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Report of the Working Group on Cephalopod Fisheries and Life History (WGCEPH)

By Correspondence

ICES International Council for the Exploration of the Sea

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Executive Summary

WGCEPH worked by correspondence during 2007–2008, although a subgroup meeting was held in Vigo, Spain, in April 2008, to work on ToR c). WGCEPH addressed three Terms of Reference:

a) Trends in landings statistics were summarized up to 2006, the last year for which full data are available. No substantial changes in the geographical and taxonomic distribution of landings were apparent. The familiar issue of lack of species discrimination is noted.

b) Recent research on cephalopods in the ICES area is described, including progress in culture of octopus and cuttlefish, essential habitat mapping and fishery forecasting based on larval abundance.

c) Progress on the Co-operative Research Report on cephalopods is summarized and a full draft (will be) appended.

In addition, WGCEPH responded to requests to provide recommendations on protocols for basic (DCR) fishery data collection and collection of information on cephalopods for research surveys. WGCEPH recommends continuation of ToRs a) and b), while the recent advances highlighted above suggest that new reviews of the state-of-the-art in assessment/management, and of prospects for cephalopod culture, would be worthwhile. It is proposed to hold a meeting of WGCEPH in Vigo, Spain, in spring 2009.

1 Introduction

The working group worked mainly by correspondence in 2008. However, a subgroup meeting was held in Vigo 10-12 April 2008 to work on the third term of reference (see below) and a brief report on that meeting is include here.

1.1 Terms of Reference

2007/2/LRC14 The Working Group on Cephalopod Fisheries and Life History [WGCEPH] (Chair: Graham Pierce, UK) will work by correspondence in 2008 to:

a) update and explore landing statistics across the ICES area;

b) report on innovative cephalopod research results in the ICES area;

c) finalize production of CRR and submit for publication.

During the subgroup meeting in Vigo, WGCEPH received a number of communications from members and other scientists, requesting advice on routine fishery data collection for these species. Although the initial steer from ICES was to focus on the above ToR, WGCEPH was subsequently requested to respond by ICES. Data collection requirements were therefore discussed within the subgroup meeting and the advice generated is included within this report. In addition, prior to the subgroup meeting, a request for advice was received from the International Bottom Trawl Survey Working Group (IBTSWG), regarding the value of data collection on cephalopods caught during trawling surveys. This point is therefore also addressed.

The justification for the above ToRs was as presented below. Cephalopods support important fisheries in the ICES area. However, they remain largely outside the scope of the European Community's Common Fisheries Policy except in so far as some species are now included within routine data collection and some local management measures are in place. Understanding of stock dynamics, particularly in European coastal waters, remains variable: although fishery diagnostics and retrospective population assessments have been developed in some areas, time-series of recruitment estimates are still too short to analyse stock/recruitment relationships.

ToR a) This activity remains fundamental to the work of the Group. The past broadening of the remit to include effort, discard, and survey data were useful but improved data, and improved access to data, are needed before the collection of the same may be resumed. [Action Number 1.2.2]

ToR b) With the current uncertainty about the level of financing available to proceed with research on cephalopods in European waters, it is to a large degree difficult to predict the direction of research. Presentation of material on current research is intended to help maintain interest and demonstrate the advantages of the work that can be carried out, while including results and analyses that will be directly applicable to the ICES action plan. It is expected that new research projects will be developed on a local basis, which will be relevant to several action plan points [e.g. assessment in the UK to action number 1.2.1]

ToR c) The final ToR aims to disseminate some of the findings of the CEPHSTOCK project to the wider community. Material that would form the basis of an ICES Co-operative Research Report on cephalopod life history and fisheries in European waters was to a large degree already compiled in the final report of the CEPHSTOCK project (which had been coordinated by the current WGCEPH chair and involved many European WGCEPH members). However, extensive editing, including cuts

and reorganization was judged to be necessary. Furthermore, several sections of the report have already been published elsewhere. A subgroup meeting was held to make progress on the editing process [Action Number 10.4].

Terms of Reference a) and b) were set up to provide ACOM with the information required to respond to requests for advice/information from NEAFC and EC DG Fish.

2 TOR a) – Update and explore landing statistics across the ICES area

2.1 Update of landing statistics

The present report provides new landing statistics for 2006 and updates numbers since 1998, for cephalopod groups caught in the ICES area (Tables 2.1 to 2.6). The data originate from the ICES STATLANT database and from additional national information supplied by members of the Working Group. The data compiled in this report represent the most precise information on cephalopod landings within the ICES area that can be obtained to date.

It is still difficult to be certain of the degree of comparability of current vs. older data, because the identification of species is not very precise within national landing statistics and no assurance can be obtained that the classification used in any one year is exactly the same as that used in another. Different squid species and families in particular are frequently lumped with each other in the landing statistics. Tables 2.1 to 2.4 give information on annual catch statistics (1998–2006) per cephalopod group in each ICES division or subarea, separately for each nation.

Table 2.1 groups species of cuttlefish and bobtail squid (families Sepiidae and Sepiolidae). The majority of landings summarized in this table are catches of *Sepia officinalis*, the common cuttlefish, plus smaller amounts of *S. elegans* and *S. orbignyana* and various species of bobtail squid (Sepiolidae) in a few instances, possibly only in the southernmost regions. The most significant landings of these two families occur in the southern and central areas, sub-Areas VIII, IX and particularly VII.

Table 2.2 groups species of common squid (including the long-finned squids *Loligo forbesi*, *L. vulgaris* and *Alloteuthis subulata*). The majority of common squid landings are *L. forbesi*, which is more important in the north, and *L.vulgaris*, more important in central and southern regions. Overall, long-finned squid landings concentrate in sub-Area VII, and particularly divisions VIId and e. It is possible that some short-finned squid are currently grouped in this category.

Table 2.3 groups species of short-finned squid (*Illex coindetii* and *Todaropsis eblanae*), European Flying squid (*Todarodes sagittatus*), Neon Flying squid (*Ommastrephes bartrami*) and occasionally a variety of species belonging to different Decapod cephalopod families. This is the least important grouping of the four defined, and landings are most important in sub-Areas VII and VIII, particularly as a result of Spanish catches.

Table 2.4 groups octopod species (including *Eledone cirrhosa*, *E. moschata* and *Octopus vulgaris*, mostly, as well as other locally and temporally abundant shallow-water species). The most significant portion of the landings in this group, by far, is believed to be of the common octopus *Octopus vulgaris*, which is particularly prevalent in divisions VIII and IX, notably as a result of Portuguese and Spanish catches.

Table 2.5 summarizes total annual cephalopod landings in the whole ICES area for major cephalopod groups. During the period in analysis (1998 to 2006), landings have been variable around the annual average of roughly 50 000 tons, with the exception of 2006 when the total cephalopod catch dropped below 40 000 tons. This, however, can be due to catches still being incompletely reported. Landings in 2001-2003 were lowest (mean approx. 43 500 tons), landings in 1999-2000 and 2004 were highest (mean approx. 57 000 tons), and 1997-1998 and 2005 were average landing years (mean approx. 50 500 tons). Total cephalopod landings in 2005 were supported by a significant increase in the octopods, slightly improving the best ever landings for the group, which had been observed in 1996 (11 658 t as compared to 17 906 t in 2005), having been less significant than in the previous year for all the other groups. Cuttlefish, traditionally providing the most significant landings, returned to values in the order of 20 000 tons, after an exceptional 2004.

Table 2.6 provides information of total annual cephalopod landings in the whole ICES area for major cephalopod groups, per fishing nation. Annual fluctuations of landings per nation do not generally cause major changes in relative importance, each nation generally taking a proportional share of the total annual landings. During 2006 no changes in the relative ranking of the most important nations could be observed, which indicates that both the abundance and exploitation patterns remained unchanged.

If species landings are grouped into three groups, cuttlefish, squid (short-finned and long-finned) and octopus, each group can be seen to be exploited by a few nations, and this situation does also not change significantly over the years. In the case of cuttlefish, France has always landed the largest proportion of the total in the ICES area and generally only Spain and Portugal have landed to any comparable degree. In the case of this group of organisms, the UK also began to land from 1989. This seems to indicate additional effort directed at the species in the group, because the global amount of the French, Portuguese and Spanish landings did not decrease and neither did the small shares of the remaining nations. The four largest landing nations in this group have always accounted for over 95% of all cuttlefish landings in the ICES area. In the case of squid, landings have also been shared mostly among France, Portugal and Spain, the largest of the shares similarly belonging to France. In the group of octopus landings, more than 95% are shared by two nations, Portugal and Spain. The shares of the two nations have changed slightly over the years, Spain having had initially the largest, which is now taken by Portugal, except in 2006. It is important to note that in spite of the continued fishing pressure, cephalopod resources in the ICES area have tended to yield increasingly throughout the 32 years of recorded data. (see ICES WGCEPH Report 2007; Figure 2.3.).

Table 2.1. Landings (in tonnes) of Cuttlefish (Sepiidae) and Bobtail Squid (Sepiolidae).

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division IIIa (Skagerrak and Kattegat)									
Denmark				2	6	18	21	29	58
ICES Division IVa (Northern North Sea)									
Denmark				2	3	7	10	7	11
France								1	
Scotland							1		
ICES Division IVb (Central North Sea)									
Belgium	3	3	7	11.8	12	4.1	5	1	1
France		1.4	0.4	0.1	0.1	0.4			
Denmark				1	13	35	36	13	21
England, Wales & Northern Ireland				0.1	3.1	0.4	1	1	
Netherlands	+	+	2		10.8	6	3	1	
Scotland							1		
ICES Division IVc (Southern North Sea)									
Belgium	4	5	12		205.9	64.4	103	57	57
England, Wales & Northern Ireland	28	22	14	4.7	4.2	2.3	2	3	3
France	140	231.4	419.8	184.2	217.2	119.8	120	116	83.5
Netherlands	+	+	97	118	363.3	229	352	146	295
Scotland							2	1	
ICES Division Vb (Faroe Grounds)									
France							5	2	

Table 2.1. (continued)

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division VIa,b (NW coast of Scotland and North Ireland, Rockall)									
England, Wales & Northern Ireland	+					0.2			
France		5.3	0.6	0.4	0.2			1	0.1
Scotland				4.8					
Spain	16		1						
ICES Division VIIa (Irish Sea)									
Belgium	1	1	1	2	4.7	1	1	1	
England, Wales & Northern Ireland	1	1	1	0.1		0.8			
France		0.1	0.9	0.7	7.1	0.5		1	0.4
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)									
England, Wales & Northern Ireland	4	3				+			
France		0.2		0.2	0.3	2.3	10	1	0.4
Spain	14		3	17	3	4.6	9.9	11.5	9
ICES Divisions VIId, e (English Channel)									
Belgium	15	9	35	223.7	497.1	472.6	607	501	661
Channel Islands	20	22	26	8	11.3	9.4	12	7	3
England, Wales & Northern Ireland	2449	2014	2910	2608	3407	4581	4858	2821	3412
France	7530	8343	11220	7242	11597	9125	13463	8656	8571
Netherlands	+	+	2	2.6	6.4	14	33	27	15
ICES Division VIIf (Bristol Channel)									
Belgium	+	1	1	11.7	3.8	7	38	16	5
England, Wales & Northern Ireland	39	9	12	6.9	18.8	39.2	28	11	8
France	36	23	22	27	62	56	52	39	20.8

Table 2.1. (continued)

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)									
Belgium	3	4	2	3.1	5.6	15	55	20	5
England, Wales & Northern Ireland	220	206	139	80.2	101.8	325.2	135	153	166
France	946	886.2	986	759.9	609.1	843.8	1168	674	844.7
Ireland								3	
Netherlands					0.1	1			
Spain	181	122	13	6		1.4	25	0.5	
ICES Subarea VIII (Bay of Biscay)									
Belgium		1	1	7.3	11.7	4	10	3	
England, Wales & Northern Ireland	19	4				28.9	18	19	1
France	4363	4434	4323	4179	2939	1156	6685	4643	3954
Netherlands				41					
Portugal	11	5	8	9.6	6.2	18	21	32	37
Spain	593	829	683	365	302	288.1	493.6	407	357
ICES Subarea IX									
Portugal	1723	1156	1357	1338	1362	1186	1706	1825	1822
Spain	1912	1868	1454	765	820	992	889	1112	1090
Grand Total	**20275**	**20237**	**23774**	**18035**	**22615**	**19551**	**30988**	**21371**	**21513**

Table 2.2. Landings (in tonnes) of Common Squid (includes *Loligo forbesi, L. vulgaris* and *Alloteuthis subulata*).

