SAC GFCM
Sub-Committee on Stock Assessment

Date*	**17**	**October**	**2011**	**Code***	**ANE1811Leo**

Authors*

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Species Scientific name*

1 *Engraulis encrasicolus* - *ANE*
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

Adriatic Sea

Geographical Sub-Area (GSA)*

18 - Southern Adriatic Sea

Combination of GSAs
1
2
3

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Assessment form

Sheet #0

Basic data on the assessment

Code: ANE1811Leo

Date*	17	Oct	2011	Authors*	Leonori I., De Felice A., Biagiotti I., Canduci G. - 1 Mandic M., Pesic A., Joksimovic A., Regner S. - 2 Kolitari J. - 3

Species Scientific name*	Engraulis encrasicolus - ANE	Species common name*	European anchovy

Data Source

GSA*	18 - Southern Adriatic Sea	Period of time*	1987-2010

Description of the analysis

Type of data*	Biomass estimation by acoustic methodology and by DEPM	Data source*	Acoustic surveys (1987-2010) in west GSA 18 and (2002-2010) in east GSA 18; DEPM surveys data in east GSA 18 (2005,
Method of assessment*	Acoustics, DEPM	Software used*	SURFER Golden Software 8, Myriax Echoview 4, ESRI Arcview 3.2

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	---	---	---	---	---	---	---	---	3	1	1	---

Comments, bibliography, etc.

Direct biomass estimations through acoustic surveys financed by Italian Ministry for Agriculture and Forestry Policies and by EU (1987-2011) in west GSA 18. In 2010 and 2011 also DEPM survey was made in west GSA 18 (FAO Adriamed project). 2011 data are not yet available.

Direct biomass estimations through acoustic and eggs and larvae surveys in the framework of AdriaMed Project (2002, 2004, 2005,2008, 2010 and 2011) in east GSA 18

? Cooperative work between ISMAR scientific team, IBMK and University of Tirana:

Data available in east GSA 18

- 2002 – acoustic biomass estimation (MNE)
- 2004 – acoustic biomass estimation (MNE)
- 2005 – acoustic and DEPM biomass estimations (MNE)
- 2008 – acoustic and DEPM biomass estimations (MNE - ALB)
- 2010 – acoustic and DEPM biomass estimations (MNE - ALB)

Comments, bibliography, etc.

Hunter, J. R. and B. J. Macewicz (1985). Measurement of spawning frequency in multiple spawning fishes. In: Lasker, R. (ed.): An egg production method for estimating spawning biomass of pelagic fish: application to the northern anchovy, Engraulis mordax. NOAA Technical Rep., NMFS 36: 79-93.

Hunter, J.R., N.C.H. Lo & R.J.H. Leong (1985). Batch fecundity in Multiple Spawning Fishes. In: Lasker, R. (ed), An Egg Production Method for Estimating Spawning Biomass of Pelagic Fish: Application to the Nothern Anchovy, Engraulis mordax, NOAA Tech. Rep. NMFS, 36: 67-77.

Parker, K. (1980): A direct method for estimating northern anchovy, Engraulis mordax, spawning biomass. Fish. Bull. U. S., 78: 541-544.

Regner, S. 1985: Ecology of planktonic stages of the anchovy, Engraulis encrasicolus (Linnaeus, 1758), in the central Adriatic. Acta Adriat., 26(1), Series Monographiae, 1:1-113p

Regner, S. 1996: Effects of environmental changes on early stages and reproduction of anchovy in the Adriatic Sea. Sci. Mar., 60 (Supl.2): 167-177

Azzali M., De Felice A., Cosimi G., Luna M., Parmiggiani F. (2002): The state of the Adriatic Sea centered on the small pelagic fish populations. P.S.Z.N.: Marine Ecology, 23, Supplement 1, 78-91

Leonori I., Azzali M., De Felice A., Parmiggiani F., Marini M., Grilli F., Gramolini R., (2009): Small pelagic fish biomass in relation to environmental parameters in the Adriatic Sea. Proceedings of Joint AIOL-SItE Meeting 2007, Ancona

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

Code: ANE1811Leo

Biology

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

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed					Reproduction season	spring-summer
Size at first maturity					Reproduction areas	continental shelf
Recruitment size					Nursery areas	continental shelf

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞					
	K					
	t0					
	Data source					
Length weight relationship	a				0.00177	
	b				3.51514	
	M					

sex ratio (mal/fem)	0.99507

Comments

Parameters a, b related to length-weight relationship and sex ratio reported here are derived from samples collected during the acoustic survey 2010.

