

SAC GFCM Sub-Committee on Stock Assessment

Date* **16** **October** **2011**

Code* **ARA0511Car**

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Species Scientific name* **1** *Aristeus antennatus* - ARA
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area* FAO 37.1.1

Geographical Sub-Area (GSA)* 05 - Balearic Island

Combination of GSAs **1**
2
3

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Assessment form

Sheet #0

Basic data on the assessment

Code: ARA0511Car

Date*	16	Oct	2011	Authors*	Carbonell, A., Guijarro, B., Gaza, M., Ordines, F.
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Species Scientific name*	Aristeus antennatus - ARA	Species common name*	Red shrimp, Crevette rouge, Gamba roja
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Data Source

GSA*	05 - Balearic Island	Period of time*	1992-2010
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Description of the analysis

Type of data*	Monthly size distribution, and year-age classes matrix. CPUE of Trips landing by vessel, and monthly fleet landings	Data source*	Fishery Department local authorities and DCR data sampling IEO programme.
Method of assessment*	LCA, Separable VPA, XSA, Yield per Recruit analysis	Software used*	VIT (Leonart and Salat, 1997) VPA-XSA (Darby and Flatman, 1994)

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	---	1	---	2	1	4	1	---	1	1	1

Comments, bibliography, etc.

Leonart, J., and J. Salat. 1997. VIT: Software for fishery analysis--. User's manual FAO Computerized information Series (Fisheries) N° 11. Rome, FAO. 1997. 105 p.

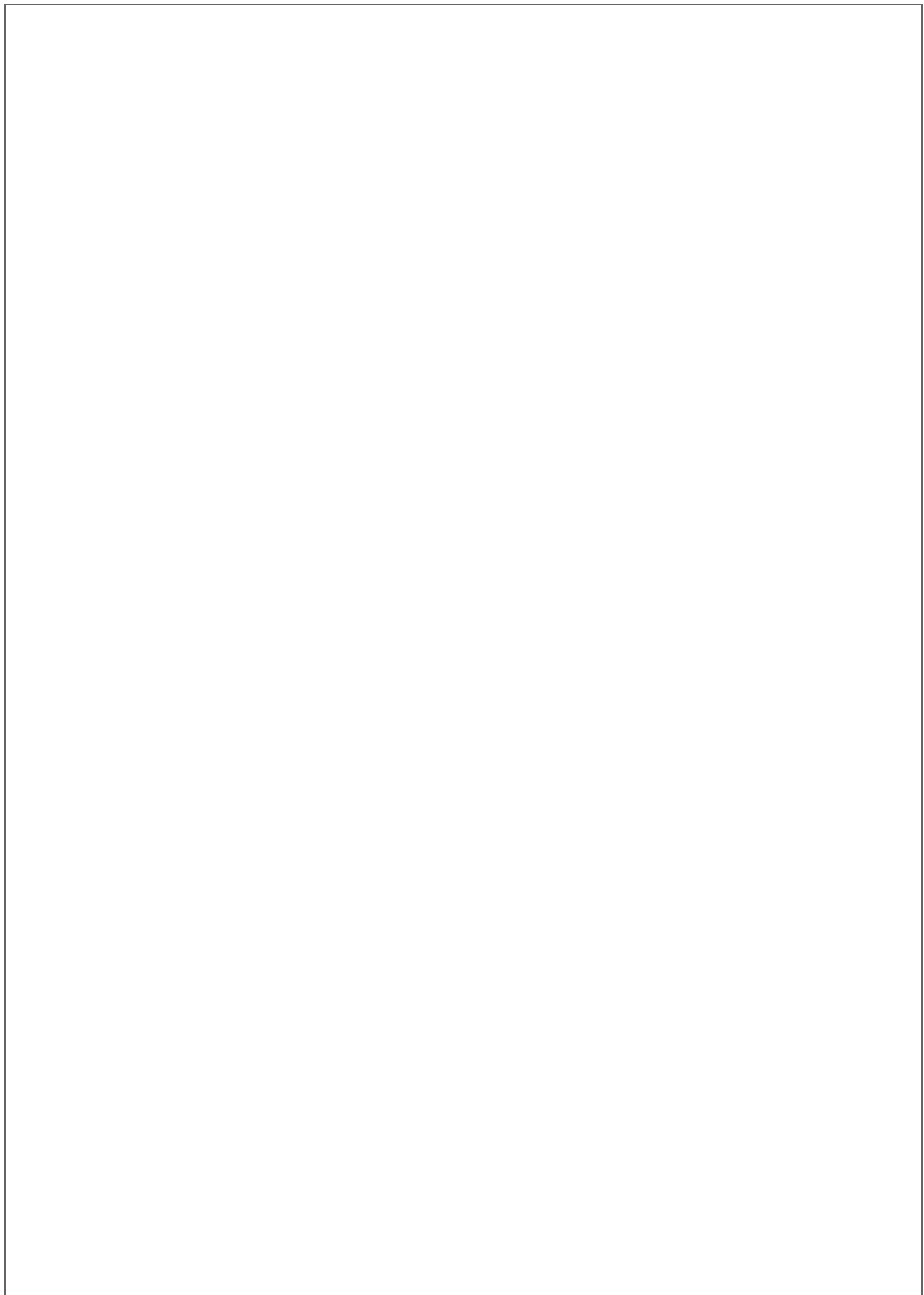
Darby, C. and D. Flatman. 1994. Virtual Population Analysis: version 3.1. (Windows/Dos) user guide. Infor. Tech. Ser., MAFF Direct. Fish. Res., Lowestof (1):85 pp.

Carbonell, A., M. Carbonell, M. Demestre, A. Grau, S. Monserrat. 1999. The red shrimp *Aristeus antennatus* (Risso, 1816) fishery and biology in the Balearic Islands, Western Mediterranean. Fisheries Research 44.1-13.

Carbonell A, Azevedo, M. 2003. Application of non-equilibrium production models to the red shrimp (*Aristeus antennatus*, Risso 1816) fishery in the North-western Mediterranean.). Fisheries Research 65, 323-334.

Carbonell, A., A. Grau, V. Lauronce, C. Gómez. 2006. Ovary Development Of the Red Shrimp *Aristeus antennatus* from Northwestern Mediterranean Sea. Crustaceana 79(6).727-743 (2006).

Carbonell, A., Lloret, J., Demestre, M. 2007. Relationship between condition and recruitment success of the red shrimp (*Aristeus antennatus*) in the balearic sea (Northwestern Mediterranean). Journal of Marine Systems 71 (2008) 403-412.



