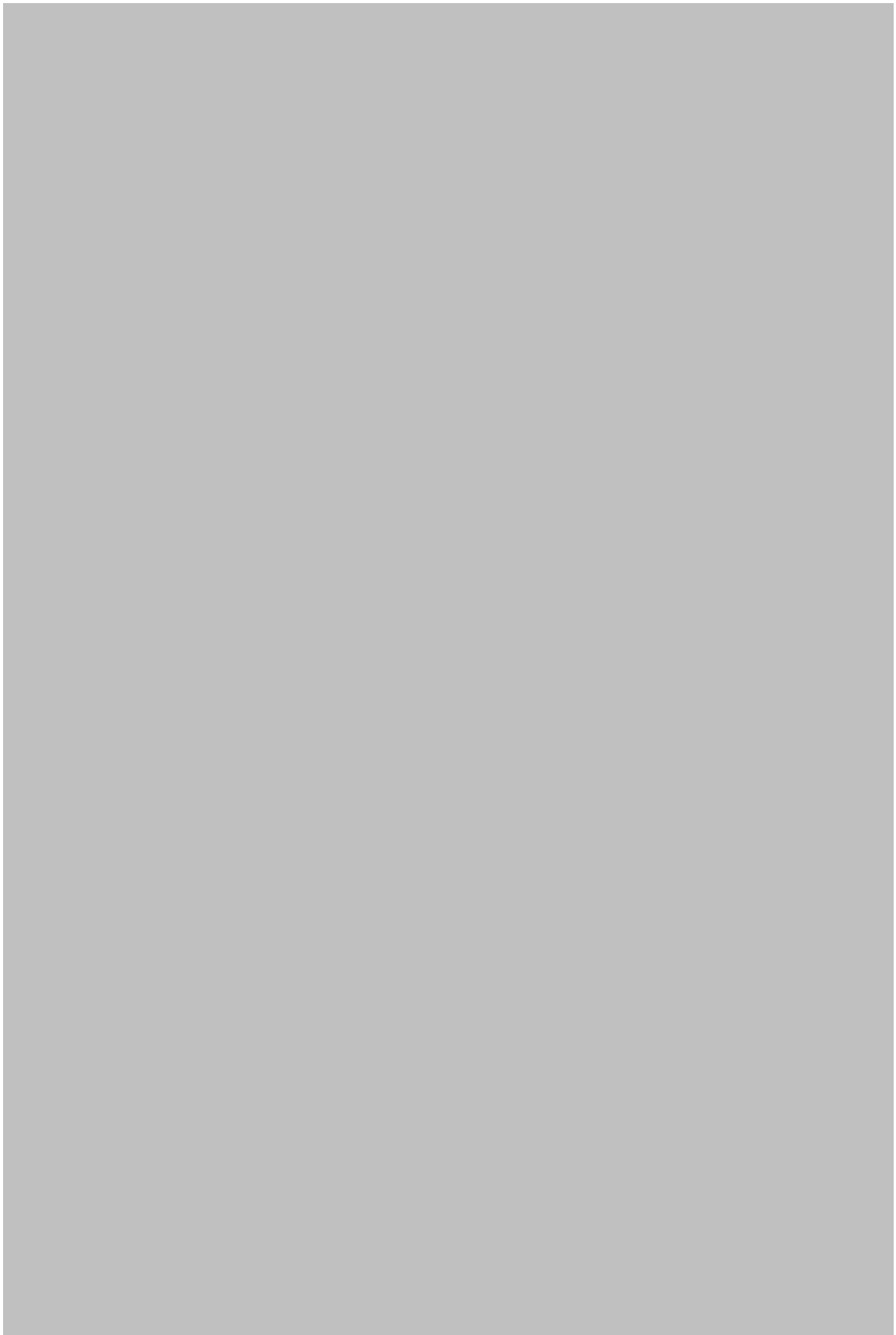












SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet A1 Indirect methods: VPA, LCA

Sex*	both
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Code: MUT0610Fer
Page 1 / 2

Time series

Analysis # *	1
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Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used	Catch equation	Tunig method	XSA
# of gears	1	Software	Lowestoft VPA suite (Darby & Flatman, 1994)
F _{terminal}	1.3		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	132.1 (2)	
Average			Average population		3097 (2)
Maximum			Virgin population		
Critical			Turnover		SSB (2)
					730
				x 10**6	in tons

Average mortality

	Total	Gear				
F ₁	0.768					
F ₂	0.1009					
Z	1.168					

(F1 and F2 represent different possible calculations. Please state them)

Comments

(1) F terminal from previous separable VPA
 (2) average 1998-2009
 F1 is the average Fbar 0-2 (1998-2009)
 F2 is the mean F at age 0 (1998-2009)
 Z=0.4+F1

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet A1 Indirect methods: VPA, LCA

Sex*	Both
------	------

Code: MUT0610Fer
Page 2 / 2

Time series

Analysis # *	2
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Data	Size	Age
(mark with X)	X	

