



SCIENTIFIC COUNCIL MEETING - JUNE 1998

Changes in Distribution and Trends in Stock Size of the Witch Flounder Resource in Divisions
2J, 3K and 3L

by

W.R. Bowering
Dept. of Fisheries and Oceans
Science Branch
P.O. Box 5667 St. John's, NF
Canada A1C 5X1

Catch History

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 about 2,700 t, the lowest since 1964, and further declined to around 400 t in 1993 (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 regulated fishery has been mainly Canadian although increased catches have been taken by EU (Portugal and Spain) in the NAFO Regulatory area of Div. 3L since the mid 1980's. 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 1370 tons, respectively. However, it is believed that these catches could be overestimated by 15-20% because of misreported Greenland halibut. The catch in 1997 was estimated to be about 850 tons nearly all of which was taken in the NAFO Regulatory Area of Div. 3L.

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.

The stock has been regulated by TAC since 1974 (first introduced by ICNAF) and managed by Canada within its zone since the introduction of the 200 mile national limit and has been under moratorium in recent years (Fig. 1). Because of the poor state of the stock, the NAFO Fisheries Commission agreed to extend the moratorium to the Regulatory Area beginning in 1998.

Canadian Research Vessel Surveys

Distribution

To illustrate the changes in spacial distribution of witch flounder over the 20 year history of the surveys a selection of graphical distribution maps (ACON plots) are shown in Figure 2. The data for the entire period has been converted from *Engel* trawl catches to *Campelen 1800* trawl catch equivalents. The overall results of the data conversion exercise is presented in Bowering and Orr (1998) (this meeting) for details. Survey distribution data from the late 1970's and early 1980's indicate that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K (Fig. 2). 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. 2). The more recent results actually using the *Campelen 1800* trawl (since 1995) (Fig. 2) clearly indicate that witch flounder remain virtually absent from the shelf and channel areas. They now appear to be located only along the deep continental slope area, especially in Division 3L both inside and outside the Canadian 200 mile fishery zone.

Biomass and Abundance Indices

Stratified-random research vessel surveys have been conducted in the fall in Div. 2J, 3K and 3L since 1977, 1978 and 1981 respectively. As indicated above, up until 1994, the surveys were conducted using an *Engel* 145' high-rise groundfish trawl whereas the 1995-97 surveys were carried out with a much more efficient *Campelen 1800* shrimp trawl. All data presented here are now in *Campelen 1800* trawl catch equivalents for 1977-94 with the actual data for 1995-97.

For Div. 2J, biomass estimates ranged from as high as 5,900 t in 1986 to a low of less than 300 t in 1994 and remained at a very low level since then (Table 2; Fig. 3). In Div. 3K, during 1979-85, there was a period of relative stability where most annual biomass estimates were near 50,000 t (Table 3; Fig. 3). Since that time estimates have declined considerably to less than 200 t in 1995, the lowest in the time series. Estimates increased slightly in 1996 and 1997 with the 1997 estimate just over 1100 tons (Table 3; Fig. 3). For Div. 3L, biomass estimates varied generally between 7,000 and 10,000 t from 1983 to 1990 but declined rapidly since then to a low of less than 400 t in 1995 (Table 4; Fig. 3). The 1996 estimate increased to nearly 1800 t, however, more than half this estimate was based on the inclusion of deep water strata (at depths of 732-1097 m) that weren't surveyed previously (Table 4). The 1997 estimate then declined to 1100 tons although there was equal coverage to that of 1996. The abundance indices followed similar trends as biomass and are shown in Tables 5-7 for Divisions 2J, 3K and 3L, respectively and illustrated in Fig. 3 by division and Fig. 4 for the divisions combined.

For the three divisions combined, there has been a very steady and rather systematic decline in the biomass index from about 65,000 tons in 1984 to under 1000 tons in 1995, by far the lowest in the time series (Fig. 4). There was some increase in 1996 and 1997 to near 3,000 tons, however, the level is still extremely low compared to the early 1980's.

Current Status

The stock remains at an extremely low level with current indices of stock size based on survey trends at about 5% of the average of the early 1980's when the stock was considered at a reasonably healthy level.

References

Bowering, W.R., and D.C. Orr: 1998. Results of Data Conversions for Witch Flounder in Divisions 3NO from Comparative Fishing Trials Between the *Engel* Otter Trawl and the *Campelen 1800* Shrimp Trawl used on research Vessels on the Southern Grand Bank. NAFO SCR Doc. 98/50, Ser. No. N3041: 23p.

Table 2 Estimated biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in Div. 2J during fall of 1977-1997 by the research vessel *Gadus Atlantica* (Engel 145 data converted to Campelen Units) and Telesoft for 1995-97 (Campelen surveys).

Year	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
Depth Range																						
Old Stratum Area (sq. n. mi.)																						
New Stratum Area (sq. n. mi.)																						
Stratum																						
101 - 200	1427	633	201	0	0	0	0	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 - 200	1823	1594	205	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 - 200	2582	1870	206	114	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 - 200	2246	2264	207	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101 - 200	733	237																				
101 - 200	778	238																				
201 - 300	440	621	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201 - 300	1608	680	209	103	14	48	122	19	152	0	0	0	0	14	0	0	0	0	0	0	0	0
201 - 300	774	1035	210	133	45	121	338	24	286	0	38	0	22	0	0	0	0	0	0	0	0	0
201 - 300	1725	1583	213	265	249	160	298	280	371	197	118	102	56	0	0	0	0	0	0	0	0	0
201 - 300	1171	1341	214	193	54	0	58	65	122	74	21	106	14	19	0	0	0	0	0	0	0	0
201 - 300	1270	1302	215	193	33	11	82	67	0	45	0	0	0	0	0	0	0	0	0	0	0	0
201 - 300	1428	2196	228	508	134	301	543	183	678	264	467	79	728	93	123	151	76	0	44	35	0	0
201 - 300	508	530	234	0	35	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301 - 400	480	487	203	0	0	0	0	0	0	0	19	0	20	0	0	0	0	0	0	0	0	0
301 - 400	448	588	208	178	36	75	367	91	608	91	0	27	0	0	0	0	0	0	0	0	0	0
301 - 400	330	351	211	447	198	100	289	70	242	12	99	72	38	0	34	0	0	0	0	0	0	0
301 - 400	360	216	0	0	27	42	56	63	85	0	54	13	10	16	0	0	0	0	0	0	2	0
301 - 400	441	450	222	197	99	29	103	155	285	69	26	46	0	173	46	0	10	0	0	0	0	0
301 - 400	567	536	229	183	177	118	215	127	139	155	103	52	857	70	145	596	32	31	28	15	13	0
401 - 500	354	288	204	57	0	38	85	125	13	91	0	71	14	42	58	14	0	0	0	0	0	0
401 - 500	268	241	217	0	15	0	0	0	0	0	54	64	72	6	0	0	0	0	13	0	0	0
401 - 500	180	158	223	13	0	0	37	0	0	31	0	139	116	59	64	18	18	8	8	14	0	7
401 - 500	686	598	227	161	123	44	482	180	358	211	85	147	329	411	203	228	1837	207	125	132	0	0
401 - 500	420	414	235	813	0	456	430	502	371	908	517	399	121	168	0	62	149	37	20	0	41	0
401 - 500	133	240																				
501 - 750	664	557	212	1564	106	640	193	630	1116	1390	822	1253	3139	834	392	588	639	111	272	44	52	71
501 - 750	420	362	218	0	0	0	0	0	15	0	44	114	79	58	13	0	8	19	0	8	19	17
501 - 750	270	228	224	0	0	0	0	0	0	32	48	120	125	17	49	33	0	23	0	23	18	23
501 - 750	237	185	230	0	0	15	0	17	0	57	15	101	396	771	1711	346	85	105	69	126	176	0
501 - 750	120	239																				
751 - 1000	213	283	219																			
751 - 1000	182	186	231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	8	13	9
751 - 1000	122	193	236	0	14	0	0	0	0	0	0	9	0	0	457	176	197	118	115	6	36	
1001 - 1250	324	303	220																			
1001 - 1250	177	195	225	0																		
1001 - 1250	236	228	232	0																		
1251 - 1500	286	330	221																			
1251 - 1500	180	201	226	0																		
1251 - 1500	180	237	233																			
Biomass (t)	5123	1302	2218	3494	2582	4909	3693	2903	3030	5920	2063	1571	2653	3672	2669	1102	627	462	255	370	465	

