SAC GFCMSub-Committee on Stock Assessment

Date*	28	October	2011		Code*	PIL1611Pat

Authors*

Patti B., Quinci E.M., Bonanno A., Basilone G., Mazzola S.

Affiliation*

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Species Scientific name*

1 *Sardina pilchardus - PIL*
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

Central Mediterranean - Straits of Sicily

Geographical Sub-Area (GSA)*

16 - South of Sicily

Combination of GSAs	1	
	2	
	3	

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Assessment form

Sheet #0
Basic data on the assessment

Code: PIL1611Pat

Date*	28	Oct	2011	Authors*	Patti B., Quinci E.M., Bonanno A., Basilone G., Mazzola S.

Species Scientific name*	Sardina pilchardus - PIL	Species common name*	Sardine

Data Source

GSA*	16 - South of Sicily	Period of time*	1998-2010

Description of the analysis

Type of data*	Landings and acoustic biomass estimates. Growth parameters. Satellite based Chl-a data.	Data source*	Database of CNR-IAMC. DCF data. FAO MedSud Med regional project. NASA SeaWiFS project.
Method of assessment*	Estimation of latest harvest rates - Estimation of exploitation rate - Fitting of a non-equilibrium production model	Software used*	MS Excel spreadsheets distributed by FAO under the BioDyn package (P. Barros)

Sheets filled out

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

Comments, bibliography, etc.

TEXT ONLY - Characheters left: **145**

FAO (2004). Report of the [...]ent of Small Pelagic Fish off Northwest Africa. Saly, Senegal, 17-27 March 2004. FAO Fisheries Report. No762. Rome, FAO. 2004. 135p.

Kallianiotis, A,. & Mazzola, S. (2002). Final report of EC-DG XIV study project "Study on purse seine activity in Eastern and Central Mediterranean" (MED 99-035).

MacLennan, D.N., Fernandes, P.G., and Dalen, J. (1996). A consistent approach to definitions and symbols in fisheries acoustics. - ICES Journal of Marine Science, 59:365-369.

Patterson, K. (1992). Fisheries for small pelagic species: an empirical approach to management targets. Review of Fish Biology and Fisheries, 2: 321-338.

Patti B., Bonanno A., Basilone G., Goncharov S., Mazzola S., Buscaino G., Cuttitta A., García Lafuente J., García A., Palombo V., Cosimi G. (2004). Interannual fluctuations in acoustic biomass estimates and in landings of small pelagic fish populations in relation to hydrology in the Strait of Sicily. Chemistry and Ecology, 20(5): 365-375.

Patti, B., Venezia, S., Piazza, I., Basilone, G., Patti, C., Caruana, L. and Mazzola, S. (2007). Final Report of Project CAS.FO. "Cattura e sforzo di piccoli pelagici nel Canale di Sicilia per la gestione delle risorse pescabili". In Italian. Regolamento C.E.E. n. 1263/99 – SFOP – Misura n 4.17 – Sottomisura B.

Comments, bibliography, etc.

Patti, B., Guisande, C., Bon̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶zola, S. (2010). Role of physical forcings and nutrient availability on the control of satellite-based chlorophyll a concentration in the coastal upwelling area of the Sicilian Channel. Scientia Marina, 74(3), 577-588.

Pauly, D. (1980). On the interrelationships between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. J. Cons. Int. Explor. Mer, 39 (3): 175-192.

Code: PIL1611Pat

Biology

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

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed				20.0	Reproduction season	Autumn - Winter
Size at first maturity	11.5	11.6	11.5		Reproduction areas	South Sicily
Recruitment size					Nursery areas	South Sicily

Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L∞	cm			21.41	
	K	y-1			0.40	
	t0	year			-1.83	
	Data source	DCF 2007-2008				
Length weight relationship	a				0.0028	
	b				3.37	

M	0.77	Pauly (1980) relationship. Ref. Temp=13.5 °C

sex ratio (mal/fem)	

Comments

TEXT ONLY - Characheters left: 1997

XXX

Comments

TEXT ONLY - Characheters left:	4000

TEXT ONLY - Characheters left: 4000

Code: PIL1611Pat

Data source*	Landings in port of Sciacca		Year (s)*	1998-2010

Data aggregation (by year, average figures between years, etc.)*	by year, average 1998-2010

Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ITA	16	H - Purse Seine (12-24 metres)	01 - Surrounding Nets	31 - Small gregarious pelagic	PIL
Operational Unit 2	ITA	16	J - Pelagic Trawl (12-24 metres)	03 - Trawls	31 - Small gregarious pelagic	PIL
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
ITA 16 H 01 31 - PIL	17	Tons	636	anchovy	negligible	negligible	fishing da
ITA 16 J 03 31 - PIL	30	Tons	736	anchovy	negligible	negligible	fishing da
	* Dec 2006	ave 1998-2010					
Total	47		1372				

Legal minimum size	11

Comments

Landings data from Sciacca port are reported here because of their importance (they accounts for about 2/3 of total landings; Patti et al., 2007) in GSA 16 and the availability of a longer time series (1998-2010) compared to the official data for the whole GSA 16 (2004-2010).

Comments

Code: PIL1611Pat
Page 1 / 2

Data source*	Port of Sciacca		OpUnit 1*	ITA 16 H 01 31 - PIL

Time series

Year*	2000	2001	2002	2003	2004	2005
Catch	978	638	1020	455	403	518
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Year	2006	2007	2008	2009	2010	2011(*)
Catch	331	363	1089	799	147	579
Minimum size						
Average size Lc						
Maximum size						
Fleet						(*) updated Sept 2011

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

TEXT ONLY - Characheters left: 200

Structure by size or age

Structure by size or age

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Assessment form

Sheet P2a
Fishery by Operational Unit

Code: PIL1611Pat
Page 2 / 2

Data source*	Port of Sciacca		OpUnit 2*	ITA 16 J 03 31 - PIL

Time series

Year*	2000	2001	2002	2003	2004	2005
Catch	1102	1018	600	704	938	680
Minimum size						
Average size Lc						
Maximum size						
Fleet						

Year	2006	2007	2008	2009	2010	2011(*)
Catch	906	693	543	451	109	176
Minimum size						
Average size Lc						
Maximum size						
Fleet						(*) updated Sept 20

Selectivity

Remarks

L25	
L50	
L75	
Selection factor	

TEXT ONLY - Characheters left: 200

Structure by size or age

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Assessment form

Sheet P2b
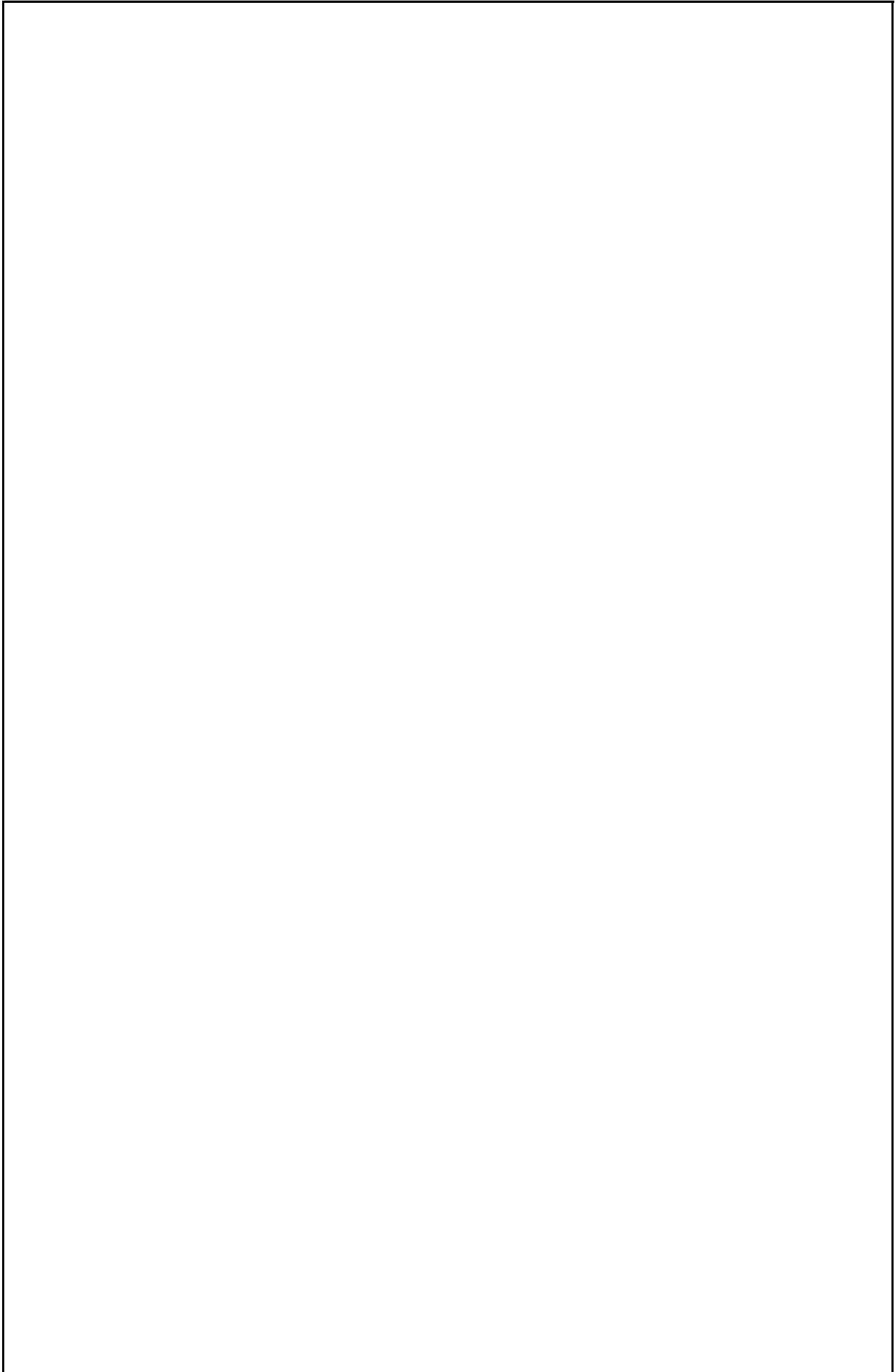**Fishery by Operational Unit**