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Catch equation	Tunig method	
# of gears	1	Software	VIT (Leonart & Salat, 1997)
F _{terminal}	1.3		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	97.6	
Average	9.7	0.86	Average population		
Maximum			Virgin population		11500
Critical	13	1.25	Turnover		
				x 10**6	tons

Average mortality

	Total	Gear				
F ₁	0.942					
F ₂						
Z	1.342					

(F1 and F2 represent different possible calculations. Please state them)

Comments

F1 is the arithmetic mean of F calculated along the different size classes
Z=F1+0.4

Code: MUT0610Fer
Page 3 / 2

Sex*	
------	--

Analysis # *	
--------------	--

Time series

Data	Size	Age
(mark with X)		

Model	Cohorts	Pseudocohorts
(mark with X)		

Equation used		Tunig method	
# of gears		Software	
F _{terminal}			

Population results (please state units)

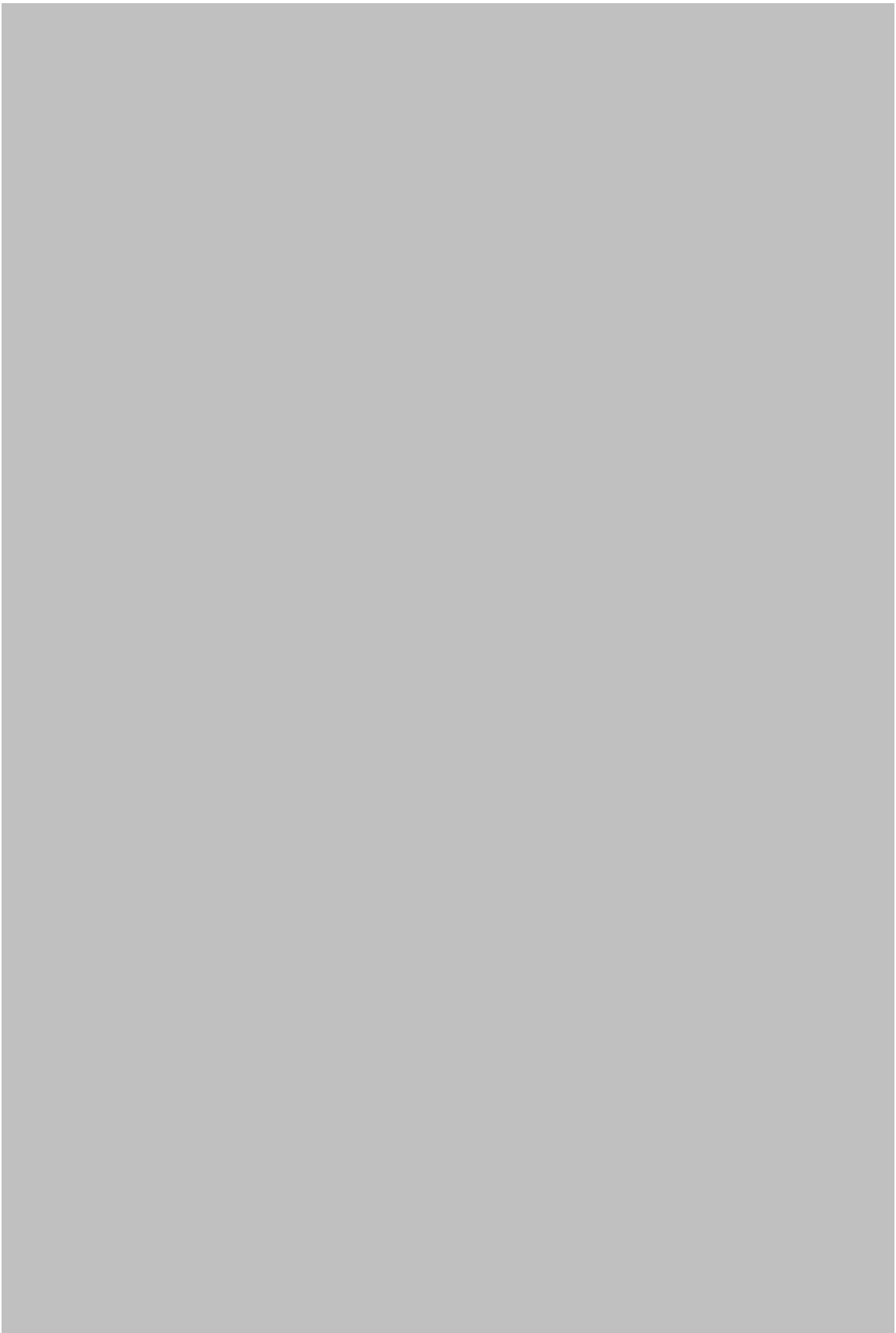
	Sizes	Ages		Amount	Biomass
Minimum			Recruitment		
Average			Average population		
Maximum			Virgin population		
Critical			Turnover		

