SAC GFCM
Sub-Committee on Stock Assessment

Date*	19	February	2009	Code*	HKE0709Ang

Authors*

Angélique Jadaud*, Beatriz Guijarro**, María Valls**, Henri Farrugio* and Enric Massutí*

Affiliation*

(*) IFREMER, 1 rue Jean Monnet, BP 171, 34203 Sète (France); (**) IEO- Centre Oceanogràfic de les Balears, Moll de Ponent s/n, 07015 Palma de Mallorca (Spain)

Species Scientific name*

1 ***Merluccius merluccius - HKE***
Source: GFCM Priority Species

2
Source: -

3
Source: -

Geographical area*

Gulf of Lions

Geographical Sub-Area (GSA)*

07 - Gulf of Lions

Combination of GSAs
1
2
3

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

Assessment form — **Sheet #0** — **Basic data on the assessment**

Code: HKE0709Ang

Date*	19	Feb	2009	Authors*	Angélique Jadaud*, Beatriz Guijarro**, María Valls**, Henri Farrugio* and Enric Massutí*

Species Scientific name*	Merluccius merluccius - HKE	Species common name*	European hake

Data Source

GSA*	07 - Gulf of Lions	Period of time*	1998-2008

Description of the analysis

Type of data*	Size composition of catches, official landings, CPUE data from commercial fleets (trawl and longline) and bottom	Data source*	IFREMER and IEO
Method of assessment*	Cohort (XSA) and pseudo-cohort (LCA, Y/R) analysis	Software used*	Lowestoft sofware (Darby & Flatman, 1994) and VIT (Lleonart & Salat, 1992)

Sheets filled out

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

Comments, bibliography, etc.

Abella A. and J.F. Caddy and F. Serena (1997) Do natural mortality and availability decline with age? An alternative yield paradigm for juvenile fisheries, illustrated by the hake Merluccius merluccius fishery in the Mediterranean. Aquat. Living Resour., 10: 257-269.

Aldebert Y., L. Recasens and J. Lleonart (1993) Analysis of gear interactions in a hake fishery: The case of the Gulf of Lions (NW Mediterranean). Sci. Mar., 57(2-3): 207-217.

Aldebert Y and L. Recasens (1996) Comparison of methods for stock assessment of European hake Merluccius merluccius in the Gulf of Lions (Northwestern Mediterranean). Aquat. Living Resour., 9: 13-22.

Bertrand, J.A., L. Gil de Sola, C. Papaconstantinou, G. Relini and A. Souplet (2002) The general specifications of the MEDITS surveys. Sci. Mar., 66 (Suppl. 2): 9-17.

Bozzano A, L. Recasens and P. Sartor (1997) Diet of the European hake Merluccius merluccius (Pisces: Merlucciiudae) in the Western Mediterranean (Gulf of Lions): Sci. Mar., 61(1): 1-8.

Darby, C.D. and S. Flatman (1994) Virtual Population Análisis: version 3.1 (Windows/DOS) user guide. Info. Tech. Ser., MAFF Direct. Fish. Res., Lowestoft, nº 1: 85 pp.

Comments, bibliography, etc.

French-Spanish WG (2001) Stock assessment of the French-Spanish shared stock of hake (Merluccius merluccius) in the gulf of Lions: a preliminary comparative approach. GFCM-SAC WG on Demersal stock assessment, Tunis 13-16 March 2001.
French-Spanish WG (2002) Stock assessment of the French-Spanish shared stock of hake (Merluccius merluccius) in the gulf of Lions. Rome 20-22 March 2002.
French-Spanish WG (2005) Stock assessment of the French-Spanish shared stock of hake (Merluccius merluccius) in the gulf of Lions. Rome 26-30 September 2005.
French-Spanish WG (2006) Stock assessment of the French-Spanish shared stock of hake (Merluccius merluccius) in the gulf of Lions. Rome 11-14 September 2006.
French-Spanish WG (2008) Stock assessment of the French-Spanish shared stock of hake (Merluccius merluccius) in the gulf of Lions. Izmir 15-19 September 2008.
García-Rodríguez M. and A. Esteban (2002) How fast does hake grow? A study on the Mediterranean hake (Merluccius merluccius L.) comparing whole otoliths readings and length frequency distributions data. Sci. Mar., 66(2): 145-156.
Lleonart J. and J. Salat (1992) VIT. Programa de Análisis de Pesquerías. Inf. Téc. Sci. Mar., 168-169: 116 pp.
Mellon-Duval C., de Pontual H. Métral L. and Quemener L., (submitted) Growth of european hake (Merluccius merluccius L.) in the gulf of Lions based on conventional tagging. ICES J. Mar. Sci.
Morales-Nin B., G.J. Torres, A. Lombarte and L. Recasens (1998) Otolith growth and age estimation in the European hake. J. Fish. Biol., 53: 1155-1168.
Morales-Nin B. and J. Moranta (2004) Recruitment and post-settlement growth of juvenile Merluccius merluccius on the western Mediterranean shelf. Sci. Mar., 68(3): 399-409.
de Pontual H., M. Bertignac, A. Battaglia, G. Bavouzet, P. Moguedet and A.-L. Groison (2003) A pilot tagging experiment on European hake (Merluccius merluccius): methodology and preliminary results. ICES J. Mar. Sci., 60: 1318–1327.
Recasens L., A. Lombarte, B. Morales-Nin and G.J. Torres (1998) Spatiotemporal variation in the population structure of the European hake in the NW Mediterranean. J. Fish. Biol., 53: 387-401.

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

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

Code: HKE0709Ang

Biology

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

Sex	Fem	Mal	Both	Unsexed		
Maximum size observed	96	85			Reproduction season	All year (winter)
Size at first maturity	40*	28*			Reproduction areas	Shelf & upper slope
Recruitment size					Nursery areas	Shelf

Parameters used (state units and information sources)

			Sex			
		Units	female	male	both	unsexed
Growth model	L∞	cm	100.7	72.8		
	K	years-1	0.236**	0.233**		
	t0	years	-0.35	-0.383		
	Data source	Tagging experiments (K only**)				
Length weight relationship	a				0.0069	
	b				3.03	
	M		vector***	vector***		
	sex ratio (mal/fem)	*				

Comments

Growth parameters, especially the estimation of K, come from first results of tagging experiments developed by IFREMER Sète in the gulf of Lions (Mellon-Duval et al., submitted.) and considering Linf and t0 from Aldebert & Recasens (1996).

