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A Stock Status Update of Witch Flounder in NAFO Divisions 3NO

by

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**Abstract**

Biomass and abundance indices from Canadian spring surveys in Div. 3N have been at very low levels throughout the period since 1984. In most years the biomass index was estimated to be less than 1,000 tons or 2 million fish. For Div. 3O where most of the stock resides, estimates of stock size exhibited considerable annual fluctuations on average between 8,000 and 24,000 tons or 6-44 million fish particularly in the late 1980's. The data indicate an overall-declining trend in stock size with the estimates for the spring 1998 survey at the lowest level observed since 1984. Indices from Canadian fall surveys for Div. 3N are similar to the spring in both stock size estimates, which are very low but lack trend. The population trends for Div. 3O in the fall surveys are quite different than in the spring series. There is an increasing trend for 1991-96, however, when the higher value for 1990 and the lower values for 1997 and 1998 are included the trend is removed. Nonetheless, the estimates for each seasonal series are generally within the same numeric range.

**Fisheries and Management**

Catches in the 1960's peaked at 11,000-12,000 tons in 1967-68 and remained relatively high during the next several years (Table 1; Fig. 1). During the period 1971-84 catches ranged from a low of about 2,400 tons in 1980 and 1981 to as high as 15,000 tons in 1971 which is the highest recorded catch in the history of the fishery, however, from 1975-84 annual catches rarely exceeded 6,000 tons. Species specific catch statistics for flatfish prior to 1973 were largely developed from breakdowns of unspecified flounders and therefore should be quoted with caution.

As a result of an increase in fishing effort in the NRA during 1985 and 1986, especially by EU-Spain and EU-Portugal, catches rose rapidly to levels of 8,800 and 9,100 tons respectively. This increased effort was primarily concentrated on the "tail" of the Grand Bank in the NAFO Regulatory area of Division 3N. Non-Contracting parties such as South Korea, USA, Cayman Islands and Panama also contributed to increased catch levels during this period. Catches remained relatively high in 1987 and 1988 at 7,600 and 7,300 tons respectively. During 1990-93 estimated catches were in the range of 4,200-5,000 tons. The estimated catch for 1994 was still in the order of 1,100 tons despite there being a moratorium introduced on fishing this stock (Table 1; Fig. 1). Since then annual catches have been estimated around 300-600 tons.

Historically, mostly Canada and the former Soviet Union conducted the fishery. Canadian catches fluctuated from between 1,200 and 3,000 tons from 1985-91 but increased to about 4,300 tons in 1992 and 4,200 in 1993 (Table 1). Virtually no catch has been taken since then due to the moratorium. The increase in 1992 and 1993 was essentially the result of a quota transfer to Canada by the Russian Federation. Catches by the USSR/Russian vessels declined from between 1,000 and 2,000 tons in the period 1982-88 to less than 100 tons in 1989-90 and little or no catch since then.

The first total allowable catch (TAC) for this resource was introduced by ICNAF in 1974 at a level of 10,000 tons largely based on average historical catches (Fig. 1). This level remained in effect until 1979 when it was reduced to 7,000 tons in consideration of declining commercial catch rates. It was further reduced to 5,000 tons in 1981 and remained at that level to 1993. The Scientific Council advised that for 1994 catches from this stock should not exceed 3,000 tons. A TAC of 3,000 tons was agreed by the NAFO Fisheries Commission, however, it was also agreed that no directed fishery would be conducted for witch flounder in 1994 due to the poor state of the stock and to allow for rebuilding. The NAFO Fisheries Commission introduced a complete moratorium for directed fishing in 1995 which has continued through 1999.

### **Canadian Research Vessel Surveys**

Stratified-random research vessel surveys have been carried out by Canada on the Grand Bank (including Div. 3NO) during spring since 1971 although during the early period coverage was limited and, in fact, for most years only surveyed to 366 meters. Since 1990, on the other hand, depth coverage was extended to 720 meters, which should be more representative of the stock distribution. Nevertheless, this still may not cover the entire range of depth distribution of witch flounder when compared to its distribution observed in other stock areas during recent years. In addition to spring surveys, a time series of fall surveys was begun in 1990 to investigate seasonal variation in stock distribution and abundance of various groundfish species. In fall 1998 the survey depth range was further extended to 1500 meters.

Beginning with the 1995 fall survey the survey gear was changed from an Engel groundfish trawl with steel bobbin footgear to a Campelen 1800 shrimp trawl with rockhopper footgear. The data from these surveys have now been converted from Engel trawl catches to Campelen 1800 trawl catch equivalents. Only the converted survey data are presented here.

### ***Survey Biomass and Abundance Indices***

Biomass estimates by stratum are presented for the spring surveys in NAFO Division 3N and 3O, respectively in Tables 2 and 3. Similar data are presented for abundance estimates from spring surveys in Tables 4 and 5, respectively. Fall survey results are shown in the same order as above for spring survey in Tables 6-9, inclusive. Graphical plots to better illustrate the comparative trends in stock biomass and abundance by season are presented by NAFO Divisions 3N and 3O separately and combined in figures 2-4, respectively.

Estimated biomass and abundance from spring surveys (which is the longer time series) in Div. 3N has been at very low levels throughout the period since 1984. In most years trawlable stock size was estimated to be less than 1,000 tons or 2 million fish (Fig. 2; Tables 2 and 4). For Div. 3O where most of the stock resides, estimates of stock size exhibited considerable annual fluctuations on average between 8,000 and 24,000 tons or 6-44 million fish particularly in the late 1980's (Fig. 2; Tables 3 and 5). The several high spikes in the time series appear related to distribution shifts between the deeper smaller strata and the more shallow large strata. This would have the effect of giving lower estimates when fish are distributed deeper and higher estimates when fish are distributed more in over the bank. Nevertheless, the data indicate an overall-declining trend in stock size (Fig. 2 and 4) with the estimates for the spring 1998 survey at the lowest level observed since 1984.

Results of the fall surveys for Div. 3N are similar to the spring in both stock size estimates, which are very low and lack trend (Fig. 3; Tables 6 and 8). The data trends for Div. 3O in the fall surveys are quite different than in the spring series (Fig. 3; Tables 7 and 9). There is an increasing trend for 1991-96, however, when the higher value for 1990 and the lower values for 1997 and 1998 are included the trend is removed (Fig. 3; Tables 7 and 9). Nonetheless, the estimates for each seasonal series are generally within the same numeric range. With Divisions 3NO combined, the most recent biomass and abundance estimates from the spring surveys are about the lowest observed and illustrate a declining trend since the beginning of the data series in 1984. The fall survey series for Divisions 3NO combined is less clear with no real trend. It should be emphasized as well that the more recent lower estimates are also based on more detailed survey coverage than in the earlier years (annual percentage contributions to the estimates are shown in Tables 2-9). Consequently, in reality the declining trends are stronger than illustrated in the figures.

