

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

Assessment form

Sheet #0

Basic data on the assessment

Code: ANE1709Doc

Date*	25	Nov	2009	Authors*	Document prepared by the AdriaMed working group for small pelagics coordinated by Santojanni A. and Cingolani N. Acknowledgements: Leonori I., Belardinelli A., Campanella F.,
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Species Scientific name*	Engraulis encrasicolus - ANE	Species common name*	Anchovy
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Data Source

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

		Units	Sex			
			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	1.02
1	0.82
2	0.67
3	0.57
4	0.54

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Sheet P1

General information about the fishery

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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.	

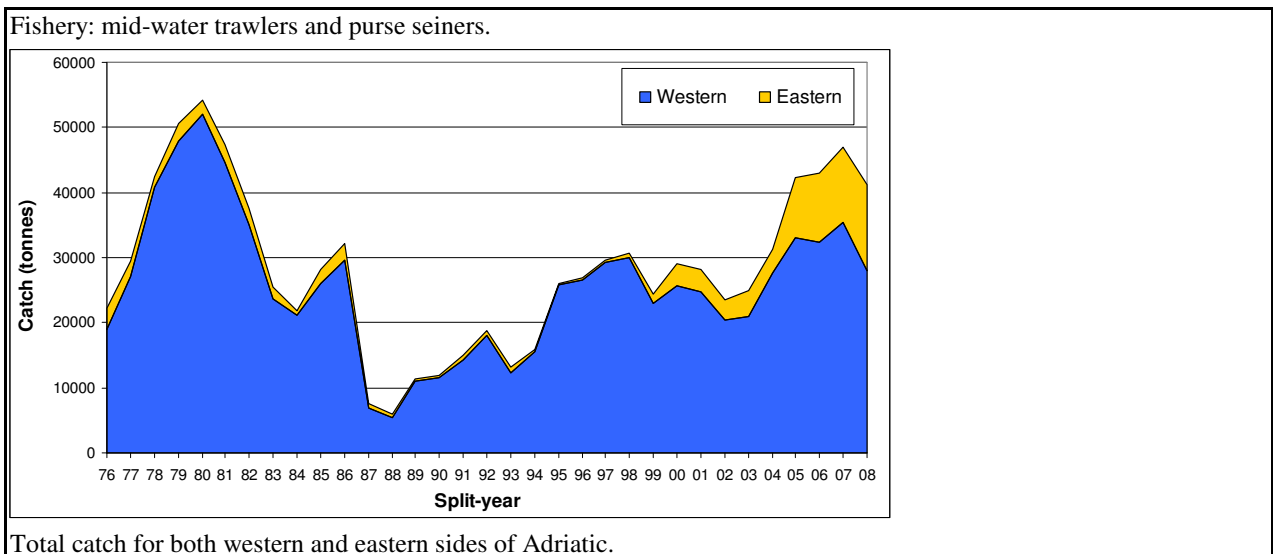
Fleet and catches (please state units)

	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



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Sheet A1
Indirect methods: VPA, LCA

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Sex*	M+F
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Analysis # *	VPA
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Time series

Data	Size	Age
(mark with X)		x

Model	Cohorts	Pseudocohorts
(mark with X)	x	

Equation used		Tuning 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

	Total	Gear					
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).

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Sheet A2
Indirect methods: data

Code: ANE1709Doc

Sex*	M+F	Gear*	mid-water trawlers and purse seiners.	Analysis # *	VPA
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Data	
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Data

Total catch at age (thousands).					
Year	Age 0	Age 1	Age 2	Age 3	Age 4+
1976	296014	684525	479128	221123	83386
1977	362613	768044	587229	339058	190335
1978	628953	#####	843579	418839	200995
1979	962588	#####	#####	376752	117138
1980	594469	#####	#####	594943	270254
1981	460071	#####	#####	599822	298850
1982	580706	#####	735865	392440	186567
1983	537655	718526	413483	211614	91908
1984	585410	624890	285204	137428	50371
1985	901813	798869	277480	121516	28871
1986	498759	632321	403491	264432	106788
1987	112751	105658	77411	72451	44108
1988	311206	116528	48572	27536	9123
1989	523045	277745	110195	40420	7359
1990	402747	268284	140591	70467	16043
1991	385454	369786	175478	88537	36216
1992	487245	309062	183829	151301	110515
1993	146572	305848	152144	114844	105160
1994	340237	476047	177820	108996	64777
1995	421086	891461	316810	154853	78549
1996	217444	833926	377616	197698	111015
1997	499981	751037	305271	245609	158403
1998	469956	746205	360614	270839	167498
1999	413504	618928	303249	225742	96053
2000	798312	898713	418008	115150	8889
2001	745798	#####	352311	74832	3694
2002	467090	864966	331765	73681	6934
2003	399291	#####	379119	76032	4771
2004	#####	#####	309451	71177	8043
2005	#####	#####	504785	47633	5382
2006	679595	#####	812586	83553	254
2007	373717	#####	#####	173514	621
2008	575585	931502	#####	382267	47452

