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Witch Flounder Population Trends in NAFO Divisions 2J, 3K and 3L

by

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### Abstract

Canadian fall surveys since the late 1970's indicated that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K. By the mid 1980's 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 in Division 3L. The fall 1998-2006 surveys indicate no change in this distribution pattern. For the three divisions combined, the biomass index declined from about 65,000 tons in 1984 to 1100 tons in 1995, by far the lowest in the time series. Mean weight per tow decreased from a maximum of near 6 kg/tow in 1984 to a low of 0.23 kg/tow in 1995. The small increase in biomass index and mean weight per tow observed between 1995 and 1996 was almost exclusively a result of inclusion of the deeper strata surveyed in Division 3L. The estimates have remained the same since then. The stock size remains extremely low.

### Fisheries and management

The fishery for witch in this area began 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 by 1993 (Table 1). Until the late 1980's, the fishery was conducted by Poland, USSR and Canada (Table 1) mainly in Div. 3K (Fig. 1). More recently, the regulated fishery has been mainly Canadian although EU (Portugal and Spain) has taken increased catches 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 catches in 1997 and 1998 were estimated to be about 850 and 1100 tons, respectively most of which was reported from the NAFO Regulatory Area of Div. 3L. From 1999 to 2005 catches ranged from 155 to 830 t and in 2006 was the lowest in the time series at 84 t.

During 1988-92, the Canadian fishery was particularly successful by fishing on pre-spawning 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 as the resource became depleted. The fishery during the winter of 1993 was very poor with the best catch rates occurring in depths greater than 1400 m. No directed fishing by Canada has been permitted since 1994 due to the poor state of the stock.

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 from 1995 to the present (Fig. 1). Because of the poor state of the stock, the NAFO Fisheries Commission agreed to extend the moratorium to the NAFO Regulatory Area in 1998 and has continued to 2007.

## Canadian Research Vessel Surveys

### *Distribution*

Changes in spatial distribution patterns of witch flounder over the 20 year history of the surveys from 1978-97 were presented in a previous assessment as graphical distribution maps (SCR Doc. 98/64). Survey distribution data from the late 1970's and early 1980's indicated that witch flounder were widely distributed throughout the shelf area in deeper channels around the fishing banks primarily in Div. 3K. 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. Since 1998, surveys catch witch flounder mostly along the deep continental slope area, especially in Division 3L both inside and outside the Canadian 200-mile fishery zone (see Bowering 1998; 1999; 2000; 2001; 2002) and in 2005 and 2006 (Fig. 2) distributions are similarly restricted.

### *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 1995-2006 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 1995-2006.

For Div. 2J, biomass estimates ranged from as high as 5,900 t in 1986 to a low of less than 200 t in 2003 and increased to almost 970 t in 2006, although the majority of the estimate results from one stratum (Tables 2 and 14; Fig. 3a). Mean weight per tow peaked at 1.82 kg/tow in 1986 and declined to 0.05 kg/tow in 2003 (Tables 11 and 15; Fig. 3b). Since then values have increased and in 2006 mean weight per tow was 0.28 kg/tow.

In Div. 3K, during 1979-85, there was a period of relative stability where most annual biomass estimates were near 50,000 t (Tables 3 and 14; Fig. 3a). Since that time estimates have declined considerably to around 400 t in 1995, the lowest in the time series. Estimates increased slightly after 1995 ranging from 500-1400 tons from 1996-2003. In 2004, the biomass estimate increased to over 2600 t, and remained at around 2900 t in 2005 and 2006, however in each of the last three surveys the majority of the estimate has been the result of high catches in one or a few strata (Table 3; Fig. 3a). Corresponding to the period of higher biomass estimates (1979-85), the mean weights per tow in Division 3K ranged from 8 to 13 kg/tow (Tables 12 and 15; Fig. 3b) and declined to a low of 0.09 kg/tow in 1995. Mean weights per tow have remained low since then and in 2002 were again at an all time low of 0.09 kg/tow. Since then estimates have increased to 0.59 kg/tow in 2006, but are still much lower than the maximum observed.

