SAC GFCM
Sub-Committee on Stock Assessment

Date*	13	October	2011	**Code***	MUT0611Fer

Authors*

Fernández, A. M.

Affiliation*

I. E. O. Centro Oceanográfico de Murcia

Species Scientific name*

1 *Mullus barbatus* - *MUT*

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: MUT0611Fer

Date*	13	Oct	2011	Authors*	Fernández, A. M.

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

Data Source

GSA*	06 - Northern Spain	Period of time*	1995-2010

Description of the analysis

Type of data*	Size composition of commercial catches, official landings and CPUE from survey and commercial fleet	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 (Lleonart & Salat, 1997) and Excel spreadsheet

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	---	---	---	1	1	3	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.

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.

Carbonell, A. (1997) Discards of the western Mediterranean trawl fleets. Final Report Contract DGXIV-MED/94/027, 142 pp.

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.

Demestre M., M. Sbrana, F. Álvarez and P. Sánchez (1997) Analysis of the interactions of fishing gear in Mullus barbatus fisheries of the Western Mediterranean. J. Appl. Ichthyol., 13: 49-56.

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.

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.

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: MUT0611Fer

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)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞				34.5	
	K				0.34	
	t0				-0.143	
	Data source	Demestre et al. 1997 (5)				
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-Rodriguez, 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

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

Code: MUT0611Fer

Data source*	Size composition of trawl catches from IEO and Spanish National Data Collection Programme; official landings and fleet from Fishermen Assotiations and Regional Governments	Year (s)*	1995-2010
Data aggregation (by year, average figures between years, etc.)*	by year		

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						

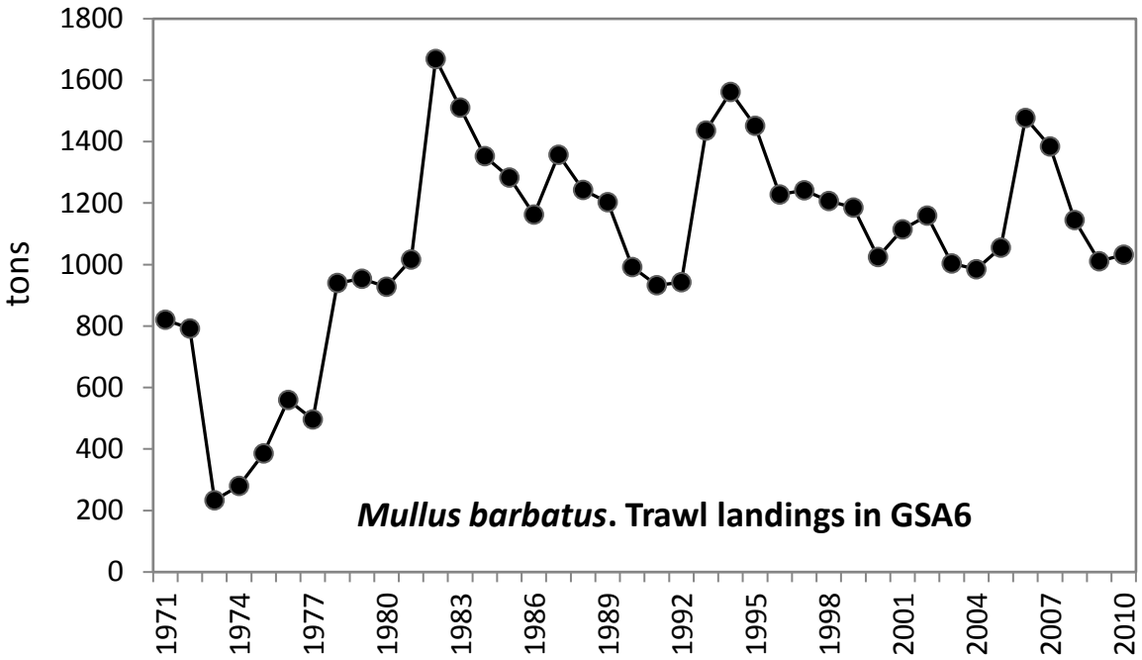
Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ESP 06 E 03 33 - MUT	707	Tons	1169	See sheet P2b	No		ishing day
Total	707		1169				

Legal minimum size	11 cm total length

Comments

Fleet (nº of boats) refers to the average number of trawlers 1998-2010
Catch refers to the average trawl landings 1995-2010
Discards are not significant (Carbonell, 1997)

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.

