SAC GFCM
Sub-Committee on Stock Assessment

Date*	18	November	2009		Code*	ANE0609Isa

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Species Scientific name*

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

2
Source: -

3
Source: -

Geographical area* GSA6

Geographical Sub-Area (GSA)* 06 - Northern Spain

Combination of GSAs
1
2
3

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Species Scientific name*	Engraulis encrasicolus - ANE	Species common name*	anchovy
			anchoa
			seito

Data Source

GSA*	06 - Northern Spain	Period of time*	2007-2008

Description of the analysis

Type of data*	Spawning Stock Biomass	Data source*	DEPM Project
Method of assessment*	DEPM	Software used*	R

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	2	---	---	---	---	---	---	2	1	1	---

Comments, bibliography, etc.

The spawning stock biomass estimates of anchovy hve been calculated as the ratio of daily production of eggs in the sea and the daily specific fecundity of the adult population, derived from Parker (1980) and Stauffer and Picquelle (1980):

$$B = P/DF = Po·A/R·S·F/W$$

B = spawning stock biomass in metric tons,
P = Total daily egg production in the sampled area
Po = daily egg production per surface unit in the sampled area,
A = survey area, in sampling units,
DF = Daily specific fecundity.
W = average weight of mature females in grams
F = batch fecundity, numbers of eggs spawned per mature female per batch
R = Sex ratio, fraction of population that are mature females, by weight.
S = fraction of mature females spawning per day.

The variance of the biomass estimate is calculated following the delta method (Seber, 1973), as a function of variance and covariance of the estimates of the parameters.

Comments, bibliography, etc.

Garcia, A. and I. Palomera. 1996. Anchovy early life history and its relation to its surrounding environment in the Western Medierranean basin. Scientia Marina, 60(2):155-166.

Palomera, I. 1992. Spawning of anchovy Engraulis encrasicolus, in the North-Western Mediterranean relative to hydrographic features in the region. Marine Ecology Progress Series, 79: 215-223.

Palomera, I. (ed) 1995. Avaluacio de les poblacions de peix blau a la costa catalana el 1994. Final Report of Project DPM Generalitat de Catalunya.

Palomera, I., B. Tejeiro and F. Alemany, 2003. Size at first maturity of the NW Mediterranean anchovy. http://www.icm.csic.es/rec/projectes/scsa/Small_pelagics_2003/Documents/

Palomera, I., and Pertierra, J. P. 1993. Anchovy spawning biomass estimate by the daily egg production method in 1990 in the Western Mediterranean Sea. Scientia Marina, 57: 243-251.

Palomera, I., L. Recasens, P. Libori, I. Alvarez Calleja, B. Molí, N. Bahamon. 2008. Spawning stock biomass of the North Western Mediterranean anchovy in 2007. CGFM Tech, Doc. SCSA_2008 _Anchovy GSA06 GSA07_DEPM.pdf

Parker, K., 1985. Biomass model for the egg production method. In R. Lasker (ed.), An egg production method for estimating spawning biomass of pelagic fish: Application to the northern anchovy, Engraulis mordax, p. 5-7. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 36.

Somarakis, S., Palomera, I., Garcia, A., Quintanilla, L., Koutsikopoulos, C., Uriarte, A., and Motos, L. 2004. Daily egg production of anchovy in European waters. ICES Journal of Marine Science, 61: 944-958.

Stauffer, G. D., and Picquelle, S. J. 1980. Estimates of the 1980 spawning biomass of northern anchovy. NMFS, SFC, La Jolla, California, Administrative Report LJ-80-09, p 41.