Average mortality

	Total	Gear				
F ₁						
F ₂						
Z						

(F1 and F2 represent different possible calculations. Please state them)

Comments



SAC GFCM - Sub-Committee on Stock Assessment (SCSA)

Assessment form

Sheet A2

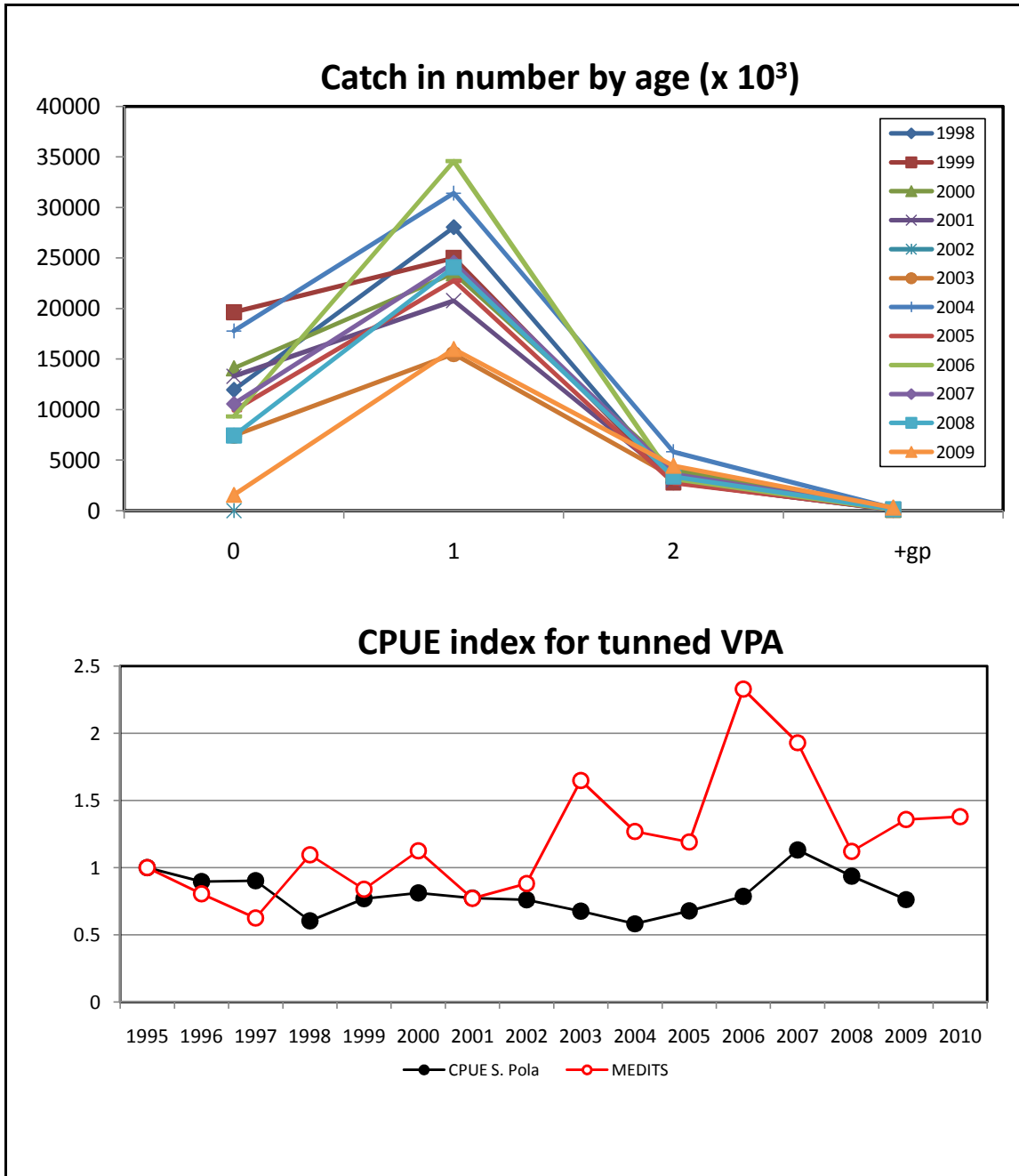
Indirect methods: data

Code: MUT0610Fer

Sex*	Both	Gear*	Trawl	Analysis # *	1
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Data	
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Data



SAC GFCM - Sub-Committee on Stock Assessment (SCSA)