Comments

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Assessment form

Sheet P1

General information about the fishery

Code: ANE1811Leo

Data source*	ISTAT (1987-2003), IREPA (2004-2010) for Italy	Year (s)*	1987-2010

Data aggregation (by year, average figures between years, etc.)*	

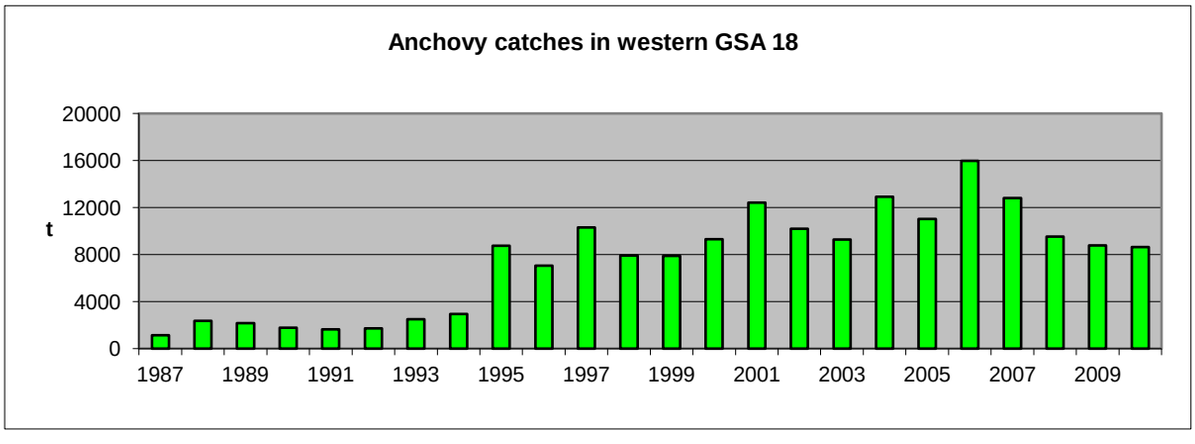
Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	MNE	18	H - Purse Seine (12-24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	ANE
Operational Unit 2	ALB	18	H - Purse Seine (12-24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	ANE
Operational Unit 3	ITA	18	H - Purse Seine (12-24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	ANE
Operational Unit 4	ITA	18	J - Pelagic Trawl (12-24 metres)	03 - Trawls	31 - Small gregarious pelagic	ANE
Operational Unit 5	ITA	18	E - Trawl (12-24 metres)	03 - Trawls	31 - Small gregarious pelagic	ANE

Operational Units*	Fleet (n° of boats)*	Kilos or Tons	Catch (species assessed)	Other species caught	Discards (species assessed)	Discards (other species caught)	Effort units
MNE 18 H 02 31 - ANE	1						
ALB 18 H 02 31 - ANE	5						
ITA 18 H 02 31 - ANE	7						
ITA 18 J 03 31 - ANE	34						
ITA 18 E 03 31 - ANE							
Total	47						

Legal minimum size	9 cm

Comments



Comments

Data source*		OpUnit 1*	MNE 18 H 02 31 - ANE

Regulations in force and degree of observance of regulations

Accompanying species

Anchovy in eastern GSA 18 is targeted mostly by small scale fisheries and to a lesser extent by purse seiners because of the small number of that type of vessels in this area. Fishing grounds are located along the coast, while accompanying species are: *Sardina pilchardus, Atherina hepsetus, Spicara spp., Boops boops, Trachurus mediterraneus, Scomber scombrus, Scomber japonicus*
In the western side anchovy is mainly targeted by purse seines and pelagic trawls; the main accompanying species are practically the same as in the eastern side.

