

SAC GFCM
Sub-Committee on Stock Assessment

Date*

17	November	2009
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Code*

MUR0509Que

Authors*

Quetglas A., Guijarro B., Ordines F., Moranta J.
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Affiliation*

IEO-Centre Oceanogràfic de Balears

Species Scientific name*

<i>Mullus surmuletus</i> - MUR

Source: GFCM Priority Species

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: MUR0509Que

Date*	17	Nov	2009	Authors*	Quetglas A., Guijarro B., Ordines F., Moranta J.
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Species Scientific name*	Mullus surmuletus - MUR	Species common name*	Striped red mullet
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Data Source

GSA*	05 - Balearic Island	Period of time*	2000-2008
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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 (Leonart and Salat, 1997)

Sheets filled out

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

Aleman F. and F. Álvarez (2003) Determination of effective fishing effort on hake *Merluccius merluccius* in a Mediterranean trawl fishery. *Sci. Mar.*, 67(4): 491–499.

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.

Bruno J., P. Oliver, A. Astudillo, X. Pastor and E. Daroca (1979) Contribution a la connaissance de la biologie du merlu (*Merluccius merluccius* L.) et du rouget (*Mullus surmuletus* L. et *Mullus barbatus* L.). *Rapp. Comm. Int. Mer Médit.*, 25/26(10): 79–86.

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 Analysis: version 3.1 (Windows/DOS) user guide*. Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft, n° 1, 85 pp.

Leonart J. and J. Salat (1997) VIT: Software for fishery analysis. User's manual. FAO Computerized Information Series (Fisheries). N° 11. Rome, FAO, 105 pp.

Mas, X, Goñi, R, Fernández, JL (2004) Yields, bycatch and discards in the *Mullus surmuletus* gillnet fishery off southeastern Mallorca (western Mediterranean). *Rapp. Comm. int. Mer Médit.*, 37: 397.

Morales-Nin B. (1991) Parámetros biológicos del salmonete de roca *Mullus surmuletus* (L. 1758) en Mallorca. *Bol. Inst. Esp. Oceanogr.*, 7: 139–147.

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Sheet B
Biology of the species

Code: MUR0509Que

Biology

	Somatic magnitude measured (LH, LC, etc)*				Total length	Units*	cm
	Sex	Fem	Mal	Both	Unsexed		
Maximum size observed					39(1)	Reproduction season	Spring(4)
Size at first maturity					14.2(2)	Reproduction areas	
Recruitment size					10(3)	Nursery areas	Continental shelf

Parameters used (state units and information sources)

Sex	Unsexed							
Growth model	on Bertalanffy							
Data source	Otolith readings of individuals from the Balearic Islands in the framework of the Spanish Nat							
L_{∞} (growth)	40.05							
K (growth)	0.164							
t_0 (growth)	-1.883							
length-weight relationship	Biological samplings of individuals from the Balearic Islands in the framework of the Spanish Nat							
a (length-weight)	0.0084							
b (length-weight)	3.118							
sex ratio								
M	Vector of M at age(5)							

Comments

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Sheet P1

General information about the fishery

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Data source*	Size composition of trawl and small-scale catches: IE	Year (s)*	2000-2008
Data aggregation (by year, average figures between years, etc.)*		By year for XSA and average 2000-2008 for pseudocohort and Y/R analysis	

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Gear Class	Group of Target Species
Operational Unit 1*	ESP	05	E - Trawl (12-24 metres)	03 - Trawls	34 - Demersal offshore species
Operational Unit 2	ESP	05	C - Minor gear with engine (6-12 metres)	07 - Gillnets and Entangling Nets	33 - Demersal inshore species
Operational Unit 3					
Operational Unit 4					
Operational Unit 5					

Operational Units*	Fleet (n° of boats)*	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
	37	94.78	See sheet P2b	No(3)		days
ESP 05 C 07 33	91	22.64	See sheet P2b	Yes (4)	Yes (4)	days
Total	128	117.42				

Legal minimum size	11 cm
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Comments

- (1) Fleets (n° of boats) refers to: 1) the average number of trawlers in Mallorca during 2000 and 2) the average number of boats from the small-scale fleet that targeted the species during the period.
- (2) Catch is the average landings, in tons, of Mallorca during the period 2000–2007.
- (3) Carbonell (1997).
- (4) Since Mas *et al.* (2004), twelve species were discarded at least in one occasion, and the discarded fraction in this fishery was 1.4% in number. *M. surmuletus* were discarded in 19 the fishing sets and made up the largest fraction of the discards (42.8% in number).