(*) from Aldebert & Recasens (1996)

(**) from Mellon-Duval et al. (submitted.)

(***) from PROBIOM (Abella et al., 1997):

Age	M
0	0.68
1	0.47
2	0.30
3	0.22
4	0.19
5	0.17
6	0.16
7	0.14

mean= 0.23

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

Assessment form

Sheet P1
General information about the fishery

Code: HKE0709Ang

Data source*	IFREMER, IEO and French and Spanish official data	Year (s)*	1998-2008
Data aggregation (by year, average figures between years, etc.)*	Average 1998-2008		

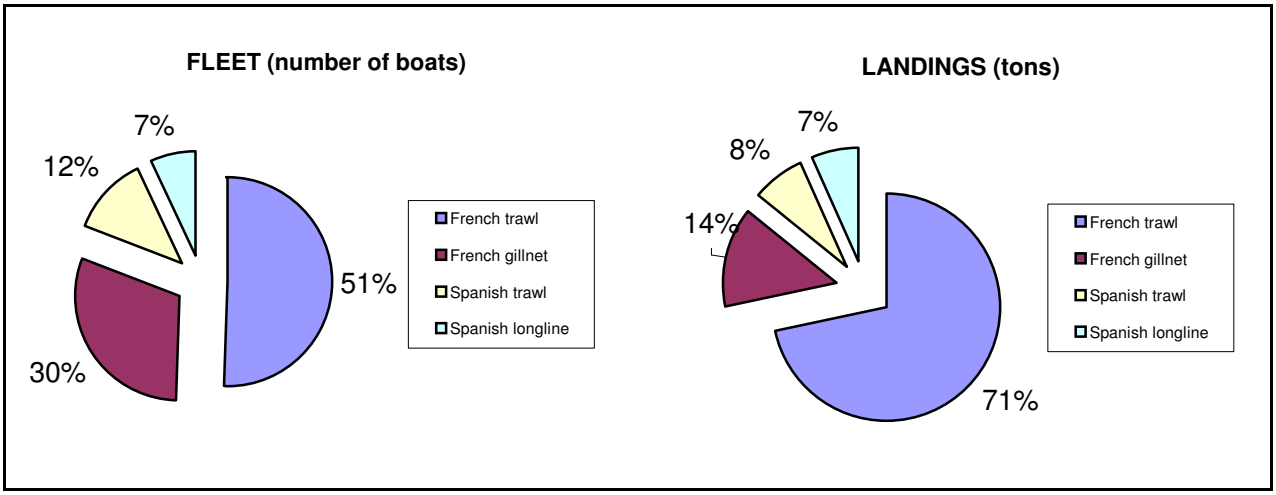
Fleet and catches (please state units)

	Country	GSA	Fleet Segment	Fishing Gear Class	Group of Target Species	Species
Operational Unit 1*	FRA	07	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	HKE
Operational Unit 2	FRA	07	C - Minor gear with engine (6-12 metres)	07 - Gillnets and Entangling Nets	34 - Demersal slope species	HKE
Operational Unit 3	ESP	07	E - Trawl (12-24 metres)	03 - Trawls	33 - Demersal shelf species	HKE
Operational Unit 4	ESP	07	I - Long line (12-24 metres)	09 - Hooks and Lines	34 - Demersal slope species	HKE
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
FRA 07 E 03 33 - HKE	111	Tons	1544	*S. pilchardus,*	included	unknow	days
FRA 07 C 07 34 - HKE	67	Tons	306	*S. scombrus* , *T.*	not discarded	unknow	days
ESP 07 E 03 33 - HKE	27	Tons	167	*Solea* spp., *Mull*	included	unknow	days
ESP 07 I 09 34 - HKE	15	Tons	141	*L. caudatus* , *H.*	not discarded	unknow	days
Total	220		2158				

Legal minimum size	20 cm total length

Comments



Data source*	IFREMER and French official data	OpUnit 1*	FRA 07 E 03 33 - HKE

Time series

Year*	1998	1999	2000	2001	2002	2003
Catch	1688	1525	1347	1835	2168	2024
Minimum size	5	3	7	6	7	7
Average size Lc	17	21	20	18	17	22
Maximum size	92	89	77	80	74	65
Fleet	113	113	113	113	120	123

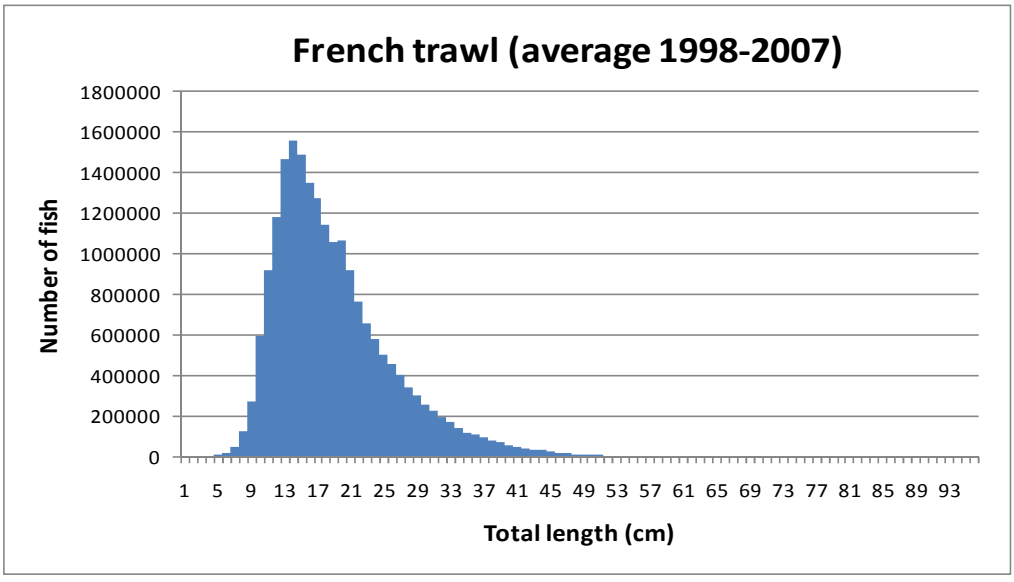
Year	2004	2005	2006	2007	2008	
Catch	1023	1002	1014	1282	2071	
Minimum size	6	7	6	5	8	
Average size Lc	19	20	22	23	21	
Maximum size	77	77	85	67	77	
Fleet	121	114	111	101	78	

