Northwest Atlantic Fisheries Organization

Serial No. N2895 NAFO SCR Doc. 97/61

SCIENTIFIC COUNCIL MEETING - JUNE 1997

A Review of the Status of Witch Flounder in Divisions 2J, 3KL

by

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The Commercial fishery

The commercial fishery began for witch in this area in the early 1960's and increased steadily from about 1,000 t in 1963 to a peak of over 24,000 t in 1973 (Table 1; Fig. 1). Catches declined rapidly to 2,800 t by 1980 and subsequently fluctuated between 3,000 and 4,500 t to 1991. The catch in 1992 declined to 2,300 t, the lowest since 1964, and further declined to 342 t in 1993 and just 12 t were reported in 1994 (Table 1). Up until the late 1980's, the fishery was prosecuted by Poland, USSR and Canada (Table 1) primarily in Div. 3K (Table 1; Fig. 1). In recent years the fishery has been mainly Canadian although increased catches have been taken by EU (Portugal and Spain) in the NAFO Regulatory area of Div. 3L. Although only 12 t were reported for 1994, a catch of 491 t was indicated for Spain in the Spanish Research Report (SCS Doc. 95/15) for the Regulatory Area of Div. 3L. In 1995 and 1996 total catches were estimated to be about 780 and 1380 tons, respectively.

From 1988-92, the offshore Canadian fishery was particularly successful by fishing on prespawning concentrations in the deep slopes of Div. 3K, especially in depths beyond 700 m. Between 1988 and 1993, however, the area fished had become increasingly smaller and substantially deeper. Based upon information from the fishing industry, the fishery during the winter of 1993 was very poor with the best catch rates occurring in depths greater than 1400 m. As the season progressed, catch rates quickly declined until they became too low for economic viability and the fishery was curtailed. Similar observations were made during the winter of 1994, only more extreme, which caused the catch in 1994 to be virtually nothing. No directed fishing by Canada took place since then.

No aging data are available since 1992.

Research vessel data

Stock size indices

Stratified-random research vessel surveys have been conducted in the fall in

Div. 2J,3K and 3L since 1977, 1978 and 1981 respectively. Up until 1994, the surveys were conducted using an Engel 145' high-rise groundfish trawl whereas the 1995 and 1996 surveys were carried out with a much more efficient Campelen 1800 shrimp trawl. No conversions have been applied as yet to standardize the historic survey catches of witch flounder to a common survey gear.

For Div. 2J, biomass estimates ranged from as high as 4,100 t in 1986 to a low of less than 160 t in 1994 (Table 2; Fig. 2). Despite the use of the new and more efficient survey trawl the biomass index only increased slightly to less than 400 t by 1996. In Div. 3K, during 1979-85, there was a period of relative stability where most annual biomass estimates were over 30,000 t (Table 3; Fig. 2). Since that time estimates have declined considerably to just over 340 t in 1994, the lowest in the time series. The Campelen trawl surveys in 1995 and 1996 indicated a biomass index of about 440 and 920 t, respectively which is still less than 3% of the 1979-85 average. For Div. 3L, biomass estimates varied generally between 6,000 and 7,000 t from 1981 to 1988 but declined rapidly since then to a low of just under 1,500 t in 1992 and less than 400 t by 1993 and 1994 (Table 4; Fig. 2). The 1995 estimate remained at the same low level even using the Campelen trawl. The 1996 estimate increased to about 1800 t, however, more than half this estimate was based on the inclusion of new deep water strata (at depths of 732-1097 m) most of which weren't surveyed previously.

For the three divisions combined, there has been a very steady and rather systematic decline from about 1984 through 1994 with the estimate of 900 t in 1994, the lowest in the time series compared to an average during 1981-84 of over 40,000 t (Fig. 2). Although the 1995 and 1996 survey estimates cannot be compared directly to previous years because of the significant differences in gear type and are overestimates by comparison, the higher 1996 value still constitutes a very small percentage of the average estimated during the late 1970's and early 1980's.

Aging data have not been available for witch flounder since 1992, however, as an indicator of the difference between the catchability of the two survey gears the abundance at length for 1993-96 is presented in Figure 3. Fish larger than 40 cm remain very low in abundance for all years, however, the expected effectiveness of the Campelen trawl to catch smaller witch flounder is evident in the 1995-96 data. Fish less than 40 cm are relatively much more abundant in the Campelen catches compared to Engel catches and comprise most of the abundance estimates for 1995-96. Length composition of witch flounder from the Spanish catch in Div. 3L in 1994 (reported in SCS Doc. 95/15) indicated that about 90% of the catch numbers are greater than 35 cm (Fig. 4). This would further indicate that the commercial abundance remains quite low even in the deep waters of Div. 3L.

Distribution

To illustrate the spatial distribution of witch flounder both historically using the Engel survey trawl and during 1995 and 1996 using the Campelen trawl, ACON plots are shown in Figures 5 and 6, respectively. The data from the late 1970's and early 1980's using the Engel trawl indicate that witch flounder were widely distributed throughout the shelf area in deep channels around the fishing banks primarily in Div. 3K (Fig. 5). By the

mid 1980's, however, they were rapidly disappearing and by the early 1990's had virtually disappeared from the area entirely except for some very small catches along the slope and more to the southern area (Fig. 5). The more recent results using the Campelen trawl (Fig. 6) clearly indicate that witch flounder remain virtually absent from the shelf and channel areas and are only located along the deep continental slope area, especially in Division 3L both inside and outside the Canadian 200 mile fishery zone. The apparent improvement between 1995 and 1996 is related to increased survey coverage particularly in deeper water along the continental slope area.

Resource Status

This stock has declined to levels well below any observed in the past with little sign of improvement to the exploitable stock. Based on the survey biomass index, the stock was relatively stable at its highest observed level during 1981-84 at an average of about 41,000 tons. The average index during 1993-94 (the last two years of the Engel trawl survey) when a fishery closure was advised was only 1,100 tons or less than 3% of the 1981-84 average. The unconverted average index of the 1995-96 survey indices using the Campelen survey trawl was only 2,100 tons or 5% of the 1981-84 average despite the fact that most of the 1995-96 biomass was comprised of smaller fish not caught during the Engel trawl surveys. In 1996 the survey coverage was most complete covering depths to 1500 m throughout Divisions 2J and 3KL. Nevertheless, the biomass estimate was still only 3,000 tons or 7% of the 1981-84 average which had less survey coverage and caught few small fish that comprise most of the recent estimates.