**Resource Status**

Based on the 1998 spring survey estimates it now appears that the resource remains at an all time low. The general trend in this longer (spring) survey series would in fact suggest that the stock might continue to decline despite a commercial fishing moratorium being in effect for several years. No aging data have been available since 1994 and are not expected to be available in the foreseeable future. Therefore, it is difficult to comment on any recruitment prospects for the resource. Population abundance at length from true *Campelen 1800* surveys in the fall of 1995-98 indicate a higher proportion of smaller fish in recent years especially in the 1998 survey (Fig. 5). However, it is quite variable from year to year which makes it difficult to track recruitment.

Table 1 . Catches and TACs ( t ) of Witch Flounder in Div. 3NO from 1960-99.

Year	USSR			Total	TAC
	Canada	(Russia)	Other		
1960	-	-	-	5799	-
1961	-	-	-	4627	-
1962	-	-	-	1228	-
1963	895	485	803	2183	-
1964	1055	-	11	1066	-
1965	1324	849	4	2177	-
1966	3644	3828	50	7522	-
1967	2863	8565	75	11503	-
1968	1503	9078	18	10599	-
1969	479	4215	6	4700	-
1970	723	6039	1	6763	-
1971	178	14774	13	14965	-
1972	3419	5738	20	9177	-
1973	4943	1714	34	6691	-
1974	2807	5235	3	8045	10000
1975	1137	5019	12	6168	10000
1976	3044	2991	-	6035	10000
1977	3013	2742	4	5759	10000
1978	1165	2275	33	3473	10000
1979	1193	1868	16	3077	7000
1980	425	1994	1	2420	7000
1981	381	2044	-	2425	5000
1982	1760	1969	3	3732	5000
1983	1674	1942	-	3616	5000
1984	834	1955	13	2802	5000
1985	2746	1908	4117	8771	5000
1986	2937	1724	4470	9131	5000
1987	2829	1425	3342	7596	5000
1988	1927	1037	4361	7325	5000
1989	1241	81	2366	3688	5000
1990	2654	9	1516	4179	5000
1991	2624	-	2223	4847	5000
1992	4328	-	632	4960	5000
1993	4337	3	250 <sup>b</sup>	4414	5000
1994 <sup>a</sup>	2	-	1117 <sup>b</sup>	1119	3000
1995 <sup>a</sup>	-	-	300 <sup>b</sup>	300	0
1996 <sup>a</sup>	64	-	294 <sup>b</sup>	358	0
1997 <sup>a</sup>	19	-	493 <sup>b</sup>	512	0
1998 <sup>a</sup>	2	5	605	612	0
1999	-	-	-	-	0

\*Note: Although a TAC of 3000 tons was agreed by the FC, it was also agreed that no directed fishing be conducted in 1994 due to the poor state of the stock.

<sup>a</sup> = Provisional Data

<sup>b</sup> = Estimated

Table 2. Biomass (tons) of Witch flounder from surveys in Div. 3N during spring 1984-1998 (Engel data converted to Campelen units for 1984-95)																		
Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998			
Depth Range (meters)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
<=56	1593	1593	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=56	1499	1499	376	0	0	0	19	0	0	0	0	0	0	0	0	0	0	8
57 - 92	2992	2992	360	1715	89	629	461	1519	175	0	0	29	165	0	0	0	115	33
57 - 92	1853	1853	361	119	0	0	39	50	0	20	0	0	0	0	39	0	0	0
57 - 92	2520	2520	362	0	82	23	18	147	0	0	0	0	0	0	0	0	0	0
57 - 92	2520	2520	373	0	0	43	0	0	0	0	0	0	0	0	0	0	0	0
57 - 92	931	931	374	0	0	0	0	0	0	0	0	0	18	34	0	0	0	0
57 - 92	674	674	383	0	57	0	37	0	0	0	0	0	0	0	0	0	0	0
93 - 183	421	421	359	231	47	99	43	306	121	0	0	0	19	0	0	0	0	0
93 - 183	100	100	377	8	0	0	72	3	32	0	0	0	0	0	0	0	0	0
93 - 183	647	647	382	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0
184 - 274	225	225	358	40	308	42	137	20	29	57	0	44	132	106	7	51	49	134
184 - 274	139	139	378	22	19	32	155	31	42	0	0	29	0	0	0	0	0	0
184 - 274	182	182	381	21	7	32	101	69	0	28	0	0	0	0	0	0	3	0
275 - 366	164	164	357	8	87	154	4	4	60	21	0	31	49	81	20	36	12	159
275 - 366	106	106	379	36	12	23	173	44	20	35	3	18	0	4	0	0	9	2
275 - 366	116	116	380	6	53	0	134	24	7	4	0	0	0	0	0	0	0	0
367 - 549	155	155	723	.	.	.	.	.	.	.	90	102	79	36	51	16	25	53
367 - 549	105	105	725	.	.	.	.	.	.	.	62	.	40	44	0	5	28	4
367 - 549	160	160	727	.	.	.	.	.	.	.	0	5	38	17	0	0	3	9
550 - 731	124	124	724	.	.	.	.	.	.	.	327	181	218	51	36	29	157	53
550 - 731	72	72	726	.	.	.	.	.	.	.	81	25	22	28	3	12	42	96
550 - 731	156	156	728	.	.	.	.	.	.	.	92	19	82	22	152	21	.	15
732 - 914	.	.	752	.	.	.	.	.	.	.	.	.	.	27	.	.	.	.
732 - 914	.	.	756	.	.	.	.	.	.	.	.	.	.	33	.	.	.	.
732 - 914	.	.	760	.	.	.	.	.	.	.	.	.	.	26	.	.	.	.
915 - 1097	.	.	753	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
915 - 1097	.	.	757	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
915 - 1097	.	.	761	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1098 - 1280	.	.	754	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1098 - 1280	.	.	758	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1098 - 1280	.	.	762	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1281 - 1463	.	.	755	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1281 - 1463	.	.	759	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1281 - 1463	.	.	763	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Biomass (>366 m)														284	242	84	255	230
Percent >366 m														55.7	78.6	49.2	57.6	40.6
Biomass (all strata)								2205	761	1078	1401	485	2217	510	308	170	443	566