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age



Data source*	IFREMER and French official data	OpUnit 2*	FRA 07 C 07 34 - HKE

Time series

Year*	1998	1999	2000	2001	2002	2003
Catch	500	500	500	500	182	248
Minimum size	13	16	18	19	17	18
Average size Lc	40	41	40	38	39	38
Maximum size	71	77	74	76	86	85
Fleet	95	95	95	95	58	58

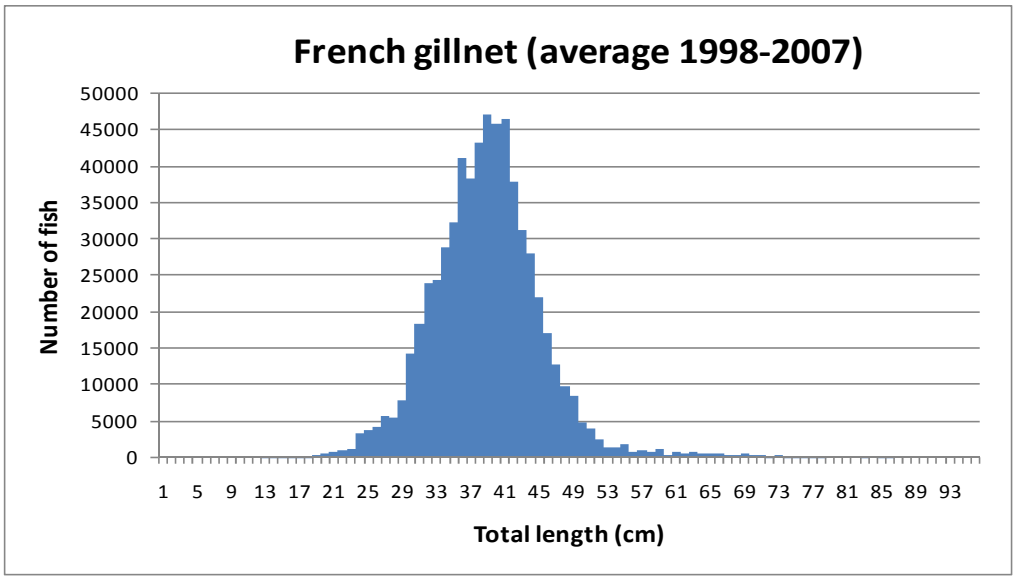
Year	2004	2005	2006	2007	2008	
Catch	99	255	299	168	111	
Minimum size	21	21	26	21	14	
Average size Lc	38	39	40	40	39	
Maximum size	72	72	71	67	74	
Fleet	56	52	52	52	30	

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age



Data source*	IEO and Spanish official data	OpUnit 3*	ESP 07 E 03 33 - HKE

Time series

Year*	1998	1999	2000	2001	2002	2003
Catch	140	279	166	196	231	206
Minimum size	5	5	5	5	5	5
Average size Lc	20	27.2	26.6	27.7	23.4	24.2
Maximum size	60	60	63	59	56	56
Fleet	18	17	32	30	30	28

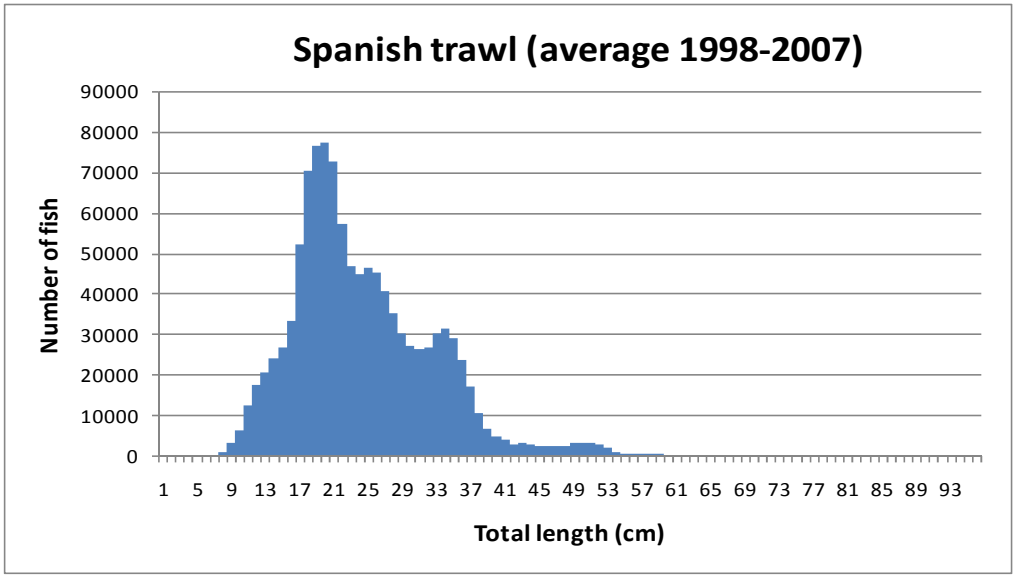
Year	2004	2005	2006	2007	2008	
Catch	101	125	116	108	192	
Minimum size	5	7	7	7	10	
Average size Lc	23.6	22.2	28.9	24.3	22.5	
Maximum size	87	64	68	72	76	
Fleet	29	30	28	25	30	

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age



Data source*	IEO and Spanish official data	OpUnit 4*	ESP 07 I 09 34 - HKE

Time series

Year*	1998	1999	2000	2001	2002	2003
Catch	101	109	285	163	146	112
Minimum size	30	30	32	30	24	23
Average size Lc	61.2	56.6	58.6	61.5	55.2	52
Maximum size	96	92	88	89	89	94
Fleet	20	20	16	18	16	13