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division IIIa (Skagerrak and Kattegat)									
Denmark	8	6	7						
Sweden*	1	1	+			1	5	3	10
ICES Division IVa (Northern North Sea)									
Denmark	5	3	3						
England, Wales & Northern Ireland	3	2	3	2.1	1.3	1.2	1	1	
France		0.2	0.1		0.3	0.7			0.1
Germany*	+	+	0.3	0.1	0.2	0.4	0.8	0.3	0.9
Scotland*	844	712	547	348.9	687.9	1428	1442	344	676
ICES Division IVb (Central North Sea)									
Belgium	11	16	24	3.2	14	22.1	16	8	17
Denmark	3	18	10						
England, Wales & Northern Ireland	144	65	29	35.5	70.4	159.3	162	161	85
France									44
Germany*	5	5	3	2	14	59	35	23	13
Netherlands*	+	+	4			27	22	27	9
Scotland*	214	144	87	112.1	218.3	323	358	214	107

Table 2.2. continued

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division IVc (Southern North Sea)									
Belgium	36	72	121	20.2	40	17.2	12	10	9
England, Wales & Northern Ireland	2	2	4	11.8	4.7	2.2	2	3	2
France	93	150.9	164.8	236.9	660.2	426.1	246	146	117.3
Germany*	6	1	2	2	3	4	4	1	1
Netherlands*	+	+	758			104	93	38	27
Scotland*						1		1	2
ICES Division Vb (Faroe Grounds)									
England, Wales & Northern Ireland	+	+	+	0.2		0.1			
Faroe Islands	32	23	+						
Scotland*	1	2	2			5	1		
ICES Division VIa (NW coast of Scotland and North Ireland)									
England, Wales & Northern Ireland	7	3	2	2.8	3.4	14	4		1
France	136	94.8	51	8.4	27.6	22.6	24	87	29.2
Ireland*	99	106	38			63	72	49	20
Scotland*	285	334	210	191.6	196.2	367	321	72	88
Spain	7	8	3		3	9.6	1.6		
ICES Division VIb (Rockall)									
England, Wales & Northern Ireland	14	1	+	0.3	0.6	2.6			
Ireland*	2	2	3			5	1	8	18
Scotland*	27	13	5	34.3	58.8	86	23		4
Spain	49	2	+		2				

Table 2.2. continued

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division VIIa (Irish Sea)									
Belgium	5	3	3	2.3	9.4	2.3	1	3	1
England, Wales & Northern Ireland	173	40	31	102.6	116.3	96.3	50	24	8
France	17	11.4	11.8	21.8	37.1	5.8	2	8	1.4
Ireland*	22	13	5		2	9	6	4	5
Isle of Man	2	2	+	0.8	0.4				
Scotland*	2	2	2			13	8	1	
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)									
England, Wales & Northern Ireland	162	59	40	34.8	22	10.1	12	23	4
France	60	35.2	74.9	6.8	6.3	20.1	42	28	40.2
Ireland*	34	40	26	2	1	84	39	29	20
Scotland*	71	34	27		19.2	14	19	2	14
Spain	51		17	18	29	35	30.7	12	19
ICES Divisions VIId, e (English Channel)									
Belgium	133	113	254	22	59.3	72.4	55	36	46
Channel Islands	5	11	9	1	2.3	1	1		2
England, Wales & Northern Ireland*	419	641	449	438.5	553.1	434.6	481	321	273
France	2689	3417	3218	2659	3980	4212	4234	3264	3178
Netherlands*	+	+	11			75	123	110	132
ICES Division VIIf (Bristol Channel)									
Belgium	6	6	8	0.5	4.8	9.5	15	9	5
England, Wales & Northern Ireland	29	68	16	55	113.9	56.2	17	172	29
France	126	147	88			145	125	276	119
Ireland								2	

Table 2.2. continued

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)									
Belgium	13	9	5	2.6	7.9	7.4	6	6	3
England, Wales & Northern Ireland	505	377	202	166.4	116.1	35.4	134	51	44
France	325	546.9	346.7	467.6	737.6	520.2	374	309	198
Ireland*	158	123	67	12	37	164	127	172	52
Scotland*	128	109	100			75	70	57	45
Spain	225	352	77	14	3	1.9	2	2	
ICES Subarea VIII (Bay of Biscay)									
Belgium	49	3	48		1.8	0.9	1	1	
England, Wales & Northern Ireland	8	3	+			18.2	18	6	
France	829	1352	1042	842.2	514.2	316	1245	1497	1051
Portugal	2	1	1	1.1	0.6		1		1
Scotland*							1	61	12
Spain	811	826	767	614	253	329.7	371.9	306	164
ICES Subarea IX									
France	+	4	42						
Portugal	1011	329	619	897.6	686	328	1264	601	92
Spain	1043	540	507	843	637	542	580.8	552	255
ICES Subarea X (Azores Grounds)									
Portugal	98	45	58	137	196	536	261	272	3
Grand Total	**11146**	**10943**	**10215**	**8234**	**9939**	**7527**	**12562**	**9420**	**7100**

Country* - These countries report undifferentiated landings of Loliginids and Ommastrephids that were grouped here. If 2 or more figures listed, the last one is the compound Loliginidae + Ommastrephidae.

Table 2.3. Landings (in tonnes) of Short-finned Squid (*Illex coindetii* and *Todaropsis eblanae*), European Flying Squid (*Todarodes sagittatus*), Neon Flying Squid (*Ommastrephes bartrami*) and other less frequent families and species of Decapod cephalopods.

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Subarea I + II (Barents Sea and Norwegian Sea)									
Norway	2	+	+						
ICES Division IIIa (Skagerrak and Kattegat)									
Sweden*						+	+		
ICES Division IVa (Northern North Sea)									
Germany*							+		+
Norway							4		
Scotland*							+		
ICES Division IVb (Central North Sea)									
Germany*							+		
Netherlands*							+		
ICES Division IVc (Southern North Sea)									
Germany*							+		
Netherlands*							+		
Scotland*							+		
ICES Division Va (Iceland Grounds)									
Iceland	4	3	1		0.1		1		

Table 2.3. continued

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division Vb (Faroe Grounds)									
Faroe Islands						16	17	1	
Scotland*						+	+		
ICES Division VIa, b (NW coast of Scotland and North Ireland, Rockall)									
England, Wales & Northern Ireland	3	5	+	0.6	1.1	13	1	1	
France		2.7	0.4	0.1	0.2				11.4
Ireland*	+		+			32	5	2	5
Scotland*						+	+		
Spain	177	3	+		11		0.3		
ICES Division VIIa (Irish Sea)									
England, Wales & Northern Ireland			+						
France		0.2	0.2						
Ireland*	+					6	5	7	
Scotland*						+	+		
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)									
England, Wales & Northern Ireland	39	18	35	18.7	24.5	16	26	1	1
France		1.3	28	5.7	2.4	16.7	19.1	14	47
Ireland*	52	+	29	75	63	27	30	8	15
Scotland*						+	+		
Spain	150	69	148	233	411	216.6	284.6	951	458

Table 2.3. continued

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Divisions VIId, e (English Channel)									
England, Wales & Northern Ireland*						0.7			
France	1	1.8	3.4	3.8	13	1.8	5.8	8.3	5.7
Netherlands*						+			
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)									
England, Wales & Northern Ireland	251	181	151	173.2	143.7	85	+	18	9
France	49	72.1	66	51.1	91.6	31.7	66.5	80.4	38.4
Ireland*	295	9	83	60	91	49	37	19	4
Spain	658	873	710	339	87	35.4	35	52	70
ICES Subarea VIII (Bay of Biscay)									
France	166	211.3	168.2	67.2	250.4	44	107.5	353.1	127.1
Portugal	5	1	2			1			
Spain	1806	1453	1400	868	584	474.2	495.1	634	326
ICES Subarea IX									
Portugal	383	313	321	232	205	118	321		
Spain	1800	4476	2461	2133	592	438.3	655.8	386	164
Grand Total	5841	7693	5607	4260	2571	1508	2114	2536	1282

Country* - These countries report undifferentiated landings of Loliginids and Ommastrephids that were grouped in Table 2.2. Here they are listed as "+".

Table 2.4. Landings (in tonnes) of Octopods (*Eledone* spp. and *Octopus vulgaris* mainly).

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division IVa (Northern North Sea)									
Scotland	13	17	15	6	1.3	11	5	2	1
ICES Division IVb (Central North Sea)									
Belgium	2	5	5	5.5	1.5	2	2	2	2
England, Wales & Northern Ireland	1	1	1	1.7	0.6	0.5	1	1	1
Netherlands				0.5					1
Scotland	1	1	+	0.1					
ICES Division IVc (Southern North Sea)									
Belgium	+	2	1	0.6	1.2	1			
England, Wales & Northern Ireland	+	+	+				+		
Netherlands				0.1		1		1	
ICES Division VIa, b (NW coast of Scotland and North Ireland, Rockall)									
Belgium	1	+	+						
England, Wales & Northern Ireland	2		+			2.1	2		
Ireland		1	1						
Scotland		+							
Spain	42		+						
ICES Division VIIa (Irish Sea)									
Belgium	26	4	5	10.9	31.1	20	5	1	2
England, Wales & Northern Ireland	+	+	+	0.4	0.1	0.3			
Ireland	1		+		1	1			
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)									
England, Wales & Northern Ireland	5	3	4	20.2	2.5	6	15	4	10
France			8.1	0.6	0.2		1	2	9.6
Ireland		2	4	5	1	6	2	1	
Scotland				1.7		1			
Spain	41	34	44	276	741	429.6	341.9	417	389
ICES Divisions VIId, e (English Channel)									
Belgium	+	+	+	0.3	2	2	3	1	3
Channel Islands		+	+			3			
England, Wales & Northern Ireland	17	9	22	15.2	19.5	20.6	14	21	21
France	3	8.1	13.2	5.1	7.3	5.3	6	9	5.6

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
ICES Division VIIf (Bristol Channel)									
Belgium	3	3	13	0.5	8.6	13	24	10	16
England, Wales & Northern Ireland	3	4	10	4.2	13	7.7	9	10	5
France		+	+					1	0.7
Spain					2				
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)									
Belgium	11	10	16	6	12	13	12	5	6
England, Wales & Northern Ireland	58	16	78	105.2	140.8	99.2	113	131	103
France	9	8	32.3	19.3	17.6	11.1	14	17.3	12.6
Ireland	2	7	7	9	11	17	11	29	3
Scotland	9	1	5	9.5	1.3	6		7	8
Spain	179	348	518	156	111	27.6	29.2	32	36
ICES Subarea VIII (Bay of Biscay)									
Belgium	4	17	4	4.9	13.4	1	5	3	6
England, Wales & Northern Ireland	1	+				0.5	29	8	
France	78	199.5	151.3	72.8	56.1	16.3	201	197	103
Netherlands				4.8					
Portugal	57	156	250	69.5	69.7	98	67	102	73
Spain	2787	1261	1057	1272	1329	1144	1724	1572	1649
ICES Subarea IX									
Portugal	6350	9098	9019	7203	7288	10038	8758	11372	3368
Spain	3298	4490	5205	2163	2936	2804	2787	4010	3164
ICES Subarea X (Azores Grounds)									
Portugal	39	12	9	14	16	16	15	10	
Grand Total	**13043**	**15718**	**16500**	**11461**	**12831**	**12191**	**14195**	**17906**	**8999**

Table 2.5. Total annual cephalopod landings (in tonnes) in the whole ICES area separated into major cephalopod species groups.

Cephalopod Group	1998	1999	2000	2001	2002	2003	2004	2005	2006
Cuttlefish	20275	20237	23774	18035	22615	19551	30988	21371	21513
Common squid	11146	10943	10215	8234	9939	7527	12562	9420	7100
Short-finned squid	5841	7693	5607	4260	2571	1508	2114	2536	1282
Octopods	13043	15718	16500	11461	12831	12191	14195	17906	8999
Total	50305	54591	56096	41990	47956	40777	59859	51233	38894

Table 2.6. Total annual cephalopod landings (in tonnes) in whole ICES area by country and separated into major cephalopod species groups.