Table 1. Catch by country of witch flounder in Div. 2J and 3KL during 1963-96.

Year	Canada	Fed. Rep. Germany	German Dem. Rep.	Poland	USSR/ Russia	UK	Others	Total
1963	17	3	0	259	89	7	570	945
1964	103	0	0	752	164	24	1	1044
1965	128	29	0	1876	2056	58	0	4147
1966	187	9	1045	559	1888	29	0	3697
1967	901	0	332	926	1933	9	0	4101
1968	446	0	358	1990	7834	33	5	10666
1969	1355	0	546	957	9726	1	0	12585
1970	4020	0	508	3566	9934	0	2	18030
1971	8030	75	508	5404	2018	9	9	16053
1972	5520	6	648	4013	7016	225	0	17428
1973	3761	1348	2327	11802	2834	258	2031	24361
1974	1868	1082	272	5302	6917	29	493	15963
1975	1352	446	374	4583	4763	0	687	12205
1976	2081	606	110	3828	3022	3	975	10625
1977	4371	300	203	3052	392	0	0	8318
1978	1979	23	58	3490	1345	1	8	6904
1979	1392	0	22	1855	150	22	656	4097
1980	1459	0	16	1235	45	0	68	2823
1981	2661	0	32	1385	85	0	31	4194
1982	1206	0	4	1151	552	0	68	2981
1983	1483	0	50	1005	516	0	34	3088
1984	2077	0	27	1617	1000	2	85	4808
1985	1305	26	33	565	1006	-	68	3003
1986	1199	2	7	3	21	-	2684	3916
1987	854	-	56	765	1057	-	1743	4475
1988	3270	-	10	760	4	-	110	4154
1989	4059	-	4	691	5	-	147	4906
1990	3271	-	-	-	-	-	696	3967
1991	2805	-	-	-	-	1	1208	4014
1992	1736	5	-	-	-	2	954	2697
1993a	342	-	-	-	-	-	-	342
1994a	12	-	-	-	-	-	491c	503
1995b	7	-	-	-	-	-	777	784
1996b	11	-	-	-	-	-	1371	1382

aProvisional
bEstimated
cSpain (SCS Doc. 95/15)

Table 2 . Biomass (tons) by stratum of witch flounder from the autumn surveys in Div. 2J from 1977-92. Based on old stratification system.

Depth Range (m)	Area (sq. nm)	Stratum	Trawlable Units ('000)	Year															
				1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
101-200	1427	201	107	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	0
	1823	205	137	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
	2582	206	194	83	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0
	2246	207	169	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0
201-300	440	202	33	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
	1608	209	121	63	18	35	81	0	54	77	11	100	0	0	0	0	10	0	0
	774	210	58	92	19	102	174	15	99	0	207	0	0	26	0	15	0	0	0
	1725	213	129	192	185	135	215	194	220	120	84	52	79	67	12	35	0	0	0
	1171	214	88	136	34	0	46	44	66	43	33	59	24	0	13	3	9	0	0
	1270	215	95	152	16	7	0	61	37	0	31	0	0	0	0	0	0	0	0
	1428	228	107	368	79	283	354	116	450	169	322	39	533	47	90	81	36	0	26
	508	234	38	0	17	30	0	0	0	0	0	0	0	0	0	-	0	0	0
301-400	480	203	36	0	0	0	0	0	30	87	0	0	11	0	0	12	0	0	0
	448	208	34	116	21	57	261	84	465	50	76	448	37	0	0	6	0	0	0
	330	211	25	304	140	59	216	43	152	5	43	37	22	20	0	20	0	0	0
	384	216	29	0	0	18	18	36	36	67	0	0	29	7	4	9	0	0	0
	441	222	33	160	57	17	58	132	204	44	27	28	0	0	93	25	0	5	0
	567	229	43	114	106	109	106	85	96	75	61	31	553	21	88	312	21	19	13
401-500	354	204	27	42	0	27	-	70	84	9	60	0	41	9	31	36	8	0	0
	268	217	20	0	0	11	0	0	0	0	-	0	33	38	21	43	3	0	0
	180	223	14	9	0	0	0	27	0	0	14	0	92	67	26	51	8	7	2
	686	227	51	140	82	44	348	129	273	167	77	116	204	265	189	135	1038	105	60
	420	235	32	560	0	293	315	363	284	701	352	244	55	79	0	37	76	17	14
501-750	664	212	50	1299	68	655	137	561	970	1110	565	959	2384	769	242	358	363	42	144
	420	218	32	0	0	-	0	0	0	0	-	8	0	55	87	42	29	8	0
	270	224	20	0	0	0	0	0	0	0	0	0	15	30	65	57	8	26	20
	237	230	18	0	0	-	9	0	0	0	13	0	29	9	97	244	440	896	156
751-1000	213	219	16	-	-	-	-	0	-	0	-	0	0	0	0	0	0	0	0
	182	231	14	0	0	-	0	-	0	0	0	0	0	0	0	0	0	278	84
	122	236	9	0	-	-	-	8	0	0	0	0	0	0	4	-	12	13	23
1001-1250	324	220	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	177	225	13	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	236	232	18	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1251-1500	268	221	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	180	226	14	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	180	233	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	25033			3829	843	1883	2337	1968	3573	2726	2020	2122	4142	1511	1061	1520	2061	1417	542
101-200	8078			83	0	0	0	0	53	0	43	0	0	0	0	0	0	0	0
201-300	8924			1002	369	592	870	429	927	410	689	249	635	141	115	134	55	0	26
301-400	2650			693	325	259	659	381	983	329	207	545	652	48	185	384	21	24	13
401-500	1908			751	82	376	663	589	641	878	503	360	426	458	267	302	1132	129	76
501-750	1591			1299	68	655	146	561	970	1110	578	967	2429	864	490	701	841	972	320
751-1000	517			0	0	0	0	8	0	0	0	0	0	0	4	0	12	292	108
1001-1250	737			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1251-1500	628			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2 (con'd) . Biomass (tons) per stratum of witch flounder from the autumn surveys in Div. 2J during 1993-96. Based on the new stratification system.

