SAC GFCM
Sub-Committee on Stock Assessment

Date*	6	July	2010	Code*	HKE0710Ang

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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

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Assessment form

Sheet #0
Basic data on the assessment

Code: HKE0710Ang

Date*	6	Jul	2010	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*	1998-2009

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*	XSA and Y/R	Software used*	

Sheets filled out

B	P1	P2a	P2b	G	A1	A2	A3	Y	Other	D	Z	C
1	1	4	4	---	1	1	2	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.
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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.
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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.
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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., (2010) Growth of european hake (Merluccius merluccius) in the Gulf of Lions based on conventional tagging. ICES J. Mar. Sci., 67: 62-70.
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.
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Assessment form

Sheet B
Biology of the species

Code: HKE0710Ang

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		-	-		
	Data source	Tagging experiments**				
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 tagging experiments developed by IFREMER Sète in the Gulf of Lions (Mellon-Duval et al., 2010.) and considering Linf from Aldebert & Recasens (1996).

(*) from Aldebert & Recasens (1996)

(**) from Mellon-Duval et al. (2010)

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

Age	M
0	0.81
1	0.47
2	0.30
3	0.24
4	0.21
5	0.19
6	0.18
7	0.18
8+	0.17

mean= 0.31

Comments

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Assessment form

Sheet P1
General information about the fishery

Code: HKE0710Ang

Data source*	IFREMER, IEO and French and Spanish official data	Year (s)*	1998-2009

Data aggregation (by year, average figures between years, etc.)*	Average 1998-2009

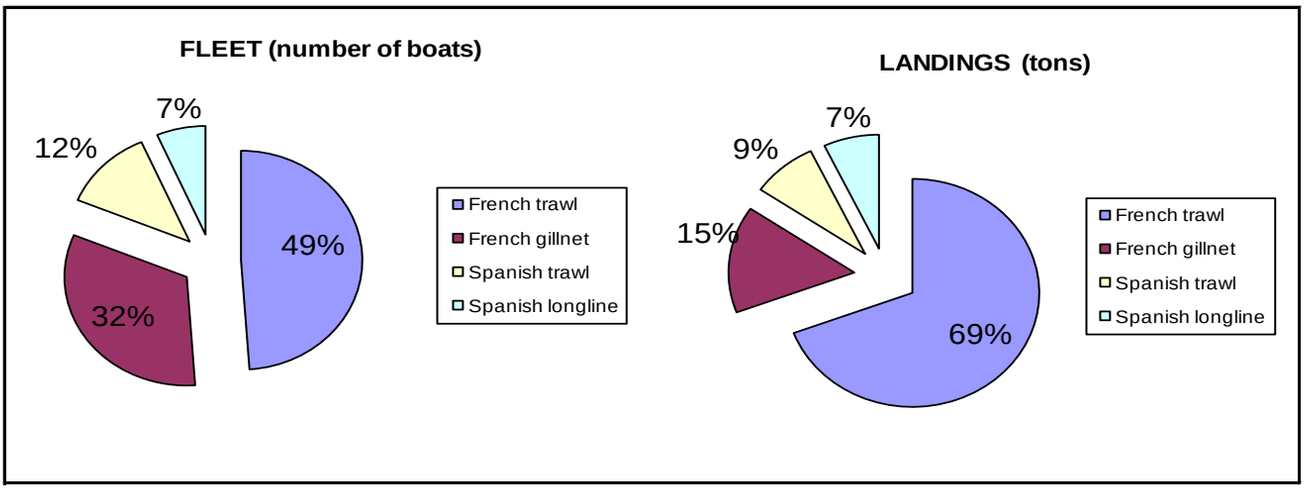
Fleet and catches (please state units)

	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	33 - Demersal shelf 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	109	Tons	1552	*S. pilchardus, E.*	included	unknown	days
FRA 07 C 07 33 - HKE	72	Tons	304	*S. scombrus, T. l*	not discarded	unknown	days
ESP 07 E 03 33 - HKE	27	Tons	167	*Solea spp., Mullu*	included	unknown	days
ESP 07 I 09 34 - HKE	15	Tons	141	*L. caudatus, H. a*	not discarded	unknown	days
Total	223		2164				

Legal minimum size	20 cm total length

Comments



Sheet P1 (page 2)

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

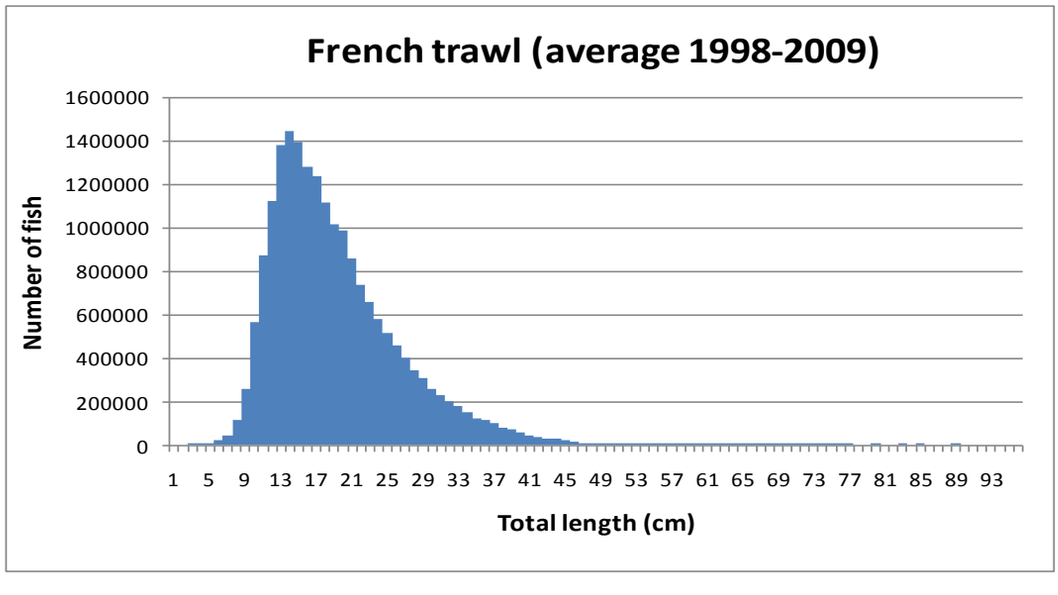
Year	2004	2005	2006	2007	2008	2009
Catch	1023	1002	1014	1282	2071	1642
Minimum size	6	7	6	5	8	3
Average size Lc	19	20	22	23	21	25
Maximum size	77	77	85	67	77	70
Fleet	121	114	111	101	86	80

Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

Structure by size or age



Structure by size or age

Data source*	IFREMER and French official data	OpUnit 2*	FRA 07 C 07 33 - 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	95	95

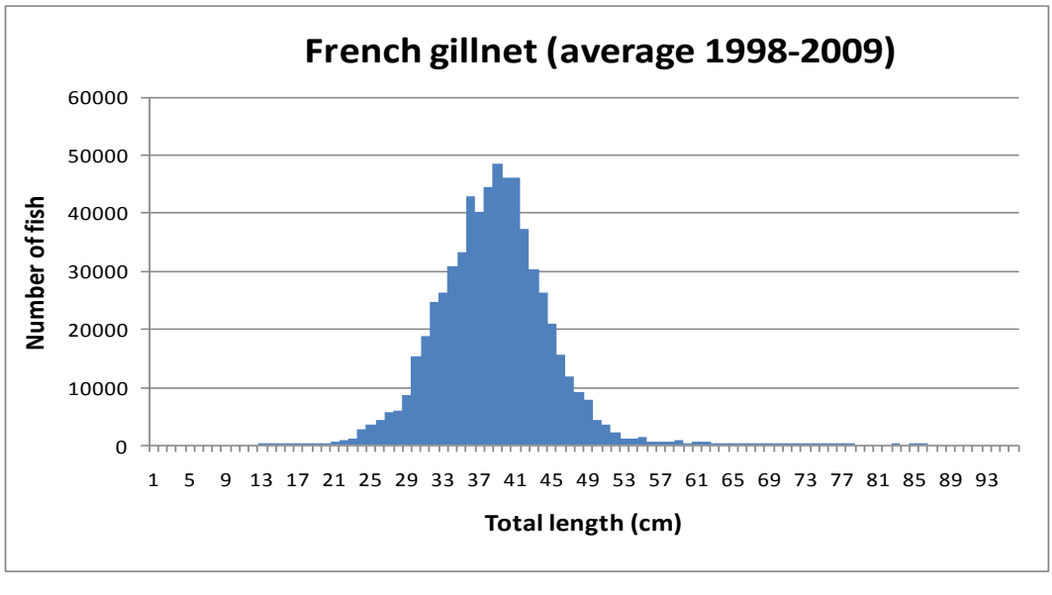
Year	2004	2005	2006	2007	2008	2009
Catch	99	255	299	168	111	286
Minimum size	21	21	26	21	14	20
Average size Lc	38	39	40	40	39	37
Maximum size	72	72	71	67	74	72
Fleet	95	95	95	95	94	94

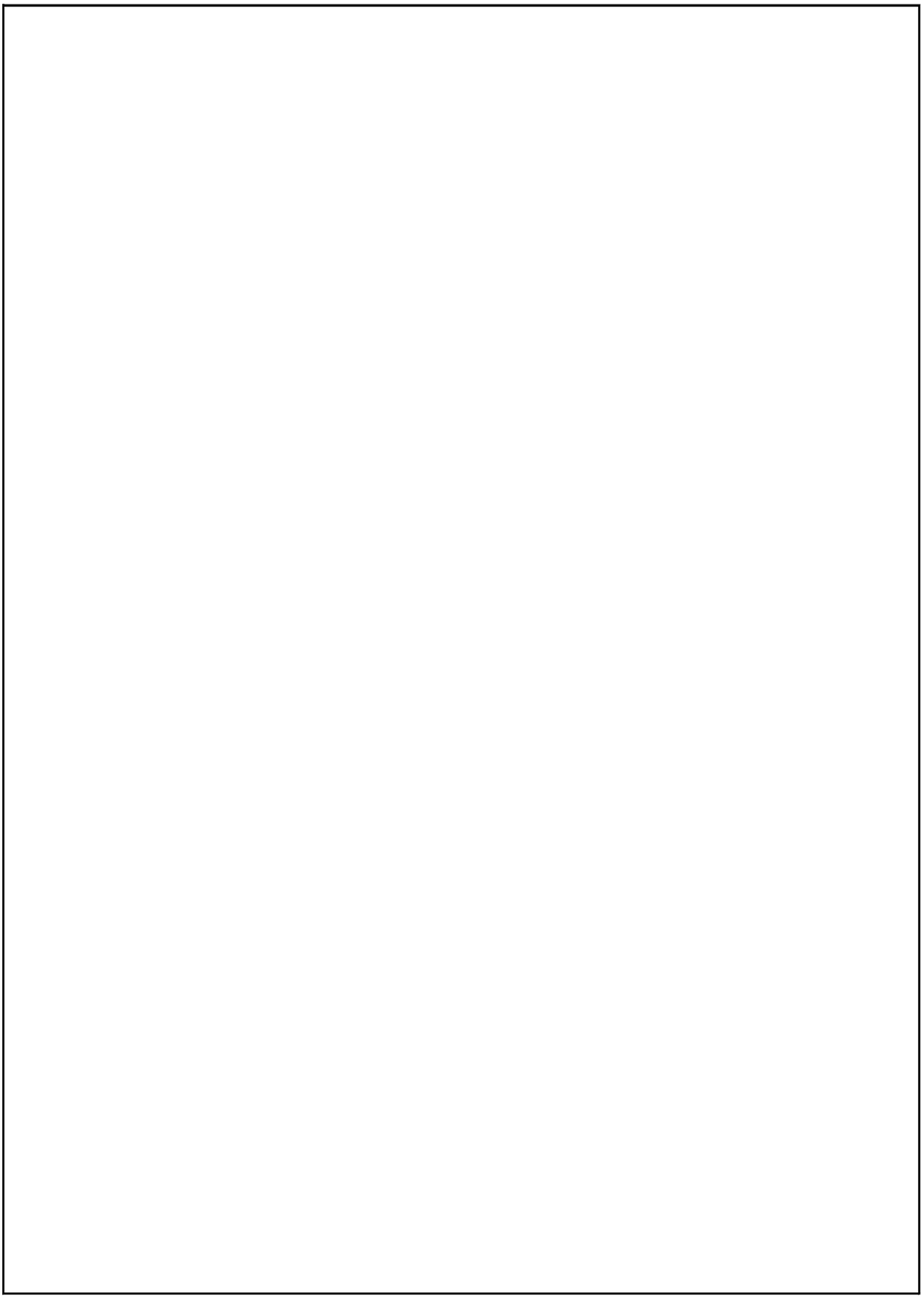
Selectivity

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	27	28	23	24
Maximum size	60	60	63	59	56	56
Fleet	18	17	32	30	30	28