Code: PIL1611Pat
Page 1 /

Data source*		OpUnit 1*	ITA 16 H 01 31 - PIL

Regulations in force and degree of observance of regulations

The regulatory pattern is based on a compulsory licensing scheme and a minimum landing size.

Accompanying species

| Data source* | Total Landings - Acoustic biomass estimates | Gear* | Purse seine - Pelagic trawl |

Model characteristic

Type of model*	Non-equilibrium surplus production model	Fitting criterion	Non linear Generalized Reduced Gradient (MS Excel Solver tool)
Software	MS Excel spreadsheets distributed by FAO under the BioDyn package	Bibliographical source	Report on the Assessment of Small Pelagic Fish off Northwest Africa

Data

Year	1998	1999	2000	2001	2002	2003	2004
Catch	2994	1850	3119	2484	2430	1739	2011
Effort							
CPUE							

Year	2005	2006	2007	2008	2009	2010	
Catch	1798	1856	1585	2448	1874	565	
Effort							
CPUE							

Adjustment

| RMS | 2.7 |

Results

Carryng capacity		a	
Growth rate		b	
Catchability			
MSY			
EMSY		TACMSY	
E0.1		TAC0.1	
Ecurrent			

Comments

Observed and predicted Abundance Indices

Comments

Trends in diagnostic ratios — — "B/BMSY"

