SAC GFCM
Sub-Committee on Stock Assessment

Date*	26	October	2011	Code*	MUT2511Cha

Authors*

Charis Charilaou

Affiliation*

DFMR- Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment, 1416 Nicosia, Cyprus

Species Scientific name*

1 *Mullus barbatus - MUT*

Source: GFCM Priority Species

2

Source: -

3

Source: -

Geographical area*

Cyprus Island

Geographical Sub-Area (GSA)*

25 - Cyprus Island

Combination of GSAs

1

2

3

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

Assessment form

Sheet #0

Basic data on the assessment

Code: MUT2511Cha

Date*	26	Oct	2011	Authors*	Charis Charilaou

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

Data Source

GSA*	25 - Cyprus Island	Period of time*	2005-2010

Description of the analysis

Type of data*	Age composition of landings per gear, official landings data, biological parameters	Data source*	DFMR
Method of assessment*	Separable VPA, VPA-pseudocohort and Y/R analysis	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	2	2	---	3	1	2	1	---	1	1	---

Comments, bibliography, etc.

Reports:

Annual Reports on the Cyprus Fisheries for the years 2005-2010. Departmental Reports. Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment.

Pilot Study Report on the Evaluation of Discards of the Cyprus Fishery, as part of Cyprus's National Fisheries Data Collection Programme 2006. November 2007. Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment.

2011 Management Plan for the Bottom Trawl Fishery Within the Territorial Waters of Cyprus. July 2011. Department of Fisheries and Marine Research, Ministry of Agriculture, Natural Resources and Environment.

Reports from the SGMED Working Groups on the Mediterranean of the Scientific, Technical and Economic Committee for Fisheries (STECF). Available at https://stecf.jrc.ec.europa.eu/events.

Comments, bibliography, etc.

References:

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. IFREMER Aquatic Living Resources. 10: 257-269.

Abella, A., Caddy, J. F. and Serena, F. (1998). Estimation of the parameters of the Caddy reciprocal M-at-age model for the construction of natural mortality vectors. DYNPOP. Genova 2-5.10.96 Cahiers Options Medit 35: 191-200.

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, no. 1, pp: 85.

Lleonart, J. and Salat. J. (1997). VIT: Software for fisheries analysis. FAO Computerized Information Series (fisheries). pp: 107.

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

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

Code: MUT2511Cha

Biology

Somatic magnitude measured (LH, LC, etc)*			Total length		Units*	cm
Sex	Fem	Mal	Both	Unsexed		
Maximum size observed			26		Reproduction season	April - July
Size at first maturity			9 (1)		Reproduction areas	Shelf
Recruitment size					Nursery areas	Shelf

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞	cm			26	
	K	years-1			0.26	
	t0	years			-0.4	
	Data source	Otolith readings (2)				
Length weight relationship	a				0.00789	
	b	cm ang g			3.12	

	M				vector (3)	

sex ratio (mal/fem)	

Comments

(1) Based on the Cyprus National Data Collection Programme.

(2) Set of growth parameters adopted by the SGMED-08-03 meeting for slow growth.

(3) Vector of M at age was used, calculated from Caddy (1991) equation using the PRODBIOM Excel spreadsheet (Abella et al, 1997):

Age	M
0	0.58
1	0.39
2	0.32
3	0.28
4	0.26
5+	0.25

Maturity at age (based on the Cyprus National Data Collection Programme)

Age	Prop. matures
0	0.09
1	0.72
2	0.93
3	0.98
4	0.99
5+	1.00

Comments

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

Assessment form — **Sheet P1**

General information about the fishery

Code: MUT2511Cha

Data source*	DFMR official landings and discards data (estimated under the Cyprus National Data Collection Programme)	Year (s)*	2005-2010
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*	CYP	25	C - Minor gear with engine (6-12 metres)	07 - Gillnets and Entangling Nets	33 - Demersal shelf species	MUT
Operational Unit 2	CYP	25	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	MUT
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
CYP 25 C 07 33 - MUT	500	Tons	14.95	see P2b-1	idered negligible		days
CYP 25 E 03 33 - MUT	4	Tons	15.97	see P2b-2	included	*S.smaris, B. boo*	days
Total	504		30.92				

Legal minimum size	11 cm TL

Comments

Red mullet -MUT in GSA 25 is exploited by the artisanal fleet using set nets (basically trammel nets - GTR) and by the bottom otter trawlers - OTB. In both fisheries the species is exploited with a number of other demersal species (see P2b).

Fleet: Since 2006 the number of licensed bottom trawlers operating in GSA25 has been reduced by 50% (from 8 to 4).
Catch: For both operational units, catch provided above refers to the average values for the years 2005-2010 (estimated as sum of products of numbers at age multiplied with weight at age).

Discards from the bottom trawl were evaluated for the first time in 2006, through a pilot study under the Cyprus National Fisheries Data Collection Programme, and are annually estimated from 2008. Since the discard values for the years 2006 and 2008 were similar, their average value was used for the years 2005 and 2007.

Discards from the artisanal fishery are considered negligible.

