



GENERAL FISHERIES COMMISSION FOR
THE MEDITERRANEAN
COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE



SAC GFCM
Sub-Committee on Stock Assessment

SCSA Assessment Forms

> Enter <



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Colours and symbols meaning

WORKSHEETS

Green ► Not compulsory sheet


Orange ► Compulsory sheet

Red ►  Not completed sheet


Bright green ►  Completed sheet

CELLS

Black asterisk ► * Compulsory sheet/field

Turquoise ►  Compulsory field not yet completed

White ►  Free cell

Light green ►  Cell with the scroll-down menu

Light yellow ►  Auto-complete cell

Excel shortcuts

Ctrl + C Copy

Ctrl + V Paste

Ctrl + X Cut
Ctrl + Z Undo
Ctrl + P Print
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SAC GFCM
Sub-Committee on Stock Assessment

SCSA Assessment Forms Release 2 (2007) beta version

Since the SAC, and SCSA, inception (1999) a set of assessment forms were made available to scientists in order to provide a common framework to present assessments.

It has been decided to present a new release of these forms to facilitate their use. We took advantage of these upgrade to modify and amend some aspects. We would like to receive comments and suggestions from the users in order to improve the forms.

The structure of this new release is basically the same. The differences are:

- Migration from Word to Excel
- Some fields (yellow) are filled automatically
- Some sheets have been added
 - o A cover sheet with title, authors, species and GSAs
 - o A new sheet "other" allowing to include assessments based on methodologies other than the usual ones.
 - o An abstract sheet to be included (copy/paste) in the SCSA report
- It is more clear what sheets or fields are compulsory to fill
- The sheets for direct methods have not been yet upgraded

Excerpts from the presentation of 1st version of the assessment forms (1999), however the sheet "other" can be used in such a case

Each assessment consists of several sheets. Each assessment will take, at least, one sheet of paper numbered "0" (Sheet #0) and will also include no less than one copy of sheets "B", "P1" and "P2a" (now using the current "operational units" terminology). It is not compulsory to fill out any of the other sheets that make up this assessment form, but the person in charge is supposed to fill out some of them: otherwise no assessment is actually made. There may be more than one copy in several cases. Sheets "D" (diagnosis) and "Z" (conclusions and recommendations) should be considered as essential too.

Sheet	Title	Contents	# of sheets	Priority
0	Preliminary basic data on the assessment	Species, person in charge, date and code. All the sheets that belong to the same assessment share this code.	1	Indispensable
B	Biology of the species	Biological parameters used in the analyses (it is assumed that only one set of parameters is used).	1	Indispensable
P1	General information about the fishery	Catches by gear and associated fleet.	1 or more	Indispensable
P2a	Fishery by Operational Unit	Time series for the operational in question, including structure by size (or age).	At least as many as the OU numbers	Indispensable
P2b	Fishery by Operational Unit	Accompanying species and regulations applicable to operational unit.	At least as many as the OU numbers	If available
G	Indirect methods: global model	Description of model, data, parameters and results of each analysis.	As many as used in the analysis	If available
A1	Indirect methods: VPA, LCA	Description of model used and of general results of an analysis.	As many as used in the analysis	If available
A2	Indirect methods: data	Description of data used by gear for the analysis in A1.	As many as used in the analysis by OU	If available, requires A1
A3	Indirect methods: results of VPA	Detailed description of results by gear, structured by size or age.	As many as used in the analysis by OU	If available, requires A1
Y	Indirect methods: Y/R	Description of model, data, parameters and results.	As many as used in the analysis	If available
Other	Other assessment methods	Description of model, data, parameters and results of other assessment methods not included in the previous sheets.	1	If available
D	Diagnosis	Synthesis of results of analyses and diagnosis on the state of resources.	1	Indispensable
Z	Objectives and recommendations	Set the objectives to be attained and recommendations for their attainment.	1	Indispensable

C	Comments	At the option of the person in charge.	Unspecified	If available
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SAC GFCM Sub-Committee on Stock Assessment

Date*	15	September	2008	Code*	SOL1708G.
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Authors* G. Fabi*, O. Giovanardi**, F. Grati*, I. Isajlovič***, D. Pehar****, P. Polidori*, S. Raicevich**, G. Scarcella*, N. Vrgoč***

Affiliation* * CNR ISMAR Ancona, Italy; ** ICRAM Chioggia, Italy; *** IOF Split, Croatia, **** FRIS Ljubliana, Slovenia

Species Scientific name* **1**
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area* Adriatic Sea

Geographical Sub-Area (GSA)* 17 - Northern Adriatic

Combination of GSAs
1
2
3

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

Assessment form

Sheet #0
Basic data on the assessment

Code: SOL1708G.

Date*	15	Sep	2008	Authors*	G. Fabi*, O. Giovanardi**, F. Grati*, I. Isajlovič***, D. Pehar****, P. Polidori*, S. Raicevich**, G. Scarcella*, N. Vrgoč***
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Species Scientific name*	Solea vulgaris - SOL	Species common name*	Common sole
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Data Source

GSA*	17 - Northern Adriatic	Period of time*	2005-2007
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Description of the analysis

Type of data*	Catch and landing data	Data source*	Rapido trawl surveys (catch data) and commercial fleet (landings)
Method of assessment*	SVPA	Software used*	ATrIS, LFDA 5.0, FISAT II, PROBIOM, Yield 1.0

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	#REF!	#REF!	#REF!	#REF!	1	#REF!	1	#REF!	1	1	#REF!