- The GFCM geographical sub-area 05 includes the waters around the Balearic Islands. The Archipelago is constituted by the islands of Mallorca, Menorca, Ibiza and Formentera. From official landings, the red mullet *Mullus surmuletus* represents the following percentages by 94.8% Mallorca, 2.7% Menorca and 2.5% Ibiza-Formentera. The present assessment has been performed considering exclusively data from Mallorca because: 1) reliability and availability of fishery statistics; and 2) both length and biological (growth, maturity, length-weight) samples were carried out in this island. Hence, it must be taken into account that the present assessment represents approximately 95% of the total GSA-05.

- From official data, the total trawl fleet of the whole geographical sub-area 05 (Balearic Islands) is composed by 53 boats: on average, 41 TRB, 53 GT and 239 HP. Some of these units (small vessels) operate almost exclusively on the continental shelf (target species: red mullets, pic octopuses, hake and sea breams), others (bigger vessels) operate almost exclusively on the continental slope (target species are decapod crustaceans) and the rest can operate indistinctly on the continental shelf and slope fishing grounds, depending on the season, the weather conditions and also economic factors (e.g. landings price). In Mallorca, the percentage of these trawl fleet segments have been estimated (Alemany & Alvarez, 2003) 30, 40 and 30% of the boats, respectively.

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Sheet P2a
Fishery by Operational Unit

Code: MUR0509Que

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Data source*	IEO: size composition of trawl catches; Official la	OpUnit 1*	0
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Time series

Year*	2000	2001	2002	2003	2004	2005
Catch	84.99	117.06	105.29	81.87	82.96	93.92
Minimum size	8	7	9	7	9	9
Average size L_c	17	16.9	16.8	16.6	16.5	16.5
Maximum size	30	31	29	30	29	30
Fleet	41	39	39	37	37	37

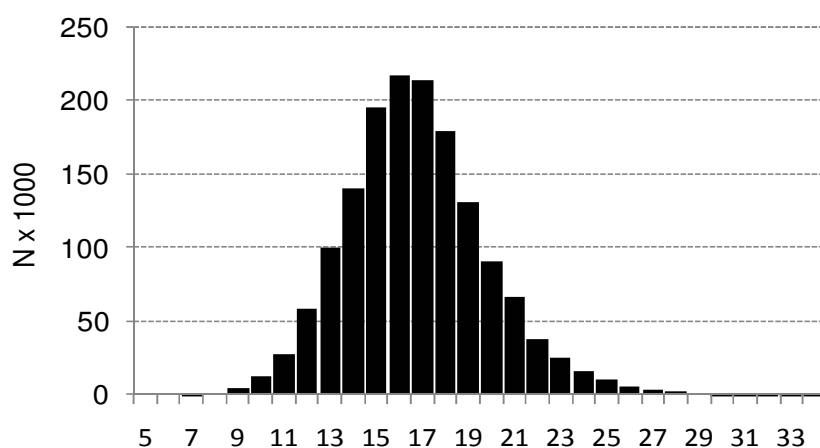
Year	2006	2007	2008			
Catch	90.77	114.22	81.92			
Minimum size	8	10	8			
Average size L_c	16	17.2	17.3			
Maximum size	33	32	32			
Fleet	36	36	34			

Selectivity

Remarks

L_{25}	6.5 cm	This data corresponds to 40 monthly hauls in the cod-end. Data source: Matusi, E., M. M. B. Guàrdia & B. Porta (2003) Informe del seguimiento científico de una acción piloto de selectividad de artes de arrastre en aguas de Mallorca (Illes Balears). Informe Secretaría General de Pesca Marítima, 76 pp.
L_{50}	8.5 cm	
L_{75}	10.5 cm	
Selection factor		

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 2000–2008. Size composition of catches have been obtained from monthly length sampling (stratified random method) on board trawl fishing vessels at different ports of Mallorca.

