SAC GFCM.
Subcommittee of Stock Assessment

Assessment form

Information and instructions

During the last meeting of the Scientific Advisory Committee (SAC) of GFCM, it was agreed that resource assessment forms should be prepared and distributed.

For the time being, the aim of delivering these assessment forms is to make an estimation of our real possibilities to yield useful results for the management of our fishery resources.

Each assessment will consist of several sheets of paper sharing the same code. The format will be at the option of the person in charge. Each assessment will take, at least, one sheet of paper numbered "0" (Sheet #0) and will also include no less than one copy of sheets "B", "P1" and "P2a". It is not compulsory to fill out any of the other sheets that make up this assessment form, but the person in charge is supposed to fill out some of them: otherwise no assessment is actually made. There may be more than one copy in several cases. Sheets "D" (diagnosis) and "Z" (conclusions and recommendations) should be considered as essential too.

Sheet	Title	Contents	# of sheets	Priority
0	Preliminary basic data on the assessment	Species, person in charge, date and code. All the sheets that belong to the same assessment share this code.	1	Indispensable
B	Biology of the species	Biological parameters used in the analyses (it is assumed that only one set of parameters is used)	1	Indispensable
P1	General information about the fishery	Catches by gear and associated fleet	1 or more	Indispensable
P2a	Fishery by gear	Time series for the type of gear in question, including structure by size (or age)	At least as many as in previous section	Indispensable
P2b	Fishery by gear	Accompanying species and regulations applicable to gear	At least as many as in previous section	If available
TS1	Direct methods: swept area			If available
TS2	Direct methods: swept area			If available
TS3	Direct methods: swept area			If available
TS4	Direct methods: swept area			If available
AS	Direct methods: acoustics			If available
PH	Direct methods: egg production			If available
G	Indirect methods: global model	Description of model, data, parameters and results of each analysis	As many as used in the analysis	If available
A1	Indirect methods: VPA, LCA	Description of model used and of general results of an analysis	As many as used in the analysis	If available
A2	Indirect methods: data	Description of data used by gear for the analysis in A1	As many as used in the analysis by gear	If available, requires A1
A3	Indirect methods: results of VPA	Detailed description of results by gear, structured by size or age	As many as used in the analysis by gear	If available, requires A1
Y	Indirect methods: Y/R	Description of model, data, parameters and results	As many as used in the analysis	If available
D	Diagnosis	Synthesis of results of analyses and diagnosis on the state of resources	1	Indispensable
Z	Objectives and recommendations	Set the objectives to be attained and recommendations for their attainment	1	Indispensable
C	Comments	At the option of the person in charge	Unspecified	If available

February 21st, 1997

Jordi Lleonart

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet #0 Basic data on the assessment

Date	4 Sept. 2007	Person in charge	Nando Cingolani (ISMAR[1], Istituto di Scienze Marine - Sezione Pesca Marittima - Ancona - Italy)	Code	
Species Scientific name	*Sardina pilchardus*, Walb.		Species common name	Sardine	

Data source

Geographical limits	Adriatic Sea - GSA 17	Period of time	1975 – 2006

Description of the analysis

Type of data	Total catches, Catch and effort data, Fleet characteristics, Length-frequency data, Length-weight data, Age-length data	Data source	Database of ISMAR (Istituto di Scienze Marine - Sezione Pesca Marittima, Largo Fiera della Pesca, 2 – 60125 Ancona, ITALY). Data collected in the ambit of an extension of AdriaMed-SP research programme.
Method of assessment	VPA (*)	Software used	MAFF – VPA (Darby and Flatman, 1994)

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	D	Z	C
x	x	x	x						x	x	

TS	TS1	TS2	TS3	TS4	AS	EP

Comments, bibliography, etc.

Darby, C.D. and S. Flatman. - 1994. Virtual Population Analysis: version 3.2 (Windows/Dos) user guide. Info. Tech. Ser. MAFF Direct. Fish. Res., Lowestoft, 1, 85 pp.

(*) VPA has been tuned using echo survey data as fishery independent data, following the recommendations of SCSA-2005 (Rome 26-30 September 2005).

[1] Former IRPEM (Istituto di Ricerche sulla Pesca Marittima). IRPEM changed as ISMAR/Istituto di Scienze Marine - Sezione Pesca Marittima since 15 January 2003.