Comments, bibliography, etc.

Branch T.A., Kirkwood G.P., Nicholson S.A., Lawlor B., Zara S.J. 2000. Yield version 1.0, MRAG Ltd, London, U.K.

Caddy J.F. 1991. Death rates and time intervals: is there an alternative to the constant natural mortality axiom?. Rev. Fish Biol. Fish. 1: 109–138.

Caddy J.F., Abella A.J. 1999. Reconstructing reciprocal M vectors from length cohort analysis (LCA) of commercial size frequencies of hake, and fine mesh trawl surveys over the same grounds. Fish. Res. 41: 169–175.

Cadima E.L. 2003. Fish Stock Assessment Manual. FAO Fish. Tec. Paper, 393.

Ferretti M., Frogliola C. 1975. Results of selectivity experiments, made with different trawls, on more important Adriatic demersal fish. Quad. Lab. Tecnol. Pesca. 2(1): 3-16.

Gramolini R., Mannini P., Milone N., Zeuli V. 2005. AdriaMed Trawl Survey Information System (ATrIS): User manual. AdriaMed Technical Documents No 17, GCP/RER/010/ITA/TD-17. 141 pp.

Gayanilo F.C.Jr., Sparre P., Pauly D. 2005. FAO-ICLARM Stock Assessment Tools II (FiSAT II). Revised version. User's guide. FAO Computerized Information Series (Fisheries), No. 8. Revised version. Rome, FAO. 168 pp.

Kirkwood G.P., Auckland R., Zara S.J. 2001. Length Frequency Distribution Analysis (LFDA), Version 5.0. MRAG Ltd, London, UK.

Lassen H., Medley P. 2001. Virtual Population Analysis: A practical manual for stock assessment. FAO Fish. Tec. Paper, 400.

Comments, bibliography, etc.

Sheet #0 (page 2)

MacCall A.D. 1986. Virtual population analysis (VPA) equations for nonhomogeneous populations, and a family of approximations including improvements on Pope's cohort analysis. *Can. J. Fish. Aquat. Sci.* 43: 2406–2409

Pilling G. M., Kell L. T., Hutton T., Bromley P. J., Tidd A. N., Bolle L. J. 2008. Can economic and biological management objectives be achieved by the use of MSY-based reference points? A North Sea plaice (*Pleuronectes platessa*) and sole (*Solea solea*) case study. *ICES J. Mar. Sci.*, 65: 1069–1080.

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Assessment form

Sheet B
Biology of the species

Code: SOL1708G.

Biology

Somatic magnitude measured (LH, LC, etc)*				TL	Units*	cm
Sex	Fem	Mal	Both	Unsexed		
Maximum size observed	40.0	38,5			Reproduction season	Late fall-early winter
Size at first maturity	25,8				Reproduction areas	*
Recruitment size			17.5-20.0		Nursery areas	**

Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L ∞	cm			39,6	
	K	1/Year			0,44	
	t0	Year			-0,46	
	Data source	Solemon Project (2004-2007)				
Length weight relationship	a				0,007	
	b				3,0638	
	M				***	
	sex ratio (mal/fem)	0,85				

Comments

* Northern Adriatic: within meridians 13°00' and 14°20' E and parallels 44°10' and 45°20' N

** Marine coastal areas, estuarine and lagoon systems along the Italian coast of the central and northern Adriatic Sea

*** The vector of natural mortality by age was calculated from Caddy's (1991) method, using the PROBIOM Excel spreadsheet (Abella et al., 1997):

Age 0: 0.9; Age 1: 0.3; Age 2: 0.3; Age 3: 0.2; Age 4: 0.2; Age 5+: 0.2

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Assessment form

Sheet P1
General information about the fishery

Code: SOL1708G.

Data source*	Catches (surveys) and landings (commercial fleet)	Year (s)*	2005 - 2006 - 2007
Data aggregation (by year, average figures between years, etc.)*	by year		

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ITA	17	E - Trawl (12-24 metres)	98 - Other Gear	33 - Demersal shelf species	SOL
Operational Unit 2	ITA	17	C - Minor gear with engine (6-12 metres)	07 - Gillnets and Entangling Nets	33 - Demersal shelf species	SOL
Operational Unit 3						
Operational Unit 4						
Operational Unit 5						

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
ITA 17 E 98 33 - SOL	124	Tons	1075	us, Sepia officinalis		equivalvis, Anadara	essel x Da
ITA 17 C 07 33 - SOL	469	Tons	204	Merluccius merluccius, Melidonichthys lucida		pecten irregularis	essel x Da
Total	593		1279				

Legal minimum size	20 cm
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Comments

Operational Unit 1: from censuses carried out at the landing sites the Italian rapido trawl fleets operating in GSA 17 were made up by 155 vessels in 2005 and 124 vessels in 2006. Their Loa ranged from 9 to 30 m, the GRT ranged from 4 to 100 and the engine power from 60 to 1000 HP. each vessel can tow from 2 to 4 rapido trawls depending on its dimensions. The vessels longer than 24 m were around 10%. The used gear is the rapido trawl, a specific gear employed for the catch of flatfish and other benthic species (e.g. cuttlefish, mantis shrimp, etc.). It resembles a toothed beam-trawl and is made of an iron frame provided with 3-5 skids and a toothed bar on its lower side. These gears are usually towed at a greater speed (up to 10-13 km h⁻¹) in comparison to the otter trawl nets; this is the reason of the name "rapido", the Italian word for "fast". These fleets usually operate on muddy bottoms outside the 3 nm offshore up to about 80 m depth.