Table 3. Biomass (tons) of Witch flounder from surveys in Div. 30 during spring 1984-1998 (Engel data converted to Campelen units for 1984-95)

Year	Old Stratum (meters)/Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
57 - 92	2089	2089	330	0	0	0	0	22	0	0	0	0	0	0	0	0	0	21
57 - 92	456	456	331	1912	302	36	18	444	0		0	0	0	0	0	74	0	36
57 - 92	1898	1898	338	134	7806	1108	1184	3075	1827	434	0	109	295	0	228	870	0	357
57 - 92	1716	1716	340	40	146	0	21	0	0	15	0	147	0	0	0	0	0	0
57 - 92	2520	2520	351	688	211	385	222	978	217	109	0	0	0	0	0	0	0	0
57 - 92	2580	2580	352	82	951	225	1275	1330	664	1427	40	105	60	40	63	59	100	53
57 - 92	1282	1282	353	4519	1122	1067	1609	7208	2486	1637	0	243	209	0	42	23	2	272
93 - 183	1721	1721	329	0	0	0	0	789	48	27	494	0	0	5071	193	0	11	51
93 - 183	1047	1047	332	3779	8589	2485	3367	6829	1485	4599	2426	2182	359	58	1791	1180	235	460
93 - 183	948	948	337	50	4129	1415	1506	1061	1543	1627	1581	580	675	50	654	330	163	321
93 - 183	585	585	339	335	0	16	223	136	0	0	0	0	0	0	0	1	0	0
93 - 183	474	474	354	495	105	1231	233	345	47	240	144	149	841	0	0	36	0	226
184 - 274	151	147	333	10	48	10	0	67	16	129	498	79	80	5196	162	7	109	25
184 - 274	121	121	336	12	7	43	25	63	0	53	492	1374	100	1057	62	180	293	23
184 - 274	103	103	355	45	181	38	71	0	97	126	136	16	34	129	43	86	48	50
275 - 366	92	96	334	0	42	42	18	22	23	26	20	108	20	860	15	150	362	4
275 - 366	58	58	335	0	98	18	2	51	22	92	42	1107	65	103	43	78	109	2
275 - 366	61	61	356	5	83	18	23	18	29	55	39	129	77	75	62	40	11	29
367 - 549	93	166	717								11	120	35	2375	53	465	4354	44
367 - 549	76	76	719								148	1024	49	14	18	137	601	15
367 - 549	76	76	721								76	48	31	72	18	16	19	38
550 - 731	111	134	718								35	29	104	221	80	71	37	33
550 - 731	105	105	720								217	134	182	95	15	21	150	32
550 - 731	93	93	722								18	49	150	217	206	89	87	31
732 - 914		105	764											60				
732 - 914		99	768															
732 - 914		135	772											75				
915 - 1097		124	765															
915 - 1097		138	769															
915 - 1097		128	773															
1098 - 1280		144	766															
1098 - 1280		128	770															
1098 - 1280		135	774															
1281 - 1463		158	767															
1281 - 1463		175	771															
1281 - 1463		155	775															
Biomass (>366 m)											504	1405	550	3128	390	800	5247	192
Percent >366 m											7.9	18.2	16.4	19.8	10.4	20.4	78.4	9.1
Biomass (tons)				12108	23820	8136	9799	22438	8503	10594	6415	7734	3364	15769	3748	3915	6691	2121

Table 4 Abundance (000's) of Witch flounder from surveys in Div. 3N during spring of 1984-1998 by the Wilfred Templeman (Engel data converted to Campelen units for 1984-95)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Depth Range (meters)															
<=56	1593	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57-92	1499	0	0	26	0	0	0	0	0	0	0	0	0	0	0
57-92	2992	2234	728	741	2641	220	0	0	59	225	0	0	0	132	65
57-92	1853	153	0	32	36	0	28	0	0	0	0	36	0	0	0
57-92	2520	0	95	25	173	0	0	0	0	0	0	0	0	0	0
57-92	2520	0	0	50	0	0	0	0	0	0	0	0	0	0	0
57-92	931	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57-92	674	0	62	0	31	0	0	0	0	43	43	0	0	0	0
93-183	421	405	58	232	985	203	0	0	0	29	0	0	0	0	0
93-183	100	14	0	186	7	83	0	0	0	0	0	0	0	0	0
93-183	647	0	0	30	0	0	0	0	0	0	0	0	0	0	0
184-274	225	77	557	93	279	31	46	93	93	294	232	31	77	83	261
184-274	139	48	29	48	354	86	115	0	96	0	0	0	0	9	0
184-274	182	25	13	42	163	75	0	25	0	0	0	0	0	0	13
275-366	164	23	180	553	11	237	56	0	90	124	102	23	40	30	373
275-366	106	66	36	68	102	44	109	7	44	0	22	0	0	18	6
275-366	116	8	88	0	247	32	8	8	0	0	0	0	0	0	0
367-549	155	723	0	0	0	0	0	288	341	256	53	181	45	51	149
367-549	105	105	0	0	0	0	0	166	0	101	87	0	13	235	26
367-549	160	727	0	0	0	0	0	0	11	55	22	0	0	11	33
550-731	124	724	0	0	0	0	0	1134	580	597	188	119	128	432	144
550-731	72	72	72	726	0	0	0	213	59	30	114	5	33	183	322
550-731	156	728	0	0	0	0	0	182	21	139	29	172	134	0	64
732-914	134	752	0	0	0	0	0	0	0	0	0	0	0	0	0
732-914	106	756	0	0	0	0	0	0	0	0	0	0	0	0	0
732-914	154	760	0	0	0	0	0	0	0	0	0	0	0	0	0
915-1097	138	753	0	0	0	0	0	0	0	0	0	0	0	0	0
915-1097	102	757	0	0	0	0	0	0	0	0	0	0	0	0	0
915-1097	171	761	0	0	0	0	0	0	0	0	0	0	0	0	0
1098-1280	180	754	0	0	0	0	0	0	0	0	0	0	0	0	0
1098-1280	99	758	0	0	0	0	0	0	0	0	0	0	0	0	0
1098-1280	212	762	0	0	0	0	0	0	0	0	0	0	0	0	0
1281-1463	385	755	0	0	0	0	0	0	0	0	0	0	0	0	0
1281-1463	127	759	0	0	0	0	0	0	0	0	0	0	0	0	0
1281-1463	261	763	0	0	0	0	0	0	0	0	0	0	0	0	0
Abundance > 366 m (000's)								1984	1013	1178	712	477	353	913	738
Percent >366 m								99.6	72.7	62.3	64.1	84.1	75.0	77.1	49.5
Total abundance (000's)	3053	1246	1837	2595	4180	955	320	1991	1394	1892	1110	567	470	1184	1491