Table 3 Estimated biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in Div. 3K during fall of 1978-1997 by the research vessel *Gladius Atlantica* (Engel 145 data converted to Campelen Units) and Telesost and W. Templeman for 1995-97 (Campelen surveys).

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
Depth Range	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum																		
101 - 200		798	608																		
101 - 200		445	612																		
101 - 200		250	616																		
101 - 200	1455	1347	618																		
101 - 200	1588	1753	619																		
201 - 300		342	609																		
201 - 300		573	611																		
201 - 300		251	615																		
201 - 300	2709	2545	620																		
201 - 300	2859	2537	621																		
201 - 300	668	1105	624																		
201 - 300	447	395	632																		
201 - 300	1618	788	634																		
201 - 300	1274	1274	635																		
201 - 300	1455	1455	636																		
201 - 300	1132	1132	637																		
301 - 400		256	610																		
301 - 400		263	614																		
301 - 400		593	617																		
301 - 400	1027	494	623																		
301 - 400	850	888	625																		
301 - 400	919	1113	626																		
301 - 400	1085	1085	628																		
301 - 400	499	499	629																		
301 - 400	544	332	630																		
301 - 400	2179	2067	633																		
301 - 400	2059	2059	638																		
301 - 400	1463	1463	639																		
401 - 500		30	613																		
401 - 500	632	691	622																		
401 - 500	1184	1255	627																		
401 - 500	1202	1321	631																		
401 - 500	198	69	640																		
401 - 500	204	216	645																		
401 - 500		134	650																		
501 - 750	584	230	641																		
501 - 750	333	325	646																		
501 - 750		359	651																		
751 - 1000	931	418	642																		
751 - 1000	409	360	647																		
751 - 1000		516	652																		
1001 - 1250	1266	733	643																		
1001 - 1250	232	228	648																		
1001 - 1250		531	653																		
1251 - 1500	954	474	644																		
1251 - 1500	263	212	649																		
1251 - 1500		479	654																		
Total biomass (t)																					
		30353	49789	44962	43405	32429	49250	49038	35694	21359	21746	18110	8976	17088	4272	1863	1327	846	184	855	1116

Table 4 Estimated biomass (tons) of Witch Flounder (M+F) per stratum from surveys in Div. 3L during fall of 1983 - 1997 by the research vessels Alfred Needler and Wilfred Templeman (Engel 145 data converted to Campelen Units for 1983-94).																			
Year				1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
Depth Range	Old Stratum	New Stratum	Stratum																
	Area (sq. n. mi.)	Area (sq. n. mi.)																	
30 - 56		268	784															0	0
57 - 92	2071	2071	350	0	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 - 92	1780	1780	363	0	85	0	50	0	0	0	264	33	41	0	0	0	0	0	0
57 - 92	1121	1121	371	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 - 92	2460	2460	372	0	144	0	0	0	16	0	38	8	0	0	0	0	27	0	0
57 - 92	1120	1120	384	120	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 - 92		465	785																0
93 - 183	1519	1519	328		45	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183	1574	1574	341	0	230	0	0	34	34	0	0	0	0	0	0	0	0	0	0
93 - 183	585	585	342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183	525	525	343	0	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183	2120	2120	348	26	334	0	0	0	44	0	0	0	0	0	0	0	0	0	0
93 - 183	2114	2114	349	0	306	0	155	0	36	0	145	0	0	0	0	0	0	0	0
93 - 183	2817	2817	364	50	202	0	143	0	39	0	27	0	0	0	0	0	0	0	0
93 - 183	1041	1041	365	0	100	0	68	29	18	0	0	36	0	0	0	0	0	0	0
93 - 183	1320	1320	370	0	190	0	0	34	0	0	0	0	0	0	0	0	0	0	0
93 - 183	2356	2356	385	0	340	0	79	58	27	0	0	0	0	0	0	0	0	0	0
93 - 183	1481	1481	390	0	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183		84	786																1
93 - 183		613	787																0
93 - 183		261	788																0
93 - 183		89	790																0
93 - 183		72	793																0
93 - 183		216	794																0
93 - 183		98	797																0
93 - 183		72	799																0
184 - 274	1494	1582	344	159	159	37	29	127	0	0	0	0	0	0	0	0	0	0	0
184 - 274	983	983	347	41	467	0	42	0	154	66	0	0	0	0	0	0	0	0	0
184 - 274	1394	1394	366	0	186	355	307	171	110	187	27	0	7	0	0	0	0	0	0
184 - 274	961	961	369	181	374	570	706	320	1061	429	473	162	0	0	0	0	0	0	0
184 - 274	983	983	386		168	519	1082	1518	1750	442	218	307	875	0	0	0	0	0	0
184 - 274	821	821	389		196	133	760	250	138	21	79	0	27	0	0	38	0	0	0
184 - 274	282	282	391	0	0	32	0	9	0	0	0	70	22	0	0	36	0	25	0
184 - 274		164	795																0
184 - 366		72	789																0
184 - 366		227	791																6
184 - 366		100	798																0
275 - 366	1432	1432	345	5808	4484	1227	617	3693	2099	2358	750	0	61	73	0	10	3	5	5
275 - 366	865	865	346	2134	1423	2240	3321	1201	1823	1287	1863	203	40	14	0	0	12	3	3
275 - 366	334	334	368		47	29	386	23	64	144	106	39	14	0	0	22	0	0	0
275 - 366	718	718	387		169	404	276	572	1775	1546	3668	159	52	32	12	63	8	2	2
275 - 366	361	361	388		1229	48		589	92	126	0	125	173	0	14	0	0	0	0
275 - 366	145	145	392	17	55	13	20	50	13	0	0	0	0	0	4	0	0	0	0
275 - 366		175	796																0
367 - 549	186	186	729		146	127	280				48	274	246	42	131	2	151	24	24
367 - 549	216	216	731		498	248					465	178	356	38	79	19			0
367 - 549	468	468	733		328	1164					1618	2110	610	183	60	24	12		0
367 - 549	272	272	735		367	34	1714					222	216	40	12	3	20		23
367 - 549		50	792																55
550 - 731	170	170	730		104	16						130	6	140	88	83	0		21
550 - 731	231	231	732		282	235					29	207	283	41	194	16	147		121
550 - 731	228	228	734		30	184					168	100	11	106	49	37	127		15
550 - 731	175	175	736	546		268	709				355	913	90	70	20	10	261		41
732 - 914		227	737																130
732 - 914		223	741																115
732 - 914		348	745																154
732 - 914		159	748																87
915 - 1097		221	738																331
915 - 1097		206	742																31
915 - 1097		392	746																120
915 - 1097		126	749																33
1098 - 1280		254	739																0
1098 - 1280		211	743																0
1098 - 1280		724	747																0
1098 - 1280		556	750																0
1281 - 1463		264	740																0
1281 - 1463		280	744																0
1281 - 1463		229	751																0
Biomass (tons)				9082	13210	7881	10743	8679	9294	6606	10341	5274	3131	778	663	390	1806	1087	

