Stock Annex: Red gurnard (*Chelidonichthys cuculus*) in subareas 3–8 (Northeast Atlantic)

Stock specific documentation of standard assessment procedures used by ICES.

Stock: Red gurnard

Working Group: Working Group on Widely Distributed Stocks (WGWIDE)

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A. General

Red gurnard (*Aspitrigla cuculus* or *Chelidonichthys cuculus*) is widely distributed in Northeast Atlantic from South Norway and north of the British Isles to Mauritania (Quéro, 1984). Hureau (1986) indicates that this species is scarce in the North Sea. This species is also present in the Mediterranean Sea and off Western Africa to the latitude of the Canaries Islands.

This benthic species occurs on grounds between 20 m and 250 m. As with other species of gurnards, red gurnards are able to make audible sounds to help schooling during the spawning period (Wheeler, 1969). In the western Channel (7.e), concentrations occur close to the Central Deep, limited to 90 m depth (Theret, 1983).

Surveys results and commercial fisheries data have shown that the species occurs from the southern North Sea to the Celtic Sea (Anon, 1993). October CGFS French surveys carried out since 1988 have confirmed that in Division 7.d, red gurnards mainly occur in the central area (Carpentier and Coppin, 2000). This species is considered common in autumn as it was present in around 50% of the hauls. It is not found in bays and estuaries (Dauvin, 1988) and also when salinity is below 34°/00. Adults are found mainly in the south of Division 7.d, off Normandy (Delcour, 1996; Carpentier *et al*., 1997; 2000). This species is usually fished on gravel or coarse sand.

On the other hand, results of French IBTS surveys in North Sea have shown that this species is scarce; with a few fish caught on rocky grounds offshore Scotland (Verin and Dufour, 1999).

Théret (1983) has suggested a spawning area in Division 7.e, between Ouessant Island and the Isle of Wight.

Observations on maturity stages showed that maturity started in December and spawning season could start at the end of February and end in June. Quéro (1984) and Hureau (1986) indicated that summer should be the spawning season. Studying all species of gurnards in the Bay of Douarnenez (west of Britany), Baron (1985) indicated that the spawning season is long (six months) and set a mean birthday at the 1st of March for red gurnard by analogy with grey gurnard but with a poor sample of red gurnards. The same author has provided some data on the size at first maturity (L50 = 27 cm for males and 28,4 cm for females). The mean size at first maturity could be set at 25 cm in a range of 26–29 cm at three years old (Forest, 2001).

A.1. Stock definition

In the English Channel, a stock structure within Divisions 7.d and 7.e has not been established and Dunn (1996) recommended not to aggregate biological parameters from the two divisions.

Data available are not sufficient to state about stock identity for red gurnard from the southern North Sea and fish from English Channel and Celtic Sea, though data from 4.c and 7.d,e were aggregated because fish are present all through the year in these divisions (Forest, 2001).

B. Data

B.1. Commercial catch

Available EuroStat/ICES statistics have shown that species of gurnards are not always discriminated and data for Triglidae also occurred.

For UK (E+W) and Spain, landings reported by ICES Divisions are mainly available for all species of gurnards combined and not usable specifically for red gurnard.

Figure B.1 and Table B.1 show the landings by country and area specific to red gurnard. There is a lack of French data in 1999. In Division 7.a, landings have fluctuated at less than 100 t. France seemed the main contributor to international landings except in area V3, but Spanish data were not available. The bulk of landings seemed to come from Divisions 7.d,e at around 4000 t. Landings in 7.f–k levelled at around 500 t. In V3, landings fluctuated at around 200 t since the beginning of 1990s. France is the main contributor to international landings in all areas described except in 7.a. In recent years, the official landings from the main areas where red gurnard is harvested (7.d to k) have shown a continuous decreasing trend from 2003–2004 to levels recorded in years before; that means a decrease of around 50%.

Based on the French database available from the fish markets network, the main species of gurnards landed in France are red gurnard and tub gurnard. The series 1999–2008 shown in Figure B.6. Seasonal landings of gurnards in France from fish markets network has been revised and updated. The drop observed previously in 2003 in the dataset used at WGNEW 2007 was due to data recorded in duplicate in the database during the period 1999–2002. The seasonal pattern is quite regular from year to year either for red gurnard or for tub gurnard. The average landings of red gurnard over the series is around 4900 t. Two higher values are observed in 2002 and 2005 and then the landings of red gurnard tend to decrease to less than 4000 t in 2008. The French landings for different métiers in 7.d and 7.e are sampled as a DCR requirement (Tables B.2 and B.3).

A series 1988–2008 based on logbooks is also available for France in Divisions 4.c, 7.d, 7.e and 7.f–k and Subarea V3 using a dataseries published in Forest (2001) and recent data from 1999 (Table B.4, Figures B.3 and B.4). The series 1999–2008 has been updated in 2010. The main area where red gurnard is caught is 7.d+7.e+7.f–k. Datasets are rather consistent to those given by EuroStat/ICES database except a larger discrepancy in 7.e in 2008. Detailed data from the Celtic Sea have shown that landings are mainly provided by Division 7.h. The contribution of Division 4.c has been generally marginal. In Division 7.d, landings have fluctuated around 1200 t in the period 1989–1996, declined to 665 t in 2000, and remained below 1000 t since then. Over the time-series, there is in 7.e a general trend of increase with fluctuations except the odd drop in 2008. In 7.f–k, the landings have also increased since 2000 and have generally fluctuated around 700

t since then. In Subarea V3 the production has become marginal between the period 1999–2004 and then increased to levels observed in the years before.

Discards

In France, several métiers contribute to discarding in the western Channel (Morizur *et al*., 1996).

- Gillnet with small meshes set in inshore waters and targeting crayfish, monk-fish, sole and hake;
- Gillnet with large meshes targeting crabs have shown discarding of small amounts of red gurnard in winter;
- Red gurnard from coastal otter trawlers is more discarded in the western part of the area than in the eastern part where gurnards are used for baiting crabpots;
- Offshore otter trawlers have been discarding around 50% of red gurnard catches when they fished in the north of 7.e, on the Smalls grounds and Bristol Channel (7.f,g).

Figures B.1 and B.2 show the estimates of landings and discards of red gurnard by French trawlers in 2010 in Divisions 7.d and 7.e respectively. Tables B.2 and B.3 summarized the observations of catches at sea from French trawlers carried out under DCF in that year by concurrent sampling. The rate of discarding is estimated at 63% and 55% in 7.d and 7 e respectively.

The DCF program has provided by concurrent sampling new datasets of the discarding practice by métier for several countries.

B.2. Biological

There was a lack of regular sampling data for red gurnard both in commercial landings and discarding to provide series of length or age compositions usable for a preliminary analytical assessment.

Since 2003, under DCF sampling program at sea, length data have been collected, in a sporadic way during the first years by observers at sea but more intensively since 2009 when the concurrent sampling was planned. The French sampling program by observation at sea under DCF should provide with length compositions of catches by métiers of the fishery when the tools to extract and exploit them will be developed (COST tools to adapt).

In surveys series, length data were available and age compositions are now available since 2008 at least for the FR-EVHOE survey which is partly funded by DCF but this survey is carried out outside the area where the bulk of landings is harvested. The abundance index per age from this survey where obtained by sampling 223 and 222 otoliths sampled during EVHOE 2008 and 2009 respectively.

Available growth parameters from several authors are summarized in Table B.11. They vary considerably. Maximum length is lower for males. Available length–weight relationships are shown in Table B.12.

A maturity ogive is not available except an assumed knife-edge at age 3. Biological parameters collected during EVHOE survey since 2008 could provide a first estimate in Celtic Sea.

Natural mortality has not been estimated in the areas studied.

A total of 696 otoliths from EVHOE (the Bay of Biscay and the Celtic Sea) and IBTS (the North Sea) surveys were interpreted. A summary of aged otoliths is shown below:

Surveys	2006	2007	2008	2009
EVHOE	236		222	222
IBTS		16		

Average sizes (cm) at the ages by sex (F: female; I: unspecified and M: male) from EVHOE 2006, 2008 and 2009 (the Bay of Biscay and the Celtic Sea):

Age	F	I	M
0	15,50	11,44	
1	19,05	16,70	18,86
2	24,24	18,75	22,98
3	29,46		25,69
4	31,86		28,36
5	34,08		33,20

The cumulated age–length key from 4th quarter FR-EVHOE survey 2006, 2008 and 2009 (the Bay of Biscay and the Celtic Sea) is shown in Table B.13. Cumulated age–length key of red gurnard from the FR-EVHOE survey 2006, 2008 and 2009.

B.3. Surveys

Multiannual surveys have been carried out by several countries and could provide some series of abundance index. The UK Western Channel Groundfish Surveys (UK-WCGFS) are operated in 7.e–h and in the north of V3.a during 1st quarter. International Bottom-trawl Surveys (IBTS) cover the North Sea also in 1st quarter. French Channel Groundfish Surveys (FR-CGFS) cover Division 7.d and French "Evaluation Halieutique à l'Ouest de l'Europe" (FR-EVHOE) survey cover the Bay of Biscay and the Celtic Sea out to 11°W respectively during the 4th quarter. None of them is especially designed to target gurnards, but data available could provide long series of abundance indices and at least total or stratified by area length distributions. Series from the UK-WGCFS discontinued in 2005 are not available yet.

Tables B.9 and B.10 shows the series of abundance index of red gurnard from IBTS database and results of the CGFS survey. Figure B.11 shows their trends and their 95% confidence interval.

The IBTS index produces very small values of index and the small trend to increase in the last decade as some higher values in 1986 and 1991 are rather uncertain.

The CGFS index in 7.d has fluctuated in the range of the confidence interval indicating no significant trend. However some higher values have been observed in 2006 and 2008.

The distribution of red gurnard in the Eastern Channel during the FR-CGFS survey in October between 1988 to 2006 is shown in Figure B.12 and indicates that higher abundance occurred in the central area along a Southwest- Northeast axis between Cotentin (FR) and Kent (UK).

The FR-EVHOE index in number or in weight by 30 mn as well show a higher abundance in Celtic Sea than in Bay of Biscay. In Celtic Sea, the index has increased sharply (x2) in 2001 and has fluctuated at this high level since then. In the Bay of Biscay, the index has fluctuated in a wider range but at low levels. The peak observed in 2008 is uncertain.

The distribution of red gurnard in the Celtic Sea and the Bay of Biscay during FR-EVHOE from 1997 to 2009 is shown in Figure B.13. Clearly the greater abundance is located offshore Brittany in the South of Division 7.h and in the North of Division V3.a quite in a geographical continuity with Division 7.e where the bulk of landings are harvested by the fishery.