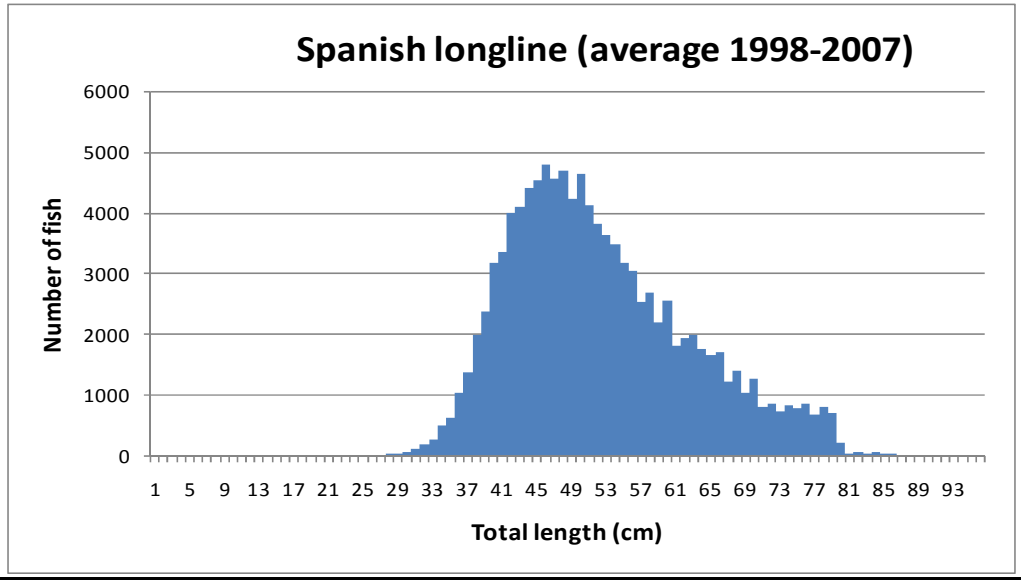
Year	2004	2005	2006	2007		
Catch	78	101	170	146		
Minimum size	27	27	29	28		
Average size Lc	46.6	45.5	48.2	50		
Maximum size	96	94	93	92		
Fleet	11	12	12	13		

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age



Data source*	IFREMER	OpUnit 1*	FRA 07 E 03 33 - HKE

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Engine power limited to 316 KW or 500 CV: not observed
- Cod-end mesh size (bottom trawl: square 40 mm; pelagic trawl: diamond 20 mm): not fully observed
- Fishing forbidden within 3 miles (France): not fully observed
- Time at sea: fully observed

Accompanying species

European pilchard (*Sardina pilchardus*)
European anchovy (*Engraulis encrasicolus*)
Atlantic mackerel (Scomber scombrus)
Atlantic horse mackerel (*Trachurus trachurus*)
European conger (*Conger conger*)
Fourspotted megrim (*Lepidorhombus boscii*)
Soles (*Solea* spp.)
Striped mullet (*Mullus barbatus*)
Red mullet (*Mullus surmuletus*)
Angler (*Lophius piscatorius*)
Black-bellied angler (*Lophius budegassa*)
Gilthead seabream (*Sparus aurata*)
European seabass (*Dicentrarchus labrax*)
Seabreams (*Pagellus* spp.)
Blue whiting (*Micromesistius poutassou*)
Poor-cod (*Trisopterus minutus capelanus*)
Tub gurnard (*Chelidonichtys lucerna*)
Triglidae

Data source*	IFREMER	OpUnit 2*	FRA 07 C 07 34 - HKE

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Maximum length of net: not fully observed

Accompanying species

Atlantic mackerel (*Scomber scombrus*)
Tub gurnard (*Trigla lucerna*)
Poor cod (*Trisopterus minutus capelanus*)
Megrims (*Lepidorhombus* spp.)
Small-spotted dogfish (*Scyliorhinus canicula*)

Data source*	IEO	OpUnit 3*	ESP 07 E 03 33 - HKE

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Engine power limited to 316 KW or 500 CV: not observed
- Mesh size in the codend (40 mm diamond): fully observed
- Fishing forbidden <50 m depth: fully observed
- Time at sea: fully observed

Accompanying species

Soles (*Solea* spp.)
Striped mullet (*Mullus barbatus*)
Red mullet (*Mullus surmuletus*)
Angler (*Lophius piscatorius*)
Black-bellied angler (*Lophius budegassa*)
Seabreams (*Pagellus* spp.)
Blue whiting (*Micromesistius poutassou*)
Poor-cod (*Trisopterus minutus capelanus*)
Horned octopus (*Eledone cirrhosa*)

Data source*	IEO	OpUnit 4*	ESP 07 I 09 34 - HKE

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Number of hook per boat: not fully observed

Accompanying species

Rockfish (*Helicolenus dactylopterus*)
Silver scabbard fish (*Lepidopus caudatus*)
Conger eel (*Conger conger*)
Red sea bream (*Pagellus bogaraveo*)
Fork-beard (*Phycis blennoides*)

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

Assessment form — **Sheet A1** — **Indirect methods: VPA, LCA**

Code: HKE0709Ang

Sex*	Both

Analysis # *	1

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used	Standard catch equation	Tunig method	Extended Survivors Analysis (XSA)
# of gears	4	Software	Darby and Flatman (1994)
$F_{terminal}$			

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	54.66	1684.9
Average			Average population	73.84	6944
Maximum			Virgin population		
Critical			Turnover	SSB	SSB
				4.41	2658
				mean-Millions	mean-Tons

Average mortality

		Gear					
	Total						
F_1	0.52						
F_2	0.59						
Z	1.01						

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

Comments

Population results as averaged (arithmetic mean) for the period 1998-2007:
F1: averaged 1998-2008 Fbar 2-4; F2: averaged 1998-2008 Fbar 0-3; Z: averaged F2 + M vector (0-3); Fbar is the averaged of all F for years and ages 2-4 or 0-3
Z has been calculated in the same way, but considering the M vector
Tuning CPUE data:
- French trawl: Mostly targeting hake (juveniles and young adults) on the continental shelf from Spanish boundary to Marseille (~70 % of total hake catches in GSA07). They have been selected considering the proportion of hake in their catches (>10% of hake and <15% of sardine and anchovy), considering the fleet of Sète, the most important harbour in hake trawl catches from GSA07-France.
- Spanish trawl: Mostly targeting hake in the western Gulf. They have been selected from a multivariant analysis, considering the fleet of Llançà, the most important harbour in hake trawl catches from GSA07-Spain.
- Bottom trawl survey MEDITS (20 mm mesh in the cod-end): It has been used data from the French surveys.
- Spanish long-line: Always targeting oldest adults of hake on the slope. It has been used data from Llançà, the most important harbour in fleet and hake long-line catches from GSA07.