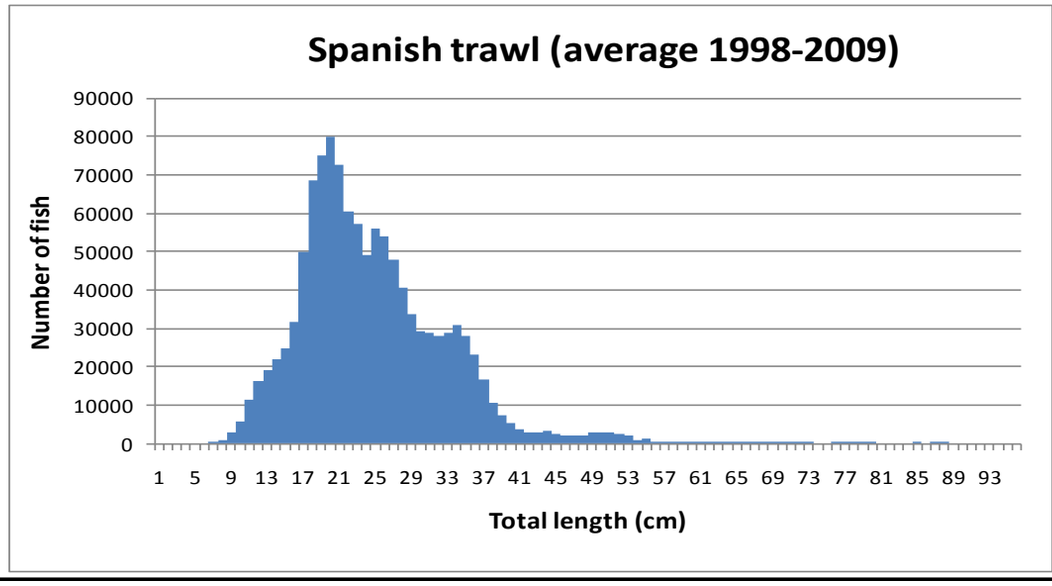
Year	2004	2005	2006	2007	2008	2009
Catch	101	125	116	108	192	258
Minimum size	5	7	7	7	10	12
Average size Lc	24	22	29	24	23	26
Maximum size	87	64	68	72	76	88
Fleet	29	30	28	25	30	31

