SAC GFCM
Sub-Committee on Stock Assessment

Date*	**5**	**October**	**2010**	**Code***	**MUT0510Que**

Authors* Quetglas A., Ordines F., González N.

Affiliation* IEO-Centre Oceanogràfic de Balears

Species Scientific name*

1
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area* Mallorca

Geographical Sub-Area (GSA)* 05 - Balearic Island

Combination of GSAs
1
2
3

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Assessment form — **Sheet #0** — **Basic data on the assessment**

Code: MUT0510Que

Date*	5	Oct	2010	Authors*	Quetglas A., Ordines F., González N.

Species Scientific name*	Mullus barbatus - MUT	Species common name*	Red mullet

Data Source

GSA*	05 - Balearic Island	Period of time*	2000-2009

Description of the analysis

Type of data*	Size composition of commercial catches, official landings, CPUE from	Data source*	IEO, Fishermen Association, Autonomous Government, Ministry of Fisheries
Method of assessment*	Tuned cohort analysis (XSA), pseudocohort analysis and yield per	Software used*	Lowestoft (Darby and Flatman, 1994), VIT (Lleonart and Salat, 1997)

Sheets filled out

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

Comments, bibliography, etc.

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 Merluccius merluccius fishery in the Mediterranean. Aquat. Liv. Res., 10: 257–269.

Astudillo A. y J.F. Caddy (1986) Periodicidad de los desembarcos de merluza (Merluccius merluccius) y salmonete (Mullus sp. sp.) en la Isla de Mallorca. Int. Symp. Long Term Changes Mar Fish Pop., Vigo: 221–233.

Caddy, J.F. (1991). Death rates and time intervals: is there an alternative to the constant natural mortality axiom? Rev. Fish. Biol. Fish., 2: 109–138.

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.

Jardim, E. and Azevedo, M. (2004). FLeda - an R package for fisheries exploratory data analysis, version 0.0-2.

Lleonart J. and J. Salat (1997) VIT: Software for fishery analysis. User´s manual. FAO Computerized Information Series (Fisheries). Nº 11. Rome, FAO, 105 pp.

Comments, bibliography, etc.

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Assessment form — **Sheet B** — **Biology of the species**

Code: MUT0510Que

Biology

Somatic magnitude measured (LH, LC, etc)*				Total length	Units*	cm
Sex	Fem	Mal	Both	Unsexed		
Maximum size observed				28.7(1)	Reproduction season	May-July
Size at first maturity				12.2(2)	Reproduction areas	Continental shelf(4)
Recruitment size				7.8(3)	Nursery areas	Continental

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞	26(5)				
	K	0.41				
	t0	-0.4				
	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 GSA01.

(2) From the Spanish DCR National Programme

(3) García-Rodriguez 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). Inf.Tec.Ins.Esp.Oceanogr. 185.

(4) 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.

(5) Set of growth parameters adopted in the SGMED-08-03 meeting.

(6) Vector of M at age, calculated from Caddy (1991) equation using the PROBIOM Excel spreadsheet (Abella et al., 1997):

Age	M
0	0.8
1	0.5
2	0.3
3	0.3
4	0.3
5	0.2
Mean	0.4

Comments

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Assessment form	**Sheet P1** **General information about the fishery**

Code: MUT0510Que

Data source*	Size composition of trawl catches: IEO and Spanish	Year (s)*	2000-2009
Data aggregation (by year, average figures between years, etc.)*	By year for XSA and average 2000-2007 for pseudocohort and 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	05	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 05 E 03 33 - MUT	37	Tons	16.3	See sheet P2b	No(3)		days
Total	37		16.3				

Legal minimum size	11 cm total length

Comments

(1) Fleets (nº of boats) refers to: 1) the average number of trawlers in Mallorca during 2000-2009.

(2) Catch is the average landings of Mallorca during the period 2000–2009.

(3) Carbonell (1997).

Comments

Data source*	IEO: size composition of trawl catches; Official la	OpUnit 1*	ESP 05 E 03 33 - MUT

Time series

Year*	2000	2001	2002	2003	2004	2005
Catch	27.8	22.3	14.4	10.5	20.3	12.7
Minimum size	8	9	8	7	9	7
Average size Lc	15.0	16.1	16.2	15.2	16.1	15.4
Maximum size	22	26	23	25	23	25
Fleet	41	39	39	37	37	37

Year	2006	2007	2008	2009		
Catch	11.3	13.7	17.9	11.9		
Minimum size	7	9	7	7		
Average size Lc	15.6	15.7	16.5	16.3		
Maximum size	26	26	26	26		
Fleet	36	36	34	32		

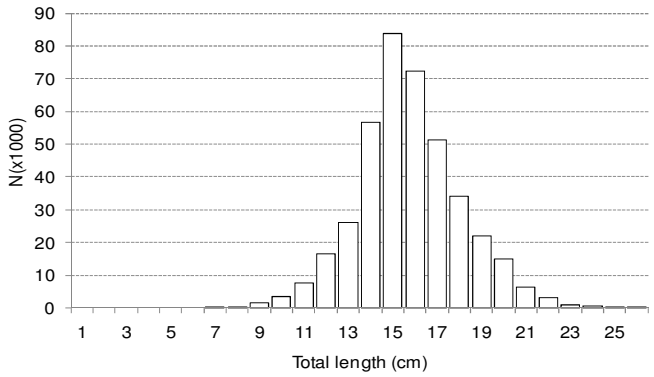
Selectivity

L25	6.9
L50	7.8
L75	8.9
Selection factor	1.95

Remarks

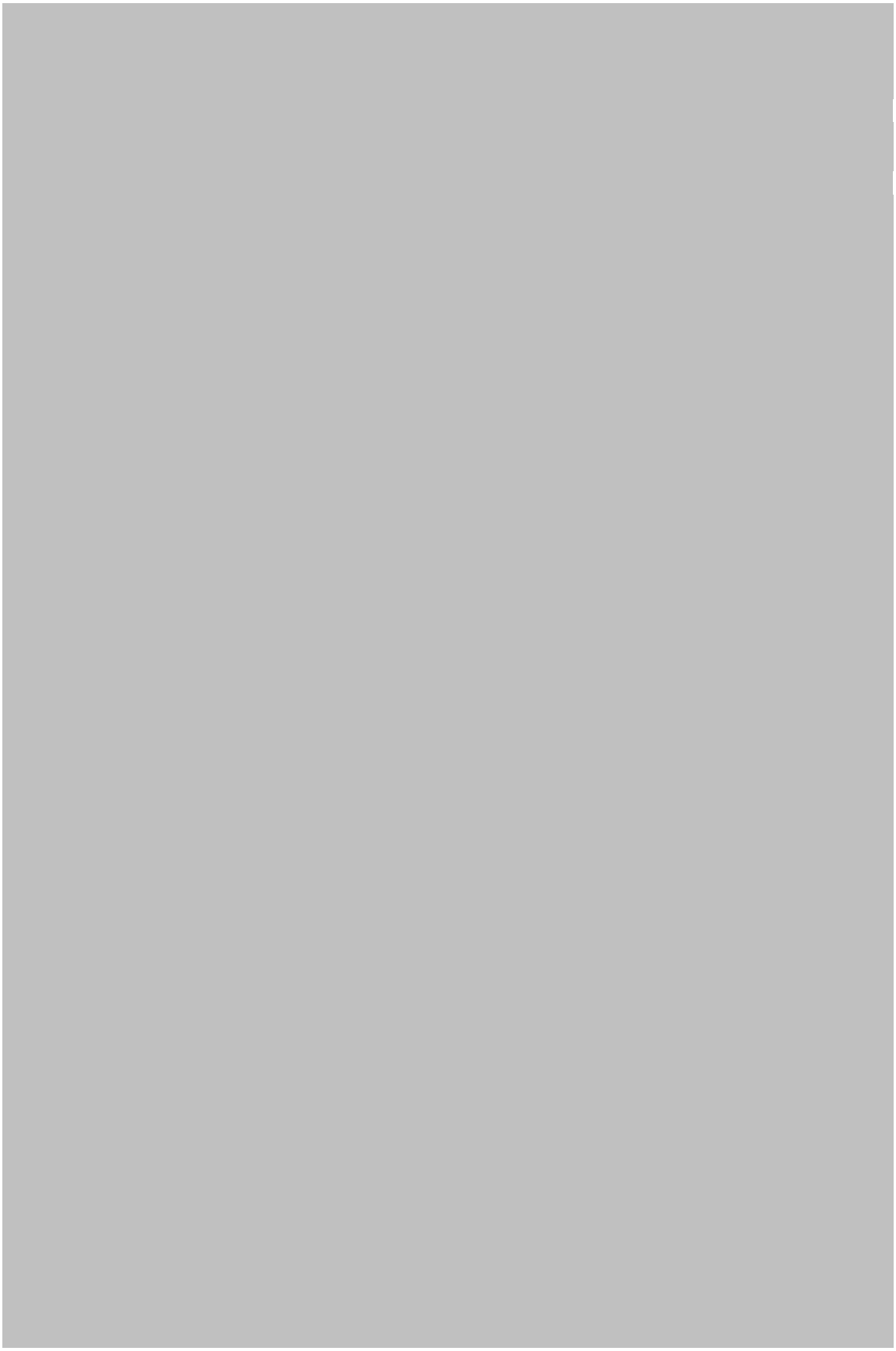
Parameters for 40 mm diamond mesh in the cod-end
From García-Rodriguez and Fernández (2005).