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Assessment form

Sheet P2a

Fishery by Operational Unit

Code: MUR0509Que

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Data source*	IEO: size composition of small-scale catches; Offi	OpUnit 2*	ESP 05 C 07 33
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Time series

Year*	2000	2001	2002	2003	2004	2005
Catch	21.49	27.31	25.72	19.75	17.57	28.61
Minimum size	15.0	15.0	15.0	15.0	15.0	15.0
Average size L_c	20.7	20.7	20.7	20.7	20.7	20.7
Maximum size	33	33	33	33	33	33
Fleet	101	102	110	86	78	86

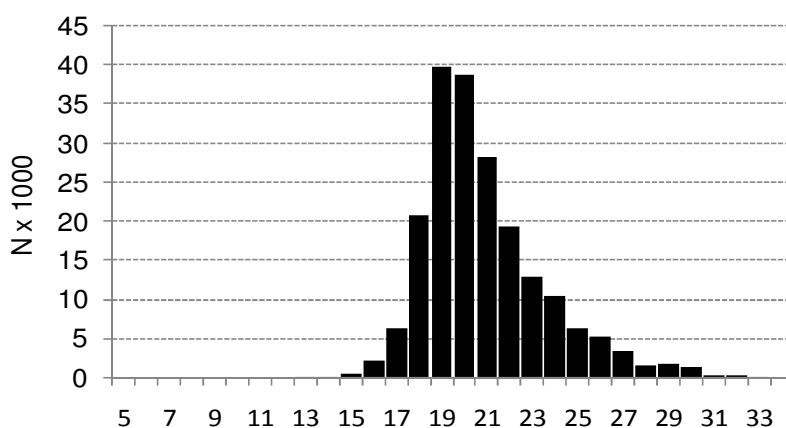
Year	2006	2007	2008			
Catch	22.13	21.29	19.88			
Minimum size	15.0	15	13			
Average size L_c	21.5	20.1	21.9			
Maximum size	31	33	33			
Fleet	84	85	84			

Selectivity

Remarks

L_{25}		
L_{50}		
L_{75}		
Selection factor		

Structure by size or age



Average size frequency distribution (cm; total length) of small-scale catches in the geographical sub-area 05 (Balearic Islands) for the period 2000–2008. Size composition of catches have been obtained from on port monthly length sampling (stratified random method).

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Assessment form

Sheet P2b
Fishery by Operational Unit

Code: MUR0509Que

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Data source*	IEO and EU research project on discards (1)	OpUnit 1*	0
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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. surmuletus*, the following species can be considered as important in landings:

- *Spicara smaris*
- *Mullus barbatus*
- *Pagellus acarne*
- *Pagellus erythrinus*
- *Trachurus mediterraneus*
- *Scyliorhinus canicula*
- *Serranus cabrilla*
- *Trachinus draco*
- *Scorpaena notata*
- *Trigloporus lastoviza*
- *Scorpaena scrofa*
- *Octopus vulgaris*
- *Eledone moschata*
- *Sepia officinalis*
- *Loligo vulgaris*

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Assessment form

Sheet P2b
Fishery by Operational Unit

Code: MUR0509Que

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Data source* IEO and EU research project on discards (1)

OpUnit 2*

ESP 05 C 07 33

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Fishing season (July to December): fully observed
- Maximum length of nets (2000 m/fisherman and 5000 m/boat): not fully observed
- Minimum mesh size (50 mm): fully observed
- Limitation to 6 fishing days per week: fully observed
- Time at sea (from sunrise to sunset): not fully observed
- Fishing forbidden deeper than 50 m depth: fully observed

Accompanying species

Since Mas *et al.* (2004), the main by-catch species were the following commercially important fish species:

- *Diplodus annularis*
- *Spicara maena*
- *Diplodus vulgaris*
- *Serranus scriba*

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Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: MUR0509Que

Sex* Unsexed

Analysis # * 1

Time series

Data	Size	Age
(mark with X)	X	X

Model	Cohorts	Pseudocohorts
(mark with X)	X	2 (more A1 sheets are

Equation used	Catch equation	Tuning method	Extended Survivor Analysis
# of gears	2	Software	Lowestoft VPA suite (Darby and Flatman, 1994)
F _{terminal}	0.453		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	8.2	219.9
Average			Average population	12.29	519.6
Maximum			Virgin population	SSN	SSB
Critical			Turnover	3.45	221.4
				N in millions	in tons

Average mortality

	Total	Gear				
F ₁	0.549					
F ₂	0.079					
Z	1.029					

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

Comments

F1 was calculated averaging FBAR0-5 from 2000–2008; FBAR0-5 is an arithmetic mean calculated for each year over all the range of ages (0–5 years).