Comments

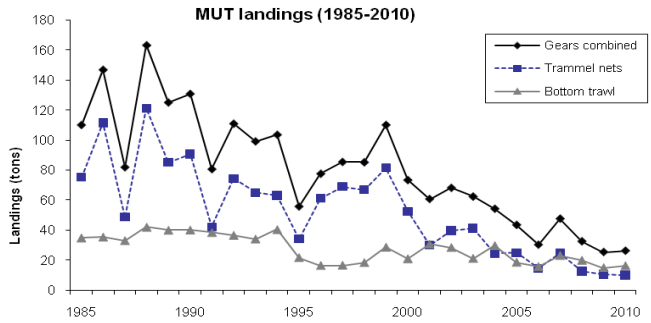


Fig. 1

As shown in Figure 1, for the period 1985-2010 there is fluctuation with clear decreasing trend in the landings of red mullet, especially for the artisanal fleet. For the last two years (2009-2010) the landings remain at the same levels.

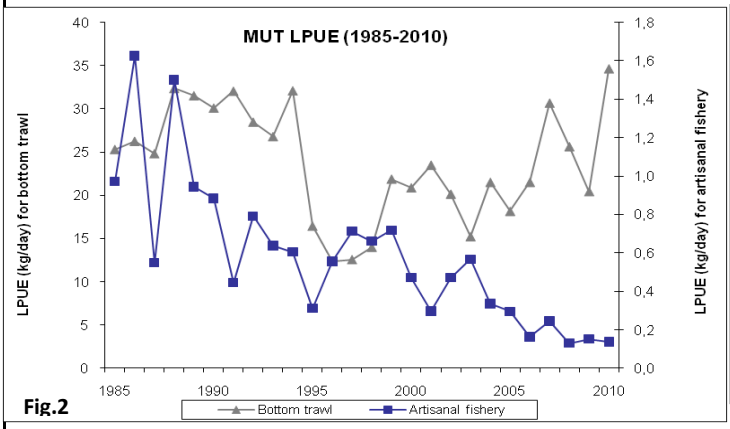


Fig.2

The figure on the left shows fluctuations in the landings per unit effort (LPUE - kg/day) of the artisanal fishery, with a clear declining trend. In the last 3 years (2008-2010) LPUE of the artisanal fishery remained at the same levels.
Fluctuations are evident also for the LPUE of the bottom trawl fishery, with a decreasing trend from the end of the 80's, a sharp decrease in 1995 and an increasing trend from 2003.

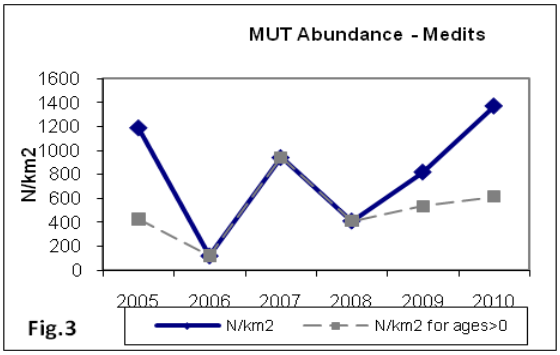


Fig.3

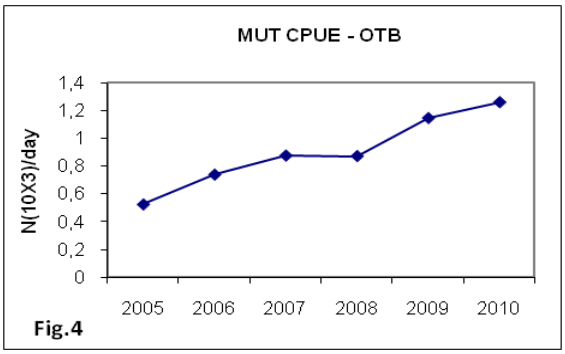
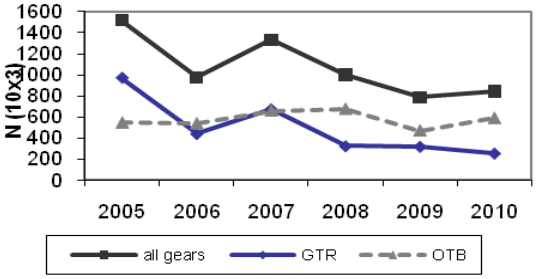


Fig.4

Fig.5 MUT catch in numbers by year



Figures 3 and 4 provide abundance indices from bottom trawl survey (Medits) and commercial bottom trawl respectively, for the period 2005-2010.

Figure 5 provides the catch-in-numbers by gear for the period 2005-2010.

Data source*	DFMR official landings and discards data (sum of products of numbers at age x weight at age)	OpUnit 1*	CYP 25 C 07 33 - MUT

Time series

Year*	2005	2006	2007	2008	2009	2010
Catch	22.36	16.31	21.70	11.32	9.14	8.85
Minimum size	11	10	10	11	9	12
Average size Lc	13	14	14	14	14	15
Maximum size	17	22	25	25	19	21
Fleet	500	457	490	498	495	500

Year						
Catch						
Minimum size						
Average size Lc						
Maximum size						
Fleet						

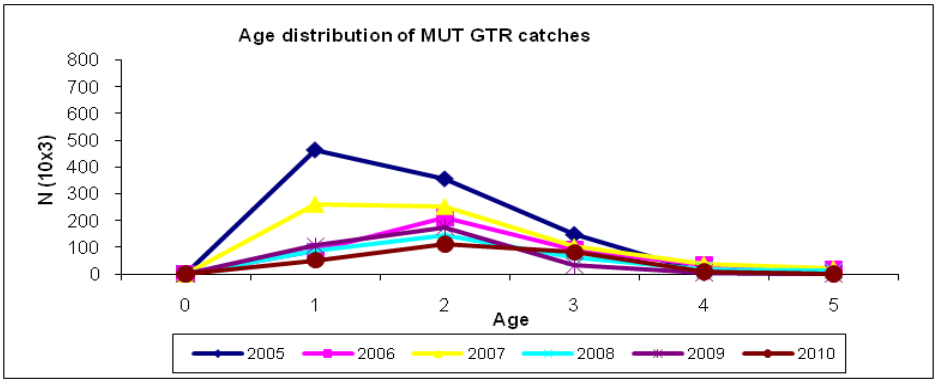
Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age

The most exploited age classes by the artisanal fleet (trammel net - GTR) are the age classes 1 and 2.



