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REPORT OF THE

WORKING GROUP ON CEPHALOPOD FISHERIES AND LIFE HISTORY

Kiel, Germany
15–17 April 1998

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International Council for the Exploration of the Sea
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1. INTRODUCTION

1.1 Terms of Reference

ICES Council Resolution 1997/2:45 stated that the Working Group on Cephalopod Fisheries and Life History (Chairman: Dr. U. Piatkowski, Germany) would meet in Kiel, Germany, from 15–17 April 1998 to:

a) update currently available landing statistics;

b) review the current status of data, methodology and results available for stock assessment of fished cephalopods, including information on stock identity, fishing effort and discards;

c) review the grey literature that is available and of importance to cephalopod fisheries;

d) contribute to the 1998 ICES Annual Science Conference Theme Session on "Impact of Cephalopods in the Food Chain and Their Interaction with the Environment".

1.2 Attendance

Six of the currently appointed WGCEPH members (names are marked with an *) and two non-members attended the 1998 WGCEPH meeting in Kiel:

Teresa Borges*	Faro, Portugal
Manuela Morais da Cunha*	Lisbon, Portugal
Ana Moreno*	Lisbon, Portugal
João Pereira*	Lisbon, Portugal
Uwe Piatkowski (Chairman)*	Kiel, Germany
Graham Pierce*	Aberdeen, UK
Luis Silva	Cadiz, Spain
Ignacio Sobrino	Cadiz, Spain

These eight participants represented 4 ICES member states. The complete list of participants is given in Annex 1. The names of appointed members to WGCEPH are provided in Annex 2.

The following members notified the Working Group that they were unable to attend: Nick Bailey, UK; Herman Bjørke, Norway; Peter Boyle, UK; Earl Dawe, Canada; Angel González, Spain; Angel Guerra, Spain; Vicente Hernández-García, Spain; Julio Portela, Spain; Jean-Paul Robin, France; Paul Rodhouse, UK; Jan Sundet, Norway; Mike Vecchione, USA.

1.3 Opening of the Meeting

The meeting took place in the conference room of the Institut für Meereskunde, Kiel from 15-17 April 1998. The agenda of the meeting is given in Annex 1.

1.4 Arrangements for the Preparation of the Report

The Chairman reminded participants that the ICES Secretariat requires that the Working Group report be drafted by the end of the meeting, as it now usually the case. Like in 1997 this could not be achieved due to some lacking data, in particular French landings statistics which were essential for including into the report. Working Group members agreed to make available these data via electronic mail as soon as possible after the meeting and to send the relevant information to the Chairman. The Chairman included this information and undertook final detailed editing of the Working Group report text prior to submitting to ICES.

1.5 Working Group Papers

Three Working Group papers (WGP) were available at the meeting and shortly thereafter. Their information was widely used to compile the present report. They are attached to this document as Annexes 4 to 6.

2. CEPHALOPOD LANDING STATISTICS (TOR a)

2.1 Compilation of Landing Statistics

Like in last year the present report updates landing statistics available for cephalopod groups within the ICES area (Tables 1 to 6). Data are largely based on last year's report (ICES, 1997). New and additional information were provided by Working Group members in accordance with their national authorities. Furthermore, available statistics originating from the ICES STATLANT 27A data base were considered. Like in other years, however, this data base information was incomplete and numbers were not identical with the information which Working Group members supplied. It must be noted that several ICES member countries did not supply updated information for 1997 (see below). In these cases a similar number like for the 1996 catch was taken as a best estimate. These estimates are marked with a "P" (provisional). It is hoped to improve these numbers in next year's WGCEPH report.

Tables 1 to 4 give information on annual catch statistics (1991–1997) per cephalopod group in each ICES division or sub-area separated for each nation. The cephalopod groups of the tables comprise the following species:

- Table 1. Cuttlefish (Sepiidae). The big majority of landings summarised in this table are catches of *Sepia officinalis*, the common cuttlefish, plus small catches of *S. elegans* and *S. orbignyana*. WGCEPH considers that no bobtail squids (Sepiolidae) occur in the reported catches.

- Table 2. Common squid (including the long-finned squids *Loligo forbesi, L. vulgaris, Alloteuthis subulata* and *A. media*). The big majority of common squid landings are specimens of *L. forbesi* and *L.vulgaris*.

- Table 3. Short-finned squid (*Illex coindetii* and *Todaropsis eblanae*) and European flying squid (*Todarodes sagittatus*).

- Table 4. Octopods (including *Eledone cirrhosa, E. moschata* and *Octopus vulgaris*).

A compilation separated into single species is yet not possible as countries report landings for cephalopod groups, mostly in the format as given in the tables. Table 5 summarises total annual cephalopod landings in the whole ICES area for major cephalopod groups. Table 6 provides information of total annual cephalopod landings in the whole ICES area for major cephalopod groups separated for each fishing nation.

2.2 General Trends

Total reported annual cephalopod landings within the ICES region varied between 34,400 t and 46,212 t during the period of 1991 to 1997 (Table 5). Detailed re-examining of the statistics revealed that annual catches more than 50,000 t as compiled in the 1997 WGCEPH report were not correct due to an over-estimation of mainly French landings. Data for 1997 are still provisional, but indicate that the total catch of approximately 38,000 t is markedly lower than in 1996 (45,000 t). This is mainly due to a pronounced decrease of cuttlefish landings by France and the UK. Octopod catches also decreased from 1996 to 1997 whereas the landings of common squid remained stable. The only obvious increase in landings appeared within the short-finned squid (see Table 5) which often have been discarded in the past, but now are reported as landings. The most important group are octopods, mainly *Octopus vulgaris* which are intensely fished by Portugal and Spain (Table 6).

In Belgium cephalopods are only caught as by-catch and yields are relatively low. Major fishing areas are the southern North Sea and the English Channel. Common squid form the most important group peaking at 468 t in 1995.

In Denmark common squid is caught as by-catch in the trawl fishery and numbers are low with a maximum catch of 54 t in 1992. Total catches are probably higher as inspections in Danish fishing ports (Hvide Sande, Hirtshals) indicate, but there is no registered information available.

Cephalopod landings by UK vessels in England,Wales and Northern Ireland were provided at the Working Group from the database held at the CEFAS Fisheries Laboratory. Like in previous years in 1997 the most important groups were cuttlefish and common squid with landings of about 2,100 t each. The CEFAS database output for the transnational Eurosquid project funded by the EEC does not correspond to data reported to the ICES data bank in some years, particularly if common squid is considered.

France remains the most important fishing nation concerning cuttlefish (*Sepia officinalis*) and common squid (*Loligo* spp.). Major fishing grounds are the English Channel and the Bay of Biscay. During the last years (1991 to 1997) catches varied from about 4,400 to 10,800 t for cuttlefish and about 2,200 to 6,400 t for common squid.

Like in other nations cephalopods are no "quota species" in Ireland. Therefore, available catch data have to be treated with great caution. Common squid (mainly *Loligo forbesi*) contribute the major share of cephalopods landed in Ireland and its catch peaked in 1995 with 1,042 t. They are mainly caught in ICES divisions VI and VII. A considerable amount of common squid caught in Irish waters is also landed in Spanish ports. Data on landings in 1997 were not available yet and 1996 numbers were provisionally listed in the tables as 1997 catches.

In Norway only the European Flying squid (*Todarodes sagittatus*) is landed. After its total absence in the early 1990s it appeared again in the fishery statistics in 1995 with a total of 352 t which were caught during autumn. The possible "return" of *T. sagittatus* into North European waters could not be confirmed, because in 1996 no catches were reported. However, landings increased again in 1997 with a total of 192 t and the development should be observed with great caution.

Portugal regularly provides catch statistics for all major groups to ICES. Octopus catches (*Octopus vulgaris* and *Eledone cirrhosa*) increased remarkably in the last decade in ICES sub-area IX and in the last two years in sub-area X (Tables 4; 6). Cuttlefish (*Sepia officinalis*) landings in sub-area IX were steady until 1995 with ca. 1,200 t annually and then slightly increased in the last two years with 1,636 t in 1996 and 1,423 t in 1997. Squid (Common and Short-finned squid) are less important in Portuguese landings showing a little increase in 1997 with 1,120 t and 364 t, respectively. In general, Portugal has been the major cephalopod fishing nation in the ICES region with about 12,000 t in 1997. A comprehensive review of the Portuguese cephalopod fisheries and its trends was provided as a WG document and is compiled in Annex 5.

Landings of cephalopods by UK vessels in Scotland were provided at the Working Group from the database held at the FRS Marine Laboratory. Data were made available for common squid (*Loligo forbesi*), octopus (*Eledone cirrhosa*) and cuttlefish (*Sepia officinalis*) and are included in Tables 1 to 6. *Loligo* catches in the North Sea were higher in 1997 than in 1996. Only minor changes were reported for the west coast of Scotland. There was less squid at Rockall than in 1996.

Detailed catch statistics of Spain were made available to the Working Group. There were no significant changes in the landings between 1996 and 1997 except for short-finned squid which increased to a total of 3,539 t making Spain to the main fishery nation of this group. This increase has taken place fundamentally in the sub-areas VIII and IXa with increases from 599 t in 1996 to 1,431 t in 1997 and from 296 t in 1996 to 1,069 t in 1997, respectively. However, there is still lack of information of short-finned squid landings in ICES subarea IXa in the years 1991 to 1993. *Octopus vulgaris* and short-finned squid were the two most important cephalopods resources for the Spanish fishing fleet during 1997, representing 31 and 30 % of the total cephalopod catches of Spain in ICES waters. A detailed WG document describing the important octopus fishery in the Spanish waters of the Gulf of Cadiz was provided and is attached as Annex 6.

2.3 Discards

WGCEPH already earlier pointed out that cephalopod discards have become of major importance in many target fisheries on other groups than cephalopods. Further information on this subject is given under ToR b. First results on discarded cephalopods from the commercial fisheries off southern Portugal were presented by Teresa Borges (Portugal) (see ICES, 1997). New information on this issue were provided in another WG document by Teresa Borges which summarises cephalopod discards in the South Portuguese fisheries (see Annex 4).

2.4 Conclusions

WGCEPH emphasizes that the quality of available landing statistics has been discussed in detail in earlier reports. During the last years there have been considerable improvements, notably in the data supplied by Portugal and Spain. However, this year no updated information was available from Ireland. Difficulties still remain in several aspects of data collection. Where cephalopod data are recorded there is frequently uncertainty on the species composition. The extent of this problem varies from country to country with some making no distinctions, some distinguishing between major groups such as cuttlefish, squid, octopus, and some providing details on individual species. As long as cephalopod species will not be regarded as quoata species this situation will not change. First important steps for management advice will be achieved by legislations on exploitation. Further, restrictions in length and weight of exploited stocks should be introduced (see ICES, 1996).

Table 1 Landings (in tonnes) of Cuttlefish (Sepiidae). Data provided by WG members (see Section 2.1).

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Division IVb (Central North Sea)							
Belgium	2	12	6	+	1	1	2
England, Wales & Northern Ireland	+	+	2	+	2	+	0
Total	2	12	8	+	3	1	2
ICES Division IVc (Southern North Sea)							
Belgium	9	13	25	13	15	5	3
England, Wales & Northern Ireland	15	26	22	47	163	90	22
France	18	52	96	96	177	88	35
Total	42	91	143	156	355	183	60
ICES Division VIa (NW coast of Scotland and North Ireland)							
England, Wales & Northern Ireland	+	1	+	1	+	+	0
France	4	+	+	1	1	3	1
Scotland	0	0	0	0	0	+	0
Total	4	1	+	2	1	3	1
ICES Division VIIa (Irish Sea)							
Belgium	1	4	1	2	1	1	1
England, Wales & Northern Ireland	5	46	11	13	19	8	1
France	2	+	4	+	+	1	+
Total	8	50	16	15	20	10	2
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)							
England, Wales & Northern Ireland	0	0	0	5	0	+	0
France	+	0	+	2	0	+	+
Total	+	0	+	7	0	+	+
ICES Divisions VIId, e (English Channel)							
Belgium	15	20	24	19	19	11	8
Channel Islands	1	4	2	2	1	11	11P
England, Wales & Northern Ireland	642	898	1,882	1,797	3,925	4,050	1,601
France	2,497	3,465	7,218	4,379	7,597	5,833	2,767
Total	3,155	4,387	9,126	6,197	11,542	9,905	4,387P
ICES Division VIIf (Bristol Channel)							
Belgium	4	4	11	14	4	1	1
England, Wales & Northern Ireland	28	35	95	38	42	64	44
France	19	18	28	22	14	33	20
Total	51	57	134	74	60	98	65
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)							
Belgium	3	9	12	4	5	2	3
England, Wales & Northern Ireland	39	101	114	134	188	367	463
France	1,059	342	391	307	385	1,576	373
Spain	20	2	2	4	+	11	52
Total	1,121	454	519	449	578	956	891

Table 1 (continued)

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Subarea VIII (Bay of Biscay)							
Belgium	0	3	5	4	+	+	0
England, Wales & Northern Ireland	42	58	41	56	2	40	37
France	3,303	4,531	3,007	3,572	2,672	1,208	1,288
Portugal	0	0	0	0	0	11	8
Spain	614	551	575	451	194	476	398
Total	3,959	5,143	3,628	4,083	2,868	1,735	1,731
ICES Subarea IX							
Portugal	1,197	1,230	1,205	1,120	981	1,625	1,415
Spain	911	1,029	832	773	1,025	924	1,072
Total	2,108	2,259	2,037	1,893	2,006	2,549	2,487
Grand Total	10,450	12,454	15,611	12,876	17,433	15,441	9,626P

P: Provisional data.

Table 2 Landings (in tonnes) of Common Squid (includes *Loligo forbesi, Loligo vulgaris, Alloteuthis subulata* and *A. media*). Data provided by WG members (see Section 2.1).