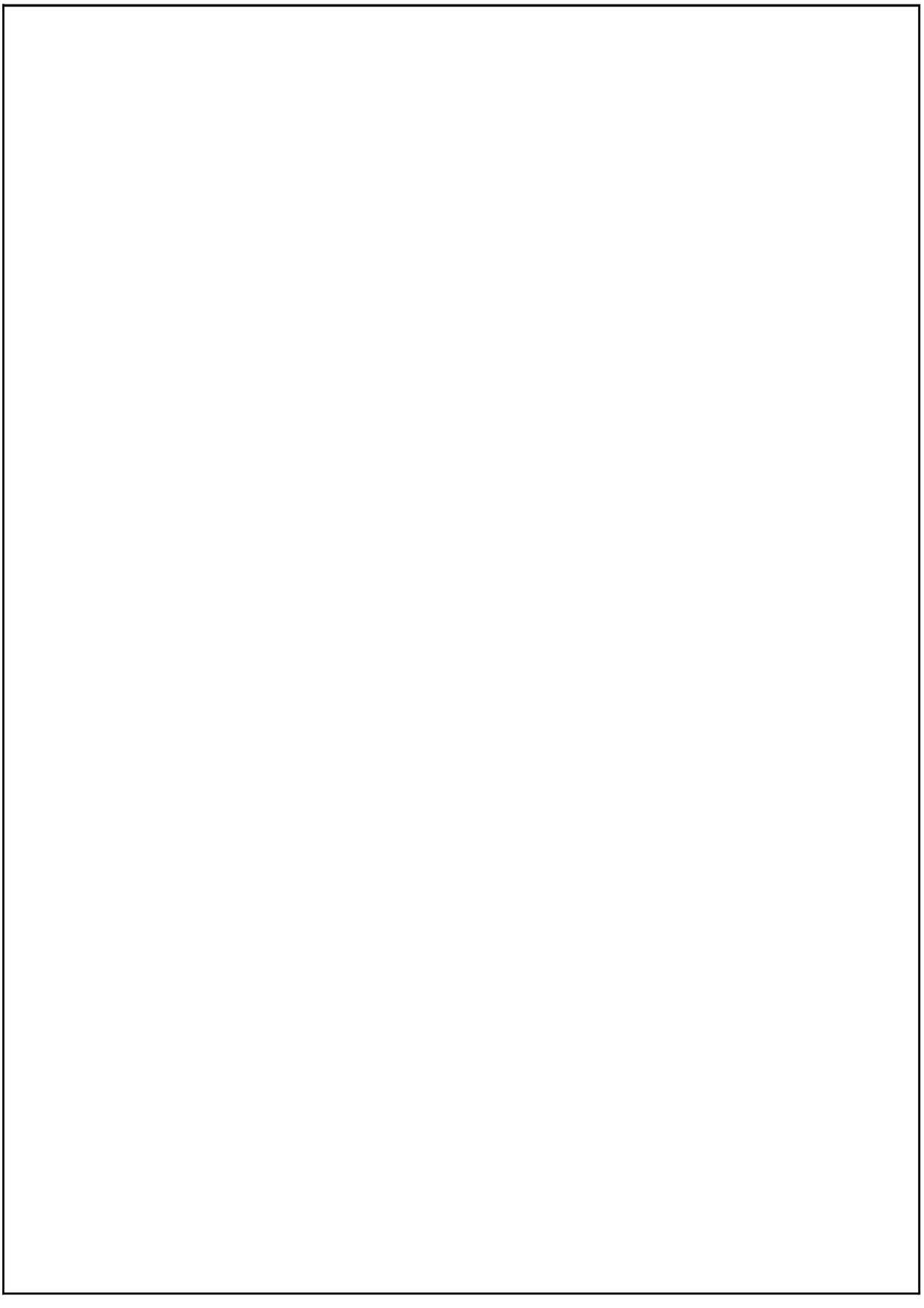
Selectivity

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

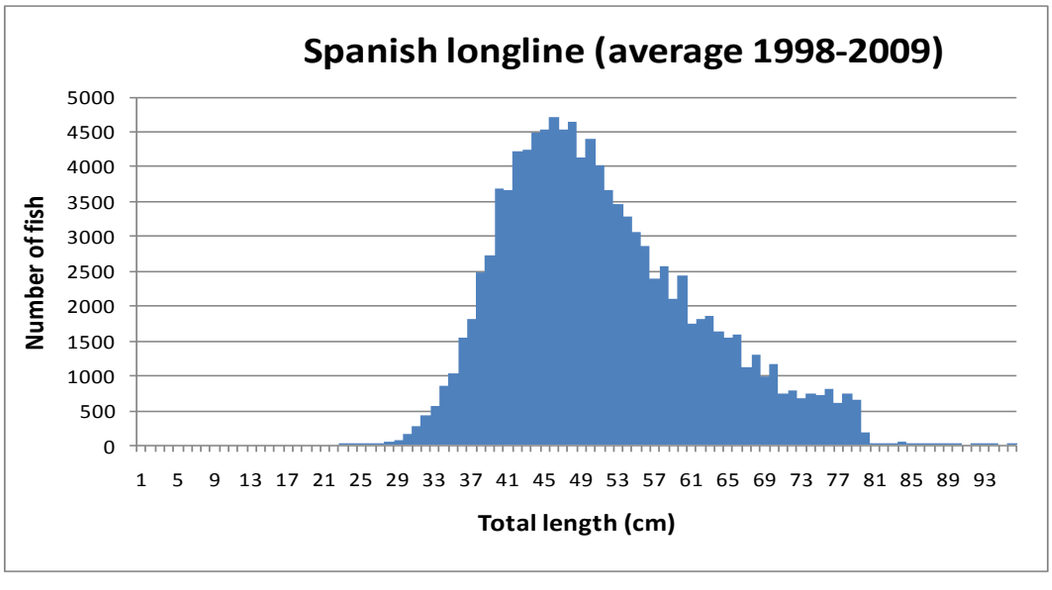
Year	2004	2005	2006	2007	2008	2009
Catch	78	101	170	146	97	83
Minimum size	27	27	29	28	25	23
Average size Lc	46.6	45.5	48.2	50	49	42
Maximum size	96	94	93	92	88	86
Fleet	11	12	12	13	11	13