The abundance index at length of red gurnard from the CGFS and EVHOE surveys are shown in Figure B.14 and Figure B.15 respectively. In CGFS dataset, there is no variability of mean lengths in the length distributions in which we can notice the quasi absence of 0 group (under 15 cm) in the catches, 1989 and 2002 excepted. For some years, bimodal distributions from the EVHOE survey series show clearly the abundance 0 group. Relatively abundant in the period 2001–2005, they are poorly represented in recent years.

Age reading of red gurnards caught during EVHOE survey has been carried out in 2006 and routinely since 2008. Therefore abundance index at age are available in 2006, 2008 and 2009. They are shown in Figure B.16 and indicate that the populations caught are mainly composed of individuals of age 1 and 2.

B.4. Commercial cpue

In some countries species of gurnards are not always distinguished by species and their contribution to international landings is much smaller than those of France. Therefore only French datasets are presented.

The dataseries proposed in WGNEW 2007 have been completely revised since the new French database Harmonie has come into service. Series 1999–2009 of lpues and total effort dedicated to gurnards by otter trawlers (OTB+OTT) are shown in Table B.4 and Figure B.3. Odd values are observed in 1999 and 2009 reflecting problems of quality in the datasets of these years. Therefore the observed window is reduced to the period 2000–2008.

A decreasing trend of effort is shown in the period 2003–2008 in 7.d,e. A similar trend has begun before, in 2002 in area 7.fgh in line with several decommissioning plans carried out in order to reduce the effort of Gadoids trawlers to manage the reduced quotas of cod. At the same time, effort in V3.ab has generally increased in that period. Over the period 2000–2008, the lpues have fluctuated without trend in each of the areas selected (Figure B.4).

Other series of French effort and lpue data using landings and effort by ICES rec-tangle over the period 1999–2008 have been constructed by métier in the Western Approaches (7.e–k) and Bay of Biscay (Area V3). Effort considered is the fishing effort by métier and area. Trends of lpue and effort are shown in Table B.4 to B.8. The main métiers contributing to red gurnard landings are the Gadoid trawlers in Western Approaches which target mainly haddock, whiting and cod and the Benthic trawlers in the same area which target mainly monkfish, megrim and rays. The fluctuations without trend of lpue of Gadoids trawlers in Western Approaches are rather similar to those observed in the series mentioned above. Lpue of Benthic trawlers in the same area increased to 2004 and since then levelled with fluctuations. Lpue of the other métiers described are

very small. In the Western Approaches, effort of Gadoids and *Nephrops* trawlers have shown an almost continuous decline over the period in line with the adjustment to the effort regulation and restrictive quotas of cod set in this area. In the same area, effort of benthic trawlers has fluctuated without trend. In Bay of Biscay, the effort of gadoid trawlers has increased since 2003, probably indicating a shift of effort from Western Approach to Bay of Biscay. Effort of *Nephrops* and benthic trawlers has fluctuated at lower levels.

A series 1999–2008 of *LPUE* and effort of French otter trawler (OTB) in 7.d is shown in Table B.6. Lpue have fluctuated between 1.2 and 2.0 kg/hour and levelled at higher values since 2005 as the fishing effort has decreased.

Over all the short series presented, only lpue in 7.d could indicate a trend of abundance increasing in recent years in that area. The other series have only shown small fluctuations without obvious trends.

C. References

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Table B.1. Official landings of Red gurnard reported to ICES by Division and country in recent years.

country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4.a											
Belg	0	0	0	0	0	0	0	0	0	0	0
Fran	0	0	0	0	0	0	0	0	0	0	0
UK	4	36	62	49	50	24	13	12	34	58	79
Total	4	36	62	49	50	24	13	12	34	58	79
	4.b										
Belg	1	2	16	23	68	19	16	23	11	11	0
Fran	0	0	0	0	0	0	1	4	3	0	10
Neth	12	590	1	2	1	5	5	1	1	1	5
UK	0	114	155	205	171	71	61	93	48	46	48
Total	13	706	172	230	240	95	83	121	63	58	63
	4.c										
Belg	15	25	26	18	15	14	15	10	15	17	7
Fran	54	111	43	39	27	26	11	14	12	35	28
Neth	33	1052	50	39	47	39	36	28	26	40	47
UK	0	0	0	0	1	1	2	3	2	0	4
Total	102	1188	119	96	90	80	64	55	55	92	86
	6.a										
Belg	0	0	0	0	0	0	0	0	0	0	0
Fran	10	6	7	2	2	8	16	7	6	5	1
Irel	0	0	0	0	0	0	0	0	0	0	0
UK	0	19	45	29	23	10	16	14	22	90	100
Total	10	25	52	31	25	18	32	21	28	95	101
	6.b										
Fran	0	0	0	0	0	0	1	0	0	0	0
Russ	0	0	0	0	0	0	0	0	0	0	0
UK	0	0	1	0	0	0	0	0	3	2	46
Total	0	0	1	0	0	0	1	0	3	2	46
	7.a										
Belg	33	26	22	24	8	11	10	7	5	3	13
Fran	6	15	12	2	0	2	0	0	0	0	0
Irel	0	0	0	0	0	0	0	0	0	0	0
Othe	1	0	0	0	0	0	0	0	0	0	0
UK	0	3	5	12	11	0	0	0	0	0	1
Isle of Man	0	0	0	0	0	0	0	0	0	1	0
Total	40	44	39	38	19	13	10	7	5	4	14
	7.b										
Fran	18	15	9	3	9	7	9	7	6	7	8
Irel	0	0	0	0	0	0	0	0	0	0	0
UK	0	3	0	0	0	0	0	0	1	0	0
Total	18	18	9	3	9	7	9	7	7	7	8

Table B.1. Continued. Official landings of Red gurnard reported to ICES by Division and country in recent years.

country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
7.c											
Fran	20	9	3	1	21	8	12	15	16	6	10
UK	0	11	6	2	2	0	0	0	0	0	0
Total	20	20	9	3	23	8	12	15	16	6	10
	7.d										
Belg	94	107	98	162	133	143	171	191	223	153	159
Fran	800	1119	1183	1043	1005	1039	898	971	894	971	1116
Neth	0	63	2	4	14	16	16	35	64	105	177
UK	0	0	0	0	0	0	17	32	55	63	79
Total	894	1289	1283	1209	1152	1198	1102	1229	1236	1292	1531
	7.e										
Belg	2	6	6	24	45	45	73	62	60	21	34
Chan	0	0	15	15	15	0	10	3	10	0	2
Fran	2499	2575	2968	2728	2436	2951	2714	2603	2382	1513	1546
Neth	0	2	0	0	0	0	0	2	1	14	22
UK	0	0	0	0	0	0	6	3	0	2	4
Total	2501	2583	2989	2767	2496	2996	2803	2673	2453	1550	1608
	7.f										
Belg	6	9	7	17	31	37	21	24	33	14	14
Fran	187	305	196	199	231	299	209	223	216	98	118
UK	0	0	1	0	0	0	0	0	0	0	0
Total	193	314	204	216	262	336	230	247	249	112	132
	7.g										
Belg	2	3	4	8	16	10	6	9	4	6	8
Fran	31	33	23	13	9	14	10	6	5	17	15
Irel	0	0	0	0	0	0	0	0	0	0	0
UK	0	0	0	0	0	0	0	0	0	0	0
Total	33	36	27	21	25	24	16	15	9	23	23
	7.h										
Belg	0	0	3	1	0	1	0	0	0	0	0
Fran	415	364	412	467	668	522	446	437	408	510	433
Total	415	364	415	468	668	523	446	437	408	510	433
	7.j										
Fran	15	10	8	6	8	5	5	4	4	6	8
Irel	0	0	0	0	0	0	0	0	0	0	0
UK	0	20	6	15	2	0	0	0	1	1	1
Total	15	30	14	21	10	5	5	4	5	7	9
7.k											
Fran	3	7	1	0	0	0	0	0	0	0	0
UK	0	0	0	0	0	0	0	0	0	0	0
Total	3	7	1	0	0	0	0	0	0	0	0

Table B.1. Continued. Official landings of Red gurnard reported to ICES by Division and country in recent years.

country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
V3.a											
Belg	0	0	0	0	1	0	0	0	0	0	0
Fran	87	86	90	118	113	133	153	139	66	98	100
Neth	0	1	0	0	0	0	0	0	0	0	0
UK	0	0	0	0	0	3	0	0	0	0	0
Total	87	87	90	118	114	136	153	139	66	98	100
	V3.b										
Belg	1	1	1	0	1	2	1	1	2	2	3
Fran	30	30	32	44	56	64	59	58	23	38	31
Neth	0	2	0	0	0	0	0	0	0	0	0
Total	31	33	33	44	57	66	60	59	25	40	34
	V3.c										
Fran	1	0	2	0	0	1	1	3	3	0	0
Port	0	0	0	0	0	0	0	0	0	1	0
Total	1	0	2	0	0	1	1	3	3	1	0
	V3.d										
Fran	1	1	1	3	0	5	5	2	1	2	Fran
Total	1	1	1	3	0	5	5	2	1	2	Total
	9										
Port	0	0	0	0	0	46	124	125	109	148	114
Spai	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	46	124	125	109	148	114

Table B.2. Summary of French sampling at sea of red gurnard under DCF Regulation in Division 7.d.

Quarter	DRB_ MOL	GNS_ DEF	GTR_ CRU	GTR_ DEF	GTR_MOL	OTB_ DEF	OTB_ MOL	OTB_ SPF	OTM _DEF
1	NA	1	NA	8	NA	155	329	30	6
2	NA	NA	NA	1	NA	248	NA	NA	NA
3	NA	NA	NA	37	NA	186	17	NA	7
4	NA	7	NA	15	NA	159	NA	NA	NA
	OTM_ MOL	OTM_ SPF	OTT_CRU	PTM_ DEF	PTM_ SPF	TBB_DEF			
1	7	NA	NA	NA	NA	2			
2	NA	1	NA	NA	51	NA			
3	NA	1	NA	NA	163	NA			
4	NA	NA	NA	64	NA	NA			

Table B.3. Summary of French sampling at sea of red gurnard under DCF Regulation in Division 7.e. In yellow cells, data aggregated in OT._DEF for further analysis to obtain a sample of measured fish both in LAN and DIS strata by quarter.

