SAC GFCM
Sub-Committee on Stock Assessment

Date*	**25**	**November**	**2009**	**Code***	**PIL1709Doc**

Authors*

Document prepared by the AdriaMed working group for small pelagics coordinated by Santojanni A. and Cingolani N.
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Species Scientific name*

1 ***Sardina pilchardus - PIL***
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

Northern and central Adriatic Sea (southern limit: Gargano Promontory).

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**

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Species Scientific name*	Sardina pilchardus - PIL	Species common name*	Sardine

Data Source

GSA*	17 - Northern Adriatic	Period of time*	1975-2008

Description of the analysis

Type of data*	Catch at age and abundance index for tuning.	Data source*	
Method of assessment*	Virtual Population Analysis (VPA) with Laurec-Shepherd tuning.	Software used*	Darby C.D., Flatman S. 1994.

Sheets filled out

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

Comments, bibliography, etc.

Patterson K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Review of Fish Biology and Fisheries, 2: 321-338.

Gislason H., N. Daan, J.C. Rice, J.G. Pope. 2008. Does natural mortality depend on individual size? ICES CM 2008/F:16.

Cardinale M., A. Abella, V. Bartolino, F. Colloca, J.M. Bellido, A. Di Natale, J.L. Bigot, F. Fiorentino, M. Garcia Rodriguez, M. Giannoulaki, G. Petrakis, L. Gil de Sola, G. Pilling, P. Martin, L.F. Quintanilla, M. Murenu, G.C. Osio, A. Santojanni, P. Sartor, M.T. Spedicato, V. Ticina, H.J. Rätz, A. Cheilari. 2008. Report of the SGMED-08-04 Working group on the Mediterranean, Part IV. Editors: Cardinale M., H.J. Rätz, A. Cheilari. EUR - Scientific and Technical Research Series. 728 pp.

Santojanni A. 2009. Comments on “Is anchovy (Engraulis encrasicolus, L.) overfished in the Adriatic Sea?” by Klanjscek and Legovic [Ecol. Model. 201 (2007): 312-316]. Ecological Modelling, 220: 430-433.

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

Code: PIL1709Doc

Biology

Somatic magnitude measured (LH, LC, etc)*	Total length.	Units*	cm

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed					Reproduction season	
Size at first maturity					Reproduction areas	
Recruitment size					Nursery areas	

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞					
	K					
	t0					
	Data source					
Length weight relationship	a					
	b					
	M					

sex ratio (mal/fem)	

Comments

M at age (in years) estimated by Gislason's method:

Age	M
0	0.75
1	0.68
2	0.58
3	0.53
4	0.49
5	0.47
6	0.43
7	0.42
8	0.42
9	0.41

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Assessment form

Sheet P1
General information about the fishery

Code: PIL1709Doc

Data source*		Year (s)*	1975-2008
Data aggregation (by year, average figures between years, etc.)*	Catch data are relative to the total fleet (Italy, Croatia, Slovenia).		

Fleet and catches (please state units)

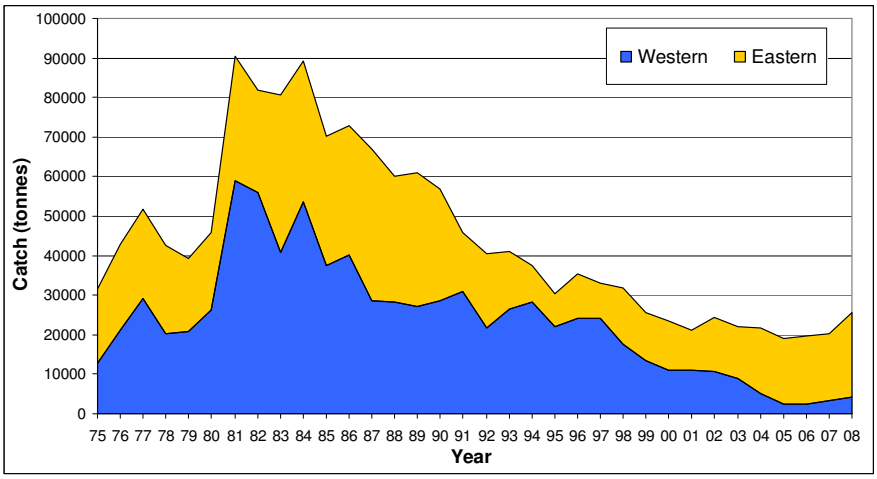
	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*						
Operational Unit 2						
Operational Unit 3						
Operational Unit 4						
Operational Unit 5						

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
Total							

Legal minimum size	

Comments

Fishery: mid-water trawlers and purse seiners.