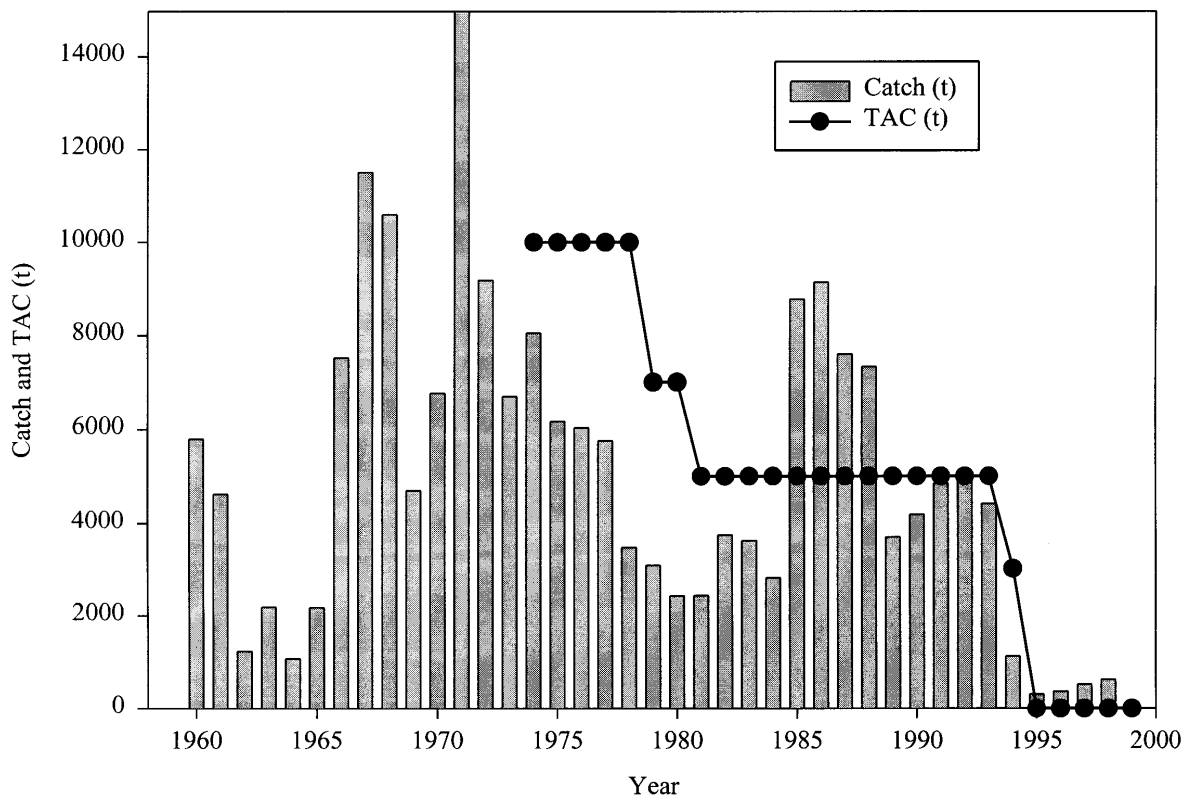


Table 6 Biomass (tons) of Witch flounder from surveys in Div. 3N during fall 1990-1998 by the Wilfred Templeman, Alfred Needler and Teleost (Engel data converted to Campelen units for 1990-94).												
Year				1990	1991	1992	1993	1994	1995	1996	1997	1998
Depth Range (meters)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum									
<=56	1593	1593	375	0	73	.	0	0	0	0	0	0
<=56	1499	1499	376	0	0	0	0	0	14	0	22	0
57 - 92	2992	2992	360	265	171	1297	173	75	888	23	427	431
57 - 92	1853	1853	361	28	467	463	0	32	0	0	14	0
57 - 92	2520	2520	362	400	221	87	0	0	0	0	0	0
57 - 92	2520	2520	373	0	0	0	0	0	0	0	0	0
57 - 92	931	931	374	0	0	.	0	0	0	0	0	0
57 - 92	674	674	383	0	0	.	0	0	0	0	0	0
93 - 183	421	421	359	0	0	278	0	0	22	0	0	1213
93 - 183	100	100	377	0	.	0	0	8	0	0	0	0
93 - 183	647	647	382	0	0	0	0	0	0	0	0	0
184 - 274	225	225	358	0	20	66	24	0	74	0	11	30
184 - 274	139	139	378	0	41	15	0	0	0	0	1	0
184 - 274	182	182	381	.	0	.	0	0	0	0	1	0
275 - 366	164	164	357	0	234	9	187	43	85	0	27	0
275 - 366	106	106	379	4	.	4	0	0	0	1	7	0
275 - 366	116	116	380	.	0	.	0	0	0	0	0	1
367 - 549	155	155	723	.	41	.	163	180	57	15	28	74
367 - 549	105	105	725	.	.	15	376	46	19	0	135	10
367 - 549	160	160	727	.	.	.	0	38	0	0	29	7
550 - 731	124	124	724	.	172	.	414	180	104	60	197	72
550 - 731	72	72	726	.	.	.	310	54	48	40	21	38
550 - 731	156	156	728	.	.	.	.	153	35	21	76	78
732 - 914	.	134	752	.	.	.	.	.	.	.	.	120
732 - 914	.	106	756	.	.	.	.	.	.	.	.	124
732 - 914	.	154	760	.	.	.	.	.	.	.	.	88
915 - 1097	.	138	753	.	.	.	.	.	.	.	.	0
915 - 1097	.	102	757	.	.	.	.	.	.	.	.	0
915 - 1097	.	171	761	.	.	.	.	.	.	.	.	46
1098 - 1280	.	180	754	.	.	.	.	.	.	.	.	0
1098 - 1280	.	99	758	.	.	.	.	.	.	.	.	0
1098 - 1280	.	212	762	.	.	.	.	.	.	.	.	0
1281 - 1463	.	385	755	.	.	.	.	.	.	.	.	0
1281 - 1463	.	127	759	.	.	.	.	.	.	.	.	.
1281 - 1463	.	261	763	.	.	.	.	.	.	.	.	.
Biomass (>731 m)												379
Percent >731 m												16.2
Biomass (all strata)				696	1441	2235	1647	808	1346	160	993	2333