Table 5. Abundance (000s) per stratum of Witch flounder (M+F) from research vessel surveys by the Gadus Atlantica in Div. 2J during fall 1977-1994 (Engel data converted to Campelen Units) and the Teleast in 1995-97 (Campelen trawl).

Year	Depth Range (meters)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
	101 - 200	1427	633	201	0	0	0	0	0	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0	
	101 - 200	1823	1594	205	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	101 - 200	2582	1870	206	129	0	0	0	0	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	101 - 200	2246	2264	207	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	101 - 200		733	237																						
	101 - 200		778	238																						
	201 - 300	440	621	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	201 - 300	1608	680	209	158	37	32	147	0	80	158	32	147	0	0	0	0	0	0	0	0	0	0	0	0	
	201 - 300	774	1035	210	142	46	106	405	35	124	0	373	0	53	0	53	0	37	0	0	0	0	0	0	0	
	201 - 300	1725	1583	213	386	271	203	326	435	475	308	190	185	185	158	30	53	0	0	0	0	0	0	0	0	
	201 - 300	1171	1341	214	268	69	0	97	64	141	101	40	134	81	27	54	32	0	0	0	0	0	0	0	0	
	201 - 300	1270	1302	215	218	22	29	0	35	78	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	
	201 - 300	1428	2196	228	565	262	393	746	196	825	295	421	56	1080	112	196	393	229	0	79	101	0	0	0	0	
	201 - 300	508	530	234	0	42	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	301 - 400	480	487	203	0	0	0	0	0	66	154	0	0	33	0	0	22	0	0	0	0	0	0	0	0	
	301 - 400	448	588	208	339	62	139	508	154	924	123	144	966	123	0	123	0	0	0	0	0	0	0	0	0	
	301 - 400	330	251	211	545	306	148	390	91	340	23	136	106	23	45	0	68	0	0	0	0	0	0	0	0	
	301 - 400	384	360	216	0	0	40	40	106	106	123	0	0	79	26	26	26	0	0	0	0	0	0	25	0	
	301 - 400	441	450	222	303	182	46	152	212	465	101	40	61	0	394	61	0	0	20	0	0	0	0	58	0	
	301 - 400	567	536	229	312	292	175	331	117	195	214	130	52	1846	260	364	1664	78	26	130	221	25	0	0	0	
	401 - 500	268	241	217	73	0	18	0	0	97	130	16	122	0	97	24	73	97	24	0	0	0	0	0	0	
	401 - 500	180	158	223	12	0	0	0	37	0	0	50	0	248	161	124	111	37	66	33	76	145	75	43	206	
	401 - 500	686	598	227	165	189	47	566	189	396	283	126	212	409	684	220	354	4404	661	330	329	0	0	0	0	
	401 - 500	420	414	235	1343	0	664	549	664	578	1358	770	520	376	289	0	202	173	96	19	0	304	0	51	28	
	401 - 500		133	240																				146	55	
	501 - 750	664	557	212	2147	183	868	228	731	1461	1705	1127	1621	4658	1302	685	891	1218	411	365	77	281	306	217	268	
	501 - 750	420	362	218	0	0	0	0	0	0	0	0	29	0	58	173	144	87	29	0	100	199	199	75	0	
	501 - 750	270	228	224	0	0	0	0	0	0	0	0	0	56	56	204	186	19	111	74	0	146	0	78	141	
	501 - 750	237	185	230	0	0	0	16	0	0	0	16	0	65	16	147	782	1695	4548	880	471	382	827	582	865	
	501 - 750		120	239																					0	
	751 - 1000	213	283	219																					58	39
	751 - 1000	182	186	231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	939	401	512	375	563	26	90	
	751 - 1000	122	193	236	0	0	0	0	25	0	0	0	0	0	0	8	0	59	34	151	199	159	133	133	13	
	1001 - 1250	324	303	220																					42	0
	1001 - 1250	177	195	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1001 - 1250	236	228	232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1251 - 1500	286	330	221																					0	0
	1251 - 1500	180	201	226																					0	0
	1251 - 1500	180	237	233																					0	0
Abundance (000s)			Total (000s)		7106	1962	3016	4503	3190	6486	4963	3840	4089	9432	3337	2746	5377	8110	6941	2463	2588	2369	1696	1724	1890	

Table 6 Abundance (000s) per stratum of Witch flounder (M+F) from research vessel surveys by the Gadus Atlantica in Div. 3K during fall 1978-1994 (Engel data converted to Campelen Units) and the Teletost and W. Templeman in 1995-97 (Campelen trawl).

Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997			
Depth Range (meters)	Old Stratum Area (sq. n. mi.)	New Stratum Area (sq. n. mi.)	Stratum																				
101 - 200	798	608																					
101 - 200	445	612																			0		
101 - 200	250	616																			0		
101 - 200	1455	1347	618																		0		
101 - 200	1588	1753	619																		0		
201 - 300	342	609																			0		
201 - 300	573	611																			0		
201 - 300	251	615																			0		
201 - 300	2709	2545	620	963	166	112	115	80	124	0	0	0	0	0	0	0	0	0	0	0	0		
201 - 300	2859	2537	621	1999	5149	696	286	393	28	66	66	0	486	0	0	0	0	0	0	0	0		
201 - 300	668	1105	624	525	230	161	597	184	368	161	92	31	0	23	0	22	0	0	0	0	30		
201 - 300	447	632	632	553	769	261	646	512	492	225	31	31	61	0	6	57							
201 - 300	1618	1555	634	841	835	1272	668	911	223	890	544	267	283	482	254	0	240	13	0	0	0		
201 - 300	1274	1274	635	1694	1906	1782	1577	876	584	2432	1127	29	146	456	175	29	0	58	0	0	70		
201 - 300	1455	1455	636	1716	1716	1887	1168	961	634	2927	976	400	486	767	240	29	0	0	0	29	33		
201 - 300	1132	1132	637	1609	3292	1972	2362	2380	4765	3530	3315	740	960	195	156	0	0	52	0	0	31		
301 - 400	256	610																			18		
301 - 400	263	614																			18		
301 - 400	593	617																			27		
301 - 400	1027	494	623	871	989	871	742	480	871	565	918	283	537	311	47	0	0	0	0	41	0		
301 - 400	888	625	1579	3976	1462	2572	585	2222	2081	1684	78	322	292	88	0	0	0	0	0	41	24		
301 - 400	919	1113	626	8849	11251	10644	1593	6928	4867	2866	1618	63	582	126	329	0	42	0	0	0	122		
301 - 400	1085	1085	628	3603	8358	5249	1841	3433	6367	2708	4229	1692	896	269	634	0	149	0	0	27	0		
301 - 400	499	499	629	3032	3672	4915	2792	1476	3638	1373	2094	526	732	755	412	103	0	46	182	136	306		
301 - 400	544	332	630	2769	1347	1123	1310	898	798	917	299	274	249	125	0	25	30	0	0	46	46		
301 - 400	2179	2067	633	2964	3897	4526	2098	2955	3047	3627	2848	3560	1853	3485	3687	1063	552	600	57	67	221		
301 - 400	2059	2059	638	6833	15200	9725	9559	5910	6849	14417	12385	11330	7534	11400	5047	535	612	317	368	13	78		
301 - 400	1463	1463	639	2013	1157	2650	2013	1429	4025	5459	2792	2382	1236	3321	503	489	67	24	0	226	115		
401 - 500	30	613																			4		
401 - 500	632	691	622	2652	1942	3347	1608	1130	2260	978	1934	696	1478	203	290	130	58	261	238	0	28		
401 - 500	1184	1255	627	6026	11618	12948	22938	18544	22322	18690	17311	7753	3882	7199	6271	1955	434	271	3625	367	792		
401 - 500	1202	1321	631	8515	5677	6338	13261	1819	8863	12666	11433	8019	3417	2563	1819	276	2563	2260	727	2453	537		
401 - 500	198	69	640	109	232	82	463	463	572	1716	2465	4018	2274	1648	245	245	0	91	0	0	38		
401 - 500	204	216	645	14	0	14	412	295	2021	393	5837	1109	463	2357	196	47	188	119	0	149	45		
401 - 500	134	650																			25		
501 - 750	384	230	641	0	80	161	60	241	0	1004	2437	17031	1366	0	53	74	79	253	190	28	147		
501 - 750	333	325	646	0	46	23	46	710	92	122	115	527	366	290	209	462	22	2209	156	444	771		
501 - 750	931	359	651	0	64	0	43	128	128	38	128	4013	2177	1089	383	173	29	0	0	0	0		
751 - 1000	409	360	647	0	0	0	0	0	0	0	0	534	1594	506	281	264	173	198	0	0	0		
751 - 1000	1266	516	652	0	0	0	0	0	0	0	0	974	0	0	0	0	0	0	0	0	0		
1001 - 1250	232	228	648	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1001 - 1250	954	531	653	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1251 - 1500	263	474	644	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1251 - 1500	479	654																			0	0	
Estimated abundance (000s)				59729	84954	72871	70058	52145	75267	79554	70384	40917	37279	35486	22734	29338	10045	6377	8918	4815	2191	5081	5716

Table 8 Estimates of biomass (tons) of witch flounder from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-97.

YEAR	DIV. 2J	DIV. 3K	DIV. 3L	TOTAL
1977	5123			
1978	1302	30353		
1979	2218	49789		
1980	3494	44962		
1981	2582	43405		
1982	4909	32429		
1983	3693	49250		
1984	2903	49038	13210	65151
1985	3030	35694	7881	46605
1986	5920	21359	10743	38022
1987	2063	21746	8679	32488
1988	1571	18110	9294	28975
1989	2653	8976	6606	18234
1990	3672	17088	10341	31101
1991	2669	4272	5274	12215
1992	1102	1863	3131	6095
1993	627	1327	778	2733
1994	462	846	663	1971
1995	255	184	390	828
1996	370	855	1806	3031
1997	465	1116	1087	2669

Table 9 Estimates of abundance (000s) of witch flounder from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-97.

YEAR	DIV. 2J	DIV. 3K	DIV. 3L	TOTAL
1977	7106			
1978	1962	59729		
1979	3016	84954		
1980	4503	72871		
1981	3190	70058		
1982	6486	52145		
1983	4963	75267		
1984	3840	79554	17914	101307
1985	4089	70384	10401	84874
1986	9432	40917	12839	63188
1987	3337	37279	10500	51117
1988	2746	35486	11269	49501
1989	5377	22734	8002	36113
1990	8110	29338	14453	51901
1991	6941	10045	7428	24414
1992	2463	6377	4748	13588
1993	2588	8918	1572	13078
1994	2369	4815	1428	8612
1995	1696	2191	865	4753
1996	1724	5081	5297	12102
1997	1890	5716	4227	11833