Quarter	DRB_ MOL	FPO_ CRU	FPO_ MOL	GNS_ CRU	GNS_ DEF	GTR_ CRU	GTR_ DEF	LTL_ DEF	OTB_ CRU
1	NA	NA	NA	2	NA	NA	NA	NA	NA
2	NA	NA	NA	19	NA	NA	18	NA	NA
3	NA	NA	NA	1	NA	NA	3	NA	NA
4	NA	NA	NA	NA	NA	NA	3	NA	NA
	OTB_ DEF	OTB_ MOL	OTM_ DEF	OTT_ CRU	OTT_ DEF	OTT_ MOL	PS_ DEF	PS_ SPF	PTM_ DEF
1	20	NA	NA	NA	NA	NA	NA	NA	87
2	155	NA	NA	NA	6	NA	NA	NA	NA
3	683	220	211	NA	NA	NA	1	NA	34
4	38	NA	NA	NA	NA	NA	1	NA	NA

Table B.4 Series of landings of red gurnard, effort and LPUE of French otter trawlers (OTB+OTT) from logbooks datasets.

	Landings kg Red gurnard			effort 000'h fished		1000	LPUE kg/h fished		
year	7de	7fgh	8ab	7de	7fgh	8ab	7de	7fgh	8ab
1999	3143378	315217	35275	810.553	230.328	48.834	3.9	1.4	0.7
2000	3026836	607484	54645	1130.318	941.991	356.194	2.7	0.6	0.2
2001	3356616	684815	49543	1067.780	994.438	302.113	3.1	0.7	0.2
2002	3813616	595813	39719	1219.589	846.449	321.536	3.1	0.7	0.1
2003	3507286	661274	49012	1391.980	893.467	426.490	2.5	0.7	0.1
2004	3248722	900132	63445	1297.526	865.703	497.762	2.5	1.0	0.1
2005	3624801	681381	112036	1085.057	778.914	768.129	3.3	0.9	0.1
2006	3452166	633692	117881	1069.908	672.443	680.123	3.2	0.9	0.2
2007	3352089	657775	100654	1002.862	623.124	716.833	3.3	1.1	0.1
2008	2254264	583834	103017	778.306	603.849	677.288	2.9	1.0	0.2
2009	1314597	336279	26941	213.796	106.379	59.186	6.1	3.2	0.5
	1999 and 2009: datasets unreliable								

Table B.5. Series of landings of red gurnard, effort and lpue by métier of French otter trawlers (OTB+OTT) from CPR datasets.

Red Gurnard France Captures (t) Metier	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Benthic Western Approaches	55	145	252	247	463	810	595	614	751	469
Gadoids Western Approaches	2685	2874	2930	3222	2851	2536	2850	2667	2421	1642
Nephrops Western Approaches	3	2	1	1	1	1	1	0	0	0
Benthic Bay of Biscay	7	29	21	22	29	28	57	62	39	51
"Gadoids" Bay of Biscay	25	24	22	16	18	30	52	49	59	51
Nephrops Bay of Biscay	3	3	2	3	4	6	6	5	5	6
	2778	3077	3228	3511	3366	3411	3561	3397	3275	2219

Red Gurnard France Fishing Effort Metier	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Benthic Western Approaches	260758	295235	289227	265173	311690	319664	277571	303860	327413	266640
Gadoids Western Approaches	603846	561385	549464	549402	532461	488775	455446	436125	394148	314761
Nephrops Western Approaches	198129	219402	195229	182732	199108	164514	168537	159230	118692	99788
Benthic Bay of Biscay	143053	137186	128085	132199	148483	166266	203183	173227	178323	170854
"Gadoids" Bay of Biscay	276271	211502	208556	184709	194668	215719	260360	291848	356308	305030
Nephrops Bay of Biscay	199384	171203	181568	182496	218913	238337	277343	277908	249244	230292
Total	1681441	1595913	1552129	1496711	1605323	1593275	1642440	1642198	1624128	1387365

Red Gurnard France LPUE (Kg/10h) Metier	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Benthic Western Approaches	2.1	4.9	8.7	9.3	14.9	25.3	21.4	20.2	22.9	17.6
Gadoids Western Approaches	44.5	51.2	53.3	58.6	53.5	51.9	62.6	61.2	61.4	52.2
Nephrops Western Approaches	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Benthic Bay of Biscay	0.5	2.1	1.6	1.7	2.0	1.7	2.8	3.6	2.2	3.0
"Gadoids" Bay of Biscay	0.9	1.1	1.1	0.9	0.9	1.4	2.0	1.7	1.7	1.7
Nephrops Bay of Biscay	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.2	0.3

Table B.6. Series of landings of red gurnard, effort and lpue of French otter trawlers (OTB) in 7.d from logbooks datasets.

year	Landings kg	Effort hours	LPUE Kg/hour
1999	731485	449924	1.6
2000	653244	551088	1.2
2001	869054	485479	1.8
2002	929381	560053	1.7
2003	813963	629978	1.3
2004	800899	573711	1.4
2005	827994	441078	1.9
2006	791125	440473	1.8
2007	811937	438125	1.9
2008	698455	342351	2.0

Table B.7. Series of landings of red gurnard, effort and lpue of French otter trawlers (OTB+OTT) from logbooks datasets.

	Landings kg Red gurnard			effort 000'h fished		1000	LPUE kg/h fished		
year	7de	7fgh	8ab	7de	7fgh	8ab	7de	7fgh	8ab
1999	3143378	315217	35275	810.553	230.328	48.834	3.9	1.4	0.7
2000	3026836	607484	54645	1130.318	941.991	356.194	2.7	0.6	0.2
2001	3356616	684815	49543	1067.780	994.438	302.113	3.1	0.7	0.2
2002	3813616	595813	39719	1219.589	846.449	321.536	3.1	0.7	0.1
2003	3507286	661274	49012	1391.980	893.467	426.490	2.5	0.7	0.1
2004	3248722	900132	63445	1297.526	865.703	497.762	2.5	1.0	0.1
2005	3624801	681381	112036	1085.057	778.914	768.129	3.3	0.9	0.1
2006	3452166	633692	117881	1069.908	672.443	680.123	3.2	0.9	0.2
2007	3352089	657775	100654	1002.862	623.124	716.833	3.3	1.1	0.1
2008	2254264	583834	103017	778.306	603.849	677.288	2.9	1.0	0.2
2009	1314597	336279	26941	213.796	106.379	59.186	6.1	3.2	0.5

1999 and 2009: datasets unreliable

Table B.8. Series of landings of red gurnard, effort and lpue of French otter trawlers (OTB) in 7.d from logbooks datasets.

year	Landings kg	Effort hours	LPUE Kg/hour
1999	731485	449924	1.6
2000	653244	551088	1.2
2001	869054	485479	1.8
2002	929381	560053	1.7
2003	813963	629978	1.3
2004	800899	573711	1.4
2005	827994	441078	1.9
2006	791125	440473	1.8
2007	811937	438125	1.9
2008	698455	342351	2.0

Table B.9. The abundance index (N/h) of red gurnard from the IBTS database in North Sea and CGFS survey in Eastern Channel.

Year	IBTS Quarter 1	CGFS
1986	11.87	20.77
1987	1.17	19.24
1988	0.00	12.33
1989	0.37	11.87
1990	4.91	16.35
1993	0.00	10.12
1994	0.00	23.71
1995	0.00	12.89
1996	0.00	9.56
1997	0.06	18.01
1998	0.00	6
1999	0.00	7.09
2000	0.11	9.83
2001	0.12	7.17
2002	0.05	11.18
2003	0.24	12.92
2004	0.22	7.34
2005	0.10	10.9
2006	0.00	13.56
2007	0.23	10.26
2008	0.00	18.64
2009	0.24	17.24

Table B.10. The average abundance (number and weight (kg) per 30 mn) of red gurnard annually from FR-EVHOE survey in the Celtic Sea (7,g,h,j) and in the Bay of Biscay (V3.a,b).

Year	Celtic Sea (VIIg, h, j)		Bay of Biscay (VIIIa, b)	
	Number/30minutes	W(kg)/30minutes	Number/30minutes	W(kg)/30minutes
1997	23.29	2.24	5.34	0.43
1998	22.32	2.35	2.79	0.25
1999	25.22	2.35	0.9	0.09
2000	19.12	1.65	1.2	0.11
2001	39.11	3.03	8.02	0.7
2002	35.75	2.97	9.79	0.69
2003	37.62	2.8	2.61	0.21
2004	43.76	3.66	7.19	0.58
2005	38.84	3.39	6.7	0.57
2006	27.89	2.56	6.82	0.53
2007	36.41	3.18	10.59	0.81
2008	33.97	3.39	14.71	1.42
2009	38.7	3.82	6.04	0.53

Table B.11. Growth parameters of red gurnard in the English Channel.

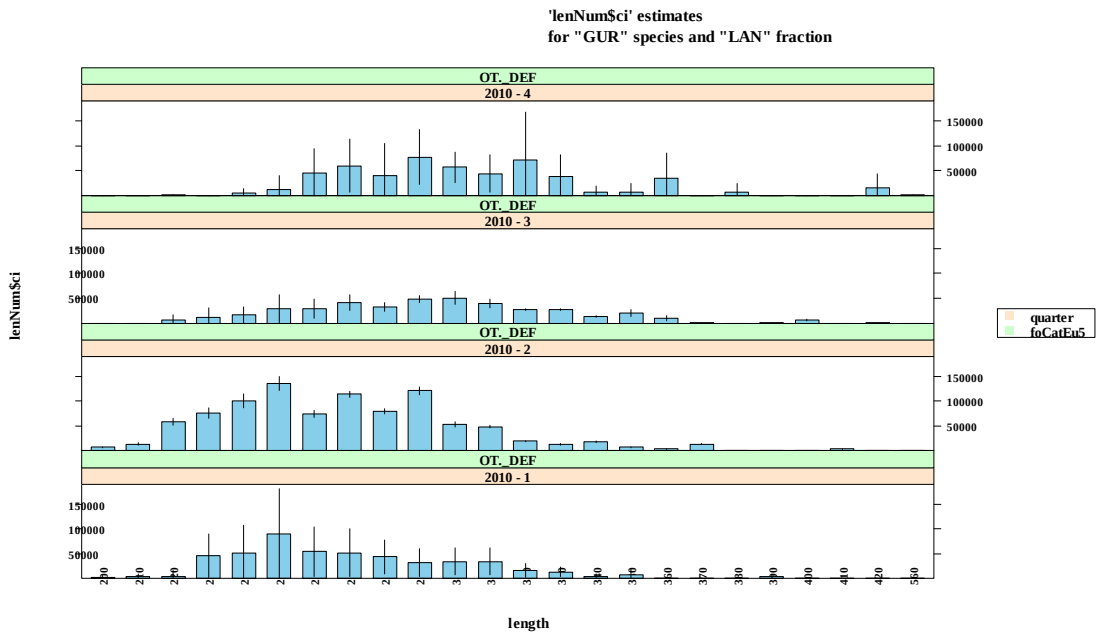
Authors	Area	Sex	Nb	L_∞	K (y^{-1})	t_0 (years)
Baron (1983)	Manche + mer du Nord	M	118	37,1	0,51	-0,08
		F	232	41,7	0,46	-0,05
Dunn *et al*. (1996)	7.d	M	213	35.75	0,232	-3,37
	7.d	F	531	41,05	0,248	-2,57
	7.e	F	147	NS	0,137	-2,09
Carpentier 1995	7.d	M+F	187	36,75	0,597	0,180
Id 1996			94	37,97	0,622	0,149
Id 1997			90	36,67	0,645	0,185
Id 1998			107	36,18	0,613	0,048
Id 1999			122	36,02	0,511	-0,277
Mean 1995–2000			704	36,34	0,543	-0,17

Table B.12. Length–weight relationships available for red gurnard in English (W = aLb, W live weight in g and L in cm).