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Division IIIa (Skagerrak and Kattegat)							
Denmark	13	37	2	0	1	1	5
Sweden	1	3	0	+	2	+	+
Total	14	40	2	+	3	1	5
ICES Division IVa (Northern North Sea)							
Denmark	7	7	1	1	1	1	2
England, Wales & Northern Ireland	1	9	1	1	+	+	+
France	10	6	1	+	+	+	+
Germany	+	+	+	+	+	+	+
Scotland	549	561	242	93	268	292	445
Total	567	583	245	95	269	293	447
ICES Division IVb (Central North Sea)							
Belgium	4	6	22	13	14	9	6
Denmark	2	10	2	+	+	+	9
England, Wales & Northern Ireland	22	50	22	4	22	20	44
France	2	+	+	+	1	0	0
Germany	+	2	1	1	3	1	3
Scotland	62	106	36	5	25	14	61
Total	92	174	83	23	65	44	123
ICES Division IVc (Southern North Sea)							
Belgium	19	35	84	113	153	87	42
Denmark	0	0	0	+	+	+	+
England, Wales & Northern Ireland	2	4	3	10	13	3	3
France	105	113	281	187	182	83	117
Germany	+	+	1	2	6	2	1
Total	126	152	369	313	354	175	163

Table 2 (continued)

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Division Vb (Faroe Grounds)							
England, Wales & Northern Ireland	0	0	0	1	+	0	+
Faroe Islands	+	+	+	1	+	+	0
France	+	+	0	+	0	0	0
Scotland	+	5	+	+	+	1	1
Total	+	5	+	2	+	1	1
ICES Division VIa (NW coast of Scotland and North Ireland)							
England, Wales & Northern Ireland	4	71	28	144	16	53	45
France	245	227	172	138	98	102	35
Ireland	15	30	78	36	158	50	50P
Scotland	248	339	182	91	267	307	296
Total	512	667	460	409	539	512	426P
ICES Division VIb (Rockall)							
England, Wales & Northern Ireland	1	8	1	6	2	8	4
France	+	+	0	+	0	0	0
Ireland	26	50	5	6	5	5	5P
Scotland	21	65	9	28	6	17	5
Spain	0	0	2	2	2	1	1
Total	48	123	17	42	15	31	15P
ICES Division VIIa (Irish Sea)							
Belgium	1	6	0	3	2	8	2
England, Wales & Northern Ireland	58	163	174	234	156	218	125
France	41	65	52	30	14	5	2
Ireland	4	5	112	66	192	349	349P
Isle of Man	7	15	15	6	7	3	3P
Scotland	6	19	10	4	2	2	3
Total	117	273	363	343	373	582	484P
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)							
England, Wales & Northern Ireland	1	13	48	79	96	307	280
France	59	20	58	66	22	81	38
Ireland	24	40	35	11	282	105	105P
Scotland	2	5	1	18	1	+	+
Total	86	78	141	174	401	493	423P
ICES Divisions VIId, e (English Channel)							
Belgium	45	86	70	132	220	163	83
Channel Islands	0	1	0	0	2	1	1P
England, Wales & Northern Ireland	416	698	869	727	672	393	496
France	1,879	2,595	3,663	2,353	2,548	1,842	1,382
Total	2,340	3,380	4,602	3,212	3,442	2,399	1,962P
ICES Division VIIf (Bristol Channel)							
Belgium	10	2	+	4	13	12	8
England, Wales & Northern Ireland	35	67	134	162	132	39	76
France	268	443	442	434	275	160	149
Total	313	502	576	599	420	211	233

Table 2 (continued)

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)							
Belgium	4	3	2	9	26	63	12
England, Wales & Northern Ireland	24	122	282	600	1,012	1,394	1,056
France	363	582	657	506	344	177	101
Germany	0	0	0	0	2	+	+
Ireland	80	135	133	164	405	242	242P
Portugal	0	0	0	0	0	3	0
Scotland	1	8	14	34	1	121	0
Spain	31	62	85	39	29	89	332
Total	503	912	1,173	1,352	1,819	2,029	1,743P
ICES Sub-area VIII (Bay of Biscay)							
Belgium	6	34	36	17	40	46	13
England, Wales & Northern Ireland	84	65	94	96	55	46	68
France	910	1,046	1,070	1,759	1,320	317	412
Portugal	0	0	0	0	0	2	2
Spain	189	267	33	588	196	427	328
Total	1,189	1,412	1,233	2,460	1,611	838	823
ICES Sub-area IX							
Portugal	1,869	1,569	508	309	908	584	842
Spain	1,034	636	300	210	245	237	338
Total	2,903	2,205	808	519	1,153	821	1,180
ICES Sub-area X (Azores Grounds)							
Portugal*	258	72	108	114	250	200	276
Grand Total	9,068	10,578	10,180	9,657	10,714	8,630	8,304P

*Landings consist exclusively of *Loligo forbesi*.
P: Provisional data.

Table 3 Landings (in tonnes) of Short-finned Squid (*Illex coindetii* and *Todaropsis eblanae*) and European Flying Squid (*Todarodes sagittatus*). Data provided by WG members (see Section 2.1).

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Sub-area I + II (Barents Sea and Norwegian Sea)							
Norway*	0	0	0	0	352	+	192
ICES Division Va (Iceland Grounds)							
Iceland*	0	0	0	0	11	3	3
ICES Division VIa, b (NW coast of Scotland and North Ireland, Rockall)							
France	1	+	0	+	+	2	+
Ireland	0	0	0	0	96	110	110P
Spain	68	2	+	0	0	0	0
Total	69	2	+	+	96	112	110P
ICES Division VIIa (Irish Sea)							
France	+	0	+	0	0	+	+
Ireland	+	+	+	66	17	23	23P
Total	+	+	+	66	17	23	23P
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)							
France	3	4	+	+	0	+	+
Ireland	0	0	0	0	21	36	36P
Total	3	4	+	+	21	36	36P
ICES Divisions VIId, e (English Channel)							
England, Wales & Northern Ireland	0	0	0	0	+	0	1
France	1	2	+	+	+	+	+
Total	1	2	+	+	+	+	1
ICES Division VIIf (Bristol Channel)							
France	+	1	+	+	0	+	+
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)							
England, Wales & Northern Ireland	0	0	0	0	29	13	4
France	63	70	42	27	25	3	16
Ireland	0	0	0	0	167	312	312P
Spain	909	469	374	643	353	1,594	1,039
Total	971	539	416	670	574	1,922	1,371P
ICES Sub-area VIII (Bay of Biscay)							
England, Wales & Northern Ireland	0	0	0	0	6	0	3
France	165	412	358	268	127	69	127
Portugal	0	0	0	0	0	0	12
Spain	699	1,088	350	505	360	599	1,431
Total	864	1,500	708	773	493	668	1,573
ICES Sub-area IX							
Portugal	509	766	259	190	101	121	352
Spain	100P	100P	100P	75	149	296	1,069
Total	609P	866P	359P	265	250	417	1,421
Grand Total	2,516P	2,914P	1,483P	1,774	1,814	3,181	4,729P

*Landings consist exclusively of *Todarodes sagittatus*.
P: Provisional data.

Table 4 Landings (in tonnes) of Octopods (*Eledone* spp. and *Octopus vulgaris*). Data provided by WG members (see Section 2.1).

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Division IVa (Northern North Sea)							
England, Wales & Northern Ireland	0	0	0	0	+	+	+
Scotland	86	31	10	2	2	2	6
Total	86	31	10	2	2	2	6
ICES Division IVb (Central North Sea)							
Belgium	43	24	10	3	0	0	0
England, Wales & Northern Ireland	2	8	1	4	+	+	+
Scotland	1	1	2	1	0	+	+
Total	46	33	13	8	+	0	0
ICES Division IVc (Southern North Sea)							
Belgium	1	0	1	1	2	0	2
England, Wales & Northern Ireland	+	1	+	4	8	4	1
Total	1	1	1	5	10	4	3
ICES Division VIa, b (NW coast of Scotland and North Ireland, Rockall)							
Belgium	0	0	0	0	0	0	1
England, Wales & Northern Ireland	5	4	+	1	+	+	+
Ireland	0	0	0	0	1	1	1P
Scotland	1	3	1	2	4	1	1
Spain	90	4	0	0	0	0	0
Total	96	11	1	3	5	2	3P
ICES Division VIIa (Irish Sea)							
Belgium	1	14	8	14	14	3	21
England, Wales & Northern Ireland	1	2	4	24	2	+	1
France	+	0	+	+	+	0	0
Ireland	0	0	0	+	1	1	1P
Scotland	0	0	0	0	0	+	+
Total	2	16	12	38	17	4	24P
ICES Divisions VIIb, c (West of Ireland and Porcupine Bank)							
England, Wales & Northern Ireland	0	0	+	+	+	4	3
France	0	0	0	+	+	0	+
Ireland	0	0	3	2	2	2	2P
Total	0	0	3	2	2	6	5P
ICES Divisions VIId, e (English Channel)							
Belgium	0	1	2	+	6	1	1
England, Wales & Northern Ireland	9	20	21	60	77	75	37
France	7	24	20	31	45	22	6
Total	16	45	43	91	128	99	44
ICES Division VIIf (Bristol Channel)							
Belgium	1	2	4	6	9	6	6
England, Wales & Northern Ireland	1	8	13	26	8	6	9
France	+	2	12	3	2	2	1
Total	2	12	29	35	19	14	16

Table 4 (continued)

Country	1991	1992	1993	1994	1995	1996	1997P
ICES Divisions VIIg-k (Celtic Sea and SW of Ireland)							
Belgium	1	2	6	10	27	17	22
England, Wales & Northern Ireland	3	22	57	77	144	127	67
France	2	6	10	7	17	2	3
Ireland	0	1	1	2	21	9	9P
Scotland	0	0	0	0	0	5	0
Spain	163	179	139	256	452	539	240
Total	169	210	213	352	661	699	341P
ICES Sub-area VIII (Bay of Biscay)							
Belgium	0	0	7	6	3	1	0
England, Wales & Northern Ireland	22	0	0	0	+	5	23
France	24	77	163	57	61	17	20
Portugal	82	144	+	154	107	113	75
Spain	1,679	2,511	2,136	1,434	1,779	2,323	2,688
Total	1,807	2,732	2,306	1,651	1,950	2,459	2,806
ICES Sub-area IX							
Portugal	7,440	9,476	7,099	7,319	9,708	11,523	8,980
Spain	2,694	3,499	2,992	3,757	3,741	2,964	2,640
Total	10,134	12,975	10,093	11,076	13,449	14,487	11,620
ICES Sub-area X (Azores Grounds)							
Portugal*	7	11	7	7	8	16	39
Grand Total	12,366	16,077	12,731	13,270	16,251	17,782	14,906P

*Landings consist exclusively of *Octopus vulgaris.*
P: Provisional data.

Table 5 Total annual cephalopod landings (in tonnes) in whole ICES area separated into major cephalopod species groups. Data provided by WG members (see Section 2.1).

Cephalopod Group	1991	1992	1993	1994	1995	1996	1997P
Cuttlefish	10,450	12,454	15,611	12,876	17,433	15,441	9,626P
Common Squid	9,068	10,578	10,180	9,657	10,714	8,630	8,304P
Short-finned Squid	2,516P	2,914P	1,483P	1,774	1,814	3,181	4,729P
Octopods	12,366	16,077	12,731	13,270	16,251	17,782	14,906P
Total	34,400P	42,023P	40,005P	37,577	46,212	45,034	37,565P

P: Provisional data.

Table 6 Total annual cephalopod landings (in tonnes) in whole ICES area by country and separated into major cephalopod species groups. Data provided by WG members (see Section 2.1).

Country	1991	1992	1993	1994	1995	1996	1997P
(a) Cuttlefish (Sepiidae, mostly *Sepia officinalis*)							
Belgium	34	65	84	56	45	21	18
Channel Islands	1	4	2	2	1	11	11P
England, Wales & N. Ireland	771	1,165	2,167	2,091	4,341	4,619	2,168
France	6,902	8,409	10,747	8,380	10,848	7,742	4,483
Portugal	1,197	1,230	1,205	1,120	981	1,636	1,423
Spain	1,545	1,582	1,409	1,228	1,219	1,411	1,522
Total	10,450	12,455	15,616	12,877	17,435	15,440	9,625P
(b) Common Squid (*Loligo forbesi*, *Loligo vulgaris*, *Alloteuthis subulata*, *Alloteuthis media*)							
Belgium	89	172	214	291	468	382	166
Channel Islands	0	1	0	0	2	1	1
Denmark	22	54	5	1	2	2	16
England, Wales & N. Ireland	648	1,260	1,656	2,063	2,176	2,481	2,197
Faroe Islands	+	+	+	1	+	+	0
France	3,887	5,100	6,400	5,476	4,803	2,708	2,236
Germany	+	2	2	3	11	3	4
Ireland	149	260	363	283	1,042	751	751P
Isle of Man	7	15	15	6	7	3	3P
Portugal	2,127	1,641	616	423	1,158	789	1,120
Scotland	889	1,108	494	273	570	754	811
Spain	1,254	965	418	837	470	753	1,004
Sweden	1	3	0	+	2	+	+
Total	9,073	10,581	10,184	9,659	10,713	8,627	8,304P
(c) Short-finned Squid (*Illex coindetii*, *Todaropsis eblanae*, *Todarodes sagittatus*)							
England, Wales & N. Ireland	0	0	0	0	35	13	8
France	234	490	402	296	152	74	143
Iceland	0	0	0	0	11	3	3
Ireland	+	+	+	66	301	481	481P
Norway	0	0	0	0	352	0	192
Portugal	509	766	259	190	101	121	364
Spain	1,776P	1,659P	824P	1,223	862	2,489	3,539
Total	2,519P	2,915P	1,485P	1,775	1,814	3,181	4,730P
(d) Octopods (*Eledone cirrhosa*, *Eledone moschata*, *Octopus vulgaris*)							
Belgium	47	43	38	40	61	28	53
England, Wales & N. Ireland	43	65	96	196	239	221	141
France	33	109	206	98	124	42	30
Ireland	0	1	4	4	25	13	13P
Portugal	7,529	9,631	7,106	7,480	9,823	11,652	9,094
Scotland	88	35	13	5	6	3	7
Spain	4,626	6,193	5,269	5,447	5,972	5,826	5,568
Total	12,366	16,077	12,732	13,270	16,250	17,781	14,906P

P: Provisional data.