Depth Range (m)	Stratum	Area (sq. nm)	1993	1994	1995	1996
101-200	201	633	0	0	-	0
	205	1594	0	0	-	0
	206	1870	0	0	0	0
	207	2264	0	0	0	0
	237	733	0	0	-	0
	238	778	-	0	-	0
201-300	202	621	0	0	-	0
	209	680	0	0	0	0
	210	1035	0	0	0	0
	213	1583	0	0	0	0
	214	1341	0	0	-	0
	215	1302	0	0	-	0
	228	2196	13	0	0	0
	234	530	0	0	-	0
301-400	203	487	0	0	-	0
	208	588	0	0	0	0
	211	251	0	0	0	0
	216	360	0	0	-	2
	222	450	0	0	0	6
	229	536	1	9	10	0
401-500	204	288	0	0	-	0
	217	241	0	1	-	7
	223	158	3	2	-	7
	227	598	66	0	0	10
	235	414	0	7	0	16
	240	133	8	4	0	17
501-750	212	557	23	12	71	96
	218	362	1	2	-	17
	224	228	0	7	-	18
	230	185	37	42	69	126
	239	120	0	0	-	0
				0		
751-1000	219	283	4	1	-	13
	231	186	93	55	122	6
	236	193	23	13	-	28
1001-1250	220	303	-	-	-	10
	225	195	-	-	-	0
	232	228	-	-	-	0
				-		
1251-1500	221	330	-	-	-	0
	226	201	-	-	-	0
	233	237	-	-	-	0
Biomass (t)			273	157	262	369
<=400			14	9	0	8
401-750			138	78	140	303
>750			120	70	122	57
<500			92	24	0	54
>500			181	133	262	314

Note: The 1995 and 1996 surveys were conducted with a Campellen 1800 shrimp trawl thus biomass estimates are not directly comparable to the estimates from previous years.

Table 3 . Biomass estimates (tons) by stratum of witch flounder from autumn surveys in Div. 3K during 1978-92 .

Depth Range(m)	Area (sq. nm.)	Stratum	Trawlable units ('000)	Year														
				1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
101-200	1455	618	109	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
	1588	619	119	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
201-300	2709	620	203	539	982	364	92	124	112	73	33	124	0	0	0	0	0	0
	2859	621	215	528	2805	519	352	148	708	238	258	15	36	0	28	0	0	0
	668	624	50	205	99	58	263	301	88	245	50	40	12	0	0	5	0	0
	447	632	34	249	447	143	336	268	308	-	157	67	15	18	54	0	2	3
	1618	634	121	497	616	703	357	680	126	638	219	163	103	216	74	0	0	7
	1274	635	96	1290	1491	1140	1033	526	337	1491	525	11	88	207	106	10	0	16
	1455	636	109	1119	1189	1334	819	639	546	2481	529	193	312	601	273	35	0	0
	1132	637	85	859	1680	1077	1445	1475	3001	2131	1802	467	597	177	144	0	0	24
301-400	1027	623	77	281	503	347	417	262	520	254	424	94	89	5	3	0	0	0
	850	625	64	509	1513	739	1077	319	1148	954	930	31	83	45	2	0	0	0
	919	626	69	2036	3642	3822	780	2732	2544	874	729	31	110	10	20	18	0	10
	1085	628	81	1669	4493	2688	882	1812	3814	1559	1765	493	316	21	92	0	0	27
	495	629	37	1102	1062	1538	1573	864	1591	771	646	159	334	98	14	28	0	2
	544	630	41	593	479	654	643	-	500	359	168	98	107	83	11	0	0	6
	2179	633	164	1773	2023	2764	1034	1793	2043	2306	1467	996	649	1179	595	173	79	49
	2059	638	155	2057	5972	2926	4134	2260	3218	6236	4841	6434	4155	5264	2368	199	202	40
	1463	639	110	944	903	1501	1233	829	2933	2819	1345	1217	490	1854	360	359	44	5
401-500	632	622	47	161	782	1198	700	356	640	474	919	130	403	3	2	13	3	10
	1194	627	90	1626	2114	5938	8492	5646	6924	5714	2298	753	886	602	216	73	1	16
	1202	631	90	738	1106	1459	5495	541	4178	4412	2739	1788	973	302	131	34	127	121
	198	640	15	81	-	119	48	342	-	316	718	1289	1616	936	840	112	116	8
	204	645	15	5	-	0	8	250	203	1367	153	-	1968	348	142	504	56	6
501-750	584	641	44	0	0	22	50	55	190	0	745	-	1200	-	-	7701	646	0
	333	646	25	0	0	44	6	15	462	75	59	-	87	-	-	151	81	21
751-1000	931	642	70	0	-	35	0	23	-	93	50	-	39	-	-	1648	730	473
	409	647	31	0	0	0	0	0	-	-	15	-	-	-	-	232	372	89
1001-1250	1266	643	95	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	232	648	17	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1251-1500	954	644	72	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
	263	649	20	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	34228			18861	33903	31130	31268	22260	36135	35881	23585	14593	14670	11970	5475	11297	2458	935
101-200	3043			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	12162			5287	9309	5337	4696	4162	5226	7297	3571	1080	1164	1219	678	49	2	50
301-400	10621			10964	20591	16979	11773	10870	18313	16133	12316	9552	6334	8559	3466	778	325	140
401-500	3430			2611	4002	8714	14743	7136	11945	12283	6828	3961	5845	2193	1331	737	303	162
501-750	917			0	0	66	57	70	652	75	804	0	1287	0	0	7853	726	21
751-1000	1340			0	0	35	0	23	0	93	66	0	39	0	0	1880	1102	562
1001-1250	1498			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1251-1500	1217			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3 (con'd) . Biomass (tons) per stratum of witch flounder from the autumn surveys in Div. 3K during 1993-96. Based on the new stratification system.