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet B Biology of the species

Code	

Biology	Somatic magnitude measured (LH, LC, etc)		Units	

Sex				
Maximum size observed	21 cm		Reproduction season	
Onset of maturity size			Reproduction areas	
Recruitment size	13-14.5 cm		Nursery areas	

Parameters used (state units and information sources)

sex			
Growth model			
Data source			
L_∞ (growth)			
K (growth)			
t_0 (growth)			
length-weight relationship			
a (length-weight)			
b (length-weight)			
sex ratio			
M	0.5 (Cingolani *et al*., 1993; Sinovcic, 1984, 1986)		

Comments

Cingolani, N., Santojanni, A., Arneri, E., Belardinelli, A., Giannetti, G., Colella, S., Donato, F. 2002. Valutazione degli stocks pelagici di alici e sardine in Adriatico con metodi di dinamica di popolazione. Rapporto scientifico per il Ministero per le Politiche Agricole, Roma. 133 pp

Cingolani, N., Arneri, E., Santojanni, A., Belardinelli, A., Giannetti, G., Colella, S., and Donato, F. 2002. Stock assessment of sardine (*Sardina pilchardus*, Walb.) in the Adriatic Sea. Biol. Mar. Medit., 9(1): 82-88.

Santojanni, A., Arneri, E., Belardinelli, A., Cingolani, N., and Giannetti, G. 2001. Fishery and stock assessment of sardine (*Sardina pilchardus*, Walb.) in the Adriatic Sea. Acta Adriat., 42(1): 151-168.

Sinovcic, G. 1984. Summary of biological parameters of sardine (*Sardina pilchardus* Walb.) from the Central Adriatic. FAO Fish. Rep. 290:147-148.

Sinovcic, G. 1986. Estimation of growth, mortality, production and stock size of sardine, *Sardina pilchardus* (Walb.), from the middle Adriatic. Acta Adriat., 27: 67-74.

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet P1 General information about the fishery

Code	
Page	

Data source	Database of ISMAR[2] (Istituto di Scienze Marine - Sezione Pesca Marittima, Largo Fiera della Pesca, 2 – 60125 Ancona, ITALY). Data collected in the ambit of an extension of AdriaMed-SP research programme.	year(s)	1975 – 2006
Data aggregation (by year, average figures between years, etc.)	By year, average 1975 - 2006, average 2004 – 2006.		

Fleet and catches (please state units)

gear	Fleet (# of boats)	catch[3] (species assessed)	other species caught	Discards (species assessed)	Discards (other species caught)
mid-water pair trawl	Italy: 60 fish. unit; total GRT=6,404; total kW=34,944; fish. days/year=8,768 (year 2005); Slovenia: 1 fish. unit ; total GRT=312; total kW=1,200; fish. days/year=260. Croatia: not available.	1,918 t		2,267 t (*)	Negligible
purse seine	Italy: 46 fish. vess.[4]; total GRT=2,033; total kW=8,187; fish.days/year=3,797 (year 2005); Slovenia: 5 fish. vess.[5] total GRT=48; total kW=519; fish. days/year=436. Croatia: not available..	13,121 t		Negligible	Negligible
Total					

Legal minimum size	Italy: no specific indication exists for the minimum legal size of sardine; Slovenia: n.a.; Croatia: 12 cm (Sinovcic, 2001).

Comments

(*) Italy: This value is the average 1987 – 2001 for Italian fleet (in the previous years the discards at sea of sardine were negligible). The annual values of discarded sardine are included in the average catch. Due to lack of information, no discards have been estimated, at the moment, for the period 2000-2004. Nevertheless it is tought that discards at sea are now negligible because more favourable market conditions. In 2005, in the ambit of Italian National Programme for the collection of fishery data according to the Council Regulation (EC) No 1543/2000, a project for the evaluation of discards at sea has been conducted for small pelagic fishery: the observer on board recorded sardine discards at sea of about 15% of sardine caught by the monitored vessels.

Sinovcic, G. 2001. Small pelagic fish from the Croatian fishing grounds. Report of the first meeting of the Adriamed working group on small pelagic resources, editors Mannini, P., Massa, F., Milone, N., FAO-MIPAF scientific cooperation to support responsible fisheries in the Adriatic Sea, GCP/RER/010/ITA/TD-03. Adriamed Techn. Doc., 3: 53-58.

[2] Former IRPEM (Istituto di Ricerche sulla Pesca Marittima). IRPEM changed as ISMAR/Istituto di Scienze Marine - Sezione Pesca Marittima since 15 January 2003.