3. CURRENT STATUS OF DATA, METHODOLOGY AND RESULTS AVAILABLE FOR STOCK ASSESSMENT OF FISHED CEPHALOPODS, INCLUDING INFORMATION ON STOCK IDENTITY, FISHING EFFORT AND DISCARDS (TOR b)

3.1 Compilation of Data

In this section, members of the Working Group contributed information on the nature of the fished cephalopod stocks, status of fisheries, data available for use in stock assessment. Where stock assessments have been previously attempted, this was noted. These points are summarised in Tables 7–11 at the end of this Section. It is intended to expand these tables and add those for other species and countries during subsequent meetings.

3.2 General Remarks on Stock Assessment for Fished Cephalopods

Cephalopod biology has several distinctive features which render many traditional approaches to stock assessment inappropriate. Thus VPA and similar methods cannot easily be used due to the short life-cycle (usually one year) and generally semelparous breeding strategy: each year's fishery takes a different generation of animals. Production models are usually unsuitable because unfished stock biomasses vary greatly from year to year. Individual growth rates and population abundance are thought to be strongly linked to environmental conditions: growth is very rapid and populations are not buffered by the presence of more than one generation.

3.3 Depletion Methods

Of the range of stock assessment methods previously used for cephalopods (see ICES, 1993; Pierce & Guerra, 1994), depletion methods are among the most promising. General requirements for application of the method are that the stock should show a decline due to mortality after reaching a peak (implying a degree of synchronisation in the life-cycle) and that data of appropriate temporal resolution are available throughout the period of the fishery. It also requires an abundance index. Landings from loliginid and cuttlefish fisheries typically show the kind of annual cycle which could be suitable for application of depletion methods. It is presently less clear whether octopod fisheries (in which landings sometimes remain at a similar level all year) or ommastrephid (short-finned squid) fisheries are amenable to these methods.

3.4 CEDA

Depletion assessment is available as a software package, CEDA (Catch and Effort Data Analaysis; MRAG, 1995), originally developed for squid fisheries in the SW Atlantic. It requires the following input data: total landings (weight, all fleets), mean body size (weight), an abundance index (e.g. landings and effort from one fleet), a recruitment index (which must be proportional to the number of recruits in the sea) and natural mortality (M). If fishery LPUE from a fleet is used as an abundance index in this software, it is obviously important that landings reflect catches and that LPUE is related to abundance.

It is important to note that CEDA estimates the number of post-recruit squid at the peak of the fishery; it tells us nothing about paralarvae and pre-recruits (nor does it use such data). It can provide only retrospective assessment unless data are collected and analysed in real time. Many cephalopods are caught mainly in by-catch fisheries for which quotas or effort limits for cephalopods could not easily be set without interfering with the target fishery. However, there are important, directed, coastal artisanal fisheries (e.g. in Spain and Portugal) for loliginid squid, *Sepia officinalis* and, particularly, *Octopus vulgaris*. The main obstacle to depletion assessment of these fisheries is the current lack of reliable fishery data, particularly on effort.

CEDA is available from MRAG and comes with a good manual. Data entry is reasonably user-friendly. Evaluation of output uses partially subjective criteria (e.g. visual inspection of goodness of fit of residuals). The results are very sensitive to the value of M and, in the absence of real data on M, results should be considered to provide relative indices only, suitable for comparison of areas or years. Natural mortality is assumed to be constant month-to-month, which is unrealistic for terminal spawners who spawn and die during the fishing season. Estimates of M may be derived from the literature or empirical equations developed by Pauly (1985; see Pierce *et al.*, 1996).

Natural mortality could be allowed to vary, and the validity of input values tested, by formulating the depletion model within purpose-written software (i.e. independent of CEDA). If the number of cephalopods (post-recruit) assumed to be eaten by predators is included as an input parameter or output from the model, its relationship to the value of M may be evaluated. Values which are less than the number of cephalopods independently estimated to have been eaten by predators (or more than the initial stock size) are usually wrong! Estimates of numbers of cephalopods eaten may be crudely calculated by multiplying proportion in the diet, daily ration, population size and the number of days in the period studied (see Pierce & Santos, 1996).

3.5 Other Approaches

Directed or groundfish surveys can provide useful abundance indices. Thus surveys are regularly used to estimate abundance of *Todarodes pacificus* off Japan (Murata, 1989). In UK waters, Scottish Office trawl surveys have been shown to produce abundance indices correlated with fishery abundance of *Loligo* spp. (Pierce *et al.*, 1998). It should be noted that, although the correlations were significant, the predictive power of the relationships was weak.

An alternative is the use of empirical models relating cephalopod abundance to environmental parameters, e.g. sea temperature (Caddy, 1983; Fogarty, 1989). Recent work has linked abundance of *Loligo* spp. to sea surface temperature in the North Sea and English Channel (Pierce, 1995; Robin & Denis, submitted; Pierce & Boyle, In Prep).

3.6 Priorities for Data Collection

Discard data

The only discard programmes for cephalopods are taking place under current projects in certain ports in Scotland, France, Spain and Portugal. Although loliginids and Sepia are probably rarely discarded, octopods and ommastrephids are known to be discarded in at least some circumstances. Without discard data, the relationship between landings and catches remains unknown. Discard data are being recorded by a current EC-funded project based at the University of the Algarve. Shrimp fisheries in the Waddensea are known to discard substantial amounts of cephalopods, e.g. *Alloteuthis* (Piatkowski, pers. comm.).

Species discrimination

Most cephalopod fisheries are mixed species fisheries. Landings are reported for the group of species. Market sampling to determine species composition currently takes place only under current EC-funded projects (as for the discard sampling). Published data are available for loliginid fisheries in the English Channel (Robin & Boucaud-Camou, 1993, 1995). Resolution of species composition is important for the application of depletion models since the timing of the life-cycle (and hence the cycle of fishery abundance) varies between species.

Natural mortality

If depletion methods are to produce reliable absolute (as opposed to relative) abundance estimates, natural mortality must be known. Information on the amount of cephalopods removed by predators can also assist in formulation of management based on the "precautionary approach". Thus fisheries must leave sufficient cephalopods to sustain predator stocks. This is the basis for setting preliminary quotas in the new *Martialia* fishery in the SW Atlantic.

Catchability

Data on catchability are needed to assess the reliabaility of LPUE data as an abundance index. Although many cephalopods are landed as a by-catch of trawls, little is known about catchability. Hastie (1996) describes results on gear selectivity from Scottish trawl surveys. Catchability may be expected to relate to towing speed (e.g., underwater video recordings by the Marine Laboratory Aberdeen show loliginid squid maintaining position in the net by active swimming) and water temperature.

3.7 Preliminary Assessments

An attempt was made to determine whether depletion assessment methods are suitable for cephalopods in the ICES area based upon CEDA, a software package developed to analyze catch effort data in short-lived species, such as *Illex argentinus*.

Commercial fishery data concerning *Loligo* spp. in Portuguese waters (e.g. effort, catches, landings, CPUE and mean individual weight per fleet) were gathered from 1991-1993 on a monthly basis. Two fishing seasons from consecutive years, during which there was a decrease in CPUE, were selected for this purpose.

The preliminary results showed that the model could be fitted to the available data, using published estimates for natural mortality and assuming no recruitment during the main period of the fishery. The fit might be improved, e.g. by including a recruitment index. This is consistent with results from previous attempts to fit such models using UK and French data.

Thus the depletion method can be a useful tool for cephalopod assessment. Further analysis of historical data may reveal spatial and temporal trends in abundance. Although this exercise used historical data the results could be used as a basis for management if assessments were carried out in real time.

Table 7 Loliginids and octopods in Scottish waters

	Loliginids in Scottish waters	Octopods in Scottish waters
DEFINITION OF STOCK		
Species composition (species which are not distinguished in landings statistics)	Mainly Lf, some Lv in the south. Small amounts of As may also be landed and occasionally Te, Ts or Ic may be mixed in with loliginids.	Mainly Ec in the North, possibly some Ov in the south
Approximate boundaries	ICES areas IV a,b,c V b, VIa,b.	-
Data on genetic structure	Lf genetically identical throughout Continental shelf (Brieley *et al*, 1995), some microsatellite evidence of separate offshore stock (Paul Shaw, University of Hull, pers. comm.)	No data
Distribution and movements	Movements around UK can be inferred from distribution of catches - squid seem to move into N. Sea from west coast of Scotland and English Channel. Note: *Loligo* thought not to live in deep water (>200m).	No data
Pragmatic considerations	The ICES fishery subdivisions are convenient units. Movements of squid between areas may necessitate aggregation into larger areas. Rockall should be kept separate.	No data
DESCRIPTION OF FISHERIES ON STOCK		
Nations involved	Scotland, England (including Wales and N. Ireland), French, also Belgium, Holland, Denmark, Spain)	Scotland, England (including Wales and N. Ireland), French, also Belgium, Holland, Denmark, Spain)
Type of fishery	By-catch	By-catch. Not always landed.
Gears	Demersal trawls and seines (mainly)	Demersal trawls and seines (mainly)
Size of vessels	Mainly small trawlers	Mainly small trawlers
Number of vessels		
Operational range	Coastal waters, some to Rockall and Faroe. Typically go to sea 1-7 days	Coastal waters, some to Rockall and Faroe. Typically go to sea 1-7 days
Season	All year round in coastal waters, landings peaking in winter; fishing at Rockall mostly in summer	Landed all year round
By-catch spp.	N/A	N/A
Legislation	Minimum landing size of 10 mm ML applies in theory	None

Table 7 (continued) Loliginids and octopods in Scottish waters.

	Loliginids in Scottish waters	Octopods in Scottish waters
FISHERY TRENDS		
Interannual (Landings, Effort, LPUE)	Big interannual fluctuations in landings and LPUE against a background of quite consistent effort. Peak landings in 1989	Not analysed
Seasonal (Landings, Effort, LPUE)	In coastal waters, regular seasonal peak in September-December, summer (May-August) peak at Rockall	Not analysed
DATA FOR ASSESSMENT		
Fishery data: collection / quality control	From logbooks and markets, screened and corrected data ultimately entered into FRS database. Some misreporting of areas known to occur, squid sometimes recorded under "other" species	From logbooks and markets, screened and corrected data ultimately entered into FRS database.
Fishery data: spatial and temporal resolution	Monthly, by ICES rectangle, by gear	Monthly, by ICES rectangle, by gear
Fishery data: access	FRS database, Aberdeen	FRS database, Aberdeen
On-board observers	Planned as part of current project	Planned as part of current project
Market sampling programmes	Some market sampling since 1995 (also within project)	None
Discard data	Recorded in Scottish discard sampling since 1998 (University of Aberdeen project), thought to be little discarding	Recorded in Scottish discard sampling since 1998 (University of Aberdeen project), thought to be little discarding
Survey data (groundfish, acoustic, jigging, pre-recruit, plankton	Length-frequencies recorded in all Scottish trawl surveys (1974 onwards at least). Recent English surveys also record cephalopods. Paralarvae (few) retrospectively extracted from plankton hauls	No data
Length-frequency and recruitment	Data collected in Scotland under current project	No data
Species composition	Samples from Scottish markets rarely contain Lv	No data; thought to be mainly Ec
Natural mortality data	Some data available on incidence in diets of marine mammals (M.B. Santos, unpubl. data; Pierce & Santos, 1996)	No data
ASSESSMENT		
Fishery-independent: surveys	Survey data analysed by Pierce *et al.* (1998)	No assessment
Analytical approaches	De Lury depletion method using CEDA package attempted for 1989-94 data (Pierce *et al.*, 1996)	No assessment
Other	Forecasting from temperature (Pierce, 1995, Robin & Denis, submitted; Pierce & Boyle, In Prep.). Analysis based on GIS in progress under current projects	No assessment

Table 8 Loliginids and Octopods in Portuguese waters

	Loliginids in Portuguese waters	Octopods in Portuguese waters
DEFINITION OF STOCK		
Species composition (species which are not distinguished in landings statistics)	Lf, Lv, As, Am (less common)	Ov, Ec, Em
Approximate boundaries	ICES Areas VIII, IX, X	ICES Areas VIII, IX, X
Data on genetic structure	Lf on the coast identical to that further North (Brierley *et al.*, 1995). In the Azores Lf is probably a separate sub-species (Brierley *et al.*, 1995)	No data on coastal stocks. Two populations distinguished morphometrically in (Cunha & Pereira, 1995)
Distribution and movements	On the mainland coast, Lv is found closer inshore than Lf. Lv shows major concentrations in the North and South – less in between. Lf is less common further south and currently (1997) very scarce from the mainland coast.	Occurs all along the mainland coast: Ov inshore, Ec offshore, Em inshore, only in south. Sedentary as adults, paralarvae of Ov planktonic
Pragmatic considerations	Separate west Portugal plus Galicia (mixed Lf and Lv) from south Portugal and Cadiz (only Lv). Treat the Azores separately.	The ICES fishery sub-divisions are convenient units. Azores kept separate.
DESCRIPTION OF FISHERIES ON STOCK		
Nations involved	Portugal, Spain	Portugal, Spain
Type of fishery	By-catch (trawl, purse seine and some artisanal gears) and directed (jigs). Hand jigs in the Azores	By-catch (trawl) and directed (pots, traps and sometimes trawl)
Gears	trawl, purse seine, artisanal gears (hand jigs, nets)	Mainly caught by trawls in North and traps in North and South. Only 10% of catches come from trawling. In Azores, mostly taken by scuba divers
Size of vessels	Mean trawler length = 31 m; a third of artisanal vessels with lengths <5 m, half between 5 and 15m and the remainder >15 m. Small vessels in the Azores.	Mean trawler length = 31 m; a third of artisanal vessels with lengths <5 m, half between 5 and 15m and the remainder >15 m.
Number of vessels	Mainland: 105 trawlers (mean between 1990 and 1993), 9172 artisanal vessels in 1995.	Mainland: 105 trawlers (mean between 1990 and 1993), 9172 artisanal vessels in 1995.
Operational range	Whole coast, all year for every fleet	Whole coast, all year for every fleet
Season	Trawling all year but most catches in autumn (Sep-Dec)	Throughout the year, highest Jan-July
By-catch spp.	None in the jig fishery	None in fishery with pots
Legislation	Min. size = 10 cm ML. No trawling is allowed within 6 miles of coast.	No trawling is allowed within 6 miles of coast. Min. weight = 750g.
FISHERY TRENDS		
Interannual (Landings, Effort, LPUE)	Landings very variable (lowest in 1994, highest in 1991). Trawling effort variable, with a peak in 1988 and another in 1993. The number of trawlers taking loliginids decreased since 1992. The number of jigs increased from 1993 to 1995.	Landings: increasing trend for all gears since 1960. Licences for traps increasing '93-'95. The number of vessels taking the species has decreased continuously from 1992, with some small fluctuations in the artisanal and purse-seine fleets.
Seasonal (Landings, Effort, LPUE)	One peak in landings (Sep-Dec). One peak in LPUE (Oct-Dec) except in years of low LPUE (which show variable patterns)	Highest landings Jan-July, sometimes into autumn as well. Higher LPUE in April-May, sometimes in Autumn as well.