Assessment form

Sheet A3

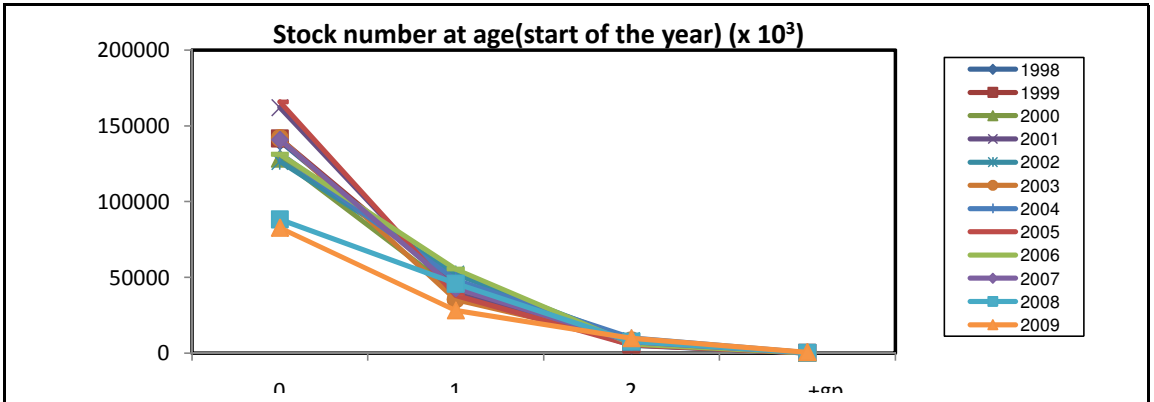
Indirect methods: VPA results

Code: MUT0610Fer

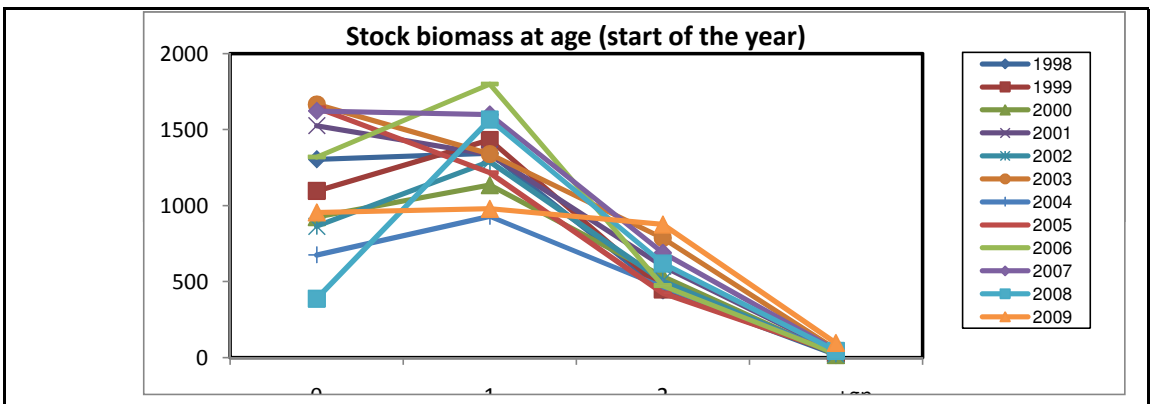
Page 1 / 1

Sex*	Both	Gear*	Trawl	Analysis #*	1
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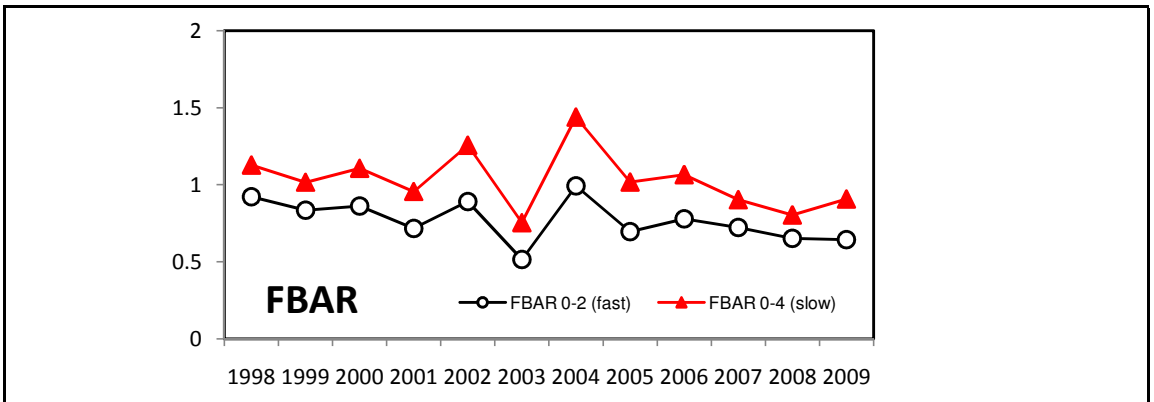
Population in figures



Population in biomass



Fishing mortality rates



SAC GFCM - Sub-Committee on Stock Assessment (SCSA)