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
(a) Cuttlefish *(Sepiidae)*									
Belgium	26	24	59	260	741	541	819	599	729
Channel Islands	20	22	26	8	11	9	12	7	3
Denmark	0	0	0	5	22	60	67	49	90
England, Wales & Northern Ireland	2760	2259	3076	2700	3535	4978	5042	3008	3590
France	13015	13925	16973	12394	15432	11247	21511	14142	13475
Ireland	0	0	0	0	0	0	0	3	0
Netherlands	0	0	101	162	381	249	388	174	310
Portugal	1734	1161	1365	1348	1368	1186	1727	1857	1859
Scotland	0	0	0	5	0	0	4	1	0
Spain	2720	2819	2154	1153	1125	1281	1418	1531	1456
Total	20275	20237	23774	18035	22615	19551	30988	21371	21513
(b) Common Squid (*Loliginidae*)									
Belgium	253	222	463	51	137	132	106	73	81
Channel Islands	5	11	9	1	2	0	1	0	2
Denmark	16	27	20	0	0	0	0	0	0
England, Wales & Northern Ireland	1466	1261	776	850	1002	830	881	762	446
Faroe Islands	32	23	+	0	0	0	0	0	0
France	4275	5759	5039	4243	5963	5523	6292	5621	5829
Germany	11	6	5	0	0	58	38	24	15
Ireland	216	178	101	14	40	0	245	264	115
Isle of Man	2	2	+	1	0	0	0	0	0
Netherlands	0	0	773	0	0	0	238	176	168
Portugal	1111	375	678	899	687	236	1526	873	96
Scotland	1572	1350	980	687	1180	0	2243	752	903
Spain	2186	1728	1371	1489	927	748	987	872	438
Sweden	1	1	+	0	0	0	5	3	10
Total	11146	10943	10215	8234	9939	7527	12562	9420	7100

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
(c) Short-finned Squid (*Ommastrephidae*)									
England, Wales & Northern Ireland	293	204	186	193	169	1	27	20	10
Faroe Islands	0	0	0	0	0	16	17	1	0
France	216	289	266	128	358	94	235	456	230
Iceland	4	3	1	0	0	0	1	0	0
Ireland	347	9	112	135	154	0	77	36	24
Norway	2	+	+	0	0	0	1	0	0
Portugal	388	314	323	232	205	119	321	0	0
Spain	4591	6874	4719	3573	1685	1253	1471	2023	1018
Total	5841	7693	5607	4260	2571	1508	2114	2536	1282
(d) Octopods (*Octopodidae*)									
Belgium	47	41	44	29	70	0	51	22	27
Channel Islands	0	+	+	0	0	3	0	0	0
England, Wales & Northern Ireland	87	33	115	147	177	137	183	175	140
France	90	216	205	98	81	33	221	154	132
Ireland	3	10	12	14	13	0	13	30	3
Netherlands	0	0	0	5	0	0	0	1	0
Portugal	6445	9266	9280	7284	7369	7550	8840	11484	3441
Scotland	23	19	20	17	3	0	5	9	8
Spain	6347	6133	6824	3867	5119	4471	4882	6031	5238
Total	13043	15718	16500	11461	12831	12191	14195	17906	8999

3 TOR b) – Report on innovative cephalopod research results in the ICES area

3.1 Published research results

Brief highlights of recently published studies relevant to fished cephalopods in the ICES area and other European waters are presented here.

Cephalopods as a food source

Pierce *et al.* (2008) report on levels of mercury and cadmium measured in squid from UK waters, noting that mercury concentrations were higher in *Todarodes sagittatus* than in the loliginids. In *Loligo forbesi*, metal concentrations differed between tissues and also varied in relation to body size, geographic origin, and season. Results indicated no significant danger to humans from consuming squid from UK waters. Experimental studies show that cadmium does not begin to accumulate in cuttlefish until after hatching, indicating that the egg shell forms an effective barrier (Lacoue-Labarthe *et al*., 2008). Lavilla *et al*. (2008) report on a new technique using ultrasound to achieve more rapid determination of trace element concentrations in various fish and shellfish including the cuttlefish *Sepia officinalis*.

Falco *et al*. (2008) measured concentrations of hexachlorobenzene (HCB) in various marine species from Catalonia, Spain, including squid and cuttlefish. Levels were considerably lower than the WHO tolerable daily intake (TDI), for non-cancer effects and for neoplastic effects in humans.

Sinanoglou *et al*. (2008) described the lipid and fatty acid composition of several commercially important Mediterranean cephalopod species. Ozogul *et al*. (2008) report on the protein and lipid composition various cephalopods, noting are good protein sources and rich in n-3 fatty acids, although generally low in lipids. Unlike lipid content, protein content of cephalopods did not vary between seasons. In a captive feeding experiment designed to test the validity of applying fatty acid analysis to study the diet of wild *Sepia officinalis,* Fluckiger *et al*. (2008) showed that the fatty acid profile of the cuttlefish digestive gland clearly reflects the profile of its recent diet.

Cephalopod culture

Domingues *et al*. (2008) describe results of feeding trials on mature cuttlefish, *Sepia officinalis*, comparing three natural frozen diets, grass shrimp (*Palaemonetes* sp.), crayfish (*Procambarus clarkii*) and fish (*Sardina pilchardus*) and two semi-humid artificial diets (based on fish powder). Results suggest that *P. clarkii* could be used as an alternative prey to shrimp for rearing adult mature *S. officinalis*. Correia *et al*. (2008a) found that the body condition of prey affected instantaneous growth rate of early stage *S. officinalis*. Growth rates increase at higher abundance levels of live prey, up to prey densities almost two orders of magnitude above the previously identified optimum (Correia *et al*. 2008b).

Valverde *et al*. (2008) compare octopus growth under different dietary regimes and note the importance of both the quantity and type of lipid supplied. Petza *et al*. (2008) examine the combined effect of body mass, maturity stage, food type and food protein content on the Specific Growth Rate (*SGR*, % day^{-1}) and the Food Efficiency (*FE*, %) of common octopus *O. vulgaris*. Their results suggest that the *SGR* decreased

with body mass and increased with food protein content, while *FE* was highest when the octopus were fed on shrimps and lowest when they were fed on mussels.

Biology and Fisheries

Molecular genetics continues to redefine our views of cephalopod taxonomy and to assist with defining stock boundaries. Cabranes *et al*. (2008) investigate stock structure in *Octopus vulgaris*, demonstrating expected differences between the Canary Islands and the Iberian Peninsula and indicating an absence of genetic differences over distances less than 200 km. they conclude that coordinated management of neighbouring "stocks" of *O. vulgaris* around the Iberian Peninsula is necessary.

Vaz *et al*. (2008) demonstrate the application of quantile regression to habitat modelling for various species in the English Channel, including cephalopods. The suggested advantage of this technique compared to other habitat modelling approaches is that the effect of other measured or unmeasured factors is disregarded and only the cases when the tested factor has a limiting effect are taken into account. For more general reviews on cephalopod-environment interactions and methodology for habitat modelling, see Pierce *et al*. (In Press) and Valavanis *et al*. (In Press) respectively.

Akyol (2008) found that *Loligo vulgaris* and *Sepia officinalis* were the second and third most frequently bycaught species, respectively, in trammelnets off Turkey.

Villanueva & Norman (2008) review the biology of the planktonic stages of benthic octopods.

Rochet *et al*. (2007) examined trends in population metrics based on data from the International Bottom Trawl Surveys in the Mediterranean (MEDITS) carried out over the period 1995-2006. They showed an increasing trend in average lengths of *I. coindetii* sampled in the eastern Ionian Sea, possibly due to the thermoaline circulation reversal in this area which has contributed to an increase in biological production.

Lefkaditou *et al*. (In Press) investigating spatial and interannual variability of the population structure and the distribution patterns of *I. coindetii* in the eastern Ionian in relation to environmental characteristics, have detected an increasing trend in frequency of occurrence and density indices for both newly recruited and adults (ML>10cm) during the period 1995-2006, this being more evident after 1999 coincident with warming of the entire water column due to the Eastern Mediterranean Transient. They also suggested a temporal shift in seasonal maturation with the peak occurring earlier during summer. Nevertheless, the authors noted the need for a more comprehensive study of both environmental processes and *I. coindetii* life history in the Ionian Sea, in order to improve the understanding of its dynamics and the links with environmental variability.

Relevant publications from other areas include Foote (2008) who notes the use of sidescan sonar to map benthic egg beds of the squid *Loligo opalescens*. Prospects for acoustic detection of squid are highlighted by Benoit-Bird *et al*. (2008), who measured target strength in the jumbo squid (*Dosodicus gigas*).

3.2 New research reported by members of WGCEPH

UK

University of Aberdeen: An industry-funded (SEAFISH, UK) study of squid fishing is currently underway at the University of Aberdeen. The study is based on two

seasonal, inshore, directed fisheries for squid (*Loligo* spp.) in UK waters; a bottom-trawl fishery in the Moray Firth in the northern North Sea and a jig fishery off the coast of Cornwall in the North East Atlantic. In collaboration with the SEAFISH team, a number of topics are being investigated, including the behaviour of squid to traditional fishing gears (using an underwater camera), marketing and product quality, general fishery descriptions and historical trends and stock assessments. The latter will involve using depletion methods and is dependant on obtaining reliable effort data.

University of Aberdeen: Associated with the SEAFISH study and the EU-funded INCOFISH project, a preliminary Ecopath model of the Moray Firth area has been constructed. The model comprises 53 functional groups, including whales, dolphins, porpoises, seals, seabirds, demersal fish, pelagic fish, bentho-pelagic fish, crabs, Norway lobster, lobsters, shrimp and prawn, scallops, bivalves, gastropods, squid, octopus, epi-benthic invertebrates, benthic infauna invertebrates, zooplankton, primary producers and detritus. After the model has been balanced, the aim is to develop an Ecosim model to simulate the effects of different fishing regimes on the Moray Firth ecosystem, with particular focus on the directed squid fishery.

University of Aberdeen: Habitat preferences of squid at different life cycle stages have been investigated within the framework of the EU-funded "EnviEFH". Squid distribution data from research surveys between 1963–2004 are being used to examine relationships between presence of *Loligo forbesi* and various eco-geographic variables, including SST, depth, seabed sediment composition, seabed aspect and slope. The identification of preferred spawning areas will supplement previously collected biological and anecdotal knowledge, with the aim of contributing to possible future management schemes for this fishery.

France

University of Caen: During 2008 new research was prepared at the University of Caen with two different objectives: (1) analysis of trophic level in exploited stages of *Loligo vulgaris* and (2) observation of cuttlefish (*Sepia officinalis*) spawning grounds in the English Channel. The first objective concerns the analysis of three squid samples collected simultaneously in December 2007 by IPIMAR (Portugal), AZTI (Basque Country, Spain) and Caen (English Channel landings from the Port-en-Bessin fish market). Basic biological parameters (length, weight, sex, maturity stage, gonad and reproductive system weight) were compared across geographic origins. Hard structures (statoliths, beaks, gladius) and soft tissues (muscle, digestive gland, gonad) were collected and are stored (dry for hard parts and frozen for tissue) to carry out stable isotope analysis. Biological parameters indicate that in spite of significant differences between samples, subsets of similar specimen in from each area can be selected to analyse trophic sources. Hard structures like the gladius should be useful to distinguish between ontogenic changes in trophic level and spatial differences.

University of Caen: To test the feasibility of a proposed INTERREG project (INTERREG IV A "CRESH" proposal) preliminary observations have been carried out of the natural substratum used by female cuttlefish to lay their eggs. The pilot study site was located on the West coast of Cotentin (Agon-Coutainville). Observations combined walks at low water spring tides and diving observations in the near subtidal range. Egg clusters were observed on seven different types of natural objects: worm tubes (*Sabella pavonina*) five types of algae (*Fucus serratus, Sargassum nuticum, Chondrus crispus, Soleria chordalis, Furcellaria vermicularis*) and seagrass (*Zostera noltii*). Coordinates of observed eggs were recorded with GPS and integrated into a GIS

application (overlaid on orthophotomaps). These preliminary observations also provided the opportunity to test how distance sampling techniques applied to transects could provide estimates of egg density. Quantitative estimates are desirable to understand changes in abundance and/or preferences for any substratum. The CRESH project (Cephalopod Recruitment from English Channel Habitats) is an INTERREG IVA France-UK project that plans to develop direct observations of cuttlefish spawning grounds on both sides of the English Channel, to study egg and juvenile ecology and to analyse the relationship between the success of prerecruit stages and fishery trends. The project will make use of fishermen's knowledge of spawning habitats and possible implementation of protected areas will be discussed with industry and management representatives.

Spain

Instituto de Investigaciones Marinas (CSIC): Variation of paralarval abundance in a region subjected to wind-driven upwelling (Ria of Vigo, northwestern Spain) has been studied (González *et al*., 2005; Otero *et al*., in Press). Research cruises were undertaken during the favourable upwelling season (May to October) in 2000 and 2001. The presence/absence of upwelling modulates the abundance and spatial distribution of loliginid and octopod paralarvae. The relationship between the distribution and movement of these paralarvae in the Ria of Vigo seems to follow the circulation system defined for this area: when the upwelling extends its influence inside the Ria, the paralarvae are transported to the inner part in a west–east direction. The dynamics of coastal upwelling areas can favour larval "washout" by means of cross-shelf transport and shoreward movement during relaxation or downwelling. A model of the effect of rapid variability in upwelling chemistry on paralarval abundance and biomass was developed. Based on this model it was found that the decrease in nitrate, ammonium and chlorophyll explain up to 88% of larval increase.

Instituto de Investigaciones Marinas (CSIC): The possible underlying causes of the wide interannual fluctuations in catches of the common octopus (*Octopus vulgaris* Cuvier 1797), one of the main small-scale fisheries off the coast of Galicia (northwest Spain) has been investigated. Galicia is at the northern boundary of the NE Atlantic Iberian-Canary current upwelling system, where local winds induce seasonal upwelling, largely driving the annual cycles of primary and secondary production. It is hypothesized that such dynamics are also fundamental for the survival of the planktonic stages of octopus and set the year-class strength. We address this hypothesis by investigating the influence of upwelling on time-series of fishery data. Wind stress structure of the spring-summer (prior to the hatching peak) and autumn-winter (during the planktonic stage) are found to affect the early life phase of this species, explaining up to 85% of the total variance of the year-to year variability of the adult catch. Despite this bottom-up modulation via environmental conditions, our results also provide evidence of a between-cohort density-dependence interaction, probably caused by cannibalism and competition for habitat (Otero *et al*., 2008).