Table 8 (continued) Loliginids and octopods in Portuguese coastal waters

	Loliginids in Portuguese waters	Octopods in Portuguese waters
DATA FOR ASSESSMENT		
Fishery data: collection / quality control	Landings data from markets is screened and entered into the DGP (official) database. Some errors in assigning names of categories in the market. After further screening, data entered into IPIMAR database. Fishing effort from sample of trawl fishery (hours fishing, since 1988), and number of licences for all fleets.	Landings data from markets is screened and entered into the DGP (official) database. Some errors in assigning names of categories in the market. After further screening, data entered into IPIMAR database. Fishing effort from sample of trawl fishery (hours fishing, since 1988), and number of licences for all fleets. In the Algarve, observers provide independent data
Fishery data: spatial and temporal resolution	Annual and monthly landings by gear type and trawl effort (1986-present), reported by port, assigned to ICES rectangle (trawl fishery - from sample of log books and corrections taking account of known species distribution and legal fishery restrictions; artisanal fishery - assume catches taken nearby).	Annual and monthly landings by gear type and trawl effort (1986-present), reported by port, assigned to ICES rectangle (trawl fishery - from sample of log books and corrections taking account of known species distribution and legal fishery restrictions; artisanal fishery - assume catches taken nearby).
Fishery data: access	DGP and IPIMAR databases. Azores data held at DOP, Azores	DGP and IPIMAR databases
On-board observers	Since 1996 in Algarve, for discards project	Currently in the Algarve
Market sampling programmes	Market sampling since 1980 for biological data	Since 1980. In the Algarve recently under current project.
Discard data	Discard data collected by current discards project, since 1996 in the Algarve	On-board observers for discards in the Algarve
Survey data (groundfish, acoustic, jigging, pre-recruit, plankton	Groundfish surveys provide data on distribution of loliginids and biological data; twice per year since 1980	Cruises south of Lisbon ran 1990-95 twice a year
Length-frequency and recruitment	Market sampling: length-frequency data since 1980, reproductive data from 1990	Length-frequency data for the whole coast since 1980. Biological data available from West coast sampling since 1997, also from on board observers and markets in the Algarve under current project
Species composition	No data on proportions of species in landings but could be obtained from survey data	Monthly sampling at market to identify % of each species. Most artisanal landings are Ov.
Natural mortality data	Stomach contents of fish analysed from crustacean trawls in the Algarve	Stomach contents of fish analysed from crustacean trawls in the Algarve
ASSESSMENT		
Fishery-independent: surveys	No assessment	No assessment
Analytical approaches	Data are suitable for use of depletion methods. Preliminary assessment using CEDA carried out during WG meeting	No assessment
Other	No assessment	No assessment

Table 9 Cuttlefish and ommastrephid squid in Portuguese waters

	Cuttlefish in Portuguese waters	Ommastrephids in Portugal
DEFINITION OF STOCK		
Species composition (species which are not distinguished in landings statistics)	Mainly So but small animals taken can be a mix of So, Se, Sr	The most common is Ic. Te is also caught, Ts more rarely. The proportions of Ic and Te change from year to year
Approximate boundaries	Areas VIII, IXa	Areas VIII, IXa
Data on genetic structure	No data	No data
Distribution and movements	Inshore species mainly, big ones offshore, extend into brackish estuarine waters. In Algarve, possible inshore migration of So into rias for reproduction, e.g. Ria Formosa by Faro	Offshore species, Te more inshore than Ic. Both more abundant in NW coast.
Pragmatic considerations	N/A	N/A
DESCRIPTION OF FISHERIES ON STOCK		
Nations involved	Portugal	Portugal, Spain
Type of fishery	By-catch and directed artisanal	By-catch only
Gears	Trawl, purse seine and (mainly) artisanal (traps, nets)	Trawl and gillnets
Size of vessels	Mean trawler length = 31 m; a third of artisanal vessels with lengths less than 5 m, half between 5 and 15m and the remainder >15 m	Mean trawler length = 31 m; a third of artisanal vessels with lengths less than 5 m, half between 5 and 15m and the remainder >15 m
Number of vessels	105 trawlers (mean between 1990 and 1993), 9172 artisanal vessels in 1995.	105 trawlers (mean between 1990 and 1993), 9172 artisanal vessels in 1995.
Operational range	Whole coast, all year for every fleet and also in estuaries	Whole coast, all year for every fleet
Season	Higher in Feb-May	Higher Nov.-April
By-catch spp.	N/A	N/A
Legislation	Minimum ML = 10 cm	None
FISHERY TRENDS		
Interannual (Landings, Effort, LPUE)	Relatively constant from year to year	Irregular, decreasing landings in recent years
Seasonal (Landings, Effort, LPUE)	Landings peak Nov-June	Landings peak Nov-Apr
DATA FOR ASSESSMENT		
Fishery data: collection / quality control	Fishery data as for other cephalopods in Portugal	fishery data as for other cephalopods in Portugal
Fishery data: spatial and temporal resolution	Fishery data as for other cephalopods in Portugal	fishery data as for other cephalopods in Portugal
Fishery data: access	DGP and IPIMAR databases	DGP and IPIMAR databases
On-board observers	Currently in the Algarve	Currently in the Algarve
Market sampling programmes	Monthly length-frequency in several markets since 1980	Monthly length-frequency in several markets since 1980
Discard data	On board observers for discards in the Algarve	Ommastrephids are discarded by trawlers, crustacean trawlers especially, on board observer for discards in the Algarve
Survey data (groundfish, acoustic, jigging, pre-recruit, plankton	Cruises S of Lisbon ran 1990-95 twice a year. (Reproductive data collected in groundfish surveys and on-board observers)	Groundfish surveys twice per year since 1980

Table 9 (continued) Cuttlefish and ommastrephid squid in Portuguese waters

Length-frequency and recruitment	Monthly length-frequency collected in market samples since 1980	Monthly length-frequency collected in market samples since 1980
Species composition	No data on proportion of species in landings. Mainly So	No data on proportion of species in landings. Could be obtained from survey data.
	Cuttlefish in Portuguese waters	Ommastrephids in Portugal
DATA FOR ASSESSMENT		
Natural mortality data	Stomach contents of fish analysed from crustacean trawls in the Algarve	Stomach contents of fish analysed from crustacean trawls in the Algarve
ASSESSMENT		
Fishery-independent: surveys	No assessment	No assessment
Analytical approaches	No assessment	No assessment
Other	No assessment	No assessment

Table 10 Loliginids and octopods in the Gulf of Cadiz

	Loliginids in Gulf of Cadiz	Octopods in Gulf of Cadiz
DEFINITION OF STOCK		
Species composition (species which are not distinguished in landings statistics)	Lv, As, Am. Note: Lv is distinguished from *Alloteuthis* spp.	Ov, Ec, Em. Ov is the most important cephalopod species for fisheries in the area. Note: Ov is distinguished from *Eledone* spp.
Approximate boundaries	IX (Gulf of Cadiz)	IX (Gulf of Cadiz)
Data on genetic structure	No data	No data
Distribution and movements	Data exist on depth distribution from surveys	Data exist on depth distribution from surveys. Abundance in Cadiz declining 1994-97 (increasing in Galicia)
Pragmatic considerations	Could be combined with adjacent Portuguese waters	Could be combined with adjacent Portuguese waters
DESCRIPTION OF FISHERIES ON STOCK		
Nations involved	Spain	Spain
Type of fishery	Mainly by-catch of trawling	By-catch and artisanal. Some trawlers occasionally target octopus.
Gears	Trawl	Trawl, artisanal gears (hand jig, clay pot, trap).Trawling is more important.
Size of vessels	Average size of trawlers: GTR 25, length 14 m	Average size of trawlers: GTR 25, length 14 m. Artisanal boats on average have GTR 5, length 7 m
Number of vessels	273 trawlers	273 trawlers, 892 artisanal boats
Operational range	Spanish waters of Gulf of Cadiz	Spanish waters of Gulf of Cadiz
Season	All year, main catches in August to January	Trawl landings quite constant through the year, artisanal landings highest Nov-Mar
By-catch spp.	N/A	N/A

Table 10 (continued) Loliginids and octopods in the Gulf of Cadiz.

Legislation	Minimum landing size 10 cm ML for Lv	Minimum landing size 1 Kg for Ov
	Loliginids in Gulf of Cadiz	Octopods in Gulf of Cadiz
FISHERY TRENDS		
Interannual (Landings, Effort, LPUE)	LPUE quite consistent over 1993-97. Effort and catches were higher in 1993. Artisanal catches quite consistent (146-236 tonnes) during 1993-97.	LPUE high 1993-95 then declined drastically in 1996-97, artisanal landings also descreased 1996-97. Total landings all fleets 2763 tonnes in 1994, 319 tonnes in 1997. No effort data for artisanal fleet
Seasonal (Landings, Effort, LPUE)	Peak of LPUE in Aug-Jan	Data not available at meeting
DATA FOR ASSESSMENT		
Fishery data: collection / quality control	Managed by IEO	Managed by IEO
Fishery data: spatial and temporal resolution	Landings data available by month, by port, by fleet. Effort data for trawlers available on same basis but no effort data for the artisanal fleet. Since 1993, *Loligo* from *Alloteuthis*.	Landings data available by month, by port, by fleet. Effort data for trawlers available on same basis but no effort data for the artisanal fleet. Since 1993 Ov and *Eledone* data have been collected separately.
Fishery data: access	IEO database	IEO database
On-board observers	Programme starting	Programme starting
Market sampling programmes	Since 1993 used to separate species (as above)	Length-frequency data collected and Ov distinguished from *Eledone*
Discard data	One year's data from a project	One year's data from a project
Survey data (groundfish, acoustic, jigging, pre-recruit, plankton	Numerical and biomass indices available since 1993, usually 1 or 2 surveys per year (8 surveys since 1993), 30 hauls per survey. Some data on all cephalopods.	Numerical and biomass indices available since 1993, usually 1 or 2 surveys per year (8 surveys since 1993), 30 hauls per survey. Length data for Ov, Ec, Em
Length-frequency and recruitment	No data	Length-frequency from market sampling and surveys
Species composition	*Loligo* and *Alloteuthis* separated	Ov and *Eledone* separated
Natural mortality data	No data	No data
ASSESSMENT		
Fishery-independent: surveys	No assessment	No assessment
Analytical approaches	No assessment	No assessment
Other	No assessment	No assessment

Table 11 Cuttlefish and ommastrephids in the Gulf of Cadiz.

	Cuttlefish in Gulf of Cadiz	Ommastrephids in Cadiz
DEFINITION OF STOCK		
Species composition (species which are not distinguished in landings statistics)	So, Se Note: So and Se are distinguished	Ic, Te (Ts appears in surveys)
Approximate boundaries	Area IXa	Area IXa
Data on genetic structure	No data	No data
Distribution and movements	Survey data exist	Survey data exist
Pragmatic considerations	Could be combined with adjacent Portuguese waters	Could be combined with adjacent Portuguese waters
DESCRIPTION OF FISHERIES ON STOCK		
Nations involved	Spain	Spain
Type of fishery	By-catch and artisanal	By-catch only
Gears	Trawl, artisanal gears. Trawlers occasionally target *Sepia*.	Trawl
Size of vessels	Average size of boats: GTR 25, length 14 m, artisanal boats on average have GTR 5, length 7 m	Average size of boats: GTR 25, length 14 m
Number of vessels	273 trawlers, 892 artisanal boats	273 trawlers
Operational range	Spanish waters of Gulf of Cadiz	Spanish waters of Gulf of Cadiz
Season	No data	No data
By-catch spp.	N/A	N/A
Legislation	Minimum landing sizes: So 8 cm ML, Se 4 cm ML	None
FISHERY TRENDS		
Interannual (Landings, Effort, LPUE)	LPUE quite consistent year to year in trawl fleet. Artisanal landings also consistent: 630-826 tonnes per year 1993-97	No data on trends
Seasonal (Landings, Effort, LPUE)	Catches highest Oct-Mar	No data
DATA FOR ASSESSMENT		
Fishery data: collection / quality control	Managed by IEO	Managed by IEO
Fishery data: spatial and temporal resolution	Landings data available by month, by port, by fleet. Effort data for trawlers available on same basis but no effort data for the artisanal fleet. So separated from Se/Sr	Landings data available by month, by port, by fleet. Effort data for trawlers available on same basis but no effort data for the artisanal fleet.
Fishery data: access	IEO database	IEO database
On-board observers	One year, during a project	One year, during a project
Market sampling programmes	None	None
Discard data	One year, during a project	One year, during a project

Table 11 (continued) Cuttlefish and ommastrephids in the Gulf of Cadiz.

