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A compilation of information on stock assessment in  
the GFCM areas presented in standard forms

## **1. Preface**

In the framework of the Scientific Advisory Committee (SAC)-GFCM mandate to develop standard forms and procedures to present data and results on stock assessment in the Mediterranean, it was recognised necessary to submit, at the first Working Group and SCSA meetings, the compilation of the existing information on assessments by the GFCM management units.

With the support of FAO COPEMED project and taking into account the suggestions of the co-ordinator of the Subcommittee for Stock Assessment of the SAC of the GFCM, J. Leonart, the available data were collected and transferred into appropriate data sheet for consideration and review by the Small Pelagic and Demersal Working Groups. Data concerned the following species:

- *Sardina pilchardus*
- *Engraulis encrasicolus*
- *Sardinella aurita*
- *Merluccius merluccius*
- *Mullus spp.*
- *Micromesistius poutassou*
- *Aristeus antennatus*

The methodology, the implementation process and the results of this meta-analysis (review of related research studies) were presented at the Working Groups on Small Pelagics and Demersals.

Data and results of available assessments carried out in the last 15 years in Mediterranean were collected, reviewed, stored and presented in a “standard form” as preliminary tool for the work of the first stock assessment Working Groups of Sub-Committee for Stock Assessment (SASC).

These “provisional standard forms” will be used as first basis discussion for defining the scheme of the “new standard form” that will be used for next assessment in the Mediterranean.

The provisional standard forms were presented and reviewed during the two first Working Groups of SASC (Little Pelagic – Fuengirola 1-3 March 2000 and Demersal – Sète 21-23 March 2000).

Taking in mind the aims of the SAC, assessment and parameters for each species were elaborate in order to give the most recent values for each Fishing Management Unit (FMU) and, when possible, keeping separate gear and harbour, on the basis of the last definition of Operative Unit, achieved in the meeting of Barcelona (January 2000, 25-27).

## **2. Material and method**

Meta-data used for the preparation of provisional standard forms were taken mainly on WinPopDyn, an existing data-base implemented by FAO (Coppola et al., 1994), that already contained many information on fisheries and resources of Mediterranean.

Data stored in WinPopDyn derived mainly from published papers, although there are also some information coming from “grey literature”.

### **• Small Pelagic Working Group**

Considering the target species of the Small Pelagic Working Group, the user version of WinPopDyn received from FAO, contained the following records:

*Sardina pilchardus* : 50  
*Sardinella aurita* : 7  
*Engraulis encrasicolus* : 75

New references were added in order to update the version of database and prepare the provisional standard forms as follows:

*Sardina pilchardus* : 86 (increase of 72%)  
*Sardinella aurita* : 9 (increase of 29%)  
*Engraulis encrasicolus* : 115 (increase of 53%)

- **Demersal Working Group**

Regarding the target species of the Demersal Working Groups, the user version of WinPopDyn received from FAO contained the following records:

*Merluccius merluccius* : 105  
*Mullus barbatus* :79  
*Mullus surmuletus* : 26  
*Micromesistius poutassou*: 15  
*Aristeus antennatus*: 33

New references were introduced in order to bring up to date the version of database and prepare the provisional standard forms as follows:

*Merluccius merluccius* : 131 (increase of 25%)  
*Mullus barbatus* : 105 (increase of 33%)  
*Mullus surmuletus* : 39 (increase of 50%)  
*Micromesistius poutassou*: 22 (increase of 46%)  
*Aristeus antennatus*: 37 (increase of 12%)

### **3. Some comments about the WinPopDyn**

#### **General :**

One of the main problems found in working with WinPopDyn consisted in difficulty in inputting time series of Biomass and Recruitment values. This information was requested in the first module, but the program did not allow easily adding more than one value.

Another problem was represented by the impossibility to input data in vectorial form (for example, the F array calculated from Virtual Population Analysis or similar approaches, or the M vector derived from analytical methods).

A further problem was the absence of a field showing the Fishing Management Unit (FMU), in which Mediterranean was divided for management purposes. This field should be obtained transforming fields that are useless for GFCM purpose (for instance the “FAO fishing Area – that will be always “Mediterranean and Black Sea”) in a FMU field.

#### **Particular :**

WinPopDyn General: it would be useful to insert the field “ Management Unit”, which is now absent. This field should be added to all the other forms.

WinPopDyn Fishery: to complete the description of fishery status a field concerning a recent measure of fishing effort “Recent f”, useful in “surplus production models” should be added. Regarding the yield per recruit analysis a field concerning recent Y/R should be added.

WinPopDyn Assessment: Taking into account the Surplus production models, a field concerning the fishing effort at MSY ( $f_{msy}$ ) and  $f_{0.1}$  should be added.

WinPopDyn Growth: The main modifications for this module might consist in changing the field “Source for K” in “Aging method” and that “Method for  $t_0$ ” in “Growth parameters method”.

WinPopDyn Mortality and Reproduction: No specific comment - see general comments.

## 4. Results

The provisional standard forms reporting results of the assessments in the GFCM areas, with the bibliographic references, were presented in tables 1 to 73.

More in detail:

- *Engraulis encrasicolus* – from table 1 to 11 ;
- *Sardina pilchardus* – from table 12 to 19 ;
- *Sardinella aurita* – no assessments were available in literature
- *Merluccius merluccius* – from 20 to 40;
- *Micromesistius poutassou* - from 41 to 45;
- *Aristeus antennatus* – from 46 to 52;
- *Mullus barbatus* – from 53 to 69 ;
- *Mullus surmuletus* – from 70 to 73.

It was very difficult to summarise in standard forms the results of assessments available for the Mediterranean given the remarkable differences in the methodology and terminology used in assessment procedures and methods.

Taking in mind the FAO subdivision of Mediterranean into the three main subareas - 37.1 (Western Basin), 37.2 (Central Basin) and 37.3 (Eastern Basin) -, a general lack of information for the Eastern Mediterranean, with the exception of Greece was found. As Cyprus concerns the assessments available were limited to red mullets (table A).

Considering the small pelagics species, only 27 papers dealt with stock assessments (17 on anchovy and 10 on sardine). No assessment was available in literature for *Sardinella aurita*. 12 assessments concerned with the Western basin, 6 assessments with the Central basin and only 4 with the Eastern basin.

Considering demersal species, only 58 of papers contained in the data-base dealt with stock assessments (23 on hake, 17 on red mullet, 5 on striped red mullet, 5 on blue whiting and 8 on blue and red shrimp. 36 assessments regarded the Western Basin, 14 assessments the Central Basin and only 5 the Eastern Basin.

Table A – Assessment of main target species carried out in Mediterranean for Management Units.

<b>MANAGEMENT UNIT</b>		<i>Engraulis encrasicolus</i>	<i>Sardina pilchardus</i>	<i>Merluccius merluccius</i>	<i>Micromesistius poutassou</i>	<i>Aristeus antennatus</i>	<i>Mullus barbatus</i>	<i>Mullus surmuletus</i>	<b>TOTAL</b>
1.1.a	Balearic Islands			1				1	<b>2</b>
1.1.b	Spain (exc.Alboran)	2	2	1	2	2	3		<b>12</b>
1.1.c	Algeria	1	1	1		1			<b>4</b>
1.1.d	Alboran Sea	1	1						<b>2</b>
1.2.e	Gulf of Lion	1	1	1					<b>3</b>
1.3.h	Sardinia			1			1		<b>2</b>
1.3.i	North Sicily			1		1			<b>2</b>
1.3.j	Italy-North Messina	2		5+1	1	3	6		<b>18</b>
1.3.k	North Tunisia			1		1		1	<b>3</b>
2.1.a	North Adriatic	1	1	1			1		<b>4</b>
2.2.b	South Adriatic	2		1	1		1		<b>5</b>
2.2.c	Ionian Sea (Italy)			1	1		1		<b>3</b>
2.2.d	Ionian Sea (Greece)			3					<b>3</b>
2.2.e	South-East Sicily	1	1				1		<b>3</b>
2.2.f	Gulfs of Gabes and Hammamed			1				1	<b>2</b>
3.1.a	Aegean Sea	1		3			2	1	<b>7</b>
3.2.c	Cyprus						1	1	<b>2</b>
<b>TOTAL</b>		<b>12</b>	<b>7</b>	<b>23</b>	<b>5</b>	<b>8</b>	<b>17</b>	<b>5</b>	<b>77</b>

Table 1 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<b>Engraulis encrasicolus</b>	Balearic	1.1.b	Spain	Light Attraction Purse Seine	
Biomass in tons:  DEPM: 10000 (1993-94)*  ES: 8000(1991-93) (2)  LCA : (1992-93) Barcelona port – 2700 Castellon port – 4750 Port selva – 2150	Recruitment in millions:  (1992-93)  Barcelona port – 900000 at 5.5 cm TL  Castellon port – 470000 at 10 cm TL  Port selva – 275000 at 6.5 cm TL	Management options :  <ul style="list-style-type: none"> <li>• Minimum legal total length of 9 cm</li> <li>• Areas within 300 m from the coast and/or shallower than 30 m are prohibited for any purse seiner.</li> <li>• Gear cannot be larger than 330 m in length and 100 in height.</li> </ul>	Recommendations:  <ul style="list-style-type: none"> <li>• With the exception of Barcelona seiners, the increase of F should not cause decrease in Y/R.</li> <li>• Increase minimum size would decrease Y/R but should increase the spawning biomass.</li> <li>• Since the recruitment occur in autumn and winter closing fishing in this period is recommended.</li> </ul>		
<p>Note : * DEPM carried out along Catalan and Valencian coasts up to 200 m depth. The biomass estimated by echo-surveys along the Catalan coast in the most recent years is lower than those found in 1991-93 (1996-3281 tons; 97-12243; 98-1569; 99-5518-see annex 5 to the Report)</p>					
Fishery and Assessment					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL:	
Fishing along Catalan coast (Barcelona, Port Selva and Castellon)	Risks of Recruitment overfishing			(1992-93) Barcelona port – 8.4 Castellon port – 12.2 Port selva – 10.2	
Recent Y:	Recent Y/R in g :	%VB - % of current biomass out the expected virgin one (1992-93)	Recent F or f:		Recent E:
	(1992-93) Barcelona port – 2.4 Castellon port – 5.5 Port selva – 2.7	(1992-93) Barcelona port – 26 Castellon port – 48 Port selva – 60	(1992-93) Barcelona port – F=0.533 Castellon port – F=0.334 Port selva – F=0.132		
Note: Parameters obtained by LCA. Average F weighted by number of individuals.					

<b>Biology</b>					
L <sub>∞</sub> F+M= 20.6 cm TL	W <sub>∞</sub>	K F+M= 0.38 y <sup>-1</sup>	t <sub>0</sub> F+M=-0.94 y	L max.	
L <sub>r</sub>	T <sub>r</sub>	A F+M= 0.002145 (g cm <sup>-3</sup> )	B F+M= 3.4121	L <sub>m</sub> F+M= 12.6 cm TL	T <sub>m</sub>
M F+M= 0.81	T C°	Ageing method LFM	VBGF method	M method Pauly (1980)	
Note:					
References:					
(1) Pertierra J.P., Lleonart J. (1996) – Scientia Marina 60 (Supl.2): 257-267.					
(2) Abad R. et al. (1996) – FAO Fish. Rep. 537: 191-193.					

Table 2 - General Data					
Scientific name: <b>Engraulis encrasicolus</b>	GFCM Subarea: Balearic	Management Unit: 1.1.b	Country: Spain	Fishery: Light Attraction Purse Seine Trawling	Stock Name:
Biomass in tons:  DEPM:  ES: 12000 (1991-93) (2)  LCA : (1988-89) 9000	Recruitment in millions:  (1988-89)  1300	Management options :		Recommendations:  <ul style="list-style-type: none"> <li>• Increase minimum size to 10.5-11 cm TL, that is close to the length at maturity.</li> <li>• Close fishing in winter.</li> <li>• Limit the use of trawling for anchovy fishing</li> </ul>	
<p>Note : ES carried out along Valencian coasts up to 200 m depth (2)  The biomass estimated by echo-surveys in the most recent years is lower than those found in 1991-93 (1996-1562 tons; 97-365; 98-835; 99-199-see annex 5 to the Report)</p>					
Fishery and Assessment					
Operational unit  Fishing along Valencian coast Purse seine Trawler	Stock Status:  Fully exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Y/R <sub>max.</sub> in g :  (1988-89) All gears - 4.1	Mean Length of capture in cm TL:  (1988-89) Purse seine - 12 Trawler - 10.5	
Recent Y:  All gears 5300 tons (1988-89)	Recent Y/R in g :  (1988-89) Purse seine - 3 Trawler - 1	Virgin Biomass ( $B_0$ ) in tons: (1988-89)  26500	Recent F or f:  (1988-89) Purse seine – 0.4* Trawler - F=0.22*		Recent E:
<p>Note: Parameters obtained by LCA and Y/R simulations. *F calculated from a vector as mean of values corresponding to the mean length of capture. The Sensitivity analysis shown that variations both in M and K can heavily affect Y/R simulations</p>					



<b>Biology</b>					
$L_{\infty}$ F+M= 19.1 cm TL	$W_{\infty}$	K F+M= 0.35 $y^{-1}$	$t_0$ F+M=-0.95 y	L max.	
$L_r$	$T_r$	A F+M= 0.002145 (g $cm^{-3}$ )	B F+M= 3.4121	$L_m$	$T_m$
M F+M= 0.54	$F_{term.}$ : F+M= 1.55	Ageing method Otolith readings	VBGF method	M method	
Note:					
References:					
(1) Leonart J. (1990) – La pesqueria de Catalunya y Valencia: description global y planteamiento de las bases para su consegimiento: Informe Final. Commision de las Comunidades Europeas, DG XIV : 1634 p.					
(2) Abad R. et al. (1996) – FAO Fish. Rep. 537: 191-193.					

Table 3 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Balearic	1.1.d	Spain + Morocco	Purse seiner	
Biomass: Area: DEPM: ES: 1780 (1991-92) Spanish Coast (1) VPA:		Recruitment:	Management options :	Recommendations:	
Note: Echo surveys carried out in October and November between 20 and 200 m depth (1).					
Fishery and Assessment					
Operational unit	Stock Status:  No assessments for Spanish coast  Over exploited (Moroccan coast) * (2)		L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Mean Length of capture:	
Recent Y: 1992 tons (1998) Moroccan coast (2)	Recent Y/R :	Recent Z:	Recent F or f: f= 5300 trip per year (1997) (2)	Recent E:	
Note: * Although a slight increase of anchovy landings was recognised from 1994 onward, the CPUE from 1992 onward was decreasing (2)					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
Note:					
References:  (1) Abad et al. (1996) – FAO Fish. Rep. 537: 191-193. (2) INRH (2000) – Note succincte sur la pecherie petits pelagiques mediterraneenne du Maroc. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 11p.					

Table 4 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Balearic	1.1.c	Algeria	Purse seiner	
Area:	Biomass: DEPM: ES: VPA:	Recruitment:	Management options :	Recommendations:	
Note :					
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 11.2-12.5 cm TL L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y:	Recent Y/R :	Recent Z: Z <sub>lccc</sub> =1.39	Recent F or f: F=0.44-0.55	Recent E: E=0.32-0.39	
Note: Assessment based on Beverton and Holt Relative Yield per Recruit Model (Y/R). Yield curves does not show any maximum.					
Biology					
L <sub>∞</sub> in cm TL F= 16.1 M= 15	W <sub>∞</sub>	K F= 0.46 M= 0.53	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M F= 0.84 M= 0.94	T C°	Ageing method LFM	VBGF method Wetherall et al. + φ'	M method Pauly (1980) + correction for small pelagics (0.8)	
Note:					
References: (1) Chavance P. et al. (1986) – FAO Fish. Rep. 347: 186-204					

Table 5 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Gulf of Lions	1.2.e	France + Spain	Trawling + Purse seiner	
Area: 2940 km <sup>2</sup> (ES) (1)	Biomass: DEPM: 41700 (1993-94) (2) ES: 50783 (1995-97) (1) VPA: 8450 (1992-93; Sète landings) (2)	Recruitment: (1992-93) VPA: 880000 millions at 8.5 cm TL in Sète Port (2)	Management options :	Recommendations:	
Note : Echo surveys carried out during July in order to evaluate the spawning stock biomass. Values obtained in the last three years shown an increasing trend (1)					
Fishery and Assessment					
Operational unit	Stock Status:  Moderately exploited (1)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture: Trawlers of Sète – 11.4 cm TL ((2)	%VB = % of current biomass out the expected virgin one
Recent Y: 7690 tons (1995-97)* (1)	Recent Y/R :	Recent Z:	Recent F or f: F=0.18** (1) F=0.2 *** (2)	Recent E:	(1992-93) Sète – 56 (2)
Note: * referred only to French catches;** calculated as ratio between annual catches and spawning standing stock (ES);***F calculated from a vector as mean of values corresponding to the mean length of capture . In Sète about 10% of the catches appears smaller than the length at maturity (2)					
Biology					
L <sub>∞</sub> F+M= 20.6 cm TL (2)	W <sub>∞</sub>	K F+M= 0.38 y <sup>-1</sup> (2)	t <sub>0</sub> F+M=-0.94 y (2)	L max.	
L <sub>r</sub>	T <sub>r</sub>  F+M= 0.002145 (g cm <sup>-3</sup> ) (2)		B F+M= 3.4121 (2)	L <sub>m</sub> F+M= 12.6 cm TL	T <sub>m</sub>
M  F+M= 0.81 (2)	T C°	Ageing method  LFM (2)	VBGF method	M method  Pauly (1980) (2)	
References: (1) Guennegan Y. et al. (2000) – Exploitation des petits pelagiques dans le Golf du Lion et suivi de l'evolution des stocks par echo-integration de 1999 a 2000. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000:27 p. (2) Pertierra J.P., Leonart J. (1996) – Scientia Marina 60 (Supl.2): 257-267.					