Author	Area	Month	Sex	Number	a	b
Théret, 1983	English Channel	September	M	31	$1,13.10^{-3}$	3,3854
			F	80	$4,50.10^{-3}$	3,14027
		November	M	33	$3,65.10^{-3}$	3,16261
			F	33	$2,94.10^{-3}$	3,20117
		December	M	55	$1,51.10^{-3}$	3,32967
			F	144	$1,05.10^{-3}$	3,38984
		January	M	112	$0,98.10^{-3}$	3,39763
			F	120	$2,19.10^{-3}$	3,25648
		February	M	31	$0,73.10^{-3}$	3,44558
			F	82	$0,88.10^{-3}$	3,41197
Dorel, 1986	idem		M + F	593	$5,61.10^{-3}$	3,16882

Table B.13. Cumulated age–length key of red gurnard from the FR-EVHOE survey 2006, 2008 and 2009.

Length	0	1	2	3	4	5	6
8	5						
9	12						
10	8						
11	10						
12	10						
13	14	1					
14	10	5					
15	2	15					
16	1	22	2				
17	1	28	2				
18		37	3				
19		32	6				
20		30	10				
21		22	18	2			
22		9	25	1			
23		5	25	5			
24		1	25	6	1	1	
25		3	16	5	4		
26			9	14	5		
27			13	8	6	1	
28		1	6	10	8	2	
29			5	8	2	3	
30			1	5	6	1	
31			2	6	7	4	
32			2	5	1	1	
33			2	6	4		
34				5	3	2	
35				3	2	2	
36				2	1	3	
37					1	2	
38					3	2	
39						1	
40					2	2	
41				1	1	1	
42						1	1
44							1
45						1	



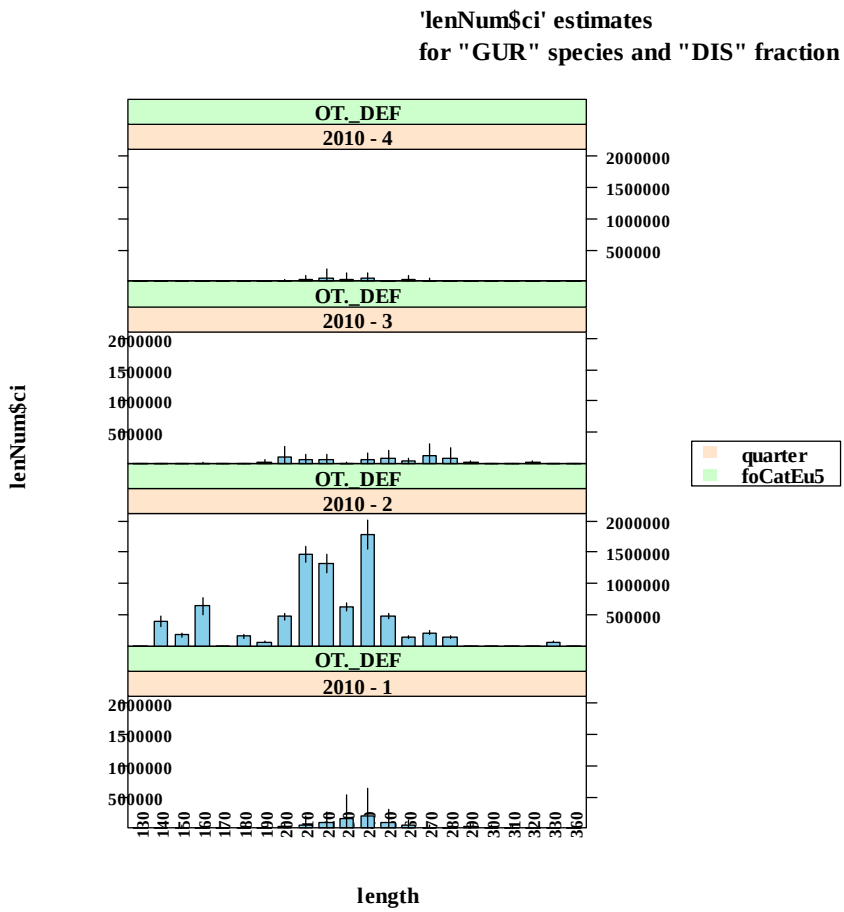
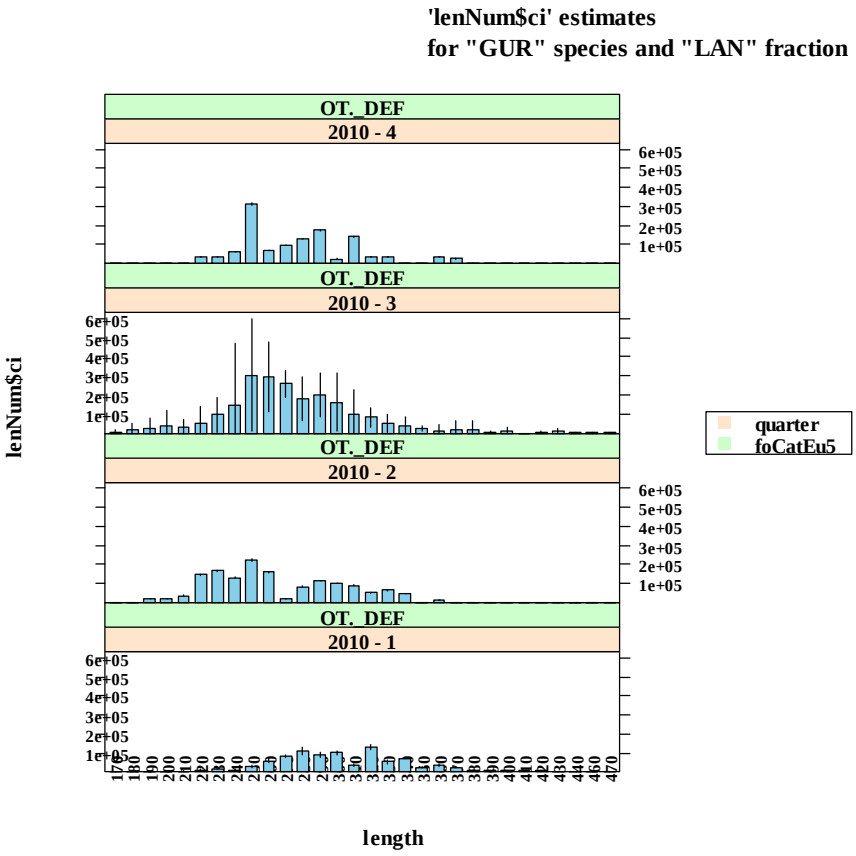


Figure B.1. Quarterly length compositions of the 2010 French landings (top) and discards (bottom) of Red gurnard of trawlers in Divisions 7.d and their confidence intervals.



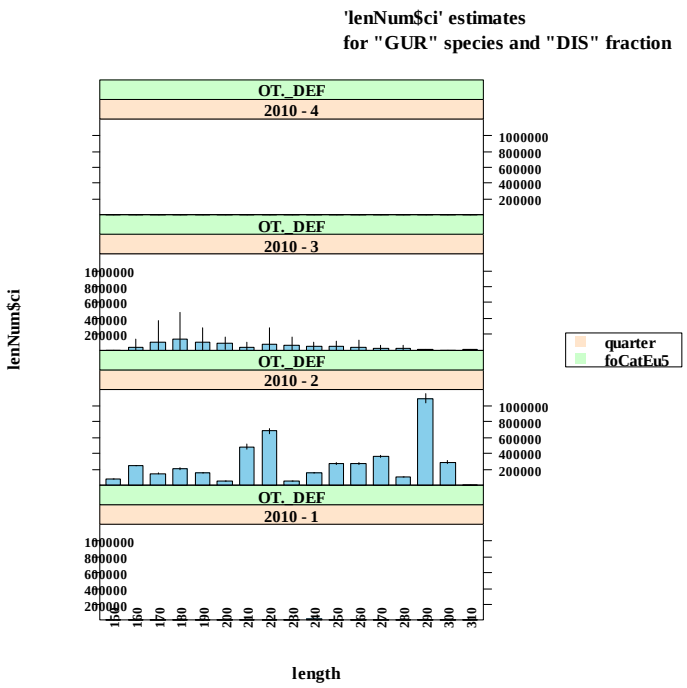
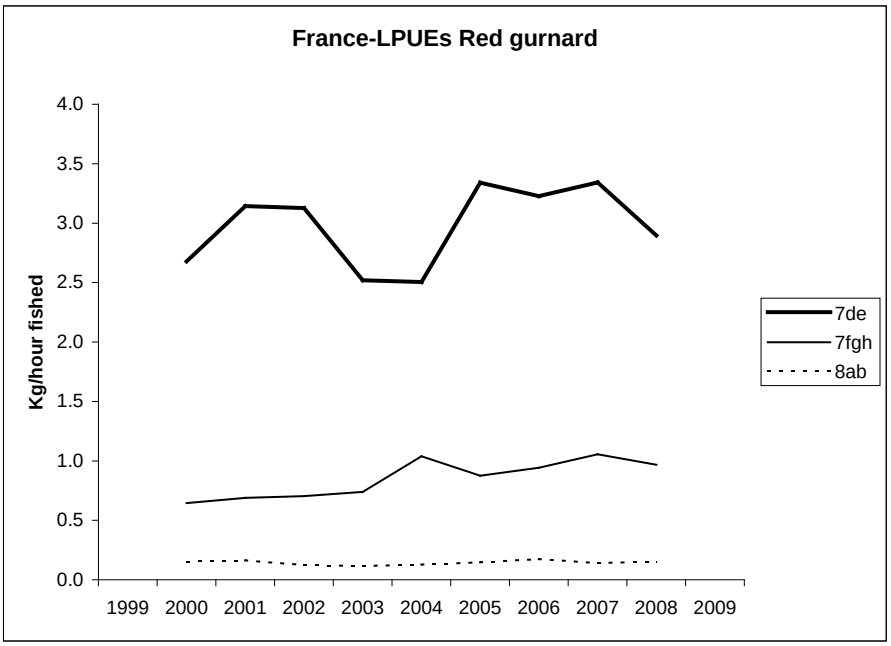


Figure B.2. Quarterly length compositions of the 2010 French landings (top) and discards (bottom) of Red gurnard of trawlers in Divisions 7.e and their confidence intervals.