Depth Range(m)	Stratum	Area (sq. nm.)	1993	1994	1995	1996
101-200	608	798	-	-	-	0
	612	445	-	-	-	0
	616	250	-	-	-	-
	618	1347	0	0	0	0
	619	1753	0	0	1	0
201-300	609	342	-	-	-	0
	611	600	-	-	-	0
	615	251	-	-	-	0
	620	2545	0	0	0	0
	621	2537	0	0	0	0
	624	1105	7	0	0	0
	634	1555	2	0	0	0
	635	1274	0	0	1	0
	636	1455	0	0	2	2
	637	1132	8	0	0	0
301-400	610	256	-	-	-	1
	614	263	-	-	-	0
	617	593	0	0	0	0
	623	494	0	0	0	0
	625	888	0	0	3	4
	626	1113	0	0	0	0
	628	1085	0	0	0	0
	629	495	0	0	4	2
	630	332	9	0	0	7
	633	2067	33	23	3	33
	638	2059	29	2	5	5
	639	1463	0	16	40	14
401-500	613	30	-	-	-	0
	622	691	4	0	5	1
	627	1255	5	9	33	8
	631	1321	11	96	78	7
	640	69	0	0	0	8
	645	216	3	1	0	18
	650	134	12	2	2	9
501-750	641	230	5	1	9	45
	646	325	13	23	3	430
	651	359	17	10	19	52
751-1000	642	418	32	29	17	7
	647	360	24	62	30	50
	652	516	131	71	52	149
1001-1250	643	733	-	-	66	0
	648	228	-	-	-	0
	653	531	288	-	66	0
1251-1500	644	474	-	-	0	0
	649	212	-	-	-	0
	654	479	-	-	0	0
Biomass (t)			633	345	438	853
<500			123	150	176	120
>500			510	195	261	733

Note: The 1995 and 1996 surveys were conducted with a Campellen 1800 shrimp trawl thus biomass estimates are not directly comparable to the estimates from previous years.

Table 4 . Biomass estimates (tons) by stratum of witch flounder from fall surveys of research vessels in Div. 3L during 1981-94.

Depth Range (m)	Area (sq. nm.)	Stratum	Trawlable Units ('000)	Year													
				1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
57-91	2071	350	155	0	0	0	81	0	0	0	0	0	0	0	0	0	0
	1780	363	134	0	67	0	55	0	27	0	0	0	158	20	32	0	0
	1121	371	84	0	0	0	24	0	0	0	0	0	0	0	0	0	0
	2460	372	185	0	0	0	89	0	0	0	9	0	31	6	0	0	0
	1120	384	84	-	0	84	62	0	0	0	0	0	0	0	0	0	0
93-183	1519	328	114	-	-	-	29	0	0	0	0	0	0	0	0	0	0
	1574	341	118	0	24	0	154	0	0	20	20	0	0	0	0	0	0
	585	342	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	525	343	39	0	-	0	54	0	0	0	0	0	0	0	0	0	0
	2120	348	159	27	95	22	220	0	0	0	24	0	0	0	0	0	0
	2114	349	159	0	0	0	167	0	90	0	17	0	87	0	0	0	0
	2817	364	211	224	97	25	125	0	97	0	23	0	19	0	0	0	0
	1041	365	78	20	98	0	56	0	50	23	11	0	0	27	0	0	0
	1320	370	99	25	0	0	110	0	0	20	0	0	0	0	0	0	0
	2356	385	177	0	0	0	168	0	35	34	16	0	0	0	0	0	0
	1481	390	111	0	0	0	92	0	0	0	0	0	0	0	0	0	0
184-274	1494	344	112	196	0	56	84	7	7	99	0	0	0	0	0	0	0
	983	347	74	209	30	24	295	0	27	0	106	59	0	0	0	0	0
	1394	366	105	175	366	0	107	203	177	115	70	90	28	0	3	0	0
	961	369	72	415	366	126	224	384	416	206	729	289	289	94	0	0	0
	983	386	74	775	129	-	81	322	742	904	1204	192	131	192	0	0	0
	821	389	62	-	270	-	126	74	502	141	116	15	49	0	14	0	0
	282	391	21	-	0	0	0	16	0	5	0	0	0	38	12	0	0
275-366	1432	345	107	2137	2351	3722	2695	764	349	2634	1375	1766	330	0	9	12	0
	865	346	65	3019	1210	1266	817	1338	2118	755	1208	925	1180	105	14	4	0
	334	368	25	13	19	-	38	19	215	11	44	113	53	20	9	0	0
	718	387	54	229	745	-	108	253	135	374	1112	970	2233	86	29	17	2
	361	388	27	-	24	-	772	24	-	332	54	81	0	65	96	0	7
	145	392	11	-	0	11	38	6	11	32	8	0	0	0	0	0	2
367-549	186	729	14	-	-	-	87	157	162	-	-	-	28	170	143	24	68
	216	731	16	-	-	-	247	154	-	-	-	-	319	95	206	19	34
	468	733	35	-	-	-	167	691	-	-	-	-	990	1255	356	104	30
	272	735	20	-	1169	-	197	31	1021	-	-	-	-	114	114	21	6
550-731	170	730	13	-	-	-	57	13	-	-	-	-	-	68	4	83	101
	231	732	17	-	-	-	178	139	-	-	-	-	16	109	393	26	95
	228	734	17	-	-	-	20	103	-	-	-	-	89	47	8	56	24
	175	736	13	-	-	302	-	151	401	-	-	-	197	505	51	29	13
Grand Total	38723			7463	7059	5640	7824	4848	6582	5702	6146	4500	6228	3016	1491	394	382
57-91	8552			0	67	84	311	0	27	0	9	0	189	26	32	0	0
92-183	17452			296	314	48	1174	0	273	96	112	0	106	27	0	0	0
184-274	6918			1769	1161	207	917	1006	1870	1469	2225	645	496	324	29	0	0
275-366	3855			5398	4348	4999	4467	2404	2828	4137	3801	3856	3797	276	156	33	11
367-549	1142			0	1169	0	699	1033	1183	0	0	0	1337	1634	819	168	138
550-731	804			0	0	302	255	405	401	0	0	0	302	729	456	194	233

Table 4 (con'd). Biomass (tons) per stratum of witch flounder from the autumn surveys in Div. 3L during 1995-96. Based on the new stratification system.