Table 6 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Sardinian	1.3.j	Italy	Purse seiner	
Area:	Biomass in tons: DEPM: 5800 (1993)* ES: 650 (1993)** TS: VPA: 375 (1992-93: Sestri Levante landings)	Recruitment: VPA:48000 in millions at 9 cm TL (1992-93: Sestri Levante landings)	Management options :	Recommendations: <ul style="list-style-type: none"> <li>Considering growth, the Ymax should be obtained above the current F.</li> <li>Since about 49% of anchovy is caught before the length at maturity, increase minimum size should increase the spawning biomass.</li> <li>The recruitment occurring in autumn and winter, fishing should be close in this period.</li> </ul>	
Note: *All Ligurian Sea; ** From coast off Genoa to the Magra River (Liorzou pers.comm.)					
Fishery and Assessment					
Operational unit Purse seiners of Sestri Levante (Ligurian coast)	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm: 11.4	%VB = % of current biomass out the expected virgin one
Recent Y:	Recent Y/R in g : 4.5	Recent Z:	Recent F or f: F=0.41	Recent E:	(1992-93) Sestri Levante – 42 (2)
Note: Collapse of catches during the late 80's and the early 90's.					
Biology					
$L_\infty$ F+M= 20.6 cm TL	$W_\infty$	K F+M= 0.38 $y^{-1}$	$t_0$ F+M=-0.94 y	L max.	
$L_r$	A F+M= 0.002145 ( $g\ cm^{-3}$ )		B F+M= 3.4121	$L_m$ F+M= 12.6 cm TL	$T_m$
M F+M= 0.81	T C°	Ageing method LFM	VBGF method	M method Pauly (1980)	
Note:					
References: (1) Perterra J.P., Leonart J. (1996) – Scientia Marina 60 (Supl.2): 257-267.					

Table 7 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Sardinian	1.3.j	Italy	Purse seiner	
Area:	Biomass in tons: DEPM: 5800 (1993)* ES: 650 (1993)** TS: VPA: 2100 (1992-93: Savona landings)	Recruitment: VPA:230000 in millions at 9 cm TL (1992-93: Savona landings)	Management options :	Recommendations: <ul style="list-style-type: none"> <li>Considering growth, the Ymax should be obtained above the current F.</li> <li>Increase minimum size should increase the spawning biomass.</li> <li>Since the recruitment occurs in autumn and winter, fishing should be close in this period.</li> </ul>	
Note : *All Ligurian Sea; ** From coast off Genoa to the Magra River (Liorzou pers.comm.)					
Fishery and Assessment					
Operational unit Purse seiners of Savona (Ligurian coast)	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm: 11.5	%VB = % of current biomass out the expected virgin one
Recent Y:	Recent Y/R in g : 4.5	Recent Z:	Recent F or f: F=0.31	Recent E:	(1992-93) Savona – 49 (2)
Note: Collapse of catches during the late 1980s and the early 1990s.					
Biology					
L <sub>∞</sub> F+M= 20.6 cm TL	W <sub>∞</sub>	K F+M= 0.38 y <sup>-1</sup>	t <sub>0</sub> F+M=-0.94 y	L max.	
L <sub>r</sub>	T <sub>r</sub>	A F+M= 0.002145 (g cm <sup>-3</sup> )	B F+M= 3.4121	L <sub>m</sub> F+M= 12.6 cm TL	T <sub>m</sub>
M F+M= 0.81	T C°	Ageing method LFM	VBGF method	M method Pauly (1980)	
Note:					
References: (1) Perterra J.P., Leonart J. (1996) – Scientia Marina 60 (Supl.2): 257-267.					

Table 8 - General Data					
Scientific name:  Engraulis encrasicolus	GFCM Subarea:  Adriatic	Management Unit:  2.1.a	Country:  Italy + Croatia	Fishery:  Mid Water Pair Trawlers (Volanti a coppia) Light Attraction Purse Seines (Lampare)	Stock Name:
Biomass in tons:  Area: 100000 km2 ES: 180000 Tons (1989-91) (1) VPA+ De Lury: 100000 Tons (1994-96) (1)	Recruitment :  It was much higher in the late 70s than in the mid to the late 80s.	Management options :  <ul style="list-style-type: none"> <li>• Minimum legal total length of 9 cm</li> <li>• Since 1988 trawling is stopped for 40 days in the summer;</li> <li>• After the starting of fisheries all trawlers can fish only for 4 days per week.</li> <li>• It is forbidden to transform Anchovy into fish-meal.</li> </ul>	Recommendations:  Because the biomass hasn't recovered at the level previous the collapse of 1987 seems reasonable to not increase the current level of fishing mortality.		
Note : "Volanti" fished mostly in the North Adriatic; "Lampare" operate mainly in the Central Adriatic and in the Gulf of Trieste. The catches are determined by the recruitment of the two immediately preceding years.					
Fishery and Assessment					
Operational unit Volanti – Northern ports Lampare – Southern ports	Stock Status:  Fully exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL:  Volanti – Northern ports = 13 (1992) Lampare – Southern ports = 15 (1992) (1)	
Recent Y:  22700 tons* (1996) (2)	Recent Y/R in g :		Recent F or f:  F=0.18 (all gears and overall area)** (2)	Recent E:	
Note: *Italy is accountable of about 90% of the catches. The first year classes (0,1 and 2) form about 80% of the captures **F values estimated as mean of VPA and Catch and effort assessments over 1988-96.					

<b>Biology</b>					
$L_{\infty}$	$W_{\infty}$	K	$t_0$	L max.	
$L_r$	$T_r$	A	B	$L_m$ F+M= 9.1 cm TL (3)	$T_m$
M F+M=	T C°	Ageing method	VBGF method	M method	
Note: Splitting of length structures of catches in age structures by using Length at Age Keys based on otolith readings.					
References: (1) Cingolani N. et al. (1996) – Scientia Marina 60 (Supl.2): 269-277. (2) Cingolani N. et al. (1998) – Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Ancona: 137 p. (3) Sinovic G. (1998) – Cah. Options Mediterr. 35:273-282.					



Table 9 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Engraulis encrasicolus	Ionian	2.2.b	Italy	Purse seiner	
Area: 14790 km <sup>2</sup>	Biomass in tons: (1994-95) DEPM: 11000	Recruitment:	Management options :	Recommendations:	
Note : Assessments carried out in the 70s and 80s, based on Annual Eggs Production Model (AEPM) overestimated biomass. Values obtained by AEPM for 1994-95 was 53000 tons (about 5 times higher).					
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y:	Recent Y/R :	Recent Z:	Recent F or f:	Recent E:	
Note:					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
Note:					
References: (1) Casavola N. (1999) – Biol. Mar. Medit. 6(1): 553-555.					

Table 10 - General Data					
Scientific name: Engraulis encrasicolus	GFCM Subarea: Ionian	Management Unit: 2.2.e	Country: Italy	Fishery: Purse seiner + Pelagic trawl	Stock Name:
Area: 13275 km <sup>2</sup> (DEPM) Area: 10976 km <sup>2</sup> (ES)	Biomass in tons: DEPM: 6200 (1998) ES: 6500 (1998)	Recruitment:	Management options :	Recommendations:	
Note : Surveys carried out in June–July 1998; Biomass estimations concerns Spawning Stock. (1) (2)					
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y:	Recent Y/R :	Recent Z:	Recent F or f: F= 0.24-0.33	Recent E:	
Note: F values estimated as ratio between catches in the area and biomass resulting from surveys (1).					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
Note:					
References: (1) Patti D. et al. (2000) – Echosurveys estimates and distribution of small pelagics fish concentrations in the Strait of Sicily during June 1998. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 11p. (2) Quintanilla L.F. et al. (2000) – Daily Egg Production estimate of the spawning biomass of the Sicilian Channel Anchovy during July 1998. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 43 p.					

Table 11 - General Data					
Scientific name: Engraulis encrasicolus	GFCM Subarea: Aegean	Management Unit: 3.1.a	Country: Greece	Fishery: Purse seiner	Stock Name:
Area: 14790 km <sup>2</sup> (Northern Aegean Sea)	Biomass in tons: DEPM: 40643 (1993) 42708 (1995) ES: 44601 (1995) 39475 (1996)	Recruitment:	Management options :	Recommendations:	
Note : Assessments carried out in the Northern Aegean Sea. Data given during the Session of WG on small pelagics – Fuengirola (Spain) 1-3- march 2000.					
Fishery and Assessment					
Operational unit Purse seiner (Kavala port)	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture: 13 cm TL (1997) 12.5 cm TL (1998)	Carrying capacity in terms of biomass 42420 tons (Schaefer Model)
Recent Y: about 1300 tons (1998-99)	Recent Y/R :	Recent Z:	Recent F or f:	Recent E:	MSY 4727 tons (Schaefer Model)
Note: Assessment based on Surplus Production Model (Schaefer, 1954)by using CEDA. After 19 of intensive fishing, the CPUE are at same level of 1981. However the mean length of catches decreased from 14.3 cm TL of 1983 (mainly 2+ age group) to 12.5 cm TL of 1998(mainly 1+ age group). (1)					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
Note:					
References: (1) Vidoris P., Kallianiotis A. (2000) - Production Model of Engraulis encrasicolus L., 1758, in the Thracian Sea. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 4 p.					

Table 12 - General Data					
Scientific name: Sardina pilchardus	GFCM Subarea: Balearic	Management Unit: 1.1.b	Country: Spain	Fishery: Light Attraction Purse Seine	Stock Name:
Biomass in tons: DEPM: ES: 119000 *(1991-93) (1) VPA : 63500**(1988-89) (2)	Recruitment in millions: 5065 (1988-89) (2)	Management options :		Recommendations:	
<p>Note : *ES carried out along Catalan coasts up to 200 m depth, between October and November.** Biomass estimated by VPA is referred to Barcelona, Port de Selva and Castellon landings</p> <p>The biomass estimated by echo-surveys in the most recent years is lower than those found in 1991-93 (1996-86640 tons; 97-86617; 98-64742; 99-65145-see annex 5 to the Report).</p>					
Fishery and Assessment					
Operational unit  Purse seine along Catalan coast (Barcelona, Port de Selva and Castellon ports) (2)	Stock Status:  Under-exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Y/R <sub>max.</sub> in g :	Mean Length of capture in cm TL:  (1988-89) 13.2 (2)	

Recent Y: 18760 tons (1988-89)	Recent Y/R in g : (1988-89) 3.6-4.5 (2)	Virgin Biomass (B <sub>0</sub> ) in tons: (1988-89) 118000 (2)	Recent F or f: (1988-89) (2) F=0.43 *  As vector on age groups 0.009<F <sub>0</sub> <0.099 ; F <sub>1</sub> =0.11 ; 0.38<F <sub>2</sub> < 0.45 ; F <sub>3</sub> = 0.46 ; 0.68<F <sub>4</sub> < 0.74 ; 0.89< F <sub>5</sub> < 0.98		
Note: Parameters obtained by VPA and Y/R simulations (VIT package). *F calculated from a vector as mean of values corresponding to the mean length of capture. The Sensitivity analysis shown that variations both in M and K can heavily affect Y/R simulations					
<b>Biology</b>					
L <sub>∞</sub> F+M= 22 cm TL (2)	W <sub>∞</sub>	K (2) F+M= 0.26 y <sup>-1</sup>	t <sub>0</sub> F+M=-1.1 y (2)	L max.	
L <sub>r</sub>	T <sub>r</sub>	A  F+M= 0.0067 (g cm <sup>-3</sup> ) (2)	B  F+M= 3.0525 (2)	L <sub>m</sub>	T <sub>m</sub>
M  F+M= 0.6 (2)	F <sub>term.</sub> :  F+M= 1.87 (2)	Ageing method  Otolith readings (2)	VBGF method  Tomlinson and Abramson (2)	M method  Pauly (1980) (2)	
Note:					
References: (1) Abad R. et al. (1996) – FAO Fish Rep. 537: 191 – 193. (2) Lleonart J. (1990) – La pesqueria de Catalunya y Valencia: description global y planteamiento de las bases para su conseguimiento: Informe Final. Commision de las Comunidades Europeas, DG XIV : 1634 p.					

Table 13 - General Data					
Scientific name: Sardina pilchardus	GFCM Subarea: Balearic	Management Unit: 1.1.b	Country: Spain	Fishery: Light Attraction Purse Seine	Stock Name:
Biomass in tons: DEPM: ES: 200000 *(1991-93) (1) VPA : 67350**(1988-89) (2)	Recruitment in millions: 3756 (1988-89) (2)	Management options :		Recommendations: Increasing F mortality due to trawling, should not produce significant variation in purse seiner Y/R , while the increase of purse seiner would affect heavily both trawling and total Y/R.	
<p>Note : *ES carried out along Valencian coasts up to 200 m depth, between October and November. The biomass estimated by echo-surveys in the most recent years is lower than those found in 1991-93 (1996-9275 tons; 97-5575; 98-4233; 99-954-see annex 5 to the Report).</p> <p>** Biomass estimated by VPA is referred to Valencia Port landings</p>					
Fishery and Assessment					
Operational unit Valencian coast (Valencia port) Purse seiners Trawlers (2)	Stock Status: Under-exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Y/R <sub>max</sub> in g : (1988-89) Purse seiners =5.2 Trawlers = No maximum	Mean Length of capture in cm TL: (1988-89) Purse seiners =14.8-15.4 Trawlers = 12.9-13.2 (2)	

Recent Y: 16430tons (1988-89) about 15% is caught by trawling	Recent Y/R in g : (1988-89) Purse seiners = 4.6-4.7 Trawlers = 0.81-0.83 (2)	Virgin Biomass (B <sub>0</sub> ) in tons: (1988-89) 107000 (2)	Recent F or f: (1988-89) (2) Purse seiners =0.30* Trawlers = 0.045*		
Note: Parameters obtained by VPA and Y/R simulations (VIT package). *F calculated from a vector as mean of values corresponding to the mean length of capture. The Sensitivity analysis shown that variations both in M and K can heavily affect Y/R simulations					
<b>Biology</b>					
L <sub>∞</sub> F+M= 22 cm TL (2)	W <sub>∞</sub>	K (2) F+M= 0.26 y <sup>-1</sup>	t <sub>0</sub> F+M=-1.1 y (2)	L max.	
L <sub>r</sub>	T <sub>r</sub>	A F+M= 0.0067 (g cm <sup>-3</sup> ) (2)	B F+M= 3.0525 (2)	L <sub>m</sub>	T <sub>m</sub>
M F+M= 0.6 (2)	F <sub>term.</sub> : F+M= 1.87 (2)	Ageing method Otolith readings (2)	VBGF method Tomlinson and Abramson (2)	M method Pauly (1980) (2)	
Note:					
References: (1) Abad R. et al. (1996) – FAO Fish Rep. 537: 191 – 193. (2) Lleonart J. (1990) – La pesqueria de Catalunya y Valencia: description global y planteamiento de las bases para su conseguimiento: Informe Final. Commision de las Comunidades Europeas, DG XIV : 1634 p.					

Table 14 - General Data					
Scientific name: Sardina pilchardus	GFCM Subarea: Balearic	Management Unit: 1.1.d	Country: Spain + Morocco	Fishery: Purse seiner	Stock Name:
Biomass: Area: ES: 36900 (1991-93) Spanish Coast (1)		Recruitment:	Management options :	Recommendations:	
Note: Echo surveys carried out in October and November between 20 and 200 m depth (1).					
Fishery and Assessment					
Operational unit	Stock Status: <ul style="list-style-type: none"><li>No assessments for Spanish coast</li><li>Over exploited (Moroccan coast) * (2)</li></ul>		$L_{25}$ $L_{50}=L_c$ $L_{75}$	Mean Length of capture:	Recent Y/R :
Recent Y:  10013 tons (1998) All Moroccan coast. Main landing in Al Hoceima (5335 tons) (2)			Recent Z:	Recent F or f: f= 5300 trip per year (1997- Moroccan coast) (2)	Recent E:
Note: * From 1992 onward landings were decreasing. CPUE of Al Hoceima Port were decreasing from 1982 onward. Catches are formed mainly of young of 0 (31%) and 1 (52%) age groups (2)					
Biology					
$L_\infty$ F+M= 21.74 cmTL (2)	$W_\infty$	K F+M= 0.261 (2)	$t_0$ F+M= -4.014 (2)	L max.	
$L_r$	$T_r$	A F+M= 0.0000058 (2)	B F+M=3.0519 (2)	$L_m$	$T_m$
M	T C°	Ageing method LFM	VBGF method Gulland and Holt plot	M method	
Note: Nurseries in coastal areas (<50 m depth); Recruitment in spring-summer (2).					
References: (1) Abad et al. (1996) – FAO Fish. Rep. 537: 191-193. (2) INRH (2000) – Note succincte sur la pecherie petits pelagiques mediterraneenne du Maroc. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 11p.					



Table 15 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<i>Sardina pilchardus</i>	Balearic	1.1.c	Algeria	Purse seiner	
Area:	Biomass: DEPM: ES: VPA:	Recruitment:	Management options :	Recommendations:	
<b>Fishery and Assessment</b>					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c=11.7-11.9$ cm TL $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture:	Recent Y/R :
Oran port Alger port	Under-exploited				
Recent Y:	Recent Z: Oran Port (1979) $Z_{lccc F}=0.719$ $Z_{lccc M}=0.755$	Alger port (1983-84) $Z_{lccc F}=0.622$ $Z_{lccc M}=0.978$	Recent F or f:	Recent E:	
			Oran Port $F=0.132-0.199$ Alger Port $F=0.215-0.453$	Oran Port $E=0.216-0.279$ Alger Port $E=0.299-0.463$	
Note: Assessment based on Beverton and Holt Relative Yield per Recruit Model ( $Y'/R$ ). Current Exploitation rates (E) were always lower than those giving the $Y'/R_{max}$ .					
<b>Biology</b>					
$L_{\infty}$ in cm TL	$W_{\infty}$	K	$t_0$	L max.	
F= 19.2-19 M= 18.3-18.5		F= 0.345-0.352 M= 0.379-0.371			
$L_r$	$T_r$	A	B	$L_m$	$T_m$
M	$T C^{\circ}$	Ageing method	VBGF method	M method	
F= 0.48-0.504 M= 0.517-0.525	17-18.2	LFM	Wetherall et al. + $\phi'$	Pauly (1980) + correction for small pelagics (0.8)	
References: (1) Bouchereau J.L. et al. (1986) – FAO Fish. Rep. 347: 163-185.					