Year				1990	1991	1992	1993	1994	1995	1996	1997	1998
Depth Range (meters)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum									
57 - 92	2089	2089	330	122	67	79	0	0	247	0	72	168
57 - 92	456	456	331	22	315	134	0	0	108	0	0	256
57 - 92	1898	1898	338	2226	438	837	3966	2193	4685	503	1329	483
57 - 92	1716	1716	340	173	280	63	0	0	204	0	22	0
57 - 92	2520	2520	351	1690	284	72	0	0	0	0	0	37
57 - 92	2580	2580	352	1415	896	1352	946	228	379	273	573	374
57 - 92	1282	1282	353	2405	343	477	0	732	538	789	168	1066
93 - 183	1721	1721	329	99	85	0	18	0	417	0	173	305
93 - 183	1047	1047	332	2102	155	1724	813	321	1114	4569	190	245
93 - 183	948	948	337	1333	188	954	563	2132	421	492	322	479
93 - 183	585	585	339	1132	224	651	119	742	1911	0	481	261
93 - 183	474	474	354	1291	23	316	75	210	191	4647	215	201
184 - 274	151	147	333	221	11	22	30	92	26	.	4	6
184 - 274	121	121	336	82	151	76	298	13	35	32	19	19
184 - 274	103	103	355	.	497	93	120	25	16	343	6	14
275 - 366	92	96	334	24	16	0	9	17	4	.	5	1
275 - 366	58	58	335	194	25	25	30	18	1	23	0	1
275 - 366	61	61	356	.	11	7	430	98	7	60	3	4
367 - 549	93	166	717	30	.	.	0	32	37	.	12	42
367 - 549	76	76	719	110	2	.	65	6	1	226	19	9
367 - 549	76	76	721	.	18	.	169	67	21	54	6	14
550 - 731	111	134	718	.	.	.	22	68	8	.	68	47
550 - 731	105	105	720	.	.	.	73	0	13	68	.	2
550 - 731	93	93	722	.	9	.	81	21	14	39	12	12
732 - 914	.	105	764	.	.	.	.	.	.	.	.	75
732 - 914	.	99	768	.	.	.	.	.	.	.	.	18
732 - 914	.	135	772	.	.	.	.	.	.	.	.	173
915 - 1097	.	124	765	.	.	.	.	.	.	.	.	24
915 - 1097	.	138	769	.	.	.	.	.	.	.	.	17
915 - 1097	.	128	773	.	.	.	.	.	.	.	.	4
1098 - 1280	.	144	766	.	.	.	.	.	.	.	.	.
1098 - 1280	.	128	770	.	.	.	.	.	.	.	.	.
1098 - 1280	.	135	774	.	.	.	.	.	.	.	.	.
1281 - 1463	.	158	767	.	.	.	.	.	.	.	.	.
1281 - 1463	.	175	771	.	.	.	.	.	.	.	.	.
1281 - 1463	.	155	775	.	.	.	.	.	.	.	.	.
Biomass (>731 m)												311
Percent > 731 m												7.15
Biomass (all strata)				14671	4036	6884	7827	7013	10397	12117	3698	4356

Table 8 Abundance (000s) of Witch flounder from surveys in Div. 3N during fall 1990-1998 by the Wilfred Templeman, Alfred Needler and Teleost (Engel data converted to Campelen units for 1990-94).												
Year				1990	1991	1992	1993	1994	1995	1996	1997	1998
Depth Range	Old Stratum	New Stratum	Stratum									
(meters)	Area (sq. n. mi.)	Area (sq. n. mi.)										
<=56	1593	1593	375	0	55	.	0	0	0	0	0	0
<=56	1499	1499	376	0	0	0	0	0	23	0	19	0
57 - 92	2992	2992	360	382	206	1646	320	103	1232	41	672	755
57 - 92	1853	1853	361	32	425	701	0	42	0	0	23	0
57 - 92	2520	2520	362	441	277	116	0	0	0	0	0	0
57 - 92	2520	2520	373	0	0	0	0	0	0	0	0	0
57 - 92	931	931	374	0	0	.	0	0	0	0	0	0
57 - 92	674	674	383	0	0	.	0	0	0	0	0	0
93 - 183	421	421	359	0	0	608	0	0	87	0	0	2722
93 - 183	100	100	377	0	0	0	0	7	0	0	0	0
93 - 183	647	647	382	0	0	0	0	0	0	0	0	0
184 - 274	225	225	358	0	46	108	31	0	234	0	31	93
184 - 274	139	139	378	0	105	19	0	0	0	0	9	10
184 - 274	182	182	381	.	0	.	0	0	0	0	7	13
275 - 366	164	164	357	0	384	23	338	135	180	0	60	0
275 - 366	106	106	379	7	.	15	0	0	0	19	22	0
275 - 366	116	116	380	.	0	.	0	0	0	0	0	8
367 - 549	155	155	723	.	53	.	330	394	117	21	88	313
367 - 549	105	105	725	.	.	36	701	173	49	0	237	29
367 - 549	160	160	727	.	.	.	0	44	11	0	55	11
550 - 731	124	124	724	.	444	.	1126	512	223	178	571	326
550 - 731	72	72	726	.	.	.	669	114	119	99	40	92
550 - 731	156	156	728	.	.	.	.	268	195	129	212	215
732 - 914	.	134	752	.	.	.	.	.	.	.	.	165
732 - 914	.	106	756	.	.	.	.	.	.	.	.	255
732 - 914	.	154	760	.	.	.	.	.	.	.	.	244
915 -1097	.	138	753	.	.	.	.	.	.	.	.	0
915 -1097	.	102	757	.	.	.	.	.	.	.	.	0
915 -1097	.	171	761	.	.	.	.	.	.	.	.	106
1098 -1280	.	180	754	.	.	.	.	.	.	.	.	0
1098 -1280	.	99	758	.	.	.	.	.	.	.	.	0
1098 -1280	.	212	762	.	.	.	.	.	.	.	.	0
1281 -1463	.	385	755	.	.	.	.	.	.	.	.	0
1281 -1463	.	127	759	.	.	.	.	.	.	.	.	.
1281 -1463	.	261	763	.	.	.	.	.	.	.	.	.
Abundance >731 m (000's)												770
Percent >731 m												14.4
Total abundance (000's)				863	1995	3272	3515	1793	2470	488	2046	5355