Depth Range (m)	Stratum	Area (sq. nm.)	1995	1996
57-91	350	2071	0	0
	363	1780	0	0
	371	1121	0	0
	372	2460	27	0
	384	1120	0	0
	785	465	-	0
Total			27	0
93-183	328	1519	-	0
	341	1574	-	0
	342	585	-	0
	343	525	-	0
	348	2120	0	0
	349	2114	0	0
	364	2817	0	0
	365	1041	0	0
	370	1320	0	0
	385	2356	0	0
	390	1481	0	0
	786	84	-	1
	787	613	-	0
	788	252	-	0
	790	89	-	0
	793	72	-	0
	794	216	-	0
	797	98	-	0
	799	72	-	0
Total			0	1
184-274	344	1582	0	0
	347	983	0	0
	366	1394	0	0
	369	961	0	0
	386	983	0	0
	389	821	43	0
	391	282	41	0
	789	81	-	0
	791	308	-	6
	795	164	-	0
	798	100	-	0
Total			84	6
275-366	345	1432	10	3
	346	865	0	12
	368	334	22	0
	387	718	63	8
	388	361	0	0
	392	145	0	0
	796	175	-	0
Total			94	23
367-549	729	186	3	151
	731	216	19	-
	733	468	24	12
	735	272	3	20
	792	50	-	55
Total			48	238
550-731	730	170	91	0
	732	231	16	147
	734	228	40	127
	736	175	12	261
Total			159	535
732-914	737	227	19	130
	741	223	-	115
	745	348	-	154
	748	159	-	87
Total			19	486
915-1097	738	221	10	331
	742	206	-	31
	746	392	-	120
	749	126	-	33
Total			10	515
1098-1280	739	254	-	0
	743	211	-	0
	747	724	-	0
	750	556	-	0
Total			0	0
1281-1463	740	264	-	0
	744	280	-	0
	751	229	-	0
Total			0	0
Grand Total			441	1804

Note: The 1995 and 1996 surveys were conducted with a Campellen 1800 shrimp trawl thus biomass estimates are not directly comparable to the estimates from previous years.

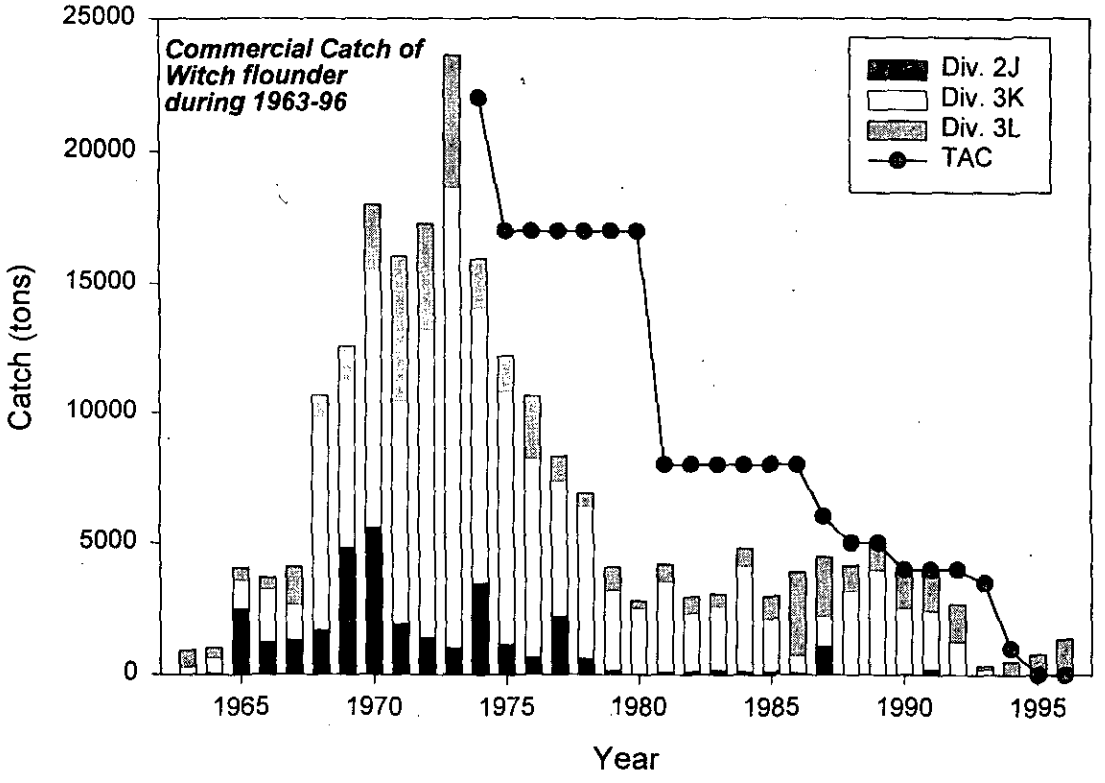


Fig. 1 Commercial catches and TAC's of witch flounder in Divisions 2J, 3K and 3L during 1963-96.

Biomass				
Year	Survey 2J	Survey 3K	Survey 3L	Survey Total
81	1968	31268	7463	40699
82	3573	22260	7059	32892
83	2726	36135	5640	44502
84	2020	35881	7824	45725
85	2122	23585	4848	30554
86	4142	14593	6582	25318
87	1511	14670	5702	21883
88	1061	11970	6146	19177
89	1520	5475	4500	11495
90	2061	11297	6228	19586
91	1417	2458	3016	6890
92	542	935	1491	2968
93	273	633	394	1300
94	157	345	382	884
95	262	438	441	1141
96	369	853	1804	3026

Note 1: Data in1981-94 from Engel trawl.
Note 2: Data in1995-96 from Campelen trawl.
Note 3: The 1995-96 surveys extended to deeper water compared to earlier years especially Div. 3L.
Note 4: New strata in Div. 3L in 1996 account for 1000 tons of the estimate.