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Biology

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

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed					Reproduction season	April to October
Size at first maturity			11 *		Reproduction areas	Ebro Delta Shelf
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				0.004	
	b				3.2025	

M					

sex ratio (mal/fem)	55/45**

Comments

* Size at first maturity obtained during 2002. Gonad analysis was made at microscopic level

** Sex ratio calculated by weight. Differences by year:
   2007: 46/54
   2008: 55/45

Length weight calculated during spawning period

Data source*	ICM Data Base and Official Statistics from the Catalonia Government	Year (s)*	1993-2008
Data aggregation (by year, average figures between years, etc.)*	Year		

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	06	G - Purse Seine (6-12 metres)	02 - Seine Nets	31 - Small gregarious pelagic	ANE
Operational Unit 2	ESP	06	H - Purse Seine (12-24 metres)	02 - Seine Nets	31 - Small gregarious pelagic	ANE
Operational Unit 3	ESP	06	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	ANE
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
ESP 06 G 02 31 - ANE	unknown						
ESP 06 H 02 31 - ANE							
ESP 06 E 03 33 - ANE							
Total							

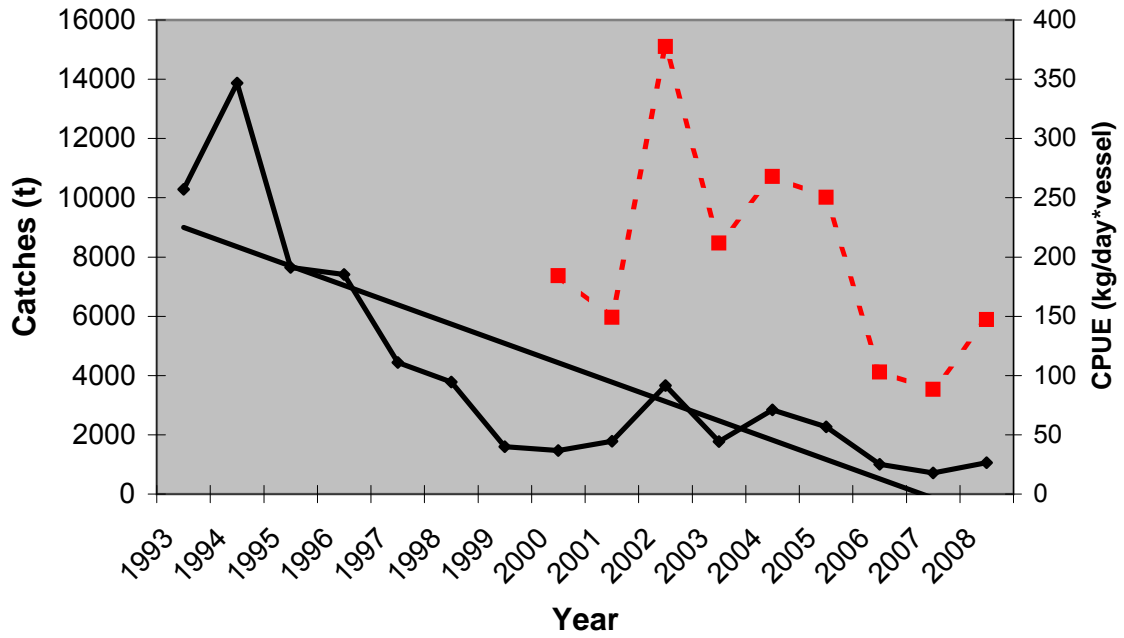| Legal minimum size	9 cm

Comments

Comments

Figure 2. Anchovy landings and CPUE of spanish fleet in catalan harbours of Northern Spain, from Blanes to Sant Carles de la Ràpita. Data on the CPUE only available from 2000.

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Assessment form

Sheet P2a
Fishery by Operational Unit

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Data source*	ICM Data Base and Official Statistics from the Catalonia Government	OpUnit 1*	ESP 06 G 02 31 - ANE

Time series

Year*	1993	1994	1995	1996	1997	1998
Catch	10286	13876	7654	7415	4437	3782
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Year	1999	2000	2001	2002	2003	2004
Catch	1604	1404	1684	3468	1689	2649
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Selectivity   **Remarks**

L25	
L50	
L75	
Selection factor	

Structure by size or age

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Assessment form

Sheet P2a
Fishery by Operational Unit

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Data source*	ICM Data Base and Officil Statistics from the Catalonia Government	OpUnit 2*	ESP 06 H 02 31 - ANE