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Assessment form	**Sheet A2** **Indirect methods: data**

Code: ANE1811Leo

Sex*		Gear*		Analysis # *	

Data source	

Data

Other assessment methods

1) One assessment was conducted using Daily Egg Production Method (DEPM).
DEPM model:
The spawning stock biomass estimation is based on the model described by Parker (1980):

B = E/k*Frb*f*R

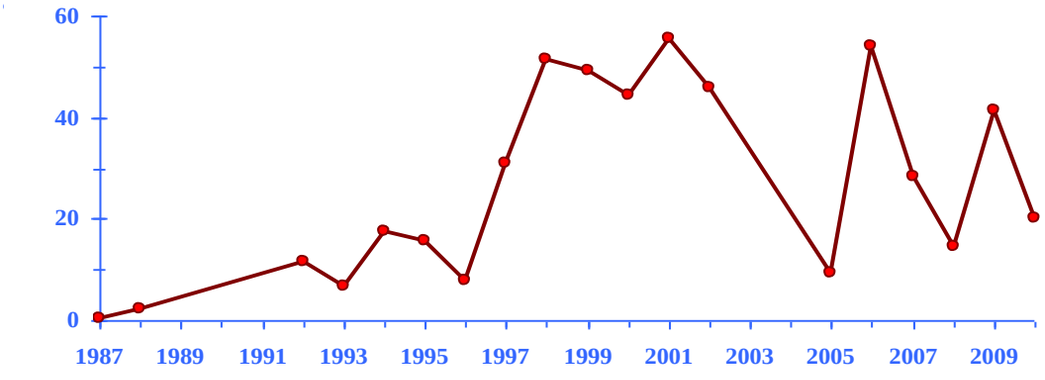
Where:

B = spawning biomass in metric tons
E = number of eggs produced per day over the area surveyed
k = conversion factor from grams to metric tons
Frb = relative batch fecundity
f = spawning frequency
R = sex ratio (fraction of mature females by weight)

2) The second assessment was made by means of acoustic methodology:

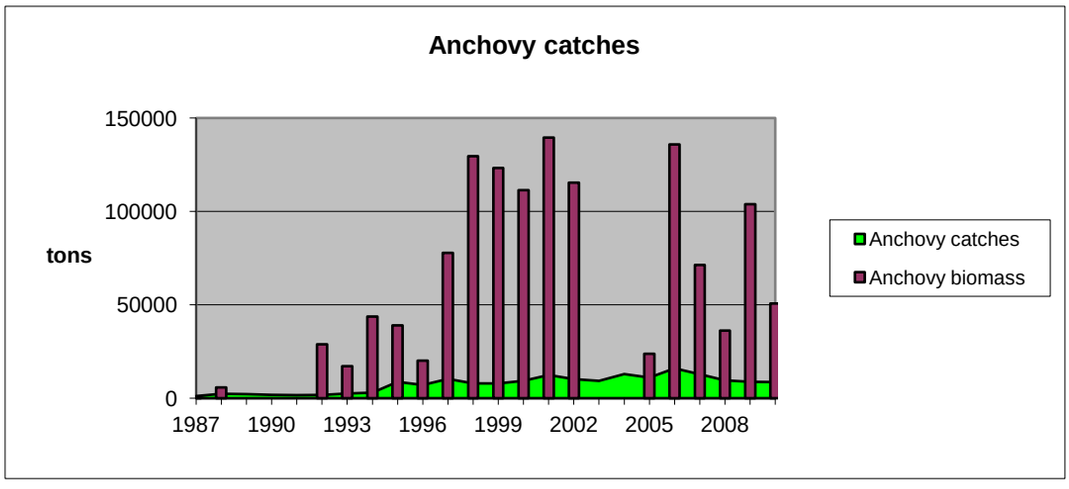
Biomass estimate is derived from the elaboration of acoustic data logged at three frequencies (38, 120 and 200 kHz) to calculate raw density of small pelagic fish in the study area converted into biomass per species on the base of percentage in weight of the different species and their

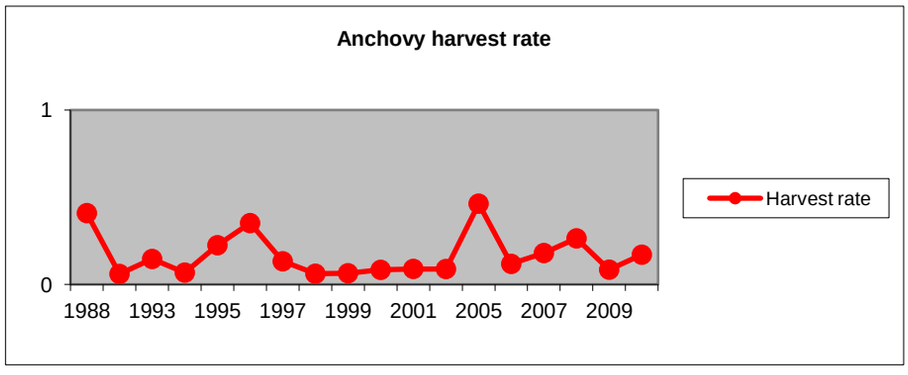
Acoustic estimation of anchovy biomass density trend in western GSA 18