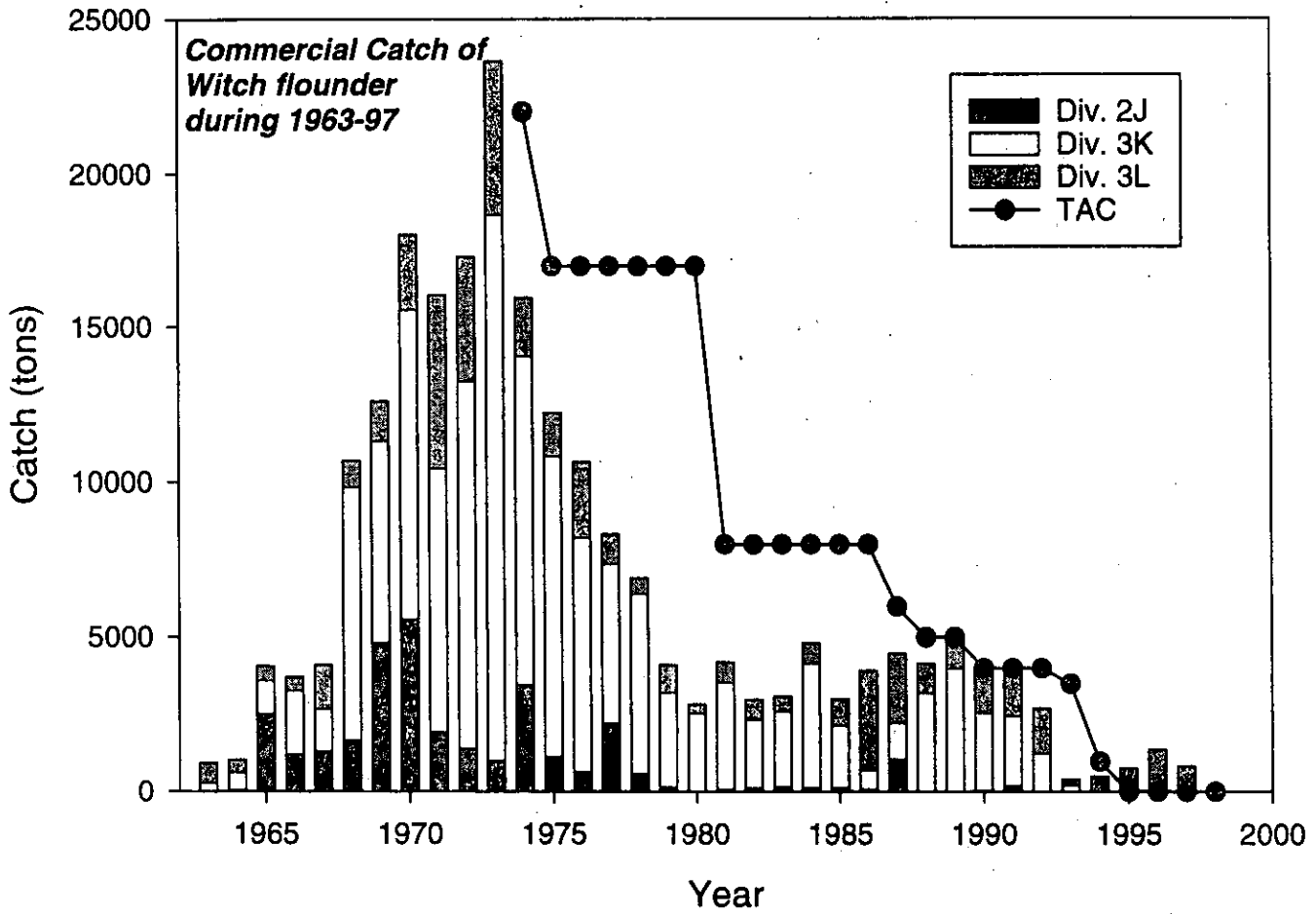


Fig. 1 Commercial catches and TAC's of witch flounder in Divisions 2J, 3K and 3L during 1963-98.