For Div. 3L, biomass estimates varied generally between 7,000 and 13,000 t from 1984 to 1990 but declined rapidly since then to a low of around 400 t in 1995 (Tables 4 and 14; Fig. 3a). In 1996 the Canadian autumn survey expanded to included deeper water strata (depths of 732-1097). In that year, half of the biomass estimate of 1,800 t was attributed to depths greater than 731 m (Table 4). Seventy percent of the 1997 estimate (1,100 t) was attributed to the deeper strata and 50% of the 1998 estimate (1,000 t) came from the deeper strata. The 1999 estimate decreased to around 800 tons with about 30% of the estimate accounted for by the new deep strata (Table 4; Fig. 3a). Little change occurred in the 2000 and 2001 surveys, however, the biomass and abundance in the deeper strata appear to have been declining since 1996 and contributed little to the survey estimates in these years (Table 4). In 2002, the increase in the estimate from 2001 (from 1000 t to 2400 t) was due almost entirely to the biomass estimate in one stratum and for 2003 was estimated to be again around 1000 tons (Table 4). In 2004, difficulties with the Canadian autumn survey resulted in incomplete coverage, particularly in the deeper strata of Div. 3L (SCR Doc. 05/34) and the biomass estimate was the lowest in the time series at 451 t. Coverage in strata greater than 731m was very limited in the 2005 survey as well, but the biomass estimate increased to 1,000 t. The biomass estimate in 2006 increased to around 2,000 t, although there were almost no witch caught in strata surveyed greater than 731m.

Mean weight per tow in Division 3L (Tables 13 and 15; Fig 3b) ranged from 2 to 2.5 kg/tow in the early part of the survey series (1984-1990). A rapid decline in mean weight per tow then resulted in the lowest observed at 0.08 kg/tow in 1995. The inclusion of deep water strata (previously not surveyed) in 1996 explains the over three-fold increase in mean weight per tow to 0.28 kg/tow. Mean weight per tow ranged from 0.10 to 0.38 kg/tow from 1997-2005 and in 2006 was 0.33 kg/tow.

The abundance indices followed similar trends as the biomass indices and are shown in Tables 5-7 and Table 16 for Divisions 2J, 3K and 3L, respectively and illustrated in Fig. 3a by Division and in Fig. 4 and Table 16 for the divisions combined. The mean numbers per tow by Division are given in Tables 8-10 and Table 17, and are shown in Fig. 3b. The exception is in the estimate of abundance and mean number per tow for Division 3L, which both show an increase from 1999-2002 (Fig. 3b). The trend in these indices is questionable when the confidence limits are considered, however, and declined once more in 2003 and 2004. The 2005 and 2006 abundance estimates are similar to the 2004 estimates in all Divisions.

For the three divisions combined, there was a very steady and rather systematic decline in the biomass index from about 65,000 tons (nearly 6 kg/tow) in 1984 to 1100 tons (0.23 kg/tow) in 1995, the lowest in the time series (Fig. 4; Table 14). Although there has been a very slight increasing trend in recent years, this increase is less obvious in the abundance index, suggesting any increase might be due to growth of the stock rather than recruitment. The current level of stock size is extremely low.

## **Assessment Results**

### *Precautionary limit reference points*

In the absence of an analytical assessment for this stock, it has not been possible to calculate precautionary limit reference points directly. As a proxy for  $B_{lim}$ , 15% of the highest observed biomass estimate has been used and is calculated to be approximately 9800 t (Fig. 5). However, the highest observed biomass estimates are in the early part of the time series when the survey did not cover the entire stock area. As a result,  $B_{lim}$  may be underestimated using this method. The stock has been below this  $B_{lim}$  since 1992.

## **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**

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Table 1. Catch statistics by country of witch flounder in Divisions 2J, 3K and 3L during 1963-2006.  
 In 1998-2001, and 2005 small portions of the "Others" catch are from Division 3M.

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	1868	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 <sup>a</sup>	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
1993	343	-	-	-	-	-	59	402
1994	12	-	-	-	-	-	491 <sup>b</sup>	503
1995	7	-	-	-	-	-	777	784
1996	11	-	-	-	-	-	1371	1382
1997	8	-	-	-	-	-	847	855
1998	-	-	-	-	2	-	1113	1115
1999	2	-	-	-	20	-	278	300
2000	85	-	-	-	6	-	578	669
2001	161	-	-	-	31	-	605	797
2002	166	-	-	-	15	-	258	439
2003	110	-	-	-	7	-	630	747
2004	26	-	-	-	16	-	787	829
2005	42	-	-	-	2	-	111	155
2006	53	-	-	-	3	-	28	84

<sup>a</sup>Since 1985 the "Others" category is mainly comprised of EU catches

<sup>b</sup>Spain (SCS Doc. 95/15)

Table 2. Estimated Biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in Div. 2J during fall of 1977-2006. (Engel 145 data converted to Campelen units for 1977-94)

Table 3. Estimated Biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in Div. 3K during fall of 1978-2006. (Engel 145 data converted to Campelen Units for 1978-94).