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

Code: MUT0611Fer

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

Time series

Year*	1999	2000	2001	2002	2003	2004
Catch	1185	1025	1115	1159	1004	985
Minimum size	5	6	5	5	6	6
Average size Lc	11.8	12.8	12.4	12.4	13.1	12.8
Maximum size	28	26	26	26	26	26
Fleet	797	774	760	757	738	729

Year	2005	2006	2007	2008	2009	2010
Catch	1055	1477	1384	1145	1011	1032
Minimum size	6	5	5	5	5	5
Average size Lc	12.8	13.2	12.4	13	14.7	13.9
Maximum size	27	28	28	27	27	28
Fleet	722	716	691	624	567	512

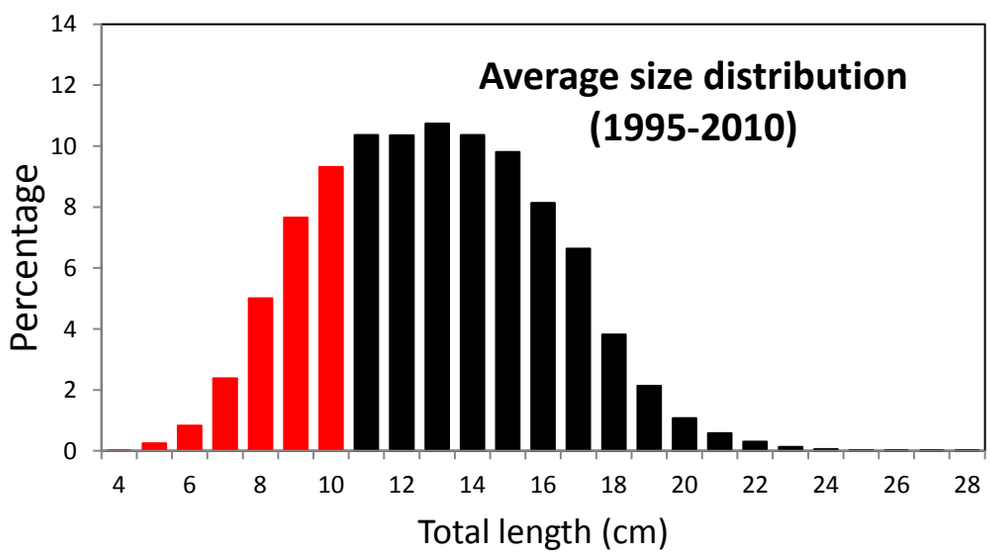
Selectivity

L25	6.9
L50	7.8
L75	8.9
Selection factor	1.95

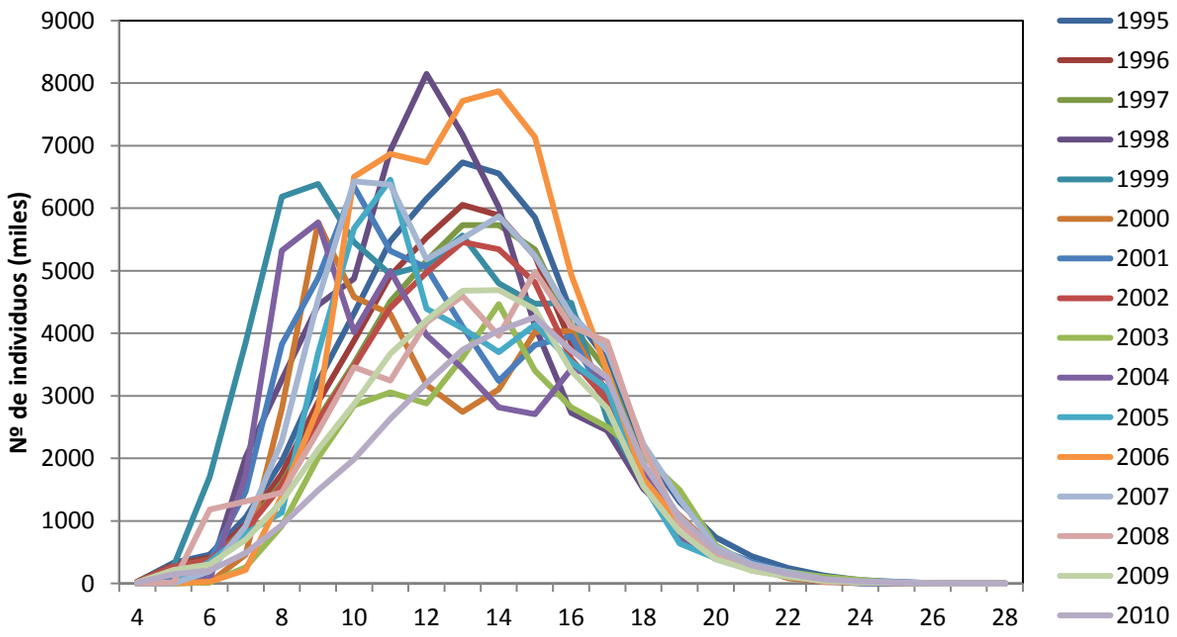
Remarks

Selectivity parameters for 40 mm diamond mesh in the cod-end (García-Rodriguez and Fernández, 2005).