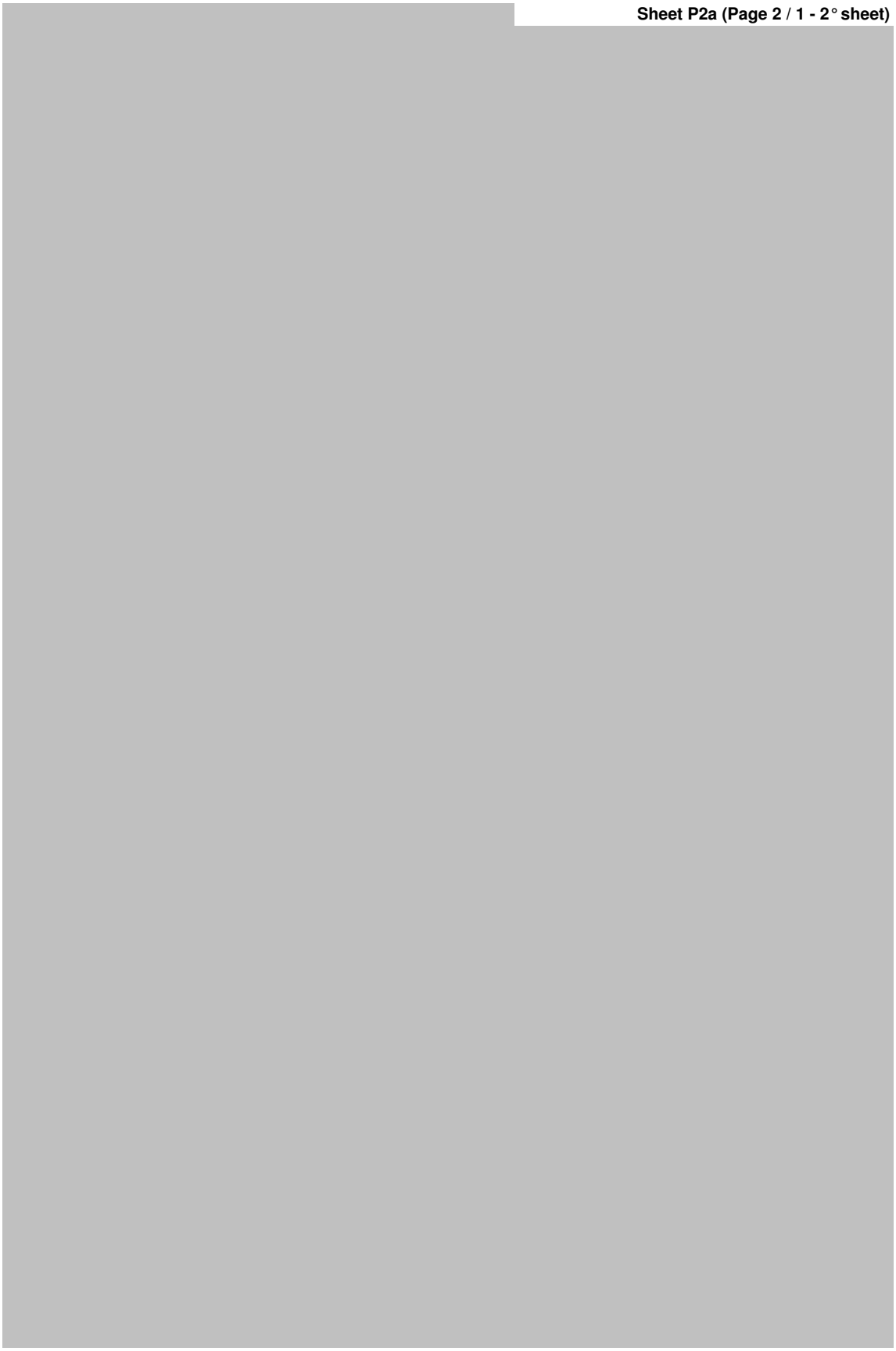
Structure by size or age

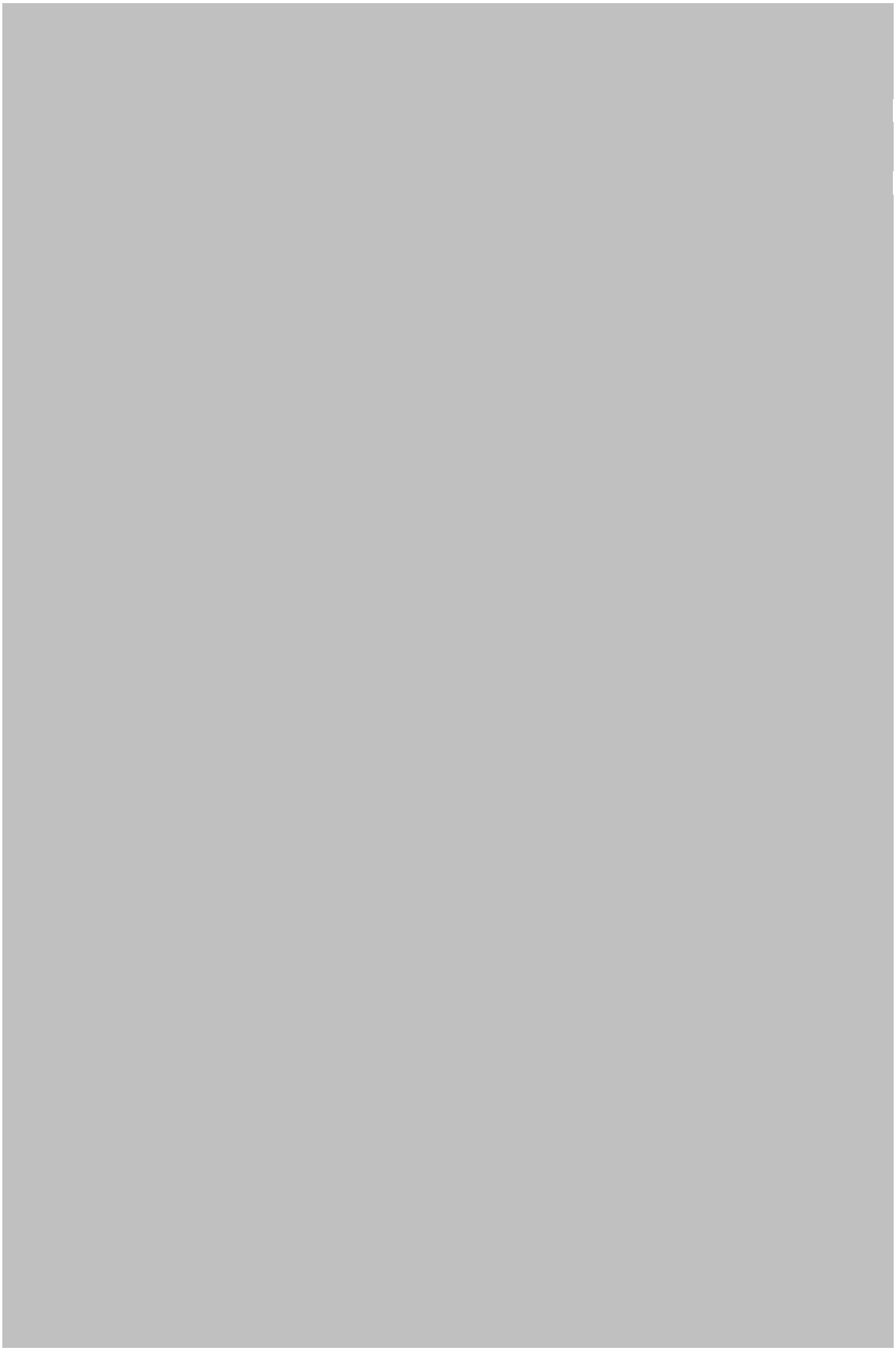


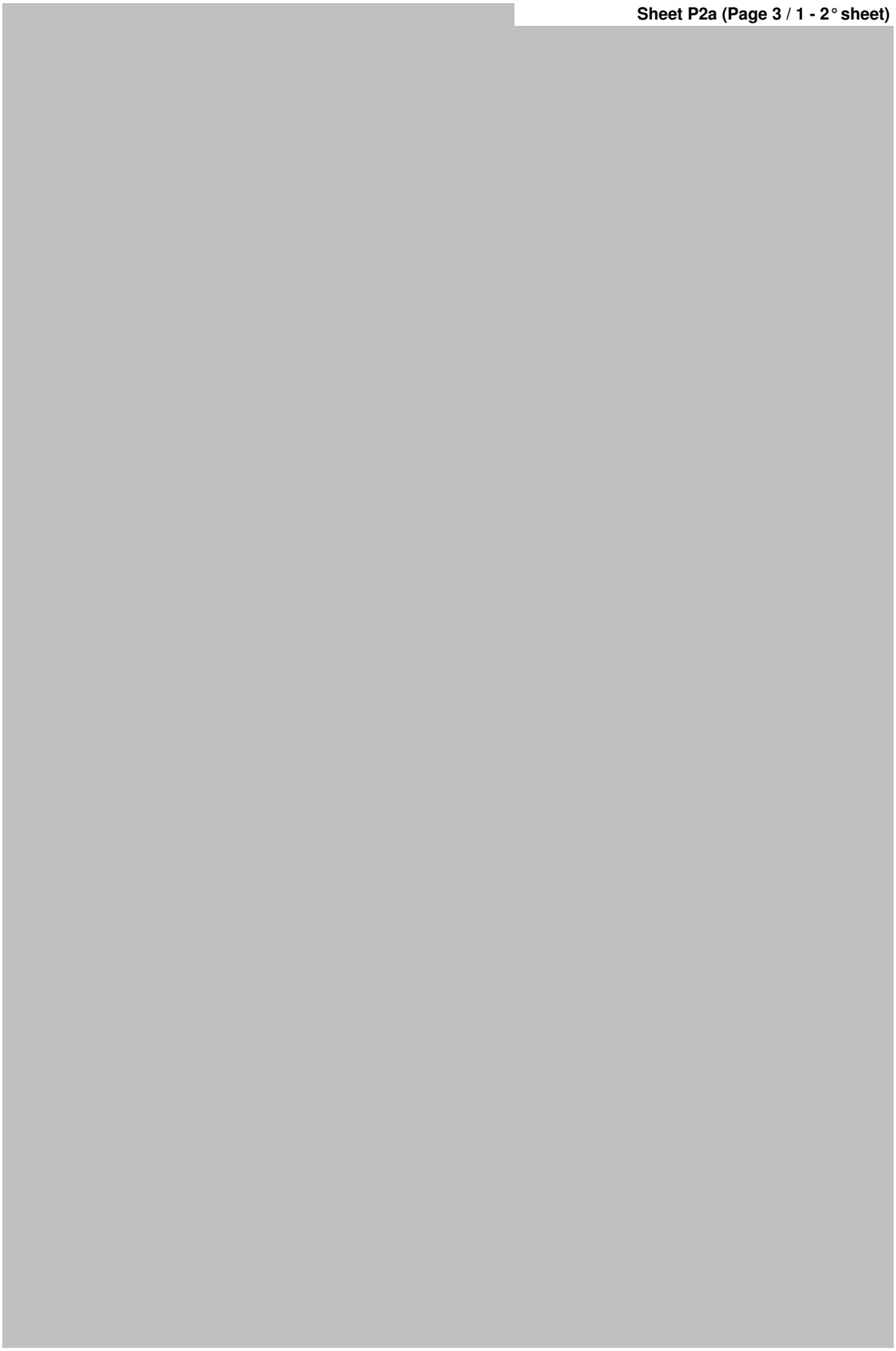
Average size frequency distribution (cm; total length) of trawl catches in the geographical sub-area 05 (Balearic Islands) for the period 2000–2009. Size composition of catches have been obtained from monthly length sampling (stratified random method) on board trawl fishing vessels at different ports of Mallorca.