Table 4. Estimated Biomass (tons) of Witch Flounder (M+F) in each stratum from surveys in Div. 3L during fall of 1983-2006.  
 (Engel 145 data converted to Campelen Units for 1983-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																						
				84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
30 - 56	.	268	784																	1	0	0	0	0	0	0
57 - 92	2071	2071	350	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
	1780	1780	363	85	0	50	0	0	0	264	33	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1121	1121	371	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2460	2460	372	144	0	0	0	16	0	38	8	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0
	1120	1120	384	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	465	785																	0	0	0	0	0	0	0
93 - 183	1519	1519	328	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1574	1574	341	230	0	0	34	34	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	25	393
	585	585	342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	525	525	343	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2120	2120	348	334	0	0	0	44	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	2114	2114	349	306	0	155	0	36	0	145	0	0	0	0	0	0	0	0	0	2	0	0	0	17	0	117
	2817	2817	364	202	0	143	0	39	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1041	1041	365	100	0	68	29	18	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0
	1320	1320	370	190	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2356	2356	385	340	0	79	58	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1481	1481	390	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	.	84	766														1	0	0	0	1	0	1	0	1	
	.	613	787														0	0	0	0	0	0	0	0	0	
	.	261	788														0	0	0	0	0	0	0	0	0	
	.	89	790														0	0	1	0	1	0	0	0	0	
	.	72	793														0	0	0	0	2	0	0	0	3	
	.	216	794														0	0	0	0	0	0	0	0	0	
	.	98	797														0	0	0	0	0	0	0	0	0	
	.	72	799														0	0	0	0	0	0	0	0	0	
184 - 274	1494	1582	344	159	37	29	127	0	0	0	0	0	0	0	0	0	0	0	1	0	3	3	2	0	0	
	983	983	347	467	0	42	0	154	66	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	
	1394	1394	366	186	355	307	171	110	187	27	0	7	0	0	0	0	0	0	0	0	0	0	6	0	0	
	961	961	369	374	570	706	320	1061	429	473	162	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
	983	983	366	168	519	1082	1518	1750	442	218	307	875	0	0	0	0	0	0	0	0	0	0	0	0	1	
	821	821	389	196	133	760	250	138	21	79	0	27	0	0	0	38	0	0	0	11	0	0	0	0	5	
	282	282	391	0	32	0	9	0	0	70	22	0	0	36	0	25	0	0	0	0	0	0	0	0	0	
184 - 366	.	164	795														0	0	0	0	0	0	0	0	0	
	.	72	789														6	0	0	0	1	3	0	5	0	
	.	227	791														0	2	21	3	23	0	0	3	2	
275 - 366	1432	1432	345	4484	1227	617	3693	2099	2358	750	0	61	73	0	10	3	5	35	3	5	0	8	5	1	36	
	865	865	346	1423	2240	3321	1201	1823	1287	1863	203	40	14	0	0	12	3	1	20	16	8	4	1	0	72	
	334	334	368	47	29	386	23	64	144	106	39	14	0	0	22	0	0	0	0	6	0	0	0	0	3	
	718	718	387	169	404	276	572	1775	1546	3668	159	52	32	12	63	8	2	0	5	38	4	6	0	0	17	
	361	361	388	1229	48	589	92	126	0	125	173	0	14	0	0	0	12	0	5	17	6	4	0	0	32	
	145	145	392	55	13	20	50	13	0	0	0	0	4	0	0	0	0	0	0	0	14	0	0	0	0	
	.	175	81	796	800											0	1	2	0	4	1	0	0	9	2	
	367 - 549	186	729	146	127	280			48	274	246	42	131	2	151	24	0	0	1	13	33	12	0	3	32	
221	216	731	498	248					465	178	356	38	79	19	0	7	19	16	4	3	13	22	25	47		
	468	733	328	1164					1618	2110	610	183	60	23	12	0	41	54	62	50	106	8	248	230	166	
	272	735	367	34	1714				222	216	40	12	3	20	23	18	12	3	3	12	0	61	61	45		
	.	50	792						355	913	90	70	20	10	261	41	135	93	415	185	1196	104	195	758		
732 - 914	.	227	737												19	130	104	438	151	11	124	502	68	48	11	
	.	223	741													115	164	313	7	0	3	159	15	10		
	.	348	745													154	212	123	65	0	0	0	7	0		
	.	159	748													87	0	40	0	0	0	37	0	0		
915 - 1097	.	221	738												10	331	127	24	0	0	7	6	423	0		
	.	206	742													31	3	9	0	0	0	0	117	0		
	.	392	746													120	126	0	0	0	0	0	7	0		
	.	126	749													33	29	0	0	0	0	0	0	0		
1098 - 1280	.	254	739													0	0	0	0	0	0	0	0	0		
	.	211	743													0	0	0	0	0	0	0	0	0		
	.	724	747													0	0	107	0	0	0	0	0	0		
	.	556	750													0	0	0	0	0	0	0	0	0		
1281 - 1463	.	264	740													0	0	0	0	0	0	0	0	0		
	.	280	744													0	0	0	0	0	0	0	0	0		
	.	229	751													0	0	0	0	0	0	0	0	0		
Grand Total																										

Table 5. Abundance (000s) per stratum of Witch Flounder (M+F) from surveys in Div. 2J during fall of 1977-2006. Engel 145 data converted to Campelen Units for 1977-94.