F2 is the F at age 0

$$Z = 0.48 + F1$$

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

Age (years)	F
0	0.092
1	0.440
2	0.754
3	0.633
4	0.464
5	0.453

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Assessment fo

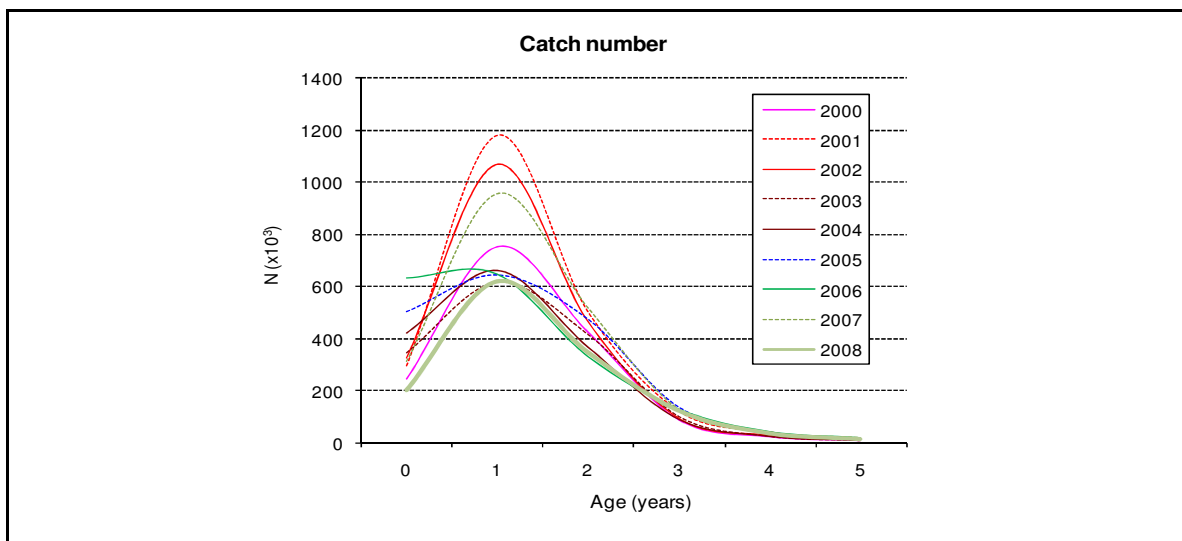
Sheet A2
Indirect methods: data

Code: MUR0509Que

Sex*	Unsexed	Gear*	Trawl+Small-scale(trammel nets and gillnets)	Analysis # *	1
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Data	Catch in number by age and CPUE from surveys and commercial fleet
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Data



VPA tuning were performed using CPUE data from scientific surveys (N individuals per km²) and daily landings from one port of Mallorca (Santanyí). It was used this port, situated in the SE of the island, because its fleet works basically on the continental shelf, and thus it can be considered that their CPUEs are a good indicator of the species abundance (*Mullus surmuletus* inhabits mainly on the shelf). The landings of this port represented 12–30% of the total catch of Mallorca during the assessed period.

Abundance indices from surveys were calculated considering different bathymetric strata. For tuning VPA, the values obtained in the stratum corresponding to the continental shelf (<100 m depth) were used because they best reflected the evolution of commercial landings.