Structure by size or age



Structure by size or age



Size distribution by year (1995-2010)

Data source*		OpUnit 1*	ESP 06 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 square): check required
- Fishing ban in areas less than 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 GSA 06 is a multi-specific fishery. In addition to *M. barbatus* the following species are important in landings:

- *Mullus surmuletus*
- *Merluccius merluccius*
- *Pagellus acarne*
- *Pagellus erythrinus*
- *Trisopterus m. capelanus*
- *Trachurus spp.*
- *Scyliorhinus canicula*
- *Eledone cirrhosa*
- *Sepia officinalis*
- *Octopus vulgaris*

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: MUT0611Fer
Page 1 / 1

Sex*	Both

Analysis # *	1

Time series

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)
$F_{terminal}$			

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	155.3 (1)	
Average			Average population		3030 (1)
Maximum			Virgin population		
Critical			Turnover		SSB (1)
					686
				x 10** 6	in tons

Average mortality

		Gear					
	Total						
F_1	0.8						
F_2							
Z							

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

Comments

(1) average 1995-2010
F1 is the average Fbar 0-2 (1995-2010)

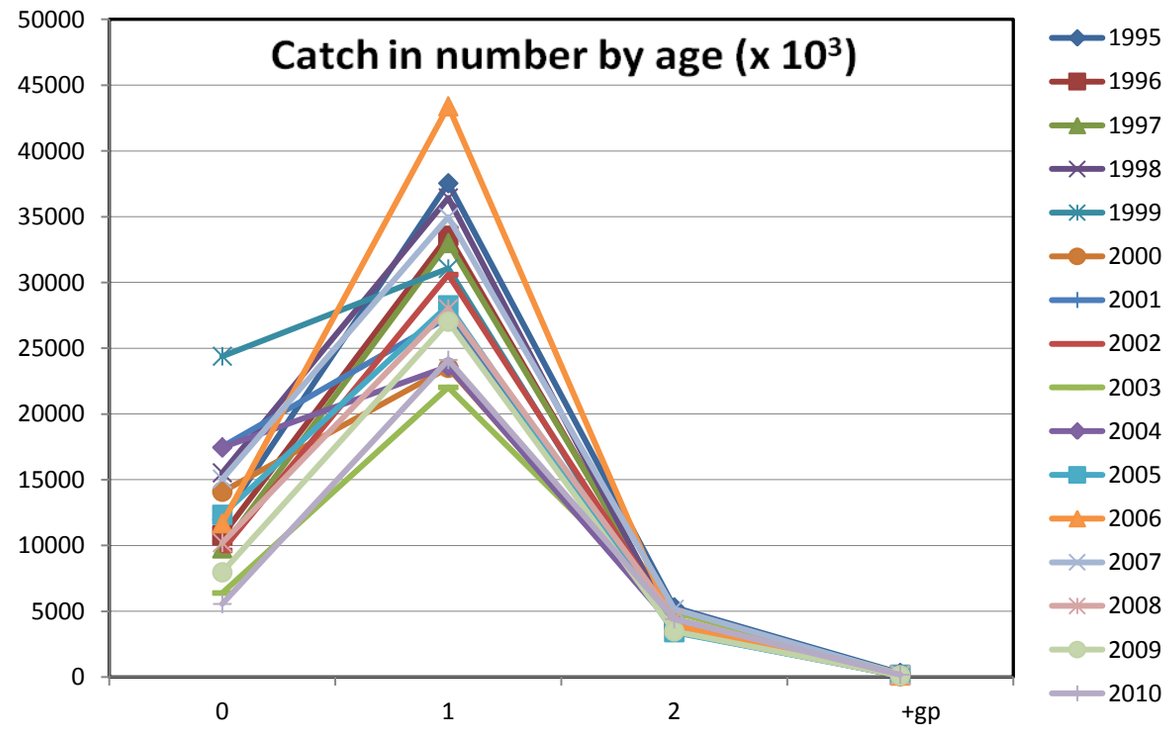
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet A2 Indirect methods: data