Instituto de Investigaciones Marinas (CSIC): A new PhD project (2008-10) is investigating the bioecology of the Atlantic bobtail squid *Sepiola atlantica* in Galician waters (NW Spain), the main objectives being (1) to study the main traits of reproduction and the type of reproductive strategy, (2) to validate the interpretation of growth increments and estimate growth rates throughout the life cycle, (3) to study its trophic ecology, and (4) to analyse major abiotic and biotic factors affecting the life

cycle. The project will involve both studying the wild population and rearing individuals in experimental tanks from eggs to adult stages.

Instituto Español de Oceanografia is currently carrying out analysis of seasonal and interannual trends in landings, species composition and size frequency distribution of ommastrephid squid landings in Galicia (see attached Working Document). Research also continues on the culture of *Octopus vulgaris* over the whole life cycle (see Iglesias *et al*., 2004, 2006, 2007).

Portugal

IPIMAR: An industry and local government-funded project on octopus from Cascais, is underway since February 2008. This aims to establish food quality standards for the octopus caught in the area and marketed throughout the country and as an export product. The final objective is to label the product with "Controlled Denomination of Origin" status, to which is associated a guaranteed quality level. The sexual and maturity condition of the specimens collected is also being analysed in order to ethically improve the catch practice and work towards the creation of a more eco-friendly octopus fishery in the area. That information will be added to the "Controlled Denomination of Origin" label. An added value which the promotors are seeking to achieve is to be able to unequivocally recognise specimens originating in the area. This work, which is being undertaken with the collaboration of the University of London, involves an assessment of the genetic constitution of the octopus found in the area, to look for identifying population characteristics.

Universidade Aberta: A new 2-year study on cuttlefish began in June 2008 and will carry out monthly sampling in Cascais (Lisbon) to determine biological parameters and quantities captured by commercial fisheries and to identify effects of environmental variation.

Greece

Hellenic Institute for Marine Research: Recent work on age and growth of *Alloteuthis media* in the North Aegean Sea by Alidromiti (2007) has provided a first estimate of lifespan and growth rates in this species. The results show that the lifespan of *Alloteuthis media* for the females reaches up to 11 months, whereas the males reach up the age of 9 months. Geographic differences in growth rate (mantle length vs. age) were detected between the Thracian Sea (faster growth) and Thermaikos bay (slower growth), which is probably due to the more productive waters of Thracian Sea. Females have faster growth rates than males.

The Department of Biology of the Faculty of Sciences in collaboration with the Department of Animal Production of the Agricultural Faculty in Athens continues research on the rearing of *Octopus vulgaris* (reviewed by Lefkaditou *et al*., 2007). Presently they are carrying out a study on the "Massive rearing of the common octopus *Octopus vulgaris,* with accent in the use of artificial food" within the framework of the Hellenic Operational Programme under the European Fisheries Fund.

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4 TOR c) – Finalize production of *CRR* and submit for publication

The presentation of some of the CEPHSTOCK project results as a Co-operative Research Report was proposed in 2005 and approved by ICES as a ToR in 2006. The document is based on the CEPHSTOCK report sections (identified by workpackage number), edited and updated. A subgroup meeting was convened in Vigo, 10–12 April 2008, to review and update the proposed structure and begin the editing work. The meeting was chaired by Graham Pierce and attended by Isabel Bruno (IEO,

Spain), Angel Guerra, Angel Gonzalez (IIM, Spain), Joao Pereira, Ana Moreno, Silvia Lourenço (IPIMAR, Portugal), Sonia Seixas (Universidad Aberta, Portugal), Noussithe Koueta (Université de Caen, France), Eugenia Lefkaditou (HCMR, Greece).

The final proposed structure is outlined below, the working title being "Cephalopod fisheries biology in European waters".

Chapter 1 – Species Exploited and Related Topics

Introduction

WP5 – Species description (including distribution, habitat, life history, trophic interactions, spawning areas if known; some reference to WP2 and WP3)

1) Introduction to the species
2) Loligo vulgaris
3) Loligo forbesi
4) Alloteuthis spp.
5) Todaropsis eblanae
6) Illex coindetii
7) Octopus vulgaris
8) Eledone cirrhosa
9) Eledone moschata
10) Sepia officinalis
11) Summary of other species of minor or potential commercial interest

WP4 – Genetics

WP3 – Because much of the WP3 material is covered by a review paper currently in press with Hydrobiologia, this will focus on habitats of paralarvae, with a brief section on juvenile and adult habitat use and modelling spawning areas.

WP6 – Disease/immune systems, parasites, contaminants

Chapter 2 – European Cephalopod Fisheries and Aquaculture

Landing statistics: a summary of trends based on recent WGCEPH reports

WP7– Current status of fisheries

- Gear categories contribution by species & temporal trends in European waters
- Geographical variation in level of species landings and shares by fishing-gear categories (maps of average catches during the studied period)
- Specific fisheries and targeted species in different geographic areas
    - Fishing gears, fleets and (temporal evolution)
    - Seasonality of specific fisheries
    - Contribution to species national/regional catches
    - Relevant legislation

WP8 – socio-economic importance of cephalopod fisheries

WP7 – Commercial aquaculture in practice

WP8 – socio-economic aspects of cephalopod culture

Chapter 3 – Assessment and Management

WP9 – Data collection

WP11 – Assessment in practice

WP12 – Cephalopod fisheries management

Chapter 4 – The Future of Cephalopod Fisheries and Culture in Europe

WP7 - Future of cephalopod fisheries

WP7 – Future of cephalopod culture

Use of waste material from processors culture

Paralarvae and fishery forecasting

Future fisheries management:

- Stakeholder involvement in management
- Cephalopods in the context of the EAFM

Recent advances in cephalopod research (research highlights)

Knowledge gaps (e.g. in life history)

A complete draft of the proposed CRR has been provided with the present WG report, although further editing is needed.

5 Data Collection Requirements

5.1 Current routine fishery data collection

Current data routine fishery collection activities for cephalopods are as follows:

Portugal: The DCR as applied to the cephalopod sampling programme in Portugal is managed by IPIMAR. There are two types of sampling: port-side length measurements and the acquisition of samples for biological parameters to be collected at the lab. At port-side, length samples of *Octopus vulgaris*, *Eledone cirhosa*, *Loligo vulgaris*, *Sepia officinalis*, *Illex coindetii* and *Todaropsis eblanae* are regularly obtained from seven ports on a weekly basis. Purchased samples are taken from 2 ports (Olhão and Peniche) for *Octopus vulgaris* (2 samples per month), at 2 ports for *Loligo vulgaris* (Peniche and Aveiro each, once monthly), and at Peniche for *Sepia officinalis* and Ommastrephid squid (1 sample per month).

Spain: The cephalopod sampling programme in Spain is managed by the "Instituto Español de Oceanografía" (IEO) Sampling and Information Network. Monthly body weight or length samples of three cephalopod species are being taken from landings made by the Spanish fleet operating in Spanish waters. Monthly body weight samples of *Octopus vulgaris* are obtained from the Galician coast (ICES Divisions VIIIc-West and IXa-North) and Gulf of Cadiz (ICES Division IXa-South) in several ports: Fisterra from Division VIIIc-West, Muros and Santa Uxía de Ribeira from VIIIc-East, and Sanlúcar de Barrameda from IXa-North. *Loligo vulgaris* is sampled in Santa Uxía de Ribeira for Division IXa-North). Monthly length samples of *Sepia officinalis* are obtained for Division IXa-South in Isla Cristina and Sanlúcar de Barrameda ports.

France: English Channel Landings are sampled monthly at the Port-en-Bessin fish market and comparisons between this harbour and other English Channel harbours (Cherbourg, Granville, Dieppe) are carried out once a year. In this area commercial landings concern only long finned squid (*Loligo forbesi* and *Loligo vulgaris*) and cuttlefish (*Sepia officinalis*). The number of specimen measured per year is 9000 (*Loligo spp*) and 3500 (*Sepia officinalis*). Length data concerns Dorsal Mantle Length measured to the cm below.

Greece: In Hellenic Seas (Eastern Mediterranean), cephalopod sampling carried out within the framework of the DCR, as it is currently applied, includes biannual samples of *Octopus vulgaris* and *Sepia officinalis*, as well as annual samples of *Loligo vulgaris* and I*llex coindetii* obtained from the Aegean (Area 3.1) and the Ionian (Area 2.2) Seas (samples of ~ 50 individuals are taken from landings of main fishing gears operating in each area).

5.2 Current routine survey data collection

Regarding data collection during trawling surveys, German and Scottish surveys have routinely included data collection on cephalopods, although the latter has been discontinued. English and Northern Irish surveys have on occasion included data collection on cephalopods.

During the annual Hellenic trawl surveys (Greece) carried out in early summer in the Aegean (area 3.1) and Ionian (area 2.2) Seas, within the framework of the DCR, following the common protocol of the "International Bottom Trawl Surveys in the Mediterranean Sea (MEDITS)" (Anonymous, 1998), total weight and number of individuals are recorded for all cephalopod species found at each station. For the target species, among which *Illex coindetii, Loligo vulgaris, Sepia officinalis, Octopus vulgaris, Eledone cirrhosa* and *Eledone moschata* are included, mantle length (ML) measurements, sex and gonad maturation stage (0: immature of undetermined sex, 1: immature, 2: maturing, 3: mature) are also assigned on board.

5.3 Recommendations

1) *Octopus vulgaris* should be in category G2 in areas VIIIc and IXa, to reflect the high economic and social importance of the fishery

2) *Loligo vulgaris* and *Loligo forbesi* should be in category G2 in areas VII and IVc, to reflect the high economic of the long-finned squid fishery in France and, to a lesser extent, England. Although not included in sampling elsewhere, *L. forbesi* can make up a very substantial proportion of landings from these areas.

3) *Loligo forbesi* is also landed in substantial quantities (several hundred tonnes annually) from areas IVa and VIa and sampling should be extended to these areas.

4) *Alloteuthis* species are becoming important in area IXa south, with landings of more than 100 tonnes per year and should be sampled in category G2.

5) The short-finned squid species *Illex coindetti* and *Todaropsis eblanae* are important in areas VIIIc and IXa, where they should be sampled in category G2.

6) For all multispecies cephalopod landing categories, the proportions of all major species in samples should be recorded (see point 2c in below).

7) For octopus, minimum sampling should be monthly, recording body weights

8) For squids and cuttlefish, minimum sampling should be monthly, recording mantle length

9) For all species, data on sex and maturity are useful, although recording such data would require purchase of samples.

Also:

10) Routine trawling surveys such as the ICES IBTS in the North Sea should collect data on the most important cephalopod species. The German RV "Walther Herwig" is doing this already since 5 or 6 years ago and we have developed an identification key for North Sea cephalopods that people on-board can easily use (available as a document on the Sharepoint page). Although the cephalopod data from the IBTS surveys are not very comprehensive, they give an excellent indication of the development of the stock size of various species from year to year, because the effort is each year the same.

The proposed data collection is summarized in Table 5.3.1 below:

Table 5.3.1. Proposed routine data collection for cephalopods.

Species (Engl.)	Species (Latin)	Area/Stock	Species group (a)	Age no/1000t	Weight	Sex	Maturity
Common squid	*Loligo vulgaris*	ICES areas: All excluding VIIIc, IXa, VII, IVc	G3				
Common squid	*Loligo vulgaris*	ICES areas: VII, IVc, VIIIc, IXa. Mediterranean: All areas	G2		T	T	T
Veined squid	*Loligo forbesi*	ICES areas: VII, IVc, IVa, VIa	G2		T	T	T
Midsize squid	*Alloteuthis* spp	ICES areas: IXa south	G2		T	T	T
Short-finned squid	*Illex coindetii*	ICES areas: VIIIc, IXa.	G2		T	T	T
Short-finned squid	*Todropsis eblanae*	ICES areas: VIIIc, IXa	G2		T	T	T
Squid	*Illex* spp., *Todarodes* spp.	Mediterranean: All areas	G2		T	T	T
Common octopus	*Octopus vulgaris*	All ICES areas, excluding VIIIc, IXa	G3				
Common octopus	*Octopus vulgaris*	ICES areas: VIIIc, IXa Mediterranean: All areas	G2		T	T	T
Cuttlefish	*Sepia officinalis*	All ICES and Mediterranean areas	G2		T	T	T
Horned octopus	*Eledone cirrhosa*	1.1, 1.3, 2.1, 2.2, 3.1	G2		T	T	T
Musky octopus	*Eledone moschata*	1.3, 2.1, 2.2, 3.1	G2		T	T	T

5.4 Justification of Recommendations

1) Historical time-series of data must be established, to allow trends in the abundance/status of different species can be monitored and to underpin any future assessment and management. Precise data needs for assessment cannot be defined at present because several different assessment methods could be used but minimum requirements can be specified.

   i) Landings, by species, by area, by month. Although not essential, resolution of catch location by ICES rectangle is desirable.

   ii) Fishing effort and discard data are also required to generate CPUE.

   iii) Length-frequency or weight-frequency data are important, collected by market or on-board sampling.

   iv) European cephalopod fisheries are of two main types: bottom trawling (often but not always bycatch) and assorted artisanal gears. Both should be monitored as should any large-scale jig fishing if introduced into the region. Monitoring of artisanal fisheries is difficult but if not carried out, very substantial proportions of landings of octopus, cuttlefish and long-finned squid will be missed.

   v) For the commercially important species, sex and maturity data are useful. Collection of such data could however be introduced later if needed to support specific assessment procedures or management measures.