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Assessment fo

Sheet A3

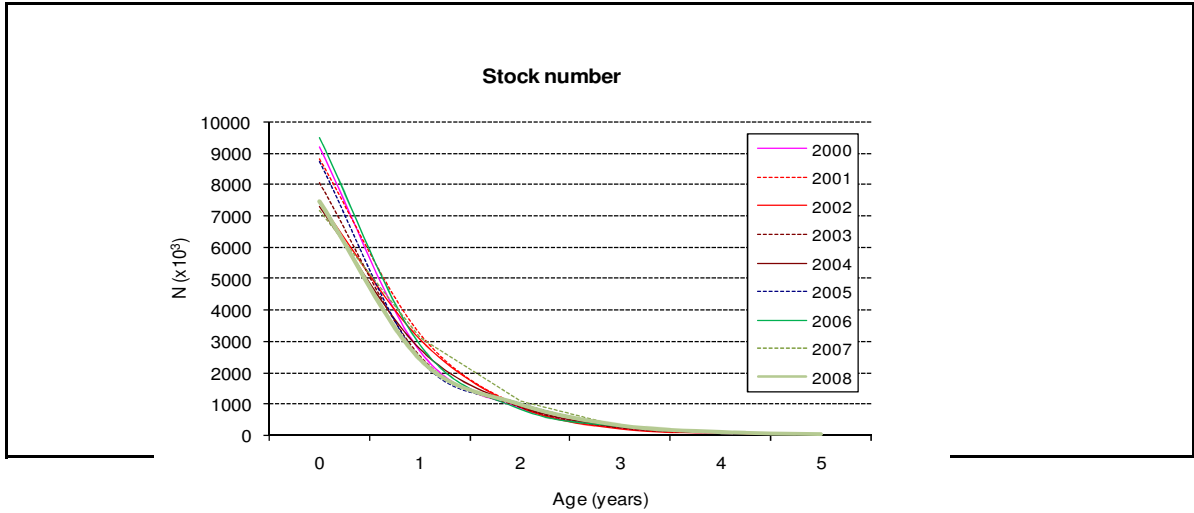
Indirect methods: VPA results

Code: MUR0509Que

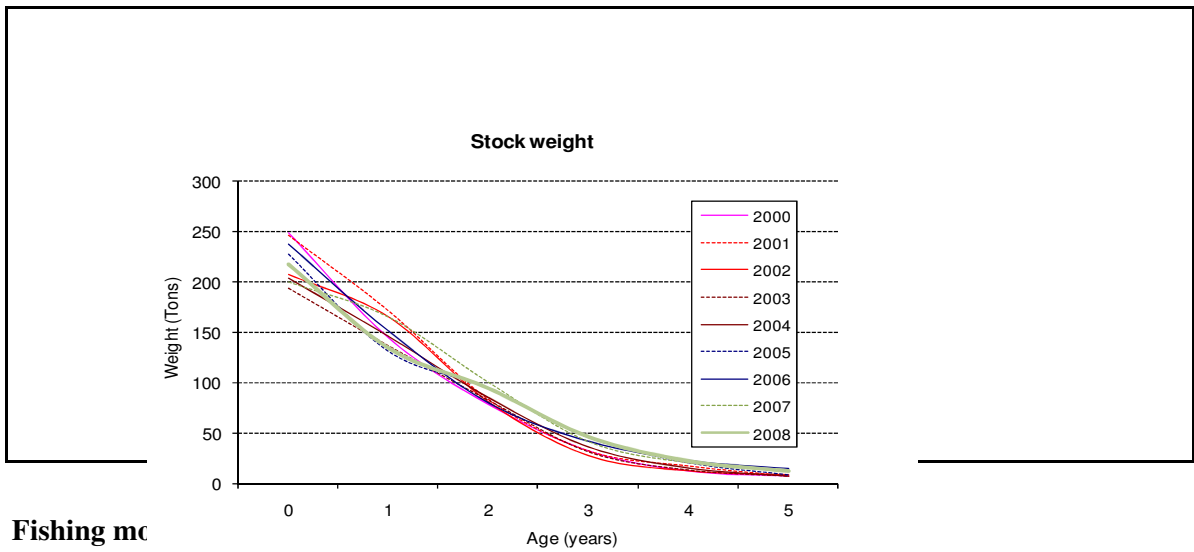
Page 1 / 2

Sex*	Unsexed	Gear*	Trawl + Small-scale (trammel nets	Analysis #*	1
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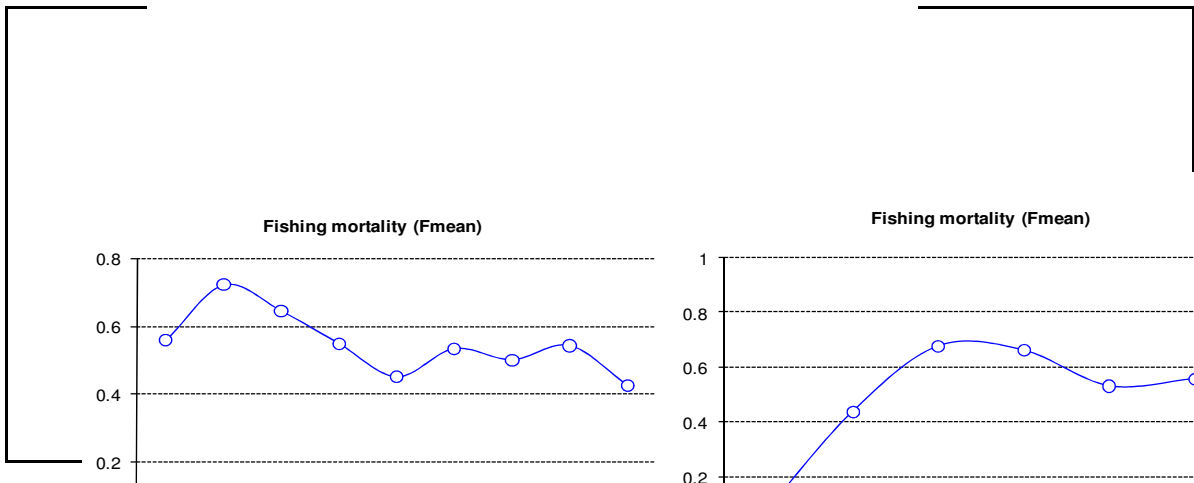
Population in figures