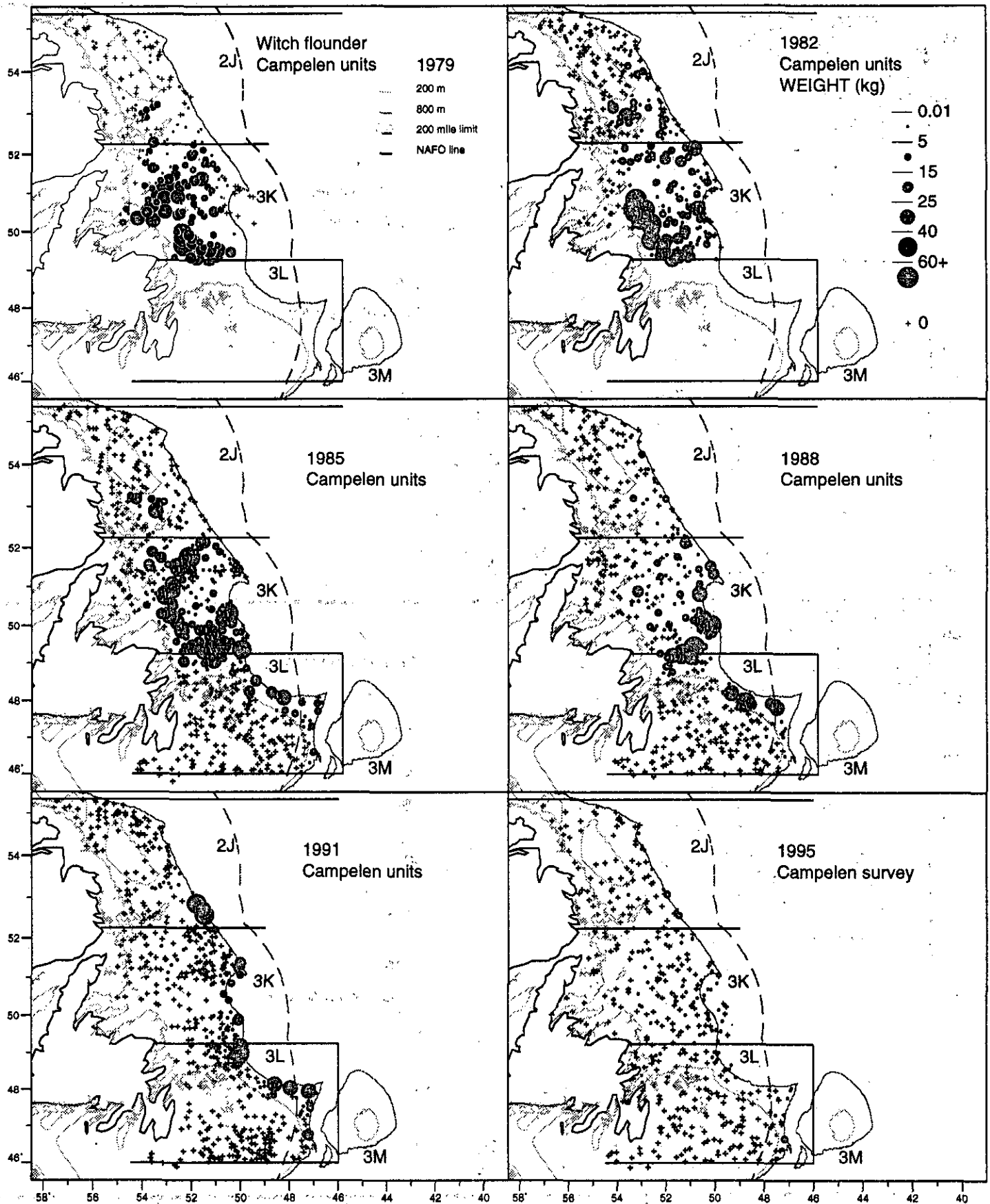
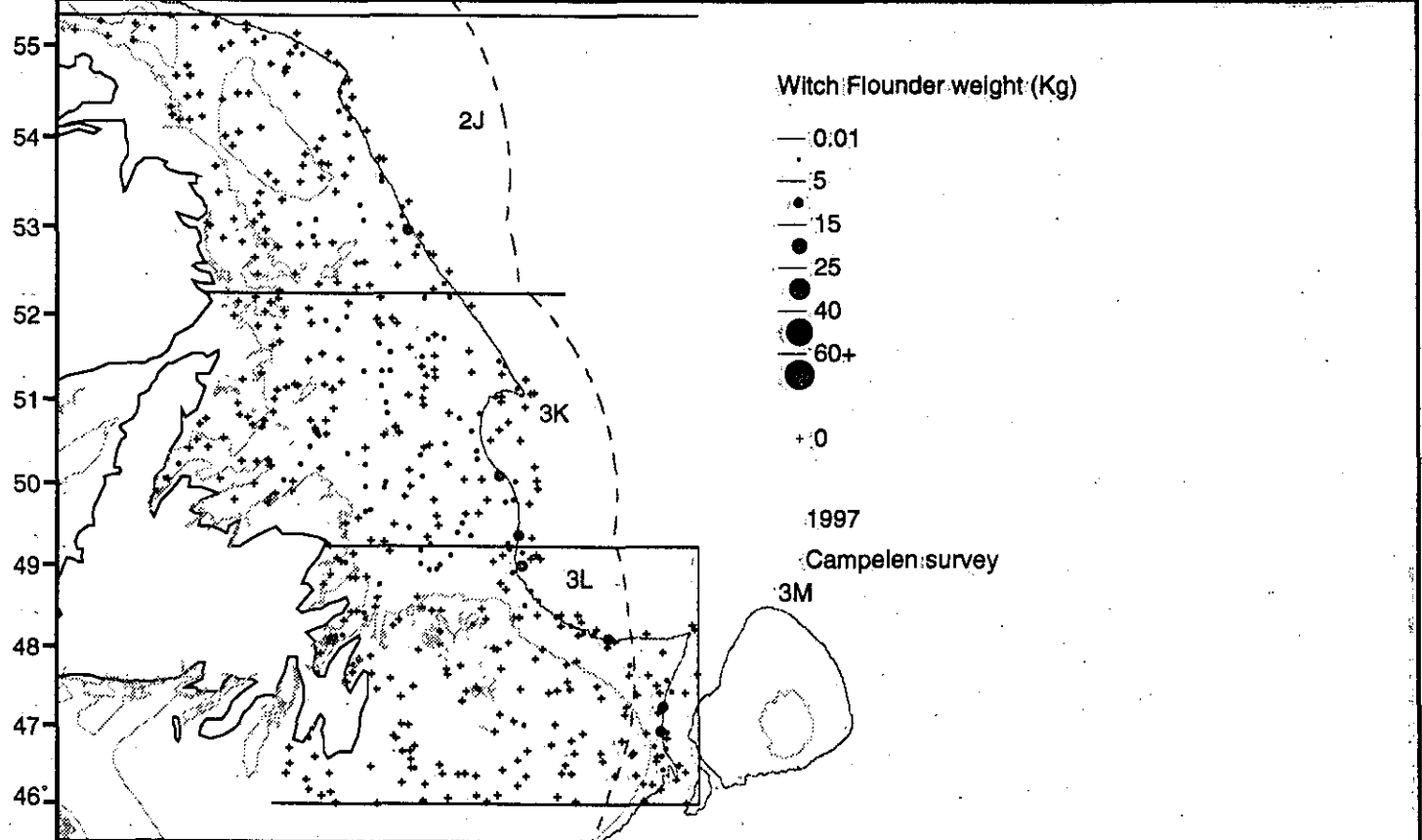
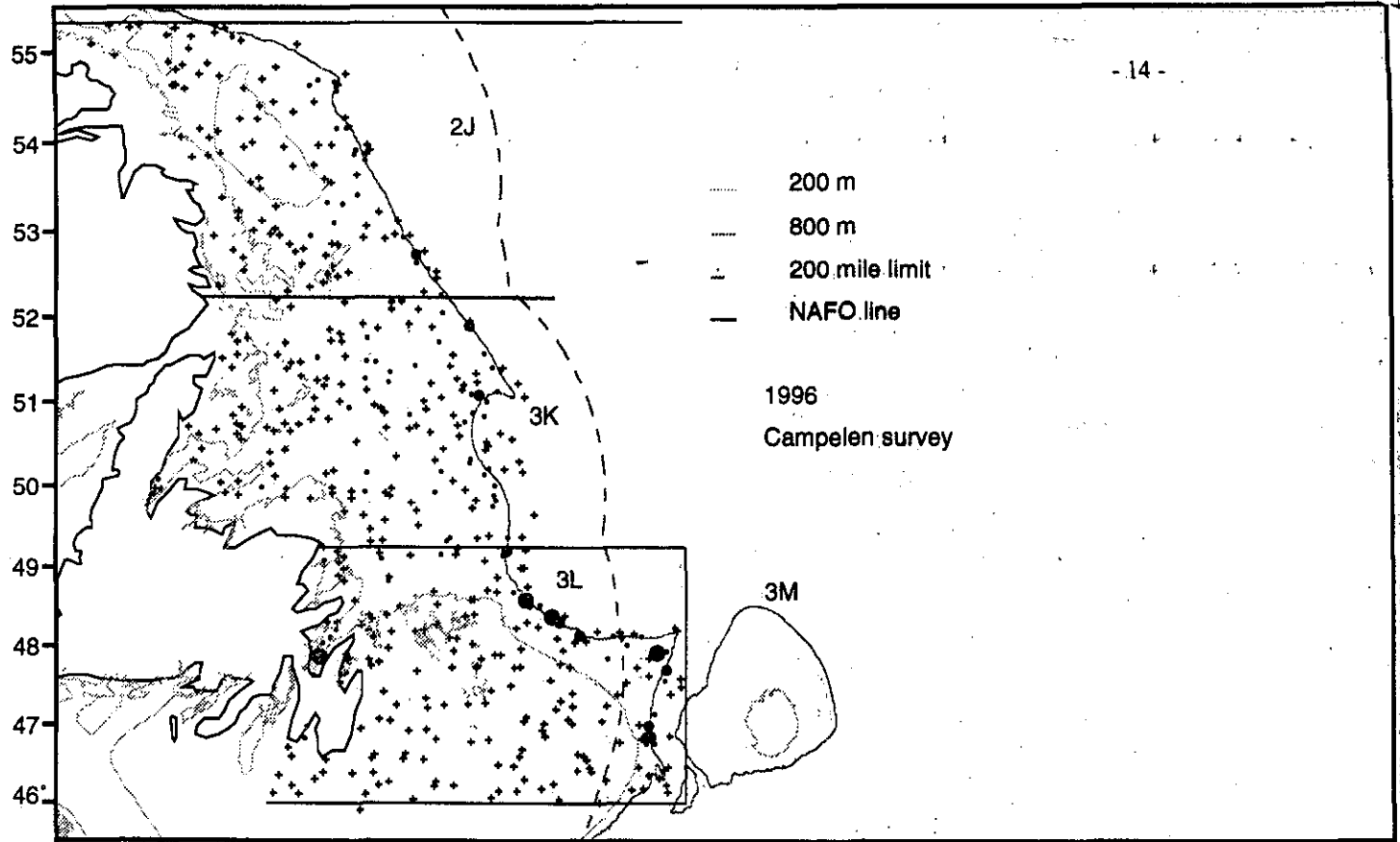


Fig. 2 Distribution of weight in Divisions 2J3KL from Canadian fall surveys for various years from 1979-1995. Expressed as weight (kg) per tow in Campelen units.



58° 57° 56° 55° 54° 53° 52° 51° 50° 49° 48° 47° 46° 45° 44° 43° 42° 41° 40° 39° 38° 37° 36° 35° 34°

2 (con'd)

6 7

Fig. 6 Distribution of weight in Divisions 2J3KL from Canadian fall surveys in 1996-1997. Expressed as weight (kg) per tow using the Campelen 1800 trawl.