Structure by size or age

Data source*	DFMR official landings and discards data (sum of products of numbers at age x weight at age)	OpUnit 2*	CYP 25 E 03 33 - MUT

Time series

Year*	2005	2006	2007	2008	2009	2010
Catch	16.358	13.823	20.448	17.886	12.929	14.39
Minimum size	7	7	7	7	6	8
Average size Lc	13	13	13	13	12.6	13
Maximum size	24	22	26	22	24	22
Fleet	8	4	4	4	4	4

Year						
Catch						
Minimum size						
Average size Lc						
Maximum size						
Fleet						

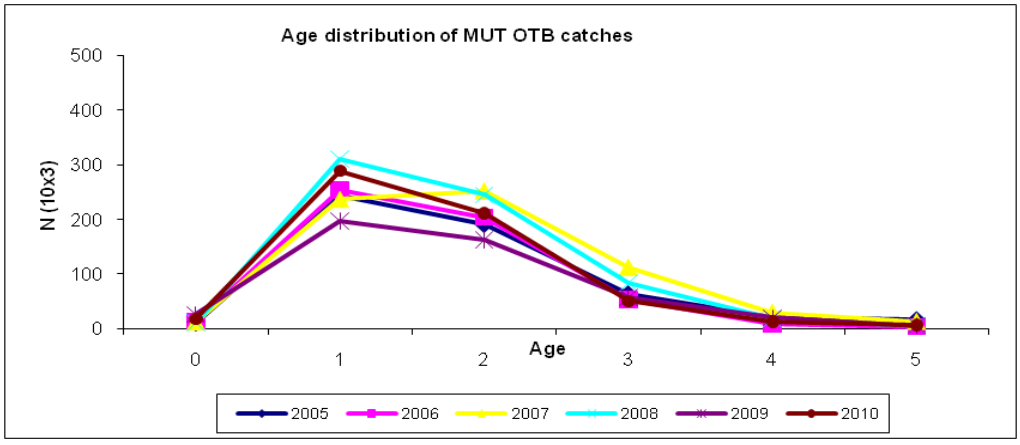
Selectivity

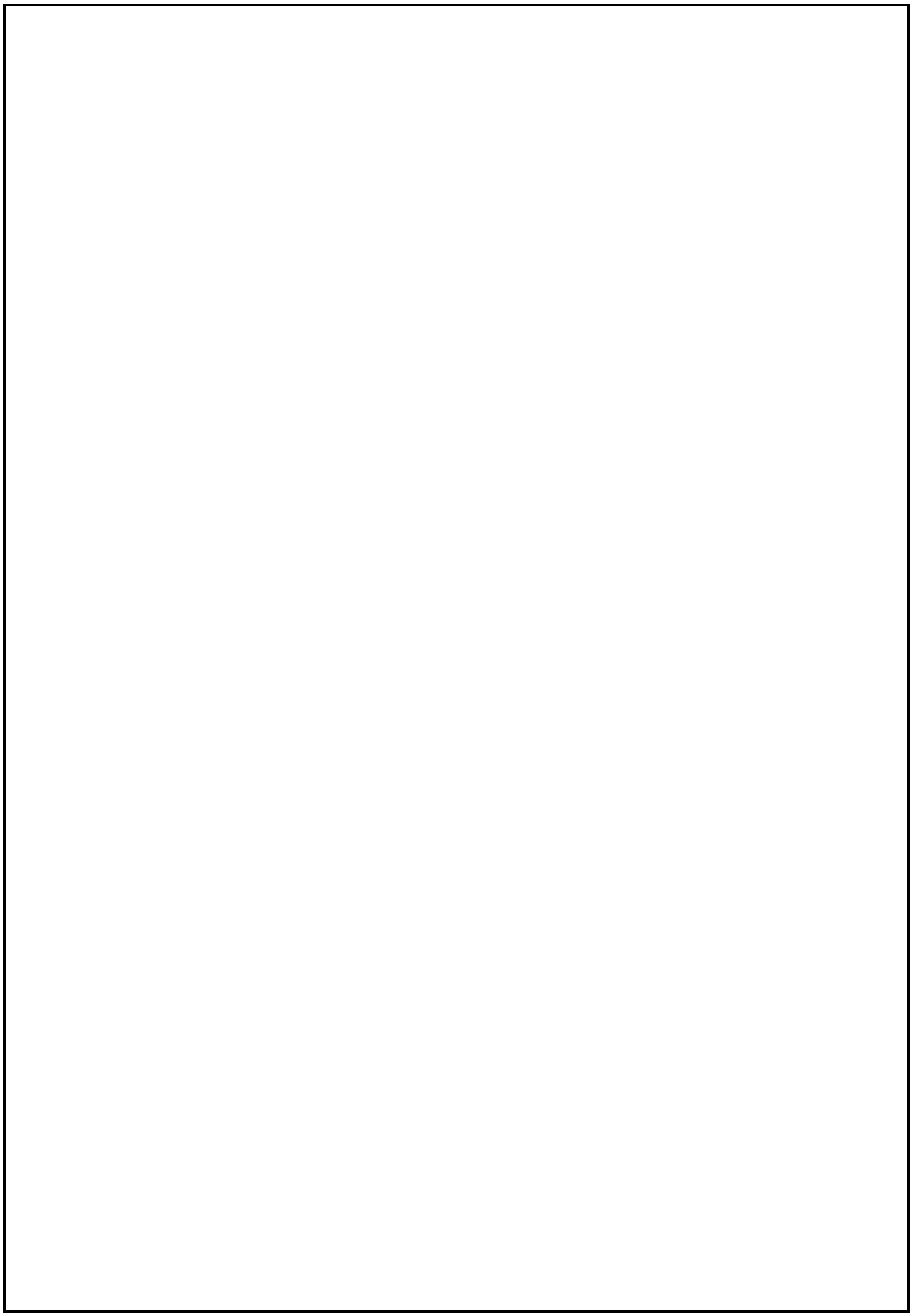
L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age