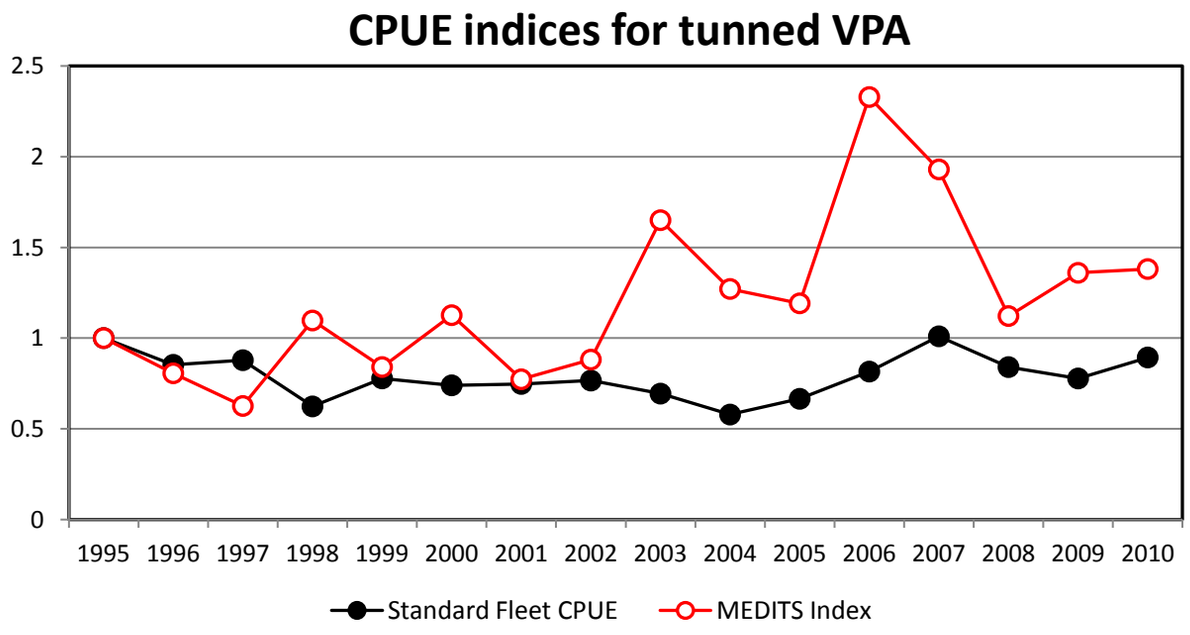
Code: MUT0611Fer

Sex*	Both	Gear*	Trawl	Analysis # *	1

Data source	

Data





Sex*	Both	Gear*	Trawl	Analysis #*	1

Population in figures

Year	Recruitment (Age 0) (10**6)		
1995	166.83	2003	121.49
1996	157.78	2004	161.29
1997	166.62	2005	209.83
1998	165.03	2006	176.21
1999	152.40	2007	152.51
2000	150.87	2008	147.13
2001	176.35	2009	126.16
2002	124.00	2010	129.69

Population in biomass

Year	Total biomass (tons)		
1995	3471	2003	2818
1996	3084	2004	2634
1997	3107	2005	3431
1998	2936	2006	3808
1999	2713	2007	3431
2000	2783	2008	2866
2001	3025	2009	2710
2002	2911	2010	2755

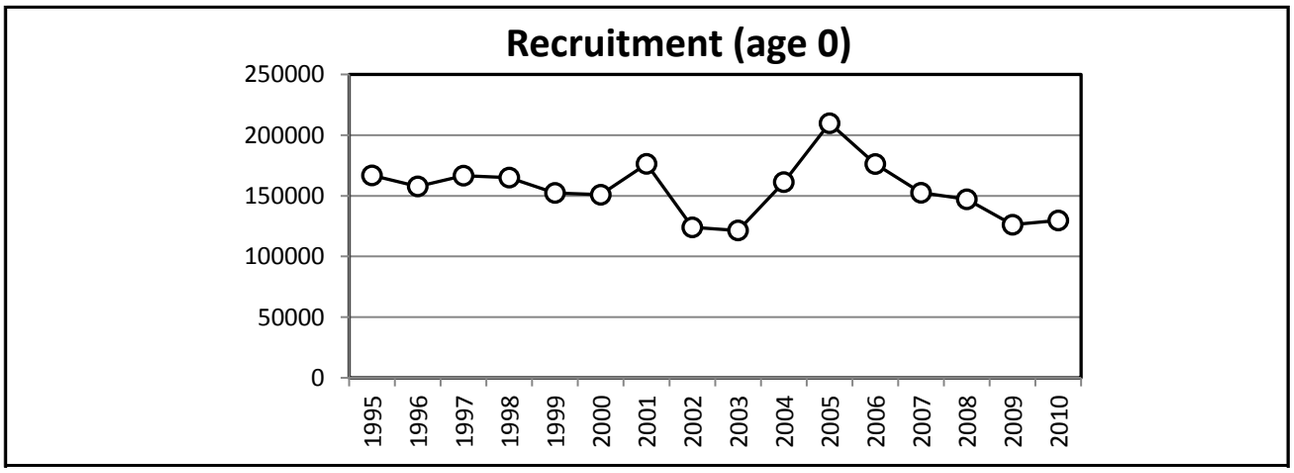
Year	SSB (tons)	Year	
1995	769	2003	753
1996	662	2004	616
1997	627	2005	674
1998	546	2006	821
1999	587	2007	785
2000	643	2008	704
2001	650	2009	689
2002	749	2010	700