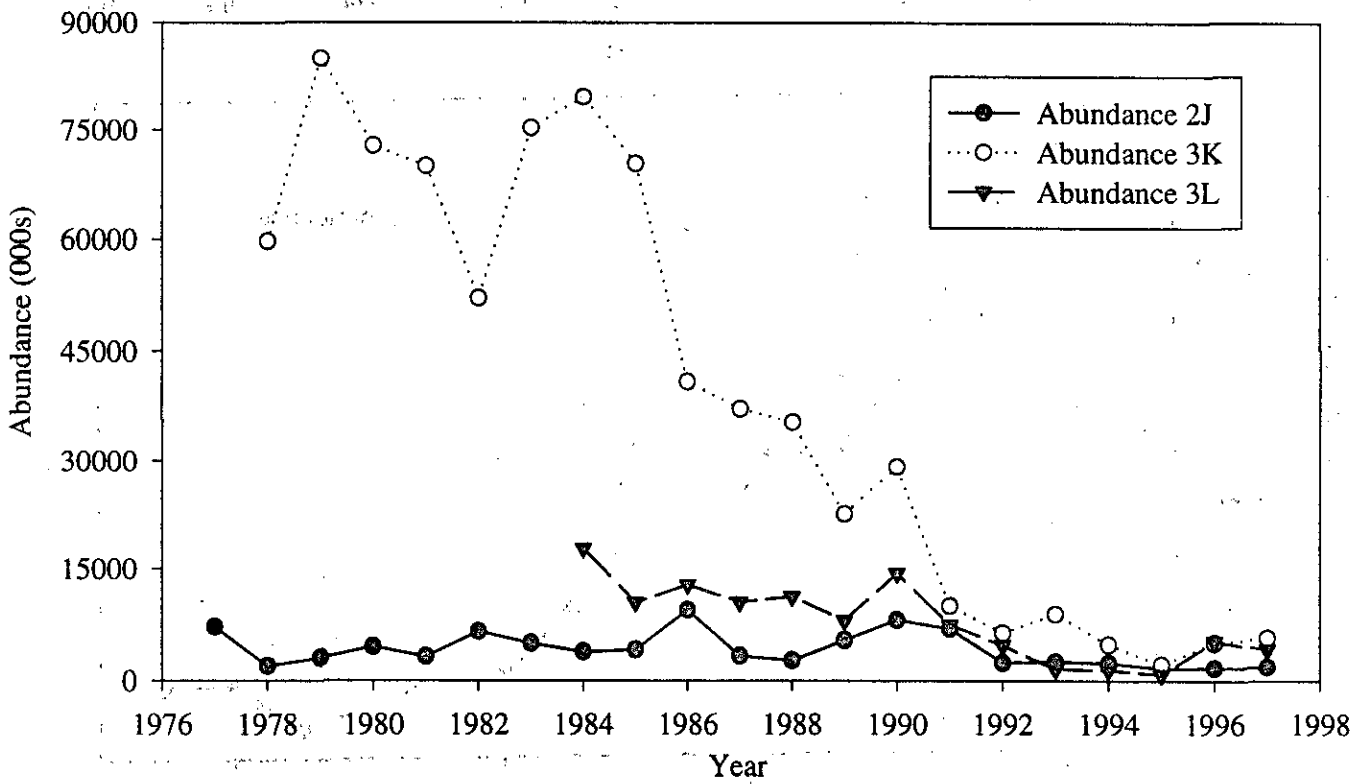
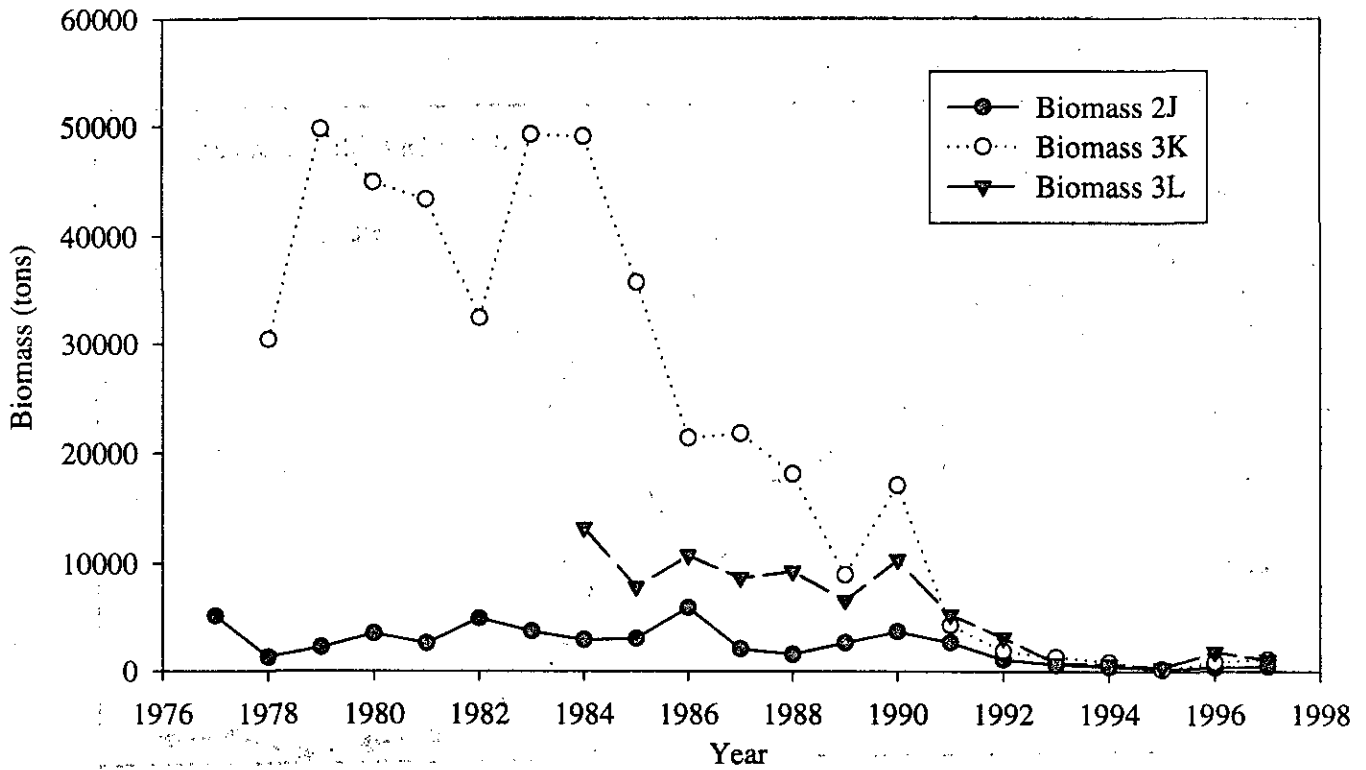


Fig. 3 Biomass (tons) and abundance (000s) of witch flounder by division from Canadian surveys in Div. 2J, 3K and 3L. Data based on Campelen trawl catch equivalents.