Time series

Year*	2005	2006	2007	2008		
Catch	2126	1009	695	1060		
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Year						
Catch						
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Selectivity   **Remarks**

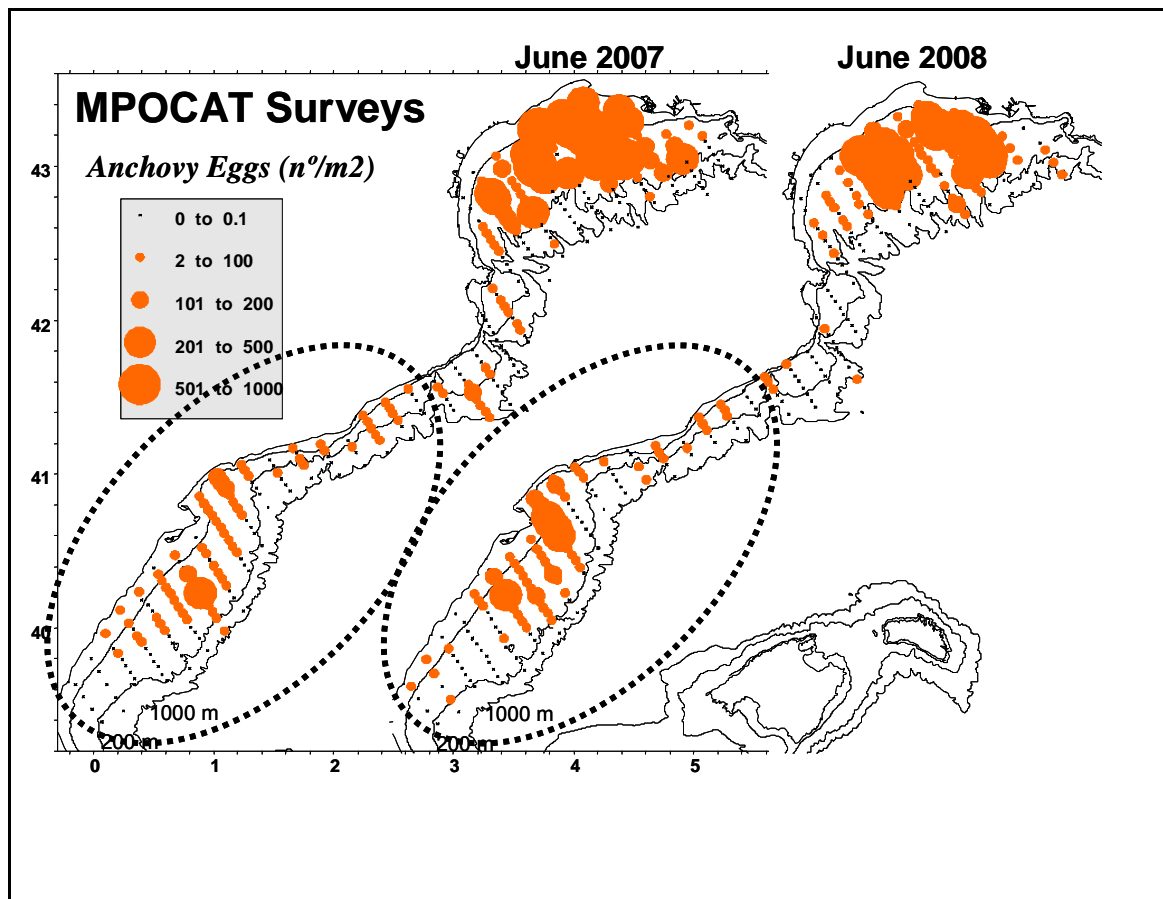| L25	
L50	
L75	
Selection factor	

Structure by size or age

Other assessment methods

The anchovy spawning biomass in the North western Mediterranean Sea, GSAs 6 and 7, i.e. Gulf of Lions (GoL) and the Spanish coast from Cape Creus to Cape La Nao, was estimated in 2007 and 2008 by means of the Daily Egg Production Methods (DEPM).