	Cuttlefish in Gulf of Cadiz	Ommastrephids in Cadiz
DATA FOR ASSESSMENT		
Survey data (groundfish, acoustic, jigging, pre-recruit, plankton	Numerical and biomass indices available since 1993, usually 1 or 2 surveys per year (8 surveys since 1993), 30 hauls per survey. Length data for So	Numerical and biomass indices available since 1993, usually 1 or 2 surveys per year (8 surveys since 1993), 30 hauls per survey. Some data on all cephalopods.
Length-frequency and recruitment	From survey data	No data
Species composition	So and Se are separated	No data
Natural mortality data	No data	No data
ASSESSMENT		
Fishery-independent: surveys	No assessment	No assessment
Analytical approaches	No assessment	No assessment
Other	No assessment	No assessment

(Species key: Lf *Loligo forbesi*, Lv *Loligo vulgaris*, As *Alloteuthis subulata*, Am *Alloteuthis media*, Ic *Illex coindetii*, Te *Todaropsis eblanae*, Ts *Todarodes sagittatus*, Ov *Octopus vulgaris*, Ec *Eledone cirrhosa*, Em *Eledone moschata*, So *Sepia officinalis*, Se *Sepia elegans*, Sr *Sepia orbignyana*)

4. REVIEW OF GREY LITERATURE IMPORTANT TO CEPHALOPOD FISHERIES (TOR c)

4.1 Available Sources and Further Action

Due to the great amount of grey literature already found and the perspective great interest of the subject, the WGCEPH decided to develop a database which would be made available to all cephalopod workers.

The categories to be included in the database:

International Fisheries Organisations

Includes literature published by International Fisheries Organisations such as

- Food and Agriculture Organisation (FAO);
- International Council for the Exploration of the Sea (ICES);
- North Atlantic Fisheries Organisation (NAFO);
- Commitee for the East Central Atlantic Fisheries (CECAF);
- International Council for the South East Atlantic Fisheries (ICSEAF);
- Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
- etc.

Institution Reports

Includes reports published by national research institutions but available upon request; e.g. "Relatórios Técnicos e Científicos" - IPIMAR, Portugal; "Informes Técnicos del Instituto Español de Oceanografía" - IEO, Spain; "Scottish Fisheries Working Papers" - Fisheries Research Services Marine Laboratory (Scottish Office Agriculture, Environment and Fisheries Department), UK.

Small and local journals

Journals published (and sometimes refereed), with a small circulation and not easily available; e.g. Açoreana - Portugal; Boletim do Instituto Português de Investigação Marítima - Portugal; Shetland Naturalist - UK; Boletín del Instituto Español de Oceanografía - Spain.

Theses and "final year" reports

Student theses for first, masters and doctorate degrees

Research Project Reports

Final reports from research projects financed by international or national organisations or institutions (e.g. FAIR, AIR, MAST - E.U.; PRAXIS XXI - Portugal)

Research cruise reports

Reports of data gathered in national or international research cruises

Popular articles

Articles published in journals, magazines, newspapers, etc., intended for the general public (e.g. National Geographic Magazine, Géo, Scientific American).

Addresses of contact institutions

Addresses of entities holding copies of the publications and which may provide reprints or copies of the literature.

5. PREPARATIONS FOR 1998 ANNUAL SCIENCE CONFERENCE THEME SESSION ON "IMPACT OF CEPHALOPODS IN THE FOOD CHAIN AND THEIR INTERACTION WITH THE ENVIRONMENT" (TOR d)

The Theme Session was been widely announced among the cephalopod researchers worldwide and a great response is expected. Two members of WGCEPH, Uwe Piatkowski (Germany) and Manuela Morais da Cunha (Portugal) will act as co-convenors of the session. The majority of the WGCEPH members has already confirmed to attend the meeting which will result in the major science conference of cephalopod workers in 1998.

6. ANY OTHER BUSINESS

6.1 New Chairmanship

A new ICES resolution says that the chairmanship of ICES Working and Study Groups ends after a term of three years. This means that WGCEPH needs a new chairman to be nominated at the end of 1998, because the old chairman (Uwe Piatkowski) chairs the Group and its precursing Study Group already since 1990. There is great agreement within the present WGCEPH to nominate Dr. Graham Pierce from Aberdeen (Scotland) as the new chairman! Dr. Pierce agreed to take this position if he will be nominated.

6.2 Comments on Working Group Function

With the availability of pre-prepared Working Group papers, WGCEPH has found a working form which has substantially enhanced the efficiency of the annual meetings. Furthermore, examination of special topics have been provided by WGCEPH sub-groups as presentations at recent ICES Annual Science Conferences. The possibility to communicate by e-mail with most members has greatly simplified administration and coordination of the Working Group. However, some countries (e.g. France, Ireland) still don't have appointed members with sufficient responsibility to supply relevant information for the Working Group's Terms of Reference. Also, the engagement by French and U.S. members in the recent Working Group activities is still on the low side.

The meeting also notes that many important data sets are not readily available, e.g. due to high costs of data purchase. This definitely hampers the work of the Group.

7. RECOMMENDATIONS

The attendance at the 1998 Working Group meeting was lower than in previous years. This was mainly due to several EEC project meetings which took place shortly before the WGCEPH meeting. For the next year a better timing of cephalopd research related meetings should be achieved. It became obvious that the next meeting should be scheduled again at the same venue and close to the current EEC Eurosquid annual meeting to assure sufficient attendance and, more important, to save travel funds for the participants who are both members of the EEC project and the Working Group.

Therefore, WGCEPH suggests to have its next meeting in Heraklion, Greece from 7–9 April 1999 in close conjunction with the 1999 meeting of the Eurosquid project. Concerning the Terms of Reference for 1999, WGCEPH recommends:

a) to update currently available landing statistics;

b) to continue the review of the current status of data, methodology and results available for stock assessment of fished cephalopods, including information on stock identity, fishing effort and discards;

c) to report on national and transnational projects which are important for data collection and assessment of fished cephalopods;

d) to develop a bibliographic database of literature, in particular grey literature, which is of importance to cephalopod fisheries.

Further, it was discussed that fishery forecasting using environmental data may be an interesting proposal for the future.

8. CLOSING OF THE MEETING

The chairman thanked the Working Group participants for the coming and the very efficient work during the meeting. He closed the meeting at 19:30 hrs on 17 April 1998.

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ANNEX 1

WGCEPH MEETING, 15–17 APRIL 1998 IN KIEL, GERMANY

AGENDA

1. Opening of the Meeting

2. Introduction

3. Adoption of 1997 Report

4. Report of the Chairman

5. Terms of Reference

5.1 Cephalopod Landing Statistics

5.2 Current Status of Data, Methodology and Results Available for Stock Assessment of Fished Cephalopods

5.3 Review of Grey Literature Important to Cephalopod Fisheries

5.4 1998 ASC Theme Session on "Impact of Cephalopods in the Food Chain and Their Interaction with the Environment"

6. Other Business

7. Recommendations

8. Closing of the Meeting

ANNEX 2

WGCEPH MEETING, 15–17 APRIL 1998 IN KIEL, GERMANY

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ANNEX 3

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ANNEX 4

WGCEPH MEETING, 15–17 APRIL 1998 IN KIEL

INFORMATION ON CEPHALOPOD DISCARD IN THE SOUTH PORTUGUESE FISHERIES

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Table 1. Cephalopod species discarded and their classification by frequency of rejection. 1 occasional; 2 frequent; 3 regular. A crustacean trawl; B fish trawl; C demersal purse-seine; E trammel net.

FAMILY	SPECIES	TRAWL		PURSE-SEINE		ARTISANAL
		A	B	C	D	E
Enoploteuthidae	*Abralia veranyi*	3				
Sepiidae	*Sepia elegans*	3	3			
	Sepia officinalis			2	2	2
	Sepia orbignyana	3	3			
Sepiolidae	*Rossia macrosoma*	3	3			
	Sepietta neglecta	3	3			
	Sepietta obscura		3	3		
	Sepiola robusta			3		
	Sepiola spp.	3				
Loliginidae	*Alloteuthis spp.*	3	3	3	3	
	Alloteuthis media	3	3	3		
	Loligo vulgaris		2	2	2	
Ommastrephidae	*Illex coindetii*	3	3			
	Todaropsis eblanae	3	3			
Octopodidae	*Eledone cirrhosa*	3	3			
	Eledone moschata	3	3			
	Octopus salutii	3	3	3		
	Octopus vulgaris	2		2	2	
	Scaeurgus unicirrhus	3	3			

Table 2. Number (n), mean mantle length (x), maximum (Max) and minimum (Min) size of the cephalopod specimens discarded in the south Portuguese coast.

FAMILY	SPECIES	n	x (cm)	Max (cm)	Min (cm)
Enoploteuthidae	*Abralia veranyi*	1	3,9	3,9	3,9
Sepiidae	*Sepia elegans*	48	4,9	6,0	3,6
	Sepia officinalis	5	8,3	12,1	4,9
	Sepia orbignyana	8	5,4	6,9	4,1
Sepiolidae	*Rossia macrosoma*	60	5,1	8,1	2,4
	Sepietta neglecta	4	2,5	3,0	1,5
	Sepietta obscura	2	2,5	3,0	1,9
	Sepiola robusta	1	2,1	2,1	2,1
	Sepiola spp.	1	2,2	2,2	2,2
Loliginidae	*Alloteuthis* spp.	12	7,6	10,4	4,3
	Alloteuthis media	7	6,6	7,5	5,7
	Loligo vulgaris	10	7,2	19,5	3,7
Ommastrephidae	*Illex coindetii*	197	14,0	26,5	7,0
	Todaropsis eblanae	46	11,0	17,6	4,6
Octopodidae	*Eledone cirrhosa*	26	10,9	13,3	7,9
	Eledone moschata	15	9,4	12,7	4,1
	Octopus salutii	21	11,0	15,5	5,4
	Octopus vulgaris	3	9,2	10,7	7,0
	Scaeurgus unicirrhus	6	7,0	10,3	4,6

ANNEX 5

Ana Moreno, Manuela Morais da Cunha and João Pereira
WGCEPH, 15–17 April 1998 Kiel, Germany
Working Document

Review of the Portuguese fisheries: fishery trends and data available for stock assessment of fished cephalopods

Some portuguese cephalopod species, such as *Octopus vulgaris* and *Loligo* spp., have stirred national political interest due to their increasing commercial value thus being in position to become a target to stock assessment and management decisions in a near future.

The cephalopod research unit from IPIMAR has not yet performed any form of stock assessment with any of the species, although available data have been gathered with that purpose in mind.

1. DESCRIPTION OF FISHERIES ON STOCKS

1.1. Portuguese fleet – general features

The Portuguese fishery in Division IXa, is carried out by a trawl fleet, an artisanal (or multi-purpose) fleet and a purse-seine fleet. The total number of Portuguese trawlers, catching demersal fish and crustaceans, decreased from 148 to 114 vessels, between 1991 and 1995. The total number of vessels of the artisanal fleet decreased from 11467 vessels in 1991 to 9172 vessels in 1995. The purse-seine fleet comprised 257 vessels in 1993.

The demersal fish trawl fleet operates along the whole Portuguese coast, throughout the year. This fleet target particularly horse-mackerel and hake, which are also the most important catches, resulting in 39.2% and 3.2% of the overall landings, respectively. The crustacean trawl fleet (35 vessels average, between 1989 and 1993) operates mainly in the Southwest and south coast between depths of 200 and 750 m, throughout the year. This fleet operates with a 55 mm mesh size, and despite its name, catches mainly anglerfish (13.4%) and hake (10.4%).

Part of the artisanal fleet operates in coastal waters and part in offshore waters. The vessels are licensed to use several types of fishing gear throughout the year. The smaller vessels are not compelled to fill up logbooks. The artisanal fleet, as a whole, catches a large variety of species from which octopus, hake, anglerfish and pouting are the most important economically.

Purse-seiners fully operate from March to December and have only 30% of activity in January and February. Sardine accounts for 79% of the landings, horse mackerel 6% as well as Spanish mackerel.

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1.2. Portuguese fleet – loliginids and octopodids fishery features

The importance of each type of fleet in what concerns cephalopod fisheries is different depending on the cephalopod category (loliginids: short and longfinned squid; octopodids: octopods; cuttlefish).

Loliginids are mainly landed by the trawl fleet (71% of the landings). The artisanal fishery represents 27% of the loliginids landings, of which 65% are not reported by specific gear. The remaining 35% comprise 74% from gillnets and trammelnets, 25% from jigs and 1% from traps. Only 2% of the landings come from the purse-seine fleet (data from 1986 to 1997). All fleets catch a mixture of *Loligo vulgaris* and *Loligo forbesi*. When small animals are present in landings, *Alloteuthis subulata* and *A. media* are also quoted as loliginids.

Octopodids are mainly landed by the artisanal fleet (84% of the landings). In this fishery, 76% of landings are not reported by specific gear. The other 24%, 66% are landings from gillnets and trammelnets (though it is not likely that species are only caught by this type of gear, since vessels also carry other gear for which they have licences), 21% from jigs and 13% from traps. The artisanal fishery catches almost exclusively *Octopus vulgaris*. The trawl fleet represents 15% of total octopodids landings and is a mixed fishery of *Octopus vulgaris*, *Eledone cirrhosa* and *Eledone moschata*. The proportion of each species landed by the trawl fishery is still unknown. Purse-seine landings are less than 1% (data from 1986 to 1997) and probably represents catches with a specific type of purse-seine gear which is very similar to a small trawl.

