SAC GFCM
Sub-Committee on Stock Assessment

Date*	25	November	2009	Code*	ANE1709Doc

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 ***Engraulis encrasicolus - ANE***
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*	Engraulis encrasicolus - ANE	Species common name*	Anchovy

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**

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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					x
	sex ratio (mal/fem)					

Comments

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

Age	M
0	1.02
1	0.82
2	0.67
3	0.57
4	0.54

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Assessment form

Sheet P1

General information about the fishery

Code: ANE1709Doc

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). Split-year was used assuming the first of June as the birth date of anchovy, e.g. split-year 2008 was formed by Jun-Dec of 2007 and Jan-May 2008.		

Fleet and catches (please state units)

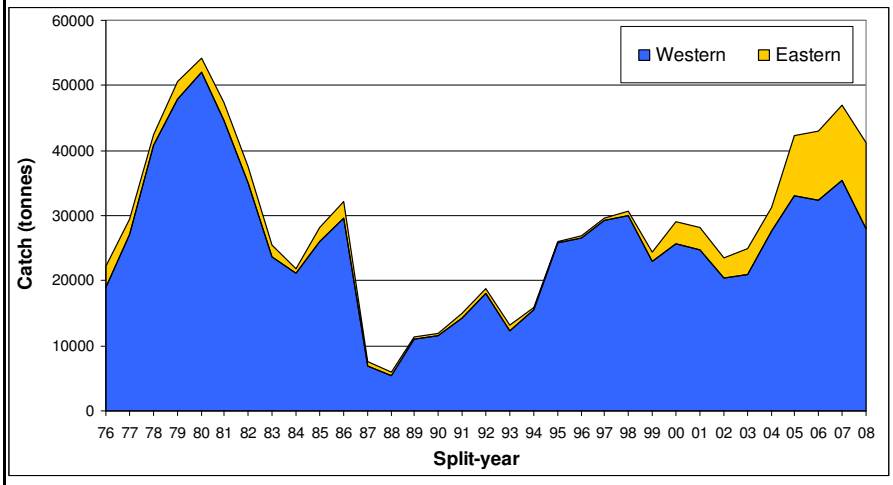
	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*						
Operational Unit 2						
Operational Unit 3						
Operational Unit 4						
Operational Unit 5						

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

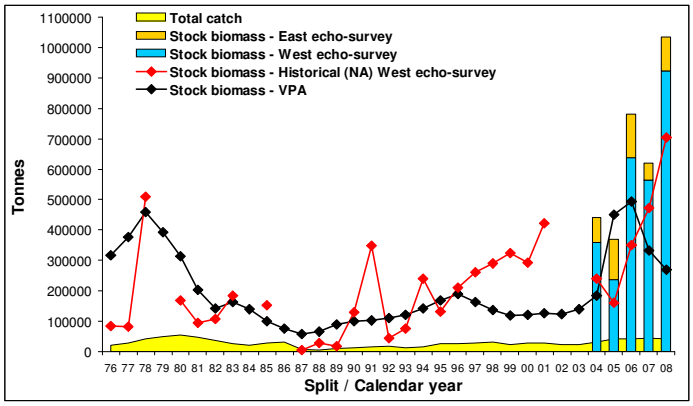
Tuning on abundance (number) at age derived from echo-surveys carried out in both western and eastern sides of Adriatic (since year 2004).

Sex*		Gear*		Analysis #*	

Population in figures

Population in biomass

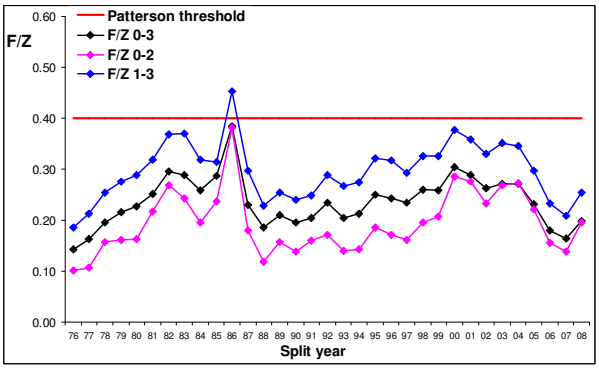
Echo-survey data are on calendar year basis, i.e. split year commercial data (e.g. catch at age) in 2008 are associated to echo-survey in 2007.



Fishing mortality rates

	1976 - 2008	1999 - 2008	2006 - 2008
Age 0	0.06	0.05	0.03
Age 1	0.24	0.3	0.14
Age 2	0.32	0.41	0.32
Age 3	0.34	0.25	0.17
Age 4+	0.34	0.25	0.17

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**

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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

Code: ANE1709Doc

Management advice and recommendations*

The recent exploitation rate F/Z is well under the Patterson's threshold 0.4. Thus, anchovy stock could be considered as moderately exploited.
However, strong changes over time are commonly observed in the abundance of small pelagics, in particular anchovies (Jacobson et al., 2001). In the past, the biomass of this stock dropped at very low level in 1987 with consequent crisis of Italian fishery. After this collapse, recovery took place, but fluctuations still occured, in particular in recent years. Moreover, an increase was observed in the total catch of most recent years. Finally, in comparison with previous assessments, precautionary natural mortality rates (i.e. M = 0.6 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.