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Sheet B
Biology of the species

Code: ARA0511Car

Biology

Somatic magnitude measured (LH, LC, etc)*				LC	Units*	mm
Sex	Fem	Mal	Both	Unsexed		
Maximum size observed	66	38	66		Reproduction season	April_September
Size at first maturity	21	26	24		Reproduction areas	GSA 5
Recruitment size	13-22	15-18	13-22		Nursery areas	GSA 5

Parameters used (state units and information sources)

		Units	Sex			
			female	male	both	unsexed
Growth model	L ∞	CL mm	75.5	42	75.5	
	K	mm/month	0.249	0.422	0.285	
	t0		-0.3936	-0.65	-0.4533	
	Data source	Carbonell et al., 1999				
Length weight relationship	a		0.00244	0.00246	0.00243	
	b		2.4536	2.4311	2.4401	

M		0.363	0.518	0.363	
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sex ratio (mal/fem)	25/75
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Comments

Aristeus present different growth and sexual maturity for females and males. The majority of landings are females dominated (70~75%)

Following the recommendation of 2010 SAC committee assessment was made:

- 1) by sex: females and males separated, afterwards results summed
- 2) by total: population (females and males together)
- 3) by Sex_combined (age matrix by sex have been summed and afterward separable VPA and XSA were made)

Results showed differences for the first option (VPAs by sex separated). The reason could be in the males age matrix composition, since it was composed by 0-4 ages, although for the last age have low number of individuals in almost all years. The main differences have been done in the recruitment estimations that double those obtained for sex_combined and total population.

Tuning have been done with fleet Palma port for all years, and with MEDITS survey data for the years 2001-2010.

The main results presented were for Separable VPA and XSA age matrix of Sex_combined data tuning with Palma harbour fleet and MEDITS survey 2001-2010 data. For LCA and Y/R data corresponded to the average size distribution by sex and total for the 2005-2010 years.

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Sheet P1

General information about the fishery

Code: ARA0511Car

Data source*	Govern Autonomus Balearic Islands, Fishery Department	Year (s)*	1992-2010
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Data aggregation (by year, average figures between years, etc.)*	Annual agregation by year, and average of all years
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Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	ESP	05	E - Trawl (12-24 metres)	03 - Trawls	34 - Demersal slope species	ARA
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
ESP 05 E 03 34 - ARA	34	Tons	164		0.00%	17%	trips
Total	34		164		0.00001	0.17	

Legal minimum size	None
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Comments

Comments

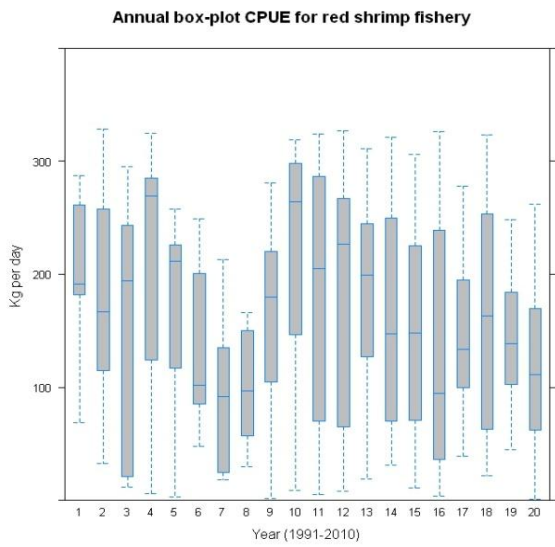


Fig. 1. CPUE. Landing (Kg) by vessel and trip.

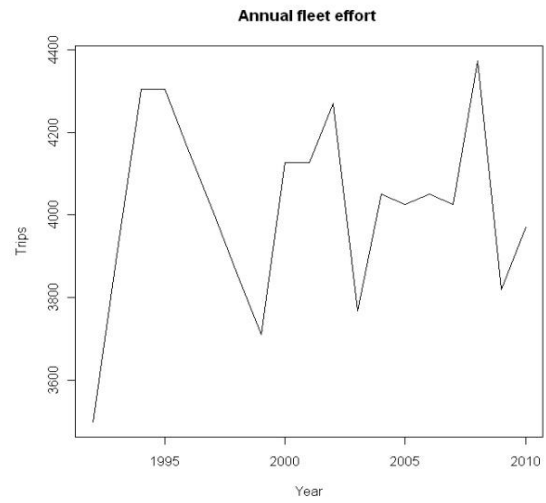


Fig. 2. Effort days for total Fleet. Trips days

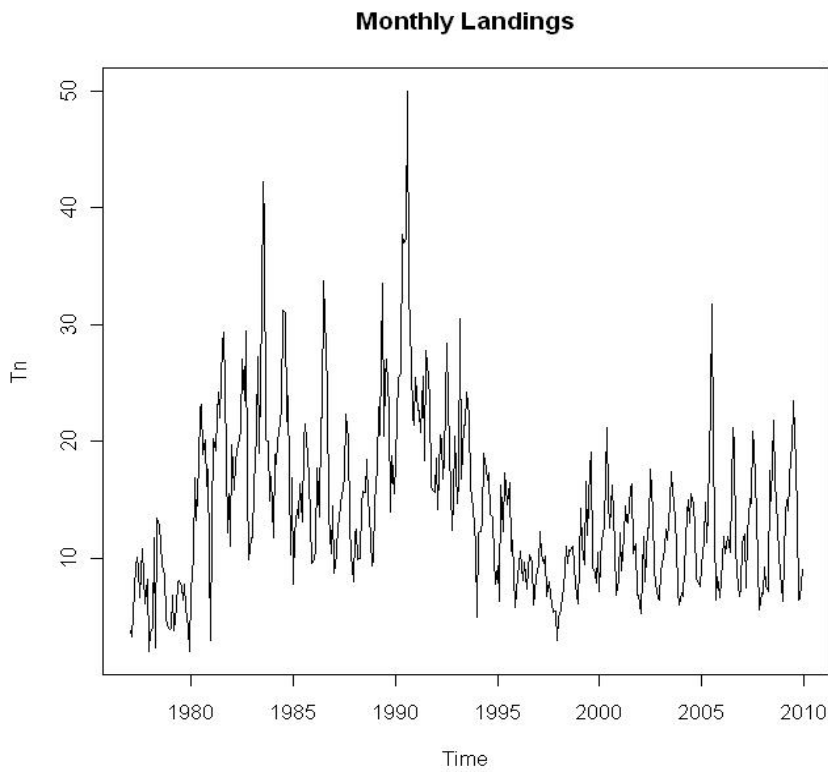


Fig. 3. Monthly landings 1978-2010 years.