Total catch for both western and eastern sides of Adriatic.

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Assessment form

Sheet A1
Indirect methods: VPA, LCA

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Sex*	M+F

Analysis # *	VPA

Time series

Data	Size	Age
(mark with X)		x

Model	Cohorts	Pseudocohorts
(mark with X)	x	

Equation used		Tunig method	Laurec-Shepherd
# of gears		Software	Darby C.D., Flatman S. 1994.
$F_{terminal}$			

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment		
Average			Average population		
Maximum			Virgin population		
Critical			Turnover		

Average mortality

		Gear					
	Total						
F_1							
F_2							
Z							

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

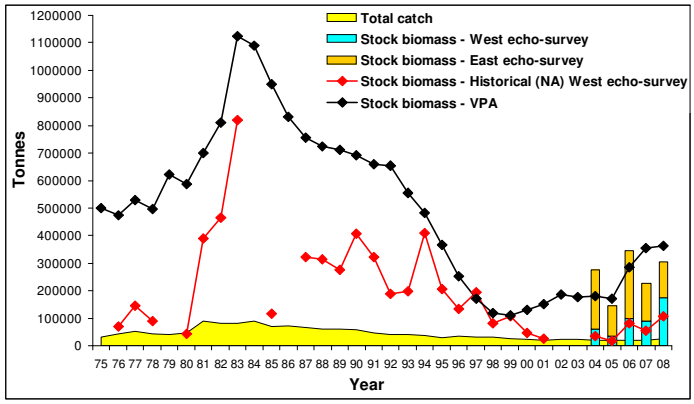
Comments

Tuning on abundance (number) at age derived from echo-surveys carried out in both western and eastern sides of Adriatic (since year 2004).

Sex*		Gear*		Analysis #*	

Population in figures

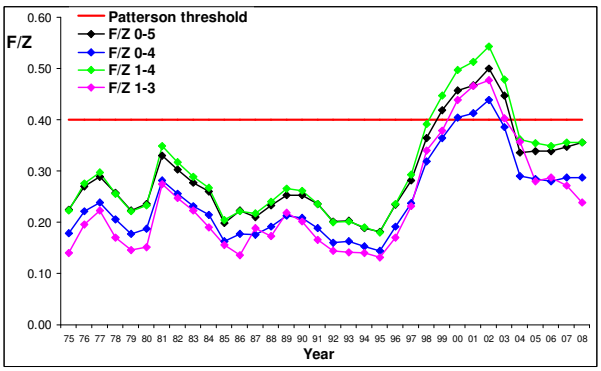
Population in biomass



Fishing mortality rates

	1975 - 08	1999 - 08	2006 - 08
Age 0	0.01	0.01	0.01
Age 1	0.07	0.09	0.03
Age 2	0.22	0.41	0.19
Age 3	0.4	0.8	0.57
Age 4	0.55	0.89	0.83
Age 5	0.62	1.1	0.91
Age 6+	0.62	1.1	0.91

Average fishing mortality at age for three different time intervals from VPA.



Exploitation rate F/Z over years from VPA.

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Assessment form	**Sheet D** **Diagnosis**

Code: PIL1709Doc

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB					
F					
Y					
CPUE					
F/Z					

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

Unidimensional

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

Bidimensional

Exploitation rate

☐	No or low fishing
☐	Moderate fishing
☐	High fishing mortality
☐	Uncertain / Not assessed

Stock abundance

☐	Virgin or high abundance
☐	Intermediate abundance
☐	Low abundance

☐	Depleted
☐	Uncertain / Not assessed

Management advice and recommendations*

The recent exploitation rate F/Z is under the Patterson's threshold 0.4. However, this pattern is less evident than in the case of anchovy (see ad hoc form) and, what is more, the values of F/Z were around/over the threshold in the time interval 1999-2003. In particular, since the end of the 1990s, the values of F were estimated as quite high for the oldest age classes. Thus, the sardine stock could be considered as fully exploited.
In addition, a strong decline of stock biomass occurred after the peak in the first half of the 1980s. This decline was continuous till the end of the 1990s. Then, a partial recovery was observed. Finally, in comparison with previous assessments, more conservative natural mortality rates (i.e. M = 0.5 for all age classes) were not used in the present analysis.
It should be noted that Adriatic small pelagic fishery is multispecies and effort on anchovy cannot be separated from effort on sardine, so that most of the management decisions should be taken considering both species.
In conclusion, it is recommended not to increase the fishing effort in next future.