Assessment form

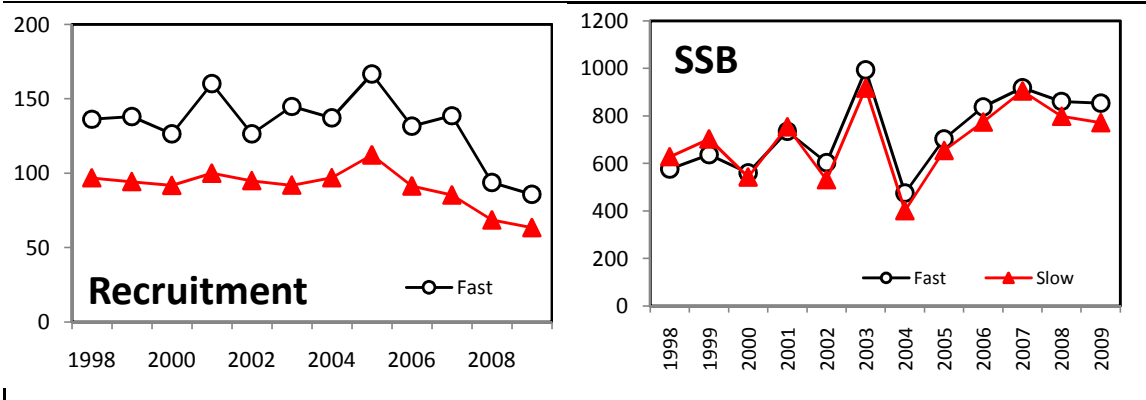
Sheet A3
Indirect methods: VPA results

Code: MUT0610Fer

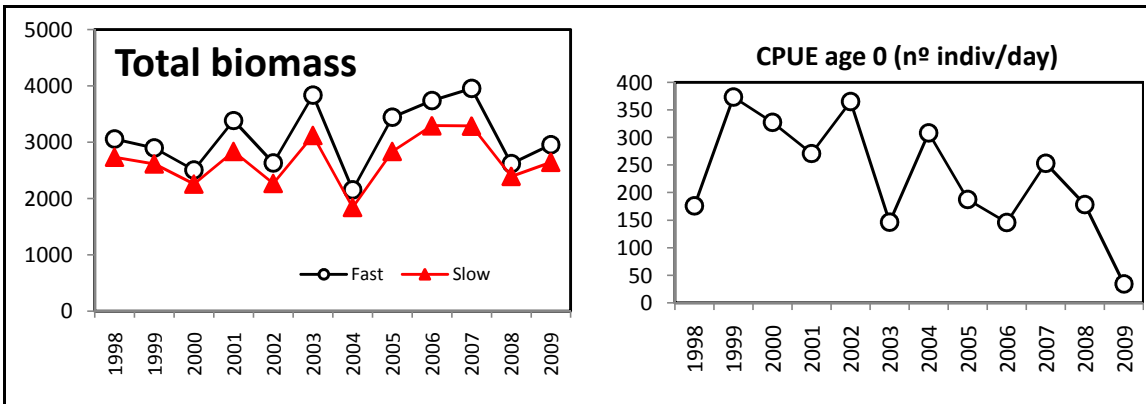
Page 2 / 1

Sex*	Gear*	Analysis #*	1
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Population in figures



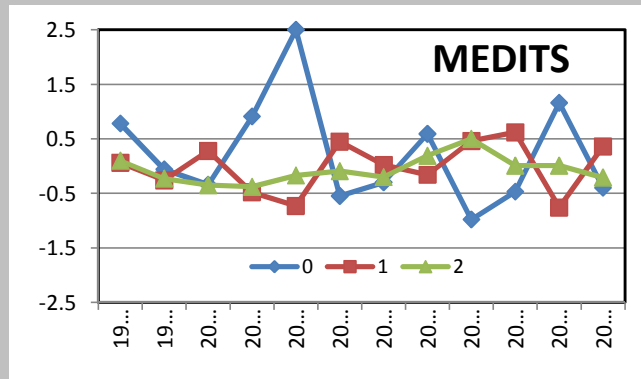
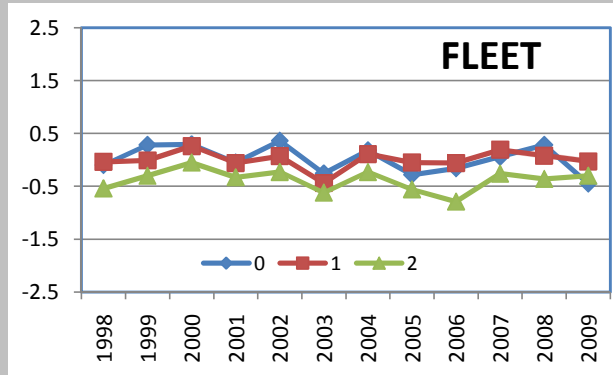
Population in biomass