1.2
1
0.8
0.6
0.4
0.2
0

Trends in diagnostic ratios —— Fi/FMSY

4
3
2
1
0

MSY

SY_{Cur}

F_{Cur}

Y_{Cur}

B_{cur} B_{MSY} $B_{0.1}$
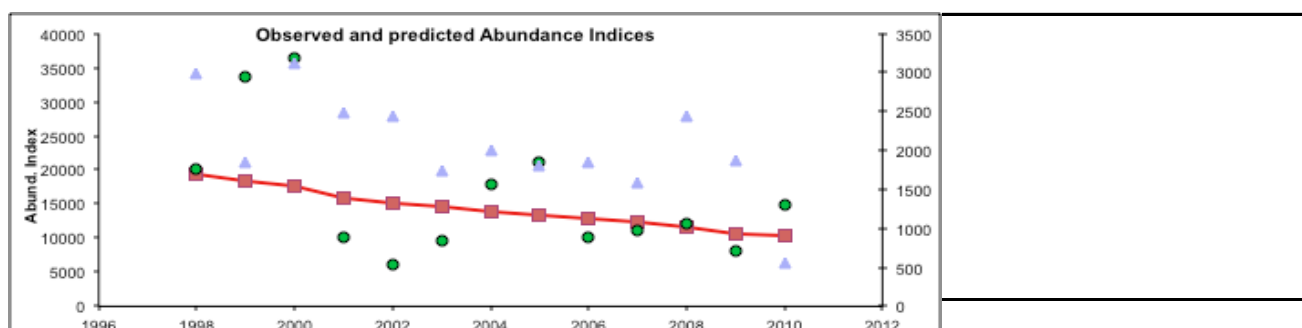