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Sheet P2a
Fishery by Operational Unit

Code: ARA0511Car

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Data source*	Autonomous Govern. Fishing statistics. IEO	OpUnit 1*	ESP 05 E 03 34 - ARA
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Time series

Year*	1999	2000	2001	2002	2003	2004
Catch	93	100	145	141	115	140
Minimum size	15	15	15	17	15	13
Average size Lc	27.25	29.02	30.13	31.34	31.98	29.05
Maximum size	65	63	65	61	64	64
Fleet	22	22	23	20	24	16

Year	2005	2006	2007	2008	2009	2010
Catch	172	164	141	149	140	164
Minimum size	15	17	15	17	13	15
Average size Lc	29.49	30.57	33.1	33.31	31.12	29.1
Maximum size	62	62	58	64	65	61
Fleet	16	16	16	17	17	17

Selectivity

Remarks

L25		
L50		
L75		
Selection factor		
		

Structure by size or age

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Structure by size or age

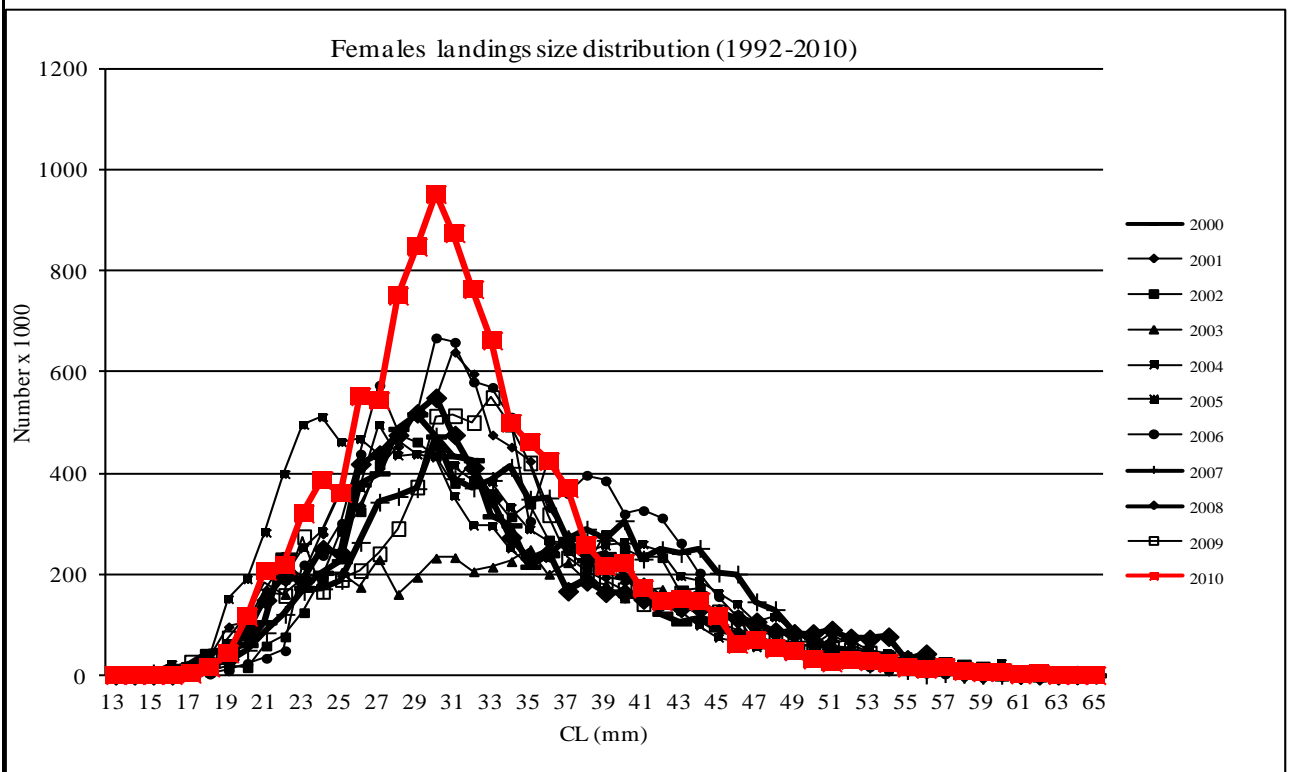
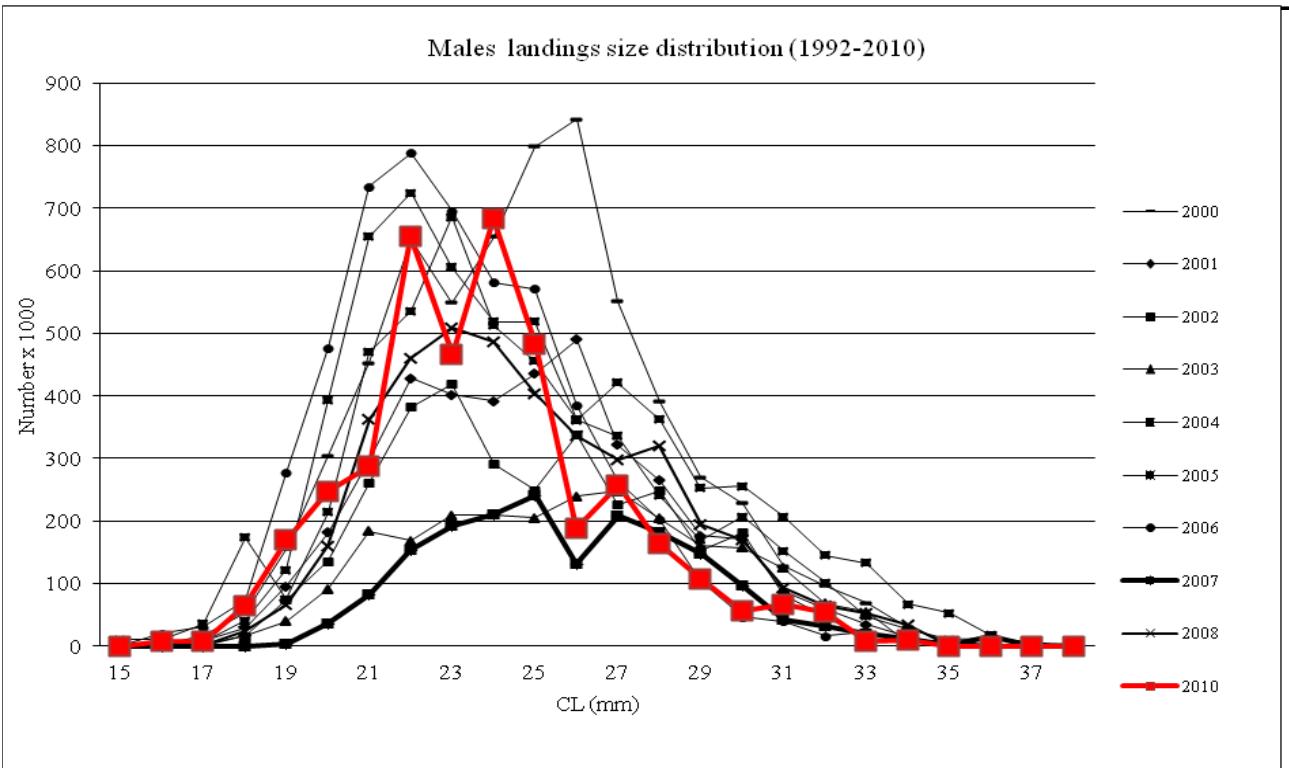


Fig. 4. Annual Cefalotorax length distribution for emales and males, from 1992 to 2010 year.