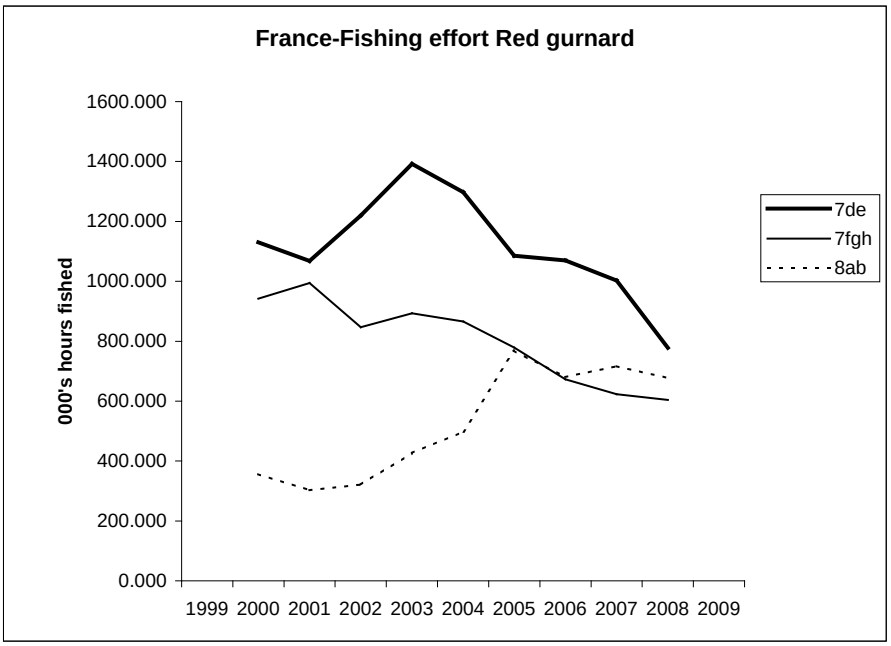
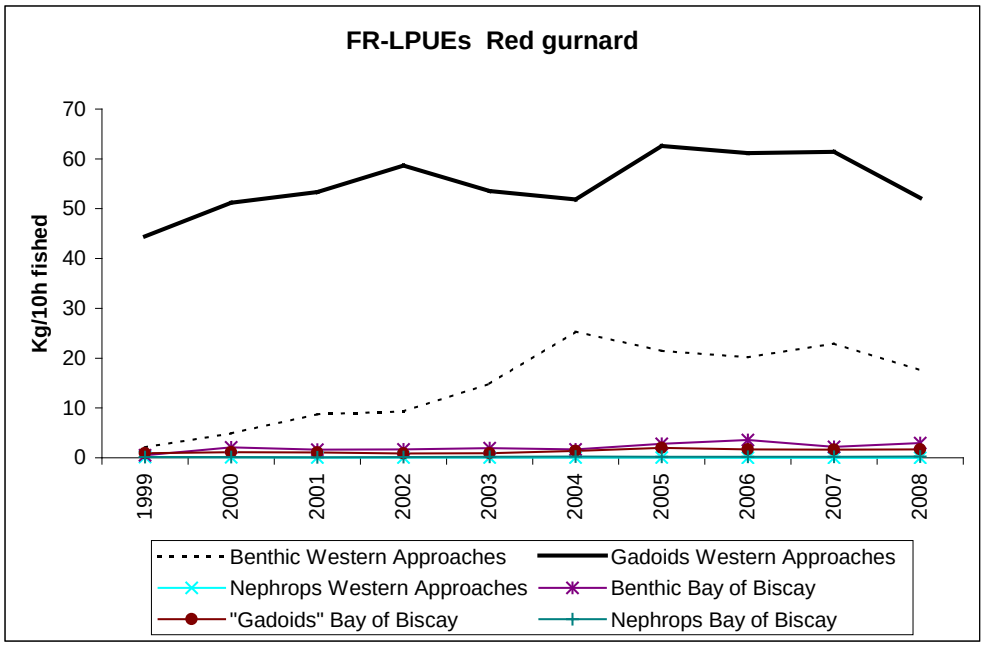


Figure B.3. Trends of lpues and French effort OTB+OTT and in 7.de, 7.fgh and V3.ab.



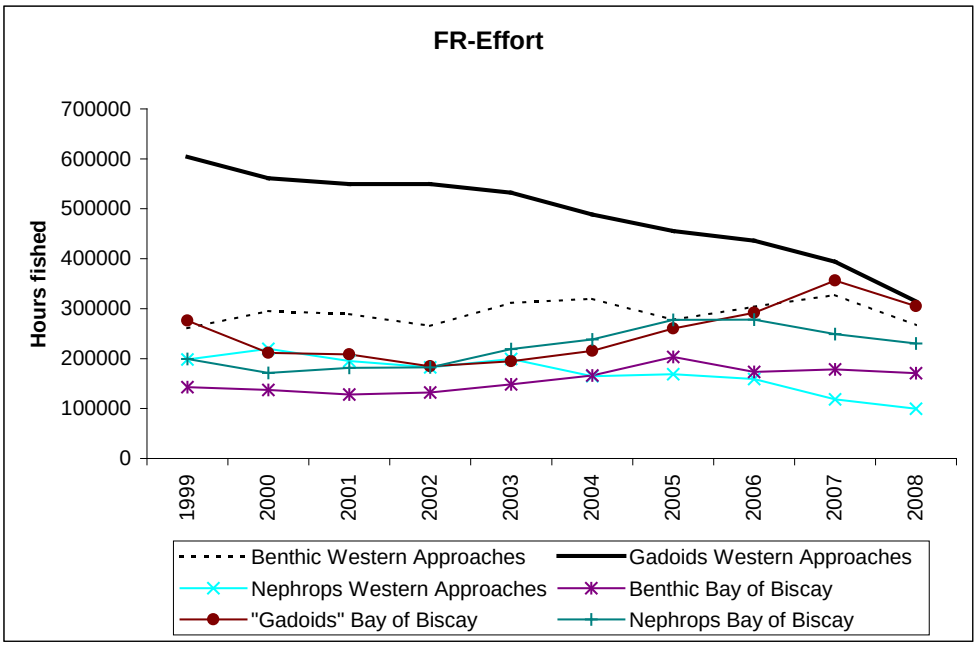


Figure B.4. Red Gurnard. Trends of lpue (kg/10h) and fishing effort (hours fished) of French otter trawlers (OTB+OTT) in Areas 7.e–k (Western Approaches) and V3 (Bay of Biscay).

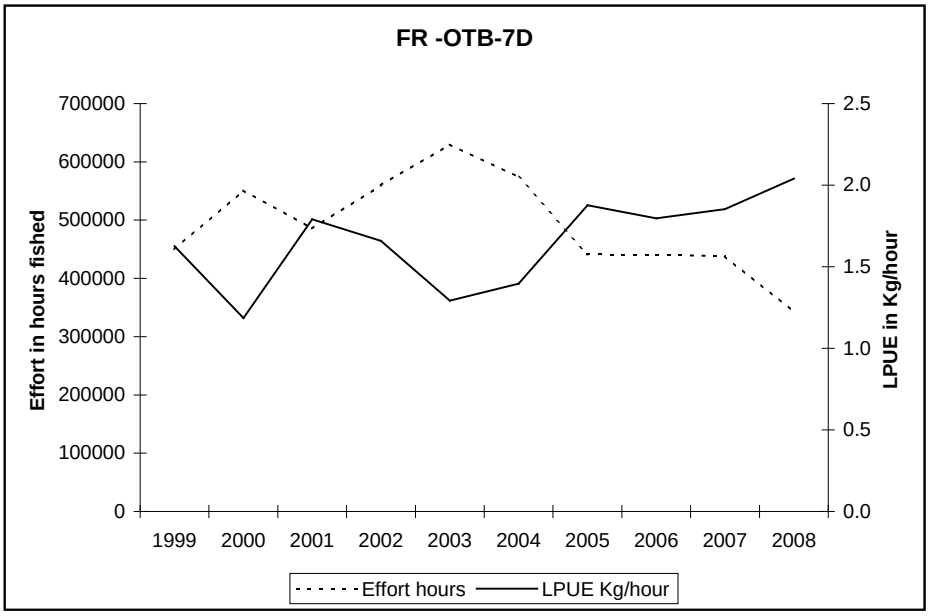


Figure B.5. France. Trends of lpue and effort in 7.d of otter trawlers (OTB) for years 1999–2008.

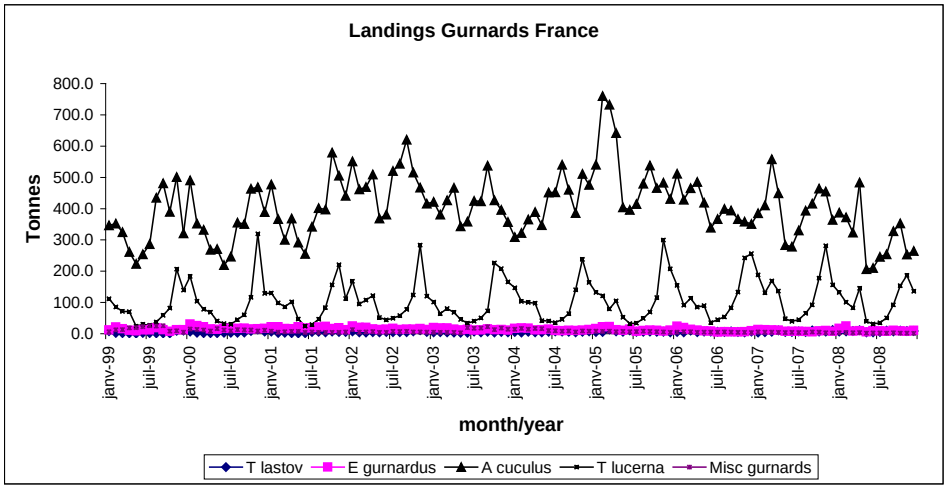


Figure B.6. Seasonal landings of gurnards in France from fishmarkets network.