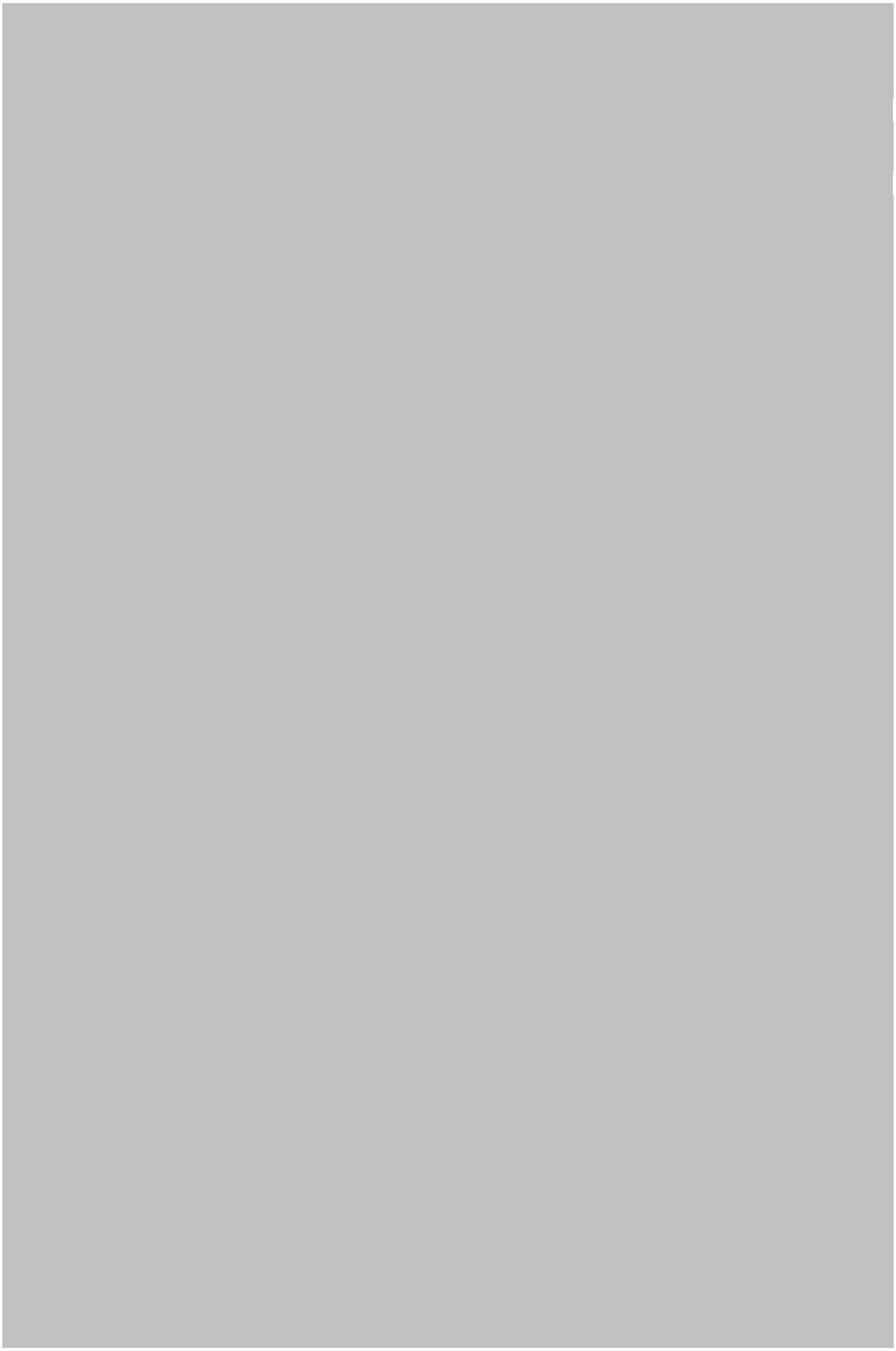
Structure by size or age

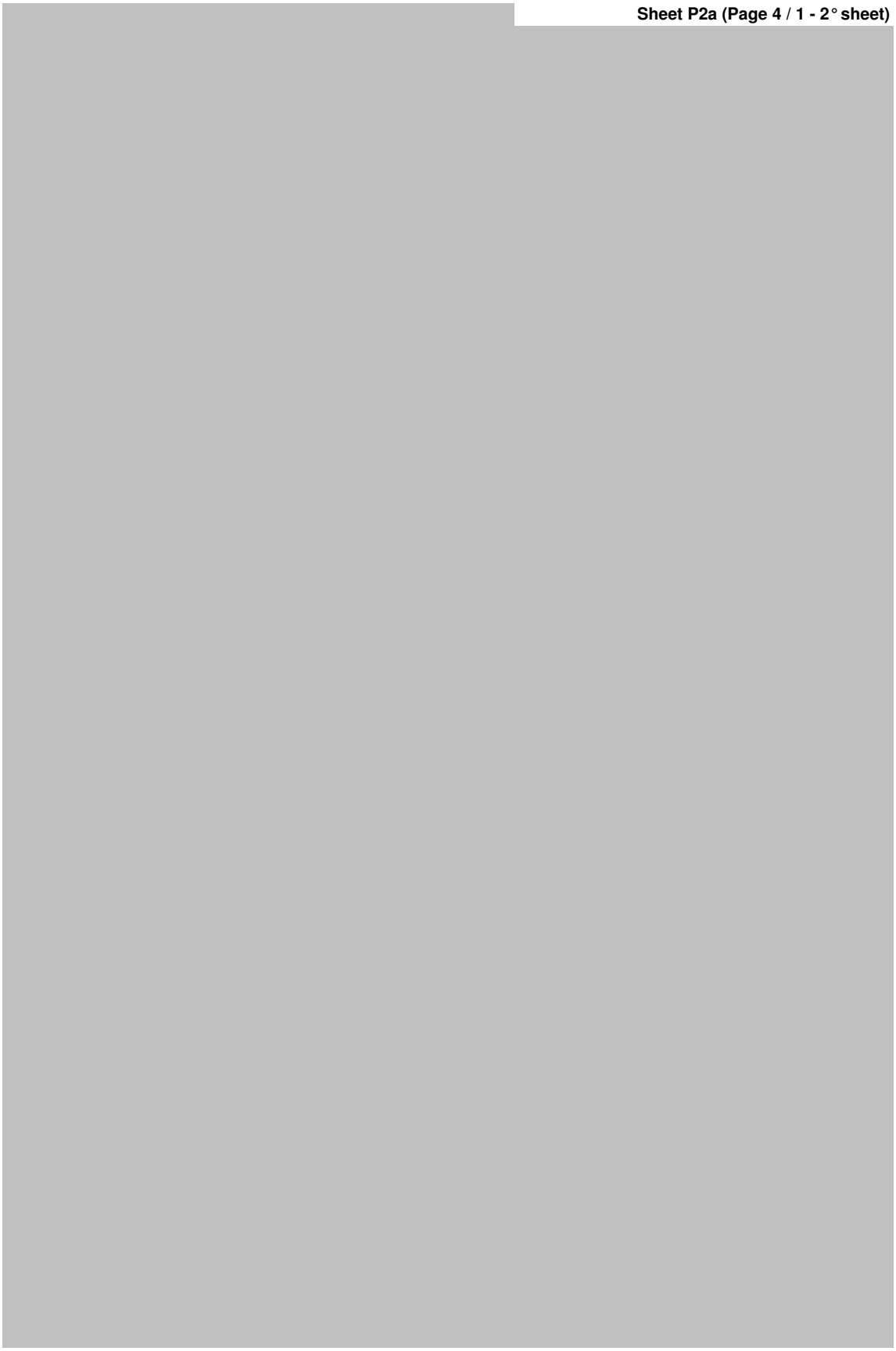


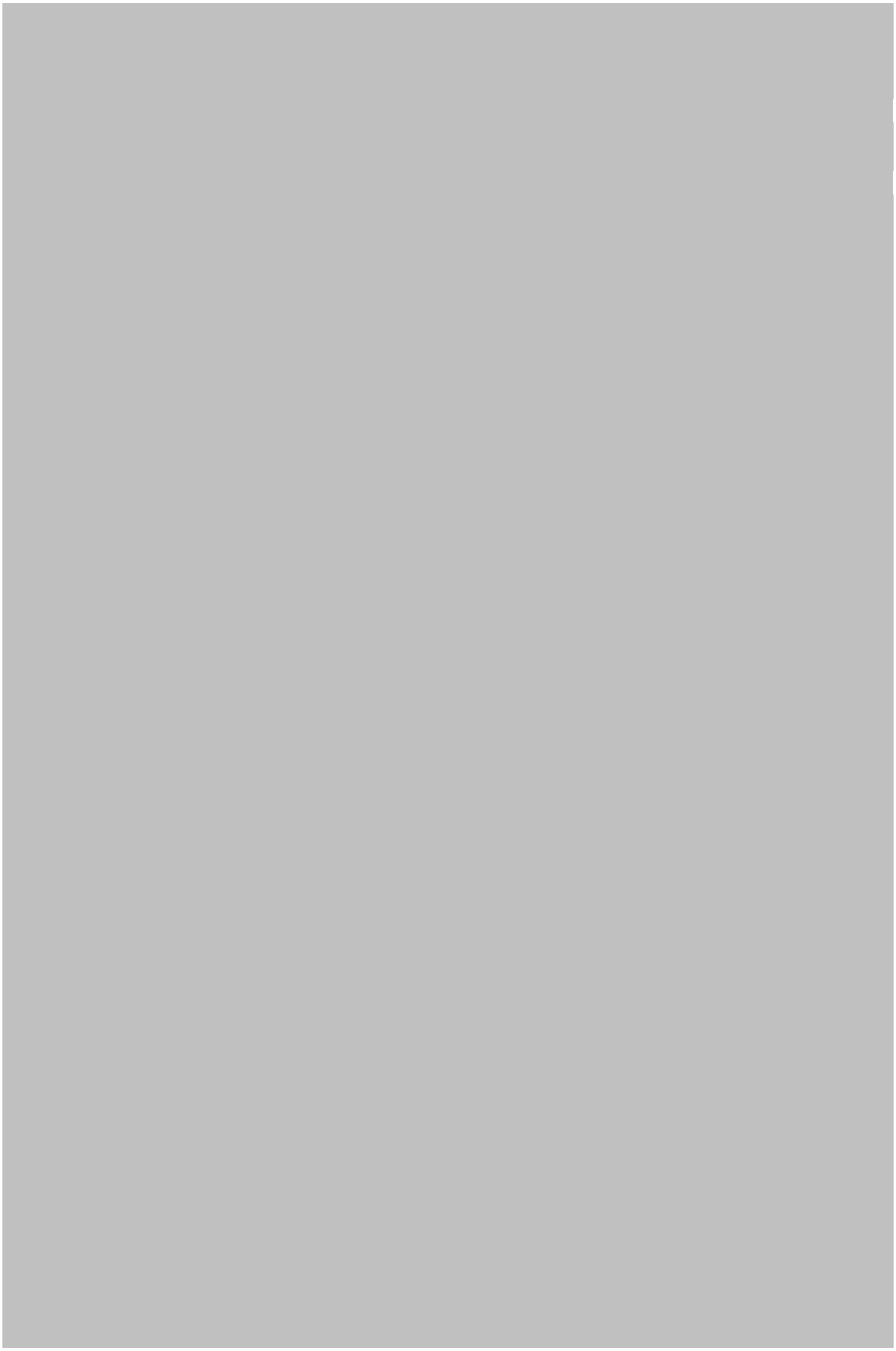


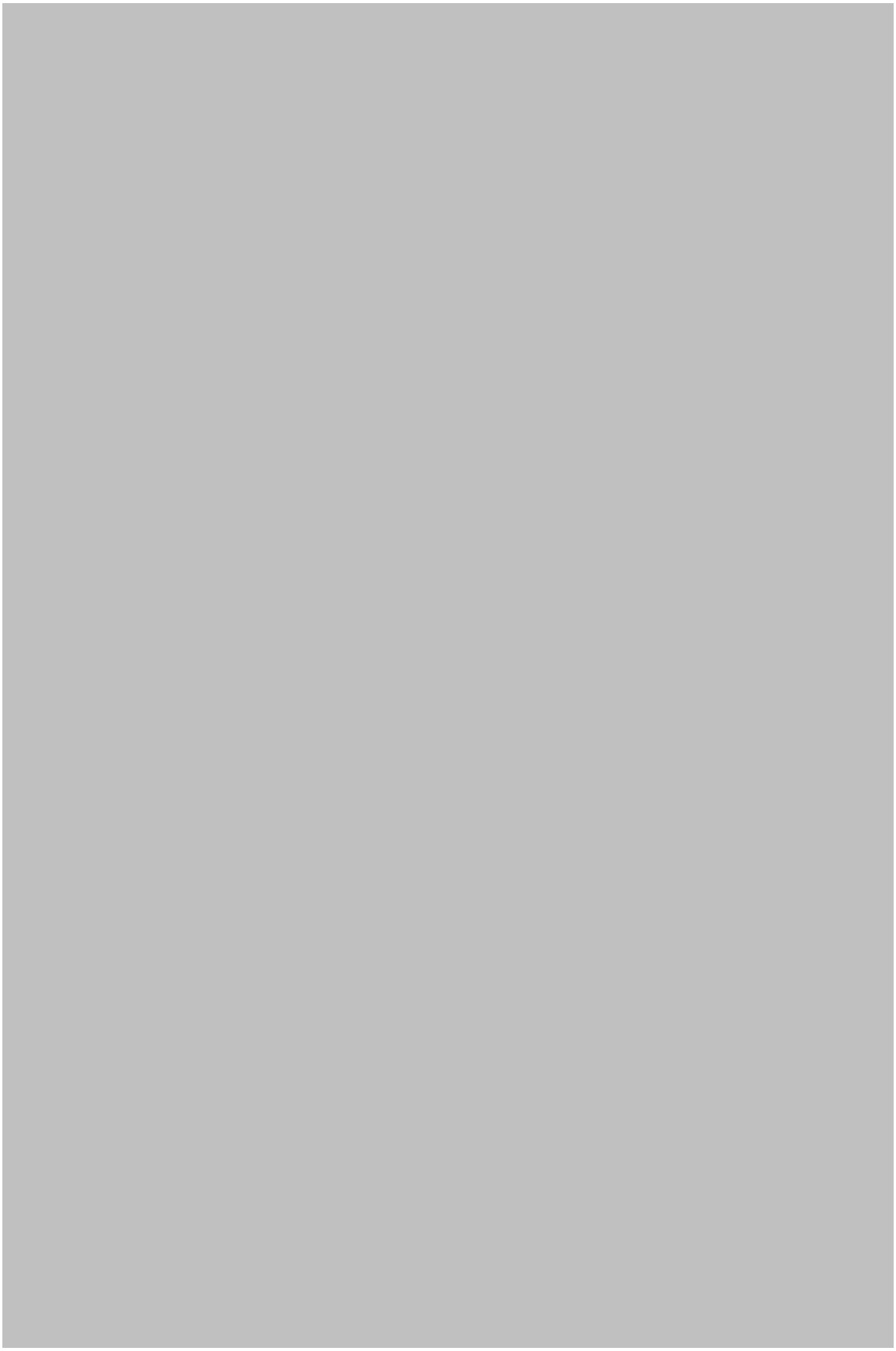












Data source*	IEO: size composition of trawl catches; Official landin	OpUnit 1*	ESP 05 E 03 33 - MUT

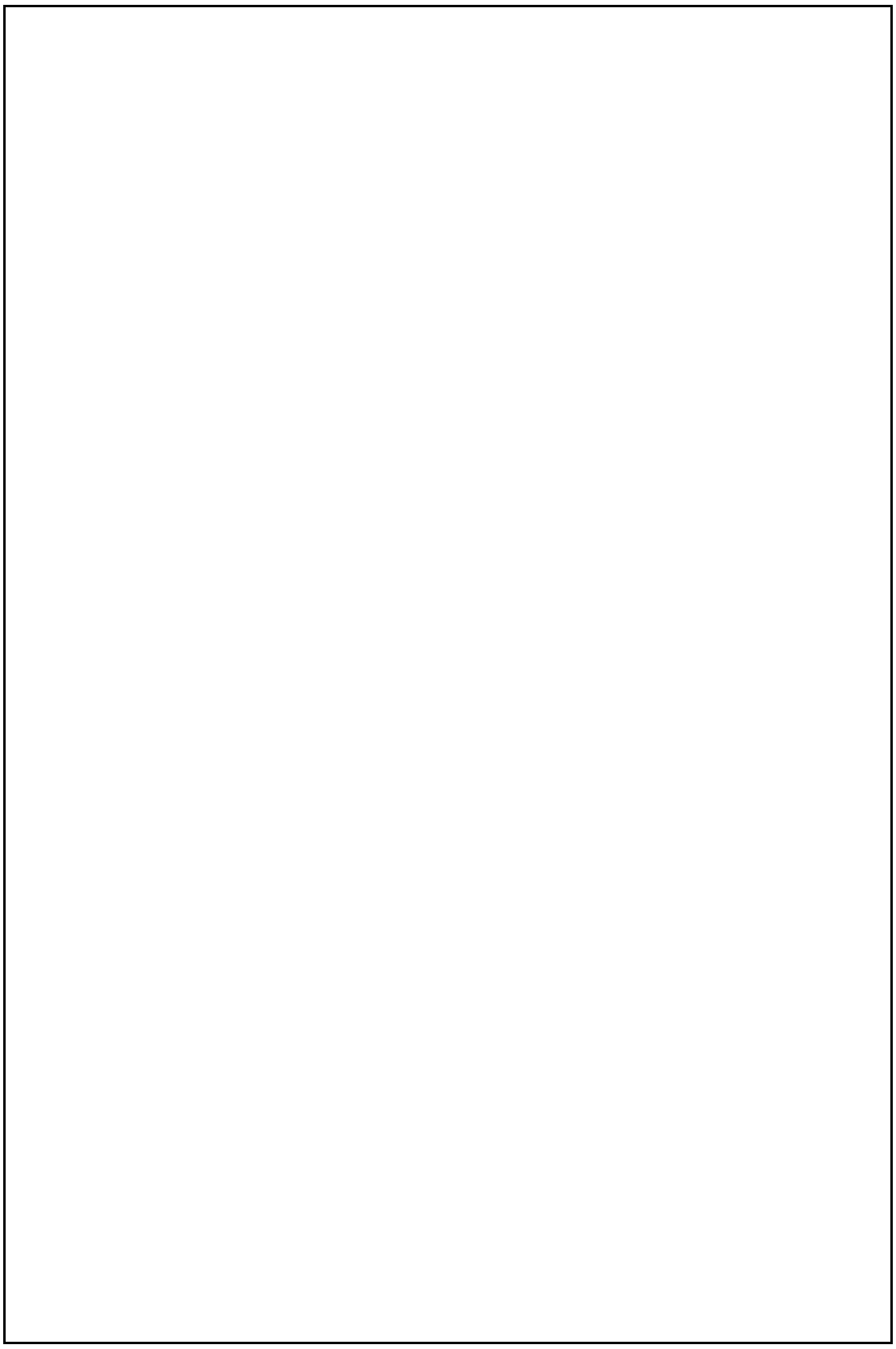