Sex*	Both

Analysis # *	2 (1998-2008)

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Standard catch equation	Tunig method	No tuning
# of gears	4	Software	VIT (Lleonart and Salat, 1992
$F_{terminal}$	0.114		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	21.4 millions	79.8 Tons
Average	21.6	0.75	Average population	28.2 millions	7679.6 Tons
Maximum			Virgin population		57578.0 Tons
Critical	27.5	1	Turnover		114.9
				SSB	1816.0 Tons

Average mortality

		Gear					
	Total	French Trawl	French Gillnet	Spanish Trawl	Sp. Longline		
F_1	0.57	0.34	0.1	0.04	0.08		
F_2	0.9	0.73	0.02	0.04	0.01		
Z	0.8						

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

Comments

F1= Mean F
F2= Global F
Z= M + Mean F

Recruitment Biomass corrected (computed as XSA: Initial Number * Mean Weight)= 878.8 Tons
Average population Biomass corrected= 4717.5 Tons

Sex*	Both

Analysis # *	3 (1998-2003)

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Standard catch equation	Tunig method	No tuning
# of gears	4	Software	VIT (Lleonart and Salat, 1992)
$F_{terminal}$	0.411		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	25.4 Millions	95.1 Tons
Average	21	0.7	Average population	33 Millions	2694.9 Tons
Maximum			Virgin population		68574.3 Tons
Critical	27.5	1	Turnover		132
				SSB	1652.5 Tons

Average mortality

		Gear					
	Total	French Trawl	French Gillnet	Spanish Trawl	Sp. Longline		
F_1	0.72	0.38	0.14	0.05	0.15		
F_2	0.85	0.78	0.03	0.04	0.004		
Z	0.95						

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

Comments

F1= Mean F
F2= Global F
Z= M + Mean F

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

Assessment form — **Sheet A1** — **Indirect methods: VPA, LCA**

Code: HKE0709Ang

Sex*	Both

Analysis # *	4 (2004-2008)

Time series

Data	Size	Age
(mark with X)		X

Model	Cohorts	Pseudocohorts
(mark with X)		X

Equation used	Standard catch equation	Tunig method	No tuning
# of gears	4	Software	VIT (Lleonart and Salat, 1992)
$F_{terminal}$	0.114		

Population results (please state units)

	Sizes	Ages		Amount	Biomass
Minimum			Recruitment	16 Millions	59.8 Tons
Average	21.3	0.72	Average population	21.4 Millions	1854.0 Tons
Maximum			Virgin population		42980.0 Tons
Critical	27.5	1	Turnover		131.2
				SSB	1121.7 Tons

Average mortality

		Gear					
	Total	French Trawl	French Gillnet	Spanish Trawl	Sp. Longline		
F_1	0.66	0.39	0.1	0.05	0.11		
F_2	0.75	0.68	0.02	0.04	0.01		
Z	0.89						

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

Comments

F1= Mean F
F2= Global F
Z= M + Mean F

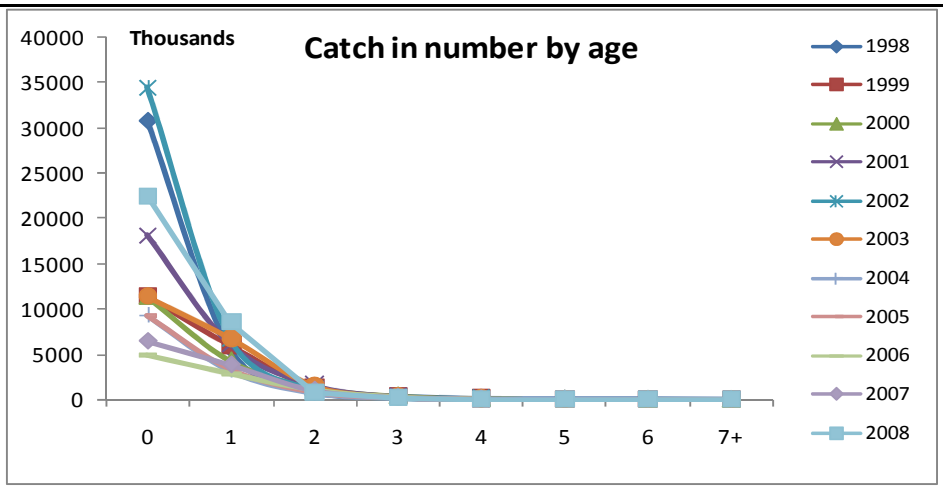
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A2** **Indirect methods: data**

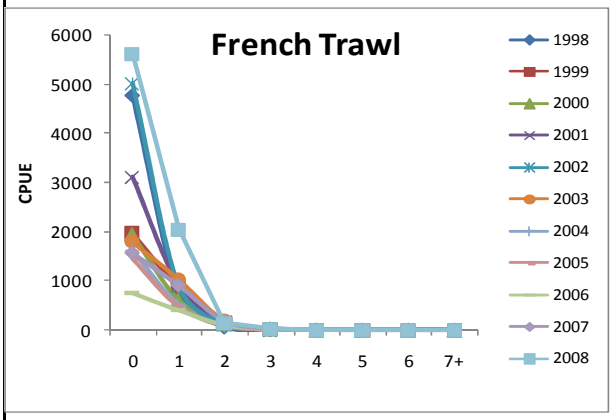
Code: HKE0709Ang

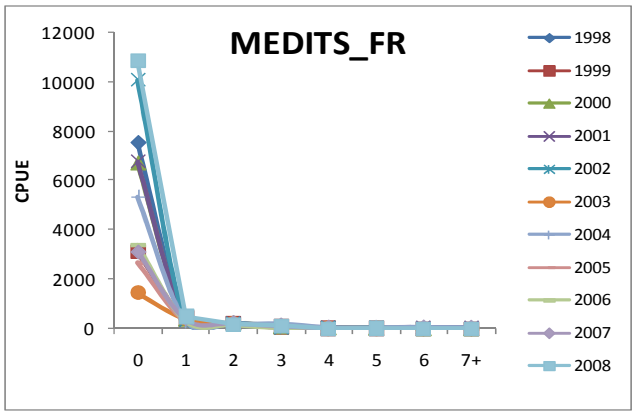
Sex*	Both	Gear*	FR trawl & gillnet, SP trawl & longline	Analysis # *	1