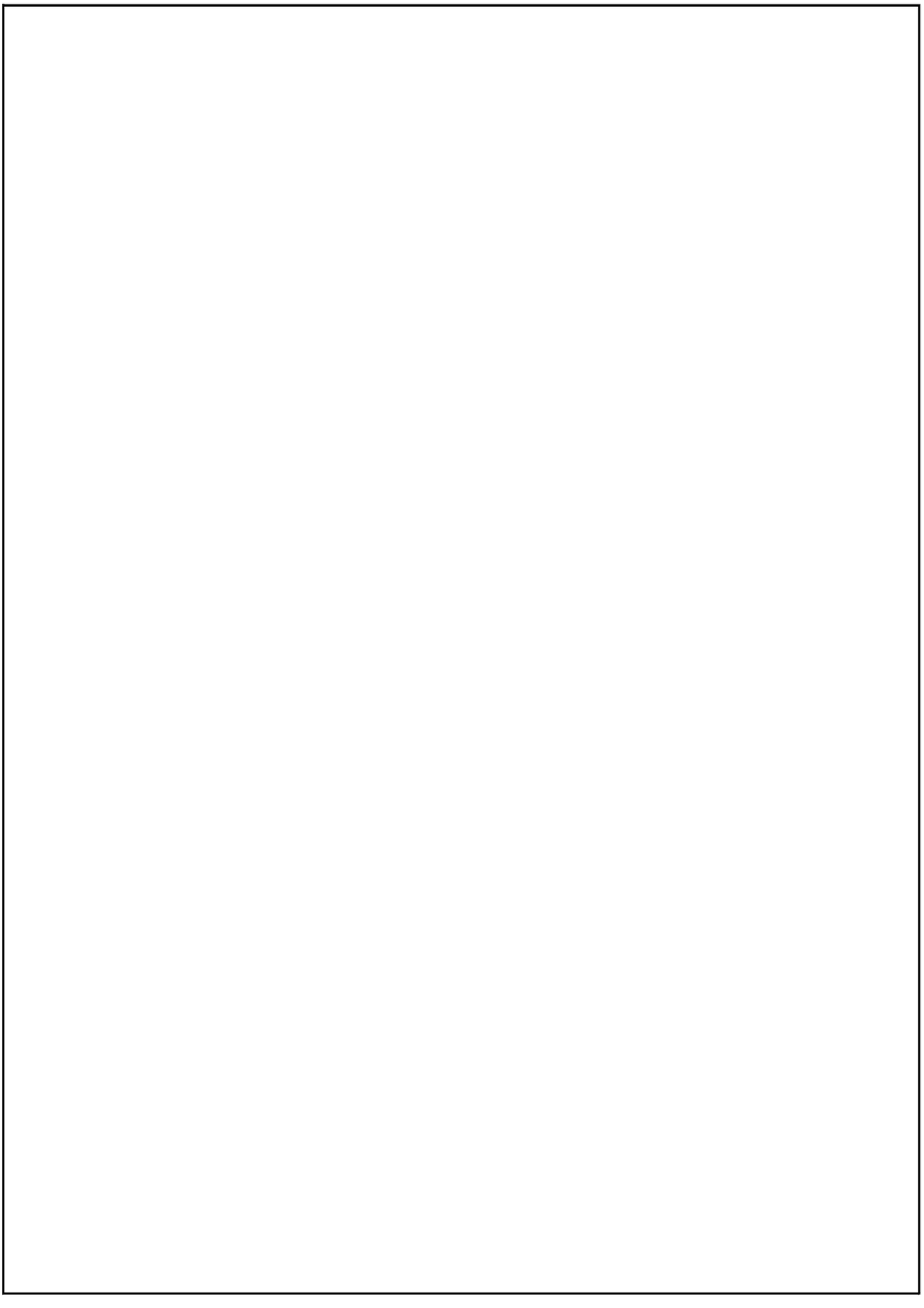
Selectivity

L25	
L50	
L75	
Selection factor	

Remarks

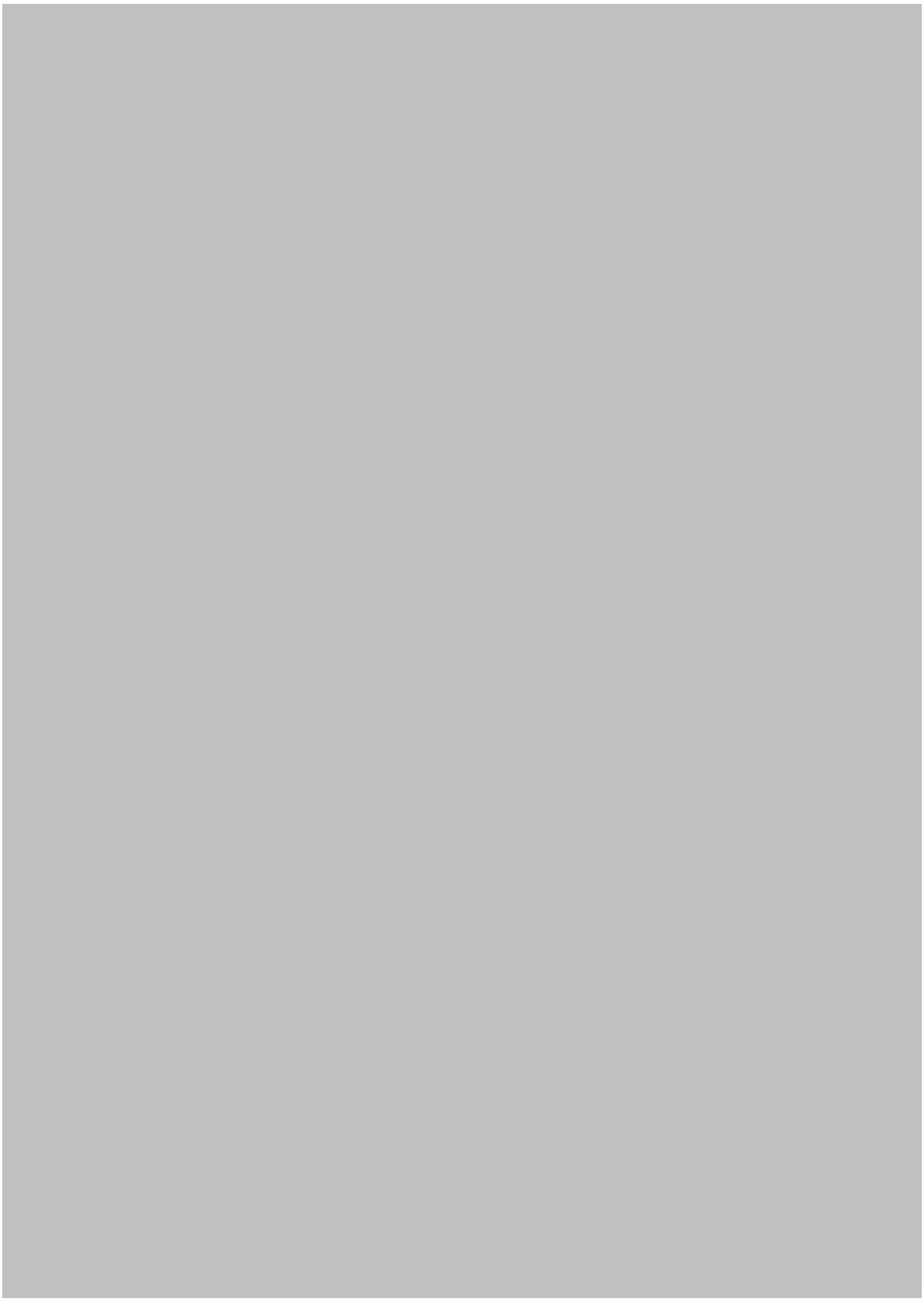
Structure by size or age





This sheet will be activated once the Operational Unit information (P1 section) will be successfully filled in

Code: HKE0710Ang

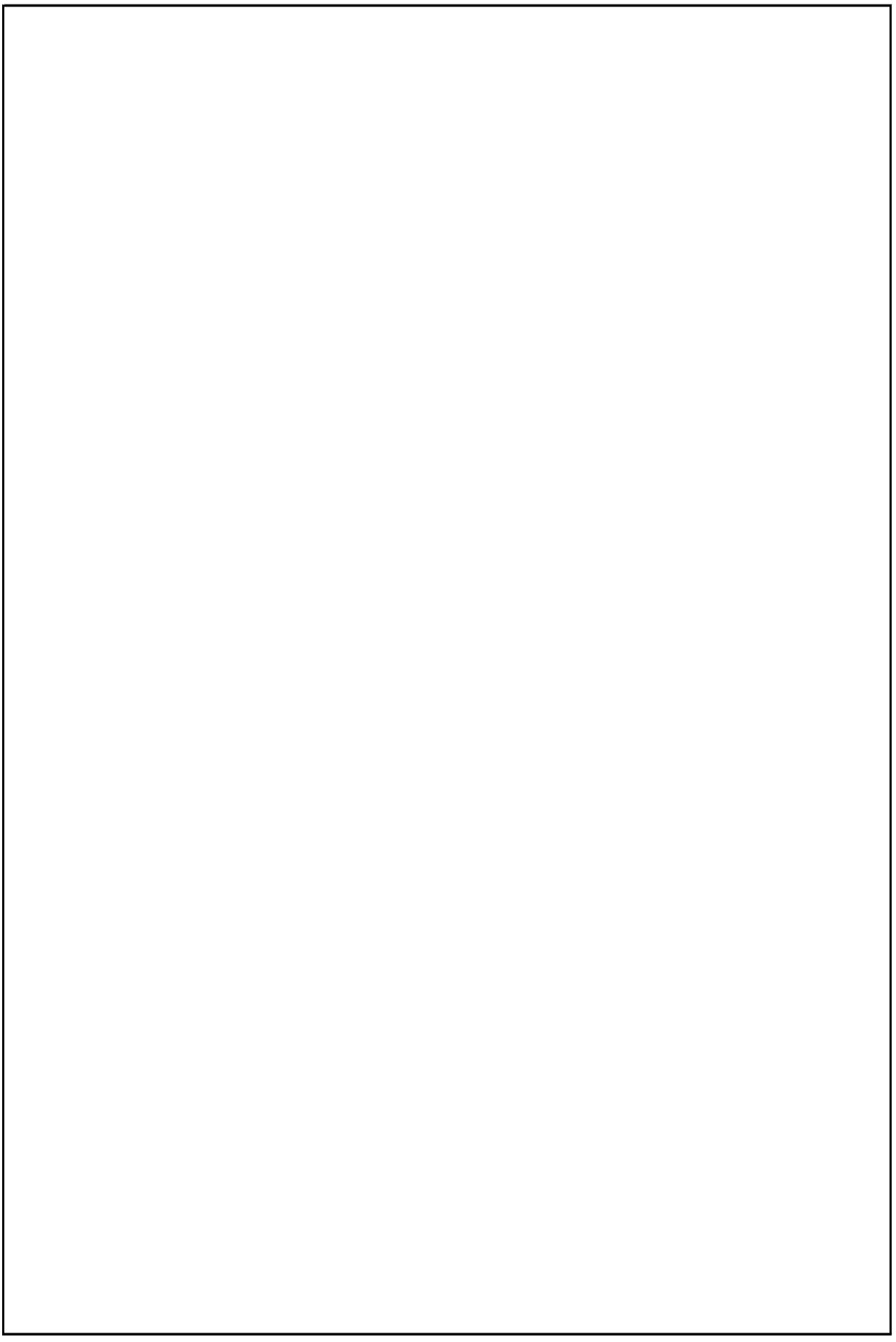


Data source*	IFREMER	OpUnit 1*	FRA 07 E 03 33 - HKE

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
- Freezing of the effort in the Fishery Restricted Area : not observed