Table 16 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Sardina pilchardus	Gulf of Lions	1.2.e	France + Spain	Trawling + Purse seiner	
Area: 2940 km <sup>2</sup> (ES) (1)	Biomass: DEPM: ES: 42839 (1995-97) (1)	Recruitment:	Management options :	Recommendations:	
Note : Echo surveys carried out during July in order to evaluate the spawning stock biomass. Values obtained in the last three years shown an increasing trend (1)					
Fishery and Assessment					
Operational unit French wide vertical opening bottom trawlers	Stock Status:  Moderately exploited (1)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y: 10330 tons (1995-97)* (1)	Recent Y/R :	Recent Z:	Recent F or f: F=0.24* (1)	Recent E:	
Note: * only referred to French catches; ** calculated as ratio between annual catches and spawning standing stock (ES).					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K )	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>		B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
References: (1) Geuennegan Y. et al. (2000) – Exploitation des petits pelagiques dans le Golf du Lion et suivi de l'évolution des stocks par echo-integration de 1999 a 2000. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000:27 p.					

Table 17 - General Data					
Scientific name:  Sardina pilchardus	GFCM Subarea:  Adriatic	Management Unit:  2.1.a	Country:  Italy + Croatia	Fishery:  Mid Water Pair Trawlers (Volanti a coppia) Light Attraction Purse Seines (Lampare)	Stock Name:
Biomass in tons:  Area: 100000 km <sup>2</sup> ES: 350000 Tons (1988-93) VPA+ De Lury: 125000 Tons (1988-96) (1)	Recruitment in millions:  Rmin = 1500 (1995) Rmax= 9500 (1983-84) Rmed= 2900 (1988-96) (3)	Management options :  Since 1988 trawling is stopped for 40 days in the summer; After the starting of fisheries all trawlers can fish only for 4 days per week.	Recommendations:		
<p>Note : "Volanti" fished mostly in the North Adriatic; "Lampare" operate mainly in the Central Adriatic and in the Gulf of Trieste. Sardine is the main target species for Croatian Purse seiners, which catch about ½ of total yield (2) A decreasing trend in biomass from the early 80s onward was observed (3)</p>					
Fishery and Assessment					
Operational unit Volanti – Northern ports Lampare – Southern ports	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL:  Northern ports = 16.5 - 17 (1994-96) Southern ports = 16.5 - 17 (1994-96) (2)	
Recent Y:  about 30000 tons* (1996) (2)	Recent Y/R in g :		Recent F or f:  F=0.18 (all gears and overall area)** (2)	Recent E:	

Note: The first years classes (0,1 and 2) form 55-75% of the captures (2)  
 \*\*F values estimated as mean of VPA, LCA and Catch and effort (Modified De Lury) assessments over 1988-96.

<b>Biology</b>					
$L_{\infty}$	$W_{\infty}$	K	$t_0$	L max.	
F+M=21 cm TL		F+M= 0.35 y-1	F+M=-2.42 y		
$L_r$	$T_r$	A	B	$L_m$	$T_m$
M	$F_{term.}$	Ageing method	VBGF method	M method	
F+M= 0.5	F+M= 0.5				
Note: Splitting of length structures of catches in age structures by using Length at Age Keys based on otolith readings.					
References: (1) Cingolani N. et al. (1998) – Biol. Mar. Medit.5 (3):321-330. (2) Cingolani N. et al. (1998) – Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Ancona: 137 p. (3) Santojanni A. et al. (1999) – Atti A.I.O.L. 13 (1):11-20.					

Table 18 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<i>Sardina pilchardus</i>	Ionian	2.2.b	Italy	Purse seiner	
Area: 14790 km <sup>2</sup>  (South-Western Adriatic Sea)	Biomass in tons:  (1994) DEPM: 14200	Recruitment:	Management options :	Recommendations:	
Note : Assessments carried out in the 70s and 80s, based on Annual Eggs Production Model (AEPM) overestimated biomass. Values obtained by AEPM for 1994 was 109000 tons (about 7.5 times higher).					
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y:	Recent Y/R :	Recent Z:	Recent F or f:	Recent E:	
Note:					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
Note:					
References: (1) Casavola N. et al. (1998) – Rapp.Comm.int.Mer Medit., 35 (2): 396					

Table 19 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Sardina pilchardus	Ionian	2.2.e	Italy	Purse seiner + Pelagic trawl	
Area: 10976 km <sup>2</sup> (South-western part of Strait of Sicily)	Biomass in tons: DEPM: no data ES: 21000 (1998)	Recruitment:	Management options :	Recommendations:	
Note : Surveys carried out in June 1998; Biomass estimations concerns Recruitment. (1)					
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture:	
Recent Y:	Recent Y/R :	Recent Z:	Recent F or f: F= 0.24-0.33	Recent E:	
Note: F values estimated as ratio between catches in the area and biomass resulting from surveys (1).					
Biology					
L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub>	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
References: (1) Patti D. et al. (2000) – Echosurveys estimates and distribution of small pelagics fish concentrations in the Strait of Sicily during June 1998. Paper presented at WG on small pelagics. Fuengirola (Spain) 1-3 March 2000: 11p.					

Table 20 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Balearic	Management Unit: 1.1.a	Country: Spain	Fishery: Trawling Gill net	Stock Name:
Area:	Biomass:  TS: LCA: 97 tons (1980 -92) (1) LCA: 169 tons(1991) (1)	Recruitment:  TS: LCA: 1.6 millions (1980-92) (1) LCA: 0.9 millions (1991) (1)	Management options :	Recommendations:  Adopting a 60 mm opening mesh size ( $F_0=0$ ; $F_1= 0.09$ ; $F_2= 0.68$ and $F_4= 0.75$ ) the Y/ R= 66.8 g should be obtained after 3 years (3).	
Note :					
Fishery					
Operational unit  Trawling around Balears	Stock Status:  Overexploited (growth overfishing)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :  12.8 (1980-92) (1)  15.9 (1991) (1)	Y/ R <sub>max</sub> in g  172.8 (1980-91) (3)  106.2 (1991) (1)
Recent Y:  99 t (1980-91) (3) 83 t (1991) (1)	Recent Y/R in g:  56.23 (1980-91) (1) 87.36 (1991) (1)	Recent Z:	Recent F or f:  F = 0.75 (1980-92) (1) F= 0.38 (1991) (1) Main F at age ( $F_0=0.005$ ; $F_1= 0.46$ ; $F_2= 0.86$ and $F_4= 0.75$ ) (3)	Effort level <sub>Y/R max.</sub> :  -86% of the current value (1980-91) (3)	SSB/SSB <sub>0</sub> :  0.5% (1980-91) (3)
(1) based on LCA on pseudocohorts					

<b>Biology</b>					
	$L_{\infty}$ M+F=94.2 cm TL (2)	$W_{\infty}$	K M+F= 0.09 y-1 (2)	$t_0$ M+F=-0.59 y (2)	L max.
$L_r$	$T_r$	A M+F=0.0043 (2)	B M+F=3.15 (2)	$L_m$ in cm TL M+F = 32 (3)	Tm
M M+F= 0.15 (2)	T C°	Ageing method	VBGF method	M method	
References:					
(1) Oliver P et al. (1995) – Cah. Options Mediterr. 10: 25-26					
(2) Oliver P, Morillas A. (1992) – Rapp. Comm. Int. Mer Medit. 33: 304					
(3) Oliver P. (1993) – Scientia Marina, 57 (2-3): 219 - 227.					



<b>Table 21 - General Data</b>					
Scientific name: Merluccius merluccius	GFCM Subarea: Balearic	Management Unit: 1.1.b	Country: Spain	Fishery: Trawling Long line gill net	Stock Name:
Area:	Biomass: TS: VPA:	Recruitment: TS: VPA: 40 millions (1991) (1)	Management options :	Recommendations: Expected increase Y/R from 43 to 98 g decreasing current F of 70%.(1)	
Note : (1) based on VPA and Y/R analysis					
<b>Fishery and Assessment</b>					
Operational unit Trawling along Catalan coast;	Stock Status: Overexploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture: 16.8 cm TL (2)	Note: * (2) mean of BH and Jones methods
Recent Y: 2390 t (1991) (2)	Recent Y/R :	Recent Z: Z= 0.47 * (1991) (2)	Recent F or f: Reported as vector	Recent E:	
<b>Biology</b>					
	$L_\infty$ M+F=110 cm TL (1)	$W_\infty$	K M+F= 0.11 y-1 (1)	$t_0$ M+F=0.3 y (1)	L max.
$L_r$	$T_r$	A M+F=0.000564 (1)	B M+F=3.069 (1)	$L_m$ F=39 cm TL (1) M=32 cm TL (1)	
M M+F=0.15 (1) – 0.12 (2)		Ageing method	VBGF method	M method	
References: (1) Recasens L. (1992) – Rapp. Comm. Int. Mer Medit. 33: 309 (2) Martin P., Sanchez P. (1992) – Rapp. Comm. Int. Mer Medit. 33: 301					

Table 22 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Balearic	1.1.c	Algeria	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :		Recommendations:
	TS: VPA	TS: VPA			
Note :					
Fishery and Assessment					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	Y/ $R_{max}$ in g
Trawling along Algerian Coasts	Overexploited				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	
		Z= 0.66 (3) (LCCC)	F= 0.36 (3)	E= 0.54 (3)	
Note: In the most important fishing port (Bouharoun) a decreasing trend was of <b>annual yield</b> was observed from the mid 80's (about 60 tons) to mid 90' (about 30 tons) (1)					
Biology					
	$L_{\infty}$ in cm TL F= 80.6 (1) M= 48.7 (1) F+M= 51.5 (3)	$W_{\infty}$	K in y-1 F= 0.442 (1) M= 0.075 (1) F+M= 0.22 (3)	$t_0$ in y F= -0.139 (1) M= -0.321 (1)	L max.
$L_r$	$T_r$	A F= 0.00655 M= 0.00443	B F= 2.99 M= 3.11	$L_m$ in cm TL F= 30.6 (2) M= 21.5 (2)	$T_m$
M M+F= 0.3 (3)	T C°	Ageing method Bhattacharya	VBGF method Fishparm	M method	
References: (1) Bouaziz et al. (1998) – Cah. Options Mediterr. 35: 35-41 (2) Bouaziz et al. (1998) – Cah. Options Mediterr. 35: 109-117 (3) Djabali et al. (1991) – FAO Fish. Rep. 447: 160-170.					

Table 23 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Gulf of Lions	Management Unit: 1.2.e	Country: France and Spain	Fishery: French trawlers Spanish trawlers French gill net Spanish long line	Stock Name:
Area:	Biomass: TS: VPA: 2150 (a) – 6400 (b) tons (1988) (1) (*) VPA: 6100 – 7100 tons (1988-91) (2) (**)	Recruitment: TS: VPA: 29 - 40 millions (1988) (1) (*)	Management options :	Recommendations: According to different biological scenarios, to obtain $Y/R_{max}$ current F would be decreased from 70 to 35 %. (1). The decrease of trawling fishing effort would produce high increasing of both gill net and long line yields (1).	
Note : (*); (**) mean values according to VIT and ANACO packages.					
Fishery and Assessment					
Operational unit French trawlers Spanish trawlers French gill net Spanish long line	Stock Status: Overexploited (growth overfishing)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL (1) : Fr. trawlers – 22.6 Sp. trawlers – 17.9 Fr. gill net – 42.9 Sp.long line – 49.5 TOTAL – 22.2	Virgin Biomass
Y in 1988 in tons (1) French trawlers – 2013 Spanish trawlers – 381 French gill net – 384 Spanish long line – 162 TOTAL – 2941	Recent Y/R (1) (*) : French trawlers = 67 (a)- 50 (b) Spanish trawlers = 12 - 9 French gill net = 13 - 9 Spanish long line = 5 - 4 TOTAL = 97 - 72	Y/R <sub>max</sub> (1) : TOTAL = 204 (a) – 78 (b)	Recent F or f: Vector of F per gear according to different biological scenarios are reported (1)	Recent E:	
Note:					

<b>Biology</b>					
	$L_{\infty}$ in cm TL F= 110 (a) (1) M= 66 F= 80.2 (b) (1) M= 55.8	$W_{\infty}$	K F= 0.11 (a) (1) M= 0.195 (1) F= 0.113 (b) (1) M= 0.179 (1)	$t_0$ F= 0.3 (a) (1) M= 0.3 (b) (1) F= -0.524 (1) M=-0.42 (1)	L max.
$L_r$	$T_r$	A F+M= 0.00564 (a) (1) F+M= 0.0069 (b) (1)	B F+M= 3.069 (a) (1) F+M= 3.03 (a) (1)	$L_m$ in cm TL F= 43 (1) M= 27	Tm
M	T C°	Ageing method	VBGF method	M method	
M+F= 0.15 (a) (1) M+F= 0.2 (b) (1) $F_{term.}=0.15$ (1)					
References: (1) Aldebert Y. et al. (1993) – Scientia Marina, 57 (2-3): 207-217. (2) Aldebert Y. and Recasens L. (1996) – FAO Fish. Rep., 537: 157-164.					

Table 24 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Sardinian	1.3.h	Italy	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
23700 km <sup>2</sup>	TS: VPA:	TS: VPA:		Protection of spawning areas mainly during spring (1)	
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Y/ R <sub>max</sub> in g
Trawling along Sardinian Coasts	Overexploited				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	
		Z= 0.85 (1) (LCCC)	F= 0.54 (1)	E= 0.64 (1)	
Note: Assessment based on trawl surveys data and Exploitation Rate as mean over 1985-97.					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F+M= 63.9 (1)		F+M= 0.15 (1)	F+M= -0.554 (1)	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
		F= 0.00655 M= 0.00443	F= 2.99 M= 3.11	F= 30.6 (2) M= 21.5 (2)	
M	T C°	Ageing method	VBGF method		M method
M+F= 0.31 (1)	14 (1)	Bhattacharya (1968)	Non Linear regression		Pauly (1980)
References:					
(1) Addis P. et al. (1998) – Biol. Mar. Medit. 5(3): 85-95.					

Table 25 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Balearic	Management Unit: 1.3.j +1.3.i (Tyrrhenian – coast of Calabria and Sicily)	Country: Italy	Fishery: Trawling Gill nets Long lines	Stock Name:
Area: 5600 km <sup>2</sup>	Biomass: TS: VPA	Recruitment: TS: VPA	Management options : Trawling is forbidden in the Gulf of S. Eufemia (Calabria) Patti and Castellammare (Sicily).		Recommendations:
Fishery					
Operational unit Trawling along Tyrrhenian coast of Calabria and Sicily	Stock Status: Overexploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Y/ R <sub>max</sub> in g
Recent Y:	Recent Y/R in g:	Recent Z: Z= 1.42 (LCCC)	Recent F or f: F= 1.15	Recent E: E= 0.80	
Note: Assessment based on trawl surveys data and Exploitation Rate as mean over 1985-97.					
Biology					
	L <sub>∞</sub> in cm TL F+M= 64.5 (1)	W <sub>∞</sub>	K in y-1 F+M= 0.14 (1)	t <sub>0</sub> in y F+M= 0.62 (1)	L max.
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M M+F= 0.27 (3)	T C°	Ageing method	VBGF method	M method	
References: (1) Greco et al. (1998) – Biol. Mar. Medit. 5 (3):74-84.					

Table 26 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Sardinian	1.3.j (Ligurian coast)	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
5800 km <sup>2</sup>	TS: VPA:	TS: VPA:		<ul style="list-style-type: none"> <li>The simulation with variable M gives Y/R much lower than those effected with constant M</li> <li>Maintaining the current exploitation pattern, the reduction of F mortality would not produce relevant increase of Y/R (1)</li> </ul>	
Fishery and assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =13.6 cm TL L <sub>75</sub>	Age at first capture (t <sub>c</sub> ): 1 y	Mean Length of capture in cm TL :	Y/ R <sub>max</sub> in g
Trawling along Ligurian Coasts	Overexploited (growth overfishing)				20
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	E max.:
	17	Z= 2.17 (1990-93) (LCCC) (1)	F= 1.6 (1990-93) (1)	E= 0.7 (1990-93) (1)	0.5
Note: Thompson Bell model with vector M-at age and nominal recruitment of 1000000 of individuals. It is assumed that from Lc to 35 cm TL all fish are retained by the cod-end; while the smallest and largest ones avoid the catch (double knife-edge selection) (1).					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	M+F= 49.75		M+F= 0.28	M+F= -0.332	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
6 in cm TL	0.33 y				
M(1)	M+F= from 3.15 (age 0.33) to 0.29 (age 4)	Ageing method Otolith readings	VBGF method Non linear regression	M method Caddy Vector for Gadus morhua of North Sea (1991)	
References: (1) Fiorentino et al. (1996) – Biol. Mar. Medit. 3 (1): 548-552.					