2) Species composition: given the short life cycles of most cephalopods (1 or 2 years), it is necessary to monitor the species composition of landings, ideally every month.

   i) Within long-finned squid landings, monitor proportions of *Loligo forbesi, L vulgaris* and *Alloteuthis* species.

   ii) within short-finned squid landings, monitor proportions of *Illex coindetii*, *Todaropsis eblanae* and *Todarodes sagittatus* (the latter is expected to be rarer but has been a significant resource in the past).

   iii) Within cuttlefish landings, record the proportion which is *Sepia officinalis.*

   iv) Within octopus landings, distinguish the proportions of *Octopus vulgaris, Eledone cirrhosa* and *Eledone moschata.*

3) Length-frequency or weight-frequency data

   i) Previous project-based studies have aimed to sample (e.g.) 1000 individuals per species per area per sampling period. In doing this, samplers need to be aware of any size-sorting in the market.

   ii) Most cephalopod species have quite flexible life history strategies. Therefore while there are typical spawning and recruitment seasons for all species, the timing of these may vary by 1 or 2 months and some species have both winter and summer spawning groups. Therefore, monthly sampling is needed to gauge the strength of recruitment and the status of the spawners.

   iii) In general, monthly sampling is necessary although 2- or 3-monthly sampling would provide some useful data. For some purposes (e.g. assessment by depletion methods), weekly sampling is needed.

4) Valuable additional information on recruitment and abundance could be gained from collection of cephalopod species length-frequency data routinely during trawl surveys (e.g. IBTS, the ICES Working Group for which has recently shown an interest in cephalopods).

5.5 References

Anonymous, 1998. MEDITS. Manuel de protocols. Biologia Marina Mediterranea 5: 515-572.

6 The future programme of WGCEPH and recommendations

6.1 Terms of reference

Terms of reference a (landings statistics) and b (new research) remain relevant and should be maintained.

WGCEPH has previously reviewed assessment and management options for European cephalopod stocks. The development of new directed cephalopod fisheries in the UK and their continued importance elsewhere in Europe, plus availability of new results on fishery forecasting (as highlighted in the present report) justify a new review of assessment and management options by WGCEPH.

There is also an increasing number of studies on culture / rearing of European cephalopods, notably octopus and cuttlefish. It may be appropriate for WGCEPH to review the current state of knowledge in relation to the viability of commercial culture for these species.

6.2 WGCEPH working arrangements

WGCEPH continues to rely to a large extent on contributions from university staff, who have no access to so-called “national funds” for attending ICES meetings. Furthermore, there is no current European project that could finance a meeting. Nevertheless, in 2008 it proved to be possible to hold a “subgroup” meeting in Vigo, Spain, to work on the CRR. It is therefore provisionally suggested that a full WGCEPH meeting be held in Vigo in spring 2009, details to be confirmed.

Annex 1: List of Participants

Contributions to the report and CRR were provided by:

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Additional written input to the CRR was provided by CEPHSTOCK project partners as follows:

Paco Bustamante (University of La Rochelle, France)

Lee Hastie (University of Aberdeen, UK)

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Sílvia Lourenço (IPIMAR, Portugal)

Shelagh Malham (University of Wales, Bangor, UK)

Pilar Sanchez (ICM, Spain)

Paul Shaw (Royal Holloway, University of London, UK)

Sansanee Wangvoralak (University of Aberdeen, UK)

Apologies were received from the following WGCEPH members, who were unable to participate: Paul Rodhouse, Michael Vecchione, Earl Dawe, Bill Macy (withdrawing from WGCEPH as now retired), Teresa Borges, Ignacio Sobrino, Begoña Santos.

Annex 2: WGCEPH terms of reference for the next meeting

The **Working Group on Cephalopod Life History and Fisheries** [WGCEPH] (Chair: G. Pierce, Spain/UK) will meet in Vigo, Spain during spring 2009 (date tbc) to:

a) Update and explore landing statistics across the ICES area;

b) Report on innovative cephalopod research results in the ICES area;

c) Report on current practice and state-of-the-art in forecasting, assessment and management options for European cephalopod stocks;

d) Report on state-of-the art for cephalopod culture in Europe

e) Review and update recommendations for data collection for cephalopods as part of routine market samples and during trawling surveys.

WGCEPH will report by 1 July 2009 to the attention of the Living Resources Committee.

Supporting Information

Priority:	High. The work of the Group is of high priority to ICES because cephalopods are an important component of marine ecosystems.
Scientific justification and relation to action plan:	Cephalopods support important fisheries in the ICES area. However, they remain outside the scope of the European Community's Common Fisheries Policy and understanding of stock dynamics, particularly in European coastal waters, varied widely between stocks/areas. Specific comments on the Terms of Reference are: ToR a) This activity remains fundamental to the work of the Group. In addition to reviewing official statistics, there is a particular need to obtain a clear picture of the status of small-scale cephalopod fisheries which are of increasing importance yet poorly monitored by official statistics. ToR b) Funding for cephalopod research is presently very limited but various projects relevant to fisheries continue at national and local levels. Continued monitoring of results will help maintain the interest and demonstrate the advantages of the work that can be carried out, while submitting results and analyses that will be directly applicable to the ICES action plan. ToR c) Research results reviewed in the 2008 report highlight important advances in fishery forecasting for octopus, based on detailed understanding of local oceanographic conditions. It remains important that appropriate assessment and management options become available when required. Experience from ongoing local-scale fishery studies (e.g. in Scotland) should be available to WGCEPH in 2009. ToR d) Cephalopod culture is a rapidly advancing field in Europe, both for ongrowing of live caught animals (notably octopus) and for culture through the life cycle (octopus and cuttlefish). The success or otherwise of commercial culture will have important implications for pressure on fished stocks. ToR e) During 2008 WGCEPH was asked to advise on both routine market sampling for cephalopods and on best practice for cephlopod data collection during trawling surveys. WGCEPH offered a rapid description of ideal sampling regimes. These recommendations should be revisited and updated, with particular reference to any changes to actual data collection that have been introduced in the meantime and to logistic issues that may have rsulted in recommendations not being followed .

Resource requirements:	WGCEPH, more than most ICES Working Groups, relies on participation from a wide range of scientists working outside the traditional government fisheries laboratories in ICES countries and has, indeed, benefited enormously over the last 10-15 years from the input of other scientists working in universities, etc, where no funding is available for participation in ICES activities. This must be taken into account in the organisation of WGCEPH meetings and explains the fact that the group has worked mainly by correspondence for several years now. Availability of financial support for attendance by some key group members is an issue.
Participants:	The next meeting is likely to attract around 10 participants althouh this could be increased if addiional financal support was available.
Secretariat facilities:	None.
Financial:	No financial implications unless ICES wishes to offer support for attendance by additional WGCEPH members.
Linkages to advisory committees:	Provision of information to ACOM as required to respond to requests for advice/information from NEAFC and EC DG Fish.
Linkages to other committees or groups:	None
Linkages to other organizations:	None

Annex 3: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY:
1.WGCEPH notes the high and increasing importance of small-scale coastal fisheries for cephalopods and the relatively poor level of monitoring of such fisheries and recommends that ICES highlights this as a data gap and that research is carried out to address the gap.	ICES (and WGCEPH itself)
2.WGCEPH notes that the cephalopods were poorly repesented in the draft DCR cirulated in April 2008 and recommends that routine data collection requirements be revised to reflect both the importance of cephalopods as fishery resources and their particular life-history characteristics	ICES (and WGCEPH itself)
3.WGCEPH notes the continued laissez-faire approach to cephalopod fisheries and recommends a review of the sustainability of these fisheries and, where appropriate, adoption of relevant assessment methods and management measures	ICES (and WGCEPH itself)
4.WGCEPH notes that research trawling surveys represent an excellent opportunity to collect useful data on distribution, abundance and biology of cephalopod and welcomes the initiative from the International Bottom Trawl Survey Working Group (IBTSWG) to seek advice from WGCEPH on apparopriate data collection protocols. WGCEPH recommends that, when feasible, such data be collected during all routine bottom trawl survey programmes.	ICES, IBTSWG

Annex 4: Working Document for the ICES WGCEPH Subgroup Meeting on Cephalopod Fisheries and Life History ,Vigo, 8-10 April

Short-finned squid fishery landings of the Spanish fishing fleet operating in the northern Atlantic off the Iberian Peninsula

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Introduction

The fishery for short finned squid (Family *Ommastrephidae*) in Northern Iberian Peninsula waters takes three species: *Illex coinndetii* (Vérany, 1839), *Todaropsis eblanae* (Ball, 1841), and *Todarodes sagittatus* (Lamarck, 1798). The presence of European flying squid (*Todarodes sagittatus*) in landings is merely anecdotal (less than 0.003%), and it is usually discarded. The other two short-finned squids (*Illex coindetii* and *Todaropsis eblanae*) make up a relatively important fishing resource and represent about 18% of cephalopod landings on the North Spanish coast.

The trawling fleet (Spanish bottom trawl and pair trawl) is responsible for 96% of the short-finned squid landings in the study area.

The present study aims to obtain information on the annual and seasonal changes in short-finned squid landings. Moreover, this work includes information on the proportion of each species in landings and its body weight composition, for both types of net.

Methods

This study was carried out on a short-finned squid population, from the Cantabrian (Asturias, Cantabria and Euzkadi) (ICES Division VIIIc East) and Galician coasts (ICES Divisions VIIIc West and IXa North), which is caught by the Spanish trawler fleet operating in this area, and landed in Galician and Cantabrian ports. **Figure 1** shows the main fishing ports for short-finned squid landings within the study area.

Data used in the present study came from the monthly landing records, and market samples of *Illex coindetii* and *Todaropsis eblanae* from landings made by the trawler fleet (Spanish bottom trawl and pair trawl) operating in ICES Divisions VIIIc and IXa North from 1994 to 2006. Data were collected by the Instituto Español de Oceanografía (IEO) Sampling and Information Network.

Monthly Ommastrephidae landings data from Spanish bottom trawl and from pair trawl were recorded in several ports for different periods: for Ribeira and Coruña since 1994; for Marín and Vigo since 1997; and for Celeiro, Avilés, Gijón and Santander since 2000. Moreover, landings data were also collected from other ports.

Because the proportion of the two short-finned squid species in landings (in terms of numbers and weight) is not known, monthly samples were collected from November 1997 to March 2004 at Galician ports. A total of 734 samples were taken, 620 of them were from the bottom trawl, of which 4 were taken in 1997, 156 in 1998, 133 in 1999, 95 in 2000, 85 in 2001, 77 in 2002, 61 in 2003 and 13 in 2004.

Most sampling was carried out in the ports of Celeiro, Coruña, Marín and Ribeira. The other 114 samples were taken from the pair trawl, in the ports of Ribeira and Celeiro. Twelve samples were taken in 1998, 9 in 1999, 29 in 2000, 32 in 2001, 21 in

2002 and 11 in 2003. Body weights of 42101 specimens of *Illex coindetii* and 24838 of *Todaropsis eblanae* were obtained (to the nearest 5g) from samples in Galician ports.

Monthly body weight distributions are available by fishing net, month and port.

Tables 1 and 2 show the number of *Illex coindetii* and *Todaropsis eblanae* individuals sampled, by gear type and month in Galician ports (ICES Divisions VIIIc West and IXa North) since 1997 to 2004.

Monthly average species proportions by gear and port were applied to landing data, to obtain estimates of the monthly species composition of landings.

Each monthly (by gear) sample of the *Illex coindetii* and *Todaropsis eblanae* body weight distributions was raised to 1000, in order to compare the monthly distributions.

Moreover, monthly body weight distributions from sampling were applied to landings by gear-type and sampled port, in order to obtain the monthly body weight composition of *Illex coindetii* and *Todaropsis eblanae* landings.

Samples of *Illex coindetii* and *Todaropsis eblanae* samples that included fewer than 40 and 24 individuals respectively were not used to estimate the species and size composition of landings.