Tables 1 and 2 show respectively, the total number of vessels, which landed loliginids and octopodids, and among those, the number of vessels, which annually landed significant quantities of such categories.

Each year, about 80% of Portuguese trawlers catch loliginids as a by-catch of demersal fish fisheries whereas the same occurs only in 10% of the licensed artisanal vessels, probably most of them using hand jigging as a directed fishery. Since 1992, the decreasing number of vessels that catch loliginids, is only a reflex of the general decrease in the total number of fishing vessels, verified in the same period. However, the trend in the number of trawlers and artisanal vessels, which catch a significant quantity of loliginids, is highly correlated with the trend in the corresponding fleet landings for this type of resources.

Table 1 - Number of vessels landing loliginids.

	Trawl fleet		Artisanal fleet		Purse-seine fleet	
Year	All	(catches > 10 t)	all	(catches > 0.5 t)	All	(catches > 0.1 t)
1992	103	27	1913	152	159	68
1993	98	17	1293	15	85	10
1994	88	10	985	3	52	8
1995	88	25	942	17	90	17
1996	84	15	729	8	72	7
1997	79	27	975	11	79	7

In 1995, 37% of the licensed artisanal vessels and 90% of trawlers landed octopodids. The number of vessels catching octopodids also decreased since 1992 as a reflex of the general decrease in the number of fishing vessels. As observed for loliginids, the trend in the number of trawlers and artisanal vessels, catching a significant quantity of octopodids, shows a correlation with the trend of the related fleet landings, although in the case of octopodids the correlation coefficient is lower (particularly for the trawl fishery).

Table 2 - Number of vessels landing Octopodids.

	Trawl fleet		Artisanal fleet		Purse-seine fleet	
Year	All	(catches > 10 t)	All	(catches > 0.5 t)	All	(catches > 0.1 t)
1992	125	37	3672	1181	93	26
1993	123	29	3533	1051	70	19
1994	110	38	3370	1011	57	19
1995	103	45	3417	1309	69	22
1996	103	46	3266	1281	75	22
1997	100	35	3229	1129	58	17

2. FISHERY TRENDS

Annual total trawl effort, total landings, and LPUE (from selected trawler logbooks) of loliginids and octopodids caught in Portuguese waters (Division IXa) are plotted in figures 1 and 2.

After a period of increasing loliginids landings, a sharp decrease occurred since 1991, showing some signs of recovery in the last 3 years. Trawl LPUE is fairly correlated with total landings and, as the fishery is no directed, it is expected to be a good abundance index for loliginids. Both total landings and trawl LPUE seam to vary independently from total trawl effort.

Octopodids fishery doesn't show any correlation between total landings and total trawl effort or between total landings and trawl LPUE. Total landings increased in the last 10 years, in spite of the trawl LPUE decrease since 1989. As mentioned before, octopodids are mainly caught by the artisanal fishery (84% of the landings), total landings reflecting this type of fishery and as expected more dependent upon variations in its fishing effort. However, trawl landings and trawl LPUE show a poor correlation and doubts remain if trawl LPUE can be used as a good abundance index or not.

Figures 3 and 4 depict respectively the loliginids and octopodids monthly total landings and trawl LPUE. Loliginids are landed in higher quantities from September-December, decreasing until April-May. The peak in trawl LPUE is also in autumn (Oct-Dec) except in years of low LPUE, when it shows variable patterns.

Octopodids highest landings are observed in an extended period: generally from January to July more often and sometimes into autumn as well. Higher trawl LPUE occurs generally around April and May, but sometimes also in autumn.

3. DATA AVAILABLE FOR STOCK ASSESSMENT

Loliginids data available from fisheries statistics and market biological sampling, present themselves amenable to the use of stock assessment methods based on depletion assumptions.

At present, the assessment of loliginids is important for geographical and temporal comparisons, while stock management is only theoretical as loliginids are a by-catch of other important trawl fisheries and in spite of the high market value, they have not been sufficiently abundant to be consider as a major resource.

The fishery statistics available for octopodids consists of monthly landings by fleet and trawl effort. Trawling is a minor source of octopodids landings, apparently not well related to effort for that fleet. The major source of landings (artisanal catches), is an indiscriminate lump of fishery fleets mostly of small vessels, using poor recorded gear for which there is not a good (or indeed any) effort estimate. A good estimate of abundance, probably based on a combination of indices (LPUE) from both types of fishery (trawling and artisanal) would be very important, but there are no appropriate effort data still available for the artisanal fishery.

Additionally, depletion methods do not appear appropriate, since the fluctuations in the abundance index (LPUE) do not suggest periods of consistent decrease.

In short, prospects for a good assessment of octopodids in Portugal appear gleam at the moment.

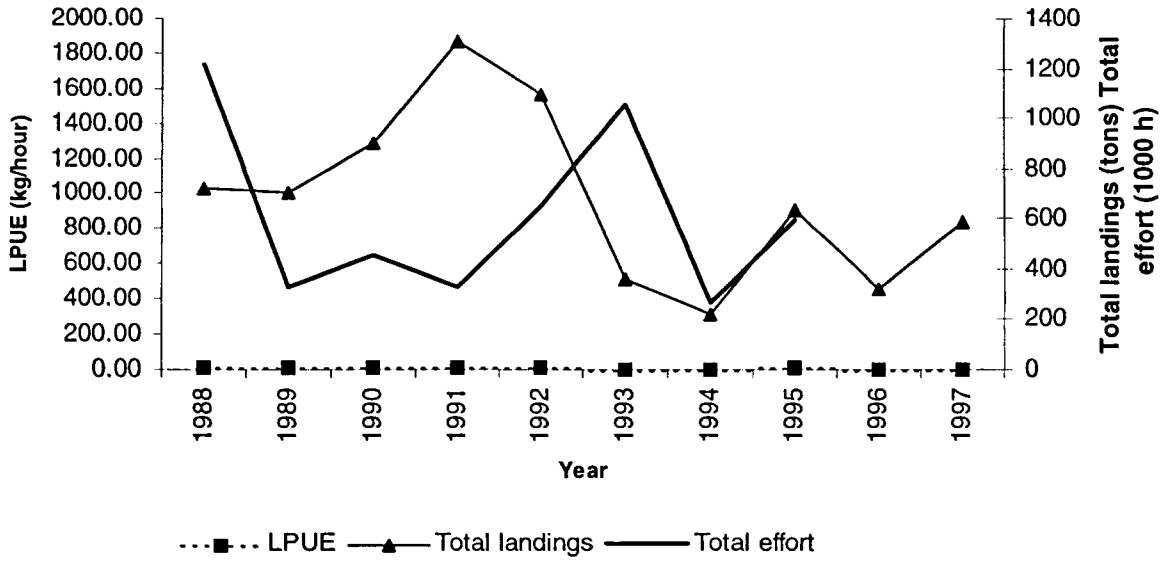


Figure 1 - Loliginids annual trawl LPUE, total landings and total effort.

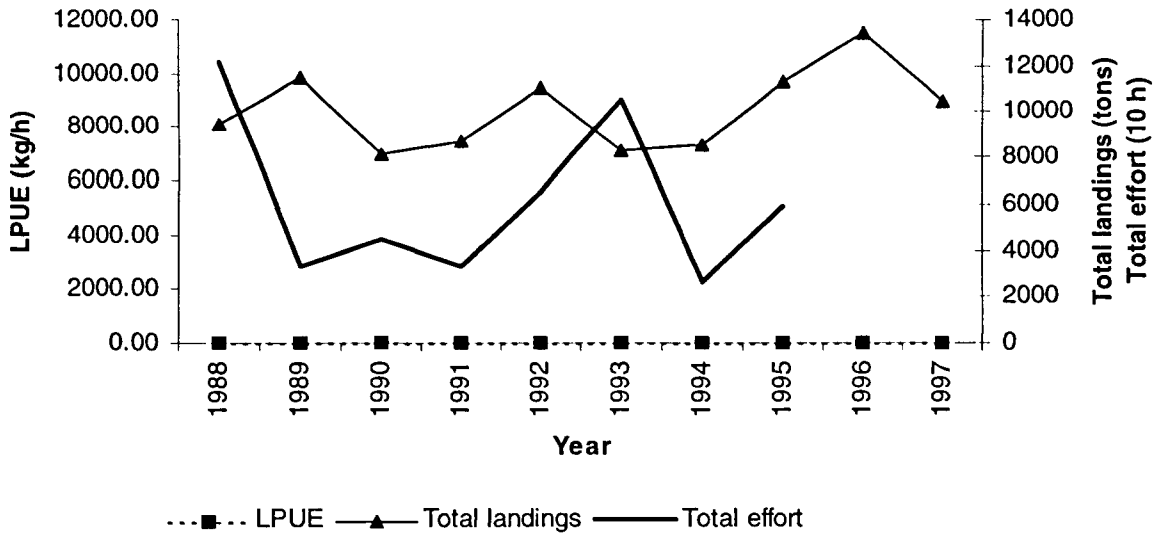


Figure 2 - Octopodids annual trawl LPUE, total landings and total effort.

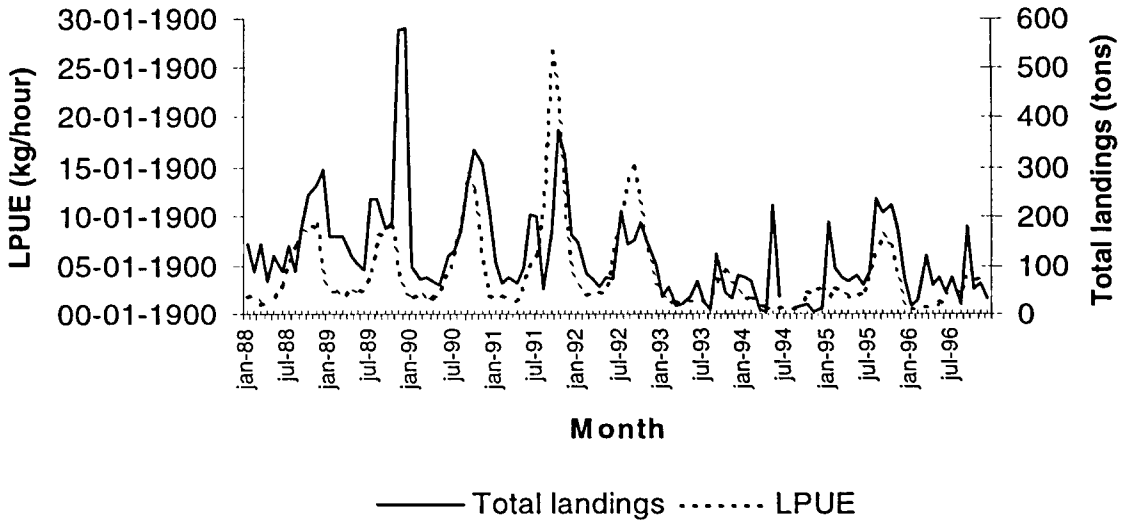


Figure 3 - Loliginids monthly trawl LPUE and total landings.

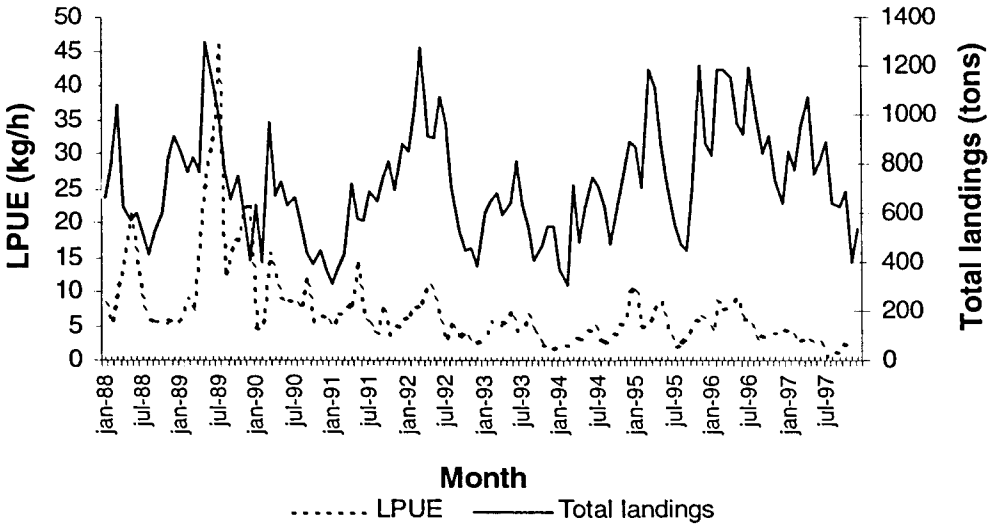


Figure 4 - Octopodids monthly trawl LPUE and total landings.

Working document presented to the ICES Working Group on Cephalopod Fisheries and Life History
Kiel (Germany), 15 – 17 April 1998.

FISHING EXPLOITATION PATTERN OF THE COMMON OCTOPUS, *Octopus vulgaris* Cuvier, 1797, IN THE SPANISH WATERS OF THE GULF OF CADIZ. ICES DIVISION IXa

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The demersal fishery (bottom-trawl and artisanal fisheries pooled) in the Spanish waters of the Gulf of Cádiz (ICES Subdivision IXa-South) is characterised by the multispecies nature of its landings. In this fishery the common octopus, *Octopus vulgaris* Cuvier, 1797, stands out as the most important species in terms of the volume of landed catches (Figure 1). For the historical series of annual landings analysed to date (1984-1996 period, Figure 2), octopus landings accounted, on average for 15 % in weight (2300 t) of the total catches landed by the demersal fleets, the highest percentages were recorded in 1994 (20 %), and the lowest in 1996 (8 %) (Sobrino *et al.*, 1994). Octopus annual landings ranged between 3004 tonnes in 1989 and 970 tonnes in 1996 (Figure 3). In 1997 year the catches descended to minimun values of the last fitteen years, recording landings of 319 tonnes

The octopus fishery in the study area is of a marked multifleet-multigear nature, in which participate both the trawl and artisanal fleets. Octopus usually is a by-catch specie for the trawl fleet (40 mm mesh size), although specific fishing trips for octopus and octopus-cuttlefish are also undertaken by this fleet (Sobrino *et al.*, 1995). Artisanal fleets targeting octopus use different species-specific fishing gears and traps. However, a clear geographical differentiation in the use of these gears can be observed;wersternmost artisanal fleets(Province of Huelva) mainly use clay-pots, locally termed 'alcatruces' or 'cajirones'. Easternmost fleets (Province of Cádiz) use home-madle hand jigs ('chivos' and 'pulperas'). Also noteworthy is the non-directed octopus fishing with artisanal traps, hook-lines and trammel nets.