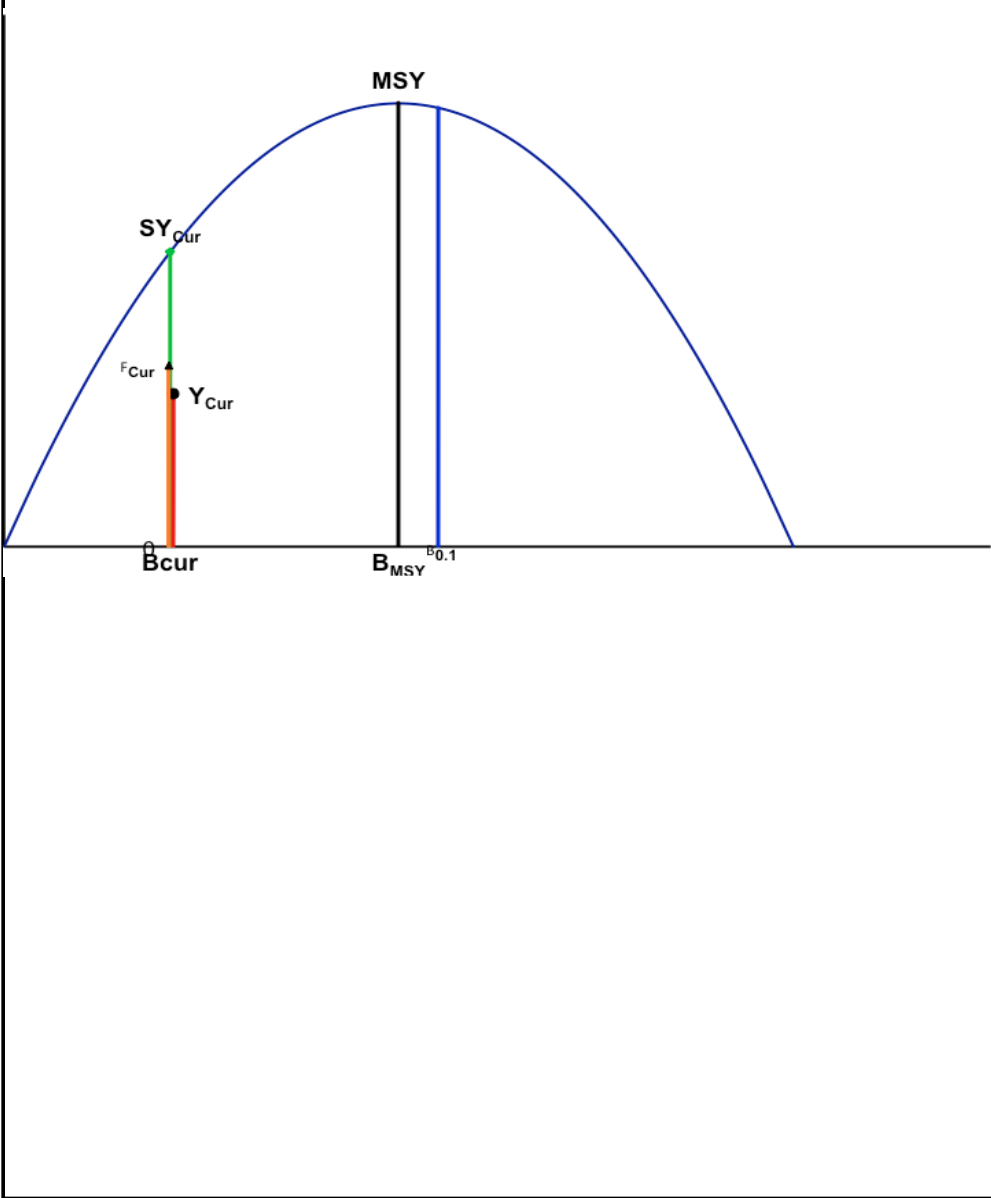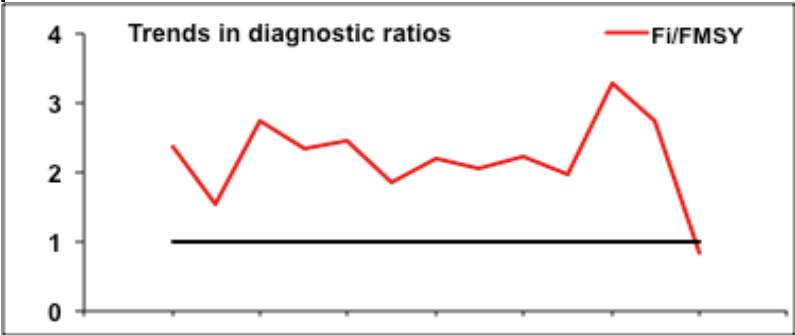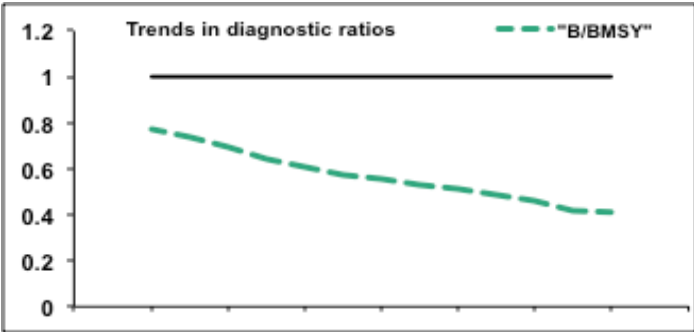
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Assessment form