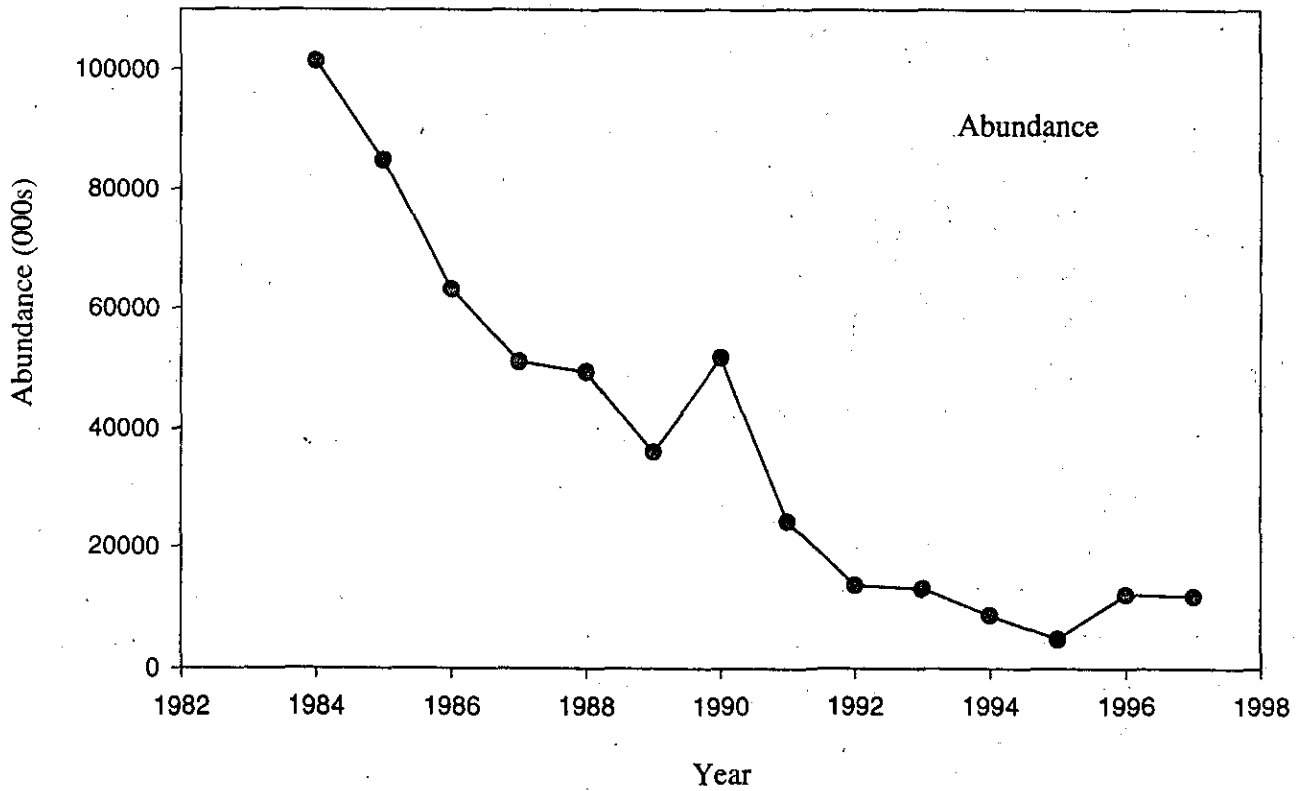
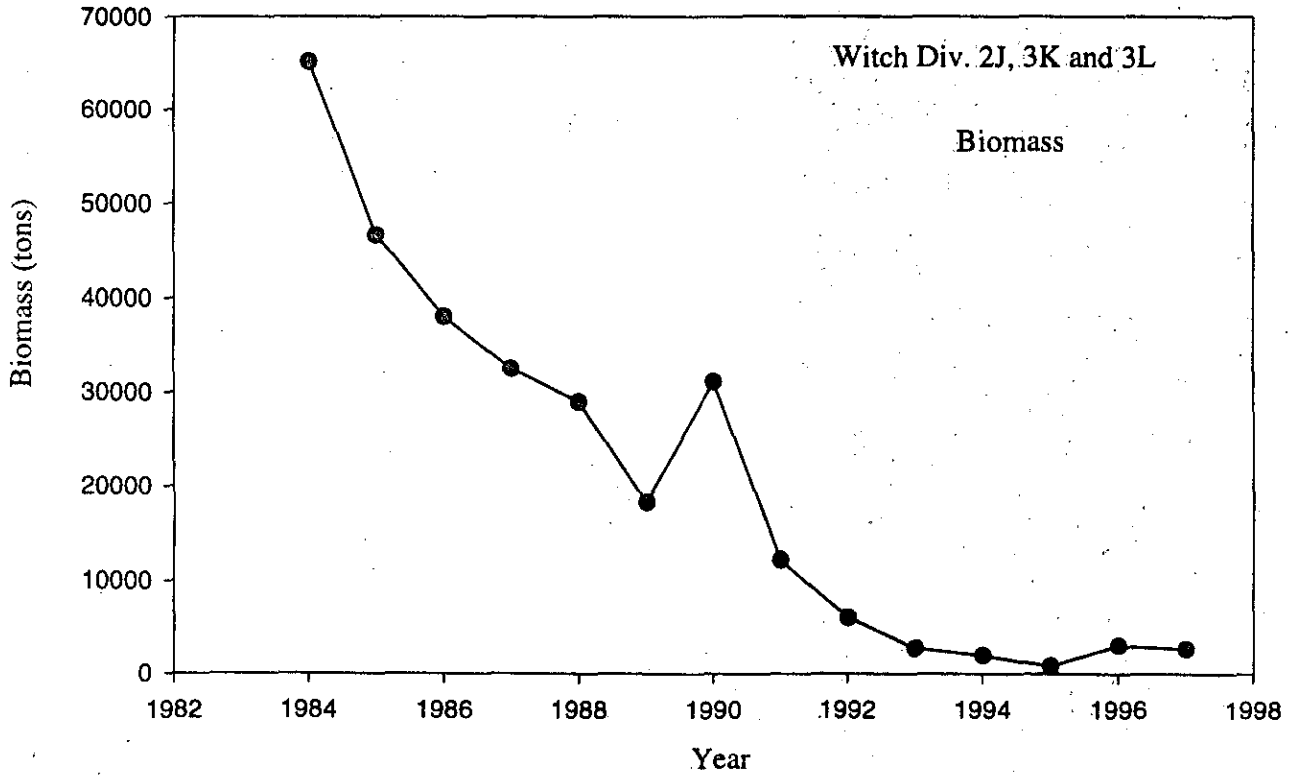


Fig. 4 Biomass (tons) and abundance (000s) of Divisions 2J, 3K and 3L combined of witch flounder from Canadian fall surveys based on Campelen trawl catch equivalents.