The most exploited age classes by the bottom trawl (OTB) are the age classes 1 and 2.





Data source*	National legislation, DFMR data	OpUnit 1*	CYP 25 C 07 33 - MUT

Regulations in force and degree of observance of regulations

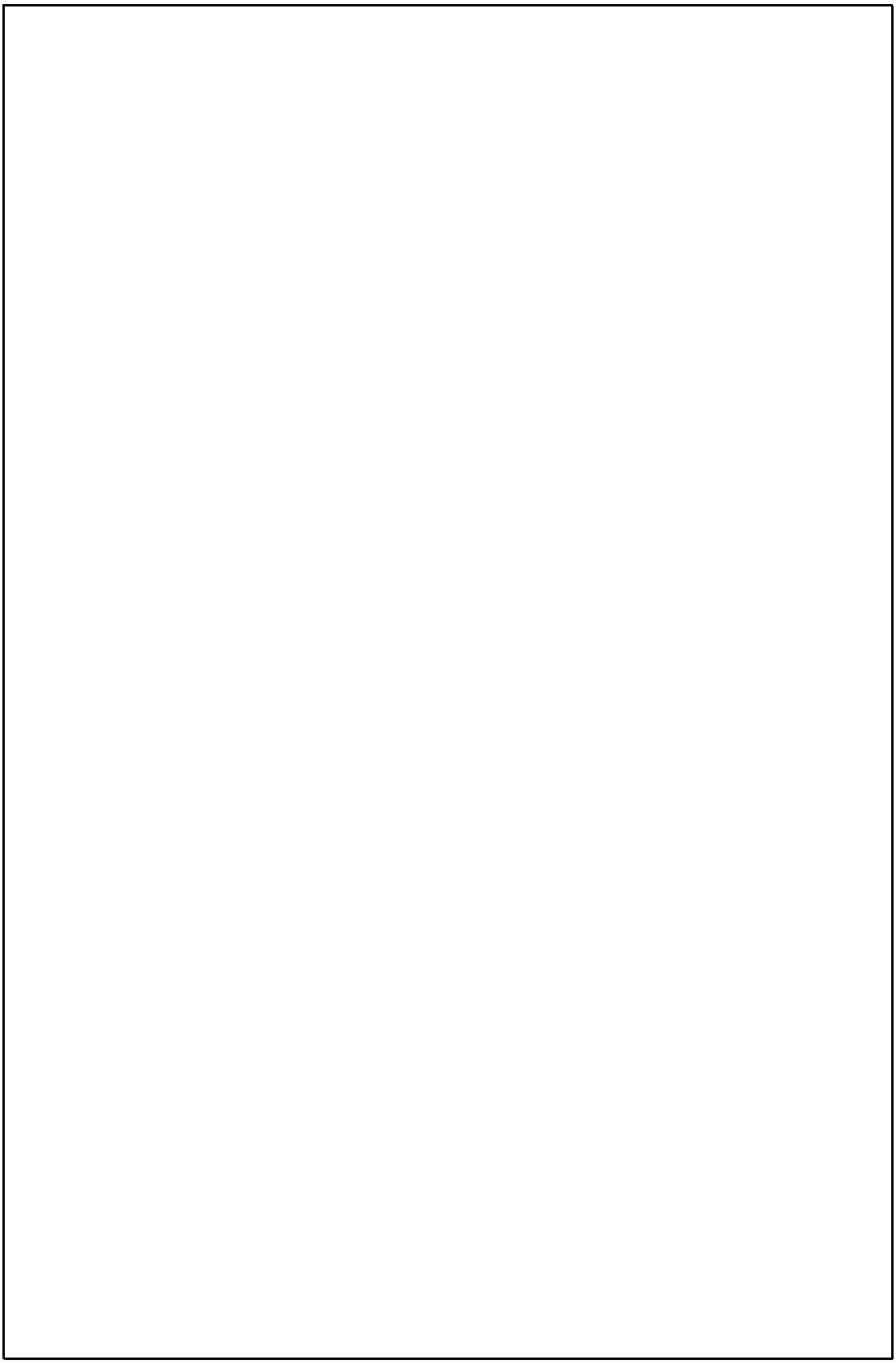
Restriction of the maximum number of licenses. Since 2008 assignment of licensed fishermen in 3 categories (A, B, C), based on their fishing activity and certain criteria. Licenses A&B restricted to 500. The restriction of licenses is fully observed.