Table 27 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Northern Tuscany)	Country: Italy	Fishery: Trawling	Stock Name:
Area:	Biomass: TS: about 300 tons (mean over 1985-95) VPA:	Recruitment: TS: VPA:	Management options :		Recommendations: it is recommended to increase the SSB/SSB <sub>0</sub> (1)
Note : No evident trends in biomass estimates were detected.					
Fishery and assessment					
Operational unit: Trawling along Northern Coasts of Tuscany (Livorno and Viareggio Fleets)	Stock Status: Fully-heavily exploited Risk of recruitment overfishing)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =11 cm TL (a) L <sub>75</sub> Vector Selectivity-Vulnerability (b)	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	SSB/SSB <sub>0</sub> 1% (a) 15% (b)
Recent Y:	Recent Y/R in g: F+M= 25 (a) F+M= 33 (b)	Recent Z: F= 1.9 LCCC(a) M=2.5 LCCC (a)	Recent F or f: F= 2.0 (a) M=1.6 (a)		Recent E: F= 0.8 (a) M= 0.8 (a)
Note: Assessment based mainly on trawl surveys data (1985-95) by using both traditional Y/R analysis and a variant assuming M-at age and vulnerability-at age vectors. The traditional approach suggests heavy overexploitation and serious danger of recruitment over-fishing; according to the second one hake is fully exploited and with minor risk for self-renewal capability (1).					
Biology References: (1) Abella A. and Serena F. (1998) – Biol. Mar. Medit. 5 (2): 136-150.					
	L <sub>∞</sub> in cm TL F =79.1 (1) M= 53.4	W <sub>∞</sub>	K in y-1 F =0.185 (1) M= 0.272	t <sub>0</sub> in y F =79.1 (1) M= 53.4	L max. F = 43 (1) M= 27
L <sub>r</sub>	T <sub>r</sub>	A F =0.0041 (1) M= 0.005	B F =3.192 (1) M= 3.119	L <sub>m</sub> in cm TL	T <sub>m</sub>
M F= 0.32 (a) M= 0.47	T C°	Ageing method LFM	VBGF method	M method a) Constant M b) Variable M	



Table 28 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Northern Tyrrhenian Sea)	Country: Italy	Fishery: Trawling and gillnet	Stock Name:
Area: 15300 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations: Protection of nursery areas
Fishery and assessment					
Operational unit Trawlers of Porto S. Stefano. Italian trawlers – French trawlers -	Stock Status: Overexploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :  Italian trawlers – 15.1 French trawlers – 16.9	Recent E: E= 0.7 (1)
Recent Y: (1991)  Total – 577 tons Italian trawlers – 417 tons French trawlers – 160 tons	Recent Y/R in g: (1991)  Total – 30 Italian trawlers – 22 French trawlers - 8	Recent Z:  (1)	Recent F or f: (1991) Italian trawlers – Values higher than 1 in 12-24 cm TL length class. Peak (F=1.9) at about 16-17 cm TL. French trawlers - Values higher than 0.5 in 16-24 cm TL length class. Peak (F=0.8) at about 17-18 cm TL. (1)	Y/R <sub>max</sub> in g  Total – 60 Italian trawlers – 40 French trawlers - 20	Reduction of current F to obtain Y/R <sub>max</sub> .  - 75%
Note: Assessment based on LCA and Y/R analysis by using VIT package (1).					

<b>Biology</b>					
	$L_{\infty}$ in cm TL M+F= 92.98	$W_{\infty}$	K in y-1 M+F= 0.119	$t_0$ in y M+F= -0.371	L max.
$L_r$ in cm TL	$T_r$	A M+F= 0.00496	B M+F= 3.108	$L_m$ in cm TL F= 40 M= 27	$T_m$
M(1) M+F= 0.21		Ageing method LFM	VBGF method	M method Pauly (1980)	
References: (1) De Ranieri S. et al. (1994) – Biol. Mar. Medit. 1 (2): 27-39.					

Table 29 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Central Tyrrhenian Sea)	Country: Italy	Fishery: Trawling and gillnet	Stock Name:
Area: 15300 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations:
Fishery and assessment					
Operational unit Trawling along Coast of Latium	Stock Status: Overexploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E: E= 0.7 (1)
Recent Y:	Recent Y/R in g:	Recent Z: 1.36 (LCCC) (1)	Recent F or f: F= 0.96(1)	F <sub>0.1</sub> : 0.27	E <sub>0.1</sub> : 0.4
Note: (1).					
Biology					
	L <sub>∞</sub> in cm TL M+F= 74.59	W <sub>∞</sub>	K in y-1 M+F= 0.23	t <sub>0</sub> in y	L max.
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M(1) M+F= 0.4		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
References: (1) Ardizzone et al. (1998) – Biol. Mar. Medit. 5 (3): 53-63.					

Table 30 – General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Sardinian	1.3.j (Southern Tyrrhenian Sea)	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :		Recommendations:
13000 km <sup>2</sup>	TS: VPA:	TS: VPA:			(1)
Fishery and assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 12.4 cm TL L <sub>75</sub> = 13.1 cm TL	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E:
Trawling along Coasts of Campania and Calabria	Overexploited				E= 0.7 (1)
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	F <sub>max</sub> :	E <sub>0.1</sub> :
		1.64 (LCCC) (1)	F= 1.28(1)	0.30	
Note: F <sub>max</sub> estimated with classical Y/R Beverton and Holt model. The necessity of reducing F of about 75%, suggested by Y/R model, does not agree with the observed relative stability of catch rates from the trawl surveys in the last 10 years (1).					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	M+F= 59.16		M+F= 0.165	M+F= -0.554	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
		M+F= 0.0045	M+F= 3.15		
M(1) M+F= 0.36		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
Note: The nursery areas was identified by geostatistical techniques – Gulf of Gaeta and Gulf of Naples (2)					
References: (1) Spedicato M.T. et al. (1998) – Biol. Mar. Medit. 5 (3): 64-73. (2) Spedicato M.T. et al. (1995) – Biol. Mar. Medit. 2(2) : 239-244. (3) Lembo et al. (1998) – Cah. Options Mediterr., 35: 147-154.					

Table 31 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Adriatic	Management Unit: 2.1.a	Country: Italy + Croatia	Fishery: Trawling	Stock Name:
Area: 100000 km <sup>2</sup>	Biomass: TS: VPA	Recruitment: TS: VPA	Recommendations: <ul style="list-style-type: none"> <li>Increasing the Lc from 14 to 16 cm with a F=0.8, a 25% increase in Yield should be achieved (3)</li> <li>Considering to multispecificity of fishery similar increase should be obtained closing to trawling nursery areas (Jabuka pit) (3)</li> </ul>		
Note : Y/R simulation with recruitment of 1000000 individuals at 8 cm TL (3)					
Fishery					
Operational unit Trawling	Stock Status: Overexploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =12.4 cm TL (1) L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	
Recent Y:	Recent Y/R in g:	Recent Z: Z=1 (1982) (2) LCCC Z=0.67-0.81 (1983-84) (3) Heincke	Recent F or f: F= 0.75(1982) (2) F= 0.90(1985-95) (4)	Recent E: E= 0.75(1982) (4)	F <sub>0.1</sub> : 0.14 (4)
Note: Populations dynamics on trawl survey data (1-4). Catch rate from trawl surveys from 1985 to 1997 shown a slight increasing trend (5).					
Biology					
	L <sub>∞</sub> in cm TL F+M= 85 (1)	W <sub>∞</sub>	K in y-1 F+M= 0.12(1)	t <sub>0</sub> in y F+M=	L max.
L <sub>r</sub> in cm TL (1)	T <sub>r</sub>	A F+M= 0.00331(2)	B F+M= 3.262 (2)	L <sub>m</sub> in cm TL	T <sub>m</sub>
M M+F= 0.2 (a) (1) M+F= 0.4 (b) M+F= 0.21-.025 (4)	T C°	Ageing method Otoliths readings	VBGF method Ford-Walford	M method Pauly (1980)	
REF : (1) Jukic S., Piccinetti C. (1988) – FAO Fish Rep. 394: 282-290 (2) Flamigni C. (1984) – FAO Fish Rep. 290: 109-115 3) Giovanardi O., Rizzoli M. (1986) - FAO Fish Rep. 345: 71-78 (4) Ardizzone G.D. (1998) – Biol. Mar. Medit. 5 (2): 151-168. (5) Piccinetti C., Piccinetti Manfrin G. (1994) – Biol. Mar Medit.1 (2): 77-87. (6) Manfrin G. et al. (1998) – Biol.Mar. Medit. 5(3): 96-108.					

Table 32 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Ionian	2.2.b	Italy	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
14200 km <sup>2</sup> (1)	TS: VPA	TS: VPA		The renewal of stock is probably due to areas inaccessible to trawling in which spawners are present	
Fishery					
Operational unit	Stock Status:	L <sub>25</sub>	Age at first capture (t <sub>0</sub> ):	Mean Length of capture in cm TL :	
Trawling	Overexploited (growth overfishing)	L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>			
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	F <sub>Ymax</sub> .
		Z <sub>LCCC</sub> =1-1.7(1985-97)(1) Z <sub>LCCC</sub> =1.31(1991-93) (3) Z <sub>LCA</sub> =0.96(1991-93) (3)	F= 0.7-1 (1991-93) (3)	E <sub>LCCC</sub> = 0.8 (1985-91)(2) E <sub>LCCC</sub> =0.8 (1991-93) (3) E <sub>LCA</sub> = 0.7 (1991-93) (3)	0.2 – 0.3 (3)
Note: Assessments based on population dynamics on trawl survey data.					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F+M= 75.7 (3)		F+M= 0.153(3)	F+M=	
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
		F+M= 0.00257(3)	F+M= 3.29 (3)	F = 30 M = 25	
M	T C°	Ageing method	VBGF method	M method	
F+M = 0.29 (3)		Otoliths readings	Ford-Walford	Pauly (1980)	
References:					
(1) Marano et al. (1988) – Biol. Mar. Medit.5 (3): 109 –119					
(2) Ungaro et al. (1992) – Biologia Marina, Suppl. Not. SIBM: 329-334					
(3) Ungaro N., Marano G. (1996)- FAO Fish Rep. 533 (Suppl.): 97 – 100					

Table 33 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Merluccius merluccius	Ionian	2.2.c	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
11000 km <sup>2</sup>	TS: VPA	TS: VPA			
Fishery					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =11.5 cm TL (1) L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Y/ R <sub>max</sub> in g
Trawling along Italian Ionian coasts	Overexploited		0.78 y		45 (1)
Recent Y/R in g:	Recent Z: (1985-1997)	Recent F or f:	F max. :	Recent E: (1985-1997)	B/R / B <sub>0</sub> /R:
32 (1):	F Z <sub>L<sub>ccc</sub></sub> = 1.07 (2) M Z <sub>L<sub>ccc</sub></sub> = 1.27	F= 0.71 (1990-93) (1)	0.2-0.3	F E = 0.83 (2) M E = 0.83	10%
Note: Assessment based on trawl survey data and Beverton and Holt Y/R and B/R models (1)					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F+M= 62 (1) F= 78.22 (2) M= 66.47 (2)		F+M= 0.19 (1) F= 0.11 (2) M= 0.13 (2)	F+M= -0.39 (1) F= -1.03 (2) M= -0.91 (2)	
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
6 (1)		F+M=0.0000024 (1)	F+M= 3.2 (1)		
M		Ageing method	VBGF method	M method	
M+F= 0.31 (1) F= 0.22 – M= 0.27 (2)		Otoliths readings	Non linear regression	Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g; reported values are mean of spring and autumn coefficients					
References: (1) Tursi A. et al. (1996) – FAO Fish. Rep. 533 (Suppl.)127-141. (2) Tursi A. et al. (1998) Biol. Mar. Medit. 5(3): 120-129.					

Table 34 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Ionian	Management Unit: 2.2.d (Ionian Sea)	Country: Greece	Fishery: Trawling Gill net	Stock Name:
Area:	Biomass: TS: VPA	Recruitment: TS: VPA	Management options :	Recommendations: Increase mesh size from 28 to 40 mm	
Fishery					
Operational unit Trawling	Stock Status: Fully exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Recent Y:	Recent Y/R in g:	Recent Z: $Z_{LCCC}=0.85(1983-84)(1)$ $Z_{LCCC}=0.78(1983-84) (1)$	Recent F or f: $F=0.67(1983-84)(1)$ $F=0.60(1983-84) (1)$	Recent E: $E=0.79(1983-84)(1)$ $E=0.77(1983-84) (1)$	$F_{Ymax}$ .
Note: Assessment based on trawl survey data and Exploitation Rate.					
Biology					
	$L_{\infty}$ in cm TL $F+M= 71.7 (1)$	$W_{\infty}$	K in $y^{-1}$ $F+M= 0.081 (1)$	$t_0$ in y	L max.
$L_r$ in cm TL 4-6 (1)	$T_r$	A $F+M= 0.000019(2)$	B $F+M= 3.234 (2)$	$L_m$ in cm TL $F = 36 (2)$ M = 31	$T_m$
M $F+M = 0.18 (1)$	T C°	Ageing method Otoliths readings	VBGF method Ford-Walford	M method Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References: (1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas) Working paper to be presented at WG on Demersals Séte 21-23 March 2000: 17 p. (2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					



Table 35 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Ionian	Management Unit: 2.2.d (Korinthiakos Gulf)	Country: Greece	Fishery: Trawling Gill net	Stock Name:
Area:	Biomass:  TS: VPA	Recruitment:  TS: VPA	Management options :	Recommendations: Increase mesh size from 28 to 40 mm	
Fishery					
Operational unit  Trawling (Korinthiakos Gulf)	Stock Status:  Fully exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Recent Y:	Recent Y/R in g:	Recent Z:  $Z_{LCCC}=0.94(1983-84)(1)$ $Z_{LCCC}=1.7(1983-84) (1)$	Recent F or f:  $F=0.76(1983-84)(1)$ $F=0.89(1983-84) (1)$	Recent E:  $E=0.81(1983-84)(1)$ $E=0.83(1983-84) (1)$	$F_{Ymax}$ .
Note: Assessment based on trawl survey data and Exploitation Rate.					
Biology					
	$L_{\infty}$ in cm TL  $F+M= 65.9 (1)$	$W_{\infty}$	K in y-1  $F+M= 0.068 (1)$	$t_0$ in y	L max.
$L_r$ in cm TL	$T_r$	A  $F+M= 0.000024(2)$	B  $F+M= 3.197 (2)$	$L_m$ in cm TL  $F = 43 (2)$ $M = 36$	$T_m$
M  $F+M = 0.18 (1)$	$T C^{\circ}$	Ageing method  Otoliths readings	VBGF method  Ford-Walford	M method  Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References: (1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas) Working paper to be presented at WG on Demersals Sète 21-23 March 2000: 17 p. (2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					

Table 36 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<i>Merluccius merluccius</i>	Ionian	2.2.d (Patraikos Gulf)	Greece	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :	Recommendations: Increase mesh size from 28 to 40 mm	
	TS: VPA	TS: VPA			
Fishery					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Trawling (Patraikos Gulf)	Fully exploited				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	$F_{Ymax}$ .
		$Z_{LCCC}=1.17(1983-84)(1)$ $Z_{LCCC}=1.23(1983-84)(1)$	$F=0.99(1983-84)(1)$ $F=1.05(1983-84)(1)$	$E=0.81(1983-84)(1)$ $E=0.83(1983-84)(1)$	
Note: Assessment based on trawl survey data and Exploitation Rate.					
Biology					
	$L_{\infty}$ in cm TL	$W_{\infty}$	K in y-1	$t_0$ in y	L max.
	F+M= 63.8 (1)		F+M= 0.075 (1)		
$L_r$ in cm TL	$T_r$	A	B	$L_m$ in cm TL	$T_m$
		F+M= 0.000020(2)	F+M= 3.23 (2)	F = 36 (2) M = 30	
M	T C°	Ageing method	VBGF method	M method	
F+M = 0.18 (1)		Otoliths readings	Ford-Walford	Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References:					
(1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas) Working paper to be presented at WG on Demersals Sète 21-23 March 2000: 17 p.					
(2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					

Table 37 - General Data				
Scientific name: Merluccius merluccius	GFCM Subarea: Sardinian and Ionian	Management Unit: 1.3.k (Strait of Sicily – Northern Tunisian Coast) 2.2.f (Strait of Sicily –Eastern and Southern Tunisian Coast)	Country: Tunisia	Fishery: Trawling Gill nets Long lines
<u>Biomass:</u> TS: LCA:	Recommendations: <ul style="list-style-type: none"> <li>Any increasing in fishing effort would lead to a long term decreases in Yield and spawning biomass; while a decreasing of effort would benefit all areas and categories of fleet.</li> <li>The increase of mesh size of trawlers (from 38 to 60 mm) would lead to important long terms gain in spawning biomass and yield especially for coastal fleet. The change in exploitation pattern should cause an immediate loss, specially for trawlers in the North and East. Therefore this measure should be gradually introduced.</li> <li>The displacement of part of trawlers from South to North should is not sufficient to have positive effects on hake landings.(1)</li> </ul>			
<u>Recruitment:</u> TS: LCA:13 millions of individuals at 10 cm TL				
Fishery				
Operational unit <u>North Trawlers</u> <u>Coastal North Eastern trawlers</u> <u>Southern Trawlers</u>	Stock Status: <b>Overexploited</b>	Y/R max. : With few difference among fleets, the highest increase of Y would be obtained reducing effort at 25% of the current value.	SSB/SSB <sub>0</sub> : 1%	MSY in tons Schaefer = 750 tons Fox = 680 tons
Recent Y:  <u>TOTAL</u> =500 tons  % for each Operational Units  <u>North Trawlers – 49%</u> <u>Coastal North – 13%</u> <u>Eastern trawlers –30%</u> <u>Southern Trawlers -7%</u>	Recent F (1988-91):  <u>North trawlers</u> = F>0.5 from 13 to 45 cm TL with the maximum at 16 cm (F=1.1). Exploited range 10-45 cm TL. <u>Coastal North</u> = F>0.25 from 22 to 32 cm TL with the maximum at 28 cm (F=0.65). Exploited range 13-42cm TL. <u>Eastern trawlers</u> = F>0.5 from 15 to 25 cm TL with the maximum at 19 cm (F=0.8). Exploited range 12-42 cm TL. <u>Southern trawlers</u> = lowest F values with maximum at 22 cm (0.25). Exploitation range 15-42cm TL. <u>TOTAL</u> = F>1 from 15 to 30 cm TL with the maximum at 20 cm (F=2.2); than decrease regularly			Recent f:  1900*FD*HP*10 <sup>6</sup> (1991)  f <sub>MSY</sub> : Schaefer=1100*FD*HP*10 <sup>6</sup> (1985) Fox= 750* FD*HP*10 <sup>6</sup> (1983)
Note: Assessment carried out on mean landings over 1988-91 by LCA and Y/R simulation. All F values are derived from graphs.				
Biology				
L <sub>∞</sub> in cm TL :	K in y-1:		t <sub>0</sub> in y	L max.
F+M= 69.5 (1)	F+M= 0.176 (1)			
M:	F <sub>term.</sub> :	A	B	L <sub>m</sub> in cm TL:
M+F= 0.2 (3)	M+F= 0.6			F+M= 27 cm TL
References: (1) Ben Mariem S., Gharbi H. (1996) – FAO Fish Rep.533 (Suppl.): 173-189.				