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																															
				78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06			
101 - 200	1427	633	201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1823	1594	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2582	1870	206	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
2246	2264	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
.	733	237	238	238	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
201 - 300	440	621	209	158	37	32	147	0	80	158	32	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1608	680	774	1035	142	46	106	405	35	124	0	373	0	53	0	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1725	1583	213	386	271	203	326	435	475	308	190	185	158	30	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1171	1341	214	268	69	0	97	64	141	101	40	134	81	0	27	54	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1270	1302	215	218	22	29	0	35	78	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
1428	2196	228	565	262	393	746	196	825	295	421	56	1080	112	196	393	229	0	79	101	0	0	0	0	0	0	0	0	0	0	0					
508	530	234	0	42	35	0	0	0	0	0	0	0	0	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	0	66	154	0	0	33	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
448	588	208	339	62	139	508	624	924	144	965	123	0	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
330	251	211	545	306	148	390	91	340	23	136	106	23	45	0	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
384	460	216	0	0	40	40	106	106	123	0	0	79	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
441	450	222	303	182	45	152	212	465	101	40	61	0	0	394	61	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
567	536	229	312	292	175	331	117	195	214	130	130	52	1846	260	364	1664	78	26	130	221	25	0	0	0	0	0	0	0	0	0					
401 - 500	288	204	73	0	73	97	130	16	122	0	97	24	73	97	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
268	241	217	0	0	18	0	0	0	0	0	0	0	74	92	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
180	158	223	12	0	0	0	0	0	0	0	0	0	248	161	124	111	37	66	33	76	145	0	43	19	0	0	0	0	0	0	0				
686	598	227	165	189	47	566	189	396	283	126	212	409	684	220	354	4404	661	330	329	0	0	0	0	206	329	0	0	0	0	0	0	0	0	0	
420	414	235	1343	0	664	549	664	578	1358	770	520	376	289	0	202	173	96	19	0	0	0	0	0	58	0	62	0	0	0	0	0	0	0		
501 - 750	664	240	2147	183	868	228	731	1461	1705	1127	1621	4658	1302	685	891	1218	411	365	77	281	306	217	268	690	536	460	68	115	575	996	1396				
420	362	218	0	0	0	0	0	0	0	0	0	29	0	58	173	144	87	29	0	100	199	17	199	75	50	47	50	0	0	0	0	0			
270	228	0	0	0	0	0	0	0	0	0	0	0	56	56	204	186	19	111	74	0	146	31	78	141	84	16	94	72	16	0	0	0			
237	230	0	0	0	0	0	0	0	0	0	0	0	16	0	65	16	147	782	1695	4548	880	471	382	827	582	865	102	674	165	130	29	129	165	329	
751 - 1000	213	283	219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
182	186	231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
122	193	236	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
1001 - 1250	324	303	220	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
180	201	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
180	237	233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Grand Total		7106	1962	3016	4503	3190	6486	4963	3840	4089	9432	3337	2746	5377	8110	6941	2463	2588	2369	1808	1724	1890	2505	2548	1096	1497	715	1870	2254	2719					
Biomass >1000m		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Percent >1000m		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 6. Abundance (000s) per stratum of Witch Flounder (M+F) from surveys in Div. 3K during fall of 1978-2006. Engel 145 data converted to Campelen Units for 1978-94.