Operational Unit 2: the fleet using set nets in GSA 17 was composed by 475 vessels in 2005 and by 469 vessels in 2006. Their Loa ranged from 5.0 to 12.0 m, their GRT from 1.0 to 10.0 and their engine power from 10 to 200 HP. This fleet usually operates on sandy and muddy bottoms inside the 3 nm offshore.

Sheet P1 (page 2)

Comments

Comments

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Assessment form

Sheet P2a
Fishery by Operational Unit

Code: SOL1708G.

#REF!

Data source*	Landings	OpUnit 1*	ITA 17 E 98 33 - SOL
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Time series

Year*	2005	2006	2007			
Catch	1350,00	1333,00	1075,00			
Minimum size	13,50	12,50	19,00			
Average size Lc	22,20	21,40	25,60			
Maximum size	34,50	36,00	33,00			
Fleet	155	124	94			

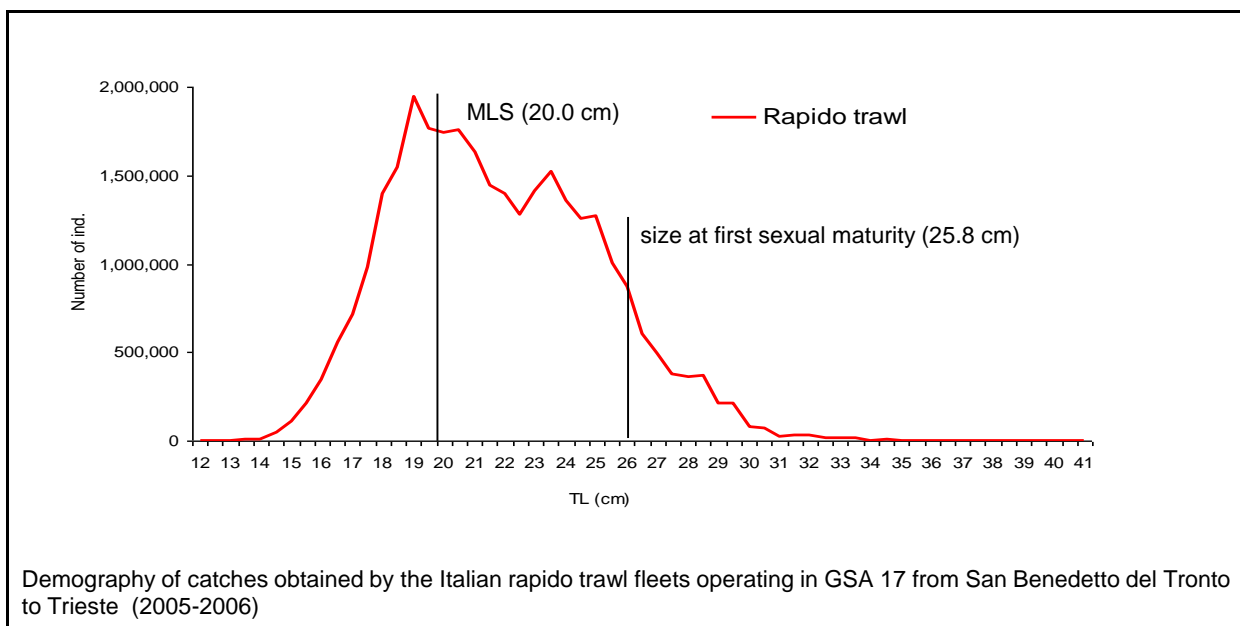
Year						
Catch						
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Selectivity