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Sheet P2b
Fishery by Operational Unit

Code: ARA0511Car

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Data source* Autonomous Govern. Fisheries statistics. IEO

OpUnit 1* ESP 05 E 03 34 - ARA

Regulations in force and degree of observance of regulations

Fishing license: fully observed

Engine power limited to 500 HP: not fully observed

Fishing forbidden at < 50 m depth: fully observed

Time at sea 5 days a week during 12 hours at sea: fully observed

Mesh size in the codend (square 40 mm or 50 mm diamond with derogation): fully observed

EC Regulations:

The minimum mesh size of all bottom gear may not be less than 40 mm (EC Regulation 1967/2006).

In addition trawling activity cannot be performed within 3 miles off the coast, where sea bed is less than 50 m depth.

Minimum landings sizes have been established for the most important commercial species, although there is not a minimum landing size for the red shrimp according to EC Regulation 1967/2006, which has replaced the previous EC Regulation 1626/94.

The use of towed dredges and trawl nets is at depth beyond 1000 m prohibited (EC Regulation 1967/2006) ational Regulations:

Effort regulations (APA/254/200) authorised trawls fishing 5 days a week during 12 hours at sea

Accompanying species

- Red Shrimp bottom trawl main accompanying species are listed below:

European hake (*Merluccius merluccius*) -

Black mouth catshark (*Galeus melastomus*) -

Pandalid shrimps (*Plesionika spp. Pasiphaea*) -

Giant red shrimp (*Aristaeomorpha foliacea*) -

Crabs (*Macropipus tuberculatus, Geryon longipes*) -

Megrim (*Lepidorhombus spp.*) -

Seabreams (*Pagellus acarne*) -

Siver scabbard fish (*Lepidopus caudatus*) -

Anglerfish (*Lophius spp.*) -

Blue-whiting (*Micromesistius poutassou*) -

Greater forkbeard (*Phycis blennoides*) -

Rockfish (*Helicolenus dactylopterus*) -

Conger eel (*Conger conger*)



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Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: ARA0511Car

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Sex*	Total
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Analysis # * LCA/VPA

Time series

Data	Size	Age
(mark with X)	X	

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Capture	Tunig method	
# of gears	1	Software	VIT (Lleonart and Salat, 1997)
F _{terminal}	2		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	13	0	Recruitment	23.46 millions	29.79 t
Average	24.46	0.978	Average population	24.72 millions	179.34 t
Maximum	66	5+	Virgin population		1271.49 t
Critical	27	1.1	Turnover		

Average mortality

	Total	Gear				
F ₁	0.586					
F ₂	1.36					
Z	0.949					

(F1 and F2 represent different possible calculations. Please state them)

Comments

Total	Biomass (g)	Percentage
Recruitment	29793258.13	12.85
Growth	201995304.8	87.15
Natural death	65100350.99	28.09
Fishing	166688212	71.91
R/B(mean)	16.61	
D/B(mean)	129.25	
B(max)/B(mean)	51.48	
B(max)/D	39.83	

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Assessment form

Sheet A1
Indirect methods: VPA, LCA

Sex* Females

Code: ARA0511Car

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Time series

Analysis # * LCA/VPA

Data	Size	Age
(mark with X)	X	

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Capture	Tuning method	
# of gears	1	Software	VIT (Leonart and Salat, 1997)
F _{terminal}	2		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	13	0	Recruitment	16.97 millions	31.83 Tn
Average	27.342	1.49	Average population	23.03 million	224.93 Tn
Maximum	66	5+	Virgin population		1039.33
Critical	30	1.64	Turnover		

Average mortality

	Total	Gear				
F ₁	0.374					
F ₂	1.087					
Z	1.45					

(F1 and F2 represent different possible calculations. Please state them)

Comments

	Biomass (g)	Percentage
Females		
Recruitment	31830273.46	14.28
Growth	191061981.7	85.72
Natural death	81647891.11	36.63
Fishing	141244364	63.37
R/B(mean)	14.15	
D/B(mean)	99.1	
B(max)/B(mean)	41.62	
B(max)/D	42	

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Sheet A1
Indirect methods: VPA, LCA

Code: ARA0511Car

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Sex* Males

Analysis # *

Time series

Data	Size	Age
(mark with X)	X	

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Capture	Tunig method	
# of gears		Software	Vit4win
F _{terminal}	2		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum	13	0	Recruitment	6.94 millions	12.35 Tn
Average	20.97	1.04	Average population	6.30 millions	27.03 Tn
Maximum	38	4+	Virgin population		96.37 Tn
Critical	21	0.99	Turnover		

Average mortality

	Total	Gear				
F ₁	0.584					
F ₂	1.531					
Z	1.102					

(F1 and F2 represent different possible calculations. Please state them)

Comments

Males	Biomass	Percentage
Recruitment	12351455.12	33.2
Growth	24853273.69	66.8
Natural death	13975981.96	37.57
---Females	Biomass	Percentage
Recruitment		

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Sheet A2
Indirect methods: data

Code: ARA0511Car

Sex*	Sex_combined	Gear*	Trawl	Analysis # *	Separable VPA
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Data source	1992-2010 years
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Data

Quality of data and inputs: Length frequency data for landings are available on a monthly basis. It was run a single VPA of males and females combined, using VPA package. The male and female length distributions for year (1992-2010) were split using L2Age, slicing ICES package to ages . The catch-at-age for the two sexes were then summed to do a separable VPA and XSA for Sex_combined data. Effort in days represent effort trips. Tuning data series was made using the Palma harbour reference fleet, and BALAR_MEDITS Surveys

PARAMETE	Females	Males	Total	Modal Age C	Females	Males	Total
Linf	75.5	42	75.7	Edades			
K	0.249	0.422	0.285	0	22.1	22	22.1
to	-0.3936	-0.65	-0.45326	1	33.9	29.6	33.9
a	0.00244	0.00246	0.002426	2	43.1	34.6	43.1
b	2.4536	2.4311	2.4701264	3	50.2	37.8	50.2
L50	26	21	21	4	55.8		55.8
M	0.363	0.517	0.517	5	60.1		60.1
				6	63.5		63.5
				GRUPO PLU:	6+	3+	5+