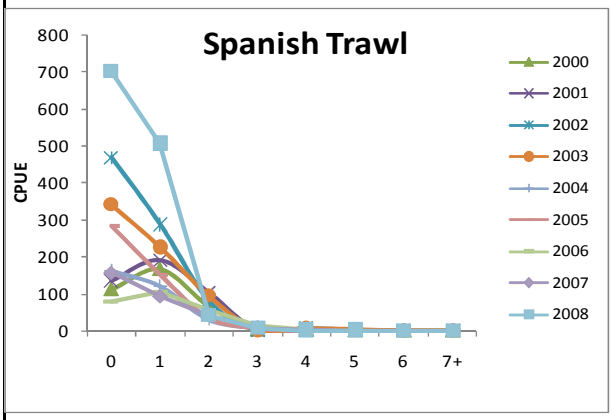
Data source	Catch in number by age and CPUE for tuning

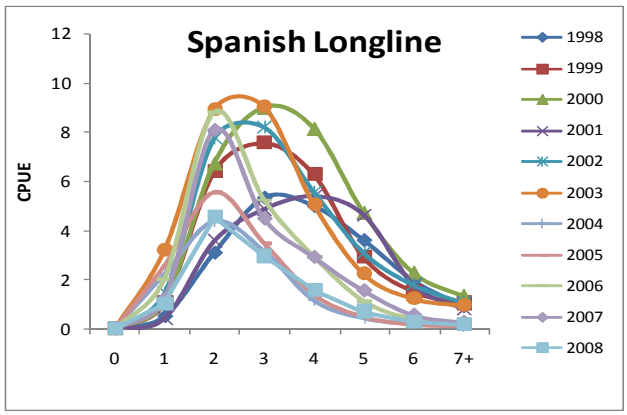
Data









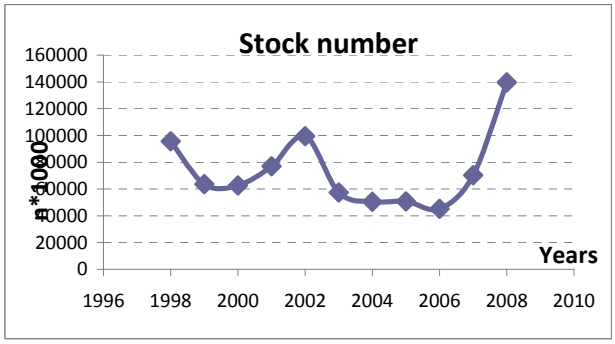


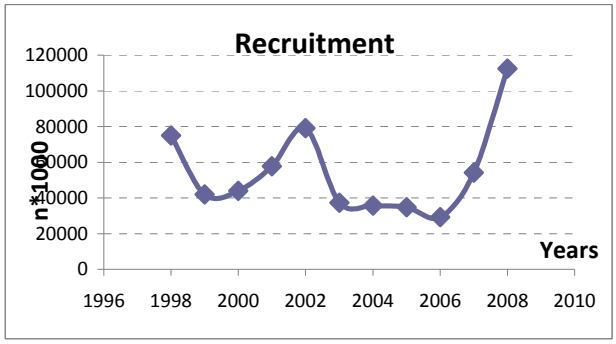
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A3** **Indirect methods: VPA results**