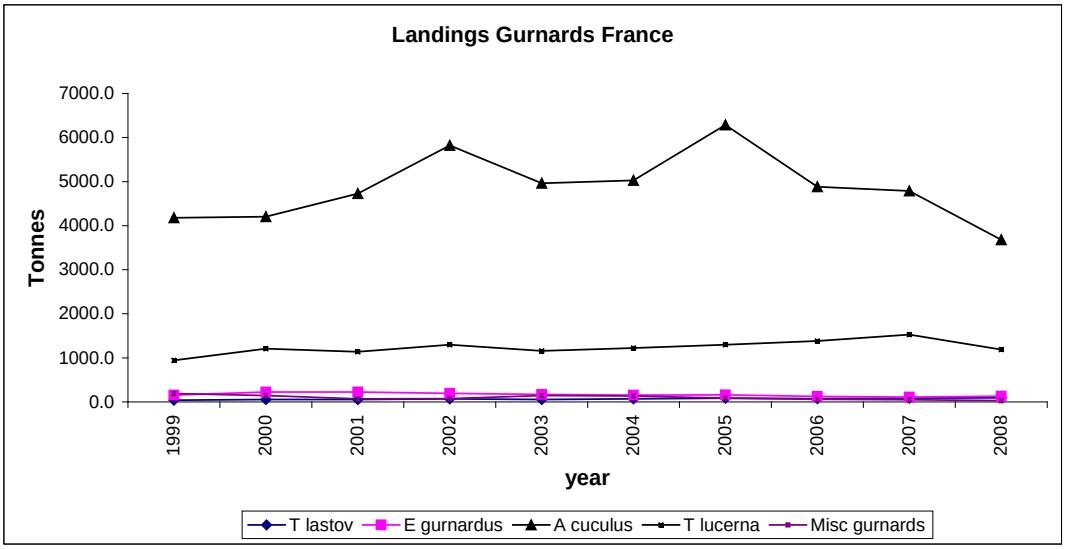


Figure B.7. Annual landings of gurnards in France from fishmarkets network.

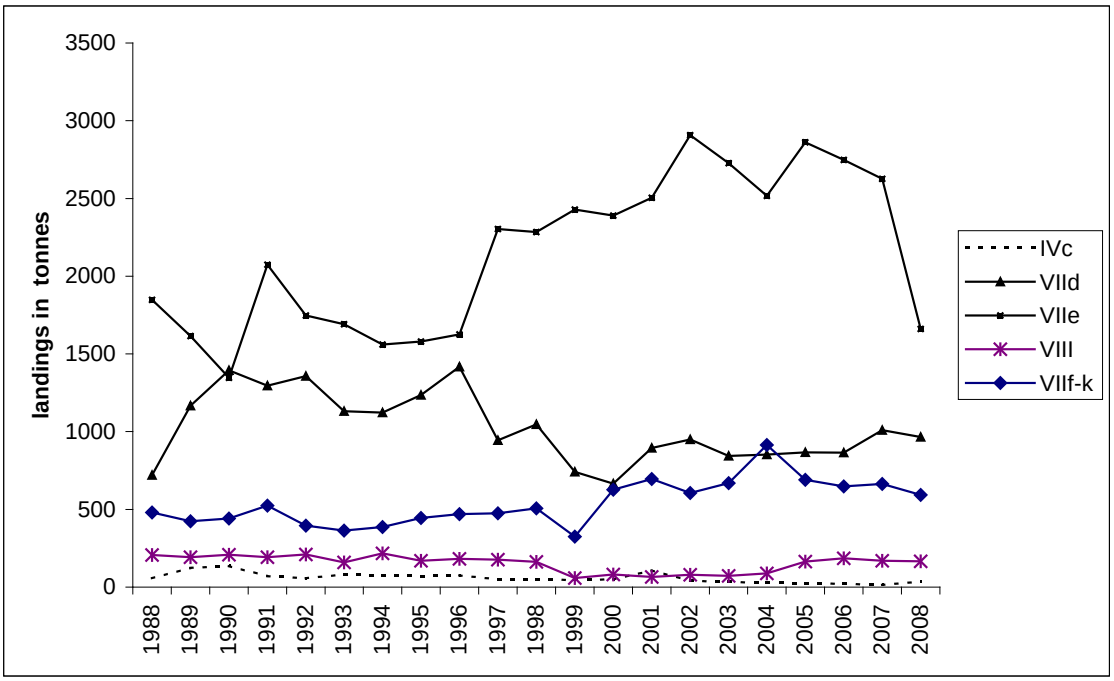


Figure B.8. France: Trends of French landings of red gurnard. Only from logbooks since 1999. In 2008 landings from 7.e have dropped by 35%, not observed in official landings from EuroStat/ICES dataset.

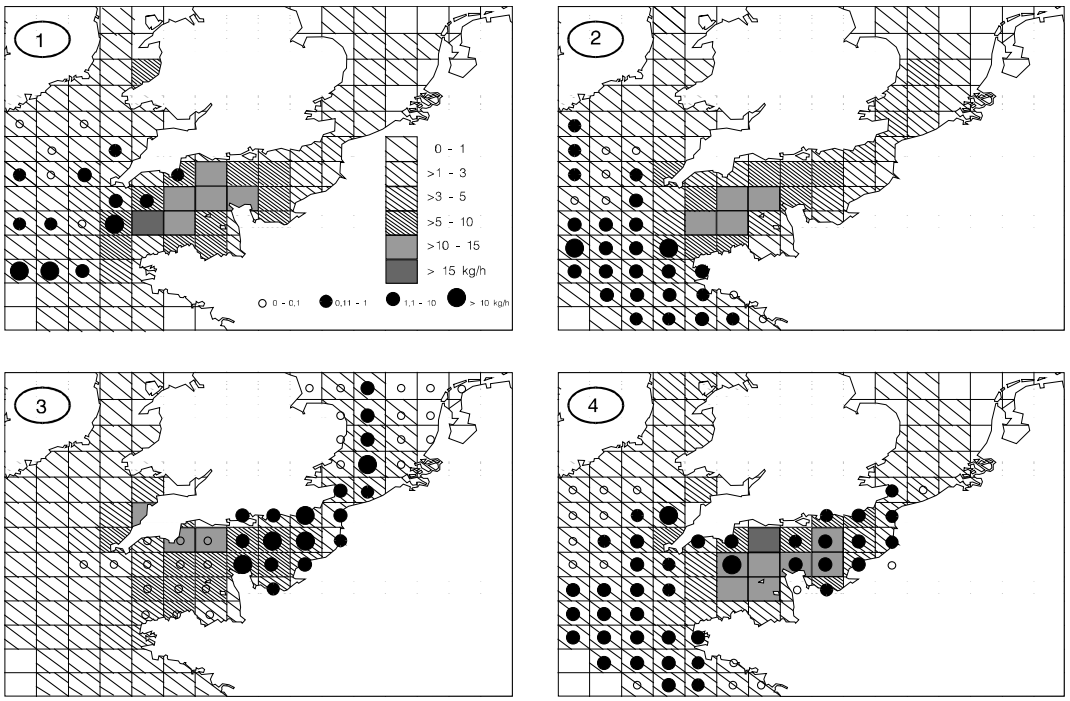


Figure B.9. Quarterly landings of red gurnard in English Channel and neighbouring areas in the period 1988–1992. Cpue in Kg/h from surveys are given as superimposed circles.

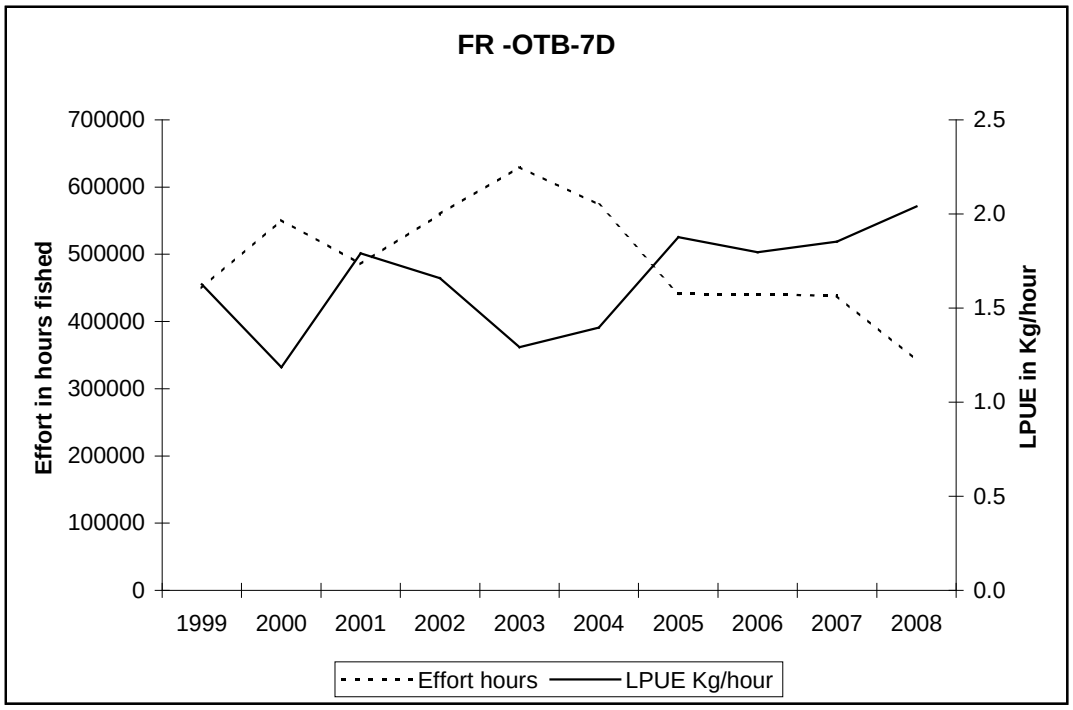


Figure B.10. France. Trends of lpue and effort in 7.d of otter trawlers (OTB) for years 1999–2008.