Regulations in force and degree of observance of regulations

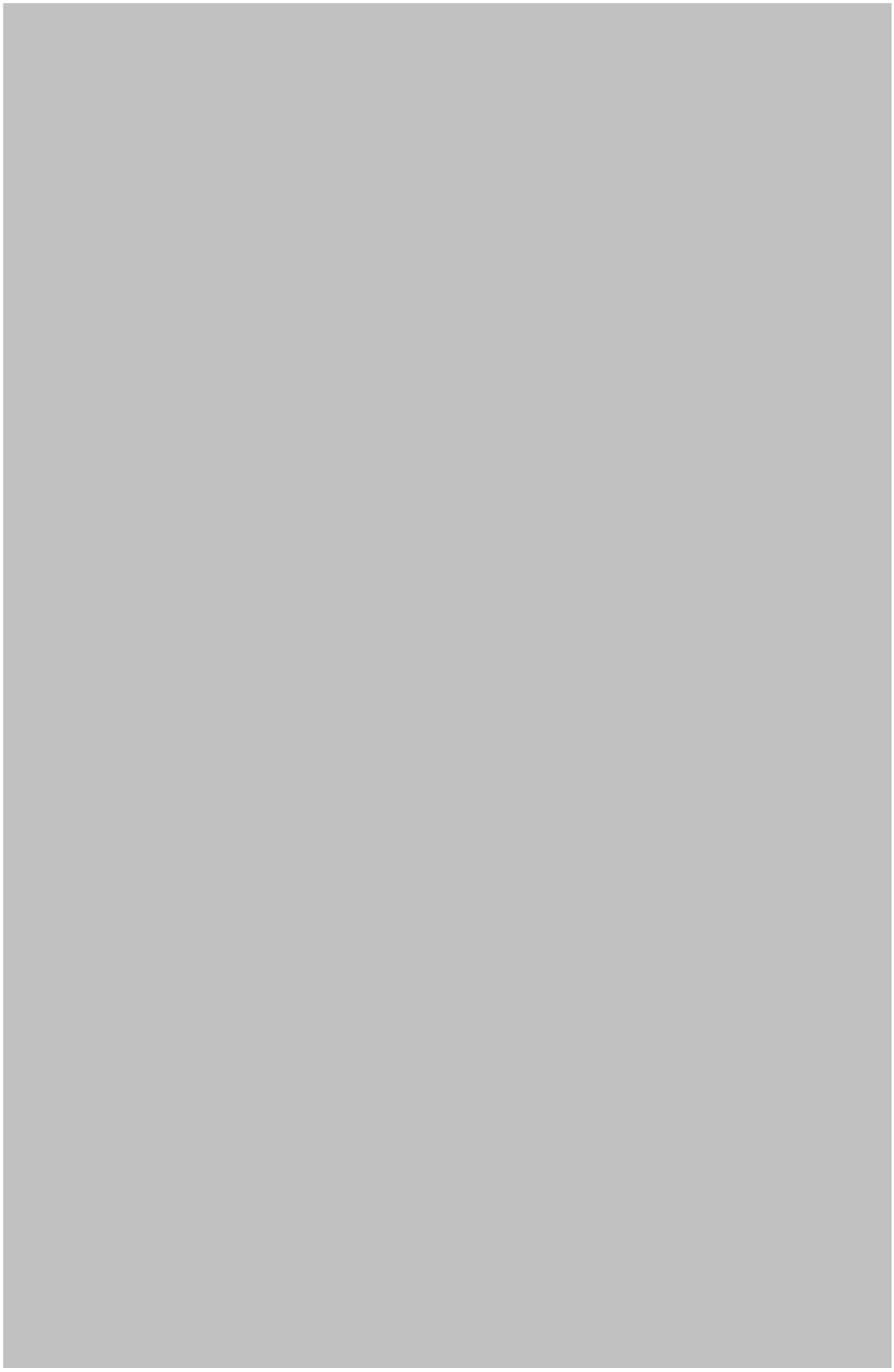
- Fishing license: fully observed
- Engine power limited to 316 KW or 500 CV: not observed
- Mesh size in the cod-end (40 mm stretched): fully observed
- Fishing forbidden upper 50 m depth: not fully observed
- Time at sea (12 hours per day and 5 days per week): fully observed