Sheet G
Indirect methods. Global model

Code: PIL1611Pat

Analysis #*	2

Page 2 / 2

Data source*	Total Landings - Acoustic biomass estimates	Gear*	Purse seine - Pelagic trawl

Model characteristic

Type of model*	Non-equilibrium surplus production model, with variable K (environmental effect)	Fitting criterion	Non linear Generalized Reduced Gradient (MS Excel Solver tool)
Software	MS Excel spreadsheets distributed by FAO under the BioDyn package	Bibliographical source	Report on the Assessment of Small Pelagic Fish off Northwest Africa

Data

Year	1998	1999	2000	2001	2002	2003	2004
Catch	2994	1850	3119	2484	2430	1739	2011
Effort							
CPUE							

Year	2005	2006	2007	2008	2009	2010	
Catch	1798	1856	1585	2448	1874	565	
Effort							
CPUE							

Adjustment

RMS	1.204

Results

Carryng capacity	64952	a	
Growth rate	0.33	b	
Catchability	1.01		
MSY	5430		
EMSY	0.17	TACMSY	3967 (current sustainable production)
E0.1	0.16	TAC0.1	
Ecurrent	0.04 (year 2010)		

Comments
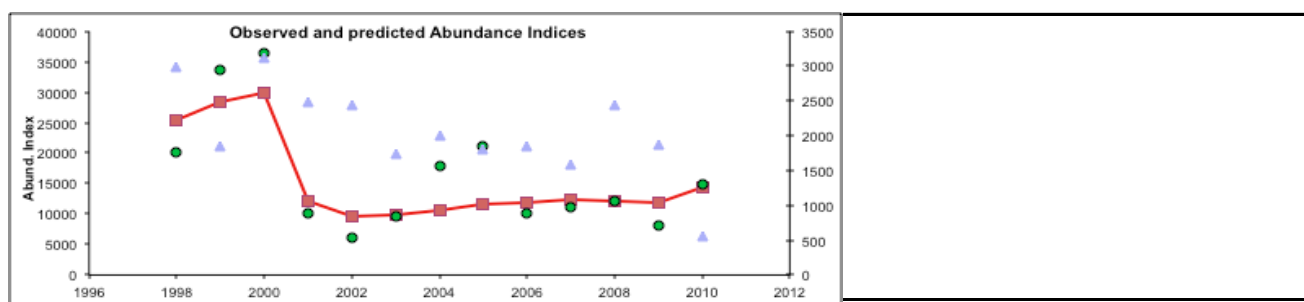
Comments
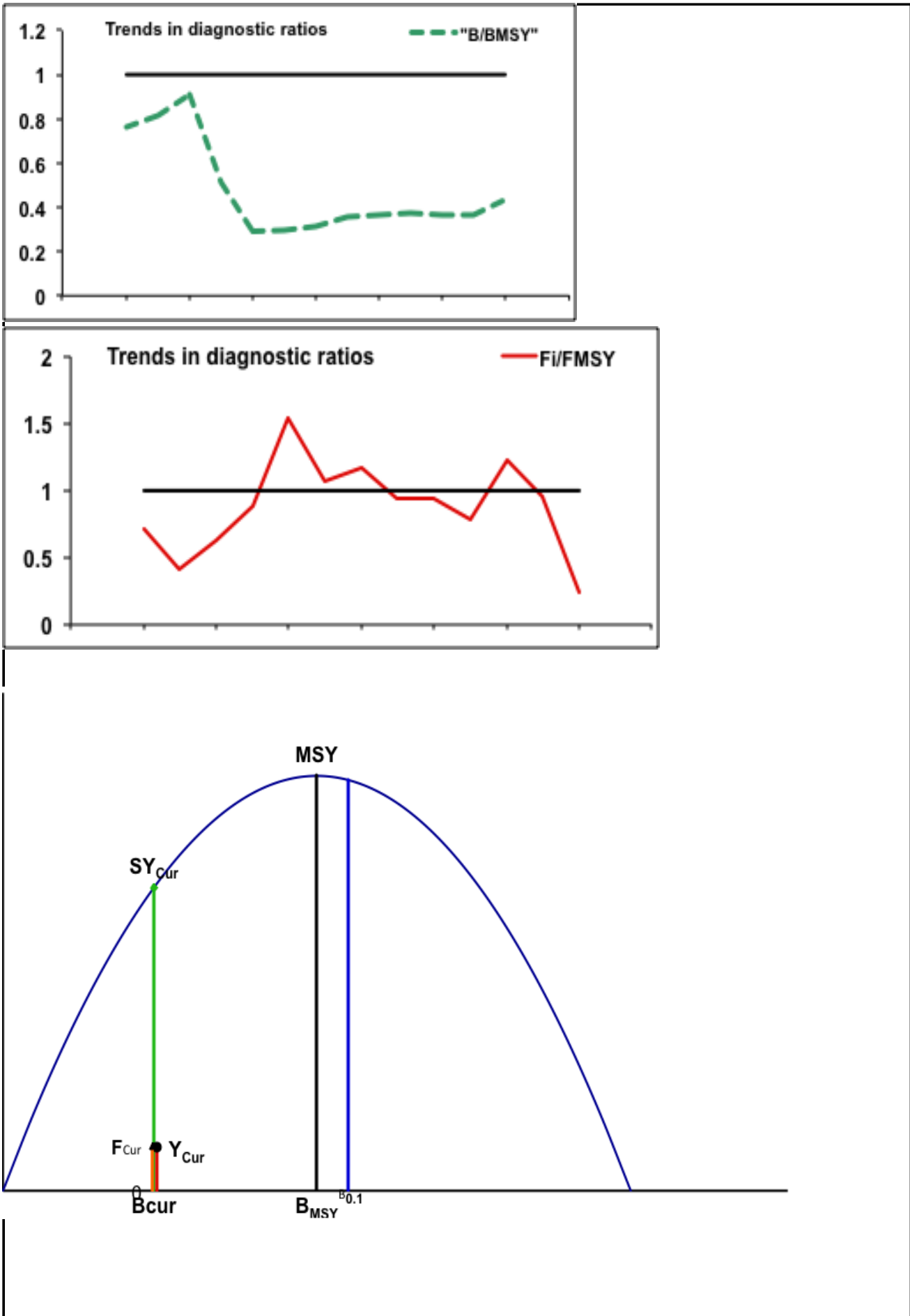
Trends in diagnostic ratios — "B/BMSY"