Although the species is practically exploited over all the continental shelf , two main fishing grounds can be differentiated (Figure 4). One area is located off the Huelva coasts, between Ayamonte and Mazagón, in gravel bottoms ranging from 10 m to 70 m depth, and the other in the Cádiz coasts, between Cabo Roche and Cabo Trafalgar, from the coast line up to 80 m depth , where the rocky bottoms are dominant. Artisanal fleets exploit the whole extent of these areas, whereas the depth range exploited by the trawl fleet in these fishing grounds is restricted to those depths beyond the 6 nautical miles offshore line, which corresponds to the shallowest legal limit for trawl fishing (Ramos *et al.*, 1996).

During the last 13 years octopus catches landed by the trawl fleet accounted, on average, for 75 % of the total annual landings of the species. However, the relative importance of the octopus landings in the artisanal fishery has increased from 8.2 % in weight in 1984 to 32.3 % in 1996 (Figure 5a and 5b). Within the artisanal fishery, the hand-jig fleet contributed to the highest volume of landings, which represented about 58 % in weight (mean values for 1993-1996), followed by the clay-pot fleet with 35 %. The remaining 7 % was landed by the artisanal fleets fishing with traps, hook lines, and, to a lesser extent, trammel nets (Figure 6).

The monthly evolution of landings during the most recent years show that the octopus artisanal fishery has marked seasonality, the highest landings being recorded from late winter to middle of spring (Figure 7). Directionality seems to be the main cause of the more fluctuating values observed in the monthly landings of this fishery as compared to those of the trawl fleet.

In 1996 a sampling of the octopus catches landed by the different fleets exploiting this resource was undertaken on a monthly basis. A total of 5071 individuals were measured (dorsal mantle length, ML, in mm) and weighed (body weight, BW, in gr). In this year, the mantle length range of the exploited population ranged between 70 and 280 mm ML. Annual size frequency distributions per fishing gear (Figures 8a and 5b) were compared through a Smirnov-Kolmogorov test. Results of the test showed the existence of significant differences ($p<0.01$) between the population fraction jointly exploited by the trawl and clay-pot fleets (group of metiers I), and that exploited by the hand-jig, hook-line and trap fleets (group of metiers II). No significant differences were found between the size compositions exploited by the different fishing gears within each group of metiers. Group I mainly fish the smallest sizes in the population (modes of 14 and 15 cm ML for the trawl and clay-pot fleets respectively), whereas group II exploits more intensively the largest sizes (modes of 20, 18-23.5 and 22 cm ML for hand-jigs, hook-lines and traps, respectively).

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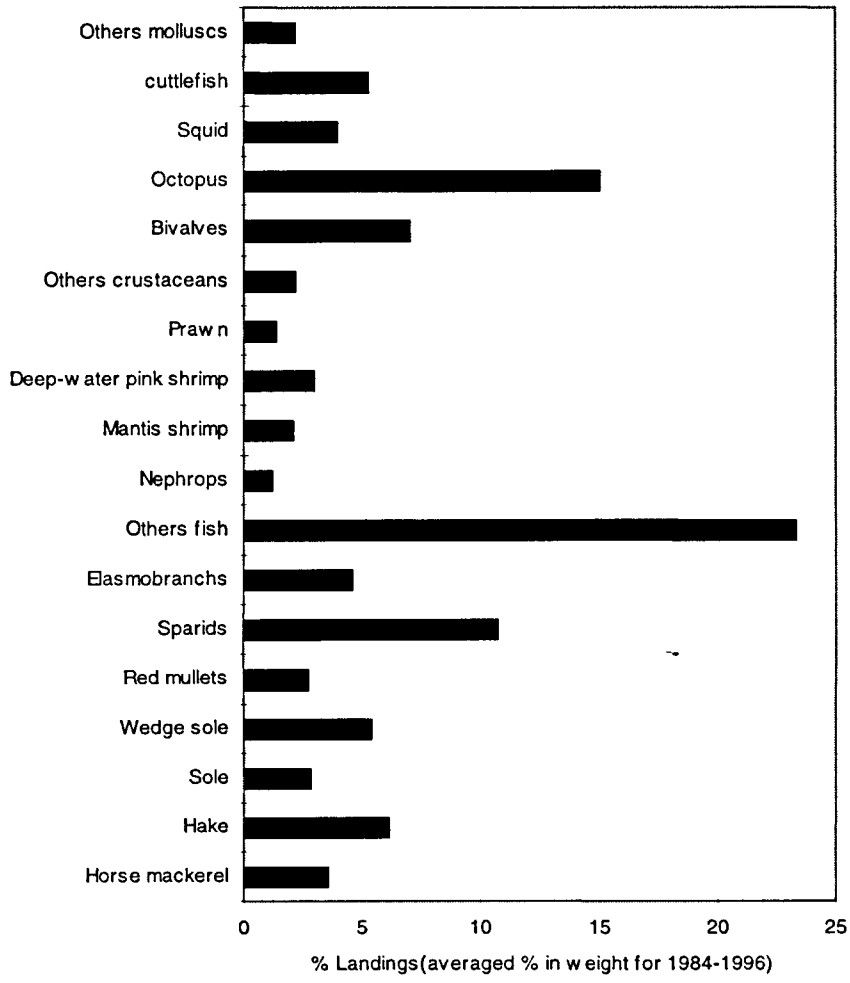


Figure 1.- Species composition (simplified) of catches landed by the Spanish South-Atlantic demersal fleet (averaged annual percentages for the 1984-1996 period).

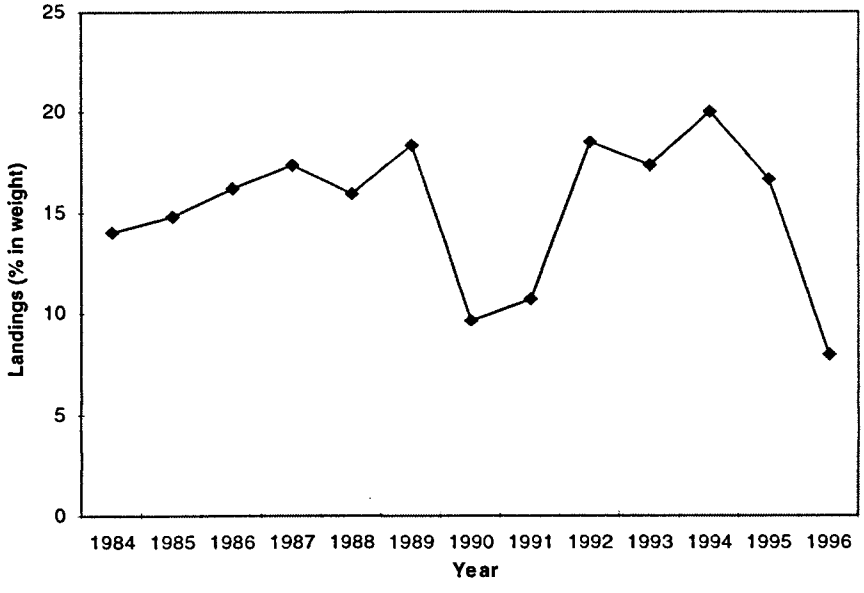


Figure 2.- Relative importance (percentage in weight) of the octopus annual landings in the demersal fishery (1984-1996).

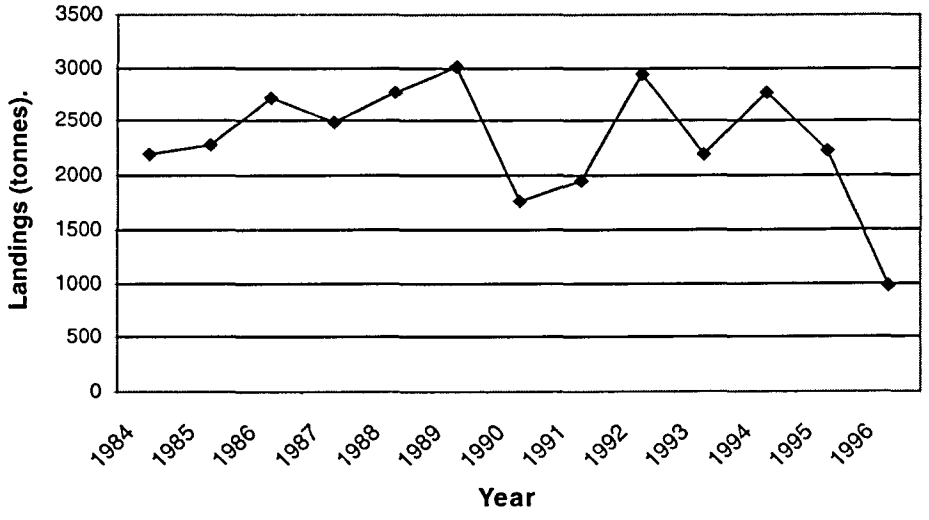


Figure 3.- Octopus annual landings in the demersal fishery (1984-1996)

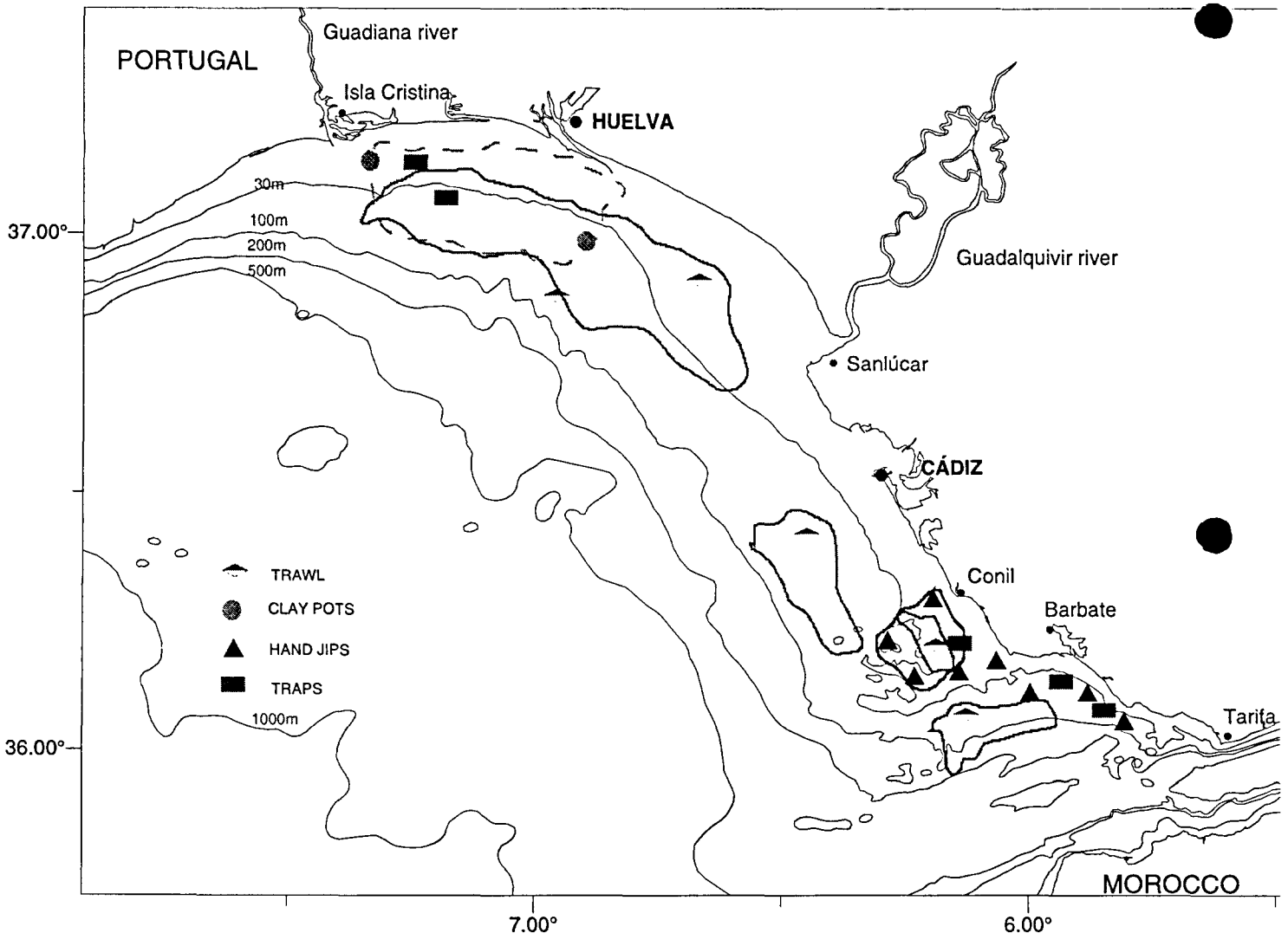


Figure 4. Map showing the main fishing grounds by gear type in the Spanish waters of the Gulf of Cádiz.