Fishing mortality rates

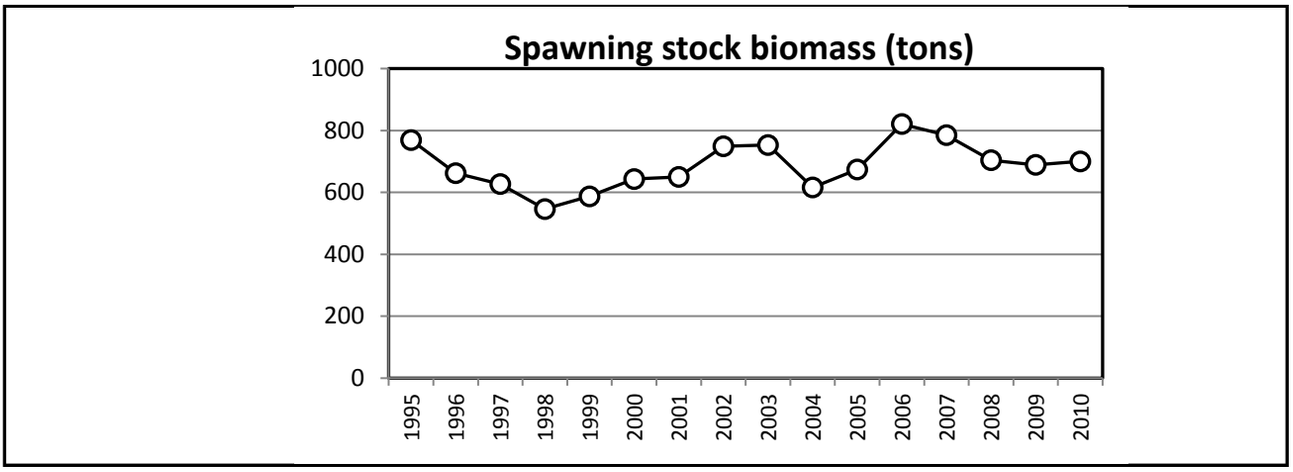
Year	Fbar 0-2	Year	
1995	0.8932	2003	0.6905
1996	0.8452	2004	0.7633
1997	0.9036	2005	0.7218
1998	0.9658	2006	0.7863
1999	0.9004	2007	0.8315
2000	0.7586	2008	0.7732
2001	0.8022	2009	0.6857
2002	0.7345	2010	0.7257