Restrictions on the use of fishing gears depending on the fishing license category.
- For licenses A & B:
  Until March 2011 minimum mesh size of nets at 32mm (open mesh size): fully observed. From March 2011 minimum mesh size of nets at 38mm (open mesh size).
  Maximum length of nets: For boats with license A is 5000m, for boats with license B is 3000m. Fully observed.
  Maximum height of nets: 4m. Fully observed.
  Restrictions on the time and duration of fishing, depending on mesh sizes. Fully observed.

- For licenses C (not fully observed):
  Minimum mesh size of nets at 36mm (open mesh size).
  Prohibition of the use of monofilament nets.
  Maximum length of nets: 600 m.
  Restriction of number of fishing days at 70 days annually, during weekends of certain months.

Accompanying species

Sparisoma cretense
Mullus surmuletus
Octopus vulgaris
Sepia officinalis
Serranus cabrilla
Scorpaena spp.
Labridae
Diplodus spp.
Boops boops
Pagellus erythrinus
Siganus spp.



Data source*	EC and National Legislation, DFMR data	OpUnit 2*	CYP 25 E 03 33 - MUT

Regulations in force and degree of observance of regulations

From 2006 maximum number of licenses restricted to 4: fully observed.

Closed trawling period from 1st of June until the 7th of November (in force since the mid '80s) : fully observed.

From June 2010 the 40mm diamond shape trawl net replaced by a diamond meshed net of 50mm at the cod-end. From November 2011 minimum mesh size of 50mm diamond in any part of the net. Fully observed.

Prohibition of bottom trawling at depths less than 50m and at distances less than 0.7 nautical miles off the coast. Fully observed.
Prohibiton of bottom trawling in the Zygi coastal area, at a distance of 3 nautical miles from the coast. Fully observed.

Accompanying species

Spicara smaris
Boops boops
Mullus surmuletus
Pagellus erythrinus
Octopus vulgaris
Loligo vulgaris
Sepia officinalis
Eledone moschata
Octopus macropus
Pagellus acarne
Serranus cabrilla
Synodus saurus
Scorpaena spp.
Trigloporus lastovisa
Uranoscopus scaber
Pagrus pagrus
Merluccius merluccius

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: MUT2511Cha

Sex*	Both

Analysis # *	1- SepVPA

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used	Pope equation (Separable VPA procedu	Tunig method	
# of gears	1 (combination of 2 gears)	Software	Lowestoft VPA suite (Darby & Flatman, 1994)
$F_{terminal}$	0.73		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	3.142	15.7
Average			Average population	5.7	93
Maximum			Virgin population		
Critical			Turnover	SSN	SSB
				2.04	50
				in million	in tons

Average mortality

		Gear					
	Total						
F_1	0.74						
F_2	0.63						
Z	1.1						

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

Comments

For the Separable VPA analysis data from the period 2005-2010 were used.

Input data:
- Reference age:2
- Terminal F used derived from performing VPA-pseudocohort analysis with VIT software on 2010 data.
- Terminal S: 0.9

Fitness of model: CV= 0.16

Average mortality:
F1: average F for ages 1-3 (Fbar 1-3)
F2: average F for ages 0-4 (Fbar 0-4)
Z: = M for years 1-3 (0.36) + F1

Sex*	Both

Analysis # *	2-VPA (2010)

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Standard catch equation	Tunig method	
# of gears	2	Software	VIT (Lleonart and Salat, 1997)
$F_{terminal}$	0.25		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	1.3	
Average	11.4	1.2	Average population		46.86
Maximum			Virgin population		140.9
Critical	16.3	2	Turnover		85.35
				SSB	36.7
				in millions	in tons

Average mortality

		Gear					
	Total	Trammel net	Bottom trawl				
F_1	0.434	0.177	0.257				
F_2	0.227	0.069	0.158				
Z	0.78						

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

Comments

Input data

Fterminal: The value of M in oldest ages (0.25) was used as Fterminal

Results

The above estimations refer to 2010.

Average mortality:
F1 refers to Mean F
F2 refers to Global F

----------	Total	Trammel net	Bottom trawl
Fbar(1-3)	0.7	0.3	0.4

Sex*	Both

Analysis # * 3 - VPA (2009)

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Standard catch equation	Tunig method	
# of gears	2	Software	VIT (Lleonart and Salat, 1997)
$F_{terminal}$	0.25		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	1.25	
Average	11.3	1.2	Average population		42.2
Maximum			Virgin population		141
Critical	16.3	2	Turnover		88.39
				SSB	32.7
				in million	in tons

Average mortality

		Gear					
	Total	Trammel net	Bottom trawl				
F_1	0.461	0.158	0.303				
F_2	0.238	0.095	0.143				
Z	0.808						

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

Comments

Input data

Fterminal: The value of M in oldest ages (0.25) was used as Fterminal

Results

The above estimations refer to 2009.