Table 38 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<i>Merluccius merluccius</i>	Ionian	3.1.a (Euboikos Gulf)	Greece	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
	TS: 48–163 tons (1986-88) VPA:	TS: VPA		Increase mesh size from 28 to 40 mm	
Fishery					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Trawling (Euboikos Gulf)	Fully exploited				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	$F_{Ymax}$ .
		$Z_{LCCC}=0.56(1986-88)(1)$	$F=0.24(1986-88)(1)$	$E=0.24(1986-88)(1)$	
Note: Assessment based on trawl surveys data and Exploitation Rate					
Biology					
	$L_{\infty}$ in cm TL	$W_{\infty}$	K in y-1	$t_0$ in y	L max.
	F+M= 59.8 (1)		F+M= 0.145 (1)	F+M=-1.59	
$L_r$ in cm TL	$T_r$	A	B	$L_m$ in cm TL	$T_m$
6-8 (1)		F+M= 0.0000035(2)	F+M= 3.147 (2)	F = 34 (2)	
M	T C°	Ageing method	VBGF method	M method	
F+M = 0.32 (1)		Otoliths readings	Ford-Walford	Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References:					
(1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas). Working paper to be presented at WG on Demersals Sète 21-23 March 2000.					
(2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					

Table 39 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
<i>Merluccius merluccius</i>	Ionian	3.1.a (Saronikos Gulf)	Greece	Trawling Gill net	
Area:	Biomass:	Recruitment:	Management options :	Recommendations: Increasing mesh size from 28 to 40 mm, short- term decrease of yield of 2.1% and long- term increase of 6% are expected (1).	
	TS: VPA	TS: VPA			
Fishery					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Trawling (Saronikos Gulf)	Fully exploited				
Recent Y:	Recent Y/R in g:	Recent Z: $Z_{LCCC}=1.87(1988)(1)$	Recent F or f: $F=1.38(1988)(1)$	Recent E: $E=0.74(1988)(1)$	$F_{Ymax}$ .
Note: Assessments based on trawl surveys data					
Biology					
	$L_{\infty}$ in cm TL $F+M= 601$	$W_{\infty}$	K in y-1 $F+M= 0.3 (1)$	$t_0$ in y	L max.
$L_r$ in cm TL 6-8 (1)	$T_r$	A $F+M= 0.000025(2)$	B $F+M= 3.203 (2)$	$L_m$ in cm TL	$T_m$
M $F+M = 0.49 (1)$	$T C^{\circ}$	Ageing method LFM	VBGF method	M method Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References: (1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas). Working paper to be presented at WG on Demersals Sète 21-23 March 2000. (2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					

Table 40 - General Data					
Scientific name: Merluccius merluccius	GFCM Subarea: Ionian	Management Unit: 3.1.a (North Aegean)	Country: Greece	Fishery: Trawling Gill net	Stock Name:
Area:	Biomass: TS:1331-2545 tons (1986-88) VPA	Recruitment: TS: VPA	Management options :	Recommendations: <ul style="list-style-type: none"> <li>• Increase mesh size from 28 to 40 mm</li> <li>• Decreasing exploitation of 0+ and 1+ groups, an increase of 20% of yield is expected.</li> </ul>	
Fishery					
Operational unit Trawling (North Aegean)	Stock Status: Fully exploited	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	
Recent Y:	Recent Y/R in g:	Recent Z: $Z_{LCCC}=0.72(1990-91)(1)$ $Z_{LCA}=0.87(1990-91)(1)$	Recent F or f: $F_{LCCC}=0.52(1990-91)(1)$ $F_{LCA}=0.70(1990-91)(1)$	Recent E: $E_{LCCC}=0.77(1990-91)(1)$ $E_{LCA}=0.81(1990-91)(1)$	$F_{Ymax}$ .
Note: Assessments based on trawl surveys data					
Biology					
	$L_{\infty}$ in cm TL F+M= 103.7 (1)	$W_{\infty}$	K in y-1 F+M= 0.075 (1)	$t_0$ in y F+M= -1.82 (1)	L max.
$L_r$ in cm TL 6-8 (1)	$T_r$	A F+M= 0.000003(2)	B F+M= 3.179(2)	$L_m$ in cm TL	$T_m$
M F+M = 0.18 (1)	T C°	Ageing method Otoliths readings	VBGF method Ford-Walford	M method Pauly (1980)	
Note: length-weight coefficients calculated with TL in mm and TW in g (2)					
References: (1) Papaconstantinou C. (2000) – The biology and the management of Hake ( <i>Merluccius merluccius</i> in the Greek Seas) Working paper to be presented at WG on Demersals Sète 21-23 March 2000. (2) Papaconstantinou C., Stergiou K.I. (1995) – Fish and Fisheries Series 15 - Chapman & Hall – London: 150-180.					

<b>Table 41 - General Data</b>					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Micromesistius poutassou	Balearic	1.1.b	Spain	Trawling	
Area:	Biomass: VPA: (1988-89) M=0.3 – 5080 (tons) M=0.5 – 7170 (tons)	Recruitment in millions VPA: (1988-89) M=0.3 – 83 M=0.5 – 143	Management options :	Recommendations:  Further increase of fishing mortality should not produce increasing in yield; while the Y/R should increase after adoption of mesh size larger than 40 mm.	
<b>Fishery and Assessment</b>					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Mean Length of capture:	Virgin biomass ( $B_0$ ):	Note:
Trawling along Catalan coast;	Slight Overexploited (with M=0.3)		(1988-89) 18.3 cm TL (1)	(1988-89) M=0.3 – 24500 (tons) M=0.5 – 17500 (tons)	
Recent Y:  2461 t (1988-89) (1)	Recent Y/R in g: (1988-89)  M=0.3 – 29.5 M=0.5 - 17	Y/R <sub>max.</sub> : (1988-89)  With M=0.3, Y/R <sub>max.</sub> is obtainable reducing current F by 30-40% (1)	Recent F or f:	Recent E:	
Note : Assessment based on VPA and Y/R analysis. Fish smaller than 16 cm TL are generally discarded (1)					
<b>Biology</b>					
	$L_{\infty}$  M+F=48.2 cm TL (1)	$W_{\infty}$	K  M+F= 0.13 y-1 (1)	$t_0$  M+F=-1.69 y (1)	L max.
$L_r$	T r	A  M+F=0.00816 (1)	B  M+F=3.00 (1)	$L_m$  M+F= 17-17.5 cm TL (1)	
M M+F=0.3 and 0.5 (1)	$F_{term.} = 0.7$		Ageing method	VBGF method	M method
References: (1) Leonart J. (1990) – La pesqueria de Catalunya y Valencia: description global y planteamiento de las bases para su conseguimiento: Informe Final. Comission de las Comunidades Europeas, DG XIV : 1634 p.					

<b>Table 42 - General Data</b>					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Micromesistius poutassou	Balearic	1.1.b	Spain	Trawling	
Area:	Biomass: VPA: (1988-89) M=0.3 – 2731 (tons) M=0.5 – 3723 (tons)	Recruitment in millions VPA: (1988-89) M=0.3 – 44 M=0.5 – 75	Management options :	Recommendations:	
<b>Fishery and Assessment</b>					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Mean Length of capture:	Virgin biomass (B <sub>0</sub> ):	Note:
Trawling along Valencian coast;	Slight Overexploited (with M=0.3)  Underexploitation (with M=0.5)		(1988-89) 18.3 cm TL (1)	(1988-89) M=0.3 – 8650 (tons) M=0.5 – 8175 (tons)	
Recent Y:  1343 t (1988-89) (1)	Recent Y/R in g: (1988-89)  M=0.3 – 30.8 M=0.5 – 18.0	Y/R <sub>max.</sub> : (1988-89)  With M=0.3, Y/R <sub>max.</sub> is obtainable reducing current F by 20%; with M=0.5 Y/R <sub>max.</sub> is obtainable increasing effort by 80% (1)			Recent F or f:
Note : Assessment based on VPA and Y/R analysis. Fish smaller than 16 cm TL are generally discarded (1)					
<b>Biology</b>					
	L <sub>∞</sub>	W <sub>∞</sub>	K	t <sub>0</sub>	L max.
	M+F=48.2 cm TL (1)		M+F= 0.13 y-1 (1)	M+F=-1.69 y (1)	
L <sub>r</sub>	T r	A	B	L <sub>m</sub>	
		M+F=0.00816 (1)	M+F=3.00 (1)	M+F= 17-17.5 cm TL (1)	
M M+F=0.3 and 0.5 (1)	F <sub>term.</sub> = 0.7		Ageing method	VBGF method	M method
References: (1) Lleonart J. (1990) – La pesqueria de Catalunya y Valencia: description global y planteamiento de las bases para su conseguimiento: Informe Final. Commision de las Comunidades Europeas, DG XIV : 1634 p.					



Table 43 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Micromesistius poutassou	Sardinian	1.3.j (Ligurian coast)	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
5800 km <sup>2</sup>	TS: VPA:	TS: VPA:		<ul style="list-style-type: none"> <li>Considering E<sub>max.</sub> as Limit Reference Point, the current fishing mortality should be reduced by 28% (1)</li> </ul>	
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ): 1 y	Mean Length of capture in cm TL :	
Trawling along Ligurian Coasts	Overexploited (growth overfishing)				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent E:	E <sub>0.1</sub> :	E max.:
			0.7 (1994-95) (1)	0.4 (1994-95) (1)	0.5 (1994-95) (1)
Note: Assessment based on trawl survey data and Beverton and Holt relative Yield per Recruit Model (1).					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	M+F=		M+F=	M+F=	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M(1)		Ageing method	VBGF method	M method	
M+F=)		Otolith readings	Non linear regression		
References: (1) Relini G. et al. (1998) – Biol. Mar. Medit. 5 (3): 20-29.					

Table 44 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Micromesistius poutassou	Ionian	2.2.b	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
14200 km <sup>2</sup> (1)	TS: VPA	TS: VPA			
Fishery					
Operational unit	Stock status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>0</sub> ):	Mean Length of capture in cm TL :	
Trawling	Overexploited (growth overfishing)				
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f:	Recent E:	F <sub>Ymax</sub> .
		Z <sub>LCCC</sub> =2.8 (1996-98) (1)	F= 2.01 (1996-98) (1)	E <sub>LCCC</sub> = 0.7 (1996-98) (1)	
Note: Assessments based on population dynamics on trawl survey data (1) .					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F+M= 41.4 - 48 (1)		F+M= 0.18 – 0.58 (1)	F+M=	
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL F +M = 20-22	T <sub>m</sub>
M	T C°	Ageing method	VBGF method	M method	
F+M = 0.79 (3)		Otoliths readings		Pauly (1980)	
References:					
(1) Marano et al. (1998) – Biol. Mar. Medit.5 (3): 109 –119					

Table 45 - General Data					
Scientific name: Micromesistius poutassou	GFCM Subarea: Ionian	Management Unit: 2.2.c	Country: Italy	Fishery: Trawling	Stock Name:
Area: 11900 km <sup>2</sup> (1)	Biomass: TS: VPA	Recruitment: TS: VPA	Management options :	Recommendations:	
Fishery and Assessment					
Operational unit Trawling	Stock status: Overexploited (growth overfishing)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>0</sub> ):	Mean Length of capture in cm TL :	
Recent Y:	Recent Y/R in g:	Recent Z: Z <sub>LCCC</sub> =1.11 (1996-98) (1)	Recent F or f: F = 0.66 (1996-98) (1)	Recent E: E <sub>LCCC</sub> = 0.59 (1996-98) (1)	F <sub>Ymax</sub> .
Note: Assessments based on population dynamics on trawl survey data (1) .					
Biology					
	L <sub>∞</sub> in cm TL F = 44.3 M = 42.5 (1)	W <sub>∞</sub>	K in y-1 F = 0.22 M = 0.24 (1)	t <sub>0</sub> in y F = -1.32 M = -1.20	L max.
L <sub>r</sub> in cm TL 8-9	T <sub>r</sub>	A F+M	B F+M	L <sub>m</sub> in cm TL F +M = 20-22	T <sub>m</sub>
M F = 0.43 M = 0.46 (1)	T C°	Ageing method Otoliths readings	VBGF method	M method Pauly (1980)	
References:					
(1) Tursi A. et al. (1998) – Biol. Mar. Medit.5 (3): 120 –129; (2) Tursi A. et al. (1992) – Biologia Marina, Suppl. Not. SIBM 1:377-378.					

Table 46 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Aristeus antennatus	Balearic	1.1.b (Catalonia)	Spain	Trawling on slope fishing grounds	
Area:	Biomass: VPA:	Recruitment in millions: VPA:	Management options :	Recommendations:	
	F M	F M		<ul style="list-style-type: none"> <li>The age composition of the stock and its dynamics is highly dependent on recruitment.</li> <li>Considering <math>Y/R_{max}</math> as target reference point, only in females a variation of +20% in K and +20% in M would compatible with overexploitation.</li> </ul>	
	1984 – 394 88	1984 – 28 10			
	1985 – 556 50	1985 – 31 11			
	1986 – 421 37	1986 – 24 8			
	1987 - 346 42	1987 - 20 12			
	1988 – 370 71	1988 – 35 18			
	1989 – 374 134	1989 – 27 30			
Note : From 1983 to 1993 the annual landings in Catalonia resulted stable (250-350 tons)					
Fishery and assessment					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Mean Length of capture in mm CL :	$B_0$ :	SSB:
Trawlers of Blanes, Arenys and Barcelona ports	Fully or under exploited		F = 34.2 – 39.5  M = 24.8 – 27.3	F M 1984 – 1098 81 1985 – 1342 98 1986 – 964 73 1987 - 677 69 1988 – 1268 142 1989 – 1168 251	
Recent Y in tons:	Recent Y/R in g:	Recent F or f:	$Y/R_{max}$ in g:	Effort level $Y/R_{max}$ (%):	
1984 – 30 1985 – 35 1986 – 24 1987 – 35 1988 – 51 1989 – 88	F- in the different pseudo-cohorts ranges between 9 and 10.7  M – $0.9 < Y/R < 1.7$	F M 1984 – 1.07 1.5 1985 – 1.31 1.7 1986 – 0.8 1.2 1987 - 1.13 1.4 1988 – 1.74 0.9 1989 – 1.44 1.6		F- 1984 1985 1986 1987 1988 1989  0 +10 +30 +30 -40 -20  M - Y/R is a monotonically increasing curve.	
Note: Assessment based on VPA and LCA and Y/R analysis by using VIT packages. Both males and females were considered. Sensitivity analysis on K and M were performed.					

<b>Biology</b>					
	$L_{\infty}$ mm CL (1) F=76 M=54	$W_{\infty}$	$K y^{-1}$ (1) F=0.3 M=0.25	$t_0 y$ (1) F=-0.07 M=-0.5	L max.
$L_r$	$T_r$	A F=0.00264 M=0.00402	B F=2.47 M=2.32	$L_m$ in cm TL	$T_m$
M F= 0.5 M=0.8	$F_{term.} =$	Ageing method LFM	VBGF method Non linear regression	M method	
References:					
(1) Demestre M., Leonart J. (1993) – Sci. Mar. 57(2-3): 183-189.					

Table 47 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Aristeus antennatus	Balearic	1.1.b (Valencian Coast)	Spain	Trawling on slope fishing grounds	
Area:	Biomass: VPA:	Recruitment in millions: VPA:	Management options :	Recommendations:	
	F      M	F      M		<ul style="list-style-type: none"> <li>The age composition of the stock and its dynamics is highly dependent on recruitment.</li> <li>Considering <math>Y/R_{max}</math> as target reference point, only in females a variation of +20% in K and +20% in M would compatible with overexploitation.</li> </ul>	
	1988 – 451    34	1988 – 24    6			
	1989 – 391    64	1989 – 33    11			
Note :					
Fishery and assessment					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Mean Length of capture in mm CL :	$B_0$ :	SSB:
Trawlers of Gandia and Calp of Valencian coast	Fully or under exploited		F = 33.8 – 41  M = 26.1 – 26.3	F      M  1988 – 1268    142 1989 – 1168    251	
Recent Y in tons:	Recent Y/R in g:	Recent F or f:	$Y/R_{max}$ in g:	Effort level $Y/R_{max}$ (%):	
1988 – 51 1989 – 88	F- 8.7 <Y/R<10.8  M – 4.3<Y/R<4.7	F      M  1988 – 0.79    1.39 1989 – 1.3      0.9		F-    1988    1989 +50    -30  M -    1988    1989 +20    +40	
Note: Assessment based on LCA and Y/R analysis by using VIT packages. Both males and females were considered. Sensitivity analysis on K and M were performed.					

<b>Biology</b>					
	$L_{\infty}$ mm CL (1) F=76 M=54	$W_{\infty}$	$K y^{-1}$ (1) F=0.3 M=0.25	$t_0$ y (1) F=-0.07 M=-0.5	L max.
$L_r$	$T_r$	A F=0.00354 M=0.00532	B F=2.39 M=2.25	$L_m$ in cm TL	$T_m$
M F= 0.5 M=0.8	$F_{term.} =$	Ageing method LFM	VBGF method Non linear regression	M method	
References:					
(1) Demestre M., Leonart J. (1993) – Sci. Mar. 57(2-3): 183-189.					

<b>Table 48 - General Data</b>					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Aristeus antennatus	Balearic	1.1.c	Algeria	Trawling on slope fishing-grounds	
Area:	Biomass:	Recruitment:	Management options :		Recommendations:
km <sup>2</sup>	TS: VPA:	TS: VPA:			
Note:					
<b>Fishery and assessment</b>					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 22 mm CL L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Optimal Length of capture in mm CL :	Recent E:
Trawling off Algerian coast	Fully exploitation		1 y		0.58
Recent Y:	Recent Y/R in g:	Recent Z: (1980)	Recent F or f:	E <sub>max.</sub> :	E <sub>0.1</sub> :
		1.115	0.64	0.62	
Note: Assessment based on trawl survey data and Relative Y/R Beverton and Holt model. Z obtained as mean of LCCC and Wetherall et al. methods.					
<b>Biology</b>					
	L <sub>∞</sub> in mm CL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F= 65.1		F= 0.365	F= 0	
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in mm CL	T <sub>m</sub>
in mm CL				F= 27	
M (1)		Ageing method	VBGF method	M	
F= 0.47		LFM	Non linear regression	estimated on virgin stock	
References: (1) Yahiaoui M. et al. (1986) – FAO Fish. Rep. 347: 221-231.					