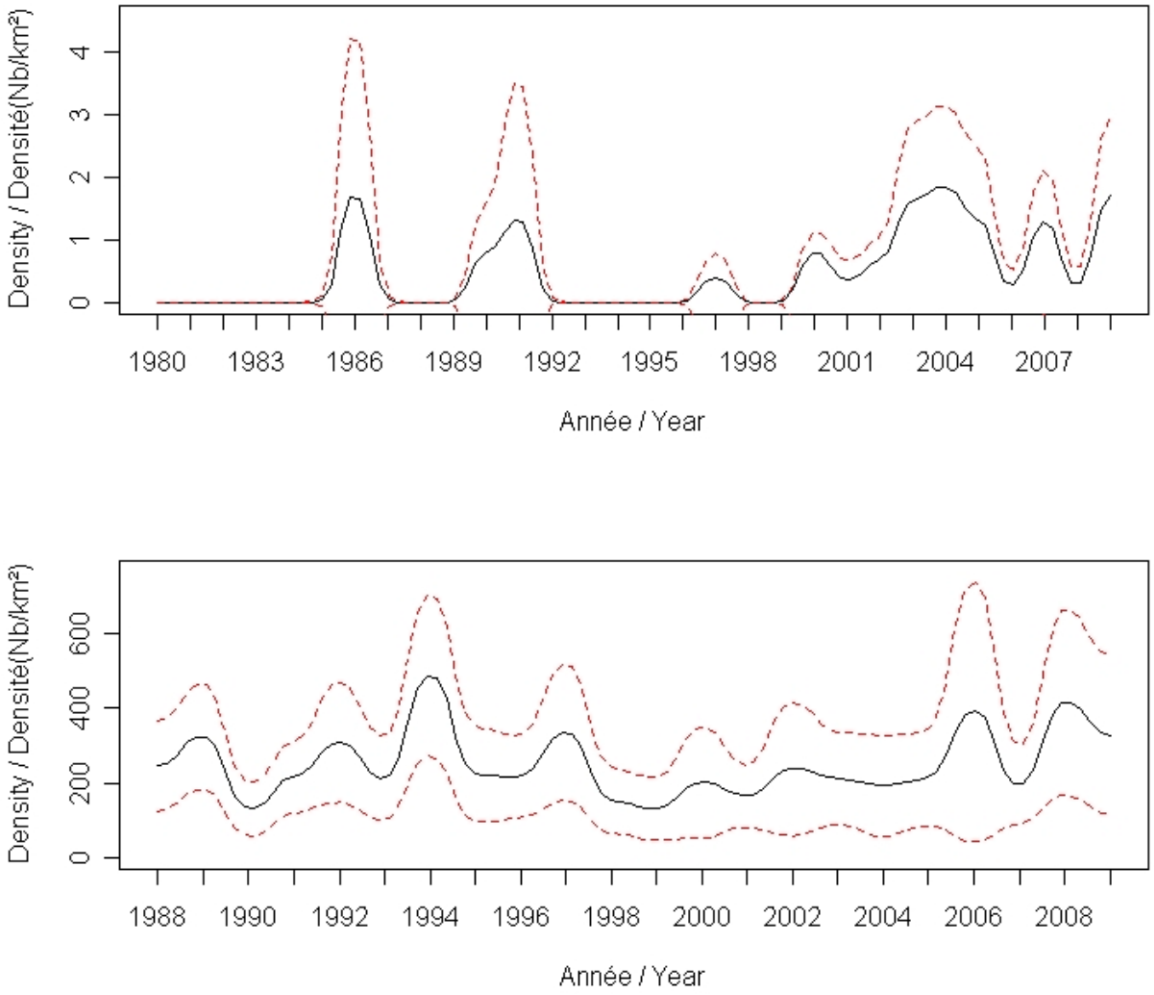


Figure B.11. Time-series of abundance of red gurnard in the North Sea base on IBTS data (Nb/km²) from 1980 to 2009 in upper panel and in the eastern Channel base on FR-CGFS data (Nb/km²) from 1988 to 2009 in the lower panel.

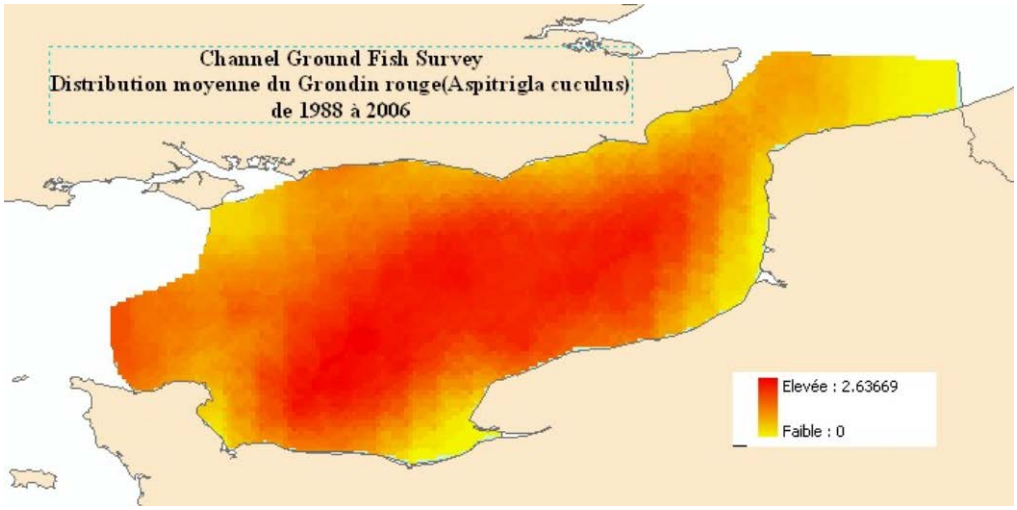


Figure B.12. FR-CGFS surveys series. Geographical distribution of red gurnard in Eastern Channel in October from 1988 to 2006.

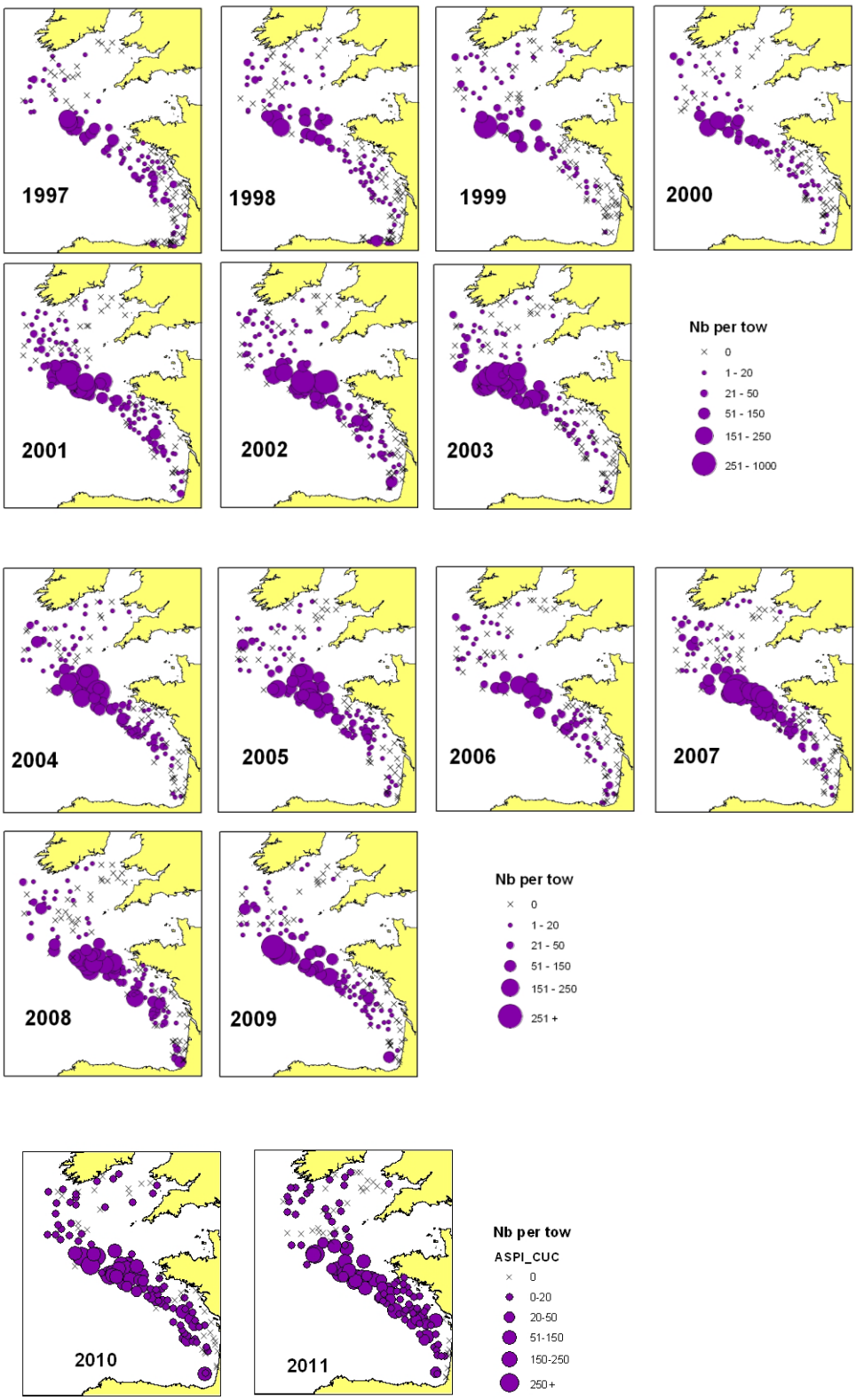


Figure B.13. Distribution of red gurnard in the Celtic Sea and in the Bay of Biscay during FR-EVHOE from 1997 to 2011.