[3] Catches of the year 2006. Catches of South Adriatic and Albania are not included.

[4] From which 21 fishing vessels are big size purse seine (average GRT 97, average engine power 390 kW), while 25 fishing vessels are small size purse seine (average GRT 9, average engine power 110 kW).

[5] Small size purse seine.

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet P2a Fishery by gear

Code	
Page	

Data source	Database of ISMAR[6] (Istituto di Scienze Marine - Sezione Pesca Marittima), Largo Fiera della Pesca, 2 – 60125 Ancona, ITALY) and data collected in the ambit of FAO AdriaMed-SP research programme.	gear	Mid-water pair trawl + Purse seine

Time series (on split year basis)

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
Catch (t)	60,900	51,056	37,427	33,388	33,553	29,553	24,686	29,205	26,180
Minimum size									
Average size L_c									
Maximum size									
Fleet									

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Catch (t)	29,758	24,161	21,807	19,512	19,189	20,532	20,839	18,984	13,121
Minimum size									
Average size L_c									
Maximum size									
Fleet									

Selectivity Remarks

L_{25}	
L_{50}	
L_{75}	
Selection factor	

Structure by size or age

Age-length key of sardine (year 2006)

Size class (cm)	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
11.0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
11.5	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.0	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.5	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13.0	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13.5	0.58	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14.0	0.48	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14.5	0.21	0.70	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.0	0.06	0.26	0.66	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.5	0.01	0.09	0.59	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.0	0.00	0.00	0.28	0.66	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16.5	0.00	0.00	0.11	0.72	0.17	0.01	0.00	0.00	0.00	0.00	0.00	0.00
17.0	0.00	0.00	0.00	0.32	0.61	0.07	0.00	0.01	0.00	0.00	0.00	0.00
17.5	0.00	0.00	0.00	0.05	0.59	0.30	0.02	0.02	0.03	0.00	0.00	0.00
18.0	0.00	0.00	0.00	0.00	0.04	0.16	0.36	0.28	0.16	0.00	0.00	0.00
18.5	0.00	0.00	0.00	0.00	0.13	0.13	0.25	0.25	0.25	0.00	0.00	0.00
19.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
19.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.67	0.00	0.00

[6] Former IRPEM (Istituto di Ricerche sulla Pesca Marittima). IRPEM changed as ISMAR/Istituto di Scienze Marine - Sezione Pesca Marittima since 15 January 2003.

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Code	
Page	

Data source	Database of ISMAR[7] (Istituto di Scienze Marine - Sezione Pesca Marittima), Largo Fiera della Pesca, 2 – 60125 Ancona, ITALY) and data collected in the ambit of FAO AdriaMed-SP research programme.	gear	Mid-water pair trawl + Purse seine

Regulations in force and degree of observance of regulations

Regulations in force in Italy:
Since 1988 closing fishing season concerning trawling is also applied to mid-water pair trawlers during Summer (about 45 days of closing season between July and September). Closing fishing season is not applied for the purse seiners. Fishing activity is suspended during week-end (Saturday and Sunday).
Discussion for further improvements of the regulations is going on in Italy.

Degree of observance of regulations (Italy): total observance because the mid-water pair trawlers have to leave their navigation documents to Maritime Authority.

Accompanying species

Engraulis encrasicolus
Scomber spp.
Sprattus sprattus
Trachurus spp.

[7] Former IRPEM (Istituto di Ricerche sulla Pesca Marittima). IRPEM changed as ISMAR/Istituto di Scienze Marine - Sezione Pesca Marittima since 15 January 2003.

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet G Indirect methods. Global model

Code	
Analysis #	
Page	

Data source		Gear	

Model characteristics

Type of model		Fitting criterion	
Software		Bibliographi-cal source	

Data

Year									
Catch									
Effort									
CPUE									

Year									
Catch									
Effort									
CPUE									

Adjustment

RMS	

Results

Carrying capacity		A	
Growth rate		B	
Catchability			
MSY			
E_{MSY}		TAC_{MSY}	
$E_{0.1}$		$TAC_{0.1}$	
$E_{current}$			

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet A1 Indirect methods: VPA, LCA

Sex	

Code	
Analysis #	

Model characteristics

Data	Size	Age
(mark with X)		

Model	Cohorts	Pseudocohorts
(mark with X)		