Sex*	Both	Gear*	Trawl	Analysis #*	1

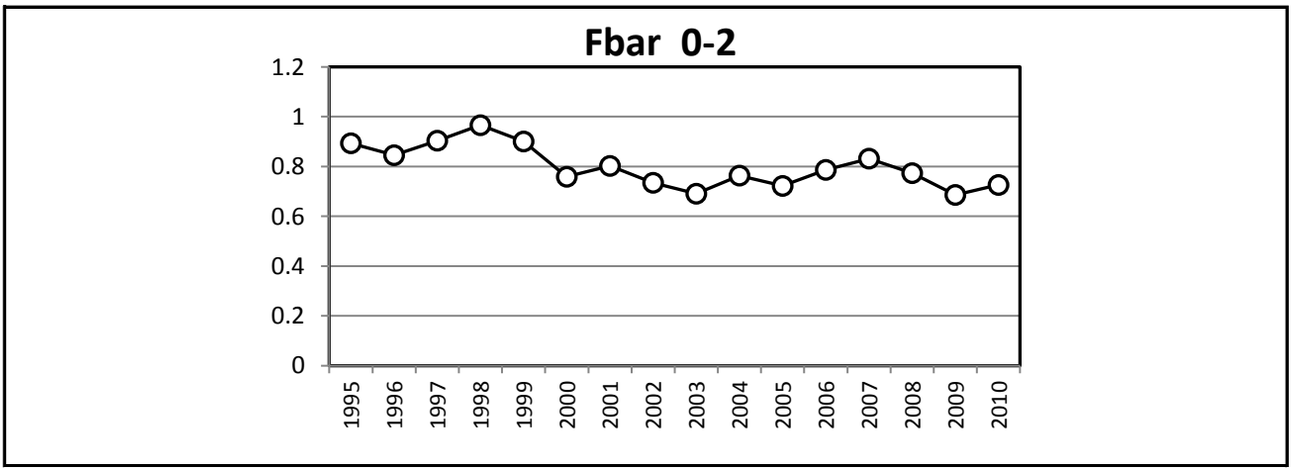
Population in figures



Population in biomass

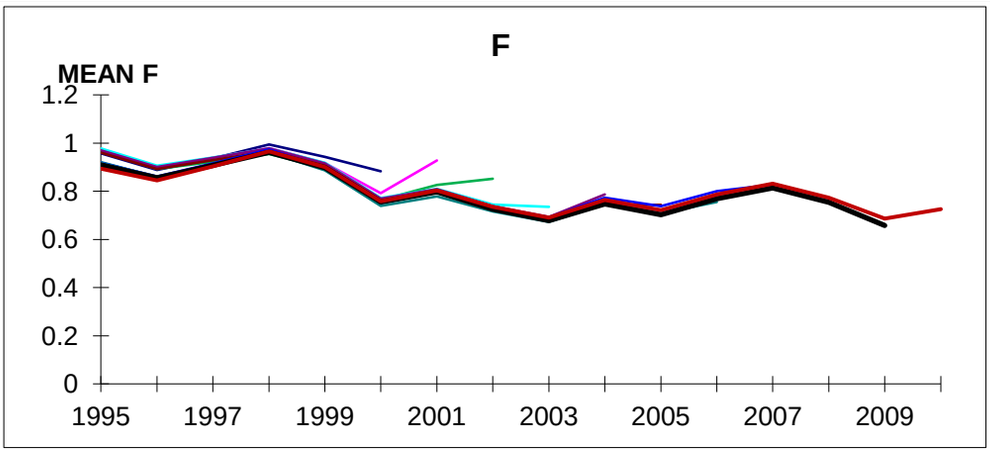


Fishing mortality rates

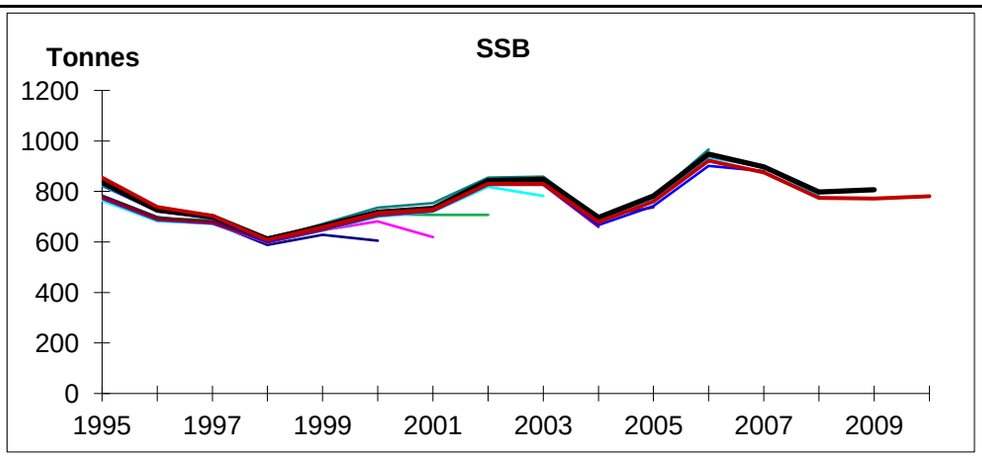


Sex*	Both	Gear*	Trawl	Analysis #*	1

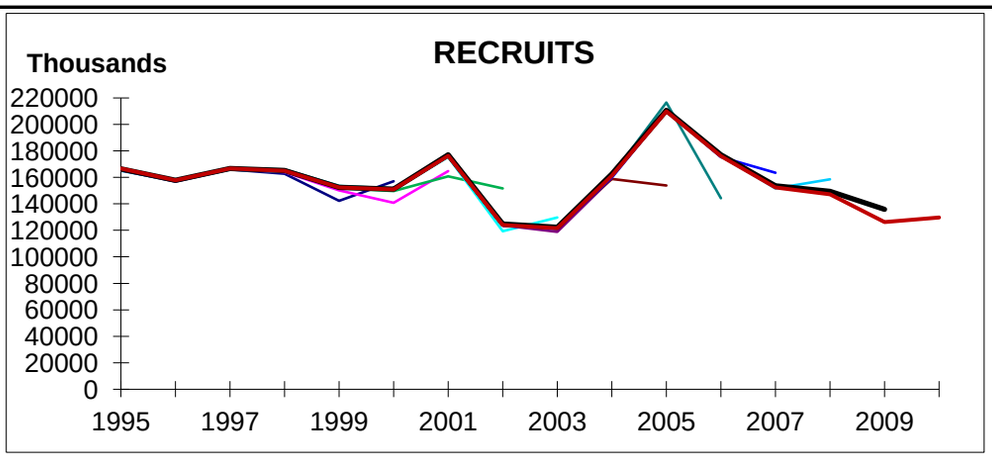
Population in figures



Population in biomass

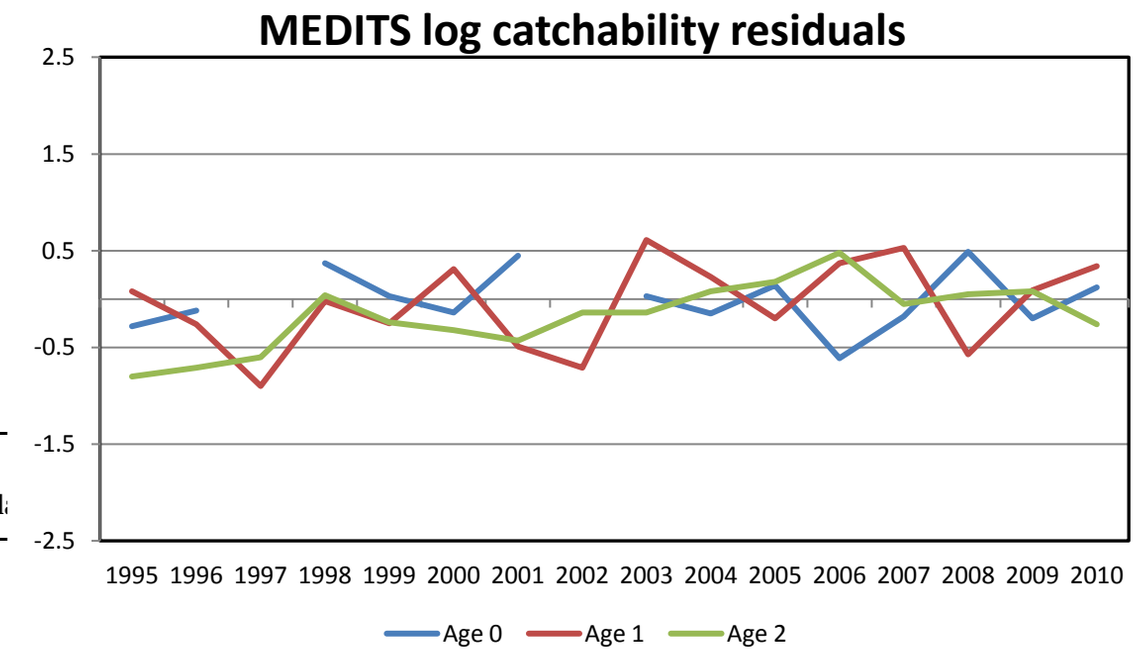


Fishing mortality rates

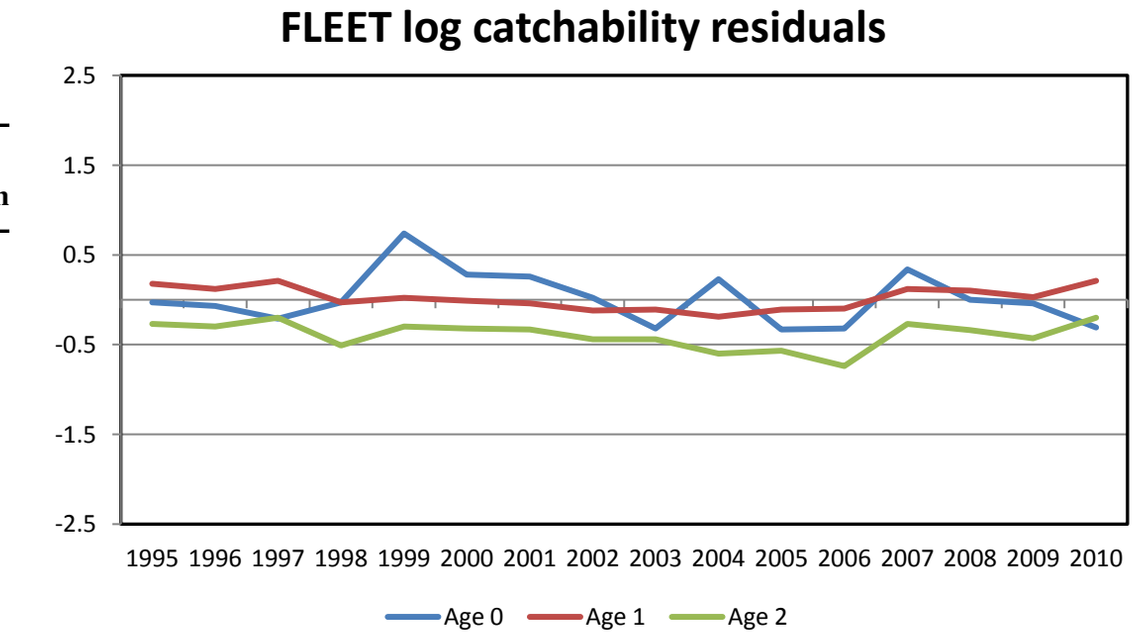


Sex*		Gear*		Analysis #*	

Population in figures



Popul



Fishin

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

Code: MUT0611Fer

Sex	Both

Analysis #	2

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

Parameters used

Vector F	From XSA
Vector M	M at age from PRODBIOM (sheet B)
Vector N	

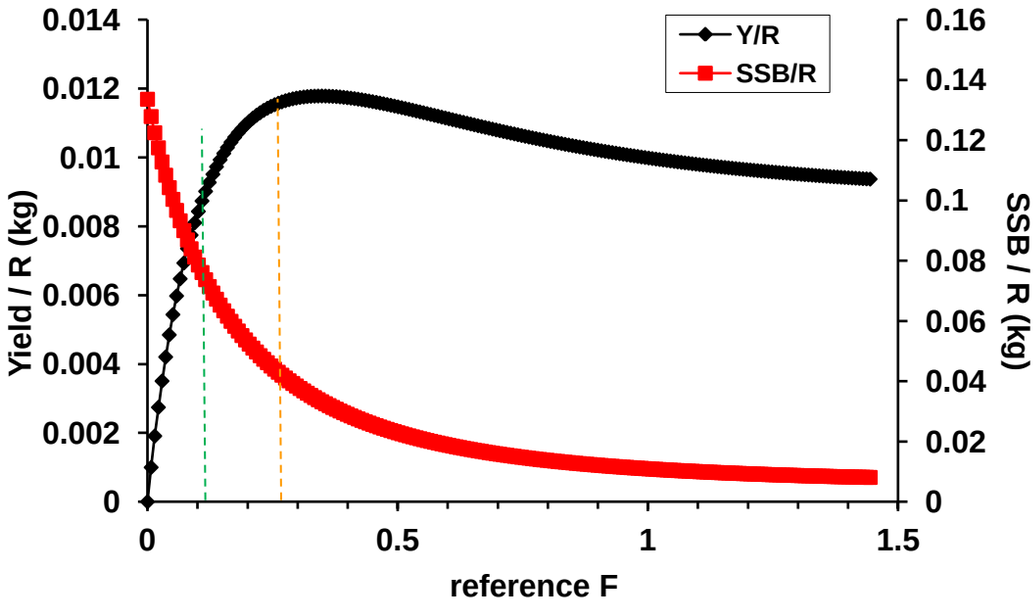
Model characteristics

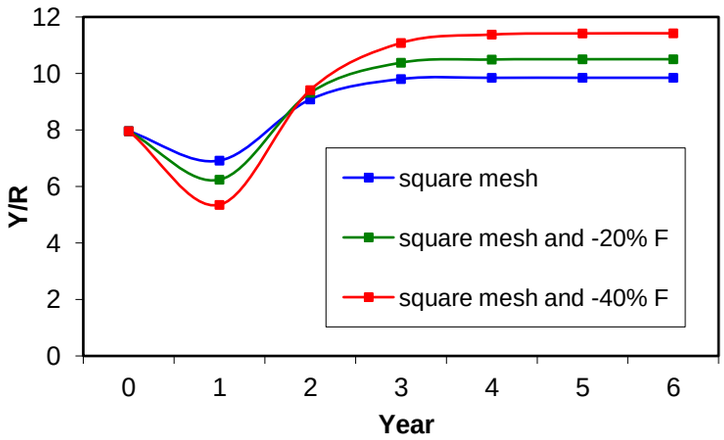
Results

	Total	Gear			
Current YR	11.37				
Maximum Y/R	11.53				
Y/R 0.1	9.93				
F_{max}	0.348				
$F_{0.1}$	0.196				
Current B/R	33.1				
Maximum B/R	55.96				
B/R 0.1	77.48				
F current	0.73				

Comments

Comments





Transition analysis (change in the Y/R)

Paramet	%	Y/R	Biomass	SSB
Linf	-10%	-13.055	10.359	11.392
	+10%	10.792	-8.3665	-8.8608
K	-10%	-9.0513	3.7185	2.7848