Code: HKE0709Ang

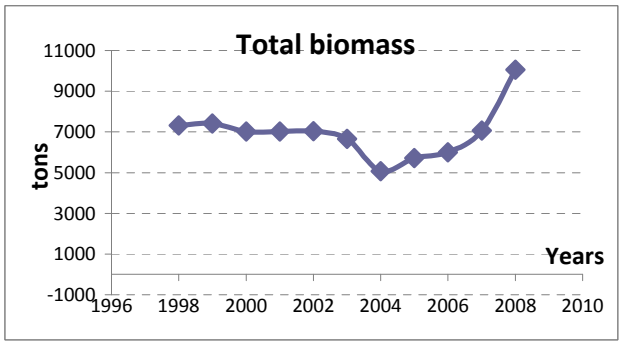
Sex*	Both	Gear*	All	Analysis #*	1

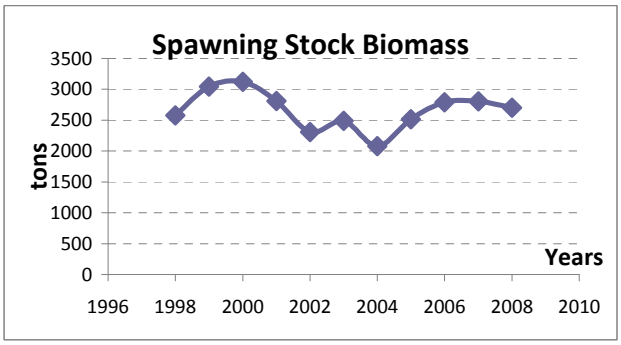
Population in figures



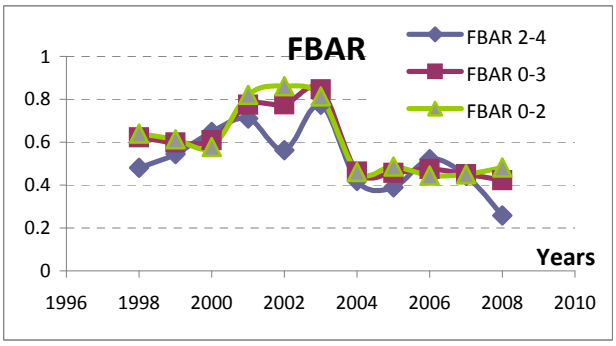


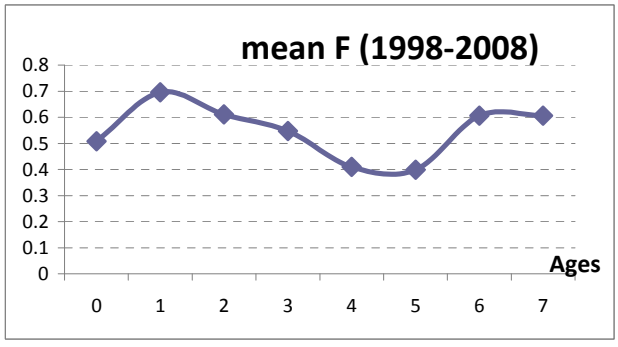
Population in biomass





Fishing mortality rates





Sex*	Both	Gear*	All ages	Analysis #*	1

Population in figures

Initial Numbers (* 10^3)

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	74985	41970	44005	57723	79148	37304	35615	34788	29203	54083	112418
1	15822	16023	13210	14162	16347	15550	10841	11411	11059	11279	22800
2	3459	4097	3881	3642	2849	3532	3085	3244	3397	3532	2982
3	986	1192	1110	1006	709	658	694	1049	1035	943	1068
4	218	283	347	278	269	214	130	220	369	298	303
5	52	68	91	99	83	93	70	44	79	126	106
6	27	15	23	22	29	25	34	30	17	28	48
7+	17	8	12	8	17	48	18	13	9	12	34

Population in biomass

Biomass (tons)

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	1920	1389	1250	1546	1981	1364	971	1025	995	2095	3998
1	2554	2633	2304	2349	2506	2515	1761	1896	1919	1850	3149
2	1488	1791	1748	1629	1315	1588	1334	1420	1516	1611	1285
3	883	1046	1000	877	617	574	589	907	897	807	885
4	286	377	468	371	355	279	167	286	477	393	375
5	93	120	167	179	146	163	123	78	138	224	182
6	57	33	50	47	63	52	75	65	37	60	101
7+	46	21	32	23	46	128	50	36	23	34	87

Fishing mortality rates

Fishing Mortality

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
0	0.863	0.476	0.454	0.582	0.947	0.556	0.458	0.466	0.271	0.184	0.328
1	0.671	0.738	0.608	0.924	0.852	0.938	0.527	0.532	0.461	0.650	0.746
2	0.386	0.626	0.670	0.956	0.786	0.948	0.399	0.462	0.602	0.516	0.374
3	0.569	0.555	0.704	0.640	0.519	0.941	0.467	0.364	0.565	0.455	0.240
4	0.489	0.451	0.571	0.535	0.382	0.436	0.393	0.342	0.395	0.358	0.160
5	0.560	0.398	0.745	0.539	0.531	0.322	0.163	0.291	0.366	0.276	0.198
6	0.544	0.969	1.805	0.874	0.476	0.411	0.156	0.156	0.678	0.483	0.117
7+	0.544	0.969	1.805	0.874	0.476	0.411	0.156	0.156	0.678	0.483	0.117

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

Code: HKE0709Ang

Sex	Both

Analysis #	2, 3, 4

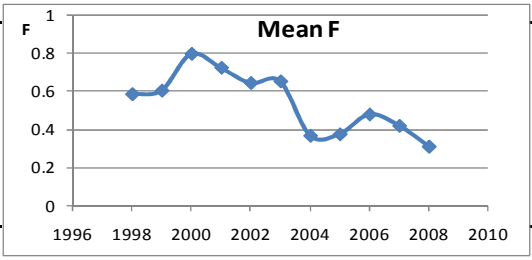
# of gears	4	Software	VIT (Lleonart and Salat, 1992)

Parameters used

Vector F	
Vector M	0.68 (Age 0), 0.47 (1), 0.3 (2), 0.22 (3), 0.19 (4), 0.17 (5), 0.16 (6), 0.14 (7+)
Vector N	From LCA

Model characteristics

From calculated mean weight.
Analysis 2: 1998-2008 (all the period)
Analysis 3: 1998-2003 (mean F >0.5)
Analysis 4: 2004-2008 (mean F<0.5)
Results as #2 / #3 / #4

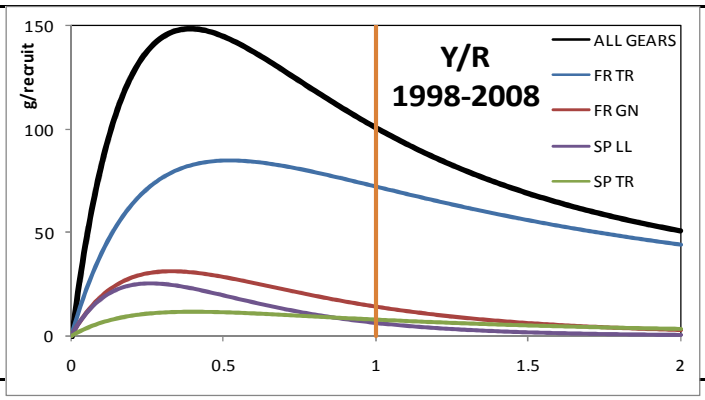


Results

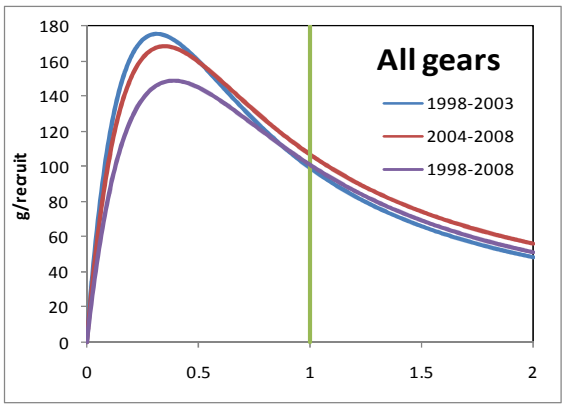
	Total	Gear			
		French trawl	French gillnet	Spanish trawl	Spanish longline
Current YR	100.9/99.2/106.9	72.2/69.4/79.9	14.3/15.9/11.7	7.9/7.9/8	6.5/6.1/7.4
Maximum Y/R	148.7/175.2/168.5	84.9/85.3/97.4	31.6/41.7/29.4	11.6/13/13.7	25.8/43.5/33.9
Y/R 0.1	84.6/115.7/104.2	40.2/44.8/50.3	19.5/28.1/19.5	6.5/7.9/8.7	18.5/34.9/25.7
F_{max}	0.4/0.32/0.36	0.53/0.47/0.48	0.34/0.3/0.31	0.41/0.36/0.34	0.27/0.22/0.25
$F_{0.1}$	0.3/0.24/0.26				
Current B/R	130.2/108.3/118.1				
Maximum B/R	691.2/782.5/695.6				
B/R 0.1	930.9/1017.7/962.5				