Table 7. Abundance (000s) per stratum of Witch Flounder (M+F) from surveys in Div. 3L during fall of 1983-2006.  
 (Engel 145 data converted to Campelen Units for 1983-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																								
				84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06		
30 - 56	.	268	784																	74	0	0	0	0	0	0		
57 - 92	2071	350	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	0		
	1780	363	92	0	35	0	0	0	0	306	43	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	1121	371	44	0	0	0	0	0	0	0	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0		
	2460	372	182	0	0	0	26	0	0	34	13	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0		
	1120	384	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	.	465	785																	32	0	0	0	0	37			
93 - 183	1519	1519	328	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	1574	341	217	0	0	24	27	0	0	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	49	606		
	585	342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	40	0	0	0	0	0	0		
	525	343	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2120	2120	348	292	0	0	58	0	0	0	0	0	0	0	0	0	49	0	73	0	0	0	0	48	42	42		
	2114	2114	349	291	0	162	0	32	0	166	0	0	0	0	0	42	0	0	42	0	0	125	42	148	0	0		
	2817	364	271	0	155	0	55	0	32	0	0	0	0	0	0	43	43	0	43	0	0	0	0	0	0	0		
	1041	1041	365	143	0	57	48	29	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0		
	1320	370	233	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	2356	385	324	0	122	36	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	1481	390	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	.	84	786														90	36	23	40	164	29	64	40	204			
	.	613	787														0	0	0	0	0	0	0	0	0	0		
	.	261	788														0	0	18	18	0	0	0	0	0	0		
	.	89	790														6	18	55	0	37	6	0	0	0			
	.	72	793														0	0	0	0	0	50	0	7	6			
	.	216	794														0	0	0	0	0	0	0	0	0			
	.	98	797														7	0	0	0	0	0	0	0	0			
	.	72	799														0	0	0	0	0	6	0	0	0			
184 - 274	1494	1582	344	206	46	117	154	0	0	0	0	0	0	0	0	0	0	0	0	64	0	87	131	50	0	44		
	983	347	586	0	34	0	135	108	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	0	0	0		
	1394	366	157	362	431	219	110	164	32	0	8	0	0	0	0	38	0	38	0	0	0	77	34	0				
	961	369	359	507	661	330	1348	529	463	162	0	0	0	0	0	0	0	0	0	0	0	0	0	32	39			
	983	386	186	568	1082	1792	1974	352	237	270	1262	0	0	0	0	0	0	0	0	0	0	0	0	52	0			
	821	389	169	158	875	226	169	28	75	0	38	0	0	33	0	0	0	0	0	301	0	0	0	38	0	151		
	282	391	0	39	0	19	0	0	0	91	26	0	0	34	0	19	0	0	0	0	0	0	0	0	0	0		
184 - 366	.	164	795														0	0	56	0	0	0	0	0	0	0		
	.	72	789														0	5	5	22	5	24	5	20	12	25		
	.	227	791														42	62	0	0	28	10	16	0	45			
275 - 366	.	100	798														7	7	172	135	530	21	0	123	41			
	1432	1432	345	6895	1488	739	4531	2589	3180	2088	0	345	394	0	113	70	223	439	149	117	79	468	184	105	569	214		
	865	346	2380	3498	3927	1487	2427	1606	2340	389	170	76	0	0	35	317	178	282	119	278	326	59	40	357	326			
	334	334	368	46	46	459	23	69	207	115	69	14	0	0	23	0	23	0	20	23	0	0	23	138	20			
	718	718	387	165	444	247	691	2025	1679	4971	198	66	33	77	99	49	44	44	44	593	44	93	0	56	176			
	361	361	388	1440	50	819	149	149	0	116	199	0	14	0	0	0	149	0	124	309	44	94	0	174	50			
	145	145	392	80	20	20	70	20	0	0	0	0	0	0	7	0	0	0	0	0	0	16	0	0	27	0		
	.	175	796	800													0	107	24	21	638	96	0	0	385	120		
	.	175	736	373	987												156	178	136	953	574	28	166	195				
	.	186	186	729	217	192	409										78	468	297	1109	390	16	281	1028	390	125		
367 - 549	216	731	877	371													520	248	604	99	200	45	0	74	56	59	15	
	468	733	338	1609													2221	2983	665	258	136	32	19	0	114	129	170	109
	272	272	735	661	37	2320											349	249	37	14	75	58	75	168	50	17	19	
	.	50	792														506	1613	217	241	34	75	782	277	1037	433	1432	
	.	170	730	105	23												117	12	195	171	108	0	47	19	21	58	509	
	.	231	732	365	302												32	270	397	48	339	78	280	413	969	508	524	
550 - 731	228	734	21	267													251	110	16	141	146	44	467	70	380	173	125	28
	175	175	736	373	987												506	1613	217	241	34	75	782	277	1037	433	1432	
	.	227	737														78	468	297	1109	390	16	281	1028	390	125	16	
	.	223	741														291	460	892	14	0	31	291	70			15	
732 - 914	.	348	745														348	745	745	311	479	168	202	24	24	0	48	0
	.	159	748														186	0	50	0	0	0	0	0	0	55	0	
	.	221	738														61	532	347	56	0	0	14	30	1049	0		
915 - 1097	.	206	742														43	14	14	13	0	0						

Table 8. Mean Numbers per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 2J during fall of 1977-2006. Engel 145 data converted to Campden Units for 1977-94.

Table 9. Mean Numbers per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 3K during fall of 1978-2006. Engel 145 data converted to Campelen Units for 1978-94.