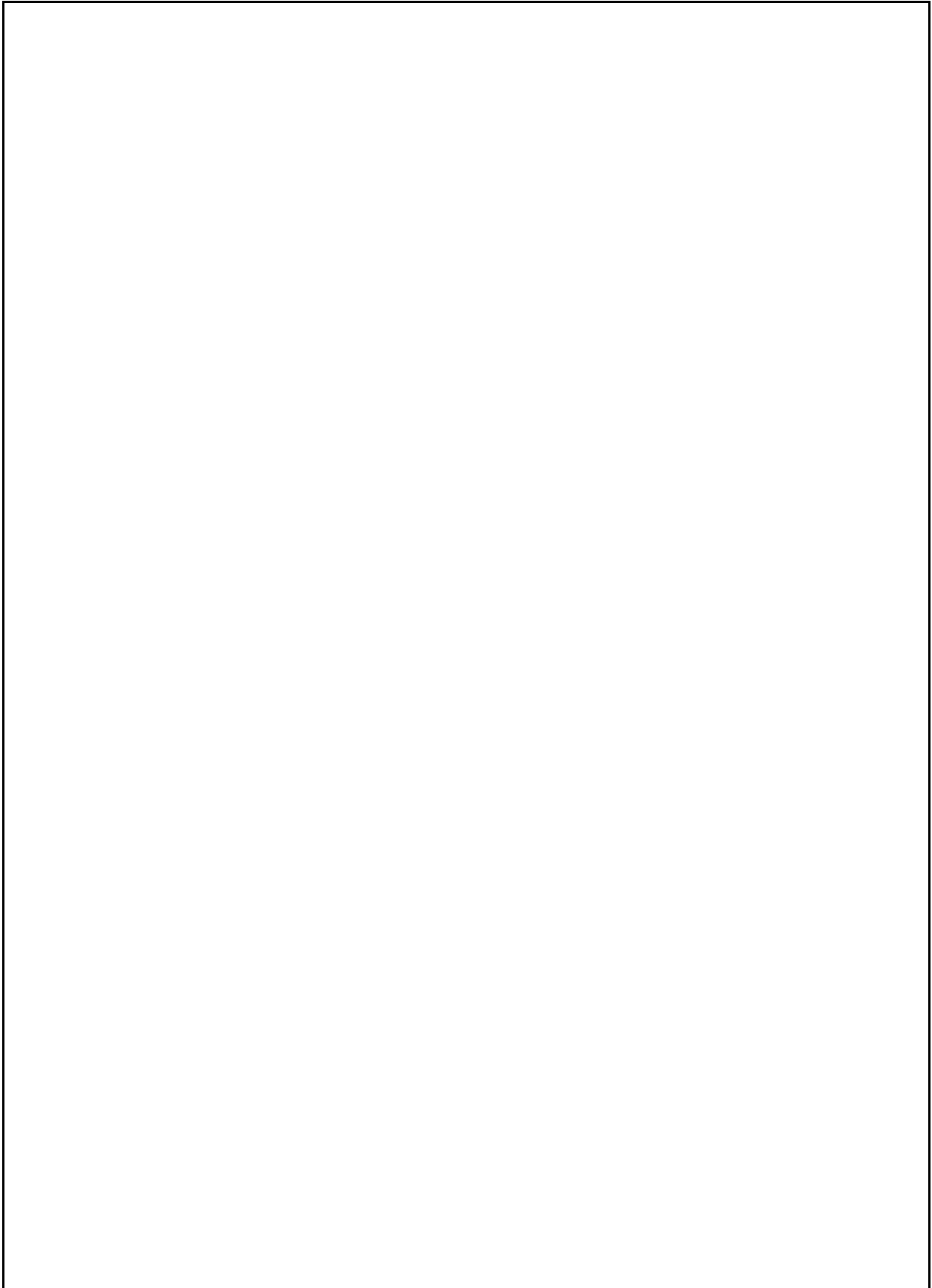
Remarks

L25	12,40	They correspond to 40.2 mm diamond mesh in the codend. The parameters have been derived from selectivity parameters given by Ferretti and Froggia (1975)
L50	14,55	
L75	16,72	
Selection factor	3,62	

Structure by size or age



Structure by size or age

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

Assessment form

Sheet P2a
Fishery by Operational Unit

Code: SOL1708G.

#REF!

Data source*	Landings	OpUnit 2*	ITA 17 C 07 33 - SOL
--------------	----------	-----------	----------------------

Time series

Year*	2005	2006	2007			
Catch	201,50	287,00	204,00			
Minimum size	14,50	15,50	15,50			
Average size Lc	22,40	22,40	22,40			
Maximum size	37,00	34,00	34,00			
Fleet	475	469	469			

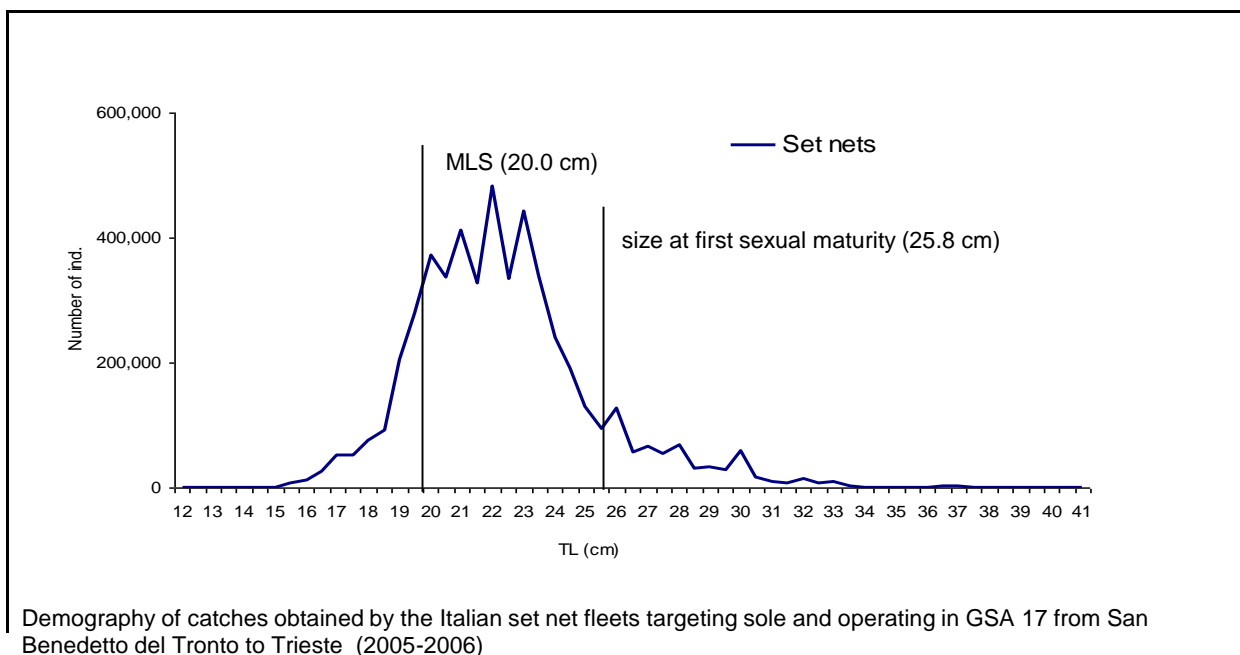
Year						
Catch						
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Selectivity

Remarks

L25		
L50		
L75		
Selection factor		

Structure by size or age



#REF!