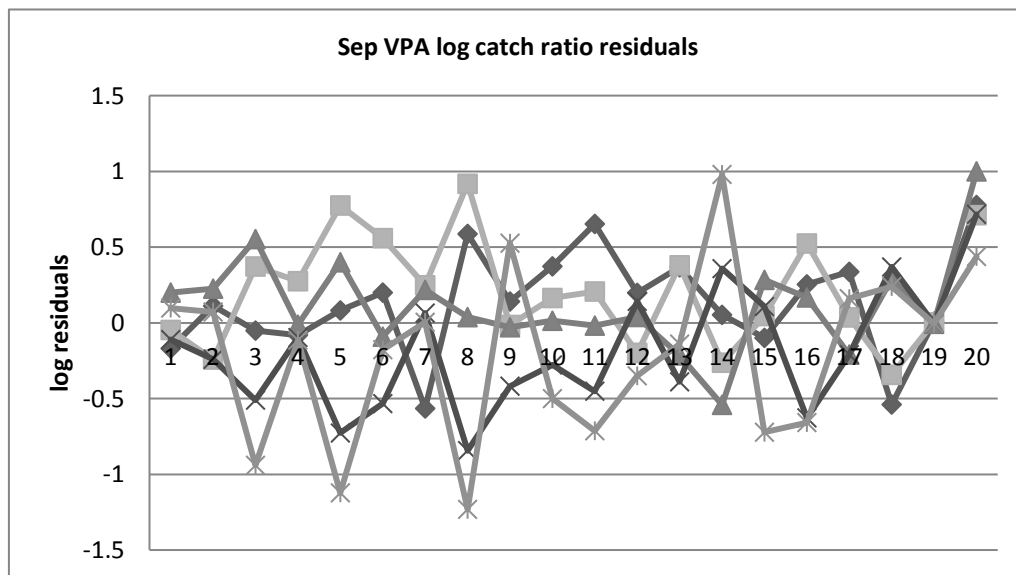
Separable VPA Setting used in the assessment

Ft = 0.5

St = 1.2

Initial sum of squared residuals was 105.197 and final sum of squared residuals is 12.696 after 56 iterations

Selection at age 2



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Assessment form

Sheet A3

Indirect methods: VPA results

Code: ARA0511Car

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Sex*	k_combin	Gear*	Trawl	Analysis #*	Sep VPA /XSA fleet Palma
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Population in figures

VPA sep	RECRU	Year	RECRUITS	XSA Fle	RECRU	Year	RECRU	XSA Sur	RECRU	Year	RECRU
1992	41787	2004	33980	1992	43677	2004	35505	1992	43295	2004	34838
1993	30743	2005	30852	1993	32140	2005	32549	1993	31837	2005	31401
1994	28045	2006	24688	1994	29542	2006	25915	1994	29054	2006	24383
1995	23274	2007	28765	1995	25182	2007	28858	1995	24106	2007	26415
1996	20465	2008	30702	1996	21880	2008	28408	1996	21247	2008	23846
1997	22936	2009	55447	1997	24622	2009	34508	1997	23667	2009	33721
1998	29886	2010	70250	1998	31504	2010	30230	1998	30882	2010	29237
1999	32021			1999	33761			1999	32900		
2000	28158			2000	30011			2000	28986		
2001	23395			2001	25022			2001	24097		
2002	21716			2002	23635			2002	22315		
2003	30670			2003	31939			2003	31478		

Population in biomass

VPA sep	TOTALB	Year	TOTALBIO	XSA Fle	TOTALB	Year	TOTALB	XSA Sur	TOTALB	Year	TOTALB
1992	601	2004	388	1992	626	2004	402	1992	608	2004	393
1993	510	2005	432	1993	533	2005	446	1993	514	2005	394
1994	455	2006	437	1994	477	2006	446	1994	456	2006	379
1995	334	2007	377	1995	349	2007	373	1995	326	2007	360
1996	291	2008	384	1996	305	2008	352	1996	284	2008	322
1997	229	2009	479	1997	240	2009	360	1997	218	2009	313
1998	242	2010	704	1998	252	2010	388	1998	236	2010	353
1999	312			1999	324			1999	302		
2000	381			2000	396			2000	363		
2001	373			2001	389			2001	365		
2002	348			2002	363			2002	345		
2003	337			2003	351			2003	325		

Fishing mortality rates

VPA sep	FBAR 2-	Year	FBAR 2-4	XSA Fle	FBAR 2-	Year	FBAR 2-	XSA sur	FBAR	Year	FBAR 2-
1992	1.2657	2004	0.8496	1992	0.8723	2004	0.4904	1992	1.2407	2004	0.8305
1993	1.2063	2005	1.4092	1993	0.8664	2005	0.6595	1993	1.1764	2005	1.3812
1994	1.1452	2006	0.962	1994	0.7987	2006	0.5362	1994	1.1283	2006	0.9691
1995	1.2683	2007	0.766	1995	0.8786	2007	0.4839	1995	1.2372	2007	0.7816
1996	1.1268	2008	1.0192	1996	0.7537	2008	0.6674	1996	1.1022	2008	1.1227
1997	1.2999	2009	0.9732	1997	0.7345	2009	0.5898	1997	1.2591	2009	1.4255
1998	1.0912	2010	0.5064	1998	0.5359	2010	0.4621	1998	1.0762	2010	1.3298
1999	0.5099			1999	0.322			1999	0.4905		
2000	0.9763			2000	0.5235			2000	0.9045		
2001	0.8468			2001	0.4881			2001	0.8106		
2002	0.8217			2002	0.5185			2002	0.7963		
2003	0.9784			2003	0.5178			2003	0.9708		

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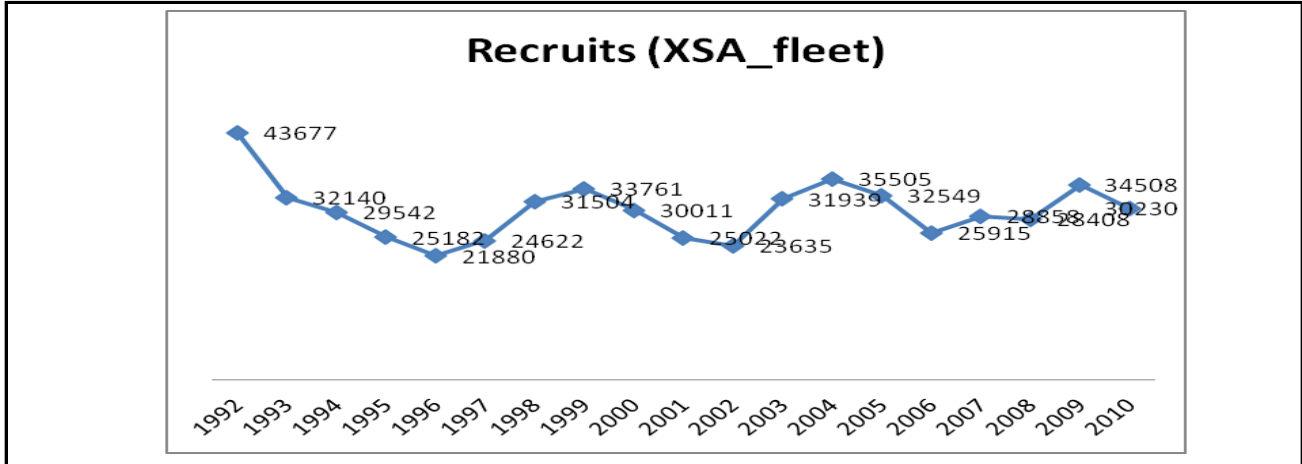
Sheet A3
Indirect methods: VPA results