Accompanying species



Data source*	IFREMER	OpUnit 2*	FRA 07 C 07 33 - HKE

Regulations in force and degree of observance of regulations

- Fishing license: fully observed
- Maximum length of net: not fully observed
- Freezing of the effort in the Fishery Restricted Area : not observed

Accompanying species

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
- Freezing of the effort in the Fishery Restricted Area : not observed

Accompanying species

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
- Freezing of the effort in the Fishery Restricted Area : not observed

Accompanying species

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Assessment form	Sheet P2b Fishery by Operational Unit

This sheet will be activated once the Operational Unit information (P1 section) will be successfully filled in

Code: HKE0710Ang

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: HKE0710Ang

Sex*	Both

Analysis # *	**1 (1998-2009)**

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	54.44	1327
Average			Average population	73.49	6401
Maximum			Virgin population		
Critical			Turnover	SSB	SSB
				2.8	2228
				mean-Millions	mean-Tons

Average mortality

		Gear					
	Total						
F_1	0.85						
F_2	0.9						
Z	1.355						

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

Comments

Population results as average (arithmetic mean) for the period 1998-2009:
F1: averaged 1998-2009 Fbar 2-5; F2: averaged 1998-2009 Fbar 0-3; Z: averaged F2 + M vector (0-3); Fbar is the averaged of all F for years and ages 2-5 or 0-3
Z has been calculated in the same way, but considering the M vector
Tuning CPUE data:
- Bottom trawl survey MEDITS (20 mm mesh in the cod-end): It has been used data from the French surveys

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

Code: HKE0710Ang

Sex*	

Analysis # *	

Time series

Data	Size	Age
(mark with X)		

Model	Cohorts	Pseudocohorts
(mark with X)	X	

Equation used		Tunig 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

		Gear					
	Total						
F_1							
F_2							
Z							

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

Comments

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

This sheet will be activated once the previous page will be successfully completed

Code: HKE0710Ang

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

Assessment form

Sheet A1
Indirect methods: VPA, LCA

This sheet will be activated once the previous page will be successfully completed

Code: HKE0710Ang

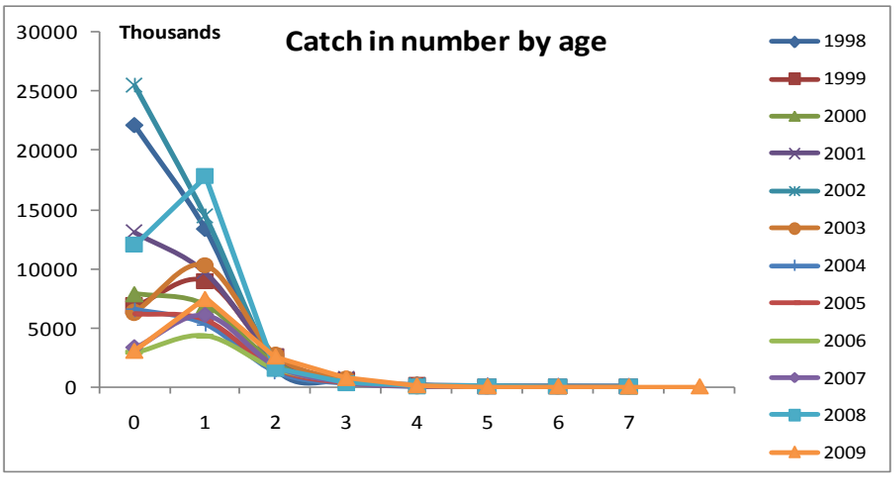
SAC GFCM - Sub-Committee on Stock Assessment (SCSA)	
Assessment form	**Sheet A2** **Indirect methods: data**