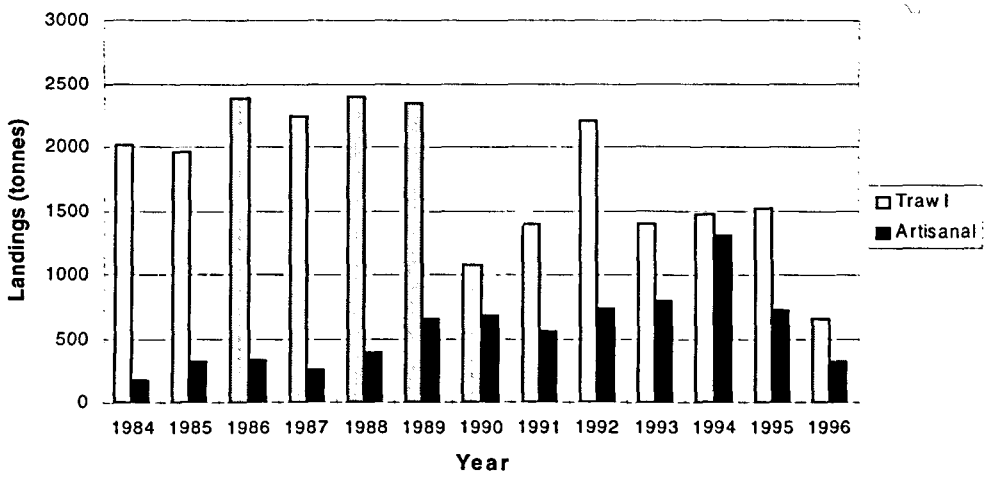


Figure 5a.- Octopus annual landings by fleet type (1984-1996)

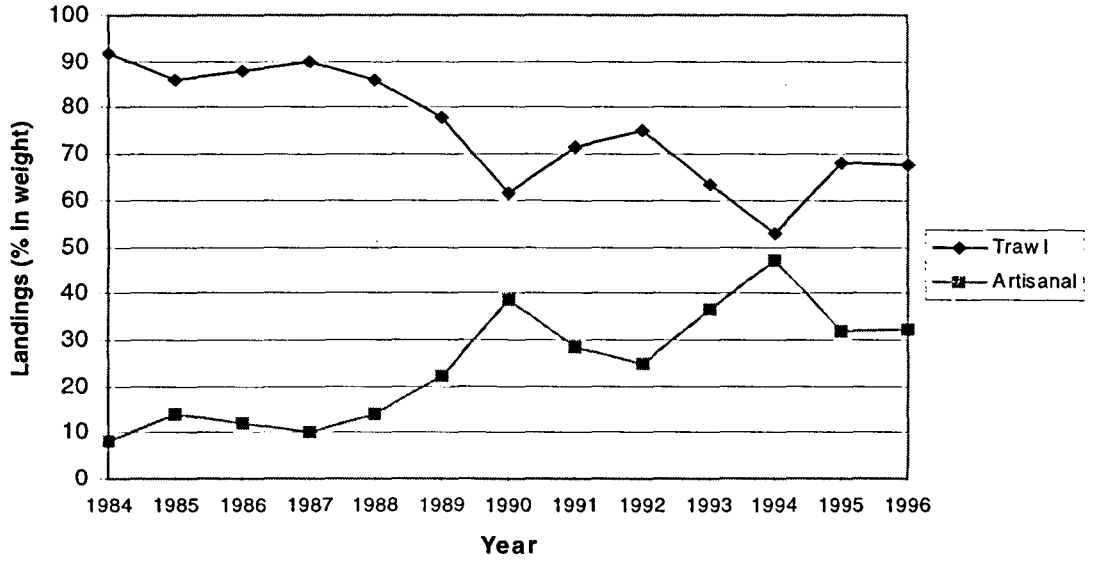


Figure 5b.- Relative importance of octopus annual landings by fleet type (1984-1996)

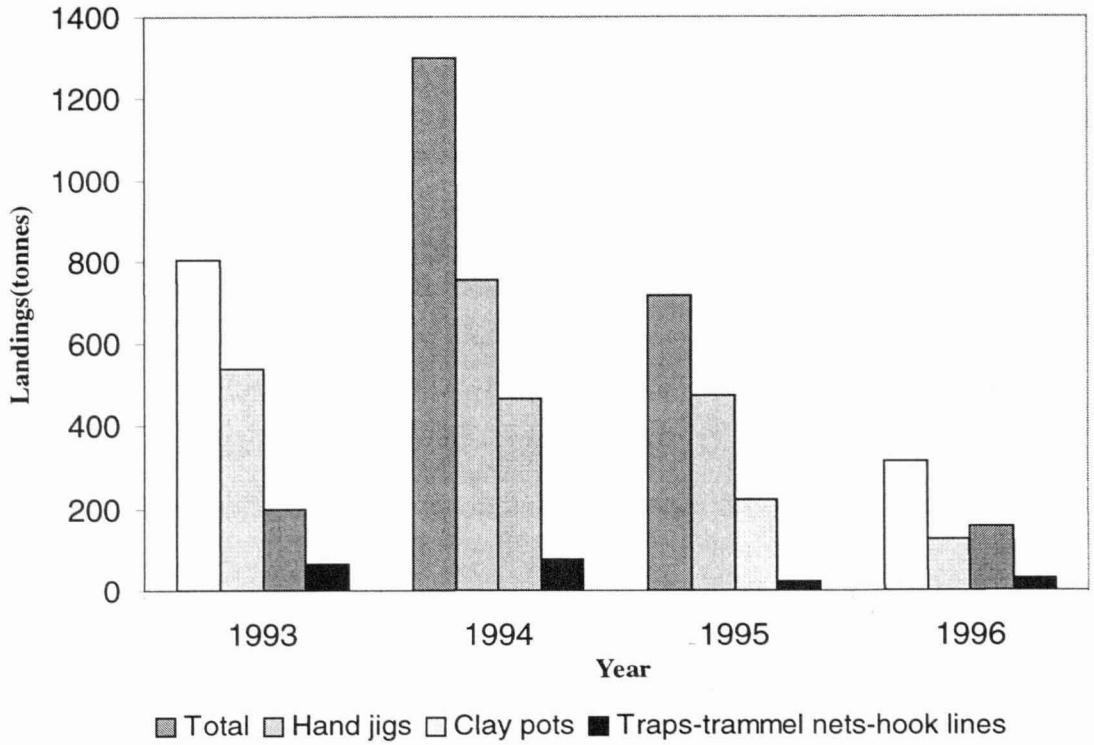


Figure 6.- Octopus annual landings by gear type in the artisanal fishery (1993-1996)

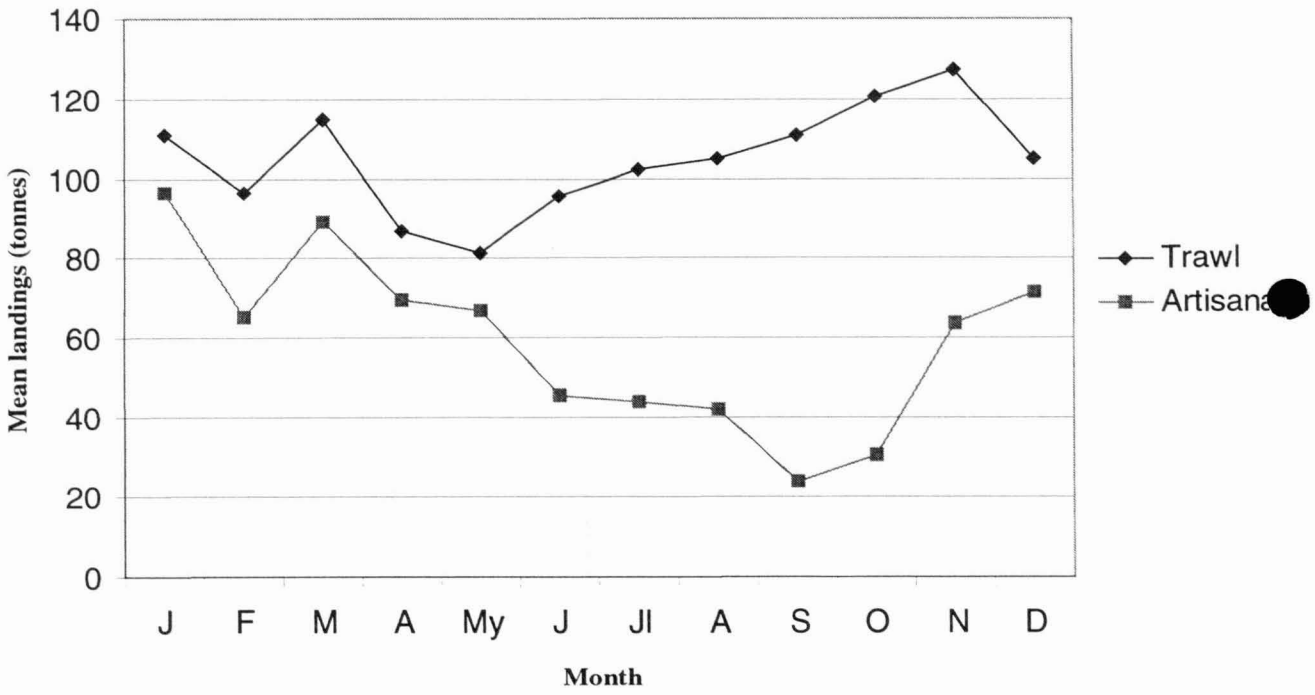


Figure 7.- Mean monthly landings of octopus by fleet for the 1993-1996 period

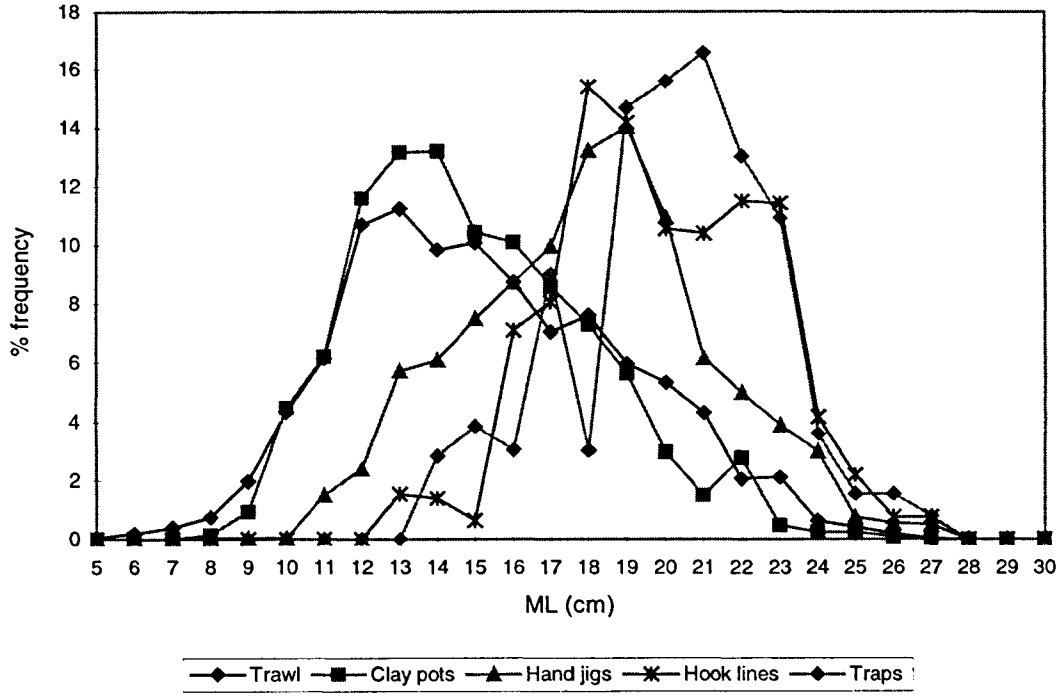


Figure 8a.- *Octopus vulgaris.* Annual size frequency distributions by gear type (year 1996)

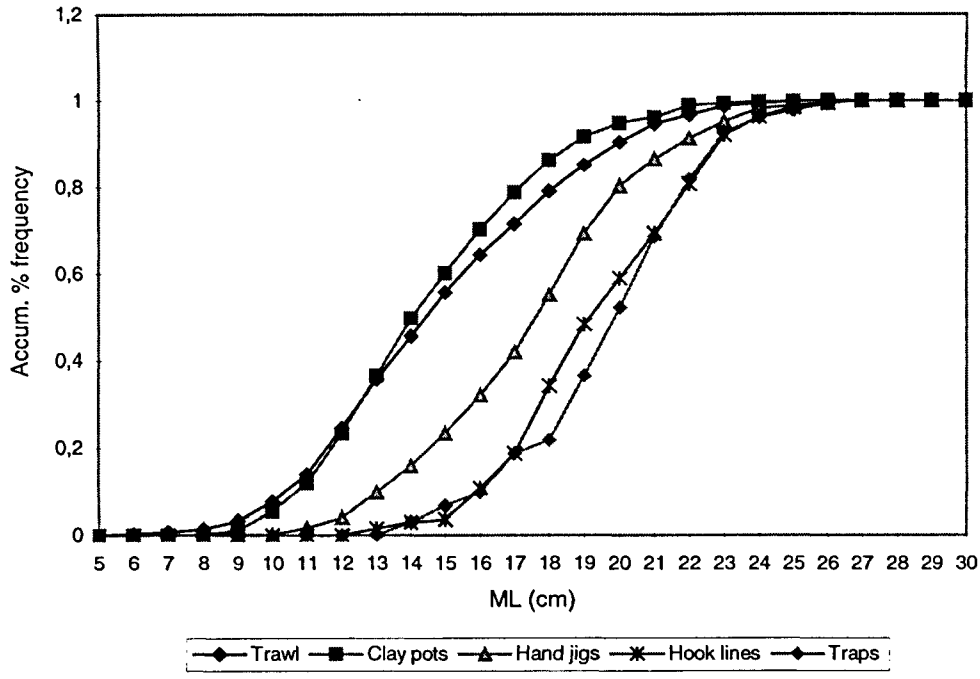


Figure 8b.- *Octopus vulgaris.* Annual accumulated size frequency distributions by gear type (year 1996)