	+10%	7.9199	-3.9841	-3.038
a	-10%	-10.009	-10.093	-9.8734
	+10%	9.9217	9.9602	10.127
b	-10%	-57.615	-55.246	-57.722
	+10%	136.99	124.97	137.22
M	-10%	8.7903	6.2417	7.0886
	+10%	-8.181	-5.9761	-6.8354

Sensitivity analysis (% variation)

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

Code: MUT0611Fer

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	2755	tons	3030	-	Bmean as reference point (Blow=2634)
SSB	700	tons	686	+	SSBmean as reference point (SSBlow=546)
F	0.7257		0.196	+	F 0.1 as reference point
Y	1032	tons	1169	-	Ymean as reference point (Ylow= 985)
CPUE	23.06	kg/day	20.42	-	Mean trawl CPUE. CPUElow= 14.93

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

Cath in number of individuals are based on younger ages (0 and 1). Average fishing mortality for ages 0-2 shows a general decreasing trend over the studied period reflecting the continuous reduction observed in the fleet. Recruitment shows a slight decreasing trend, being under the average of the whole period in the last two years. There isn't any trend in the total biomass whereas SSB shows a slight increasing trend.
Transition analysis indicates that a 24% increase in Y/R is expected with the square mesh in the cod-end. A 32% increase in Y/R is expected with both the square mesh and a 20% decrease in fishing effort and a 44% increase in Y/R is expected with a 40% decrease in fishing effort and the use of the square mesh.

Code: MUT0611Fer

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 2009 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

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Abstract for SCSA reporting

Authors Fernández, A. M.

Year 2011

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, althought 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 minimun legal size.
The total number of boats (trawl fleet) in the GSA6 has been reduced by 30% since 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 1995-2010. The assessment has been carried out applying tuned VPA (Extended Survivor Analysis, XSA) and Y/R analysis. 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 aplying 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). Ad hoc Excel spreadsheet for the Y/R analysis and the VIT program (Lleonart and Salat, 1997) for the transition and sensitivity analysis were used.

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	**Stock abundance**
High fishing mortality	Low abundance

Comments

Management advice and recommendations*

Advice for scientific research*