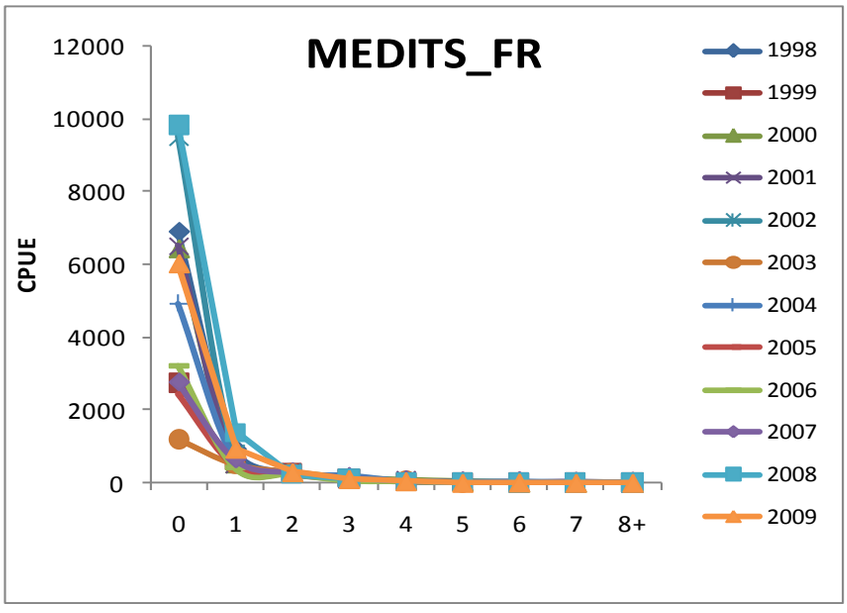
Code: HKE0710Ang

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

Data source	Catch in numbers by age and CPUE for tuning

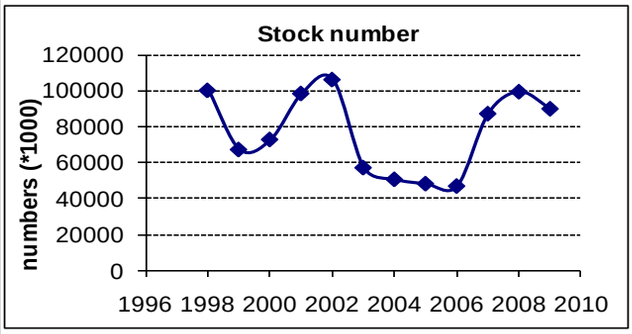
Data

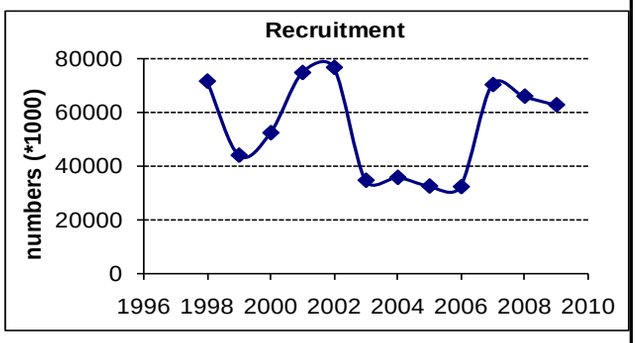




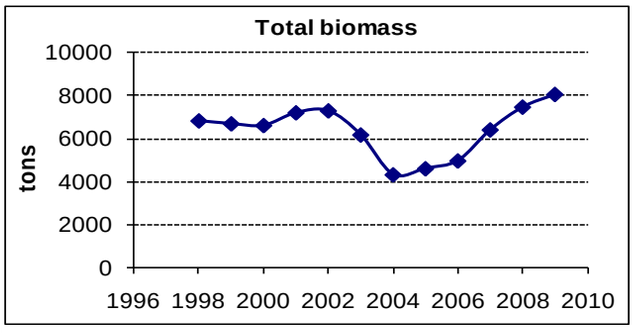
Sex*	Both	Gear*	All	Analysis #*	1

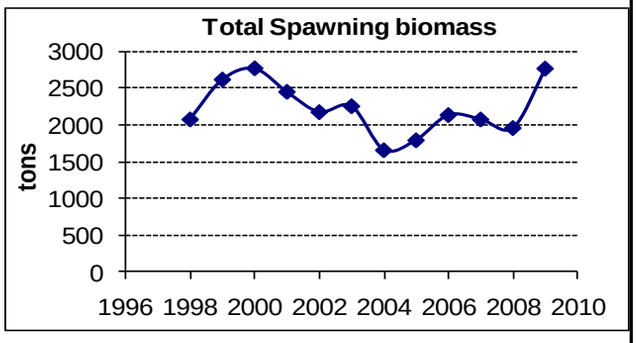
Population in figures



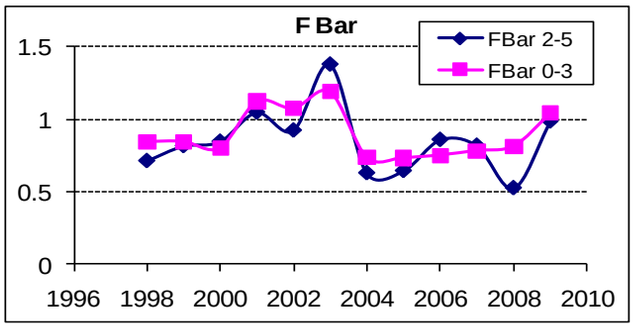


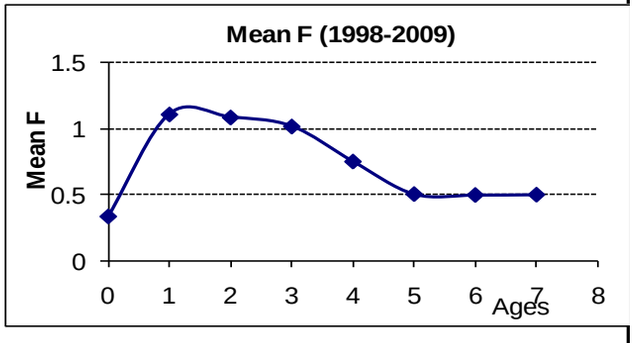
Population in biomass





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	2009
0	71580	43961	52338	74782	76712	34609	35688	32451	32226	70286	65966	62760
1	23944	17071	15006	18052	24525	17096	11199	11536	10355	12425	29075	21327
2	3129	4412	3584	3928	3610	3909	2584	2844	2779	3071	2993	4074
3	910	1063	1067	913	668	921	605	822	800	738	762	901
4	214	335	336	305	147	160	167	197	326	210	210	348
5	99	66	150	114	129	41	51	81	79	126	72	120
6	26	58	29	81	58	73	7	32	54	37	77	44
7	14	12	40	4	51	38	54	2	23	38	19	58
8+	9	6	29	3	36	35	30	1	13	18	12	58

Population in biomass

Biomass (Tons)

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0	1646	967	1125	1608	1649	917	749	763	838	2073	2045	1538
1	2382	2083	1853	2229	2636	2129	1333	1390	1315	1534	2791	2836
2	1302	1844	1548	1650	1511	1577	1070	1202	1235	1317	1214	1652
3	846	964	978	804	585	811	548	728	708	658	684	800
4	317	503	503	459	218	235	244	283	472	305	303	485
5	201	134	309	237	266	85	103	164	159	257	150	245
6	67	151	75	207	151	188	19	84	141	94	191	114
7	42	38	127	12	162	125	167	5	72	119	59	188
8+	37	22	108	10	128	122	109	4	46	66	43	211

Fishing mortality rates

Fishing mortality

AGE	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
0	0.6235	0.2648	0.2545	0.3049	0.6912	0.3183	0.3193	0.3322	0.1431	0.0727	0.3192	0.0975
1	1.2213	1.0908	0.8705	1.1396	1.3664	1.4195	0.9005	0.9533	0.7455	0.9534	1.4952	0.5862
2	0.7799	1.1193	1.0673	1.4716	1.066	1.5666	0.8458	0.9689	1.0255	1.0937	0.9001	1.3014
3	0.7606	0.9129	1.0134	1.5868	1.1873	1.4663	0.8831	0.6837	1.0948	1.0165	0.5453	2.1842
4	0.9647	0.592	0.8704	0.6491	1.0561	0.9323	0.5096	0.7043	0.7379	0.8562	0.3539	0.3303
5	0.3436	0.6391	0.4324	0.4848	0.3837	1.552	0.2755	0.218	0.5764	0.3059	0.3004	0.1252
6	0.5628	0.188	1.842	0.268	0.2397	0.1248	1.2858	0.1665	0.1861	0.4771	0.0953	0.2136
7	0.4562	0.4161	0.1782	1.7739	0.082	0.2315	0.0374	1.8886	0.1562	0.1076	0.1356	0.0246
8+	0.4562	0.4161	0.1782	1.7739	0.082	0.2315	0.0374	1.8886	0.1562	0.1076	0.1356	0.0246

Sex*		Gear*		Analysis #*	

Population in figures

Population in biomass

Fishing mortality rates

This sheet will be activated once the previous page will be successfully completed