Results

Yearly landing by gear

Figure 2 shows yearly landings of short-finned squid, by gear. The Spanish trawling fleet represented around 96% of the yearly landings of short-finned squid along the Northern Iberian Peninsula coast. Around 75% of short-finned squid landed along the Galician coast (ICES Divisions VIIIc West and IXa North) were due to the Spanish bottom trawl fleet, and 22% to pair trawl. For the Cantabrian coast (ICES Division VIIIc East), bottom trawl represented 49% of Ommastrephidae landings, and pair trawl 37%. A small part of short-finned squid landings arises from other fishing gears, such as hooks and gillnet. They represented around 14% of landings on the Cantabrian coast, and only 3% on the Galician coast (**Figure 2**).

It can be seen in **figure 3** that proportion of landings from the two types of trawl differs between ports. Mean yearly landings from pair trawl represent 86% of the total in Celeiro, 41% in Ribeira, 16% in Coruña, and there were no landings of short-finned squid by pairtrawlers in Vigo.

Yearly landing by port

Galician ports receive around 85% of short-finned squid landed in the Northern Spanish coast.

Yearly Ommastrephidae landings data by port from 1994 to 2006 are represented in **figure 4**. The largest amount of short-finned squid landed along the Galician coast (ICES Divisions VIIIc West and IXa North) was in Ribeira and represented about 42% of the total, as compared to 22% forCoruña, 16% in Marín, 10% in Vigo and 5% in Celeiro. The highest amount of Ommastrephidae landings for the Cantabrian coast (ICES Division VIIIc East) from 2000 to 2006 took place in Avilés (49%), Gijón (25%) and Santander (17%).

Species composition of landings by gear

Differences in species (*Illex coindetii* and *Todaropsis eblanae*) composition of landings, between Spanish bottom trawl and pair trawl operating along the Galicia coast (ICES

Divisions VIIIc West and IXa North) since 1997 to 2004, can be observed in **figure 5**. The monthly mean percentage by weight of *Illex coindetii* in short-finned squid landings by Spanish bottom trawlers was 62%, as compared to 38% for *Todaropsis eblanae*. For pairtrawlers, the relative importance of the tto species was reversed: *Illex coindetii* represented 19% of landings, and *Todaropsis eblanae* 81%. These percentages varied between t years (the proportion of *I. coindetii* in bottom trawl landings was about 75% for 1998-1999, 71% in 2000, around 56% for 2001-2003, and 88% in 2004; figures for *I. coindetii* for the same years were 28%, 26% and 11% respectively) (**Figure 5**). Moreover, proportions also varied between different months of the year. It seems these differences can be mainly due to the fishing fleet behaviour, although differences in species biology may contribute.

Monthly landings

Figure 6 shows monthly landings data for short-finned squid, collected by the IEO Sampling and Information Network, in the northern Atlantic Iberian Peninsula (ICES Divisions VIIIc and IXa North), from 1994 to 2006. Landings data from the Cantabrian coast (ICES Division VIIIc-East) are available only since 2000. Monthly landings data by species are available for Galician ports where short-finned squid landings were sampled (Celeiro, Coruña, Marín and Ribeira), from November 1997 to March 2004.

In spite of the high variation between monthly amounts of short-finned squid landings, a seasonal pattern can be observed for most years, mainly due to the seasonal trend in landings along the Galician coast, with higher mean annual values in spring (30%) and autumn (26%), and lowest in summer (19%). This agrees with results obtained for the Galician coast by González *et al*. (1996), whom attribute the low summer landings to the annual life cycle: if mature specimens die after reproduction, only some adults and recruits born in autumn and winter are accessible to the fishery in the summer, whereas new recruits born in spring and early summer, would not start to join the exploitable population until autumn-winter.

Moreover, a strong reduction in landings was observed at the end of 2002 and in early 2003, due to the fishing restrictions implemented after the "B/T Prestige" oil spill in November 2002.

The influence of oceanographic variability on Ommastrephidae abundance fluctuations has been described by several authors (Rasero, 1994, in Galicia; Waluda *et al*., 1999, in the Southwest Atlantic; Dawe and Warren, 1993, in the Northwest Atlantic, etc.), nevertheless, fleet behaviour also strongly affects variation in landings: these species used to be caught by Spanish trawling fleet as a bycatch. By other hand, landings only reflect retained catches. Short-finned squid discards are unknown and can depend on the market price and the amount of target species that have been caught.

Body weight distributions

Figure 7 shows the monthly body weight distributions for *Illex coindetii* landings (size distribution raised to 1000) from the Spanish bottom trawl fleet operating in Galicia waters (ICES Divisions VIIIc West and IXa North), from November 1997 to March 2004; **Figure 8** presents results for the pair trawl fleet operating in same area, from April 1998 to February 2003.

A seasonal pattern in the monthly body weight distributions of *Illex coindetii* was observed in landings from the Spanish bottom trawl fleet. **Figure 7** shows the effect of recruitment in autumn and winter. Their growth in spring and summer, can be

observed, when some of the bigger sizes disappear after reproduction (summer). Bigger specimens were more abundant in winter and spring.

Illex coindetii from pair trawl landings were generally bigger than those from Spanish bottom trawl, except for 2002 (there is a peak of individuals lesser than 40 g, that represents the 95% of animals present in May and November) (**Figure 8**).

Figure 9 includes the monthly body weight distributions of *Todaropsis eblanae* in landings of the Spanish bottom trawl fleet, from December 1997 to March 2004, and **Figure 10** shows distributions for the pair trawl fleet from April 1997 to June 2004.

Although the seasonal trend in monthly body weight distribution of *Todaropsis eblanae* is not very clear in most years, the data show increases in recruitment in the period January-May (this period includes 75% of individuals with body weight less than 50 g). Hastie *et al*. (1994) indicated that production of juvenile *Todaropsis eblanae* occurs in the early part of the year (January-June) in Scottish waters.

2003 was an atypical year, with high peaks of juveniles in March, April, September, October, November and December for Spanish bottom trawl landings.

Fishing gear selectivity

Differences in *Illex coindetii* and *Todaropsis eblanae* size (body weight) selectivity have been observed between Spanish bottom trawl and pair trawl fleets operating in Galician coast from 1988 to 2003.

Most of the Spanish bottom trawl landings were made up of *Illex coindetii* (75% by weight), while *Todaropsis eblanae* represented 81% of pair trawl landings of Ommastrephidae.

Figure 11 shows that the body weight distribution of *Todaropsis eblanae* from bottom trawl landings is wider, and includes a larger proportion of big sizes than pair trawl landings (6% of individuals landed by bottom trawl were ≥ 200 g, as compared toy 3% for pair trawl landings). A similar result was obtained for *Illex coindetii* in pair trawl landings: animals ≥ 120 g represented 42% of the total number, as compared to only 24% for bottom trawl.

Moreover, it seems that smaller sizes (range ≤ 30 g) of *Todaropsis eblanae* and *Illex coindetii* are landed by bottom trawl and pair trawl respectively (Figure 11), although this is at least in part due to anomalous frequency distributions observed in 2003 for *Todaropsis eblanae* (Figure 9), and in 2002 for *Illex coindetii* (Figure 8).

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Tables And Figures

Table 1. Number of *Illex coindetii* sampled specimens by trawler fishing art in Galician ports, since 1997 to 2004. Numbers intro grey rectangles represent the discarded monthly samples due their low size.

Illex coindetii

FISHING ART	YEAR	MONTH												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	TOTAL
Spanish bottom trawl	1997											88	146	**234**
	1998	226	509	982	1183	1219	1142	803	901	908	960	689	647	**10169**
	1999	757	785	802	1056	992	911	649	609	800	564	805	821	**9551**
	2000	500	405	164	224	385	417	600	413	324	558	731	425	**5146**
	2001	553	554	516	626	570	207	319	431	270	244	104		**4394**
	2002	361	280	364	159	423	487	460	441	584	541	250		**4350**
	2003		243	251	571	648	637	465	150	224	341	285	303	**4118**
	2004	208	139	189										**536**
Pair trawl	1997													
	1998				17		9	66	9			8	4	**113**
	1999			6			6	9	4	19	125			**169**
	2000			165	270	156	16	186	159	279		4	39	**1274**
	2001	80	96	84	223	245	207	100	4	85		5		**1129**
	2002	5	102	178	98	155	9			34	6	87		**674**
	2003	64	175		4		1							**244**
	2004													

Table 2. Number of *Todaropsis eblanae* sampled specimens by trawler fishing art in Galician ports, since 1997 to 2004.

Todaropsis eblanae

FISHING ART	YEAR	MONTH												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Set	Oct	Nov	Dec	TOTAL
Spanish bottom trawl	1997											12	160	**172**
	1998	175	300	512	357	423	274	126	68	244	237	177	325	**3218**
	1999	126	162	314	225	189	186	127	185	256	329	269	287	**2655**
	2000	439	411	448	484	431	297	253	313	313	201	303	439	**4332**
	2001	302	269	92	144	39	238	129	508	288	240	236		**2485**
	2002	444	426	261	419	40	321	237	79	155	145	218		**2745**
	2003		98	35	83	171	73	55	186	17	159	113	168	**1158**
	2004	37	24	34										**95**
Pair trawl	1997													
	1998				85		195	342	195			196	98	**1111**
	1999			198			96	91	98	83	79			**645**
	2000		102	141	137	150	188	222	147	128	91	206	165	**1677**
	2001	235	243	233	269	144	244	117	83	269	191	186		**2214**
	2002	121	246	143	227	143	200	101		114	197	12		**1504**
	2003	123	6	197	304		197							**827**
	2004													

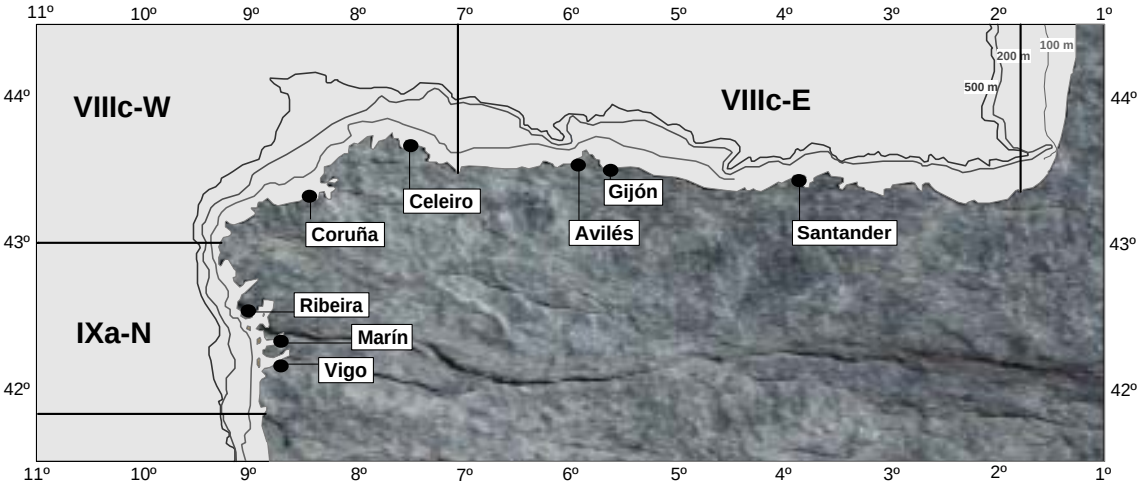

Figure 1. Map of the study area, showing the main high short-finned squid landing fishing ports.

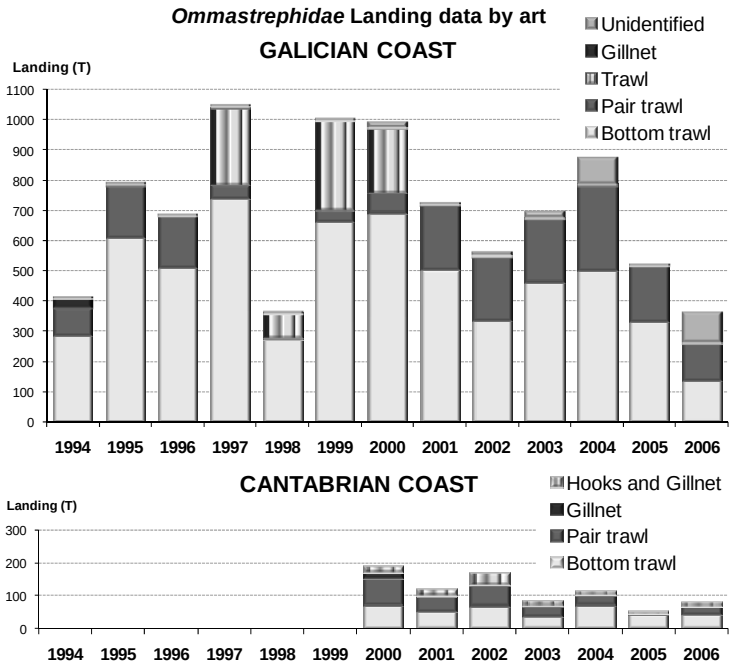

Figure 2. Short-finned squid yearly landing data by fishing art for Galician coast since 1994 to 2006 and for Cantabrian coast since 2000 to 2006.