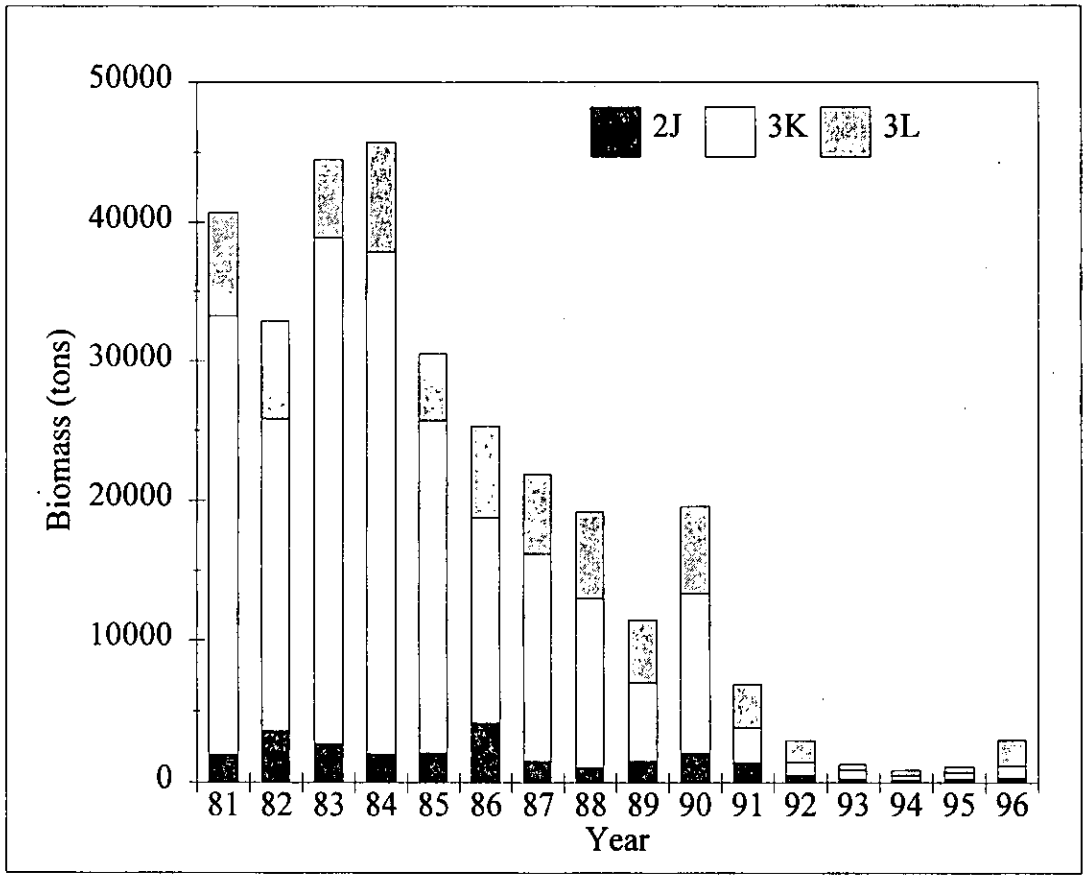


Fig. 2 Biomass indices of witch flounder from fall surveys in Divisions 2J, 3K and 3L during 1981-96.

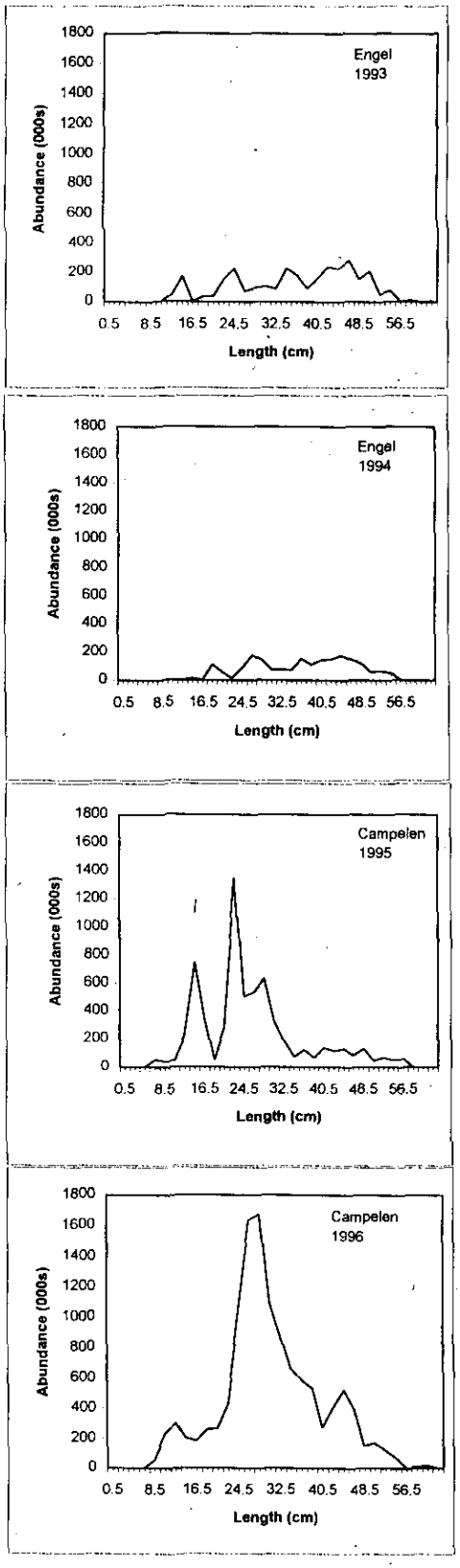
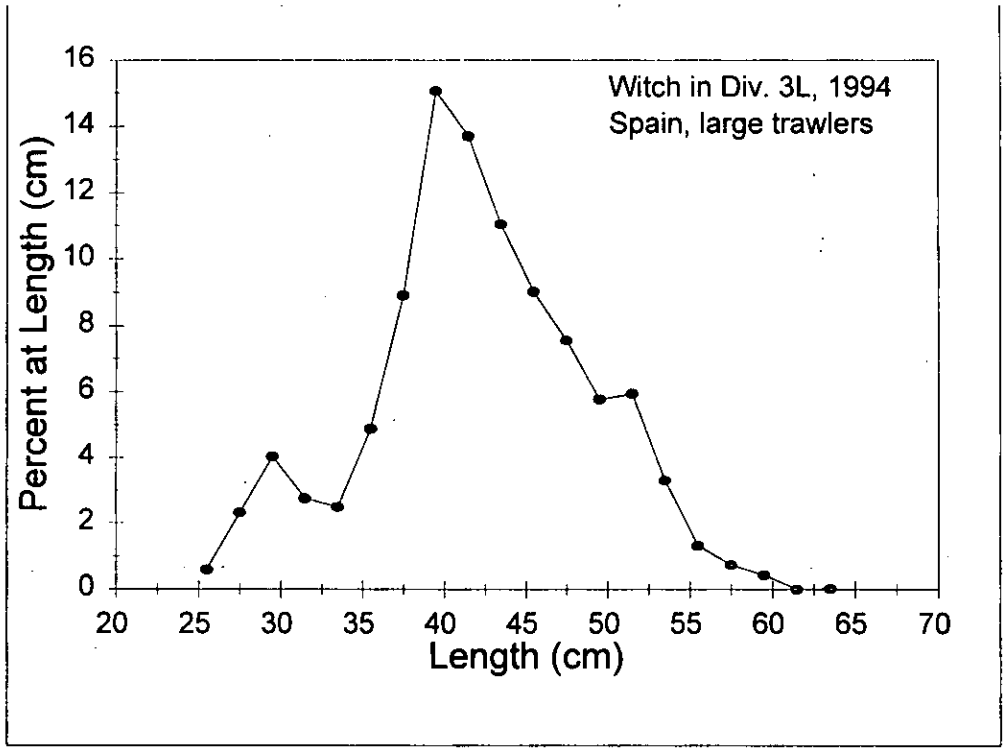