<b>Table 49 - General Data</b>					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Aristeus antennatus	Sardinian	1.3.i + 1.3.k	Italy	Trawling on slope fishing-grounds	
Area:	Biomass:	Recruitment:	Management options :		Recommendations:
km <sup>2</sup>	TS: VPA:	TS: VPA:			The adoption of the 40 mm opening mesh size is recommended.
Note:					
<b>Fishery and assessment</b>					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = CL L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Optimal Length of capture in mm CL :	Recent E:
Trawling N-W Strait of Sicily	Under exploitation (a) or fully exploitation (b)		1 y		
Recent Y:	Recent Y/R in g:	Recent Z:	Recent F or f: F= 0.3 (a) F= 0.6 (b)	F <sub>max.</sub> : F= 1.1 (a) F= 0.6 (b)	E <sub>0.1</sub> :
Note: (1). Assessment based on trawl survey data and Modified Y/R Beverton and Holt model (Paulik and Gales, 1964).					
<b>Biology</b>					
	L <sub>∞</sub> in mm CL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F= 69.1		F= 0.53	F= 0	
L <sub>r</sub> in mm CL	T <sub>r</sub>	A	B	L <sub>m</sub> in mm CL	T <sub>m</sub>
M (1)		Ageing method	VBGF method	M method	
F= 0.5 (a) F= 0.8 (b)		LFM	Non linear regression		
References: (1) Ragonese S., Bianchini M. (1996) – Fish. Res. 26: 125-137.					

Table 50 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Aristeus antennatus	Sardinian	1.3.j	Italy	Trawling on slope fishing-grounds	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
	TS: VPA:	TS: VPA:		<ul style="list-style-type: none"> <li>Given the direct harvest of spawning aggregations a prudential approach is recommended</li> <li><math>F_{0.1}</math> is suggest as target reference point for fishery.</li> <li>According to the assessments using <math>M=0.3</math>, a 50% reduction of <math>F</math> might not increase <math>Y/R</math>. However highest level of recruitment are expected (1).</li> </ul>	
Note : In the early 80's the resource collapsed (2) After the recovery (1987) CPUE (kg per trawler per day) of S.Margherita Ligure trawlers decreased from 35 to 18 between 1987 and 1995 (1).					
Fishery and Assessment					
Operational unit	Stock Status:	Recent F or f:	$F_{max}$ (1) :	$F_{0.1}$ (1) :	Current Spawning Potential Ratio (%) :
Trawling along the Central Eastern Ligurian coast.	Overexploited (risk of recruitment overfishing)	$M=0.3+a$ : 0.4 $M=0.5+a$ : 0.29 $M=0.3+b$ : 0.28 $M=0.5+b$ : 0.19	$M=0.3+a$ : 0.33 $M=0.5+a$ : no maximum $M=0.3+b$ : 0.28 $M=0.5+b$ : no maximum	$M=0.3+a$ : 0.18 $M=0.5+a$ : 0.5 $M=0.3+b$ : 0.13 $M=0.5+b$ : 0.19	$M=0.3+a$ : 18.5 $M=0.5+a$ : 37 $M=0.3+b$ : 23.5 $M=0.5+b$ : 46.8
Y in in tons (1) 1991 – 58 1992 – 62 1993 – 47	Recent Y/R (1) (*) :	Y/R <sub>max</sub> (1) :	Y/R <sub>0.1</sub> (1) :	Mean Length of capture in cm TL (1) :	$F_{0.1}$ Spawning Potential Ratio (%) :
	$M=0.3+a$ : 13.8 $M=0.5+a$ : 8.9 $M=0.3+b$ : 11.7 $M=0.5+b$ : 6.6	$M=0.3+a$ : 13.8 $M=0.5+a$ : no maximum $M=0.3+b$ : 11.7 $M=0.5+b$ : no maximum	$M=0.3+a$ : 12.9 $M=0.5+a$ : 8.5 $M=0.3+b$ : 10.7 $M=0.5+b$ : 6.6		$M=0.3+a$ : 35.8 $M=0.5+a$ : 41.6 $M=0.3+b$ : 39.2 $M=0.5+b$ : 47
Note: Females forms more than 90% of the catches. The fraction of young females (LC<38mm) decreased from 60 to 35% between 1991 and 1995. Assessment based on landings and trawl survey data. LCA by using VIT package (1).					

<b>Biology</b>					
	$L_{\infty}$ in mm CL F= 71.21 (a) (1) F= 76.9 (b) (1)	$W_{\infty}$	K F= 0.317 (a) (1) F= 0.213 (b) (1)	$t_0$ F= -0.047 (a) (1) F= -0.019 (1)	L max.
$L_r$	$T_r$	A F = 0.00354) (1)	B F+M= 2.386 (1)	$L_m$ in cm TL F= 43 (1)	$T_m$
M F= 0.3-0.5 (1)	$F_{term.}$ F =0.15 (1)	Ageing method FLM	VBGF method Non linear regression	M method	
References: (1) Fiorentino et al. (1998) - Cah. Options Méditerr., 35: 323-333. (2) Orsi Relini L., Relini G. (1998) - Cah. Options Méditerr., 35: 311-322.					

Table 51 - General Data					
Scientific name: Aristeus antennatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Central Tyrrhenian Sea)	Country: Italy	Fishery: Trawling on slope fishing-grounds	Stock Name:
Area: 15300 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations: The adoption of the legal mesh size (40 mm of opening) would better the status of stock exploitation.
Note: A slight decreasing trend of mean length of females and catch rate in trawl surveys from 1991 to 1995 is shown.					
Fishery and assessment					
Operational unit Trawling along Coast of Latium	Stock Status: Overexploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =34.8 mm CL L <sub>75</sub> (1991-95)	Age at first capture (t <sub>c</sub> ):	Optimal Length of capture in mm CL : 39.6	Recent E: (1991-95) E= 0.74 (1)
Recent Y:	Recent Y/R in g:	Recent Z: (1991-95) 1.77 (LCCC) (1)	Recent F or f: (1991-95) F= 1.32 (1)	F <sub>0.1</sub> : (1991-95) 0.53	E <sub>0.1</sub> : (1991-95)
Note: (1). Assessment based on trawl survey data and classical Y/R Beverton and Holt model. Since males are negligible in the catch, only females (more than 85% of catches) are considered.					
Biology					
	L <sub>∞</sub> in mm CL F= 67.65	W <sub>∞</sub>	K in y-1 F= 0.49	t <sub>0</sub> in y F= 0	L max.
L <sub>r</sub> in mm CL	T <sub>r</sub>	A	B	L <sub>m</sub> in mm CL F= 27	T <sub>m</sub>
M(1) F= 0.45		Ageing method LFM	VBGF method Non linear regression	M method Djabali et al. (1994)	
References: (1) Colloca F. et al.(1998) – Biol. Mar. Medit. 5 (2): 218-231.					

Table 52 - General Data					
Scientific name: Aristeus antennatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Southern Tyrrhenian Sea)	Country: Italy	Fishery: Trawling on slope fishing-grounds	Stock Name:
Area: 13000 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :	Recommendations:	
Fishery and assessment					
Operational unit Trawling along Coasts of Campania and Calabria	Stock Status: Light Overexploitation	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 32.8 mm CL L <sub>75</sub> =	Age at first capture (t <sub>c</sub> ): 1 y	Mean Length of capture:	Recent E: (1)
Recent Y:	Recent Y/R in g: 9	Recent Z: 1.96 (LCCC) (1)	Recent F or f: F= 1.31 (1)	F <sub>max</sub> : 1.31	F <sub>0.1</sub> : 0.57
Note: Assessment based on trawl survey data and classical Y/R Beverton and Holt model. Since males are negligible in the catch, only females are considered.					
Biology					
	L <sub>∞</sub> in mm CL F= 66.8	W <sub>∞</sub> F= 82	K in y-1 F= 0.558	t <sub>0</sub> in y F= -0.234	L max.
L <sub>r</sub>	T <sub>r</sub>	A M+F= 0.00241	B M+F= 2.484	L <sub>m</sub> in cm TL	T <sub>m</sub>
M(1) F= 0.65		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
References: (1) Spedicato et al. (1998) – Biol. Mar. Medit. 2 (2): 239-244.					

Table 53 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Balearic	Management Unit: 1.1.b (Catalonia)	Country: Spain	Fishery: Trawling Trammel nets	Stock Name:
Area:	Biomass:  TS: VPA: 31.3 tons (1993-94) (1)	Recruitment:  TS: VPA: 6400000 individuals (1993-94) (1)	Management options :	Recommendations: Modifying trawling (long term) : <ul style="list-style-type: none"> <li>• A decrease of 10% of effort, increase trawler Y of 7% and trammel of 37%.</li> <li>• An increase of mesh size from 40 to 50, increase trawler Y of 67% and trammel of 245%.</li> <li>• Applying both measures should produce an increase of trawler Y of 73% and trammel of 317%.</li> </ul>	
Note : After changing fishing level and exploitation pattern of trawling the new equilibrium should be reached after about 4 years.					
Fishery and assessment					
Operational unit  Fishing off Vilanova i la Geltru (Catalonia)	Stock Status:  Overexploited (growth overfishing)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):  0.73 y	Mean Length of capture in cm TL :  8.5 (1)	$B_0$ :  558 tons
Recent Y: (Sep.1993- Oct.94) <u>total</u> – 72 tons (1)  % of different gears <u>Trawl</u> – 98% <u>Trammel net</u> – 2%	Recent Y/R in g:  <u>Trawl</u> – 10.97 <u>Trammel net</u> – 0.22 (1)	Recent F or f:  <u>Trawl</u> – values higher than 2 in 8-12 and in 17-20 length classes. <u>Trammel net</u> – values lower than 0.5 all over length classes (1)	Y/R $_{max}$ in g:  <u>Trawl</u> – 15.93 <b>Trammel net – 0.62</b>	Effort level $_{Y/R \max}$ :  -64% of the current value	SSB:  17.2 tons
Note: Assessment based on VPA by using VIT and MSFLA packages.					

<b>Biology</b>					
	$L_{\infty}$ M+F=33 cm TL (1)	$W_{\infty}$	K M+F= 0.38 y-1 (1)	$t_0$ M+F=-0.07 y (1)	L max.
$L_r$	$T_r$	A M+F=0.008 (1)	B M+F=3.145 (1)	$L_m$ in cm TL	$T_m$
M M+F=0.432 (1)	$F_{term.} = 0.2$	Ageing method Bhattacharya (1967)	VBGF method Non linear regression	M method Djabali et al. (1994)	
References:					
(1) Demestre M. et al. (1997) – J. Appl. Ichthyol. 13: 49-56.					

Table 54 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Balearic	Management Unit: 1.1.b (Castellon)	Country: Spain	Fishery: Trawling Trammel nets	Stock Name:
Area:	Biomass: TS: VPA: 77 tons (1993-94) (1)	Recruitment: TS: VPA: 5800000 individuals (1993-94) (1)	Management options :	Recommendations: Modifying trawling (long term) : <ul style="list-style-type: none"> <li>• A decrease of 10% of effort, increase trawler Y of 2% and trammel one of 28%.</li> <li>• An increase of mesh size from 40 to 50, increase trawler Y of 12% and trammel one of 47%.</li> <li>• Applying both measures should produce an increase of trawler Y of 14% and trammel one of 82%.</li> </ul>	
Note : After changing fishing level and exploitation pattern of trawling the new equilibrium should be reached after about 4 years.					
Fishery and assessment					
Operational unit Fishing off Castellon (Valencian Community)	Stock Status: Overexploited (growth overfishing)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ): 0.85 y	Mean Length of capture in cm TL : 13.5 (1)	$B_0$ : 610 tons
Recent Y: (Sep.1993- Oct.94) total – 123 tons (1)  % of different gears Trawl – 93% Trammel net – 7%	Recent Y/R in g:  <u>Trawl</u> – 21.64 <u>Trammel net</u> – 2.59 (1)	Recent F or f:  <u>Trawl</u> – values higher than 1.5 from 11 to 20 cm TL with a peak (F=2.5) at 12 and at 19 cm TL. <u>Trammel net</u> – values higher than 0.5 from 15 to 22 cm TL. With a peak at 19 (F=1)(1)	Y/R <sub>max</sub> in g:  <u>Trawl</u> – 22.76 <b>Trammel net – 5.15</b>	Effort level Y/R <sub>max</sub> : -52% of the current value	SSB: 29.9 tons
Note: Assessment based on VPA by using VIT and MSFLA packages.					



<b>Biology</b>					
	$L_{\infty}$ M+F=32 cm TL (1)	$W_{\infty}$	K M+F= 0.385 y-1 (1)	$t_0$ M+F=-0.593 y (1)	L max.
$L_r$	$T_r$	A M+F=0.008 (1)	B M+F=3.145 (1)	$L_m$ in cm TL	$T_m$
M M+F=0.432 (1)	$F_{term.} = 0.2$	Ageing method Bhattacharya (1967)	VBGF method Non linear regression	M method Djabali et al. (1994)	
References:					
(1) Demestre M. et al. (1997) – J. Appl. Ichthyol. 13: 49-56.					

Table 55 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Balearic	Management Unit: 1.1.b (Santa Pola)	Country: Spain	Fishery: Trawling Trammel nets	Stock Name:
Area:	Biomass: TS: VPA: 127.5 tons (1993-94) (1)	Recruitment: TS: VPA: 7300000 individuals (1993-94) (1)	Management options :	Recommendations: Modifying trawling (long term) : <ul style="list-style-type: none"> <li>• A decrease of 10% of effort, increase trawler Y of 5% and trammel one of 24%.</li> <li>• An increase of mesh size from 40 to 50, increase trawler Y of 48% and trammel one of 161%.</li> <li>• Applying both measures should produce an increase of trawler Y of 51% and trammel one of 193%.</li> </ul>	
Note: After changing fishing level and exploitation pattern of trawling the new equilibrium should be reached after about 4 years.					
Fishery and assessment					
Operational unit Fishing off Santa pola (Valencian Community)	Stock Status: Overexploited (growth overfishing)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ): 0.87 y	Mean Length of capture in cm TL : 10.05 (1)	$B_0$ : 871 tons
Recent Y: (Sep.1993- Oct.94) total – 114 tons (1)  % of different gears <u>Trawl</u> – 97% <u>Trammel net</u> – 3%	Recent Y/R in g:  <u>Trawl</u> – 14.02 <u>Trammel net</u> – 1.61 (1)	Recent F or f:  <u>Trawl</u> – values higher than 1 from 10 to 17 cm TL with main peak (F=1.5) at 12 cm TL. <u>Trammel net</u> – values lower than 0.5.(1)	Y/R <sub>max</sub> in g:  <u>Trawl</u> – 14.77 <u>Trammel net</u> – 2.2	Effort level Y/R <sub>max</sub> : -36% of the current value	SSB: 97.4
Note: Assessment based on VPA by using VIT and MSFLA packages.					

<b>Biology</b>					
	$L_{\infty}$ M+F=33 cm TL (1)	$W_{\infty}$	K M+F= 0.280 y-1 (1)	$t_0$ M+F=-0.493 y (1)	L max.
$L_r$	$T_r$	A M+F=0.008 (1)	B M+F=3.145 (1)	$L_m$ in cm TL	$T_m$
M M+F=0.37 (1)	$F_{term.} = 0.2$	Ageing method Bhattacharya (1967)	VBGF method Non linear regression	M method Djabali et al. (1994)	
References:					
(1) Demestre M. et al. (1997) – J. Appl. Ichthyol. 13: 49-56.					

<b>Table 56 - General Data</b>					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.h (Sardinian Sea)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 23700 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations:
<b>Fishery and assessment</b>					
Operational unit Trawling along Coast of Sardinian	Stock Status: Fully/Heavy-exploitation	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E: E= 0.58 (1)
Recent Y/R in g:	Recent Z: 2.86 (LCCC) (1)	Recent F or f: F= 1.65(1)	F <sub>0.1</sub> : 0.53	E <sub>0.1</sub> : 0.38	
Note: Assessment based on trawl surveys data and Exploitation Rate (1).					
<b>Biology</b>					
References: (1) Addis P. et al. (1998) – Biol. Mar. Medit. 5 (3): 85-95.					
	L <sub>∞</sub> in cm TL M+F= 24.55	W <sub>∞</sub>	K in y-1 M+F= 0.79	t <sub>0</sub> in y M+F= 0.479	L max.
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL F= 14 M=11	T <sub>m</sub>
M(1) M+F= 1.21 with 15 °C		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	

Table 57 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Southern Tyrrhenian Sea)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 5800 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options : Trawling ban in: <ul style="list-style-type: none"> <li>• Gulf of S. Eufemia (Calabria)</li> <li>• Gulf of Patti (Sicily)</li> <li>• Gulf of Castellammare (Sicily)</li> </ul>	Recommendations: After the trawling ban in the Gulf of Castellammare catch rate of M.barbatus are much higher than before (up to 20-30 time).	
Fishery and assessment					
Operational unit Trawling along Coasts of Calabria and Sicily (1)	Stock Status: Over-exploited (1)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub> =	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E: E= 0.75 (1)
Recent Y:	Recent Y/R in g:	Recent Z: Z= 1.42 (LCCC) (1)	Recent F or f: F= 1.07 (1)	F <sub>max.</sub> :	
Note: Assessment based on trawl surveys data and exploitation rate.(1).					
Biology					
	L <sub>∞</sub> in cm TL F= 26.7 M=21.9	W <sub>∞</sub>	K in y-1 F= 0.168 M=0.212	t <sub>0</sub> in y F= -3.39 M=-2.1	L max.
L <sub>r</sub>	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M(1) M+F= 0.35		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
References: Greco S. et al. (1998) – Biol. Mar. Medit. 5 (3): 74-84.					