Trends in diagnostic ratios — Fi/FMSY
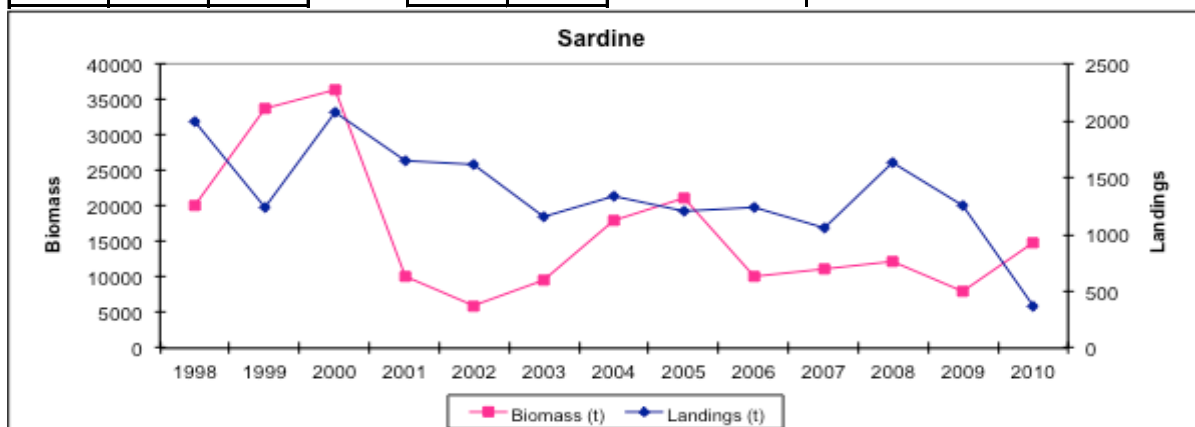
Code: PIL1611Pat

Page 1 / 1

Other assessment method | TEXT ONLY - Characeters left: | 1247

Acoustics

Vessel: R/V Dallaporta
Date: June to September
Transects design: perpendicular to bathymetry
Inter-transect distance (nm): 5
Area covered: 2500 nm^2
Time of day: Full time
EDSU (nm): 1
Bottom depth (min, m): 10
Echo sounding depth (min, m): 3
Echo sounding depth (max, m): 300
Fishing gear: Pelagic trawl
Geographic area: G.S.A. 16 (1998-2010), 15 (2004-2010)
Target species: Anchovy and Sardine
Other species: Mackerel, Sardinella Horse mackerel
Echo sounder: Simrad Ek-60
Frequency for assessment (kHz): 38
Complementary frequencies (kHz): 120, 200
Pulse duration (ms): 1
Threshold for acquisition (db): -80

YEAR	Acoustics	Landings	(Tons, Sciacca port only)
1998	20000	1996	
1999	33700	1233	
2000	36370	2080	
2001	10054	1656	
2002	6000	1620	
2003	9510	1159	
2004	17960	1341	
2005	21219	1199	
2006	10220	1237	
2007	11043	1057	
2008	12152	1632	
2009	8028	1249	
2010	14771	377	

Year	Total GSA16 landings
2006	2226
2007	2175
2008	2067
2009	1642
2010	772

Sardine

Code: PIL1611Pat

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB					
F					
Y					
CPUE					
E	0.17		0.4		Harvest rate used for E estimate is the average over the last four years
					(2007-2010). Landing data from DCR for the whole GSA16. Exploitation rate is estimated assuming M=0.77.

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		Stock abundance	
○ No or low fishing	○ Virgin or high abundance	○ Depleted
◉ Moderate fishing	○ Intermediate abundance	○ Uncertain / Not assessed
○ High fishing mortality	◉ Low abundance	
○ Uncertain / Not assessed		

_____

SCSA Assessment Forms

Comments

Graghs for diagnos <mark>**TEXT ONLY - Characheters left:**</mark> <mark>**3921**</mark> and on sheet "G".

Code: PIL1611Pat

Management advice and recommendation

TEXT ONLY - Characheters left: 2594

Results of the adopted modelling approach suggest that the environmental factors can be very important in explaining the variability in yearly biomass levels (mostly due to recruitment success) and indicate that the stock status was well below the BMSY during the considered period. In 2010 the stock only partially recovered from the high decrease in biomass occurred in 2006 (-52% from July 2005 to June 2006), and this fact, along with the general decreasing trend in landings over the last decade, also suggests questioning about the sustainability of current levels of fishing effort.