Code: ARA0511Car

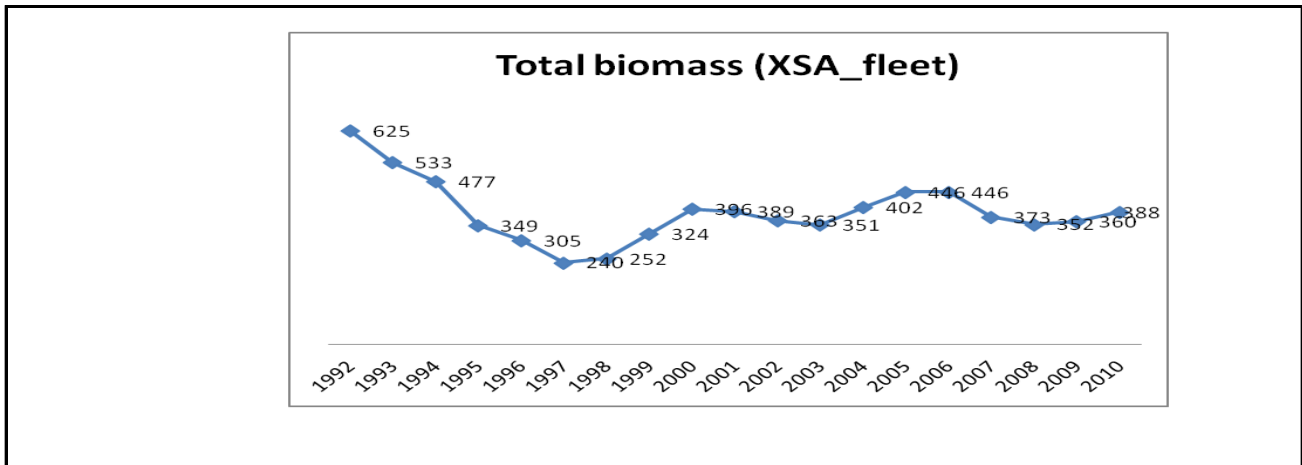
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Sex*	Sex_co	Gear*	Trawl	Analysis #*	XSA Tuning Fleet
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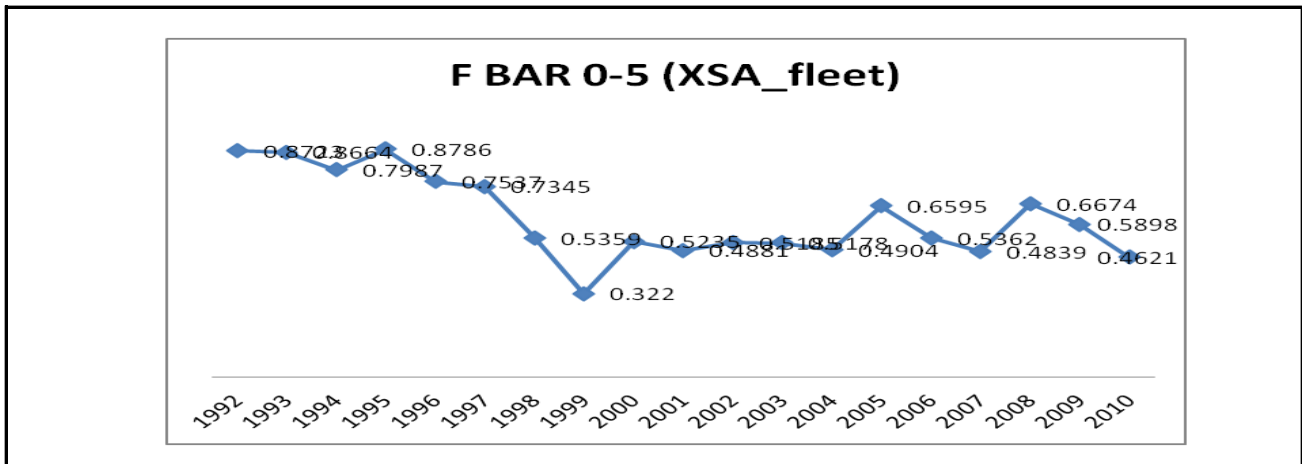
Population in figures



Population in biomass



Fishing mortality rates



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Assessment form

Sheet A3
Indirect methods: VPA results

Code: ARA0511Car

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Sex*	Sex_co	Gear*	Trawl	Analysis #*	XSA Fleet tuning
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Population in figures

SUMMARY STATISTICS FOR FLEET PALMA HARBOUR TUNING

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q	t Test
0	1.34	-0.146	13.73	0.02	19	1.08	-12.85	0.88563864
1	1.28	-0.255	9.71	0.08	19	0.59	-9.73	0.80178243
Ages with q independent of year class strength and constant w.r.t. time.								
Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q	
2	5.03	-1.064	10.06	0.01	19	2.74	-9.04	0.30220926
3	6.78	-1.66	10.55	0.01	19	3.34	-8	0.11524625
4	4.02	-1.636	10.01	0.03	19	1.79	-7.33	0.12021761
5	1.78	-1.156	7.94	0.18	19	0.76	-6.85	0.26366959

Population in biomass

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	0.44	0.17	-0.38	-1.19	-0.38	0.58	0.05	0.62	0.58	-0.87
1	0.42	0.34	0.23	0.18	0.32	0.7	0.57	0.23	0.31	-0.94
2	0.41	0.68	0.01	0.54	0.73	0.67	0.89	0.65	0.01	-0.66
3	0.6	0.4	0.48	0.34	0.82	0.32	0.48	0.76	0.02	-0.29
4	0.92	0.83	0.61	-0.01	0.54	0.01	0.21	0.09	0.13	-0.31
5	1.8	1.7	1.71	-0.24	1.03	0.38	0.61	0.64	0.16	0.39
Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	
0	0.03	0.28	-0.95	0.67	1.25	-2.51	0.33	-0.14	1.05	
1	0.2	0.23	0.23	0.34	0.39	-0.21	-1.36	-0.17	0.09	
2	0.07	0.3	0.02	0.34	-0.01	-0.33	-1.24	-0.27	0.24	
3	-0.06	-0.34	-0.06	0.28	-0.02	-0.35	-1.25	0.11	0.66	
4	0.04	-0.38	0.06	0.3	0.06	0.13	-1.3	0.32	0.46	
5	0.53	0.24	0.29	0.64	0.8	0.35	-0.44	1.1	0.74	

Fishing mortality rates

The log catchability residuals for the fleet (1992-2010) were lower than surveys time series (2001-2010). Residual show change of the pattern of exploitation between 2008 and 2010. The Q plateau was not achieved for mean log catchability and standard error of last age.

Regression analysis for the ages with catchability dependent on year class strength shows there is no significant differences from 1. Therefore catchability could be considered constant with respect to population abundance (direct proportionality) for all ages.