Population



Fishing mc



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Assessment fo

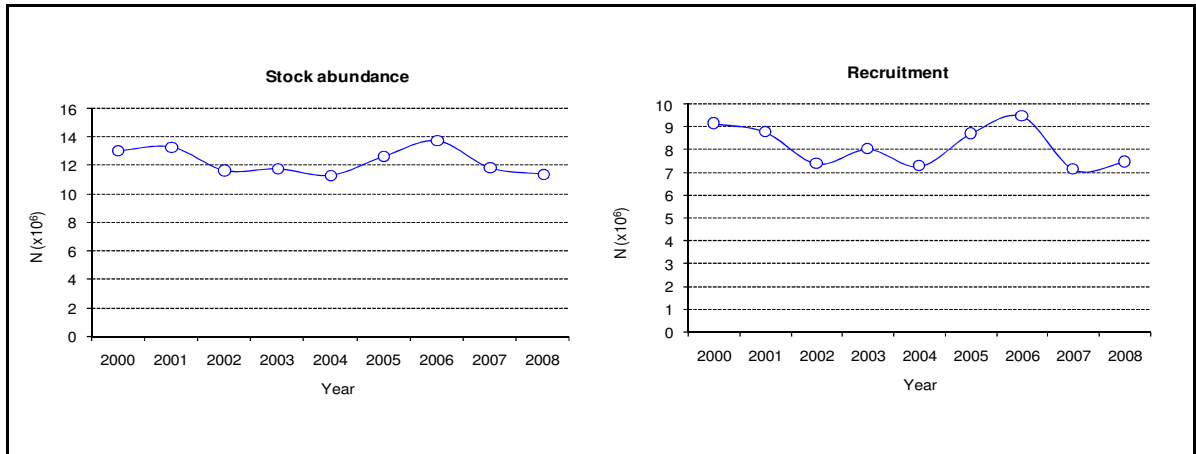
Sheet A3
Indirect methods: VPA results

Code: MUR0509Que

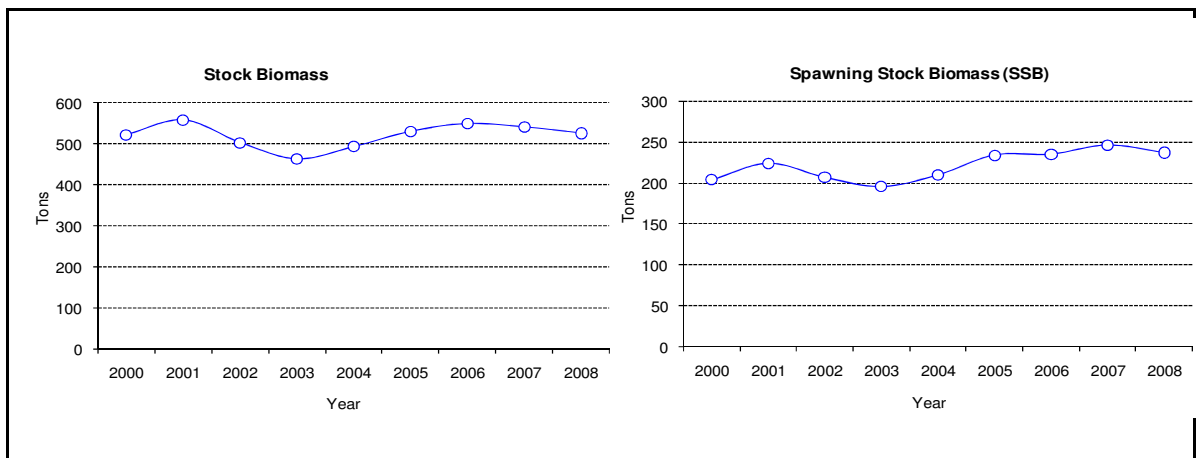
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Sex*	Unisex	Gear*	Trawl + Small-scale (trammel nets)	Analysis #*	1
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Population in figures



Population in biomass



Fishing mortality rates



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Assessment form	Sheet A1 Indirect methods: Y/R

Sex	Unsexed	Code: MUR0509Que
		Analysis #
		2

# of gears	2	Software	VIT (Lleonart and 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	From pseudocohort analysis

Model characteristics

From calculated mean weights

Results

	Total	Gear		
		Trawl	Small-scale	
Current YR	15.75	12.72	3.04	
Maximum Y/R	16.02	14.07	3.38	
Y/R 0.1	14.95	11.62	3.31	
F _{max}	1.43	2.00	0.61	
F _{0.1}	0.73			
Current B/R	38.05			
Maximum B/R	50.55			
B/R 0.1	45.80			

Comments

<p>In Results, small-scale gear refers to trammel net and gillnet combined.</p> <p>Total (red), Trawl (green) and Small-scale (yellow)</p>	
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Assessment form

Sheet other

Code: MUR0509Que

Other assessment methods

Other results from Analysis 2 (pseudo-cohort analysis)

Population results (please state units)

	Sizes (cm)	Ages (years)		Numbers (millions)	Weight (t)
Minimum			Recruitment ⁴	7.42	171.01
Average	14.4	0.91	Population ⁴	11.39	462.39
Maximum			SSB		212.63