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																														
				78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06		
101 - 200	. 798	608	612																															
	. 445	250	616																															
1455	1347	618																																
1588	1753	619																																
201 - 300	.	342	609	611	573	611	251	615	258	5.30	1.67	0.40	0.44	0.30	0.31	0.21	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	27.09	25.45	620	621	5.08	13.09	1.77	0.73	0.43	1.75	0.64	1.00	0.07	0.17	0.00	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
2859	2537	624	5.71	2.50	1.75	6.50	5.00	2.00	4.00	1.75	1.00	0.33	0.00	0.00	0.25	0.00	0.00	0.14	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
668	1105	624	3.78	3.75	5.71	3.00	4.09	4.09	4.00	1.20	1.27	2.17	1.14	0.00	0.00	1.08	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1618	1555	634	9.67	10.88	10.17	9.00	5.00	3.33	13.88	6.43	0.17	0.83	2.60	1.00	0.17	0.00	0.33	0.00	0.17	0.00	0.40	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1274	1274	635	8.57	8.57	9.43	5.83	4.80	3.17	14.63	4.88	2.00	2.43	3.83	1.20	0.14	0.00	0.00	0.00	0.14	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
1455	1455	636	10.33	21.14	12.67	15.17	15.29	30.60	22.67	21.29	4.75	6.17	1.25	1.00	0.00	0.00	0.33	0.00	0.00	0.00	0.20	0.40	0.93	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
1132	1132	637	9.00	12.50	4.25	10.50	8.33	8.00	3.67	1.50	0.50	1.00	0.00	0.10	0.92																			
447		632	256	610	263	614	593	617	617	7.00	6.17	3.40	6.17	4.00	6.50	2.00	3.80	2.20	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	1027	494	623	13.50	34.00	12.50	22.00	5.00	19.00	17.80	14.40	0.67	2.75	2.50	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
850	888	625	70.00	89.00	84.20	12.60	54.80	38.50	22.67	12.80	0.50	1.00	2.60	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
919	1113	626	24.14	56.00	35.17	12.33	23.00	44.00	18.14	28.33	11.33	6.00	1.80	4.25	0.00	0.00	1.00	0.00	0.00	0.00	0.18	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
1085	1085	628	44.17	53.50	71.60	40.67	21.50	53.00	20.00	30.50	7.67	10.67	11.00	6.00	1.50	0.00	0.67	2.67	2.00	4.50	0.50	1.00	5.50	4.11	0.67	0.00	0.00	0.00	0.00	0.00				
499	495	629	37.00	18.00	15.00	17.50	12.00	10.67	12.25	4.00	3.67	3.33	1.67	0.00	0.00	0.33	0.67	0.00	0.00	1.00	0.00	0.50	2.50	2.21	0.33	0.44	0.00	0.00	0.00	0.00	0.00			
544	332	630	9.89	13.00	15.10	7.00	9.86	10.17	6.18	11.63	12.30	3.55	1.20	1.84	2.11	0.00	0.00	0.24	1.00	0.00	0.00	0.22	0.67	0.78	1.00	0.48	0.25	0.11	0.00	0.00	0.00			
2179	2067	633	24.13	53.67	34.33	33.75	20.87	24.18	50.10	43.73	40.00	26.60	40.25	17.82	1.89	2.16	1.12	1.30	0.05	0.28	0.53	0.56	2.33	2.13	3.60	2.18	0.89	1.16	2.40	1.95	1.98			
2059	2059	638	10.00	5.75	13.17	10.00	7.10	20.00	27.13	13.88	11.83	6.14	16.50	2.50	2.43	0.33	0.12	0.00	1.13	0.57	0.17	0.50	0.83	0.00	0.00	0.46	0.00	0.00	0.00	0.00				
1463	1463	639	30	613	622	30.50	22.33	38.50	18.50	13.00	26.00	11.25	22.25	8.00	17.00	2.33	3.33	1.50	0.67	3.00	2.50	0.00	0.30	0.24	0.33	1.00	0.00	0.67	1.67	0.00	0.67	0.63		
	632	627	37.00	71.33	79.50	140.83	13.86	136.50	114.75	106.29	47.60	23.83	44.20	38.50	12.00	2.67	1.67	21.00	2.13	4.59	0.73	7.78	13.00	3.82	11.66	4.48	2.10	0.78	2.75	2.24	6.36			
1184	1225	631	51.50	34.33	38.33	80.20	11.00	53.60	76.60	69.14	48.50	20.67	15.50	11.00	1.67	15.50	13.67	4.00	13.50	2.96	9.88	3.13	6.77	1.46	3.46	1.73	1.17	0.67	2.75	3.76	0.91			
1202	1321	640	4.00	8.50	3.00	17.00	21.00	63.00	90.50	147.50	83.50	60.50	9.00	9.00	3.33	0.00	0.00	4.06	2.00	6.50	0.00	4.06	2.00	6.50	1.50	1.50	1.00	0.50	16.86	1.50	16.50			
198	204	645	0.50	0.50	0.00	0.00	0.50	14.67	10.50	72.00	14.00	208.00	39.50	16.50	84.00	7.00	1.67	6.33	4.00	0.00	5.00	1.50	0.44	3.50	2.50	3.71	2.50	0.00	0.00	9.83	8.50	8.50		
	501	584	641	0.00	0.00	1.00	2.00	0.75	3.00	0.00	12.50	30.33	212.00	17.00	0.00	1.67	2.33	2.50	8.00	6.00	16.00	11.94	25.00	4.93	9.50	61.50	7.33	37.00	0.00	0.00	0.00	0.00	0.00	
333	325	646	0.00	0.00	1.00	0.50	1.00	15.50	2.00	2.67	2.50	11.50	8.00	6.33	4.67	10.33	5.00	49.41	3.50	3.50	17.83	12.00	17.57	2.00	7.00	6.50	2.00	0.00	0.00	0.00	0.00	0.00		
359	651	642	0.00	0.50	0.00	0.33	1.00	1.00	0.67	1.00	1.00	31.33	17.00	8.50	6.67	3.00	1.50	0.50	0.00	0.50	0.00	3.00	10.39	0.57	1.00	5.50	0.50	22.50	1.50	0.00	0.00	0.00	0.00	
418	360	647	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	9.50	28.33	9.00	5.67	5.33	1.00	3.50	4.00	5.50	15.00	0.00	17.50	0.50	7.00	13.57	14.50	0.50	0.50	0.00	0.00	0.00			
409	516	652	1266	733	643	0.00	0.00																											
1001-1250	1232	648	0.00	0.00																														
1251-1500	954	644	0.00	0.00																														
1263	212	649	0.00	0.00																														
All strata		279	654	1393	21.04	18.61	17.89	13.58	20.32	18.87	16.24	10.24	8.71	8.82	5.65	6.77	2.32	1.47	2.03	1.12	1.56	1.17	1.64	1.42	0.74	0.72	2.05	2.00	2.00	2.05	2.00	2.00		