Equation used		Tuning method	
# of gears		Software	
$F_{terminal}$			

Population results (please state units)

	sizes	ages		amount	biomass
Minimum			Recruitment		
Average			Average population		
Maximum			Virgin population		
Critical			Turnover		

Average mortality

		Gears					
	Total						
F_1							
F_2							
Z							

(F_1 and F_2 represent different possible calculations. Please state them)

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet A2 Indirect methods: data

				Code	
sex		gear		Analysis #	

Data source	

Data

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet A3 Indirect methods: VPA results

				Code	
sex		gear		Analysis #	
				Page	

Population in figures

Population in biomass

Fishing mortality rates

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet Y Indirect methods: Y/R

sex	

Code	
Analysis #	

# of gears		software	

Parameters used

Vector F	
Vector M	
Vector N	

Model characteristics

Results

	Total	Gears					
Current Y/R							
Maximum Y/R							
Y/R 0.1							
F_{max}							
$F_{0.1}$							
Current B/R							
Maximum B/R							
B/R 0.1							

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet D Diagnosis

Code	
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Reference points (for further information see CADDY, 1996, *FAO Fish. Tecn. Pap.*, 347)

Criterion	Value	Units	Trend	Comments
B_{now}	85,000 t		Slight increase	Mid-year biomass at sea estimated by VPA (tuned with echo-survey data): average on the period 2004-2006.
SSB				.
B_{virgin}				
F_{now}				
F_{msy}				
$F_{0.1}$				
$F_{2/3msy}$				
F_{low}				
F_{med}				
F_{high}				
$F_{\% SPR}$				
TAC				
$TAC_{0.1}$				
Y_{now}	18,000 t		Stable	Average catch on the period 2004-2006.
MSY				
MBAL				
F_{mean}	0.22			Average on the period 1975-2006 estimated by VPA (mean for the age interval 0-5).
F_{min}	0.11			Minimum value estimated by VPA (mean for the age interval 0-5); value obtained for the years 1994 and 1995.
F_{max}	0.76			Maximum value estimated by VPA (mean for the age interval 0-5); value obtained for the year 2003, according to more optmistic scenario.
F_{now}	0.46			Average on the period 2004-2006 estimated by VPA (mean for the age interval 0-5).
F/(F+M)	0.47			Exploitation rate: average on the period 2004-2006 (M = 0.5, F estimated by VPA, as mean for the age interval 0-5); with 0.4 being the threshold suggested by Patterson, K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Rev. Fish Biol. Fish., 2: 321-338.

General state of resource: underexploited, overexploited, collapsed, unknown, etc.

Fully exploited: the mean ratio between catch and the estimated biomass, in the last three years, is about 0.21. Since 1998 Croatian sardine catches increased from about 7,500 t to about 17,500 t in 2005 (10,610 t in 2006); in the meantime Italian sardine catches decreased from about 13,500 t to 2,200 t (2,511 t in 2006).

Particularities of the state of the resource: growth overexploitation, recruitment overexploitation, existence of inaccessible segments, trends observed, etc.

Risks

The stock seems fully exploited, the biomass shows a continuous decrease since nineties, but in 2005 and 2006 show a slight increase.

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet Z Objectives and recommendations

Code	
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Management objectives

Not to increase the fishing effort. Small pelagics fishery is multispecies and effort on sardine cannot be separated form effort on anchovy. Monitoring of sardine discards at sea, because they are not negligible.

Management recommendations

Area closures	
Temporal closures	
Effort limitation	Since decline of stock biomass is observed after the peak in the first half of 1980s and lowest values of this series correspond just to recent years. Even though, 2005 and 2006 show an increase of biomass, it would be unwise for fishing effort to be allowed to rise.
Minimum size	
Technical steps concerning gear	
Quotas	
Market	
	The research programme supported by FAO-ADRIAMED, entitled "Data Collection and Biological Sampling System on Small Pelagics in the Adriatic Sea (AdriaMed-SP)" started in June 2001 is ended in June 2003 like direct financing support of FAO-ADRIAMED project. Nevertheless, Adriamed-SP continuing. Data collected with this project already improved stock assessment of sardine in northern and central Adriatic (GFCM Management Unit 17). In next future, thanks to Adriamed-SP, further improvements will be expected in stock assessment of sardine. AdriaMed-SP covers also the South Adriatic area, it is recommended to rebuilt the time series of catch and fishing effort, in order to try stock assessment in those area.