Structure by size or age

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Assessment form

Sheet P2b
Fishery by Operational Unit

Code: SOL1708G.

####

Data source*	ISMAR	OpUnit 1*	ITA 17 E 98 33 - SOL
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Regulations in force and degree of observance of regulations

Minimum mesh opening (40 mm): observed. The mesh opening used by rapido trawlers ranges from 48 to 56 mm, hence larger than the legal minimum mesh size.

Minimum landing size for sole (20 cm): not observed. The rapido trawl catches include a relevant portion (>40% in number of individuals) of undersized specimens (see graphic in sheet P2a1).

Fishing ban inside the 3 miles offshore: partially observed. Rapido trawlers sometimes fish illegally inside this area.

Accompanying species

#REF!

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

Assessment form

Sheet P2b
Fishery by Operational Unit

Code: SOL1708G.

####

Data source*

OpUnit 2*

ITA 17 C 07 33 - SOL

Regulations in force and degree of observance of regulations

Minimum mesh opening (16 mm stretched): observed. The mesh opening used by set netters targeting sole range from 60 to 80 mm (gill net and inner panel of trammel net), hence larger than the legal minimum mesh size.

Minimum landing size for sole (20 cm): not observed. The set net catches include a portion (16% in number of individuals) of undersized specimens (see graphic in sheet P2a2).

Maximum length of nets x vessel x day (5,000 m): partially observed. Several vessels use longer sets of net (around 6,000 m).

Accompanying species

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SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet A1 Indirect methods: VPA, LCA

Sex*	Both
------	------

Code: SOL1708G.
#REF!

Analysis # *	SVPA
--------------	------

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used	MacCall (1986)	Tunig method	Abundance-at-age from rapido trawl survey
# of gears	3 (rapido trawl, otter trawl and set nets)	Software	Excel spreadsheet
F_{terminal}	0,38		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum		0	Recruitment	94,900,000 ind	1,994 tons
Average			Average population		
Maximum		5+	Virgin population		
Critical		0 - 1 - 2	Turnover		

Average mortality

	Total	Gear				
F_1	0.52*					
F_2	0.44**					
Z	1.34***					

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

Comments

* Fbar for ages 0 - 2
 ** Fbar for ages 0 - 5+
 *** from Length-converted catch curves of rapido trawl survey data

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Assessment form

Sheet A2
Indirect methods: data

Code: SOL1708G.

Sex*	Both	Gear*	3	Analysis # *	SVPA
------	------	-------	---	--------------	------

Data	Catch at age from commercial landing (matrix Ca,y (N. ind.)) and CPUE from survey data at start of the year (matrix CPUEa,y (N.ind / km ²))
------	---

Data

Ca,y (N. ind.)

age	2005	2006	2007
0	2E+06	3E+06	4E+06
1	1E+07	2E+07	1E+07
2	3E+06	2E+06	2E+06
3	137837	158651	82412
4	11439	19800	6327,4
5+	7791,8	10029	1375,5

CPUEa,y from survey (N.ind / km²)

age	2005	2006	2007
0	565,08	307,76	685,22
1	274,49	599,51	460,13
2	121,28	144,13	239,18
3	41,55	32,73	59,55
4	11,39	4,64	4,01
5+	5,01	3,94	1,94

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

Assessment form

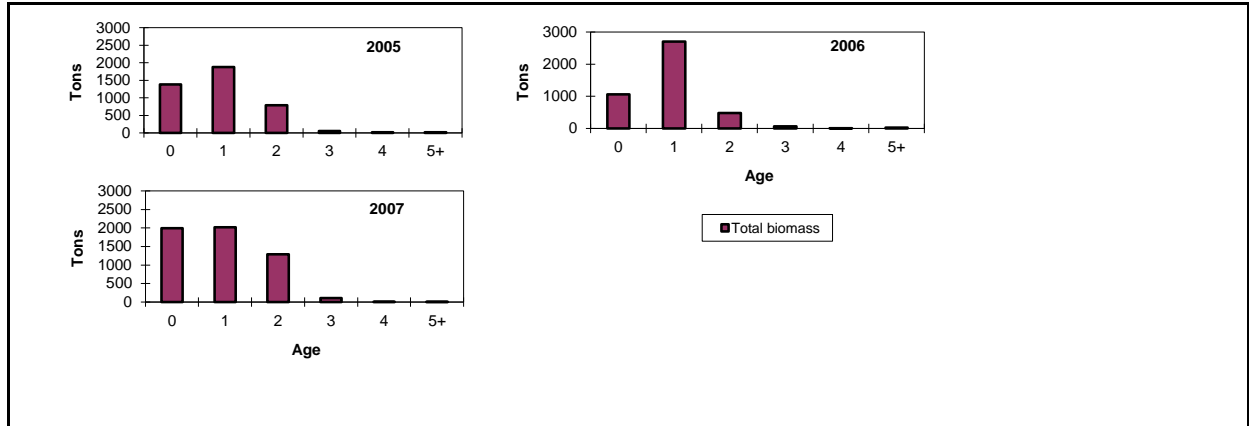
Sheet A3
Indirect methods: VPA results

Code: SOL1708G.