Given that the stock biomass over the last years appears to be in a stable low abundance phase and considering the fishing mortality pattern observed throughout the time series, fishing effort should not be allowed to increase and consistent catches should be determined. However, as the small pelagic fishery is generally multispecies, any management of fishing effort targeting the sardine stock would also have effects on anchovy. Local small pelagic fishery appears to be able to adapt at resource availability and market constraints, targeting the fishing effort mainly on anchovy. But due to the generally low biomass levels experienced by the anchovy stock over the last years (see related assessment), measures should be taken to prevent a possible further shift of effort back from anchovy to sardine.

Advice for scientific research*

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Abstract for SCSA reporting

Authors	Patti B., Quinci E.M., Bonanno A., Basilone G., Mazzola S.	**Year**	2011

Species Scientific name

Sardina pilchardus - PIL

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area   16 - South of Sicily

Fisheries (brief description of the fishery)*

TEXT ONLY - Characheters left: 746

In Sciacca port, the most important base port for the landings of small pelagic fish species along the southern Sicilian coast (GSA 16), accounting for about 2/3 of the total landings in GSA 16, two operational units are presently active, purse seine and pelagic pair trawlers. In both OUs anchovy represents the main target species due to the higher market price, so generally sardine catches are to be considered of secondary importance for local fishery.

Average sardine landings over the period (1998-2010) were about 1,400 metric tons, with a general decreasing trend. Sardine biomass, estimated by acoustic methods, ranged from a minimum of 6,000 tons in 2002 to a maximum of 39,000 tons in 2005. Current acoustic biomass is at intermediate level.

Source of management advice*

(brief description of material -data- and method TEXT ONLY - Characheters left: 87

Census data for catch and effort information (on deck interviews) in Sciacca port since 1998. Biological samples for fish biology information (DCF, 2007-2008 data). Acoustic data for fish biomass evaluations. Total offical landings (DCF) for the last 4 years (2007-2010) were also taken into account.

Modelling approach based on a non-equilibrium surplus production model (BioDyn package; Fao, 2004). The model uses four basic parameters: Carring capacity (or Virgin Biomass) K, population intrinsic growth rate r, initial depletion BI/K (starting biomass relative to K) and catchability q. Given the best parameter estimates, the model calculates the MSY, BMSY and FMSY reference points. The model implementation adopted allows for the optional incorporation of environmental indices, so that the r and K parameters of each year can be considered to depend on the corresponding value of the applied index.

The input data used for the stock was total yearly catch estimates, and a series of abundance indices from acoustic surveys over the period 1998-2010. In addition an enviromental index, based on the satellite estimate of yearly average chlorophyll-a concentration over the continental shelf off the southern sicilian coast, was used in the attempt of improving the performance of the model fitting, as expected because pelagic stocks are known to be significantly affected by environmental variability.

Stock Status*

F - Fully exploited. The fishery is operating at or close to an optimal yield level, with no expected room for further expansion;

Exploitation rate   **Stock abundance**

Moderate fishing mortality   Low abundance

Comments

Graghs for diagnostics are in the previous sheet ("Other") and on sheet "G".

Management advice and recommendations*

Results of the adopted modelling approach suggest that the environmental factors can be very important in explaining the variability in yearly biomass levels (mostly due to recruitment success) and indicate that the stock status was well below the BMSY during the considered period. In 2010 the stock only partially recovered from the high decrease in biomass occurred in 2006 (-52% from July 2005 to June 2006), and this fact, along with the general decreasing trend in landings over the last decade, also suggests questioning about the sustainability of current levels of fishing effort.

Given that the stock biomass over the last years appears to be in a stable low abundance phase and considering the fishing mortality pattern observed throughout the time series, fishing effort should not be allowed to increase and consistent catches should be determined. However, as the small pelagic fishery is generally multispecies, any management of fishing effort targeting the sardine stock would also have effects on anchovy. Local small pelagic fishery appears to be able to adapt at resource availability and market constraints, targeting the fishing effort mainly on anchovy. But due to the generally low biomass levels experienced by the anchovy stock over the last years (see related assessment), measures should be taken to prevent a possible further shift of effort back from anchovy to sardine.

Advice for scientific research*

xxx