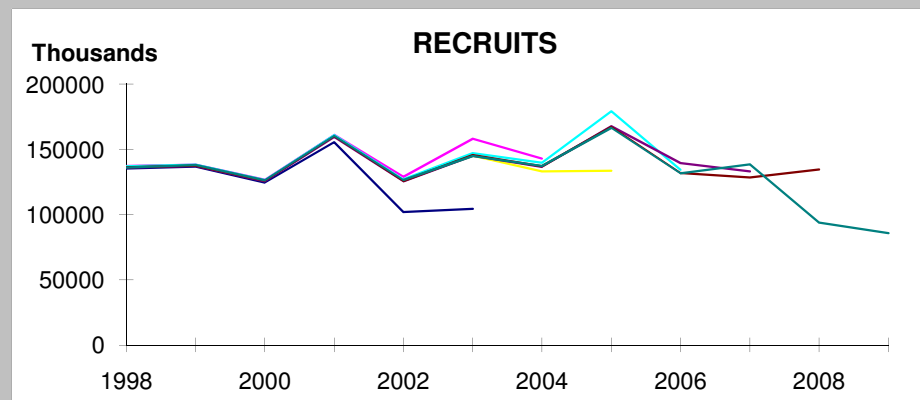
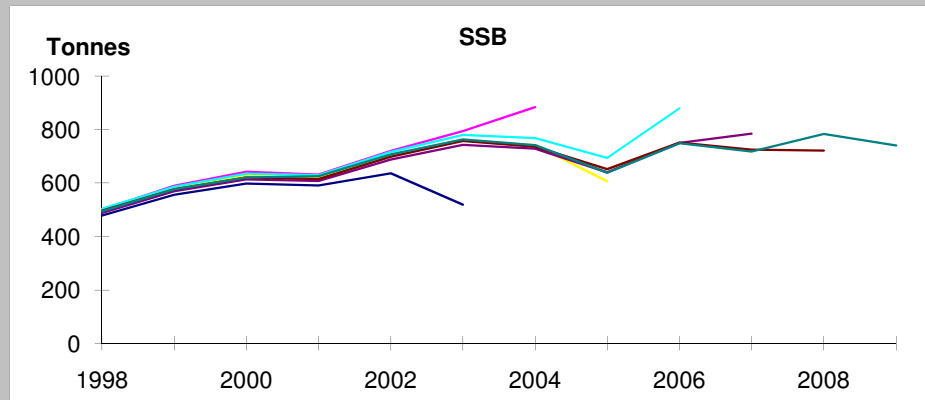
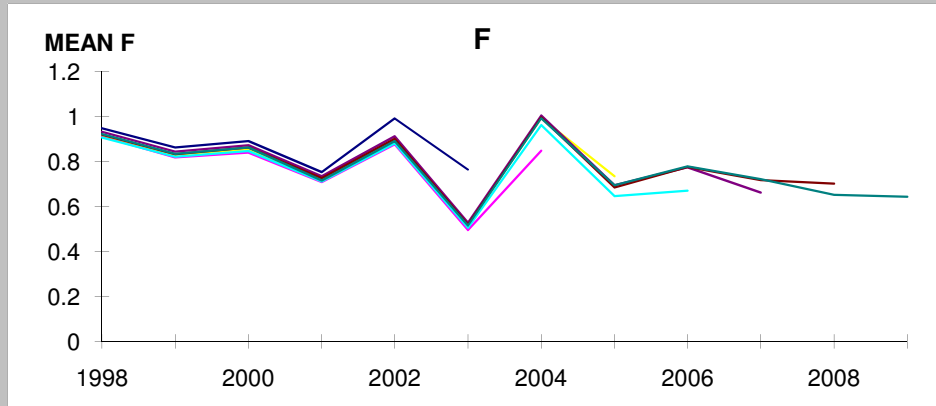
Fishing mortality rates

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0	0.1554	0.2656	0.202	0.1463	0.2826	0.0876	0.2389	0.103	0.1235	0.1336	0.139	0.0301
1	1.6483	1.2955	1.394	1.1451	1.3913	0.8001	1.62	1.2502	1.5124	1.2522	1.1176	1.0902
2	0.9603	0.9402	0.9898	0.856	1.0003	0.6568	1.1177	0.7307	0.6974	0.7786	0.698	0.8084
+gp	0.9603	0.9402	0.9898	0.856	1.0003	0.6568	1.1177	0.7307	0.6974	0.7786	0.698	0.8084
3AR 0- 2	0.9214	0.8338	0.8619	0.7158	0.8914	0.5148	0.9922	0.6946	0.7778	0.7214	0.6515	0.6429

Log catchability residuals



RETROSPECTIVE ANALYSIS



SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet Y Indirect methods: Y/R

Sex	Both	Code: MUT0610Fer
		Analysis # 2

# of gears	1	Software	VIT (Lleonart & Salat, 1997)
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Parameters used

Vector F	From a previous separable VPA (see comments in sheet A1)
Vector M	Vector of M at age shown in sheet B
Vector N	Pseudocohort 1998-2009

Model characteristics

See Lleonart & Salat (1997) page 94.