Code: HKE0710Ang

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

Assessment form

Sheet Y
Indirect methods: Y/R

Code: HKE0710Ang

Sex	Both

Analysis #	2

# of gears	4	Software	

Parameters used

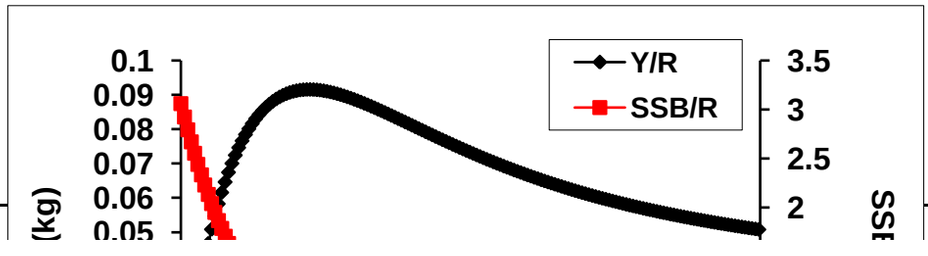
Vector F	from XSA
Vector M	0.81 (0), 0.47 (1), 0.30 (2), 0.24 (3), 0.21 (4), 0.19 (5), 0.18 (6), 0.17 (7), 0.17 (8+)
Vector N	

Model characteristics

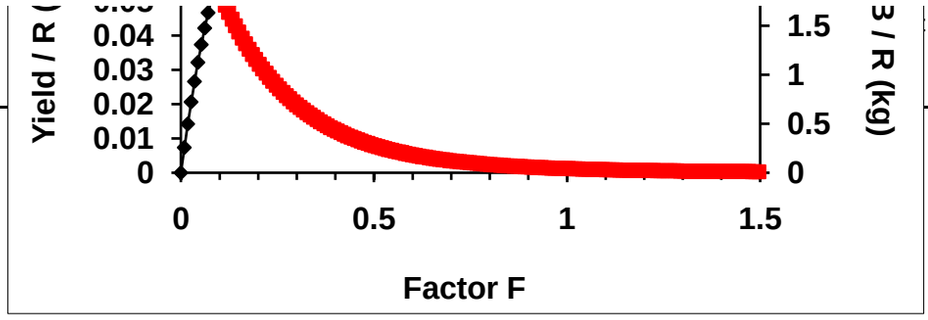
Results

	Total	Gear			
Current YR	0.067				
Maximum Y/R	0.091				
Y/R 0.1	0.090				
F_{max}	0.335				
$F_{0.1}$	0.229				
Current B/R	0.159				
Maximum B/R	3.209				
B/R 0.1	0.914				

Comments



Comments



Ffactor		SSB/R		Y/R	
F Current	1	0.06	0	0.07	
-0.1	0.90	0.09	+36%	0.07	+6%
-0.2	0.80	0.12	+89%	0.08	+12%
-0.4	0.60	0.25	+286%	0.08	+26%
F max (-67%)	0.33	0.72	+1028%	0.09	+36%
F 0.1 (-77%)	0.23	1.11	+1623%	0.08	+26%

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

Code: HKE0710Ang

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

Comments

The stock is characterized by growth overexploitation and by periodically good recruitments (1998, 2002 and 2008) which ensure the sustainability of the exploitation. The trend of the SSB does not show any risk of stock depletion or collapse.

Code: HKE0710Ang

Management advice and recommendations*

Management advice and recommedantions:
To reduce growth overfishing:
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal to the minimum legal landing size
- close nursery areas at least temporally (see doc. "Nursery area for hake for the Gulf of Lions" - p33, SAC 2010 report)
- Reduce the effort of trawl, from reducing time at sea, number of fishing boats, engine power, Bollard pull and/or trawl size

To avoid recruitment 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*

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. We reiterate the importance of VMS as a valuable source of data for having precise informations on effort distribution.

Abstract for SCSA reporting

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

Year 2010

Species Scientific name Merluccius merluccius - HKE

Source: GFCM Priority Species

Source: -

Source: -

Geographical Sub-Area 07 - Gulf of Lions

Fisheries (brief description of the fishery)*

Hake (Merluccius merluccius) is one of the most important demersal target species of the commercial fisheries in the Gulf of Lions (GFCM-GSA07). In this area, hake is exploited by French trawlers, French gillnetters, Spanish trawlers and Spanish long-liners. Around 220 boats are involved in this fishery and, according to official statistics, total annual landings for the period 1998-2009 have oscillated around a mean value of 2160 tons (2260 tons in 2009). The fishing capacity of the GSA 07 has shown in these last 10 years a progressive decrease considering the French trawlers. The number of these trawlers decreased of about 30% on the period.

Most fleets and catches correspond to French trawlers (49 and 70%, respectively). Trawlers catches range between 3 and 92 cm total length (TL), with an average size of 20 cm TL, followed by French gillnetters (~32 and 15% respectively, ranging 13-86 cm TL and average size 39 cm TL), Spanish trawlers (~12 and 8%, respectively, ranging 5-87 cm TL, and average size 25 cm TL), and Spanish long-liners (~7 and 7%, respectively, ranging 23-96 cm TL and average size 54 cm TL). Hake trawlers fishery exploits a highly diversified species assemblage: Striped mullet (Mullus barbatus), Red mullet (Mullus surmuletus), Angler (Lophius piscatorius), Black-bellied angler (Lophius budegassa), European conger (Conger conger), Poor-cod (Trisopterus minutus capelanus), Fourspotted megrim (Lepidorhombus boscii), Soles (Solea spp.), horned octopus (Eledone

Source of management advice*

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

The information used for the assessment of the stock consisted in annual size composition of catches (estimated from monthly or quarterly sampling in the main landing ports), official landings and biological parameters estimated by Aldebert and Recasens (1996). The growth coefficient (k) comes from tagging experiments developed by IFREMER in the area (Mellon-Duval et al, 2010). The vector of natural mortality by age was calculated from Caddy´s formula, using the PROBIOM Excel spreadsheet (Abella et al., 1997). For the period of the study (1998-2009), the methodology applied was a tuned virtual population analysis (VPA), applying the Extended Survivor Analysis (XSA) method considering, as tuning fleet French MEDITS campaign indices. The software used was Lowestoft VPA program (Darby and Flatman, 1994). For 2009, a yield per recruit (Y/R) analysis was performed

Stock Status*

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;

Exploitation rate

High fishing mortality

Stock abundance

Low abundance

Comments

Management advice and recommendations*

Management advice and recommedantions:
To reduce growth overfishing:
- Improve the fishing pattern of the trawl to arise the minimum length of catches equal to the minimum legal landing size
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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. We reiterate the importance of VMS as a valuable source of data for having precise informations on effort distribution.