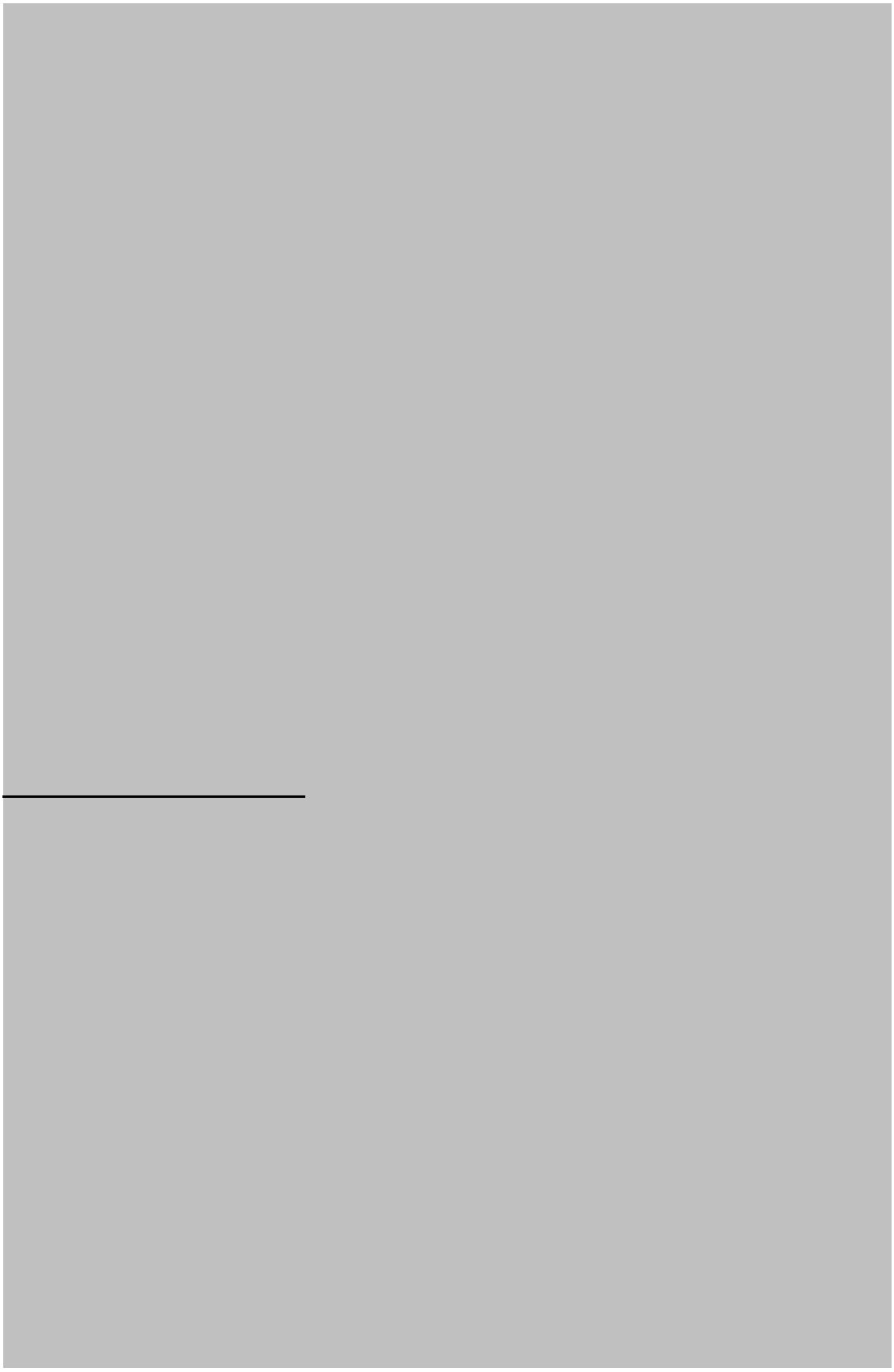
Accompanying species

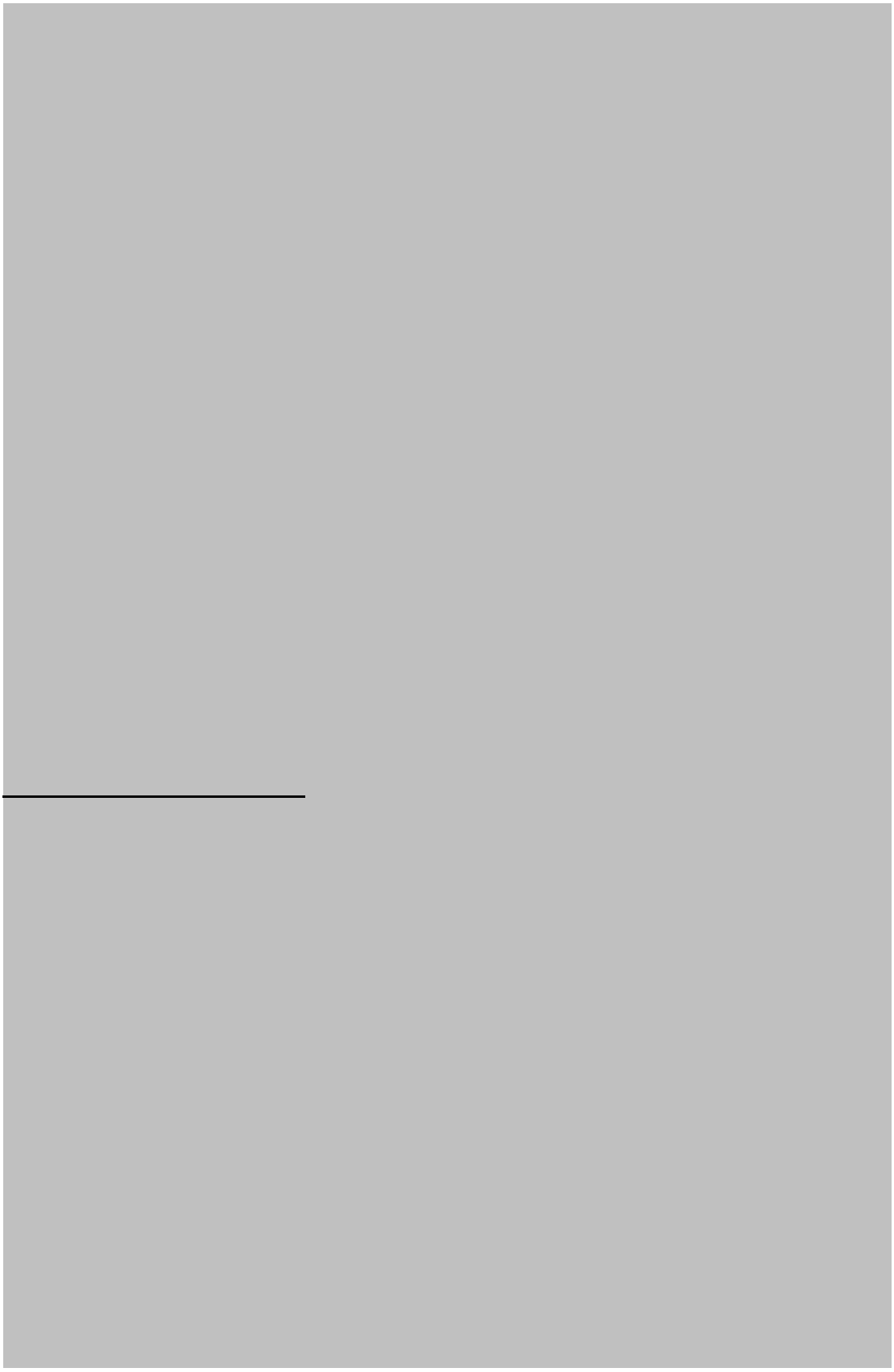
Trawl fishery developed along the continental shelf of the Balearic Islands is a multi-specific fishery. It is performed mainly on detritic bottoms of rhodophytic and corallinic algae. In addition to *M. barbatus*, the following species can be considered as important in landings:

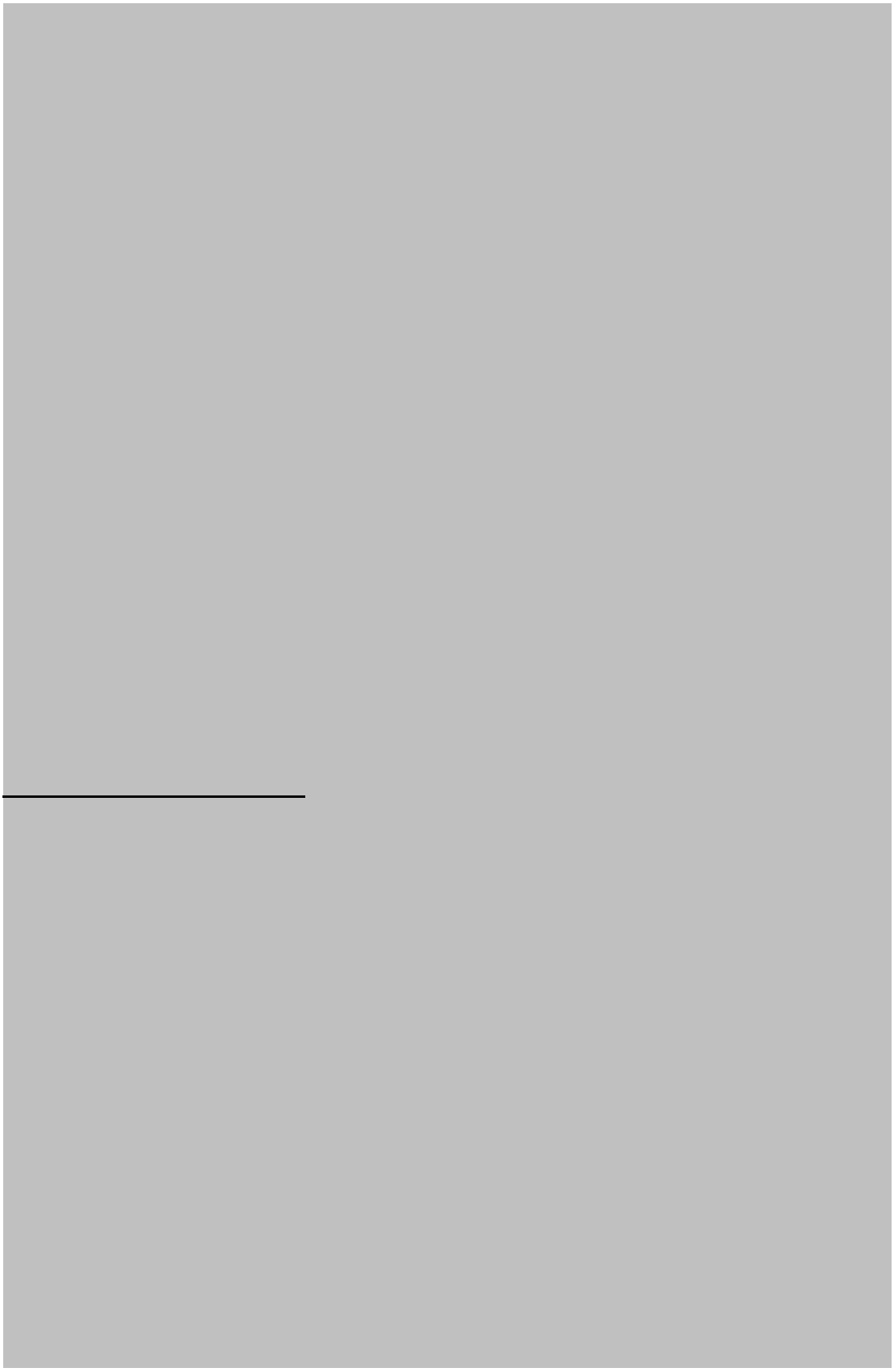
- *Spicara smaris*
- *Mullus surmuletus*
-*Merluccius merluccius*
- *Pagellus acarne*
- *Pagellus erythrinus*
- *Trachurus mediterraneus*
- *Scyliorhinus canicula*
- *Trachinus draco*
- *Scorpaena notata*
- *Trigloporus lastoviza*
- *Scorpaena scrofa*
- *Octopus vulgaris*











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Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: MUT0510Que

Sex*	Unsexed

Analysis # *	1

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used	Catch equation	Tunig method	Extended Survivor Analysis
# of gears	1	Software	Lowestoft VPA suite (Darby and Flatman, 1994)
$F_{terminal}$	1.123		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	1.26	12.7
Average			Average population	2.01	50.3
Maximum			Virgin population	SSN	SSB
Critical			Turnover	0.95	30.2
				N in millions	in tons

Average mortality

		Gear					
	Total						
F_1	0.884						
F_2	0.0061						
Z	1.284						

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

Comments

F1 was calculated averaging FBAR0-5 from 2000–2009; FBAR0-5 is an arithmetic mean calculated for each year over all the range of ages (0–5 years).

F2 is the mean F at age 0 from 2000 to 2009.

Z= 0.4+F1

The vector of fishing mortalities by age in the last year was obtained from a previous separable VPA:

Age (years)	F
0	0.006
1	0.561
2	1.321
3	1.281
4	1.144
5	1.123

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

Assessment form — **Sheet A1** — **Indirect methods: VPA, LCA**

Code: MUT0510Que

Sex*	Unsexed

Analysis # *	2

Time series

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 (Lleonart and Salat, 1997)
$F_{terminal}$	1.123		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	1.51	6.8
Average	10.0	0.9	Average population	2.49	41.98
Maximum			Virgin population		106
Critical	16.3	2	Turnover		119.45
				SSN	SSB
				1.09	27.2

Average mortality

		Gear					
	Total						
F_1	0.868						
F_2	0.264						
Z	1.268						

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

Comments

F1 is the arithmetic mean of F calculated along the different ages.
F2 is Global F, which equates to an average F weighted by the number of individuals (Lleonart and Salat, 1992).

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)

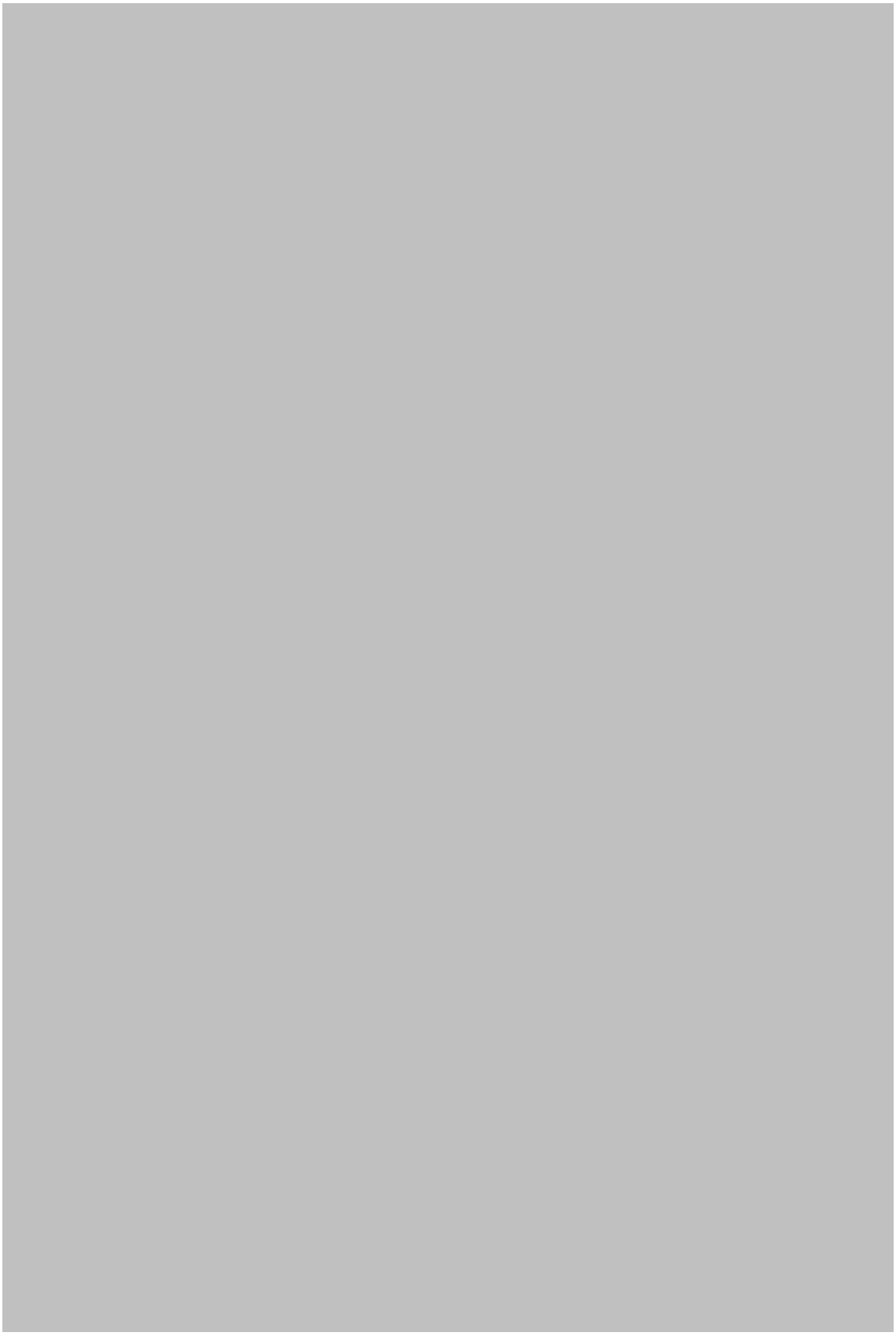
	Sizes	Ages		Amount	Biomass
Minimum			Recruitment		
Average			Average population		
Maximum			Virgin population		
Critical			Turnover		

Average mortality

		Gear					
	Total						
F_1							
F_2							
Z							

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

Comments



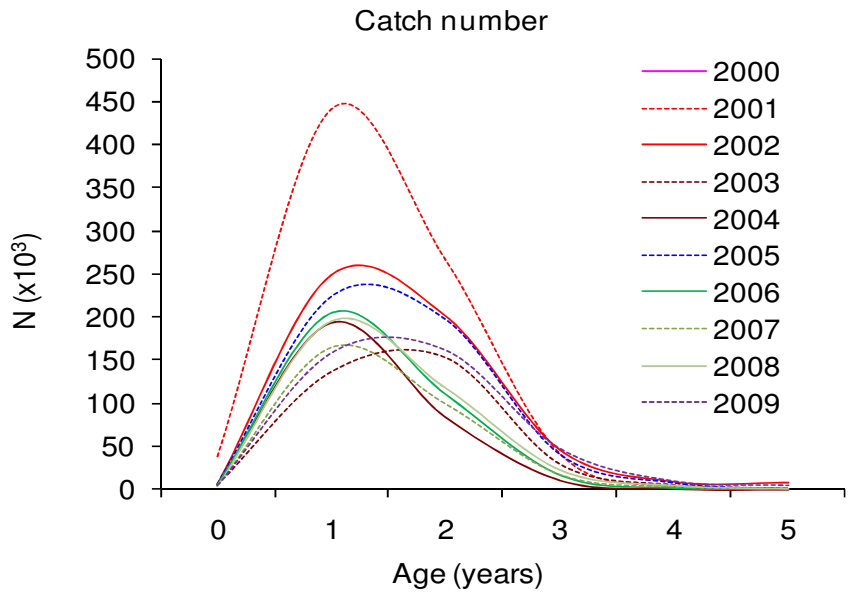
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A2** **Indirect methods: data**