Table 9 Abundance (000s) of Witch flounder from surveys in Div. 3O during fall 1990-1998 by the Wilfred Templeman, Alfred Needler and Teleost (Engel data converted to Campelen units for 1990-94).												
Year				1990	1991	1992	1993	1994	1995	1996	1997	1998
Depth Range (meter)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum									
57 - 92	2089	2089	330	131	144	72	0	0	517	0	96	335
57 - 92	456	456	331	42	502	125	0	0	408	0	0	596
57 - 92	1898	1898	338	3264	627	1436	6893	4700	8459	522	2872	1723
57 - 92	1716	1716	340	262	330	118	0	0	295	0	47	0
57 - 92	2520	2520	351	1837	347	58	0	0	0	0	0	50
57 - 92	2580	2580	352	1597	1242	2011	1115	355	371	355	1141	754
57 - 92	1282	1282	353	2822	485	941	0	1176	999	882	573	5467
93 - 183	1721	1721	329	132	101	0	47	0	663	0	616	852
93 - 183	1047	1047	332	3625	396	5281	2064	960	5233	11954	1248	2544
93 - 183	948	948	337	2347	424	2347	1043	5216	1435	717	1130	1613
93 - 183	585	585	339	1556	241	724	121	966	2776	0	1086	356
93 - 183	474	474	354	1891	33	685	359	424	489	8955	489	782
184 - 274	151	147	333	582	52	83	62	312	187	.	192	147
184 - 274	121	121	336	222	466	216	633	42	549	208	100	215
184 - 274	103	103	355	.	1459	298	425	85	63	768	28	170
275 - 366	92	96	334	76	70	0	21	57	56	.	33	20
275 - 366	58	58	335	371	100	112	68	52	64	64	4	40
275 - 366	61	61	356	.	25	8	1255	252	40	113	13	34
367 - 549	93	166	717	122	.	.	0	96	703	.	46	833
367 - 549	76	76	719	209	42	.	277	10	52	612	183	178
367 - 549	76	76	721	.	47	.	444	183	102	131	17	125
550 - 731	111	134	718	.	.	.	107	428	164	.	535	618
550 - 731	105	105	720	.	.	.	339	0	105	316	.	29
550 - 731	93	93	722	.	26	.	243	58	64	134	51	103
732 - 914	.	105	764	.	.	.	.	.	.	.	.	357
732 - 914	.	99	768	.	.	.	.	.	.	.	.	217
732 - 914	.	135	772	.	.	.	.	.	.	.	.	1514
915 - 1097	.	124	765	.	.	.	.	.	.	.	.	165
915 - 1097	.	138	769	.	.	.	.	.	.	.	.	180
915 - 1097	.	128	773	.	.	.	.	.	.	.	.	35
1098 - 1280	.	144	766	.	.	.	.	.	.	.	.	.
1098 - 1280	.	128	770	.	.	.	.	.	.	.	.	.
1098 - 1280	.	135	774	.	.	.	.	.	.	.	.	.
1281 - 1463	.	158	767	.	.	.	.	.	.	.	.	.
1281 - 1463	.	175	771	.	.	.	.	.	.	.	.	.
1281 - 1463	.	155	775	.	.	.	.	.	.	.	.	.
Abundance >731 m (000's)												2468
Percent >731 m												12.3
Total abundance (000's)				21086	7158	14515	15517	15369	23795	25731	10499	20054



**Fig. 1 Commercial catches of witch flounder in Div. 3NO from 1960-97 and TAC's from 1974-99. Catches in recent years include estimates of those not reported.**

**\*Note: Although a TAC of 3000 tons was agreed by the Fisheries Commission, it was also agreed that no directed fishing on witch flounder in Div. 3NO take place during 1994 due to the poor state of the stock.**

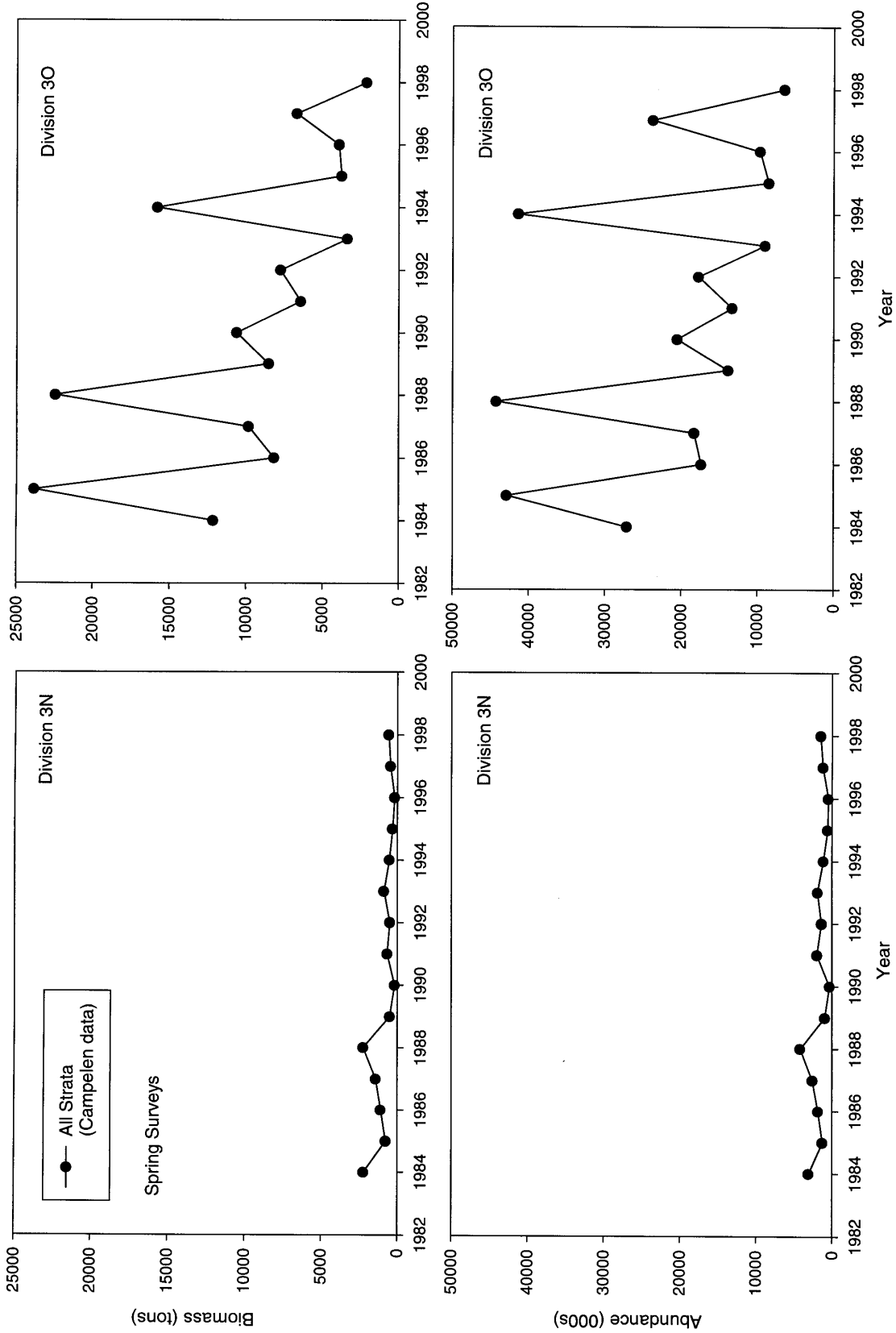


Fig. 2 Biomass (tons) and abundance estimates (000s) of witch flounder from Canadian spring surveys in Div. 3N and 3O during 1984-98.