Average mortality:
F1 refers to Mean F
F2 refers to Global F

----------	Total	Trammel net	Bottom trawl
Fbar(1-3)	0.7	0.3	0.4
Fbar(1-4)	0.6	0.2	0.4

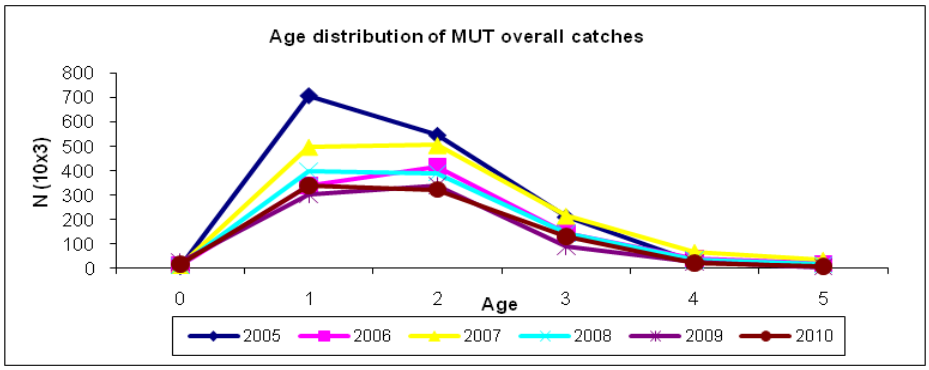
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A2** **Indirect methods: data**

Code: MUT2511Cha

Sex*	Unsexed	Gear*	Combined (OTB, GTR)	Analysis # *	**1 - Sep. VPA**

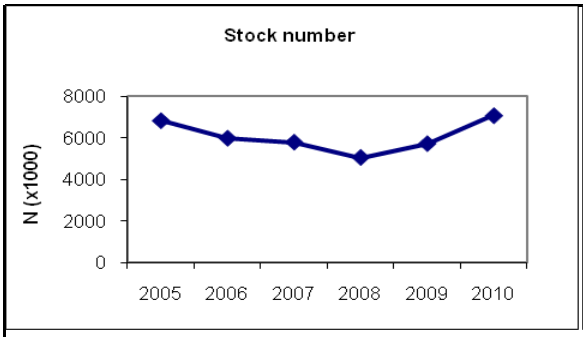
Data source	Catch in numbers at age (2005-2010)

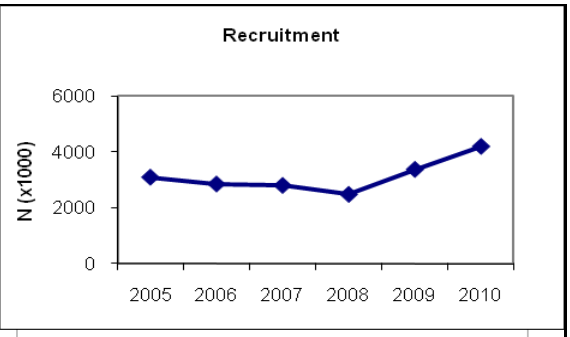
Data



Sex*	Both	Gear*	1 (Combination of 2 gears)	Analysis #*	1-SepVPA

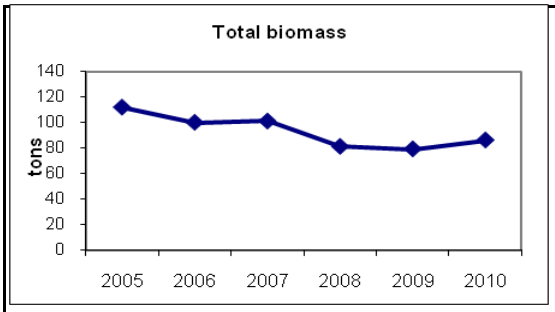
Population in figures

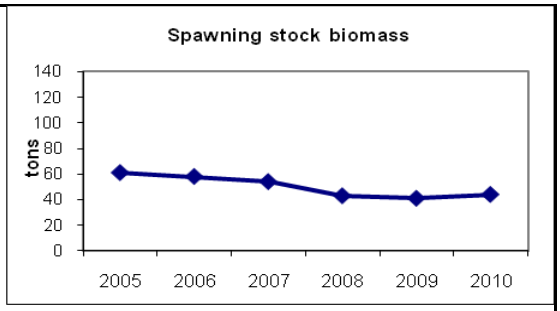




The recruitment can be considered constant for the period 2005-2010

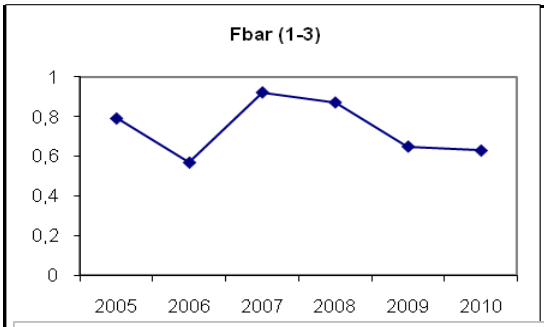
Population in biomass

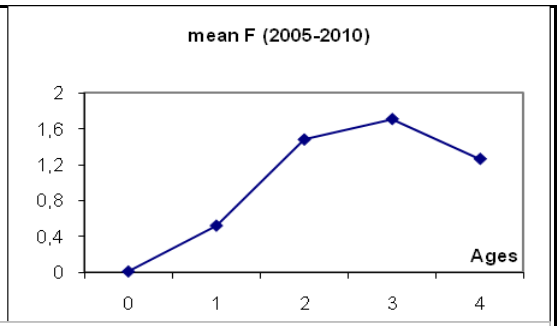




There is a decreasing trend in the SSB, although in the last 2 years the SSB remains constant.