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Sheet A3

Indirect methods: VPA results

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Sex*	M+F	Gear*	mid-water trawlers and purse seiners.	Analysis #*	VPA
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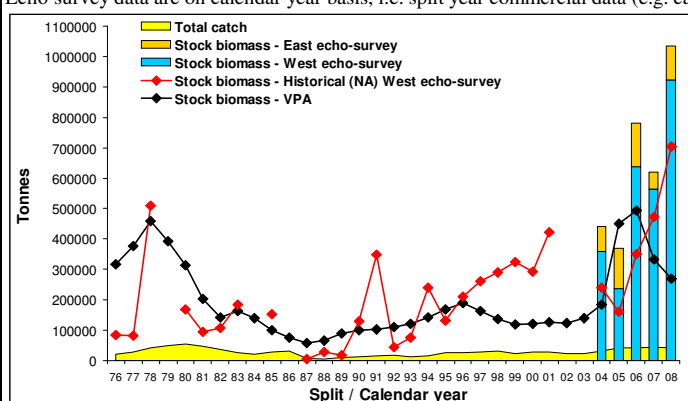
Population in figures

Number of fish at sea (* 10⁻⁴).

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	1E+06	1E+06	1E+06	1E+06	1E+06	1E+06	2E+06	3E+06	7E+06	5E+06	2E+06	3E+06
1	610623	441241	391607	393565	468165	456049	410569	673211	1E+06	2E+06	2E+06	684606
2	222560	221099	147068	133217	116845	142284	146209	108088	190298	377171	912819	660263
3	84058	92694	88164	54342	39674	35741	49990	48814	34149	62778	137013	357484
4+	53540	56615	37042	4141	1933	3320	3096	5444	3808	188	484	43791

Population in biomass

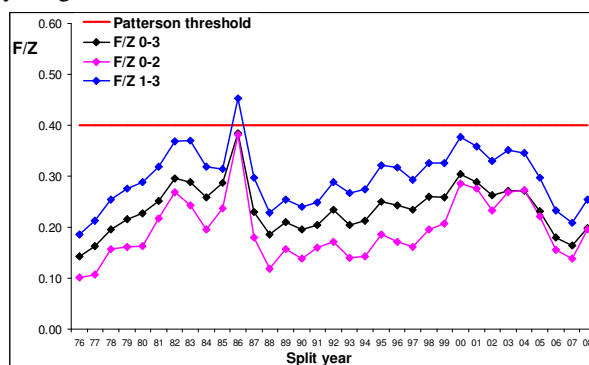
Echo-survey data are on calendar year basis, i.e. split year commercial data (e.g. catch at age) in 2008 are associated to echo-survey in 2007.



Fishing mortality rates

	1976 - 2008	1999 - 2008	2006 - 2008
Age 0	0.06	0.05	0.03
Age 1	0.24	0.30	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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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	<input type="checkbox"/>	? - (or blank) Not known or uncertain. Not much information is available to make a judgment;
	<input type="checkbox"/>	U - Underexploited, undeveloped or new fishery. Believed to have a significant potential for expansion in total production;
	<input type="checkbox"/>	M - Moderately exploited, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;
	<input type="checkbox"/>	F - Fully exploited. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;
	<input type="checkbox"/>	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="checkbox"/>	D - Depleted. Catches are well below historical levels, irrespective of the amount of fishing effort exerted;
	<input type="checkbox"/>	R - Recovering. Catches are again increasing after having been depleted or a collapse from a previous;

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

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Sheet Z

Objectives and recommendations

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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 occurred, 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.

Advice for scientific research*

To use more extensively Integrated Catch Analysis (ICA); at the present time trials were done.