Table 10. Mean Numbers per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 3L during fall of 1983-2006.  
(Engel 145 data converted to Campelen Units for 1983-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																							
				84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	
30 - 56	.	268	784																								
57 - 92	2071	2071	350	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00			
	1780	1780	363	0.38	0.00	0.14	0.00	0.00	0.00	1.25	0.18	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1121	1121	371	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	2460	2460	372	0.54	0.00	0.00	0.00	0.08	0.00	0.10	0.04	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1120	1120	384	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	.	465	785																					0.50	0.00	0.57	
93 - 183	1519	1519	328	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	1574	1574	341	1.00	0.00	0.00	0.11	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.23	2.80		
	585	585	342	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.00	0.00		
	525	525	343	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	2120	2120	348	1.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.25	0.00	0.00	0.00	0.16	0.14		
	2114	2114	349	1.00	0.00	0.56	0.00	0.11	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.14	0.00	0.00	0.43	0.14	0.51		
	2817	2817	364	0.70	0.00	0.40	0.00	0.14	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.11	0.00	0.00	0.00	0.00	0.00		
	1041	1041	365	1.00	0.00	0.40	0.33	0.20	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00		
	1320	1320	370	1.29	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	2356	2356	385	1.00	0.00	0.38	0.11	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	1481	1481	390	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	.	84	786														7.79	3.14	2.00	3.50	14.22	2.50	5.50	3.43	17.64		
	.	613	787														0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	.	261	788														0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00		
	.	89	790														0.50	1.50	4.50	0.00	3.00	0.50	0.00	0.00	0.00		
	.	72	793														0.00	0.00	0.00	0.00	5.00	0.00	0.67	0.57	0.00		
	.	216	794														0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	.	98	797														0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	.	72	799														0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00		
184 - 274	1494	1582	344	1.00	0.22	0.57	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.40	0.60	0.23	0.00	0.20	0.00		
	983	983	347	4.33	0.00	0.25	0.00	1.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	1394	1394	366	0.82	1.89	2.25	1.14	0.57	0.86	0.17	0.00	0.04	0.00	0.00	0.00	0.00	0.20	0.00	0.20	0.00	0.00	0.40	0.18	0.00			
	961	961	369	2.71	3.83	5.00	2.50	10.20	4.00	3.50	1.22	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.30			
	983	983	386	1.38	4.20	8.00	13.25	14.60	2.60	1.75	2.00	9.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00		
	821	821	389	1.50	1.40	7.75	2.00	1.50	0.25	0.67	0.00	0.33	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00		
184 - 366	282	282	391	0.00	1.00	0.00	0.50	0.00	0.00	2.33	0.67	0.00	0.00	0.89	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	.	164	795														0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00	0.44		
	.	72	789														0.00	0.50	0.50	2.22	0.50	2.44	0.50	2.00	1.17	2.50	
	.	227	791														1.00	2.00	0.00	0.00	0.89	0.33	0.50	0.00	1.44		
275 - 366	.	100	798														0.50	0.50	12.50	9.78	38.50	1.50	0.00	8.94	3.00		
	1432	1432	345	35.00	7.56	3.75	23.00	13.14	16.14	10.60	0.00	1.75	2.00	0.00	0.57	0.36	1.13	2.23	0.76	0.59	0.40	2.38	0.93	0.53	2.89	1.09	
	865	865	346	20.00	29.40	33.00	12.50	20.40	13.50	19.67	3.27	1.43	0.64	0.00	0.00	0.30	2.67	1.50	2.37	1.00	2.33	2.74	0.50	0.33	3.00	2.74	
	334	334	368	1.00	1.00	10.00	0.50	1.50	4.50	2.50	1.50	0.30	0.00	0.50	0.00	0.00	0.00	0.50	0.00	0.44	0.50	0.00	0.00	0.50	3.00	0.44	
	718	718	387	1.67	4.50	2.50	7.00	20.50	17.00	50.33	2.00	0.67	0.33	0.78	1.00	0.50	0.44	0.00	0.44	6.00	0.44	0.44	0.00	0.57	1.78		
	361	361	388	29.00	1.00	16.50	3.00	3.00	0.00	0.00	2.33	4.00	0.00	0.29	0.00	0.00	0.00	3.00	0.00	2.50	6.22	0.89	1.89	0.00	3.50	1.00	
	145	145	392	4.00	1.00	1.00	3.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	0.00	
	.	175	796														0.00	0.44	1.00	0.89	26.50	4.00	0.00	0.00	0.00	16.00	5.00
	.	81	800														14.00	16.00	12.22	85.50	51.56	2.50	14.89	17.50			
	186	186	729	8.50	7.50	16.00					2.50	13.33	16.50	2.00	11.33	1.33	14.67	4.50	0.00	0.00	1.33	0.50	3.11	1.00	0.00	0.89	4.00
550 - 731	216	216	731	29.50	12.50					17.50	8.33	20.33	3.33	6.71	1.50	0.00	2.50	1.89	2.00	0.00	0.50	1.33	3.91	6.29	3.17	6.00	
	468	468	733	5.25	25.00					34.50	46.33	10.33	4.00	2.11	0.50	0.30	0.00	1.78	2.00	2.64	1.70	6.72	0.94	23.39	13.50	8.17	
	272	272	735	17.67	1.00	62.00					9.33	6.67	1.00	0.36	2.00	1.54	2.00</td										