Fishing mortality rates

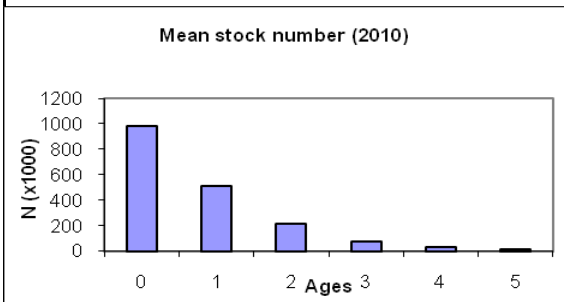


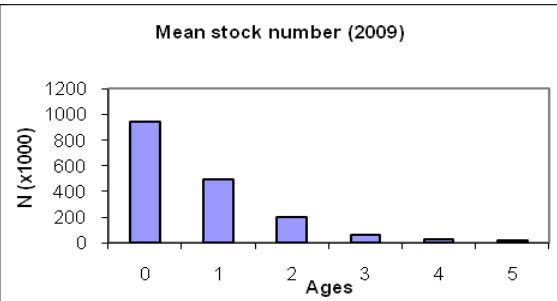


Fbar(1-3) shows a decreasing trend from 2007, while for 2009-2010 it seems constant. F is higher for the older ages(2-4).

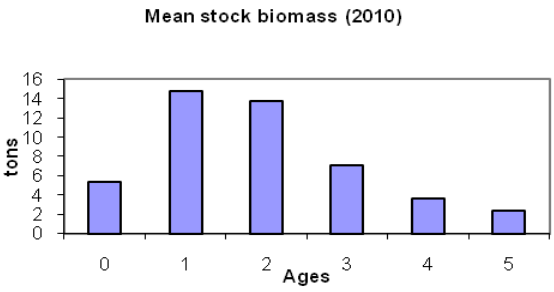
Sex*	Both	Gear*	All	Analysis #*	2-VPA(2010),3-VPA(2009)

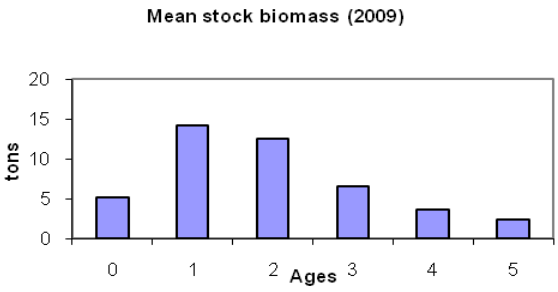
Population in figures



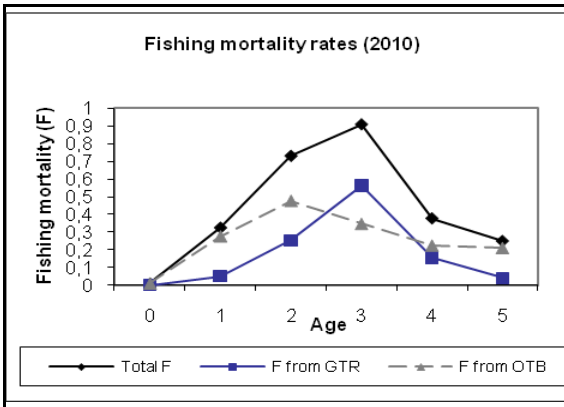


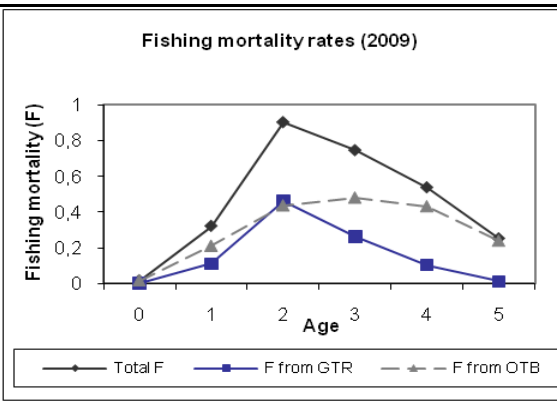
Population in biomass





Fishing mortality rates





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

Code: MUT2511Cha

Sex	Both

Analysis #	2,3

# of gears	2	Software	VIT (Lleonart and Salat, 1997)

Parameters used

Vector F	From VPA-pseudocohort analysis
Vector M	See sheet B
Vector N	From VPA-pseudocohort analysis

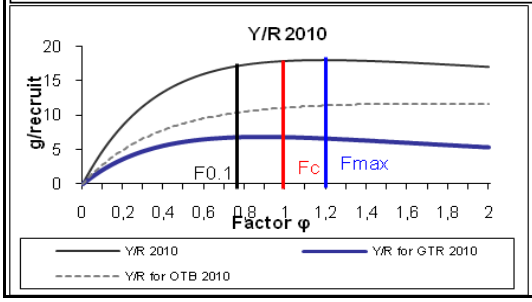
Model characteristics

Results

	Total	Gear			
		Trammel net	Bottom trawl		
Current YR	17.89 / 17.6	6.8 / 7.2	11.1 / 10.4		
Maximum Y/R	18.01 / 17.75	6.62 / 7.4	11.39 / 10.4		
Y/R 0.1	17.15 / 16.9	6.8 / 6.8	10.4 / 10.15		
F_{max}	0.51 / 0.51	0.38 / 0.6	0.8 / 0.45		
$F_{0.1}$	0.33 / 0.33				
Current B/R	36.1 / 35.6				
Maximum B/R	31.7 / 30.6				
B/R 0.1	44.1 / 42.9				

Comments

In the results, the first values refer to 2010 analysis and the second values to 2009.