Code: MUT0510Que

Sex*	Unsexed	Gear*	Trawl	Analysis # *	1

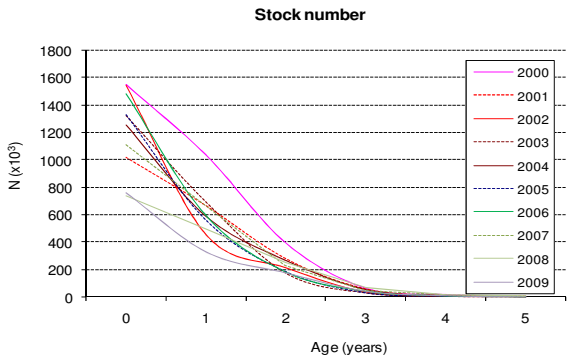
Data	Catch in number by age

Data



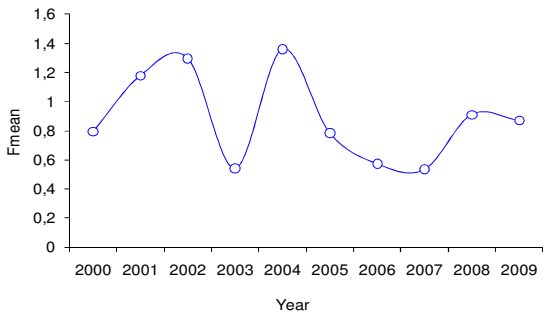
Sex*	Unsexed	Gear*	Trawl	Analysis #*	1

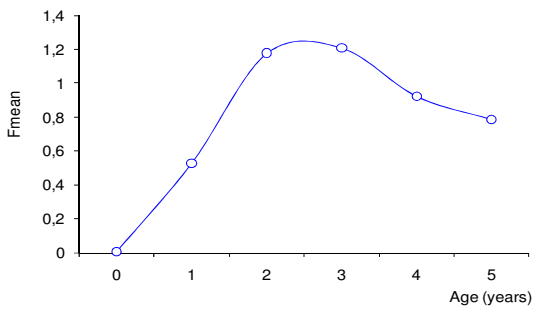
Population in figures



Population in biomass

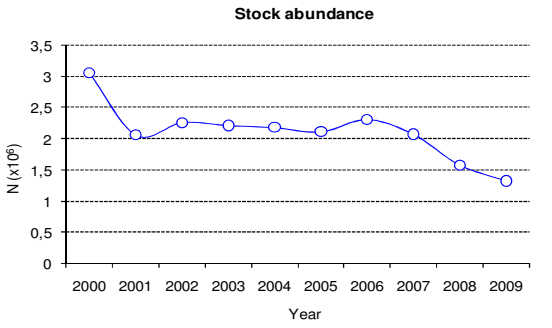
Fishing mortality rates

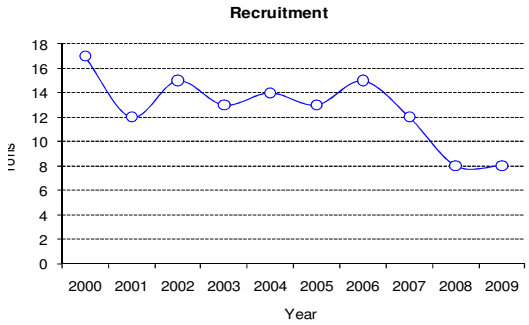




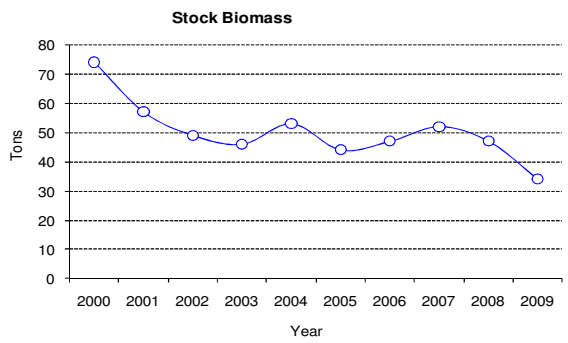
Sex*	Unsexe	Gear*	Trawl	Analysis #*	1

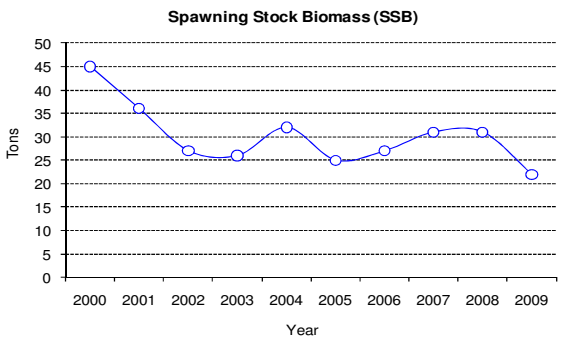
Population in figures





Population in biomass





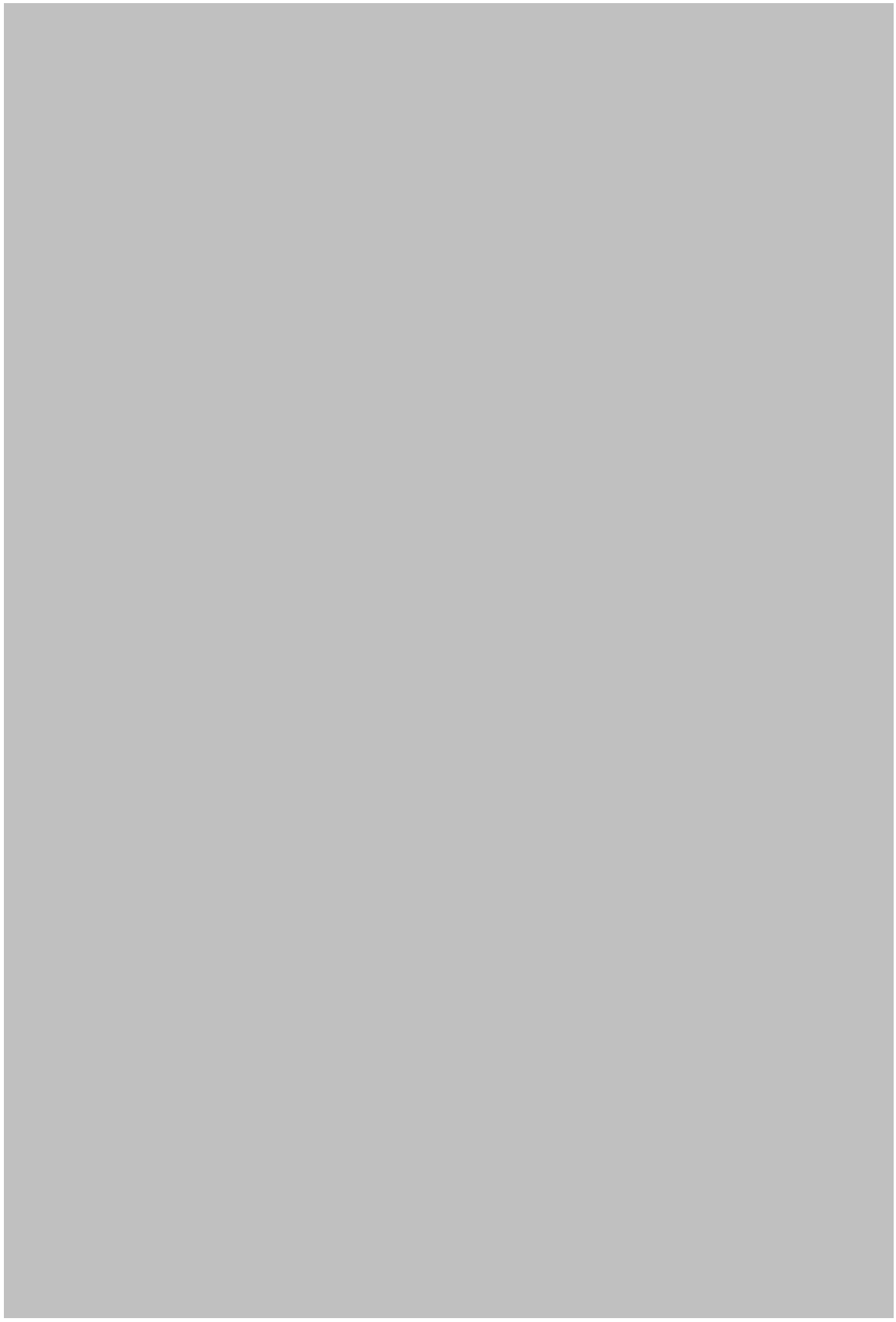
Fishing mortality rates

Sex*		Gear*		Analysis #*	

Population in figures

Population in biomass

Fishing mortality rates



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

Code: MUT0510Que

Sex	Unsexed	Analysis #	3

# of gears	1	Software	VIT (Lleonart and Salat, 1997)

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	From pseudocohort analysis

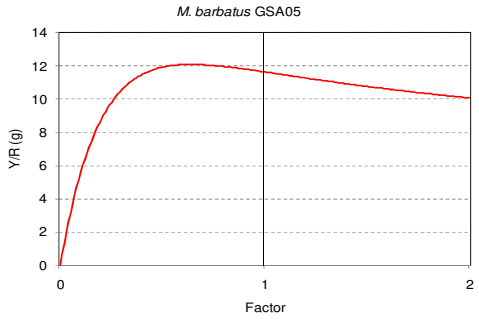
Model characteristics

See Lleonart and Salat (1997), page 94.

Results

	Total	Gear			
Current YR	11.64				
Maximum Y/R	12.10				
Y/R 0.1	11.50				
F_{max}	0.53				
$F_{0.1}$	0.33				
Current B/R	16.26				
Maximum B/R	31.29				
B/R 0.1	22.65				
Fcurrent	0.82				

Comments



Comments

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet D Diagnosis**

Code: MUT0510Que

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	34	tons	50.3	-	Bmean as reference point (Blow=34)
SSB	22	tons	30.2	-	SSBmean as reference point (SSBlow= 22)
F	0.82		0.328	-	F0.1
Y	11.9	tons	16.3	-	Ymean as reference point (Ylow= 10.5)
CPUE	27	/day/bo	28.58	-	Total Mallorca trawl fishery data. CPUElow= 17.22
F					

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

Unidimensional

☐	? - (or blank) Not known or uncertain. Not much information is available to make a judgment;
☐	U - Underexploited, undeveloped or new fishery. Believed to have a significant potential for expansion in total production;
☐	M - Moderately exploited, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;
☐	F - Fully exploited. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;
◉	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;
☐	D - Depleted. Catches are well below historical levels, irrespective of the amount of fishing effort exerted;
☐	R - Recovering. Catches are again increasing after having been depleted or a collapse from a previous;

Bidimensional

Exploitation rate

☐	No or low fishing
◉	Moderate fishing
☐	High fishing mortality
☐	Uncertain / Not assessed

Stock abundance

☐	Virgin or high abundance
◉	Intermediate abundance
☐	Low abundance

☐	Depleted
☐	Uncertain / Not assessed

Comments

Current Y/R very close to the maximum and Bnow being 25% of Bvirgin.