Each year we have performed two separated evaluations by dividing the whole area in two regions, according the knowledge on spawning areas, egg transport and fishing fleet.
Here we present the results corresponding to the GSA 6 area corresponding to the north of Spanish coast from Blanes to Cape La Nao (area covered by dashed line in Figure).

The anchovy Spawning Stock Biomass obtained for the GSA6 (Figure) was 3050 tones in 2007 and 5762 tones in 2008. This values are more than 50% lower than in 1993 and 1994, when the same assessment method was used (Table 2)

Other assessment methods

The mean weight of mature females was lower in 2008 (14.8 cm) than in 2007 (26.4 cm) (Table 1).

The total Egg Production in the area per day was 180.000x10e-6 (15,9 eggs /m2 per day) in 2007 and 280.000x10e-6 (24.53 eggs/m2 per day) in 2008.

The spawning area was similar in extension in 2007 and 2008 and also to that obtained in 1994 (Table 2)

Table 1. Model Parameters

DEPM Parameters	2007	2008
P_0 (eggs/m^2/ per day)	15.90 (0.25)	24.53 (0.305)
A (km^2)	11338.16	11234.94
W (female weight average in g)	26.42 (0.02)	14.85 (0.45)
F (batch fecundity)	9968.90 (0.08)	6142.3 0.33
S (spawning fraction/day)	0.29 (0.05)	0.26 (0.27)
R (fraction of mature females)	0.54 (0.05)	0.45 (0.43)
BIOMASS (T)	3046.87 (0.26)	5761.58 (0.54)

Table 2

	1993	1994	2007	2008
BIOMASS (tons)	8422	11044	3047	5762
Spawning Area (km2)	9454	12862	11338	11235

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Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB	5762		8420*	ecreasir	* Anchovy biomass value obtained in 1993 with DEPM.
F					
Y					
CPUE	147				kg/day*vessel

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;

	Exploitation rate	Stock abundance	
Bidimensional	☐ No or low fishing	☐ Virgin or high abundance	◉ Depleted
	☐ Moderate fishing	☐ Intermediate abundance	☐ Uncertain / Not assessed
	☐ High fishing mortality	☐ Low abundance	
	◉ Uncertain / Not assessed		

Comments

The anchovy Spawning Stock Biomass obtained for the GSA6 (Figure 1) was 3050 tones in 2007 and 5762 tones in 2008.

Comparisons of the present results to those obtained in 1993 and 1994 with the same method as well with acoustic evaluations indicated an important decrease in anchovy biomass and also in egg production.

Although we do not have any point of reference on the minimum sustainable biomass for anchovy in the North Western Mediterranean, everything seems to indicate that the stock might be at risk with a reduced reproductive capacity. Moreover, it is unlikely that a small size stock like the present one could have a strong recruitment, mostly if we consider the well documented cases about the quick influence that any environmental variation can have on small pelagic fish populations

Since 2002 the CPUE (kg/day*vessel).of the spanish fleet in that region has been decreasing being the lower value in 2007 (88 kg/day*vessel) that has slightly increased in 2008 (147 kg/day*vessel), but still being the 50% less of the 2002 value. (Figure 2)

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Management advice and recommendations*

To reduce the level of fishing effort

To increase the minimun legal size above the size at first maturity (9 cm to 11 cm)

To establish points of reference on the minimum sustainable biomass

Management decisions might be taken together with the sardine and to consider the economic relationship between species

A Marine Protected Area for spawners could be a possible solution to increase the recruitment of anchovy stock.

Advice for scientific research*

It is imperative to obtain the adequate information from scientific studies to get and establish management reference points on the minimum sustainable biomass for anchovy in the area.

It would be advisable that an evaluation by means of the DEPM could be yearly applied to the anchovy stocks in the Northwestrn Mediterranean. That would allow to compare results obtained by Acoustic methods by french and spanish scientists, and to follow the possible changes in the biological and ecological parameters obtained by this method. That is especially important in the current situation of the anchovy stocks, that could be critical for its future.

In general, it would be advisable that the DEPM could be applied to anchovy stocks in the Mediterranean.