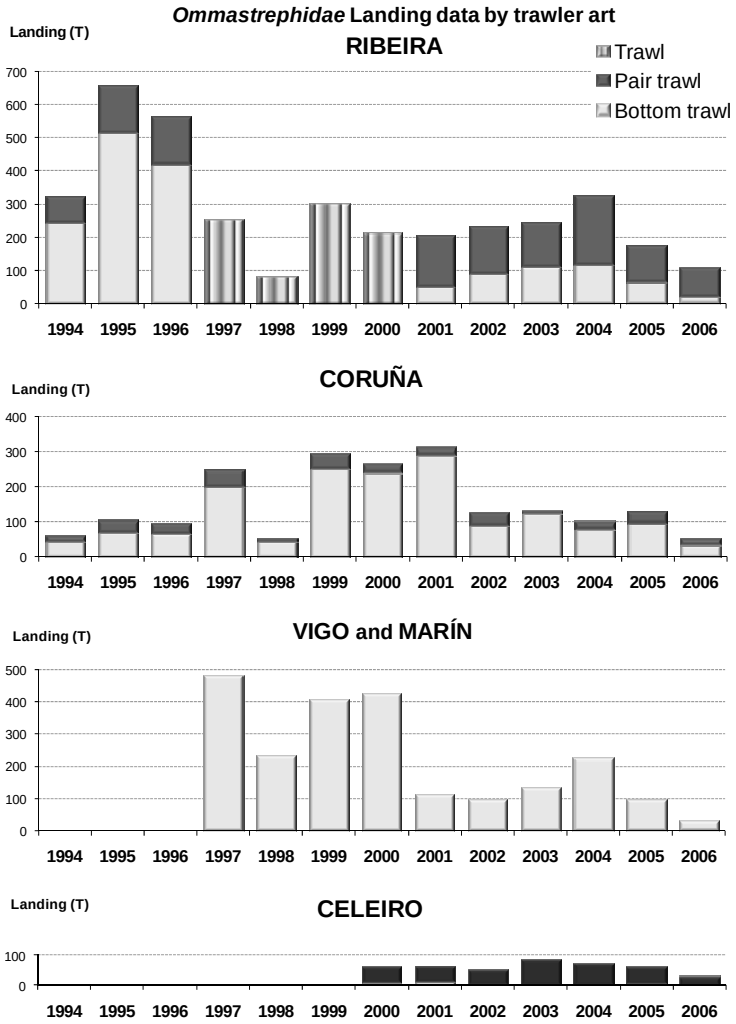

Figure 3. Short-finned squid yearly landing data by Spanish bottom trawl and pair trawl in the main fishing ports of Galician coast.

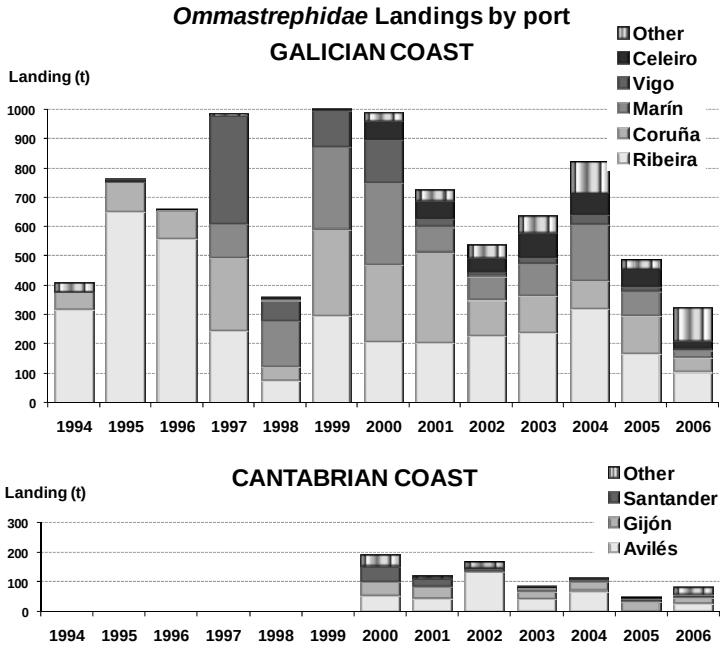

Figure 4. Short-finned squid yearly landing by fishing ports in Galician coast (ICES Divisions VIIIc West and IXa North) since 1994 to 2006, and in Cantabrian coast (ICES Division VIIIc East) since 2000 to 2006.

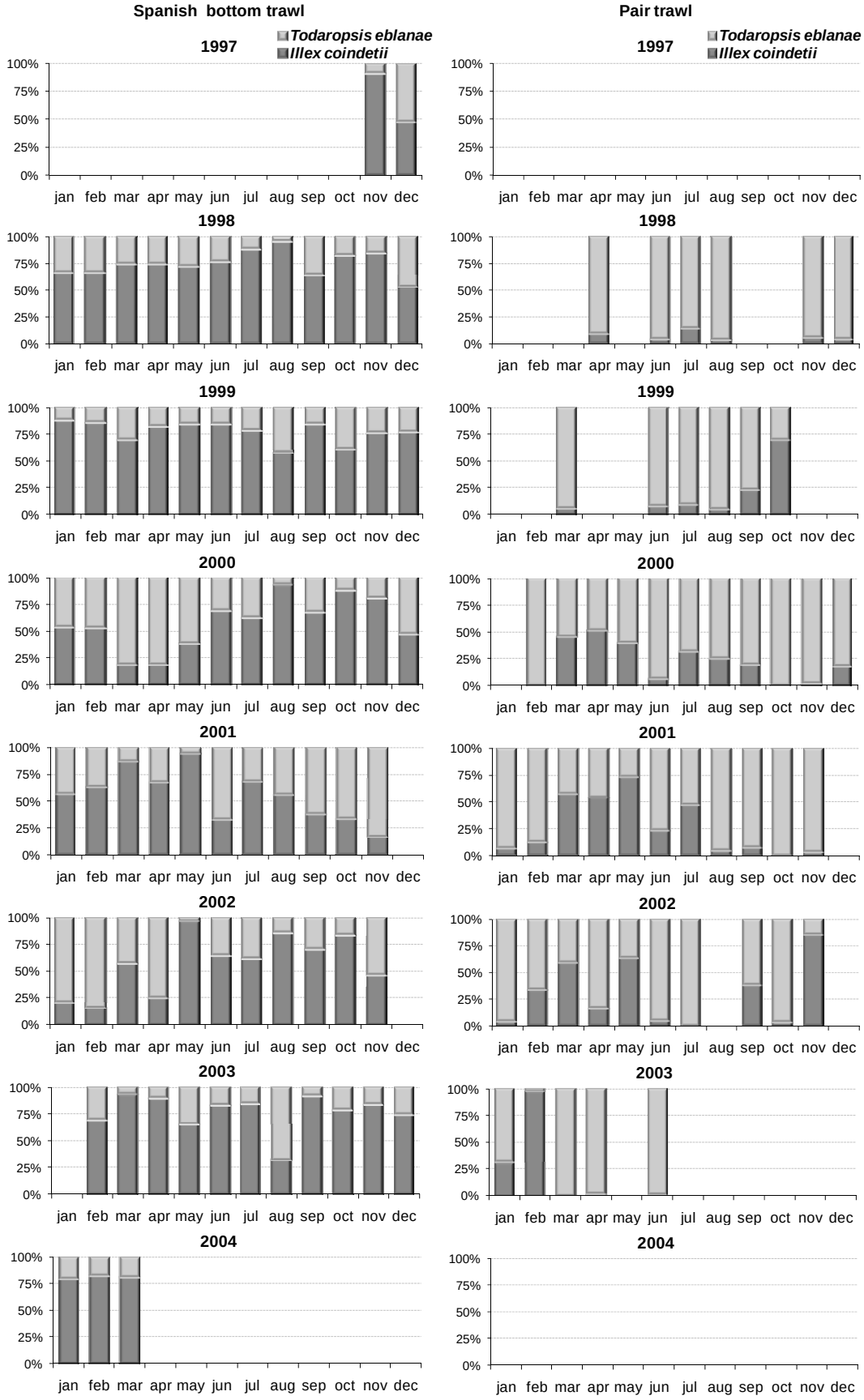

Figure 5. Monthly percentages of *Illex coindetii* and *Todaropsis eblanae* landings for Spanish bottom trawl and pair trawl operating in Galician coast since 1997 to 2004.

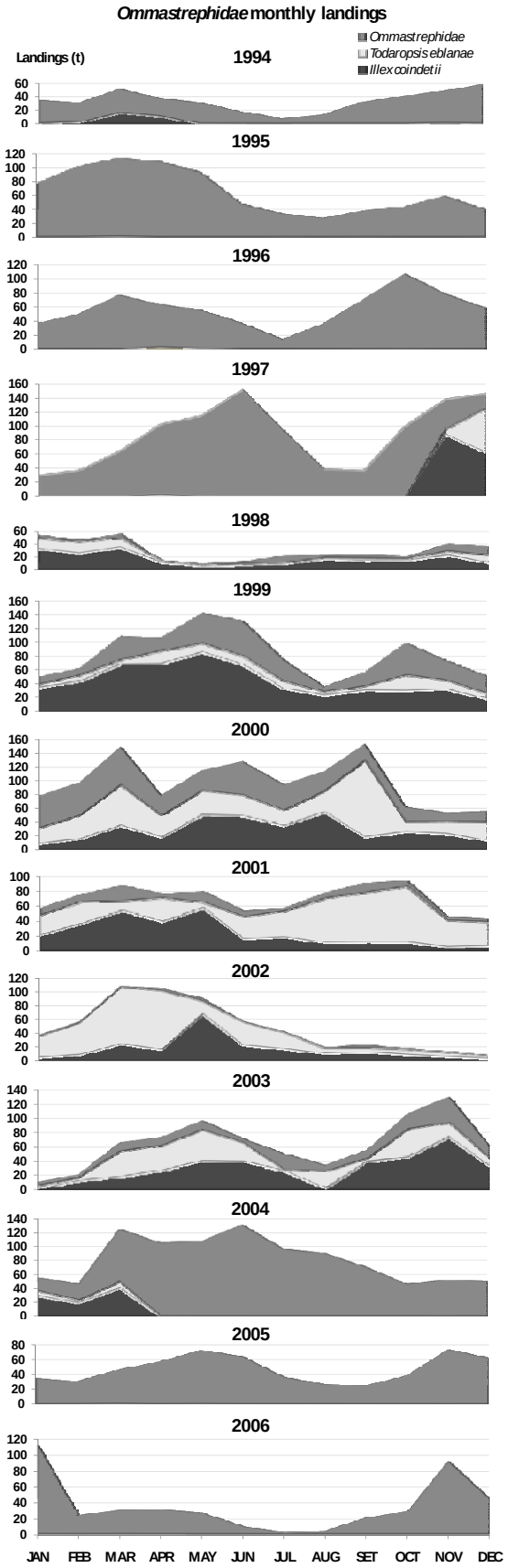

Figure 6. Short-finned squid monthly landings in northern Atlantic Iberian Peninsula (ICES Divisions VIIIc and IXa North), since 1994 to 2006. Landing data from Cantabrian coast (ICES Division VIIIc-East) only are included since 2000.