Code: MUT0510Que

Management advice and recommendations*

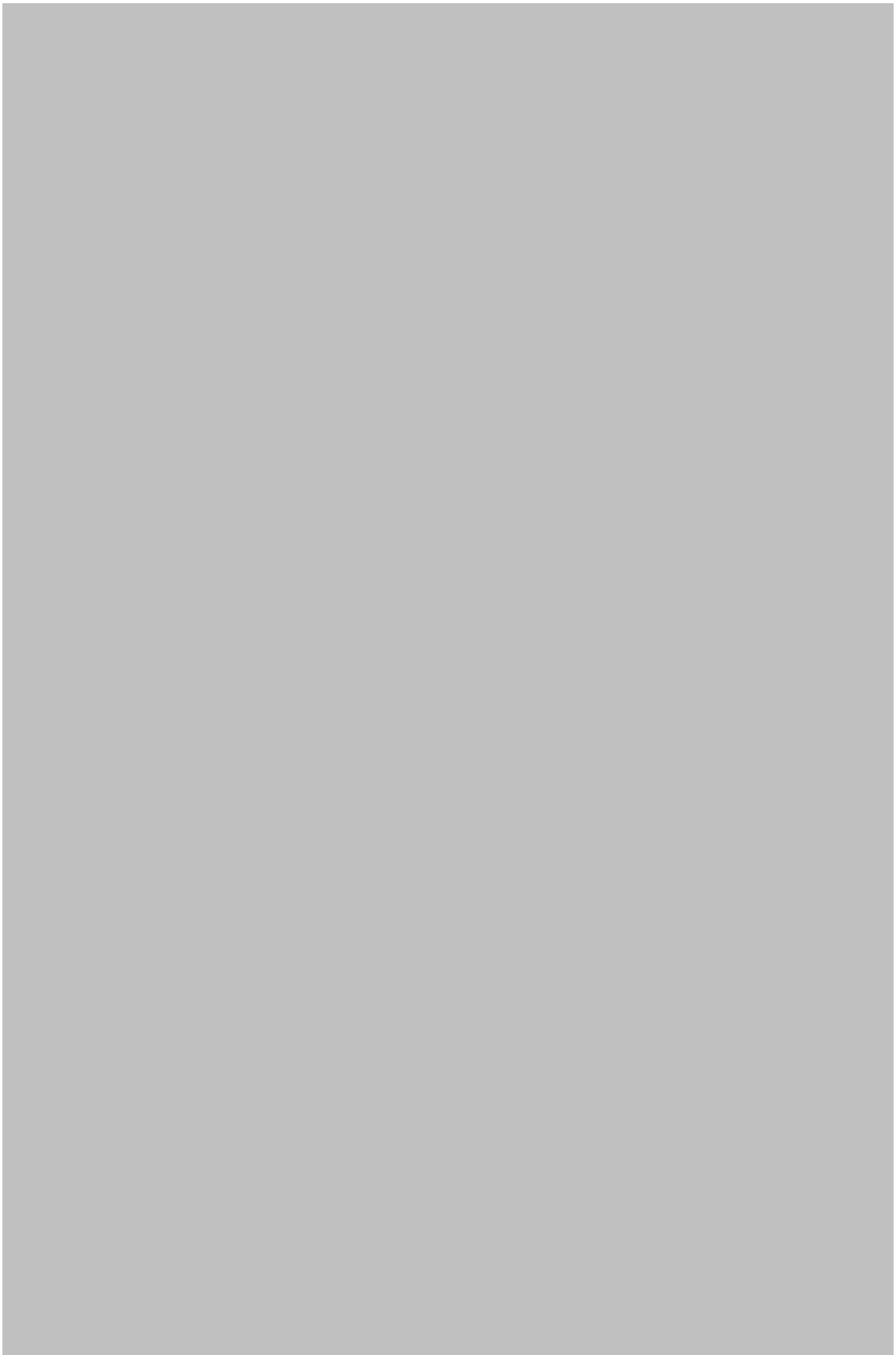
To reduce fishing mortalities by 30% to 50% which can be achieved with reducing effort capacity and improving the selection pattern of the fishery

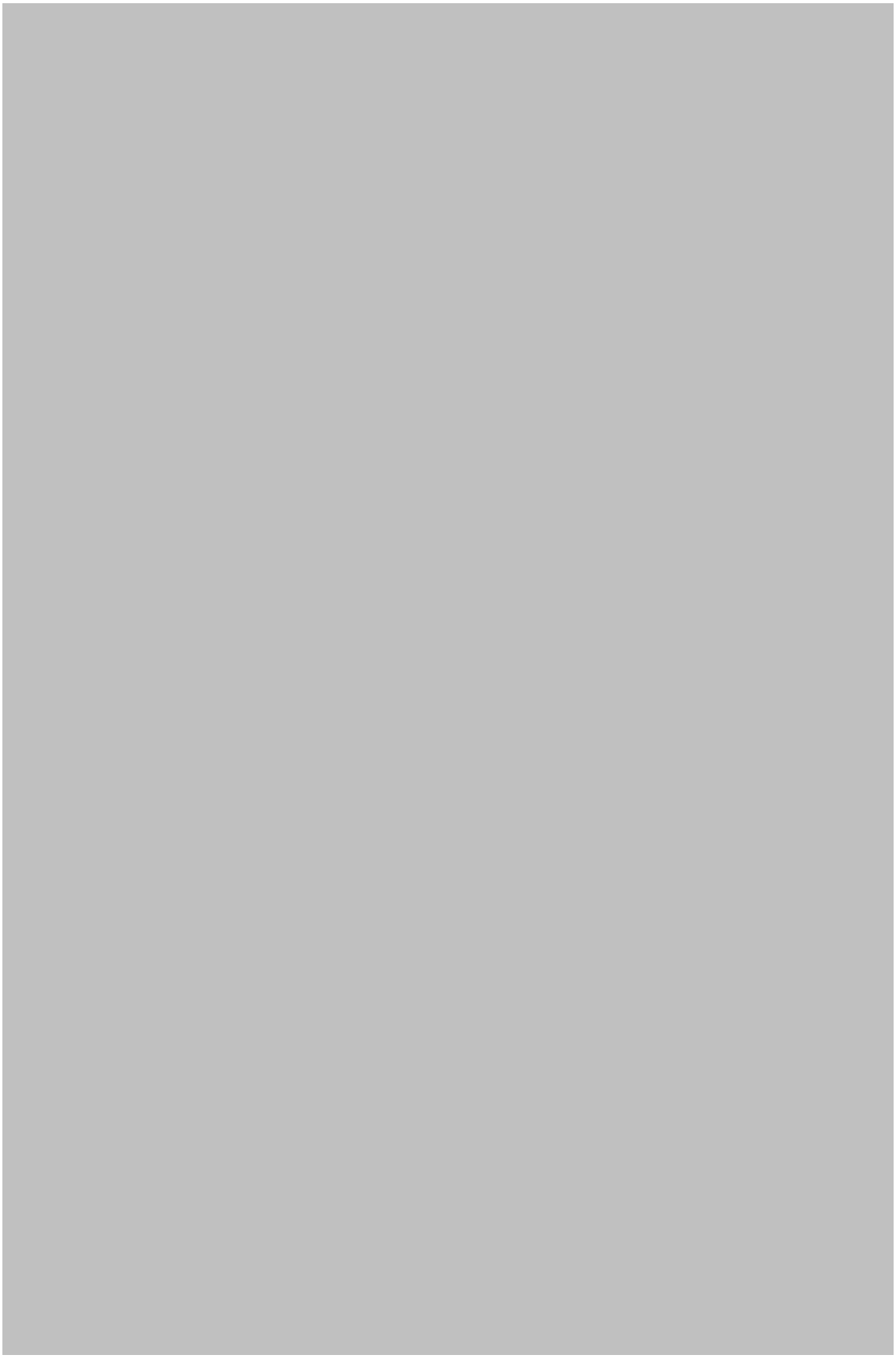
Advice for scientific research*

Comments*

A retrospective analysis was performed without showing any trend.
It would be necessaty to further explore the parametrization of the model.
Both Biomass and Recruitment showed a decreasing trend during last years.

Comments*





Abstract for SCSA reporting

Authors Quetglas A., Ordines F., González N.

Year 2010

Species Scientific name Mullus barbatus - MUT

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 05 - Balearic Island

Fisheries (brief description of the fishery)*

The two species of red mullet inhabiting the Mediterranean, Mullus surmuletus and M. barbatus, are present in the Balearic Sea. However, M. surmuletus predominates in this area where the species is targeted by both the artisanal and trawl fleet working along the continental shelf. On the contrary, M. barbatus is caught as a by-catch species by trawlers operating mainly on the deep shelf. In the Balearic Islands, M. surmuletus and M. barbatus represent about 80% and 20% of the total red mullet catches respectively. During the 2000-2009 period, the landings of M. barbatus from Mallorca have ranged between 10.5 and 27.8 tons.

Source of management advice*

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

The stock of Mullus barbatus of the GFCM-GSA05 has been assessed using data from the trawl fishery on a time series covering eight years (2000-2009). The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) on the cohorts present during 2000-2007 and both VPA and Y/R analysis on a mean pseudo-cohort from that period. These approaches were performed using monthly size composition of catches, official landings and the growth parameters accorded in the SGMED-08-03 meeting. Other biological parameters (length-weight relationships, oogive of maturity) were obtained within the framework of the Spanish Data Collection Programme. The VPA was tuned with CPUE from bottom trawl surveys carried out around the Balearic Sea during 2001–2009. The vector of natural mortality by age was calculated from Caddy´s (1991) formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997). Terminal fishing mortality was obtained from the catch equation using the FLeda package (Jardim and Azevedo, 2004) and the vector of fishing mortality by age from a separable VPA. The software used to run the assessments were the Lowestoft VPA program (Darby and Flatman, 1994) for the XSA and the VIT program (Lleonart and Salat, 1997) for the VPA and 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

Moderate fishing mortality

Stock abundance

Intermediate abundance

Comments

Current Y/R very close to the maximum and Bnow being 25% of Bvirgin.

Management advice and recommendations*

To reduce fishing mortalities by 30% to 50% which can be achieved with reducing effort capacity and improving the selection pattern of the fishery

Advice for scientific research*