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Assessment form

Sheet A3
Indirect methods: VPA results

Code: ARA0511Car

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Sex*	Sex_co	Gear*	Trawl	Analysis #*	XSA fleet tuning
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Population in figures

XSA: Tuning Fleet Palma harbour :1992-2010
 Total absolute residual between iterations 109 and 110 = .00045
 Age range: 0-7; Classe plus 5+
 First age for normal catchability independ analysis: Age class 2
 First age at which q is considered independent of age: Age class 2
 Tape time weighting applied? YES, Tricubic over 20 years F shrinkage: YES; YEAR RANGE = 5 Population shrinkage: YES AGE RANGE = 3-5 Minimum Log SE for terminal population estimates: 1.0
 TUNING SURVEY: MEDIT_BALAR; Year range: 2001-2010
 Tuning converged after 11 iterations
 Age range: 0-7; Classe plus 5+
 First age for normal catchability independ analysis: Age class 2
 First age at which q is considered independent of age: Age class 2
 Tape time weighting applied? YES, Tricubic over 20 years F shrinkage: YES; YEAR RANGE = 5 Population shrinkage: YES AGE RANGE = 3-5 Minimum Log SE for terminal population estimates: 1.0

Population in biomass

Log catchability residuals.											
Fleet : Survey											
Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
0	-0.37	-0.94	-0.9	-1.11	0.45	0.24	0.81	-0.15	0.26	1.29	
1	-0.29	-0.36	-0.14	-0.42	-0.01	-0.13	0.27	0.09	0.3	0.5	
2	0.49	1.67	1.49	0.51	-0.9	-0.44	-0.28	0.55	-0.05	-2.45	
3	0.92	1.59	1.49	1.1	-1.01	-0.69	-1.13	0.42	0.09	-2.08	
4	1.26	1.68	0.64	2.03	-1.17	-0.2	-1.9	-0.09	0.01	-1.49	
5	1.28	1.66	-0.4	1.98	-1.01	-0.08	-0.66	-0.38	0.11	-1.83	
6	99.99	99.99	-2.6	99.99	-2.85	99.99	99.99	-2.07	-0.75	99.99	

Fishing mortality rates

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q	T test
0	-0.66	-0.893	14.41	0.04	10	0.85	-3.9	0.39792313
1	-0.31	-2.053	11.62	0.25	10	0.33	-3.72	0.07416189
Ages with q independent of year class strength and constant w.r.t. time.								
Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q	
2	-3.36	-0.438	27.2	0	10	4.26	-3.23	0.67297184
3	0.44	0.666	5.22	0.16	10	0.57	-2.4	0.52414678
4	0.49	0.807	4.02	0.26	10	0.67	-1.81	0.44299543
5	0.49	1.183	2.63	0.42	10	0.57	-0.39	0.27077086
6	1.28	-0.136	2.2	0.11	4	1.51	-2.43	0.89518125

SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	Sheet Y Indirect methods: Y/R

Sex <u> </u> ales and Males	Code: ARA0511Car
	Analysis # <u> </u> 1

# of gears		Software	Vit4win
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Parameters used

Vector F	1
Vector M	0.363
Vector N	1

Model characteristics

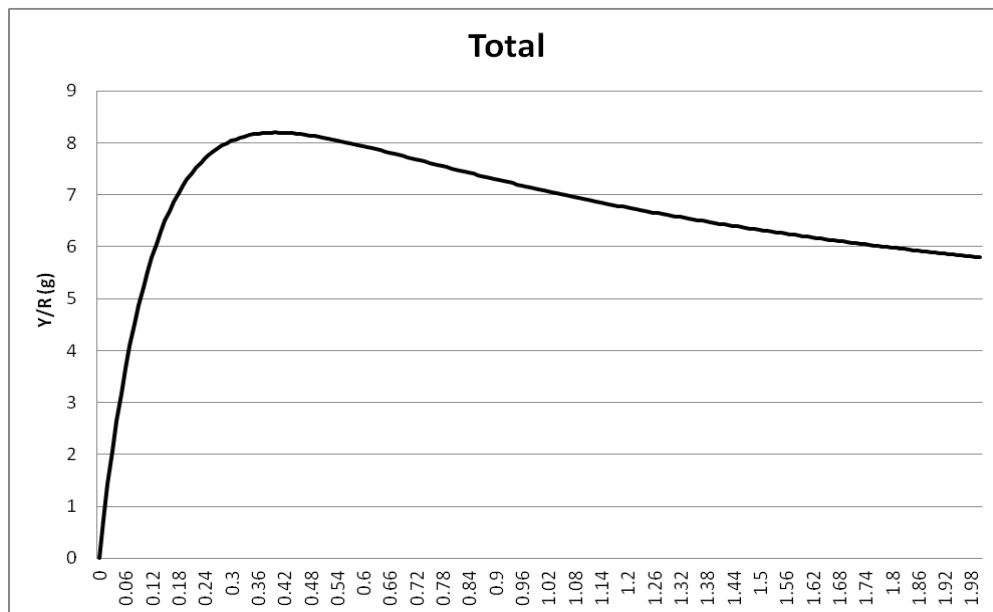
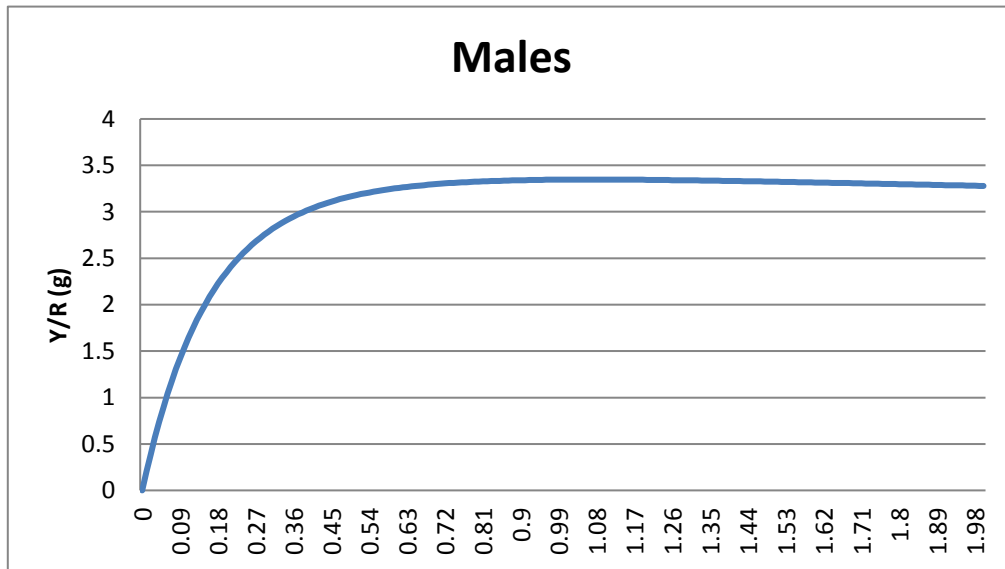
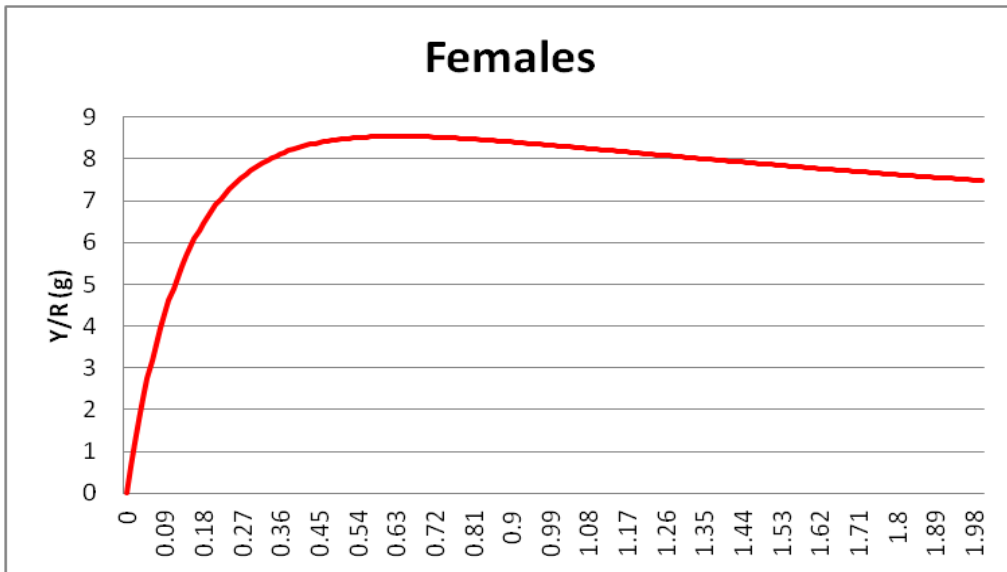
Yield per Recruit analysis were made by sex , assuming the current steady state exploitation pattern for the period 2005-2010. Results of equilibrium landings and SSB/R estimated the current exploitation close to the maximum.