Fig. 3 Abundance at length of witch flounder from research surveys in Divisions 2J, 3K and 3L combined during the fall of 1993-96. (Revised on May 27, 1997)



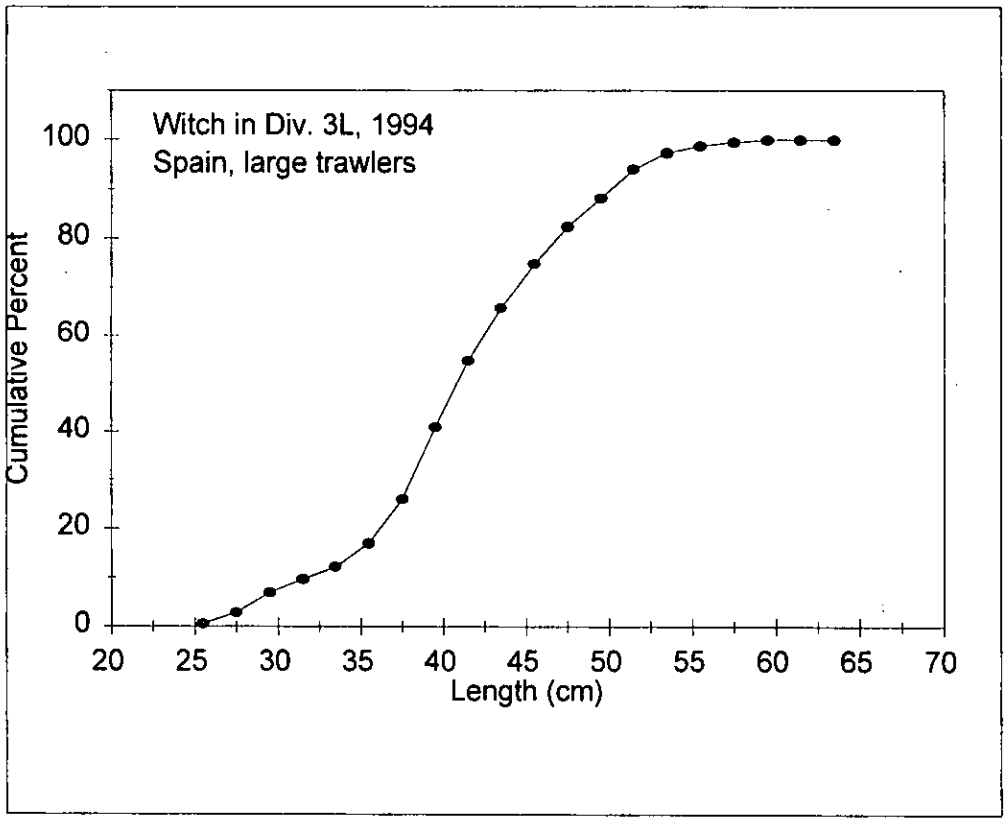


Fig. 4 Size distribution of witch flounder catches by Spain in the NAFO Regulatory Area of Div. 3L in 1994 (Data from SCS Doc. 95/15).