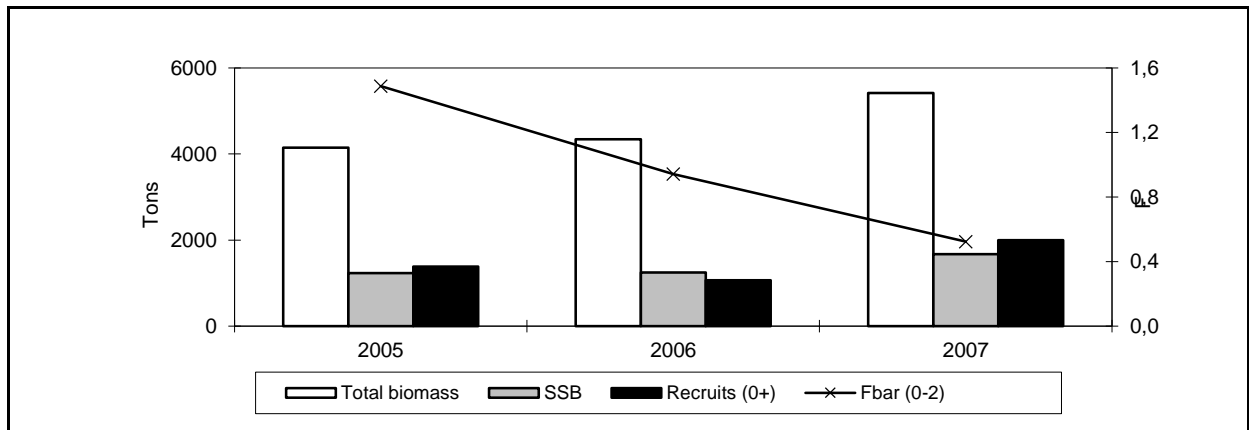
#REF!

Sex*	Both	Gear*	3	Analysis #*	SVPA
------	------	-------	---	-------------	------