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Assessment form	Sheet C
	Comments

Code	
Page	

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form	Sheet EP
	Direct methods: DEPM	

Code	
Page	

Regionalisation	YES	NO	(please use one sheet for each region)
Sampling area			
Region			

Egg production

Cruise				Date	
Total area (km^2)		Positive		Negative	

Parameters (exponential mortality model)			value	CV
P_0 (# of eggs /0.05 m^2)				
Z ($days^{-1}$)				
Temperature range	ºC	ºC		

Adult sampling

Sampling area	
Type of gear	
Type of sampling	

Model parameters	value	CV
P_0 (# of eggs/0.05 m^2 per day)		
A (area of regionin 0.05 m^2)		
W (average female weight in gr)		
F (batch fecundity: eggs / batch per mature female)		
S (spawning fraction: # spawning female per mature female)		
R (sex ratio: females/total)		

Result	value	CV
Biomass (t)		

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet TS Direct methods: swept area

Code	
Page	

Cruise		B/O	
Total area (km^2)		Date	

Objective (in general)	
Sampling strategy	
Gear	
Sampler (gear used)	
Minimum and maximum depths	

Results	Index 1	Variance	Index 2	Variance
Species				

Comments

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Assessment form	Sheet AS
Direct methods: acoustics	

Code	
Page	

Cruise		B/O	
Total area (km^2)		Date	

Objective (in general)	
Target species	
Echosounder	
Sampling strategy	
ESDU	
Pulse duration	
Echogramm identification	
Samples (gear used)	
Biological data obtained	

Results obtained. (Biomass in metric tons, amount of fish etc.)	

Comments

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet TS1 Direct methods: trawl based abundance indices

Code	
Page	

Survey		Species	Trawler		
GFCM – Management Unit		Geographical area		Date	

Objective (in general)	
Sampling strategy	
Sampler (gear used)	
Cod –end mesh size as opening in mm	
Minimum and maximum depths in m	

stratum	Total surface (km^2)	Trawlable surface (km^2)	Number of hauls
1 (10-50 m)			
2 (51 –100 m)			
3 (101 – 200 m)			
4 (201 – 500 m)			
5 (501 – 800 m)			
Shelf (10-200m)			
Slope (201–800m)			
Total (10 – 800 m)			

stratum	Kg per km^2	CV	Relative * biomass All age group	CV	N per km^2	CV	Relative * abundance All age group	CV
1 (10-50 m)								
2 (51 –100 m)								
3 (101 – 200 m)								
4 (201 – 500 m)								
5 (501 – 800 m)								
Shelf (10-200m)								
Slope (201–800m)								
Total (10 – 800 m)								

* with catchability coefficient assumed 1

Comments

One sheet for each surveys

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet TS 2 Direct methods: trawl based length structure of population at sea

Code	
Page	

Survey		Species	Trawler
Total area (km^2)		Date	

Objective (in general)	
Sampling strategy	
Cod –end mesh size as opening in mm	
Sampler (gear used)	
Minimum and maximum depths of presence of species	

Length classes	females	males	not sexed	total	Sex ratio (females/ Females + males)
total					

Comments

One sheet for each surveys

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet TS 3 Direct methods: Trawl based total mortality rates

Code	
Page	

Survey			Trawler
Total area (km^2)		Date	

Objective (in general)	
Sampling strategy	
Z method	Report formula
Sampler (gear used)	
Minimum and maximum depths of presence of species	

Survey	Total mortality rates (Z)	Survey	Total mortality rates (Z)	Survey	Total mortality rates (Z)

Note: Z is expressed by year

Comments

One sheet for each species;

Specify if Z vector are available

SAC GFCM. Subcommittee of Stock Assessment	Assessment form Sheet TS 4 Direct methods: trawl based Recruitment analysis

Code	
Page	

Survey		B/O	
Total area (km^2)		Date	

Objective (in general)	
Sampling strategy	
Cod –end mesh size as opening in mm	
Sampler (gear used)	
Minimum and maximum depths of presence of species	
Recruitment season	
Age at fishing-grounds recruitment	
Length at fishing-grounds recruitment	

Surveys	Area in km^2	N of recruit per km^2	CV (%)	Relative recruitment (N of individuals)	CV (%)

Comments

Note on type of recruitment:
1) continuous and diffuse
2) discrete and diffuse
3) discrete and localised
4) continuous and localised.