Table 58 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Ligurian Sea)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 5800 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations: (1)
Fishery and assessment					
Operational unit Trawling along Ligurian Coasts (1) From French border to Leghorn (2)		Stock Status: Fully-exploited (1) Over-exploitation (2)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ): 0.4	Mean Length of capture in cm TL :
Recent Y:	Recent Y/R in g: 13	Recent Z: Z= 0.97 (1985-87) (LCCC) (1) Z <sub>(0-1)</sub> = 5.2 (1994-95) Survival rates (2)	Recent F or f: F= 0.46 (1985-87) (1)	Recent E: E= 0.47(1985-87) (1)	Z <sub>MBP</sub> : (2) Schaefer = 3 Fox = 1.8
Note: Assessment based on trawl surveys data by using: (1) Classical Beverton and Holt Model; (2) Composite Surplus-Production Models.					
Biology					
	L <sub>∞</sub> in cm TL M+F= 23.2	W <sub>∞</sub>	K in y-1 M+F= 0.336	t <sub>0</sub> in y M+F= -0.904	L max.
L <sub>r</sub> 6 in cm TL	T <sub>r</sub> 0.25 y	A	B	L <sub>m</sub> in cm TL F=14 (3) M=11	T <sub>m</sub>
M(1) M+F= 0.51		Ageing method Otolith readings	VBGF method Non linear regression	M method Mean of different methods	
References: (1) Relini et al. (1994) – Biol. Mar. Medit. 1 (2): 11-21. (2) Abella et al. (1999) – Aquat. Living Resour. 12(3): 155-166. (3) Orsi Relini L., Arnaldi D. (1986) – Boll. Mus. Ist. Biol. Univ. Genova, 52: 237 – 250.					

Table 59 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Ligurian Sea - Northern Tuscany)	Country: Italy	Fishery: Trawling	Stock Name:
Area:	Biomass:  TS:  VPA:	Recruitment:  TS:  VPA:	Management options :	Recommendations: <ul style="list-style-type: none"> <li>• Increase of the SSB/SSB<sub>0</sub> is recommended</li> <li>• Decreasing F only a slight increase of Y/R (about 10 %) should be expected (b).</li> <li>• Increasing L<sub>c</sub> to 11-12 cm TL an increase of about 15-20% of Y/R should be likely. This may be obtained with a trawling ban during September-October. (b) (1)</li> </ul>	
Note :					
Fishery and assessment					
Operational unit: Trawling along Northern Coasts of Tuscany (1) From Leghorn to Elba Island (2)	Stock Status: (1) Fully-exploited Risk of recruitment over-fishing (2) Fully-exploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> =9.3 cm TL (a) L <sub>75</sub> Vector Selectivity- Vulnerability (b)	Age at first capture (t <sub>c</sub> ):	SSB/SSB <sub>0</sub>  4%	
Recent Y/R in g:  (a) F= 10.5 M= (b) F=12.5 M= 12Y:	Recent Z: (a) F= 3.81 M= 3.65 (b) Vector derived from survival rates obtained from trawl surveys  Z <sub>(0-1)</sub> = 3.38 (1994-95) Survival rates (2)	Recent F or f: (a) F= 2.0 M= 1.6 (b) F= Higher than 2 from 9.5 to 15.5 cm TL classes. Peak at 13.5 cm (F=5). M= Higher than 2 from 9.5 to 13.5 cm TL classes. Peak at 10.5 cm (F=5).	Z <sub>MBP</sub> : (2)  Schaefer = 3  Fox = 1.8		

Note: Assessment based on trawl surveys data (1985-95) by using both traditional Thompson and Bell analysis and a variant assuming M- at age and F-at age vectors. The traditional approach (a) suggests heavy overexploitation. A 65% reduction of F would produce 35% improvement of Y/R, and increase Lc to 16 cm TL would produce 50% augment in Y/R.; according to the second one (b) red mullet is fully exploited (1).  
 Assessment based on trawl surveys data and Composite Surplus Production Models (2).

**Biology**

	L <sub>∞</sub> in cm TL F =29.2 (1) M= 22	W <sub>∞</sub>	K in y-1 F =0.68(1) M= 0.74	t <sub>0</sub> in y	L max. F = 43 (1) M= 27
L <sub>r</sub>  6 cm	T <sub>r</sub>	A F =0.007 67 (1) M= 0.0078 8	B F =3.149 (1) M= 3.132	L <sub>m</sub> in cm TL F =16 (1) M= 3.132	T <sub>m</sub>
M F= 1.01 (a) M= 1.13	T C°	Ageing method  LFM	VBGF method	M method  c) Constant M – Pauly (1980) d) Variable M – (Abella et al.1997)	

References:

(1) Voliani A. et al. (1998) – Biol. Mar. Medit. 5 (2): 169-183. (2) Abella et al. (1999) – Aquat. Living Resour. 12(3): 155-166.



Table 60 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinia	Management Unit: 1.3.j (Northern Tyrrhenian Sea)	Country: Italy	Fishery: Trawling Trammel nets	Stock Name:
Area:	Biomass: TS: VPA: 62.7 tons (1993-94) (1)	Recruitment: TS: VPA: 5200000 individuals (1993-94) (1)	Management options :	Recommendations: Modifying trawling (long term) : <ul style="list-style-type: none"> <li>• A decrease of 10% of effort, increase trawler Y of 7% and trammel of 37%.</li> <li>• An increase of mesh size from 40 to 50, increase trawler Y of 67% and trammel of 245%.</li> <li>• Applying both measures should produce an increase of trawler Y of 73% and trammel of 317%.</li> </ul>	
Note : After changing fishing level and exploitation pattern of trawling the new equilibrium should be reached after about 4 years.					
Fishery and assessment					
Operational unit  Trawlers of Porto S. Stefano (Tuscany) (1) From Argentario to Giannutri Island (2)	Stock Status:  Over-exploited (1) (growth overfishing)  Over-exploited (2)	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :  9.3 (0.83 y) (1)	$B_0$ :  558 tons
Recent Y: (Sep.1993- Oct.94) total – 95 tons (1)  % of different gears <u>Italian type trawl</u> – 18% <u>French type trawl</u> – 82%	Recent Y/R in g:  <u>Italian type trawl</u> – 3.3 <u>French type trawl</u> – 15.17 (1)	Recent F or f: (1) <u>Italian type trawl</u> – values higher than <b>0.5</b> from 20 to 28 cm TL. <u>French type trawl</u> – values higher than <b>1</b> from 11 to 24 cm TL and higher than <b>2</b> from 18 to 23 cm TL. (1)	Y/R <sub>max</sub> in g: (1) <u>Italian type trawl</u> – 7.45  <b>French type trawl – 20.36</b>	Effort level Y/R <sub>max</sub> :  -72% of the current value (1)	Recent Z:  $Z_{(0-1)} = 5.0$ (1994-95) Survival rates (2)
				SSB:  43.2 tons (1)	$Z_{MBP}$ : (2)  Schaefer = 3  Fox = 1.8

Note: Assessment based on: VPA and Y/R analysis by using VIT and MSFLA packages (1); trawl surveys data (MEDITS) and Composite Surplus Production Models (2).

**Biology**

	$L_{\infty}$ M+F=34.5 cm TL (1)	$W_{\infty}$	K M+F= 0.336 y-1 (1)	$t_0$ M+F=-0.143 y (1)	L max.
$L_r$	$T_r$	A M+F=0.008 (1)	B M+F=3.125 (1)	$L_m$ in cm TL	$T_m$
M M+F=0.404(1)	$F_{term.}=0.2$	Ageing method Bhattacharya (1967)	VBGF method Non linear regression	M method Djabali et al. (1994)	

References:

(1) Demestre M. et al. (1997) – J. Appl. Ichthyol. 13: 49-56. (2) Abella et al. (1999) – Aquat. Living Resour. 12(3): 155-166.

Table 61 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Central Tyrrhenian Sea)	Country: Italy	Fishery: Trawling and gillnet	Stock Name:
Area: 15300 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations:
Fishery and assessment					
Operational unit Trawling along Coast of Latium	Stock Status: Fully-exploited	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E: E= 0.37 (1)
Recent Y/R in g:	Recent Z: 1.35 (LCCC) (1)	Recent F or f: F= 0.49(1)	F <sub>0.1</sub> : 0.53	E <sub>0.1</sub> : 0.38	
Note: Assessment based on trawl surveys data and Beverton and Holt Y/R analysis (1).					
Biology					
	L <sub>∞</sub> in cm TL M+F= 25.33	W <sub>∞</sub>	K in y-1 M+F= 0.44	t <sub>0</sub> in y	L max.
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M(1) M+F= 0.86		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
References: (1) Ardizzone et al. (1998) – Biol. Mar. Medit. 5 (3): 53-63.					

Table 62 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Sardinian	Management Unit: 1.3.j (Southern Tyrrhenian Sea)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 13000 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :		Recommendations:
Fishery and assessment					
Operational unit  Trawling along Coasts of Campania and Calabria (1)  Gulf of Gaeta and Naples (2)		Stock Status:  Fully-heavily exploited (1)  Over-exploited (2)		L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 12.4 cm TL L <sub>75</sub> = 13.1 cm TL	Recent E:  E= 0.6 (1)
Recent Y:	Recent Y/R in g:	Recent Z:  Z= 2.49 (LCCC) (1) Z <sub>(0-1)</sub> = 6.6 (1994-95) Survival rates (2)	Recent F or f:  F= 1.58 (1)	F <sub>max.</sub> :  F= 1.49 (1)	Z <sub>MBP</sub> : (2)  Schaefer = 3  Fox = 1.8
Note: F <sub>max.</sub> estimated with classical Y/R Beverton and Holt model. The Y <sub>max.</sub> would be obtained reducing 5-6% current F (1). Trawl surveys data (MEDITS) and Composite Surplus Production Models (2).					
Biology					
	L <sub>∞</sub> in cm TL  F= 27.28 M=20.96	W <sub>∞</sub>	K in y-1  F= 0.467 M=0.594	t <sub>0</sub> in y  F= -0.414 M=-0.249	L max.
L <sub>r</sub>	T <sub>r</sub>	A  M+F= 0.00776	B  M+F= 3.18	L <sub>m</sub> in cm TL F= 13.5 M=11.5	T <sub>m</sub>
M(1) M+F= 0.36		Ageing method LFM	VBGF method Non linear regression	M method Pauly (1980)	
References: (1) Spedicato et al. (1998) – Biol. Mar. Medit. 5 (3): 64-73. (2) Abella et al. (1999) – Aquat. Living Resour. 12(3): 155-166					

Table 63 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Mullus barbatus	Adriatic	2.1.a	Italy + Croatia	Trawling	
Area:	Biomass:		Management options :	Recommendations:	
100000 km <sup>2</sup>	TS Italy + International waters 1983 – 554 tons 1984 - 504 1985 - 444 Ex Yugoslavia 1983 - 2297 1984 - 2680			Seasonal fishing ban for 30-45 days in summer (Italian Fleet) affects positively fishery, allowing recruitment at a larger size.	
Note: *Recruitment occurs mainly along Italian coast, while spawning stock is present mainly along Croatian Coasts (1)					
Fishery and assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = (1) L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	
Trawling					
Recent Y*:	Recent Y/R in g:	Recent Z:	Recent F or f:	F <sub>0.1</sub> :	
		Z <sub>(0-1)</sub> =1.64 (1983-84) (2) Survival rate	F= 2.6 (1985-95) (3) Estimated from LCCC	1.00 (3)	
Note: Populations dynamics on trawl survey data (2) and (3). Catch rate from trawl surveys from 1985 to 1997 shown a slight increasing trend (1).					
Biology					
	L <sub>∞</sub> in cm TL F+M = 27.5	W <sub>∞</sub>	K in y-1 F+M = 0.5	t <sub>0</sub> in y	L max.
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
M F+M = 0.91-0.51 (3)	T C°	Ageing method	VBGF method	M method Pauly (1980); Djabali et al. (1993)	
References: (1) Piccinetti C. (1998) – Biol. Mar. Medit.1 (2): 77-87. (2) Arneri E., Jukic S. (1986) - FAO Fish Rep. 345: 79 – 85. (3) Ardizzone G.D. (1998) – Biol. Mar. Medit. 5 (2): 151-168.					

Table 64 - General Data					
Scientific name:	GFCM Subarea:	Management Unit:	Country:	Fishery:	Stock Name:
Mullus barbatus	Ionian	2.2.b	Italy	Trawling	
Area:	Biomass:	Recruitment:	Management options :	Recommendations:	
14200 km <sup>2</sup> (1)	TS: VPA	TS: VPA			
Fishery and Assessment					
Operational unit	Stock Status:	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = 8 cm TL L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	F <sub>0.1</sub> :
Trawling	Overexploited (growth over-fishing)				0.33 (1)
Recent Y/R in g:	Y/R <sub>max.</sub> in g:	Recent Z:	Recent F or f:	Recent E:	F <sub>Ymax.</sub> :
8		Z <sub>LCCC</sub> =1.13(1991) (1) Z <sub>LCCC</sub> =1.28(1992)	F=0.7 (1991) (1) F=0.85 (1992)	E =0.61 (1991) (1) F=0.66 (1992)	0.64 (1)
Note: Assessment carried out from trawl surveys data and Beverton and Holt Y/R model.					
Biology					
	L <sub>∞</sub> in cm TL	W <sub>∞</sub>	K in y-1	t <sub>0</sub> in y	L max.
	F+M= 19.7 (1)		F+M= 0.360 (1)	F+M= -1.18 (1)	
L <sub>r</sub> in cm TL	T <sub>r</sub>	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
5		F+M= 0.08 (1)	F+M= 3.09 (1)	F = 14 (1) M = 11	
M	T C°	Ageing method	VBGF method	M method	
F+M = 0.43 (1)		Otoliths readings	Non Linear regression	Chen and Watanabe (1989)	
References:					
(1) Marano et al. (1988) – Biol. Mar. Medit.5 (3): 109 -119					
(2) Ungaro et al. (1994) – Biol. Mar. Medit.1 (1): 317-318.					
(3) Ungaro N., Marano G. (1996)- FAO Fish Rep. 533 (Suppl.): 97 - 99					

Table 65 – General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Ionian	Management Unit: 2.2.c (Ionian Sea – Italian versant)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 11900 km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options :	Recommendations:	
Fishery and assessment					
Operational unit Trawling in Italian side of Ionian Sea(1)	Stock Status: Over-exploited (1-2)	$L_{25}$ $L_{50}=L_c= 8.5 *(1)$ $L_{75} =$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	Recent E: E= 0.74 (1)
Recent Y/R in g: 9.5	Recent Z: $Z_{LCCC} =1.59$ (1990-93) (1)	Recent F or f: F= 1.18 (1)	B /B <sub>0</sub> by B/R analysis: 14%	Recent Y/R <sub>max</sub> . in g: 10.5	F <sub>max</sub> . : F= 0.4
Note: Assessment based on trawl surveys data by using Beverton and Holt Y/R and B/R Model. Lc corresponding to 30 mm opening mesh size *. (1)					
Biology					
	$L_{\infty}$ in cm TL F+M= 25.2 (1)	$W_{\infty}$	K in y-1 F+M= 0.26 (1)	$t_0$ in y F+M= -1.71 (1)	L max.
$L_r$	$T_r$	A F+M=0.0000057 (2)	B F+M=3.22 (2)	$L_m$ in cm TL F= 13.5 (1) M=12.5	$T_m$
M(1) M+F= 0.41		Ageing method Otolith readings	VBGF method Non linear regression	M method Djabali et al. (1993)	
References: (1) Tursi A. et al. (1994) – Mar. Life 4 (2) : 33-43. (2)Tursi A. et al. (1996) – FAO Fish. Rep. 533 (Suppl.): 127-141.					

Table 66 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Ionian	Management Unit: 2.2.e (Strait of Sicily-Sicilian versant)	Country: Italy	Fishery: Trawling	Stock Name:
Area: 5800 km <sup>2</sup>	Biomass: TS: VPA:	Management options	Recommendations: <ul style="list-style-type: none"> <li>• Keeping constant the present fishing patter and varying from 0.5 to 2 times the current value of current F, the long term yield does not change significantly. However in terms of economic value, to double the potential value of the catches fishing mortality should be reduced to 40 % of current value.</li> <li>• Increasing mesh size from 32 to 40 mm opening, not only a 3% rise of yield and 14% of value, but also higher benefits would be expected from a 50% effort increase (→ a 5% weight increase) (1)</li> </ul>		
	Recruitment: TS: VPA:				
Fishery and assessment					
Operational unit Trawling in Sicilian side of Strait of Sicily (1)	Stock Status: Over-exploited (1)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub> =	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	Recent E: E= 0.7 (4)
Recent Y: 865 tons (1985-87) (3)	Recent Y/R in g:	Recent Z:	Recent F or f:	E <sub>max.</sub> : 0.59 (1)	
				E <sub>0.1</sub> : 0.56 (1)	
Note: Assessment based on trawl surveys data by using Beverton and Holt Relative Y/R Model and Thompson and Bell Model (1).					



<b>Biology</b>					
	$L_{\infty}$ in cm TL F+M= 27.6	$W_{\infty}$	K in y-1 F+M= 0.154	$t_0$ in y F+M= -2.637	L max.
$L_r$ 5-6 cm	$T_r$	A F+M=0.0103	B F+M=3.0183	$L_m$ in cm TL	$T_m$
M(1) M+F= 0.25		Ageing method Otolith readings	VBGF method Non linear regression	M method Chen and Watanabe (1989)	
References: (1) Levi D. et al. (1993) – Fish. Res., 17: 333-341. (2) Cannizzaro L. et al. (1991) – N.T.R. – I.T.P.P. 39: 1-33. (3) Andreoli M.G. et al. (1995) – N.T.R. – I.T.P.P. ( Special publication), 4 (2): 223 p. (4) Levi D. et al. (1998) – Biol. Mar. Medit. 5 (3): 130-139.					