Current stock ²	15.1	1	Virgin population		757.83
Virgin stock ³	24.8	4	Turnover (%)		107.99
			B _{now} /B _{virgin} (%)		37.3

²Critical size and age at current stock

³Critical size and age at virgin stock, assuming constant recruitment

⁴Mean values

Average mortality

	Fleets			
	Total	Trawl	Small scale	
⁵ F ₁ = Mean F	0.507	0.351	0.156	
⁵ F ₂ = Global F	0.246	0.218	0.028	
⁶ F ₀	0.079	0.079	0	
⁷ F _{1-2 years}	0.667	0.549	0.119	
⁷ F _{3-4 years}	0.588	0.363	0.225	
Z = 0.48 + F ₁	0.987	0.831	0.636	

⁵F₁ and F₂ are mean and global F, respectively, as defined by Leonart and Salat (1997)

⁶F₀ is the F at age 0

⁷F_{i-j} are mean fishing mortalities calculated between age classes *i* and *j*

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Sheet D
Diagnosis

Code: MUR0509Que

Reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	525	tons	519.6	+	Bmean as reference point (B _{low} = 462)
SSB	237	tons	221.4	+	SSBmean as reference point (SSB _{low} = 196)
F	0.428		0.549	-	Fmean as reference point (F _{low} = 0.428)
Y	101.8	tons	117.42	-	Ymean as reference point (Y _{low} = 100.5)
CPUE					
CPUE					
Density					

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

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

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

Comments

Current Y/R very close to the maximum and B_{now} being 37.3 B_{virgin}.

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Sheet Z

Objectives and recommendations

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Management advice and recommendations*

No increase the fishing effort.