Other assessment methods

Data in the graph (see below) are referred to the western GSA 18; for 2008 and 2010 data refer to western GSA 18 + Albania waters because of availability of both biomass estimation and catches. It is evident a rise in anchovy catches after the crisis of 1987-90. After that catches don't vary much while anchovy biomass show fluctuations. The level of anchovy catches seems sensible to the level of the biomass below a certain threshold and if low levels of biomass persist for 2-3 years at least. The estimation of harvest rate over the historical series is reported in the second figure below. The harvest rate was considered as an estimate of fishing mortality (F). M was considered as 0.82 in agreement with the value used for age class 1 in GSA 17; in fact age class 1 resulted dominant in the years 2009-10 in which samples from acoustic survey were used for age reading purpose. The exploitation rate (E) was calculated by: F/F+M.
It is known that part of the fishing effort is made traditionally in GSA 17; this was supposed to be a systematic error.
Fishery on small pelagic fish in Montenegro and Albania is not very much developed and landings data available are not much.
For this reason this analysis has to be considered for the western side only

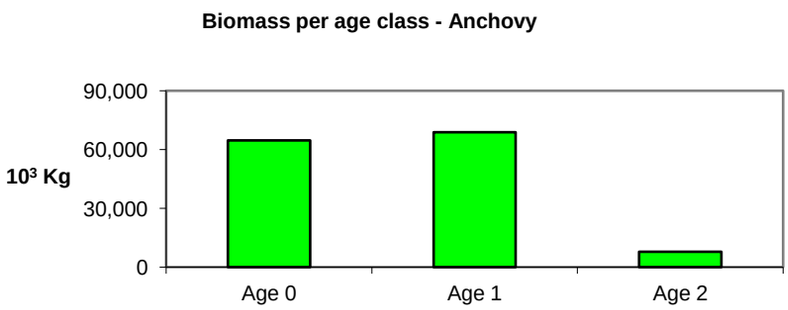




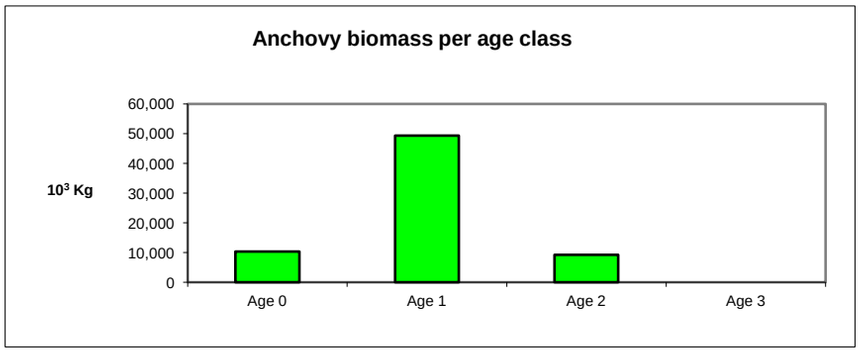
Other assessment methods

Biomass in western GSA 18 for the years 2009 and 2010 are reported in the graphs below. Age class 1 results well represented in both years and is clearly dominant in 2010.

2009



2010



SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet D Diagnosis**

Code: ANE1811Leo

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	63773	tons		decreasir	results are referred to both eastern and western GSA 18 for 2010
SSB	100352	tons		decreasir	results are referred to both eastern and western GSA 18 for 2010
F	0.17				harvest rate of last 4 years has been taken as F estimation
Y					
CPUE					
E	0.17		0.4		M was considered = 0.82, value referred to age class 1 of GSA 17

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

Comments

The trends for anchovy stock biomass between western and eastern GSA 18 (2002-2010) estimated by acoustics are slightly different even considering the fact that there are some holes in the historical series (2003-2004 west, 2003, 2006, 2007, 2009 east). In the western side sardine biomass shows an incresing tendency even with strong fluctuations, while in the eastern side it moderately tends to decrease. DEPM anchovy biomass estimations give higher values respect to acoustics particularly for 2010, but they are coherent in seeing a decrease in anchovy biomass in 2010 respect to 2008 in the eastern side and also in seeing a much higher biomass in the western side respect to the eastern side in 2010.