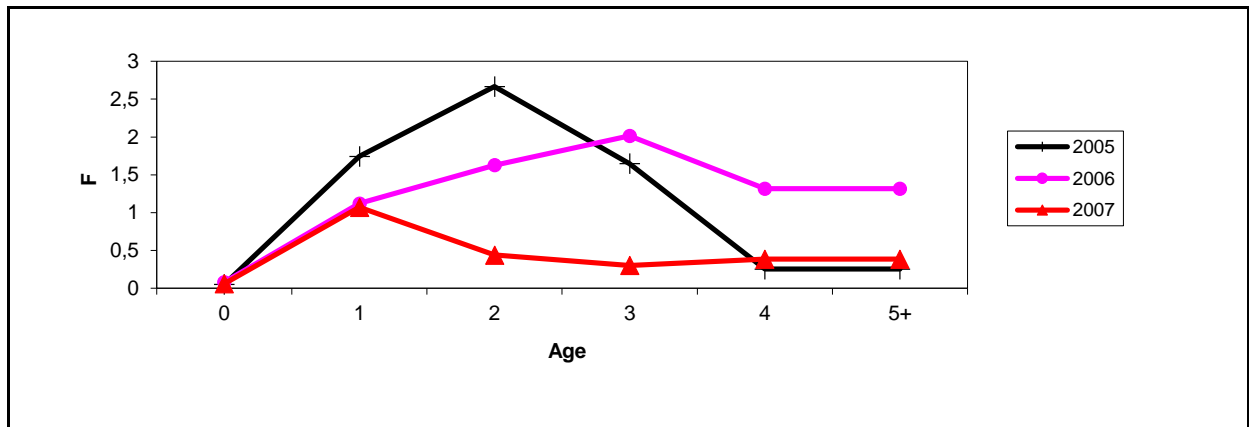
Population in figures



Population in biomass



Fishing mortality rates



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

		Code: SOL1708G.	
Sex	Both	Analysis #	Y/R

# of gears	3	Software	Yield 1.0
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Parameters used

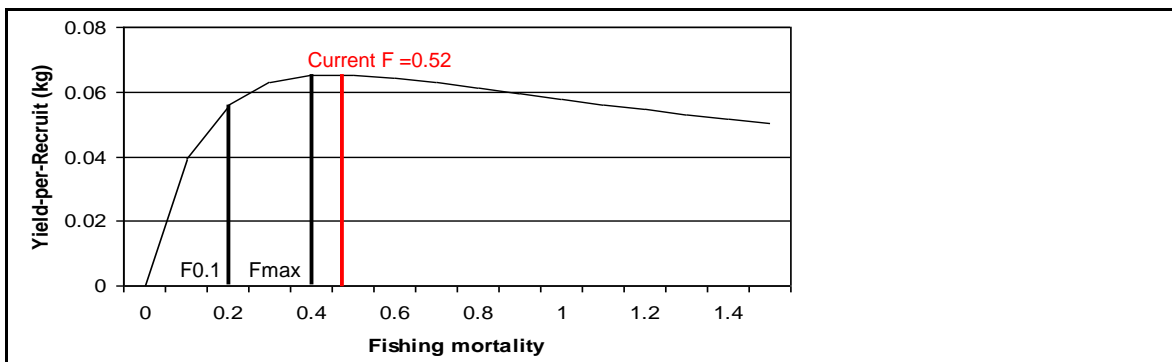
Vector F	
Vector M	Age 0: 0.9; Age 1: 0.3; Age 2: 0.3; Age 3: 0.2; Age 4: 0.2; Age 5+: 0.2
Vector N	
VBGE - L/W	Linf: 39.6 cm, K: 0.44, t0: -0.46; a: 0.007, b: 3.0638;
SRR - Maturity - Capture	Beverton-Holt model (CV: 0.31), Steepness: 0.9 (Pilling <i>et al.</i> 2008) Age maturity: 1.5; Age first capture: 0.7

Model characteristics

Results

	Total	Gear			
Current Y/R	0,065				
Maximum Y/R	0,065				
Y/R 0.1	0,060				
F _{max}	0,460				
F _{0.1}	0,260				
Current B/R	0,133				
Maximum B/R	0,150				
B/R 0.1	0,242				

Comments



Comments

The Y/R analysis applied with the age at first capture of 0.7 (around 16 cm TL) showed that an Fbar value of 0.52 is still higher than Fmax (0.46) and that the resource is fully exploited/overexploited. Taking into account that the exploitation is mainly orientated towards juveniles and the success of recruitment is strictly related to environmental conditions, a high risk of stock depletion might exist in the case of both unsustainable level of fishing effort and scarce recruitment.

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

Assessment form

Sheet D
Diagnosis

Code: SOL1708G.

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	5419	t			from VPA
SSB	1673	t			from VPA
F	0,52		0.46*		from VPA and Y/R (*Fmax)
Y					
CPUE					

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

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

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

Comments

Analytical results and survey indexes showed similar patterns for total biomass, SSB and recruits. The total biomass and SSB remained practically constant from 2005 to 2007, while a low recruitment occurred in 2006. The SSB pattern over the three years is likely related to the fact that the main spawning area (north-eastern Adriatic Sea) is only partially exploited by both the Italian rapido trawlers and the Croatian set netters.

Fbar estimated for the most exploited age classes (0+, 1, 2) decreased in the three years reaching the minimum of 0.52 in 2007. This Fbar pattern was due to a decrease of the fishing effort by the main Italian rapido trawl fleets in GSA 17 in terms of both number of vessels and fishing time, as well as to the switching of rapido trawlers towards other resources (e.g. gastropods and bivalves).

More than 40% of landed soles, corresponding to about 20% of landed biomass, have a TL < 20 cm (Minimum Landing Size; EC 1967/2006). Therefore, the Y/R analysis applied with the age at first capture of 0.7 (around 16 cm TL) showed that an Fbar value of 0.52 is still higher than Fmax (0.46) and that the resource is fully exploited/overexploited.

Taking into account that the exploitation is mainly orientated towards juveniles and the success of recruitment seems to be related to environmental conditions, a high risk of stock depletion might exist in the case of both unsustainable level of fishing effort and scarce recruitment.

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

Assessment form

Sheet Z

Objectives and recommendations

Code: SOL1708G.

Management advice and recommendations*

- A further reduction at least of 10% to reach the F_{max} and around 50% to reach $F_{0.1}$ of the ' fishing pressure applied by rapido trawlers (in terms of number of vessels and/or fishing time) would be recommended.
- A two-months closure for rapido trawling inside 6 nm offshore along the Italian coast, after the biological fishing stop (August), would be advisable to reduce the portion of undersized specimens (mainly YOY);
- Despite of the mesh opening used by the Italian rapido trawlers is larger (48 mm or more) than the legal one, the catches usually include a noticeable portion of undersized specimens. As no specific studies on rapido trawl selectivity are available at present, it is not sure that the adoption of a larger mesh size could correspond to a decrease of illegal catches.
- The safeguard of spawning areas (both in spatial and temporal terms) to prevent a possible future exploitation might be crucial for the sustainability of the Adriatic sole stock.
- A set of specific rules for rapido trawl fishery would be advisable (e.g.: size and number of gears, mesh size, towing speed).

Advice for scientific research*

Scientific investigations aimed to assess and increase rapido trawl selectivity considering the following technical aspects: mesh size, mesh shape, towing speed, etc.

Abstract for SCSA reporting

Authors

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Year

2008

Species Scientific name

Solea vulgaris - SOL

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area

17 - Northern Adriatic

Fisheries (brief description of the fishery)*

Sole (*Solea solea*) is one of most important target species of rapido trawl and set net fleets in GSA 17. The stock is shared between the Adriatic countries (Italy, Croatia and Slovenia). The Italian fleets exploit this resource with rapido trawl and set nets (gill nets and trammel nets), while only trammel net is used in the countries of the eastern coast. More than 90% of catches come from the Italian side.

Landings fluctuated between 1,000 and 2,300 t in the period 1996-2006 (data source: FAO-FishStat and IREPA-SISTAN time series).