Results

	Total	Gear			
		Females	Males		
Current YR	7.104	8.321	3.345		
Maximum Y/R	8.199	8.54	3.346		
Y/R 0.1	7.772	7.854	2.992		
F _{max}	0.41	0.64	1.08		
F _{0.1}	0.25	0.31	0.38		
Current B/R	7.644				
Maximum B/R	17.637				
B/R 0.1	24.738				

Comments

Comments



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Assessment form

Sheet D
Diagnosis

Code: ARA0511Car

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B	388	Tn			
SSB	388	Tn			
F	1.054				
Y	7.104	g			
CPUE	32.89	Kg/Trip			

Stock Status* Use one (or both) of the following two systems for the stock assessment status description

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

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

Comments

The stock is in overfishing status.

The XSA log catchability residuals are over 0.5 for the age 0 for almost all years and for the last age only for 1991-1994, 1996 and 2009. The youngest age classes are only partially recruit to the fishery (low abundance of age 0). Residual show change of the pattern of exploitation between 2008 and 2010. The highest residuals was -2.51 for age 0 in 2007 and the lowest residuals was 0.01 for the age 2 in 1994 and 2001 years..The two tuning,, fleet and survey, give similar estimates of survivors and have the similar weight in the F-at-age values. Total Biomass decreased from 550 tn (1992) to around 250 tn (1998), increasing from them until 2002, and decreasing again from 500 tn to 300 tn in 2006, afterwards biomass estimates are around 400 Tn. For the lasts assessment Fishing effort fluctuated around the similar values.The log catchability residuals for the surveys time series (2001-2010) were higher than those obtained from the fleet. The final XSA was tuned with the Palma harbour fleet.

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Assessment form

Sheet Z

Objectives and recommendations

Code: ARA0511Car

Management advice and recommendations*

The last year recommendation to do not increase the effort continue for this year. Landings for 2010 still decreasing catches for males and increasing for females. The VPAs and XSAs of 2009 and 2010 assessments have been changed the F estimation from 1 to 0.5 (corr. coef with effort trip = 0.30) and Selection at age from 1 to 1.2 (better Q plateau). Tuning log catchability residuals was lower for the Palma fleet, although there was small differences in estimates for both tunings XSA models. Spawning Stock Biomass showed a slight increase, while Recruitment and Fishing mortality showed a slight decrease for the last year. Correlation coefficients for regression points of the XSA catchability model were very low (close to 0) which make difficult to fit catchability model. The slopes of regression model are not significantly different from 1 for all ages (no direct proportionality) and slopes are negative (with the meaning of increasing catchability with decreasing population abundance). Yield per Recruit model at F0.1 recommend effort reduction. Since the mean size and landings appear close to the mean values for the whole time series, the monitoring of the fishery should continue carefully looking for the progress of the fishery. By the other hand complementary management measures will be provided like temporal fishing time reduction for some periods like at the beginning of the reproduction or spawning period and during the recruitment period at the beginning of autumn which could have a beneficial effect in the overall red shrimp population.

Advice for scientific research*

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

Assessment form

Sheet C
Comments

Code: ARA0511Car

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Comments*

The available proxies of F_{max} and $F_{0.1}$, correspond to reductions in F of about 60-70% at the current level at F status, improvement in selectivity pattern would be a improvement on the yields and mean size of fishing. The recently applied change in the mesh size may be detected in the next estimates of the future assessments. However, not all the fleet uses the square 40 mm mesh size, as some use (by derogation) the 50 mm diamond. This is the year which marks the shift in the mesh type.

Abstract for SCSA reporting

Authors Carbonell, A., Guijarro, B., Gaza, M., Ordines, F. **Year** 2011

Species Scientific name Aristeus antennatus - ARA
Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 05 - Balearic Island

Fisheries (brief description of the fishery)*

Bottom trawl fleet fishing effort of the Majorca Island were quite stable for the period studied. Around 35 vessels operated in the area, whose lengths are between 12- 24 m. The cod end mesh size used was a diamond 40 mm of mesh opening until Jun 1st 2009, when (following EC Regulation) it was changed to a square 40 mm of mesh opening or (by derogation) to a 50 mm diamond mesh. The slope fishery employ the 60% of the trawl fleet in the Balearic Islands, doing daily trips mostly with an unique haul directed to the red shrimp, with a duration between 5 and 7 hours.

Source of management advice*

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

The Separable VPA and XSA were made for the Annual Catch at Age for females and males summed to obtain the final Sex_combined matrix.
The LCA (Pseudocohort analysis) was made for the average Cephalorax length (CL mm) size distribution for the years 2005-2010, for females, males and total.

Software used:
Separable VPA and Extended Survivor Analysis (XSA) (Darby and Flatman, 1994)
Pseudocohort analysis and Yield per Recruitm using VIT (Leonart and Salat, 1997)

Complementary data used were:
1- Time series of landings (1978-2010)
2- Time series cpues (Kg/day~trip) (1992-2010)
3- Total days effort fleet.

Stock Status*

[Redacted area]

Exploitation rate

Moderate fishing mortality

Stock abundance

Low abundance

Comments

[Redacted area]

Management advice and recommendations*

The first year management advice to... (faint, illegible text)

Advice for scientific research*