Code: ANE1811Leo

Management advice and recommendations*

Eastern GSA 18: Due to the fact that there is a lack of consistent fishery effort here the stock could be considered moderately exploited. In any case if an increase in fishing effort is foreseen in eastern GSA 18 for a precautionary approach it has to be introduced slowly and step by step, also due to the fact that biomass estimations through two direct methods indicated a decrease for anchovy stock in 2010.
Western GSA 18: anchovy is targeted mainly by purse seiners and pelagic trawls; fishing effort is bigger than in the eastern side.
The exploitation rate E estimated through the harvest rate over the historical series of biomass estimates by acoustics and the landings data resulted 0.17 (0.4 Patterson's Reference Point), then the stock could be considered moderately exploited also due to the fact that part of the fleet operates in GSA 17.

Advice for scientific research*

There is the need to keep investigation of all GSA 18 using two independent methods simultaneously. Another suggestion is to try to improve the quality and availability of landings data.

Abstract for SCSA reporting

Authors Leonori I., De Felice A., Biagiotti I., Canduci G. - 1
Mandic M., Pesic A., Joksimovic A., Regner S. - 2
Kolitari J. - 3

Year 2011

Species Scientific name Engraulis encrasicolus - ANE

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 18 - Southern Adriatic Sea

Fisheries (brief description of the fishery)*

Italy
Anchovy is exploited by pelagic trawl, purse seine and to a lower level by bottom trawl (bycatch of small pelagics). Highest landings in weight are those of pelagic trawling followed by purse seine. Fishing is carried out five days a week. Exploitation is mainly based on age classes 1 and 2. Purse seiners during most of the fishing season operate in GSA 17. Pelagic trawlers mainly fishing small individuals (bianchetto) are no more allowed to operate.
From official data, the pelagic trawl and purse seine fleet of the geographical sub-area 18 (South-Western Adriatic Sea) is made up by 41 boats, but not all of them are operating all over the year.

Montenegro

Anchovy is targeted mostly by small scale fisheries. Fishing grounds are located along the coast, and also in the Boka Kotorska Bay. In small scale fishery almost all types of nets are used (gillnet, purse seines, trammel net etc. and long lines). With this type of fishery, a lot of economically important fishes are caught but there are no precise data about their amounts.

Albania

At present there are 4 pelagic vessels in Albania which are active for 3 - 5 months during the year. There are three main exploitation areas: Shengjin, Durres and Valona. The catch goes to market or is used by the local conservation industry. There are three conservation industries in Shengjin; most of the product for these industries is imported.

Source of management advice*

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

Data used for anchovy biomass assessment are from the acoustic surveys made in the western side in the period 1987-2010 and in the eastern side in the period 2002-2010, in both areas some years are missing. Data coming from DEPM surveys concern Montenegro (2005) continental shelf, Montenegro and Albania (2008) continental shelf and the entire GSA 18 continental shelf (2010).

For acoustic methodology the analysis was made through echograms interpretation and standard echointegration procedure. Multifrequency comparison and data thresholding were used in order to separate information of small pelagic fish from other unwanted echoes (i.e. plankton echoes). Iormation on the composition by species of the pelagic biomass and the relative distributions were derived from pelagic trawls and used to subdivide total pelagic biomass per species. Conversion of raw density into biomass per species was made using specific Conversion Factors derived from ex situ and in situ experiments. IDW interpolator was used in GIS software for mapping.

For DEP method objective analysis, obtained by KRIGING method was applied for determination of anchovy spawning areas, abundance and horizontal distribution of eggs and larvae, and distribution of environmental factors (especially temperature and salinity).

Stock Status*

M - Moderately exploited, exploited with a low level of fishing effort. Believed to have some limited potential for expansion in total production;

Exploitation rate

Moderate fishing mortality

Stock abundance

Intermediate abundance

Comments

Management advice and recommendations*

Eastern GSA 18: Due to the fact that there is a lack of consistent fishery effort here the stock could be considered moderately exploited. In any case if an increase in fishing effort is foreseen in eastern GSA 18 for a precautionary approach it has to be introduced slowly and step by step, also due to the fact that biomass estimations through two direct methods indicated a decrease for anchovy stock in 2010.
Western GSA 18: anchovy is targeted mainly by purse seiners and pelagic trawls; fishing effort is bigger than in the eastern side.
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Advice for scientific research*

There is the need to keep investigation of all GSA 18 using two independent methods simultaneously. Another suggestion is to try to improve the quality and availability of landings data.