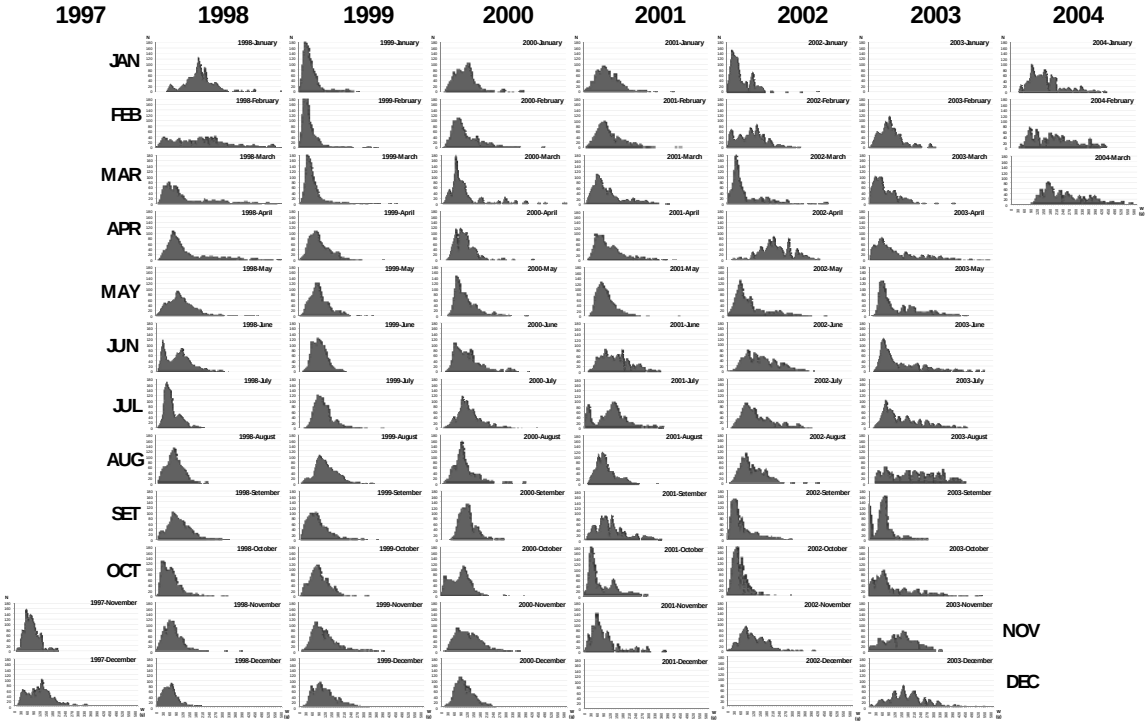

Figure 7. Monthly body weight distributions of *Illex coindetii* landings made by the Spanish bottom trawl fleet operating in Galicia waters (ICES Divisions VIIIc West and IXa North), since November 1997 to March 2004. Size distributions were raised to 1000.

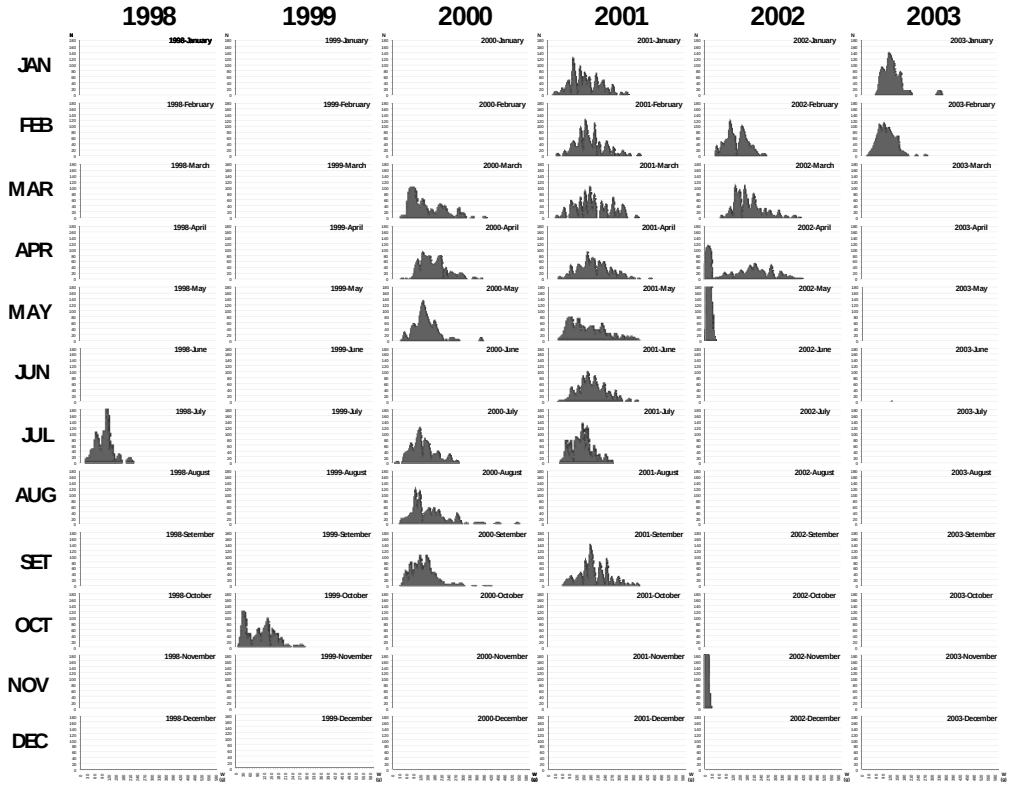

Figure 8. Monthly body weight distributions of *Illex coindetii* landings made by the pair trawl fleet operating in Galicia waters (ICES Divisions VIIIc West and IXa North), since April 1998 to February 2003. Size distributions were raised to 1000.

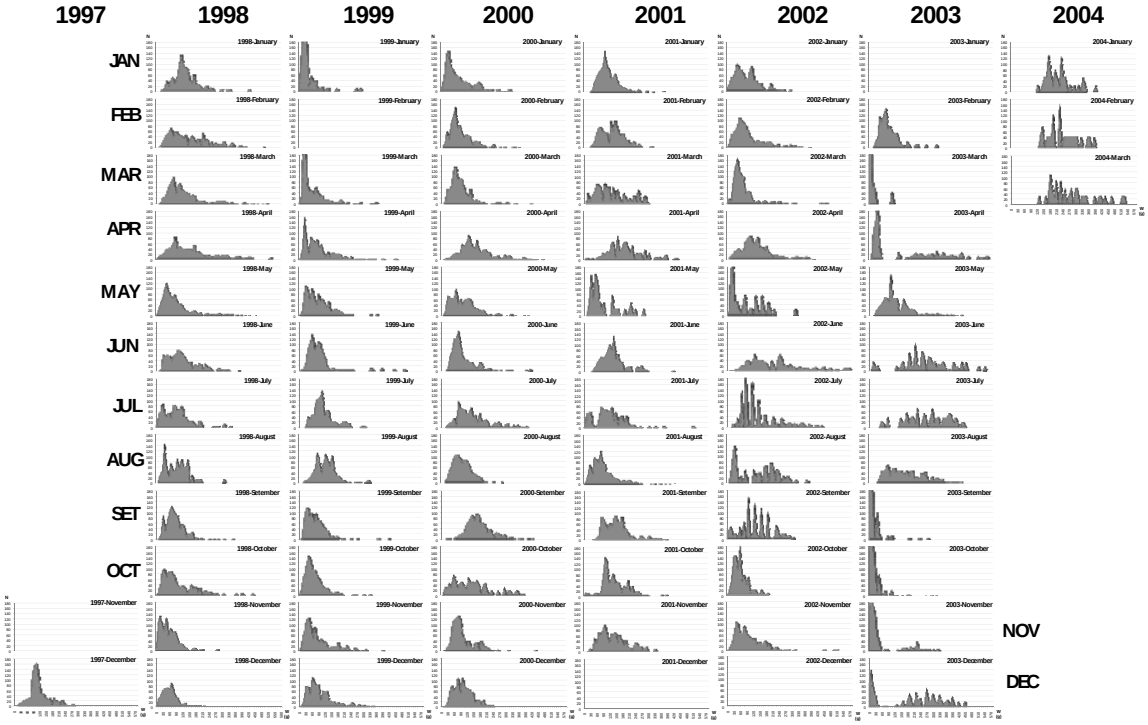

Figure 9. Monthly body weight distributions of *Todaropsis eblanae* landings made by the Spanish bottom trawl fleet operating in Galicia waters (ICES Divisions VIIIc West and IXa North), since December 1997 to March 2004. Size distributions were raised to 1000.

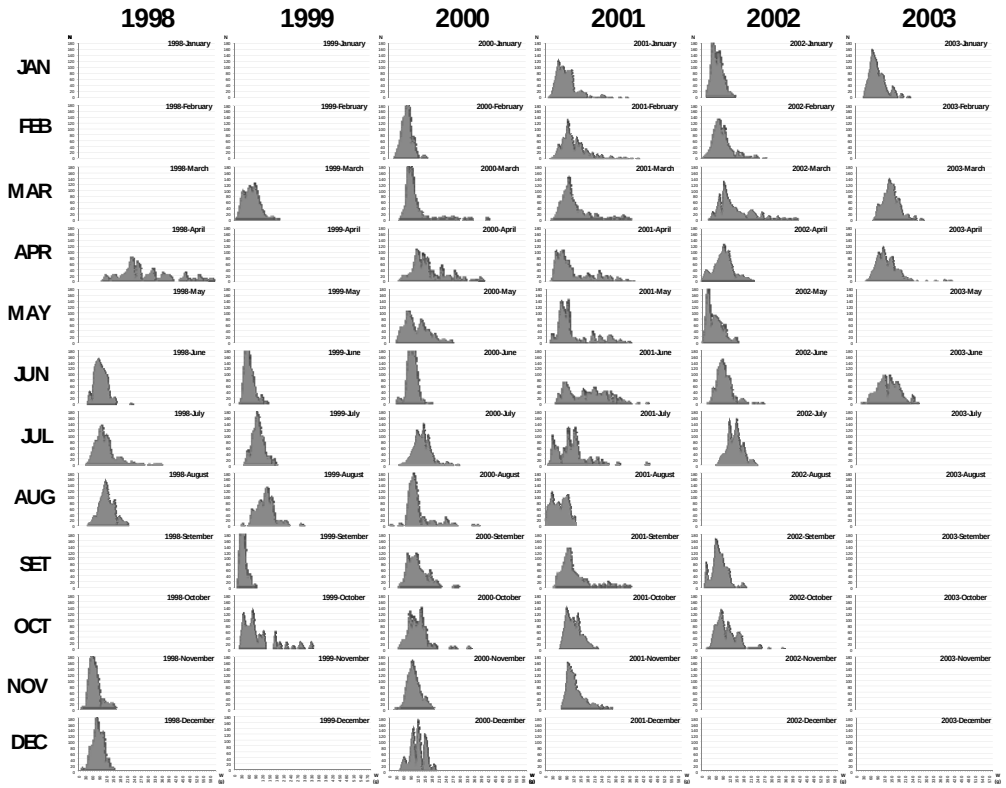

Figure 10. Monthly body weight distributions of *Todaropsis eblanae* landings made by the pair trawl fleet operating in Galicia waters (ICES Divisions VIIIc West and IXa North), since April 1997 to June 2004. Size distributions were raised to 1000.

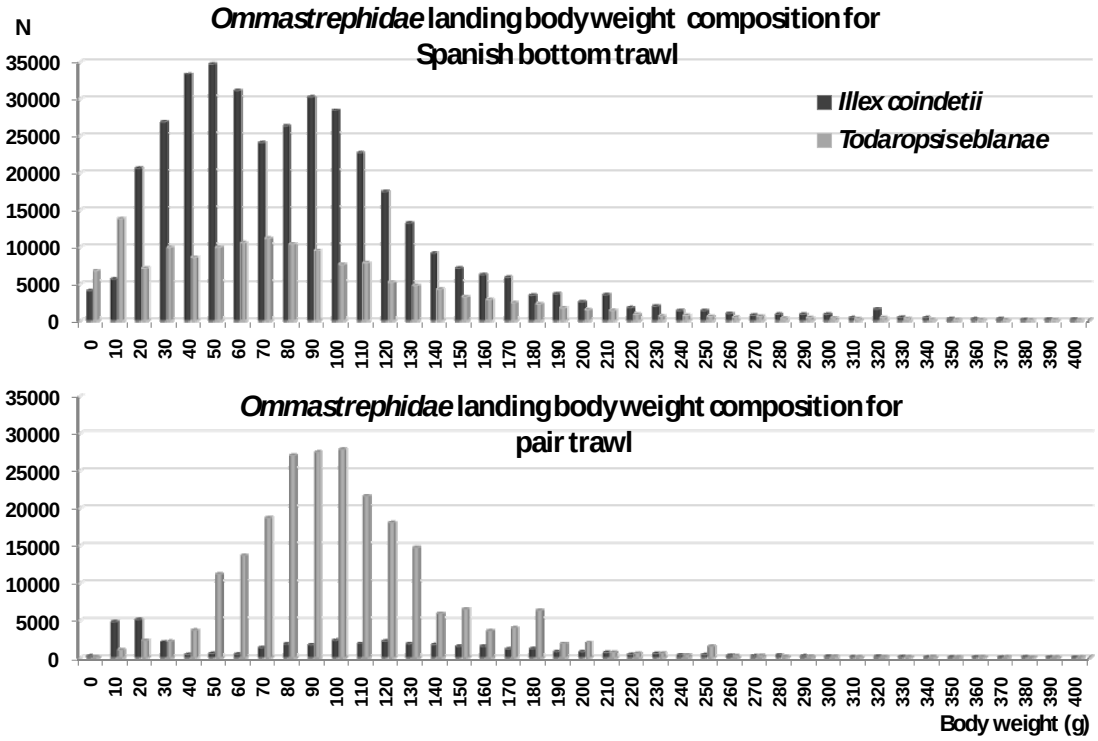

Figure 11. *Ommastrephidae* (*Illex coindetii* and *Todaropsis eblanae*) landings body weight composition for Spanish bottom trawl and pair trawl in Galicia coast (DivisionsVIIIc West and IXa North), for the period 1998-2003.