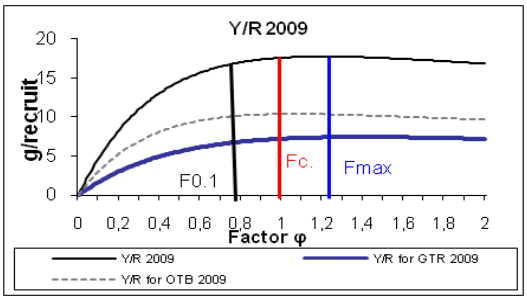


Based on the Y/R analysis for 2010, the current fishing mortality - Fc. (0.434) is 24% higher than the F0.1 reference point (0.33), but smaller than Fmax (0.51).

Comments

Results

	Total	Gear			
Current YR					
Maximum Y/R					
Y/R 0.1					
F_{max}					
$F_{0.1}$					
Current B/R					
Maximum B/R					
B/R 0.1					



Based on the Y/R analysis for 2009, the current fishing mortality -Fc. (0.461) is 28% higher than the F0.1 reference point (0.33), but smaller

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

Code: MUT2511Cha

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB					
F	0.43/0.46		0.33/0.33		First values refer to 2010 and second to 2009. Reference point: F0.1
Y					
CPUE					

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

The stock is in overfishing state, considering that the current fishing mortality should be reduced by 24% (based on 2010 Y/R analysis) or by 28% (based on 2009 Y/R analysis) for reaching the F0.1 reference point.

The stock abundance seems to be in low levels, on the basis of the available time series and considering the decrease in official landings and the LPUE of the stock throughout the years.

Code: MUT2511Cha

Management advice and recommendations*

Fishing mortality from both fleets should be reduced. This could be achieved with the following measures that have been recently implemented/will be implemented in the near future in Cyprus:

Reduction on the number of licensed trawlers: From November 2011 the licensed bottom trawlers fishing in territorial waters will be restricted to 2 (50% reduction). This measure has been included in the 2011 Cyprus Management Plan for Bottom Trawlers fishing in territorial waters.

Reduction on the number of licensed small scale artisanal boats: DFMR is currently evaluating the possibility of reducing the number of licensed vessels in the artisanal fishery.

Increase of the selectivity of gears targeting the stock:
- From June 2010 the 40mm diamond shape trawl net was replaced by a diamond meshed net of 50mm at the cod end, while from November 2011 the diamond meshed net of 50mm will be enforced as minimum mesh size in any part of the net.
- From March 2011 the minimum mesh size of all passive nets was increased from 32 mm to 38 mm.

New measure included in the 2011 Management Plan for trawlers: From November 2011 a restriction of 2 areas from fishing with trawl nets will be applied, on a rotational basis (northwest part of Cyprus from 8 November – 15 February, southeastern part from 16 February – 31 May every year).

Advice for scientific research*

A re-evaluation of the growth parameters of the stock is adviced, as well as the adoption of acceptable ranges of the species' growth and natural parameters for the Eastern Mediterranean.

Abstract for SCSA reporting

Authors Charis Charilaou

Year 2011

Species Scientific name Mullus barbatus - MUT

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 25 - Cyprus Island

Fisheries (brief description of the fishery)*

Red mullet in GSA 25 is exploited by the artisanal fleet using trammel nets and by the bottom otter trawlers. The species is exploited with a number of other demersal species for both fisheries. For the assessment period (2005-2010) the average landings by each fleet was around 15-16 tons. The most exploited age classes by both fleets are the age classes 1 and 2.

Source of management advice*

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

Data and parameters:

Catch-at age data derived from landings for each fishing gear exploiting the stock (trammel net and bottom trawl) and discards data from bottom trawl. The assignment of catches in ages was based on Age Length Keys.

M vector for each age class was used, estimated by PRODBIOM (Abella et al., 1997).

The L-W relationship and the maturity at age used were estimated within the framework of the Cyprus National Data Collection Programme.

The growth parameters used were the ones adopted by the STECF SGMED-08-03 meeting for slow growth (estimated from otolith reading).

Assessment method:
Separable VPA for the period 2005-2010, VPA-pseudocohort and Y/R analysis for 2009 and 2010 separately.

Model performance:
The Separable VPA model fitted well with the data (CV=0.16).

Stock Status*

Exploitation rate	**Stock abundance**
High fishing mortality	Low abundance

Comments

Management advice and recommendations*

Fishing mortality from both fleets should be reduced. This could be achieved with the following measures that have been recently implemented/will be implemented in the near future in Cyprus:

Reduction on the number of licensed trawlers: From November 2011 the licensed bottom trawlers fishing in territorial waters will be restricted to 2 (50% reduction). This measure has been included in the 2011 Cyprus Management Plan for Bottom Trawlers fishing in territorial waters.

Reduction on the number of licensed small scale artisanal boats: DFMR is currently evaluating the possibility of reducing the number of licensed vessels in the artisanal fishery.

Increase of the selectivity of gears targeting the stock:
- From June 2010 the 40mm diamond shape trawl net was replaced by a diamond meshed net of 50mm at the cod end, while from November 2011 the diamond meshed net of 50mm will be enforced as minimum mesh size in any part of the net.
- From March 2011 the minimum mesh size of all passive nets was increased from 32 mm to 38 mm.

New measure included in the 2011 Management Plan for trawlers: From November 2011 a restriction of 2 areas from fishing with trawl nets will be applied, on a rotational basis (northwest part of Cyprus from 8 November – 15 February, southeastern part from 16 February – 31 May every year).

Advice for scientific research*

A re-evaluation of the growth parameters of the stock is adviced, as well as the adoption of acceptable ranges of the species' growth and natural parameters for the Eastern Mediterranean.