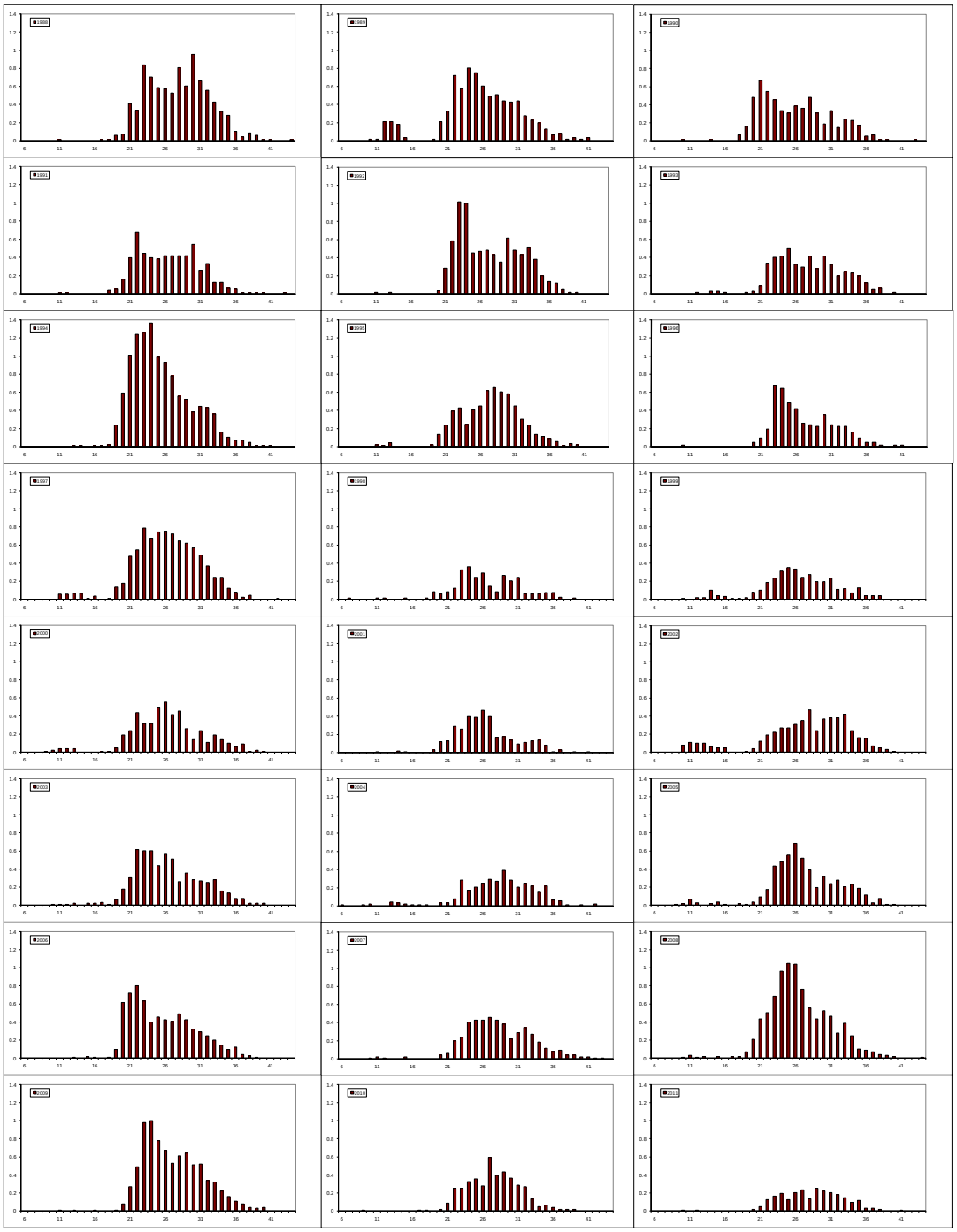


Figure B.14. Abundance index at length of red gurnard in Eastern Channel from CGFS survey time-series 1988 (top left)–2011(bottom right).

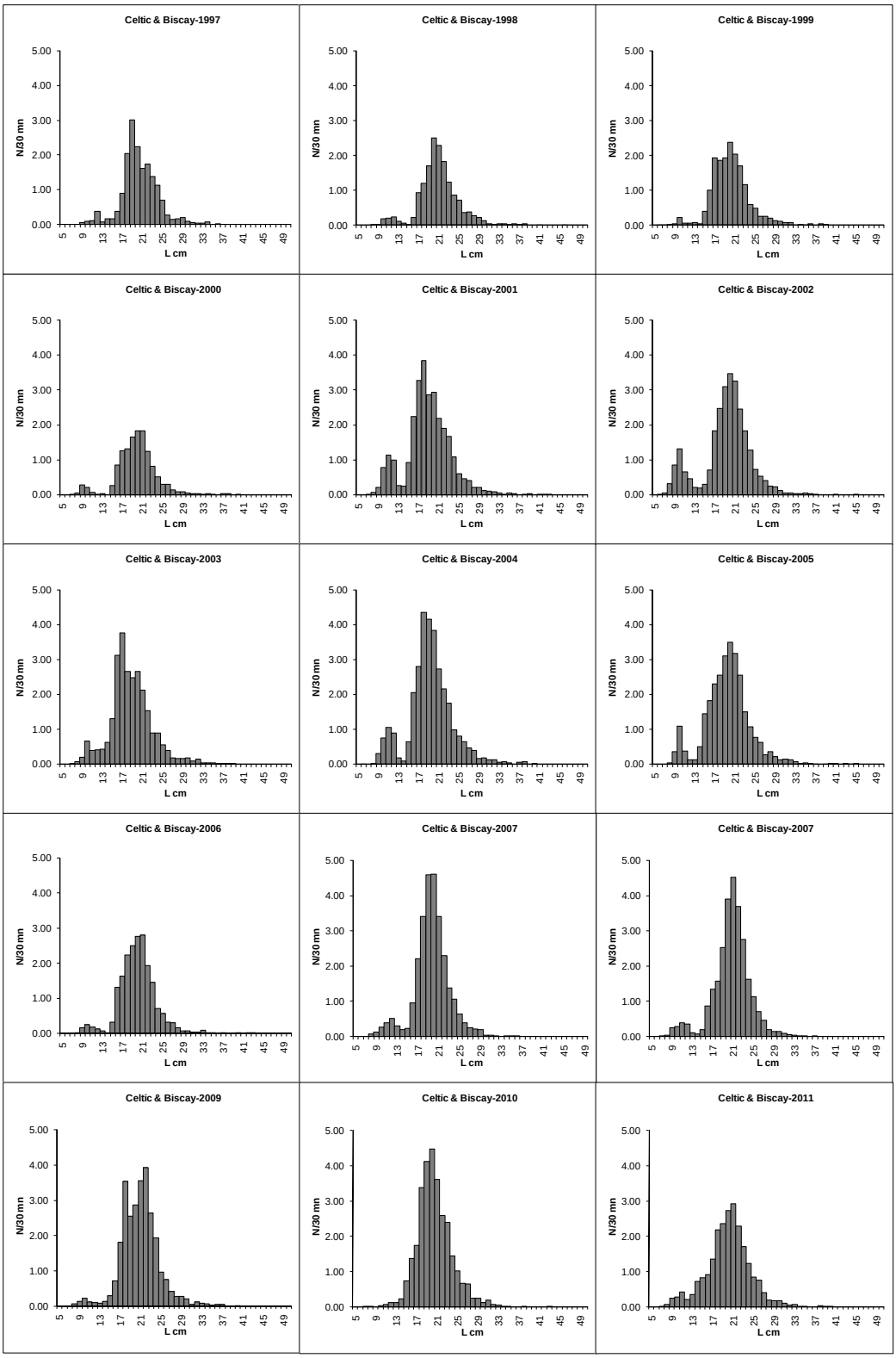


Figure B.15. Length abundance index of red gurnard in the combined areas of Celtic Sea and Bay of Biscay from EVHOE-WIBTS-Q4 survey time-series.

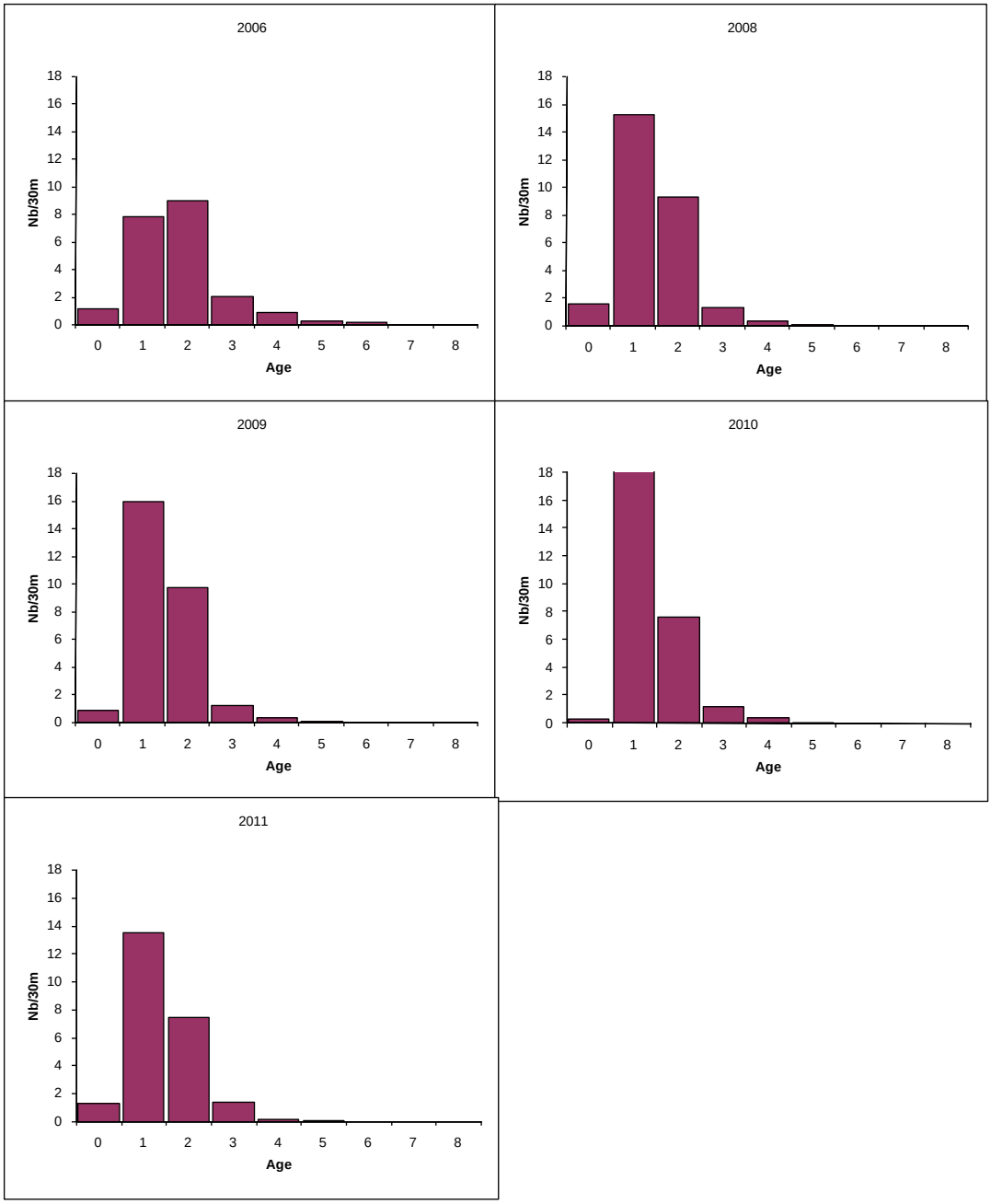


Figure B.16. Abundance index at age of red gurnard in the combined areas of Celtic Sea and Bay of Biscay from FR-EVHOE surveys series for 2006 and 2008 to 2011.