Table 67 - General Data					
Scientific name: Mullus barbatus	GFCM Subarea: Aegean Sea	Management Unit: 3.1.a (Saronikos Gulf)	Country: Greece	Fishery: Trawling	Stock Name:
Area: km <sup>2</sup>	Biomass: TS: VPA:	Recruitment: TS: VPA:	Management options : Trawling – Beach seiner-	Recommendations: <ul style="list-style-type: none"> <li>• Before accepting conclusions of assessment, it is necessary to validate estimation of M.</li> <li>• It is, however, recommended to prevent any increase of current fishing levels.</li> </ul>	
Fishery and assessment					
Operational unit Trawling in Saronikos Gulf (1)	Stock Status: <u>Fully exploitation</u> with $0.5 < M < 0.6$ or <u>Under exploitation</u> with $0.75 < M < 0.95$	$L_{25}$ $L_{50}=L_c= 12.8$ (1) $L_{75} =$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	$E_{max}$ : (1) E=0.85 (a) E= 0.75 (b) E= 0.75 © E= 0.70 (d)
Recent Y/R in g:	Recent Z:  $Z_{LCCC} = 1.88$ (1989-90) (1)	Recent F or f:  F= 0.93 (a)(1) F= 1.13 (b) F= 1.28 © F= 1.38 (d)	Recent Y/R <sub>max</sub> in g:	Recent E: (1) E= 0.50 (a) E= 0.60 (b) E= 0.68 © E= 0.73 (d)	$E_{0.1}$ : (1) E=0.75 (a) E= 0.70 (b) E= 0.65 © E= 0.60 (d)
<p>Note: Assessment based on trawl surveys data by using Beverton and Holt Relative Y/R Model. <math>L_c</math>, corresponding to 28 mm opening mesh siz, was estimated by LCCC (1). According to a Fox Surplus Production Model, based on catches and effort of all Mullidae in all Greek Seas from 1964 to 1986 and using <math>f_{0.1}</math> as reference, resulted that fully exploitation was achieved in 1986 (2).</p>					

<b>Biology</b>					
	$L_{\infty}$ in cm TL F+M= 23.5 (1)	$W_{\infty}$	K in y-1 F+M= 0.51 (1)	$t_0$ in y F+M= -0.86 (1)	L max.
$L_r$	$T_r$	A F+M=0.0000057 (2)	B F+M=3.22 (2)	$L_m$ in cm TL F= 13.5 (1) M=12.5	$T_m$
M(1) M+F= 0.94 (a)with 16°C M+F=0.75 (b) M+F=0.6 (b) M+F=0.5 (b)		Ageing method  Otolith readings	VBGF method  Non linear regression	M method  Pauly (1980) and other guessed values	
Note: length-weight coefficients calculated with TL in mm and TW in g.					
References: (5) Karlou C., Vrantzas N. (1989) – FAO Fish. Rep. 412: 28-43. (6) Vrantzas N. et al. (1992) - FAO Fish. Rep. 477: 51-67. (7) Stergiou K.I. et al. (1992) - FAO Fish. Rep. 477: 97- 113.					

Table 68 - General Data						
Scientific name: Mullus barbatus	GFCM Subarea: Aegean Sea	Management Unit: 3.1.a (Central Aegean Sea)	Country: Greece	Fishery: All Greece (2)  Trawling –72.6% of total Greek catches Beach seiner – 3.8 % Coastal fishery – 23.6	Stock Name:	
Area: km <sup>2</sup>	Biomass: (1990-91) TS : 94 tons (0-200m) – Western Aegean TS : 2048 tons (0-200m) – Northern Aegean)	Recruitment:  TS: VPA:	Management options :		Recommendations:	
Fishery and assessment						
Operational unit  Trawling in Central Aegean Sea (1)	Stock Status:  Over-fished	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub> =	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	E <sub>max</sub> : (1)	
Recent Y/R in g: Aegean Sea (1986) 1848 tons of M. barbatus over 3841 tons of Mullidae (2).	Recent Z:  Z = 1.28 (1990-91) (1)	Recent F or f:  F= 0.80 (1)	Recent Y/R <sub>max</sub> in g:	Recent E: (1) E= 0.62	E <sub>0.1</sub> : (1)	
Note: Assessment based on trawl surveys data and Exploitation Rate analysis (1). According to a Fox Surplus Production Model, based on catches and effort of all Mullidae in all Greek Seas from 1964 to 1986 and using f <sub>0.1</sub> as reference, resulted that fully exploitation was achieved in 1986 (2).						

<b>Biology</b>					
	$L_{\infty}$ in cm TL F= 25.5(1) M= 22.7	$W_{\infty}$	K in y-1 F= 0.21(1) M= 0.25	$t_0$ in y F= -2.13 (1) M= -1.85	L max.
$L_r$ 6-8 cm FL	$T_r$	A F+M=0.0000064 (1)	B F+M=3.179 (1)	$L_m$ in cm TL F= 10.4 (1) M= 9.4	$T_m$
M(1) M+F= 0.48		Ageing method Otolith readings	VBGF method Ford-Walford plot	M method Pauly (1980)	
Note: length-weight coefficients calculated with FL in mm and TW in g.					
References: (1) Vassiloupou V., Papaconstantinou C. (1992) – FAO Fish. Rep. 477: 115-126. (2) Stergiou K.I. et al. (1992) - FAO Fish. Rep. 477: 97- 113.					

<b>Table 69 - General Data</b>					
Scientific name: Mullus barbatus	GFCM Subarea: Eastern	Management Unit: 3.2.c (Ciprus)	Country: Ciprus	Fishery: Trawling	Stock Name:
Area: km <sup>2</sup>	Biomass: TS: ACA: 229 tons (1989)	Recruitment: TS: ACA: 7.3 millions (1989)	Management options : Trawling and Coastal fishery	Recommendations: <ul style="list-style-type: none"> <li>Displace trawlers from inshore to offshore fishing-grounds or forbid inshore trawling from November to February for 2 years.</li> <li>Introduction of closed areas for 2 years.</li> </ul>	
Note: Biomass at Sea, estimated at beginning of fishing season (31 October of each year), remained quite stable from 1986 to 1989 (1)					
<b>Fishery and assessment</b>					
Operational unit Trawling and Coastal fishery (1)	Stock Status: Over exploited	$L_{25}$ $L_{50}=L_c$ $L_{75} =$	Age at first capture ( $t_c$ ): 0.5 y (1)	Mean Length of capture in cm TL :	$Y/R_{max}$ : (1)  All gears 18.7
Recent Y: All gears 118 tons (1989)	Recent Y/R in g: All gears 15.3 (1989)	Recent Z: All gears $Z = 1.28$ (1989) (1) Based on ACA	Recent F or f: All gears $F_{mean} = 1.01$ (1)  F at age result lower than mean one on 0 and 1 age groups ( $F=0.1$ ) and higher on 4 age group ( $F=2.8$ ).	Recent E: (1) All gears $E = 0.79$	$F_{max}$ : All gears $F_{mean} = 0.4$ (1)
Note: Assessment based on Age Cohort Analysis (ACA) and Beverton and Holt Y/R Model(1).					

<b>Biology</b>					
	$L_{\infty}$ in cm TL F+M= 25 (1)	$W_{\infty}$ F+M= 166 (1)	K in y-1 F+M= 0.27 (1)	$t_0$ in y F+M= -1.2 (1)	L max.
$L_r$	$T_r$ 0.33 y	A	B	$L_m$ in cm TL	$T_m$
M M+F= 0.27 (1)		Ageing method	VBGF method	M method	
References: (8) Hadjistephanou N.A. (1992) - FAO Fish. Rep. 477: 23-34					

Table 70 - General Data					
Scientific name: Mullus surmuletus	GFCM Subarea: Balearic	Management Unit: 1.1.a	Country: Spain	Fishery: Trawling Gill net	Stock Name:
Area:	Biomass: TS: LCA: tons (1980 -91) (1)	Recruitment: TS: LCA: 3.9 millions (1980-91) (1)	Management options :	Recommendations: Adopting a 60 mm opening mesh size (F <sub>0</sub> =0; F <sub>1</sub> = 0.2; F <sub>2</sub> = 1.4 and F <sub>4</sub> = 1.7) the Y/ R= 62.1g should be obtained after 3 years (1).	
Note : Current opening mesh size 40 mm (1)					
Fishery					
Operational unit Trawling around Balears	Stock Status: Overexploited (growth overfishing)	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> L <sub>75</sub>	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL : 15.8 ( 1.31 y) (1980-91) (1)	Y/ R <sub>max</sub> in g (1980-91) 58.05 with current exploitation pattern; 67. 3 with 60 opening m.s. (1)
Recent Y:	Recent Y/R in g: 36.61 (1980-91) (1)	Recent F or f: (1980-91) (1) Highest values of F on age 1 and 2 groups (F=1.9). Lowest ones on age 0 and 5 groups (0.14<F<0.17). Intermediate values on age 3 (F=0.72) and age 4 (F=0.24) groups.		Effort level <sub>Y/R max.</sub> : -74% of the current value	SSB/SSB <sub>0</sub> : 2% (1980-91) (1)
	Recent B/R in g: 29.6 (1980-91) (1)				
(1) based on LCA carried out on pseudocohorts					



<b>Biology</b>					
	$L_{\infty}$ M+F=29.75 cm TL (1)	$W_{\infty}$	K M+F= 0.49 y-1 (1)	$t_0$ M+F=-0.31 y (1)	L max.
$L_r$	$T_r$	A M+F=0.0093 (1)	B M+F=3.07 (1)	$L_m$ in cm TL M+F = 15 (1)	$T_m$
M M+F= 0.20 (1)	$F_{term.}$ : 0.35	Ageing method  Otolith readings	VBGF method	M method	
References:					
(1) Oliver P et al. (1995) – Cah. Options Mediterr. 10: 25-26					
(2) Oliver P, Morillas A. (1992) – Rapp. Comm. Int. Mer Medit. 33: 304					
(3) Oliver P. (1993) – Scientia Marina, 57 (2-3): 219 - 227.					

Table 71 - General Data					
Scientific name: Mullus surmuletus	GFCM Subarea: Sardinian + Ionian	Management Unit: 1.3.k and 2.2.f	Country: Tunisia	Fishery: • Trawling • Coastal fishery	Stock Name:
Area:	Recruitment	Recommendations: <ul style="list-style-type: none"> <li>• 50 % increasing trawling effort would produce an 12 % and 18% improve of trawler Y/R in North and East coast respectively, while a 25% decrease in both coastal fisheries.</li> <li>• 40 % decreasing trawling effort would produce an 21 % and 25% decrease of trawler Y/R in North and East coast respectively, while a 12% increase in both coastal fisheries.</li> <li>• The adoption of a 60 mm opening mesh size would produce a 30 and 51 % decrease of trawler Y/R in North and East coast, respectively, while a 89% increase of coastal fisheries</li> <li>• Maintaining the current M.S., a 40% increase of effort only in North coast would produce a an 36 % and 27% increase of trawlers and coastal in North and East coast respectively (1).</li> </ul>			
Biomass: TS: LCA:	Management options				
Note : Current opening mesh size 38 mm (1)					

<b>Fishery and assessment</b>					
Operational unit	Stock Status:	$L_{25}$ $L_{50}=L_c$ $L_{75}$	Age at first capture ( $t_c$ ):	Mean Length of capture in cm TL :	Y/ R <sub>max</sub> in g
Northern coast (1.3.k)	<b>Northern coast</b>				
Eastern coast (2.2.f)	Under exploited				
Southern coast (2.2.f)	<b>Eastern coast</b> Fully Exploited				
	<b>Southern coast</b> Overexploited				
Surplus Production Model (1980-91)		Recent f:	Recent F (1988-91) (1)		
Northern –Eastern coast MSY = 550 t (Schaefer) – 580 (Fox).  $f_{MSY} = 1115 \cdot 10^4$ day*HP (Schaefer) - $1576 \cdot 10^4$ day*HP (Fox).		Northern -Eastern coast  $f_{1991} = 600 \cdot 10^4$ day*HP	<b>Northern coast - trawler</b> Highest values of F on 14 cm TL (F=0.8). Values higher than 0.25 from 11 to 18 cm TL. Exploited range 9-21 cm TL. <b>Northern coast – coastal fishery</b> Values between 0.25 and 0.4 for TL > 18 cm. Exploited range 16-21cm TL. <u>All gears North</u> – Mean F=0.75 from 12 to 21 cm TL; Mean F=0.25 from 9 to 12 cm TL.		
Southern coast MSY = 1035 t (Schaefer) – 930 (Fox).  $f_{MSY} = 1539 \cdot 10^6$ day*HP (Schaefer) - $1373 \cdot 10^6$ day*HP (Fox)		Southern coast  $f_{1991} = 2100 \cdot 10^6$ day*HP	<b>Eastern coast - trawler</b> Values lower than 0.1 all over length classes. Exploited range 9-21 cm TL. <b>Eastern coast – coastal fishery</b> Values close 0.2 for TL>18 cm. Exploited range 16-21cm TL.		
Note: Assessment based on Surplus Production Model and LCA carried out on pseudocohorts (ANALEN) (1)					

<b>Biology</b>					
	$L_{\infty}$ M+F=27.06 cm TL (1)	$W_{\infty}$	K M+F= 0.5 y-1 (1)	$t_0$	L max.
$L_r$	$T_r$	A M+F=0.0093 (1)	B M+F=3.07 (1)	$L_m$ in cm TL M+F = 15.5 (1)	$T_m$
M M+F= 0.54 (1)	$F_{term.}$ : 0.57	Ageing method	VBGF method	M method	
Note:					
References:					
(1) Ben Mariem et al. (1996) – FAO Fish. Rep. 533 (Suppl.): 269-284.					

Table 72 - General Data					
Scientific name: Mullus surmuletus	GFCM Subarea: Aegean Sea	Management Unit: 3.1.a (Central Aegean Sea)	Country: Greece	Fishery: All Greece (2) <u>Trawling</u> –72.6% of total Greek catches <u>Beach seiner</u> – 3.8 % <u>Coastal fishery</u> – 23.6	Stock Name:
Area: km <sup>2</sup>	Biomass: (1990-91)  TS :	Recruitment:  TS: VPA:	Management options :	Recommendations:	
Fishery and assessment					
Operational unit  Trawling in Central Aegean Sea (1)	Stock Status:  Over-fished	L <sub>25</sub> L <sub>50</sub> =L <sub>c</sub> = L <sub>75</sub> =	Age at first capture (t <sub>c</sub> ):	Mean Length of capture in cm TL :	E <sub>max.</sub> : (1)
Recent Y:  Aegean Sea (1986) 1993 tons of M. barbatus over 3841 tons of Mullidae (2).	Recent Z:  Z = 1.31(1990-91) (1)	Recent F or f:  F= 0.94 (1)	Recent Y/R in g:	Recent E:  E=0.72 (1)	E <sub>0.1</sub> :
Note: Assessment based on trawl surveys data and Exploitation Rate analysis (1). According to a Fox Surplus Production Model, based on catches and effort of all Mullidae in all Greek Seas from 1964 to 1986 and using f <sub>0.1</sub> as reference, resulted that fully exploitation was achieved in 1986 (2).					

<b>Biology</b>					
	$L_{\infty}$ in cm FL F= 41.3(1) M= 38	$W_{\infty}$	K in y-1 F= 0.0996 (1) M= 0.1043	$t_0$ in y F= -2.77 (1) M= -2.76	L max.
$L_r$ 6-8 cm FL	$T_r$	A F=0.0000056 M=0.0000051 (1)	B F= 3.23 M=3.25 (1) (1)	$L_m$ in cm TL F= 13.8 (1) M= 11.5	$T_m$
M(1) M+F= 0.37		Ageing method Otolith readings	VBGF method Ford-Walford plot	M method Pauly (1980)	
Note: length-weight coefficients calculated with FL in mm and TW in g.					
References: (3) Vassiloupou V., Papaconstantinou C. (1992) – FAO Fish. Rep. 477: 115-126. (4) Stergiou K.I. et al. (1992) - FAO Fish. Rep. 477: 97- 113.					

<b>Table 73 - General Data</b>					
Scientific name: Mullus surmuletus	GFCM Subarea: Eastern	Management Unit: 3.2.c (Ciprus)	Country: Ciprus	Fishery: Trawling and Coastal fishery	Stock Name:
Area: km <sup>2</sup>	Biomass: TS: CA: 307 tons (1989)	Recruitment: TS: CA: 11.2 millions (1989)	Management options :	Recommendations: <ul style="list-style-type: none"> <li>Displace trawlers from inshore to offshore fishing-grounds or forbid inshore trawling from November to February for 2 years.</li> <li>Introduction of closed areas for 2 years.</li> </ul>	
Note: Biomass at Sea, estimated at beginning of fishing season (31 October of each year), remained quite stable from 1986 to 1989 (1)					
<b>Fishery and assessment</b>					
Operational unit Trawling and Coastal fishery (1)	Stock Status: Fully exploited	Age at first capture (t <sub>c</sub> ): 0.5 y (1)	Mean Length of capture in cm TL : Trawlers= 11.2 Inshore fishery= 10	Y/R <sub>max.</sub> : (1) All gears 18.7	Recent Y/R in g: All gears 18.7 (1989)
Recent Y: All gears 155 tons (1989)	Recent Z: All gears Z = 1.09 (1989) (1) Based on CA	Recent F or f: All gears F <sub>mean</sub> = 0.74 (1) F at age result lower than mean one on 0 (F=0.03), 1 (F=0.33) and 5plus (F=0.35) age groups. From 2 to 4 age groups F ranges between 0.97 and 1.31.		Recent E: (1) All gears E= 0.68	F <sub>max</sub> : All gears F <sub>mean</sub> = 0.6 (1)
Note: Assessment based on Age Cohort Analysis (CA) and Beverton and Holt Y/R Model (1).					
<b>Biology</b>					
	L <sub>∞</sub> in cm TL F+M= 33.2 (1)	W <sub>∞</sub> F+M= 506 (1)	K in y-1 F+M= 0.103 (1)	t <sub>0</sub> in y F+M= --3.24 (1)	L max.
M M+F= 0.35 (1)	T <sub>r</sub> 0.33 y	A	B	L <sub>m</sub> in cm TL	T <sub>m</sub>
References: (1) Hadjistephanou N.A. (1992) - FAO Fish. Rep. 477: 23-34					

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