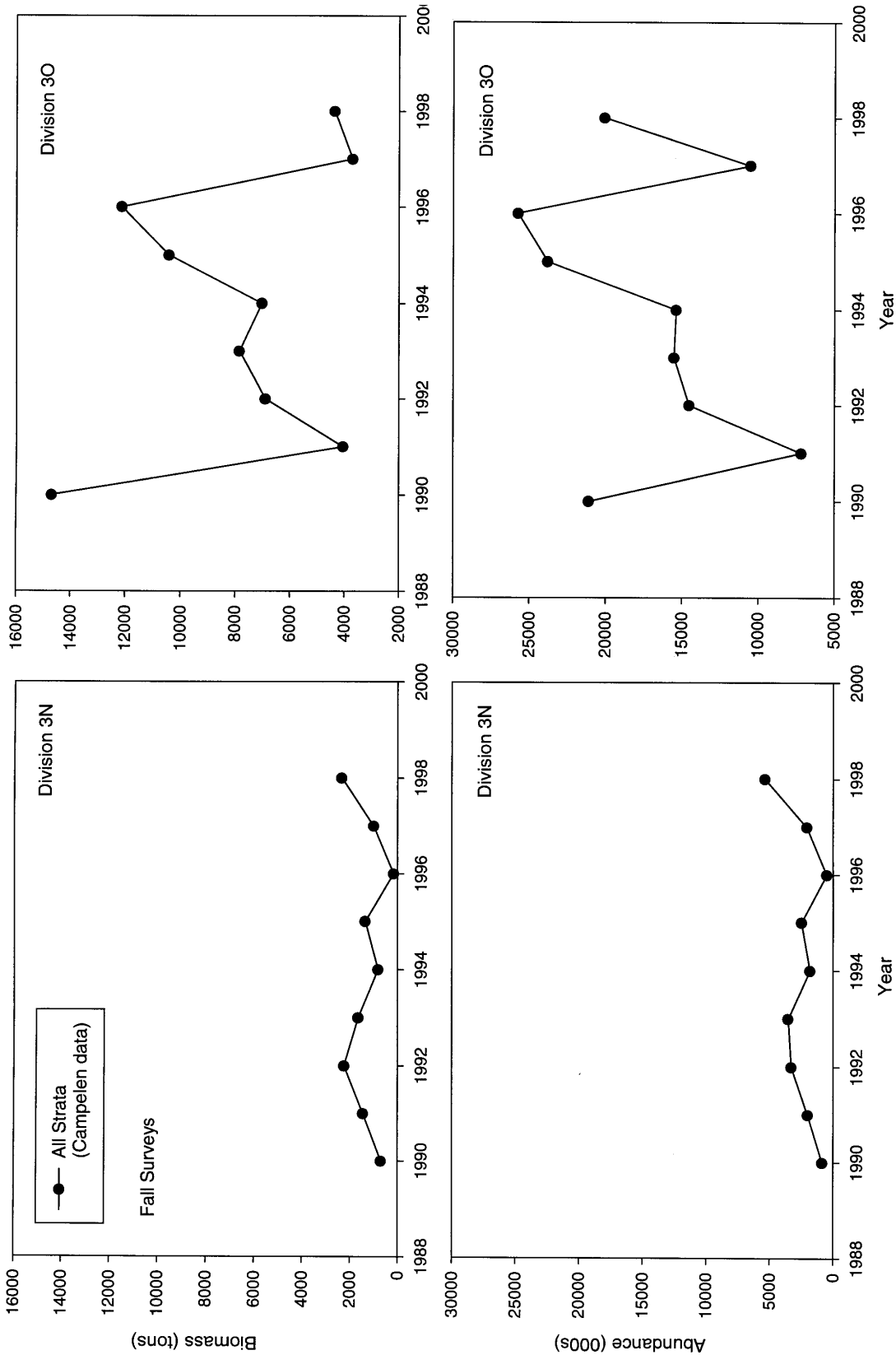


Fig. 3 Biomass (tons) and abundance estimates (000s) of witch flounder from Canadian fall surveys in Div. 3N and 3O during 1990-98.