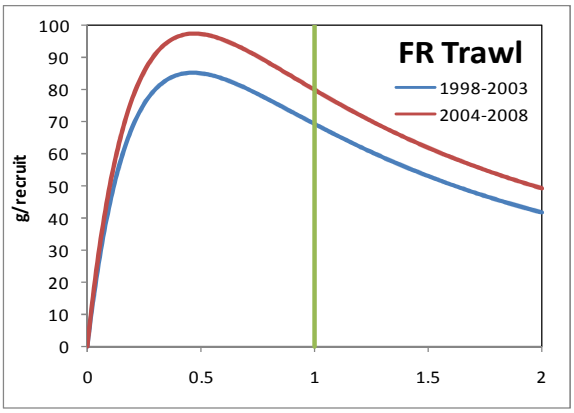
Comments

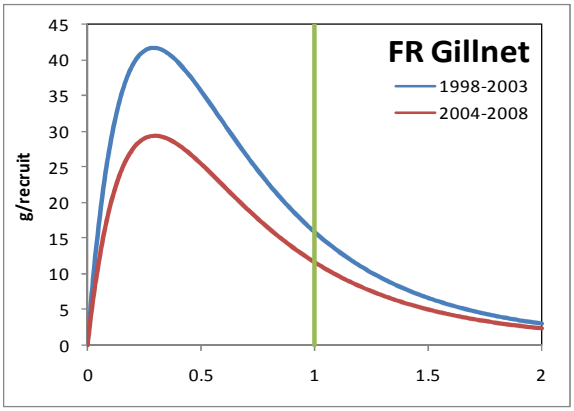
Analysis 2: 1998-2008
(all the period)

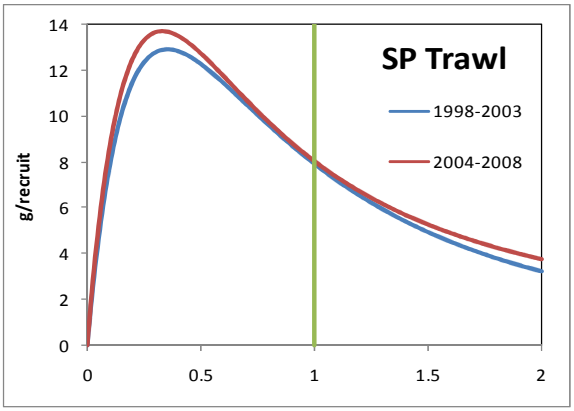


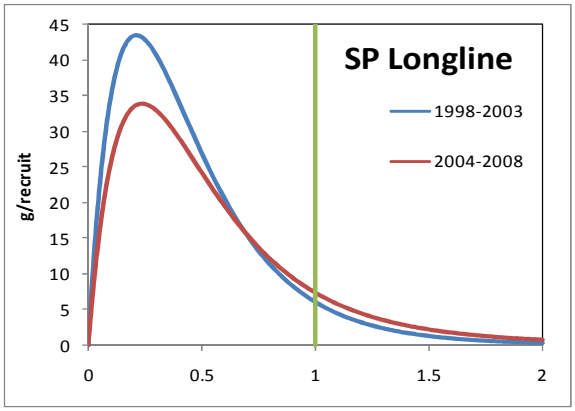
Comments


All gears
1998-2003
2004-2008
1998-2008
g/recruit
180
160
140
120
100
80
60
40
20
0
0
0.5
1
1.5
2


FR Trawl
1998-2003
2004-2008
g/recruit
100
90
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2


FR Gillnet
1998-2003
2004-2008
g/recruit
45
40
35
30
25
20
15
10
5
0
0
0.5
1
1.5
2


SP Trawl
1998-2003
2004-2008
g/recruit
14
12
10
8
6
4
2
0
0
0.5
1
1.5
2


SP Longline
1998-2003
2004-2008
g/recruit
45
40
35
30
25
20
15
10
5
0
0
0.5
1
1.5
2

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

Code: HKE0709Ang

Indicators and reference points

Criterion	Current value	Units	Reference Point	Trend	Comments
B					
SSB					
F					
Y					
CPUE					

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

Code: HKE0709Ang

Management advice and recommendations*

Management advice and recommedantions:
To avoid recruitment overfishing:
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal the minimum legal landing size by: (i) closing nursery areas, at least temporally; and, (ii) by replacing 40 mm diamond mesh cod-end by 40 mm square mesh cod-end.
- Reduce the effort of trawl, from reducing time at sea, number of fishing boats, engine power, Bollard pull and/or trawl size

To reduce growth overfishing:
- Reduce the effort of longline and gillnets in order to increase (or at least maintain) the SSB.
- Establish temporal closures for longline and gillnet during the period of maximum spawning.

Advice for scientific research*

It is considered necessary the development of further studies on the biology of hake in the area, to verify the maximum length for males and to estimate new parameters on reproduction (e.g. sex-ratio, length of first maturity, spawning seasons and spawning areas), and to improve national statistics on catches and effort (e.g. vessel monitoring system

Comments*

Our working group considers very necessary the improvement of sampling activities and development of further studies on the biology of hake in the gulf of Lions to verify the maximum length for males (and females) and to estimate new parameters and information on the reproduction biology of the species in the area (e.g. sex-ratio, length of first maturity, spawning seasons and spawning areas).

Our working group also considers necessary the improvement of national statistics on catches and effort (e.g. vessel monitoring system). Some catches are still estimations.