The fishing effort applied by the Italian rapido trawlers gradually increased from 1996 to 2005, and slightly decreased in the last years.

Source of management advice*

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

The assessment of sole stock was performed for the period 2005-2007 by means of VPA Separable tuned with CPUEs from commercial fleets and abundant indexes from rapido trawl surveys.

Abundance and biomass indexes from rapido trawl surveys were computed using ATrIS software (Gramolini et al., 2005) which also allowed drawing GIS maps of the spatial distribution of the stock, of spawning females and of juveniles. Underestimation of small specimens in catches due to the gear selectivity was corrected using the selectivity parameters given by Ferretti and Frogia (1975).

VPA flow was processed by means of an Excel spreadsheet using catch-at-age from commercial landings, assuming a natural mortality vector (Ma) from Caddy's method (1991) (PROBIOM Excel spreadsheet; Caddy and Abella, 1999) and abundance-at-age (start year) from survey data. Yield-per-recruit (Y/R) analysis (Yield version 1.0, MRAG: Branch et al., 2000) was applied to estimate the reference points.

Stock Status*

O - Overexploited. The fishery is being exploited at above a level which is believed to be sustainable in the long term, with no potential room for further expansion and a higher risk of stock depletion/collapse;

Exploitation rate

High fishing mortality

Stock abundance

Low abundance

Comments

Analytical results and survey indexes showed similar patterns for total biomass, SSB and recruits. The total biomass and SSB remained practically constant from 2005 to 2007, while a low recruitment occurred in 2006. The SSB pattern over the three years is likely related to the fact that the main spawning area (north-eastern Adriatic Sea) is only partially exploited by both the Italian rapido trawlers and the Croatian set netters.

Fbar estimated for the most exploited age classes (0+, 1, 2) decreased in the three years reaching the minimum of 0.52 in 2007. This Fbar pattern was due to a decrease of the fishing effort by the main Italian rapido trawl fleets in GSA 17 in terms of both number of vessels and fishing time, as well as to the switching of rapido trawlers towards other resources (e.g. gastropods and bivalves).

More than 40% of landed soles, corresponding to about 20% of landed biomass, have a TL < 20 cm (Minimum Landing Size; EC 1967/2006). Therefore, the Y/R analysis applied with the age at first capture of 0.7 (around 16 cm TL) showed that an Fbar value of 0.52 is still higher than Fmax (0.46) and that the resource is fully exploited/overexploited. Taking into account that the exploitation is mainly orientated towards juveniles and the success of recruitment seems to be related to environmental conditions, a high risk of stock depletion might exist in the case of both unsustainable level of fishing effort and scarce recruitment.

Management advice and recommendations*

- A further reduction at least of 10% to reach the F_{max} and around 50% to reach $F_{0.1}$ of the ' fishing pressure applied by rapido trawlers (in terms of number of vessels and/or fishing time) would be recommended.
- A two-months closure for rapido trawling inside 6 nm offshore along the Italian coast, after the biological fishing stop (August), would be advisable to reduce the portion of undersized specimens (mainly YOY);
- Despite of the mesh opening used by the Italian rapido trawlers is larger (48 mm or more) than the legal one, the catches usually include a noticeable portion of undersized specimens. As no specific studies on rapido trawl selectivity are available at present, it is not sure that the adoption of a larger mesh size could correspond to a decrease of illegal catches.
- The safeguard of spawning areas (both in spatial and temporal terms) to prevent a possible future exploitation might be crucial for the sustainability of the Adriatic sole stock.
- A set of specific rules for rapido trawl fishery would be advisable (e.g.: size and number of gears, mesh size, towing speed).

Advice for scientific research*

Scientific investigations aimed to assess and increase rapido trawl selectivity considering the following technical aspects: mesh size, mesh shape, towing speed, etc.

Assessment of Common sole (*Solea vulgaris* - SOL) from 17 - Northern Adriatic. G. Fabi*, O. Giovanardi**, F. Grati*, I. Isajlović***, D. Pehar****, P. Polidori*, S. Raicevich**, G. Scarcella*, N. Vrgoč***

Description of fishery: Sole (*Solea solea*) is one of most important target species of rapido trawl and set net fleets in GSA 17. The stock is shared between the Adriatic countries (Italy, Croatia and Slovenia). The Italian fleets exploit this resource with rapido trawl and set nets (gill nets and trammel nets), while only trammel net is used in the countries of the eastern coast. More than 90% of catches come from the Italian side.

Landings fluctuated between 1,000 and 2,300 t in the period 1996-2006 (data source: FAO-FishStat and IREPA-SISTAN time series).

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Yield-per-recruit (Y/R) analysis (Yield version 1.0, MRAG: Branch et al., 2000) was applied to estimate

Exploitation rate: High fishing mortality

Stock abundance: Low abundance

Comments: Analytical results and survey indexes showed similar patterns for total biomass, SSB and recruits. The total biomass and SSB remained practically constant from 2005 to 2007, while a low recruitment occurred in 2006. The SSB pattern over the three years is likely related to the fact that the main spawning area (north-eastern Adriatic Sea) is only partially exploited by both the Italian rapido trawlers and the Croatian set netters.

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Management advice and recommendation: - A further reduction at least of 10% to reach the F_{max} and around 50% to reach $F_{0.1}$ of the ' fishing pressure applied by rapido trawlers (in terms of number of vessels and/or fishing time) would be recommended.

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