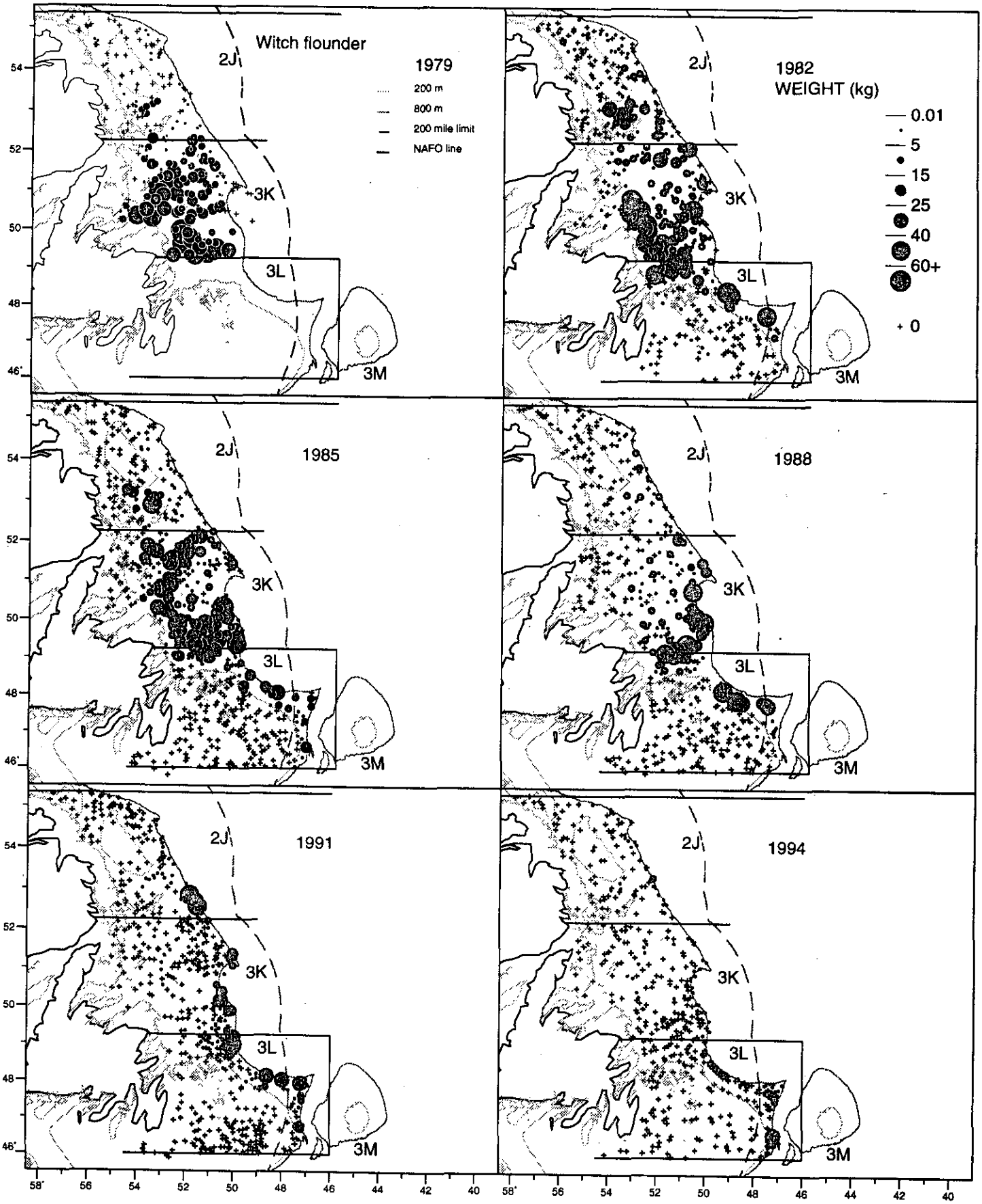


Fig. 5 Distribution of weight in Divisions 2J3KL from Canadian fall surveys for every third year from 1979-1994. Expressed as weight (kg) per tow using the Engel trawl.

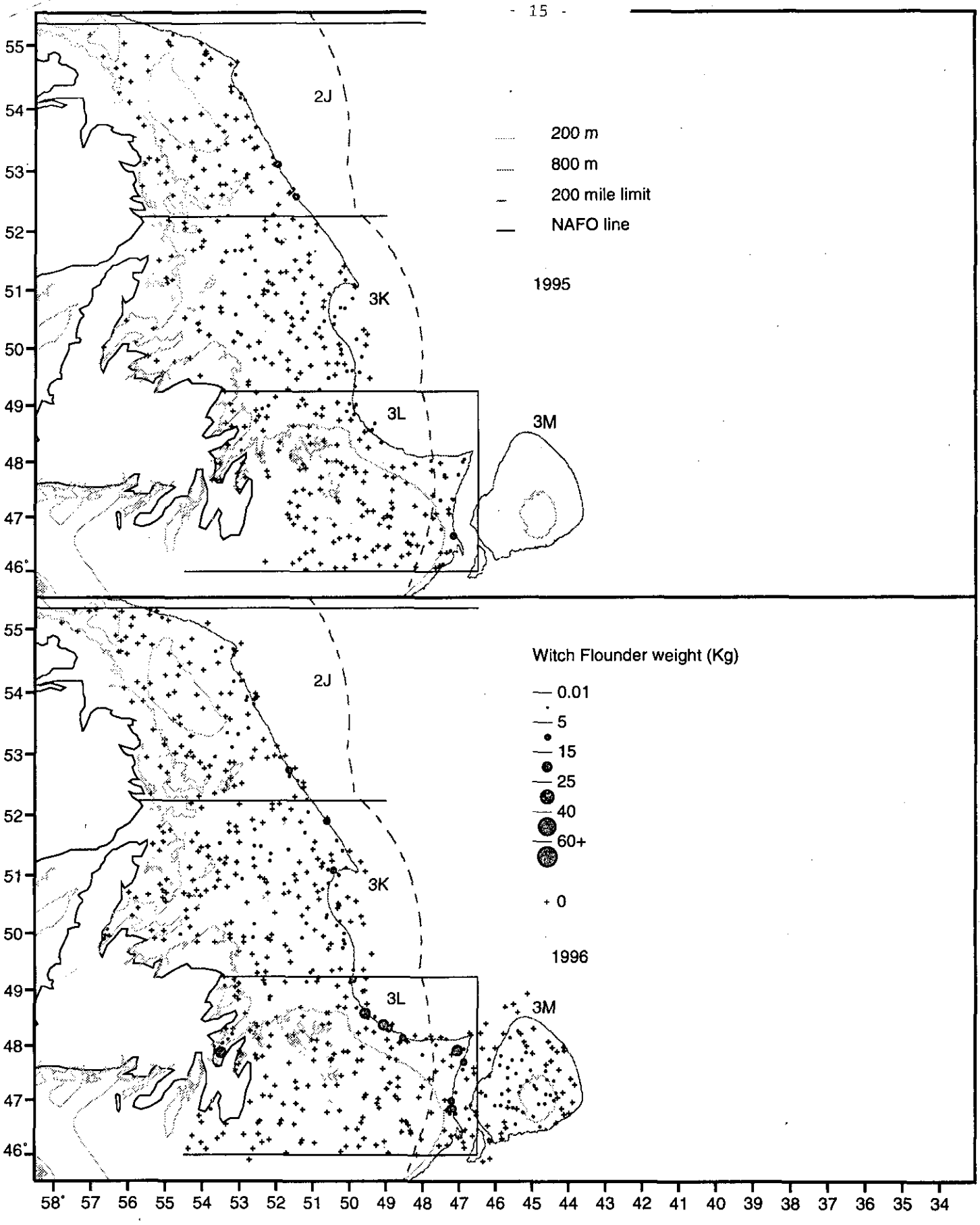


Fig. 6 Distribution of weight in Divisions 2J3KL from Canadian fall surveys in 1995-1996. Expressed as weight (kg) per tow using the Engel trawl.

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