Results

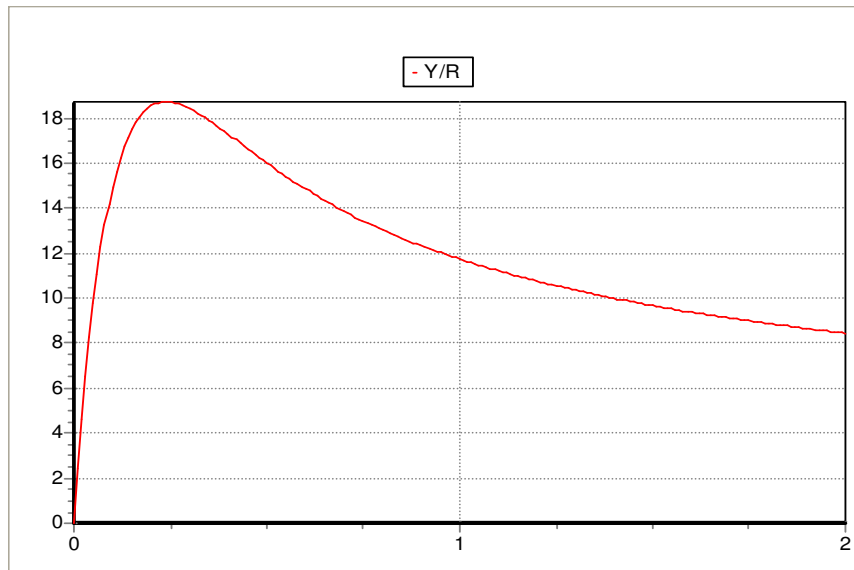
	Total	Gear			
Current YR	11.7				
Maximum Y/R	18.7				
Y/R 0.1	18.1				
F _{max}	0.25				
F _{0.1}	0.17				
Current B/R	7.8				
Maximum B/R	118.1				
B/R 0.1	46				

Comments

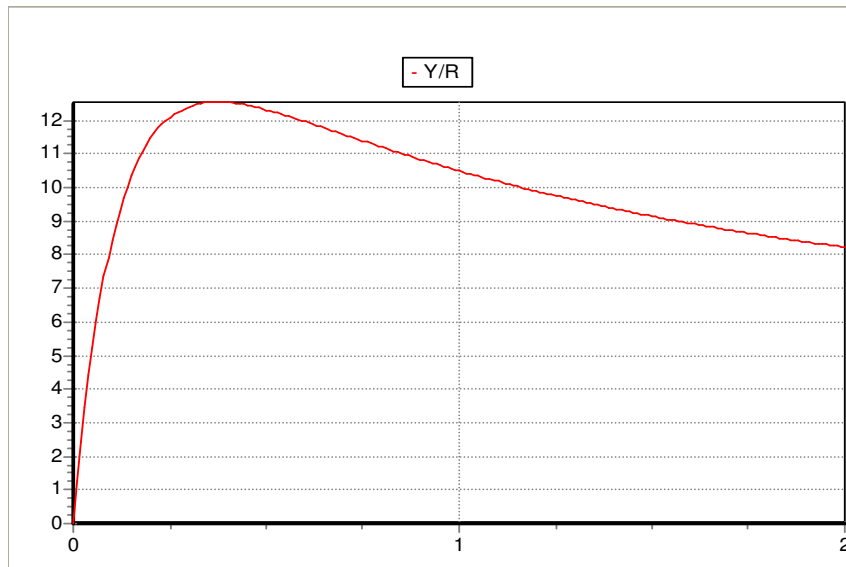
	Fast	Slow	Comparative results for the two sets of growth parameters
SSB	408.7	718.8 tons	
R	97.6	109.2 mill	
Turnove	205.17	142.14	
B virgen	11500	14683 tons	
F max	0.25	0.38	
F 0.1	0.17	0.23	
F global	0.67	0.46	

Comments

Fast growth



Slow growth



Code: MUT0610Fer

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	2956	tons			Bmean as reference point (B _{low} =2150)
SSB	854	tons			SSBmean as reference point (SSB _{low} =475)
F	0.643				Mean Fbar 0-2 as a reference point (F _{low} =0.515)
Y	1011	tons			Ymean as reference point (Y _{low} = 985)
CPUE	22.36	kg/day			Total trawl fishery data. CPUE _{low} = 17.08

Stock Status* Use one (or both) of the following two systems for the stock assessment status description

Unidimensional	<input type="radio"/>	? - (or blank) Not known or uncertain. Not much information is available to make a judgment;
	<input type="radio"/>	U - Underexploited, undeveloped or new fishery. Believed to have a significant potential for expansion in total production;
	<input type="radio"/>	M - Moderately exploited, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;
	<input type="radio"/>	F - Fully exploited. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;
	<input checked="" type="radio"/>	O - Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;
	<input type="radio"/>	D - Depleted. Catches are well below historical levels, irrespective of the amount of fishing effort exerted;
	<input type="radio"/>	R - Recovering. Catches are again increasing after having been depleted or a collapse from a previous;

Bidimensional	Exploitation rate		Stock abundance	
	<input type="radio"/>	No or low fishing	<input type="radio"/>	Virgin or high abundance
	<input type="radio"/>	Moderate fishing	<input type="radio"/>	Intermediate abundance
	<input checked="" type="radio"/>	High fishing mortality	<input checked="" type="radio"/>	Low abundance
	<input type="radio"/>	Uncertain / Not assessed	<input type="radio"/>	Depleted
			<input type="radio"/>	Uncertain / Not assessed

Comments

Catch in number of individuals are based on younger ages (0 and 1). Average fishing mortality for ages 0-2 show a general decreasing trend over the studied period. Although some fluctuations are observed, recruitment has remained more or less constant between 1998-2007. Nevertheless recruitment is under the mean for the period 1998-2007 in the last two years. SSB has recovered after the minimum observed in 2004; in the last four years is above the average for the whole period. Total biomass show wide fluctuations but any trend is observed.