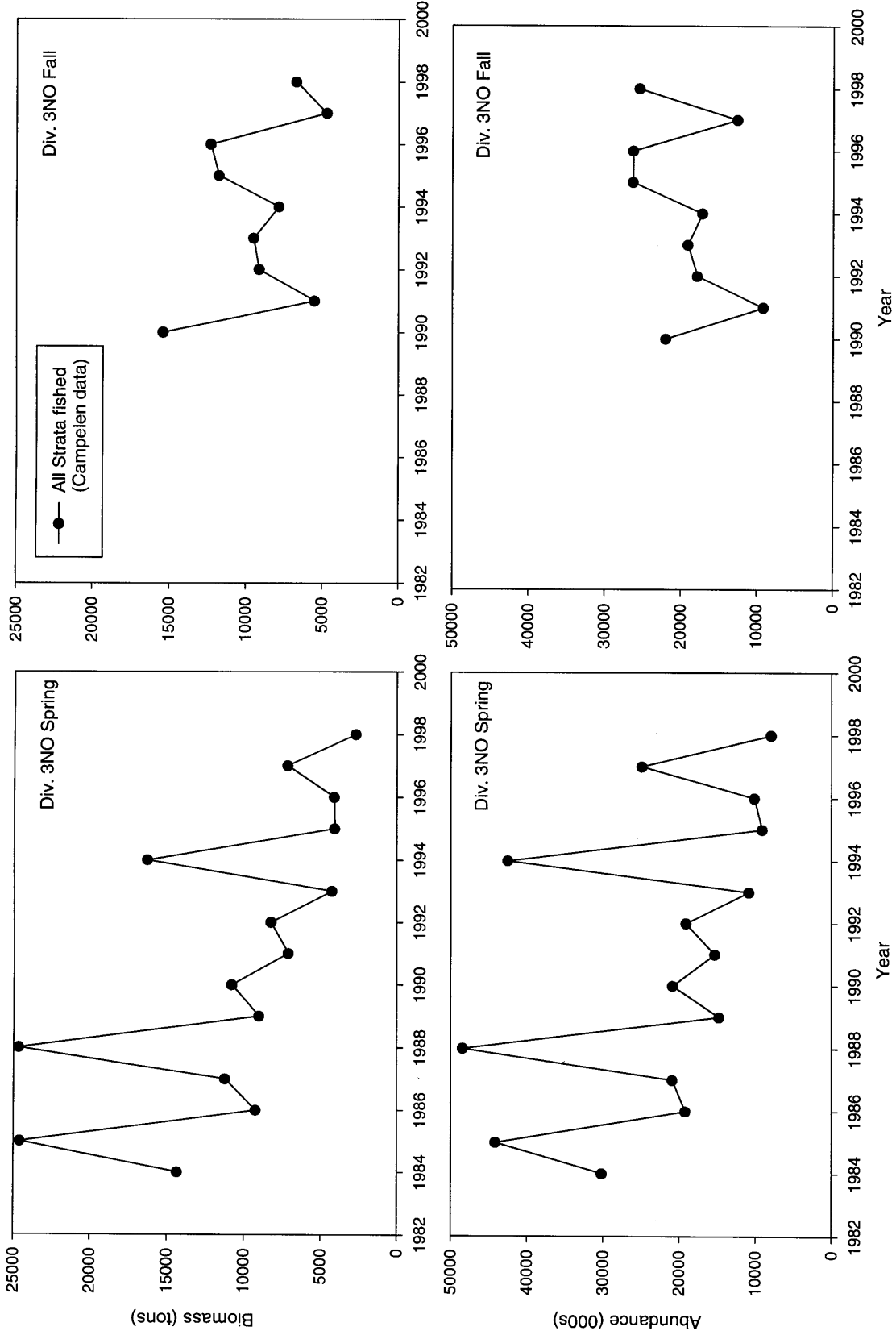


Fig. 4 Comparison of biomass (tons) and abundance estimates (000s) of witch flounder for converted data from Canadian spring (1984-98) and fall (1990-98) surveys in Div. 3NO combined.



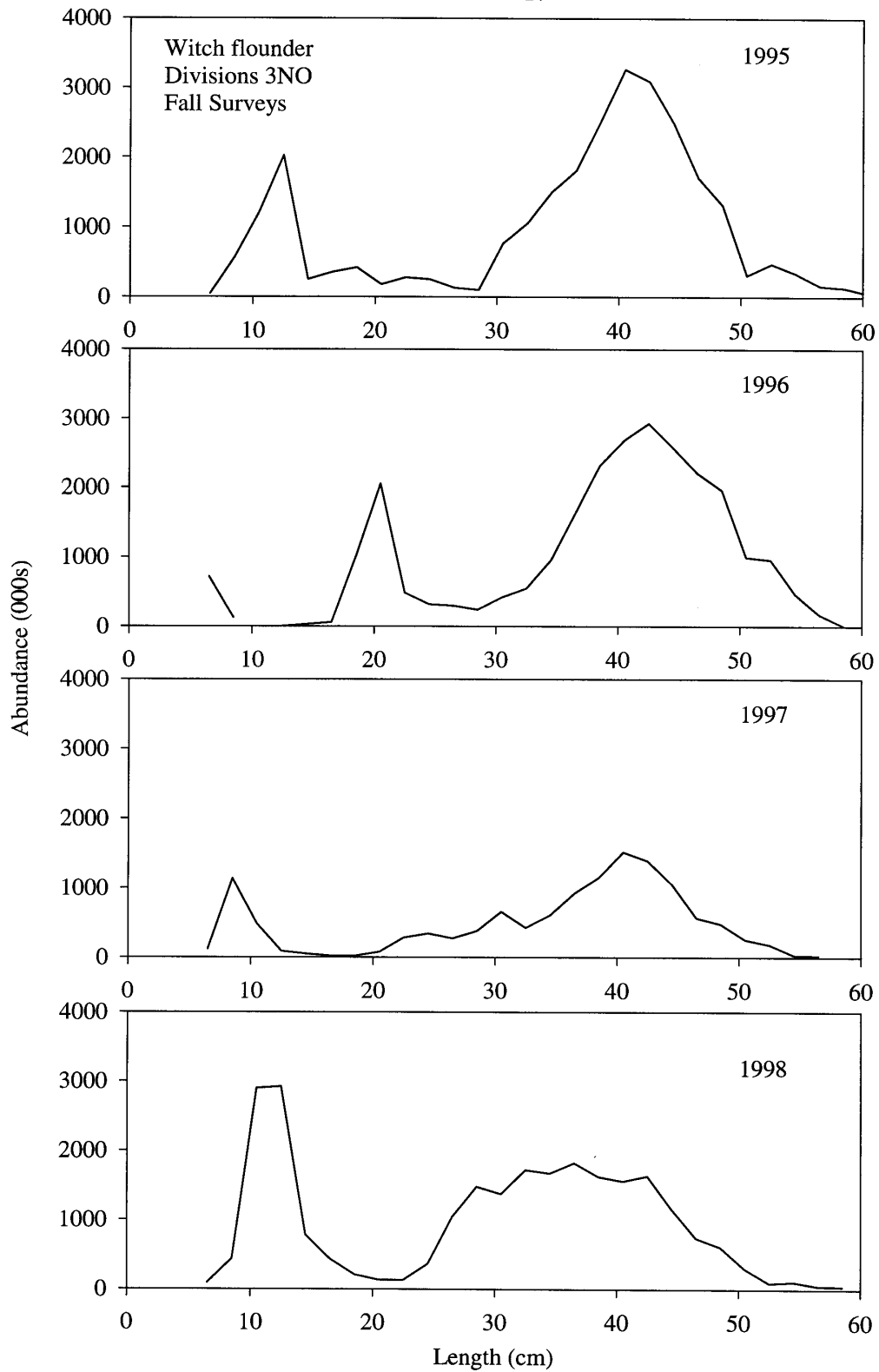


Fig. 5 Length frequency distributions of witch flounder from fall surveys in 1995-98 using the Campelen 1800 shrimp survey trawl.