Trends in recruitment, F_{bar} , stocks biomass and SSB are similar for both set of parameters used (fast and slow from SGMED-08-03).

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)

Assessment form

Sheet Z

Objectives and recommendations

Code: MUT0610Fer

Management advice and recommendations*

- (1) To reduce the fishing effort 70%.
- (2) More effective control in shelf areas above 50 m depth should reduce the catch of small individuals under the minimum legal size.
- (3) According to transition analysis (MUT0608Fer) the compulsory use of the 40 mm square mesh in the cod-end from 2010 onwards should improve trawl exploitation pattern and Y/R by 24%, but a close supervision of the observance of this measure is needed.

Advice for scientific research*

- To improve biological and growth parameters
- Besides on board sampling, sampling at port is also needed

Abstract for SCSA reporting

Authors

Fernández, A. M.

Year

2010

Species Scientific name

Mullus barbatus - MUT

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area

06 - Northern Spain

Fisheries (brief description of the fishery)*

Both species of red mullet, *Mullus surmuletus* and *M. barbatus*, are exploited by trawl and artisanal fisheries fleets in GSA 06, although small gears (trammel nets and gillnets) account only for 5% of the total landings of these species (Demestre et al., 1997). Trawl fisheries developed along the continental shelf and upper slope are multi-specific. Small vessels operate almost exclusively on the continental shelf targeting on red mullets, octopus, cuttlefish and sea breams. Medium and large vessels usually operates on the slope areas targeting on hake and decapod crustaceans, but some of these units can also operate on the continental shelf depending on the season (e.g. red mullet is more intensively exploited from September to November; Martín et al., 1999), the weather conditions or market prices. Landings of *M. barbatus* increased continuously from the earliest 1970's until 1982. From this year until now a general decreasing trend with fluctuations is observed. An important fraction (28% of individuals) of *M. barbatus* are under the minimum legal size. The total number of boats (trawl fleet) in the GSA6 has been reduced 30% from 1998.

Source of management advice*

(brief description of material -data- and methods used for the assessment)

The stock of *Mullus barbatus* of the GFCM-GSA06 has been assessed using data from the trawl fishery on a time series covering the period 1998-2009. The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) and Y/R analysis on the pseudo-cohort 1998-2009. These approaches were performed using monthly size composition of catches, official landings and the growth parameters accorded in the SGMED-08-03 meeting. Length-weight relationships and oogive of maturity were obtained within the framework of the Spanish Data Collection Programme. The vector of natural mortality-at age was obtained from Caddy's (1991) formula using the PROBIOM Excel spreadsheet (Abella et al., 1997). The VPA was tuned with CPUE data from MEDITS surveys and standardised fleet CPUE (by applying GLM models). Several XSA runs were carried out using different values for the terminal fishing mortality, retaining for the final analysis the value that minimised the SSQ. Software used were the Lowestoft VPA program for the XSA (Darby and Flatman, 1994) and the VIT program (Leonart and Salat, 1997) for the Y/R analysis from a mean pseudo-cohort.

Stock Status*

O - Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;

Exploitation rate

High fishing mortality

Stock abundance

Low abundance

Comments

Catch in number of individuals are based on younger ages (0 and 1). Average fishing mortality for ages 0-2 show a general decreasing trend over the studied period. Although some fluctuations are observed, recruitment has remained more or less constant between 1998-2007. Nevertheless recruitment is under the mean for the period 1998-2007 in the last two years. SSB has recovered after the minimum observed in 2004; in the last four years is above the average for the whole period. Total biomass show wide fluctuations but any trend is observed. Trends in recruitment, Fbar, stocks biomass and SSB are similar for both set of parameters used (fast and slow from SGMED-08-03).

Management advice and recommendations*

- (1) To reduce the fishing effort 70%.
- (2) More effective control in shelf areas above 50 m depth should reduce the catch of small individuals under the minimum legal size.
- (3) According to transition analysis (MUT0608Fer) the compulsory use of the 40 mm square mesh in the cod-end from 2010 onwards should improve trawl exploitation pattern and Y/R by 24%, but a close supervision of the observance of this measure is needed.

Advice for scientific research*

- To improve biological and growth parameters
- Besides on board sampling, sampling at port is also needed