Table 11. Mean Weight (kg) per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 2J during fall of 1977-2006. Engel 145 data converted to Campelen for 1977-94.

Table 12. Mean Weight (kg) per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 3K during fall of 1978-2006. Engel 145 data converted to Units for 1978-94.

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Year																											
				78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05
101 - 200	798	608																													
	445	612																													
1455	250	616																													
1588	1347	618																													
201 - 300	1753	619																													
	342	609																													
	573	611																													
251	615																														
2709	2545	620																													
2859	2537	621																													
668	1105	624																													
1618	1555	634																													
1274	1274	635																													
1455	1455	636																													
1132	1132	637																													
447	.	632																													
301 - 400	.	256																													
	263	614																													
593	617																														
1027	494	623																													
850	888	625																													
919	1113	626																													
1085	1085	628																													
499	495	629																													
544	332	630																													
2179	2067	633																													
2059	2059	638																													
1463	.	639																													
401 - 500	.	30																													
	613																														
632	691	622																													
1184	1255	627																													
1202	1321	631																													
198	69	1.89																													
204	216	645																													
501 - 750	584	630																													
333	325	641																													
751 - 1000	931	418																													
409	516	647																													
1001 - 1250	1266	733																													
232	228	648																													
1251 - 1500	954	531																													
All strata	.	7.08	12.33	11.48	11.09	8.44	13.30	11.63	8.24	5.35	5.08	4.50	2.23	3.94	0.99	0.43	0.30	0.20	0.09	0.17	0.22	0.25	0.19	0.25	0.28	0.09	0.13	0.52	0.56	0.59	

Table 13. Mean Weight (kg) per Tow of Witch Flounder (M+F) in each stratum from surveys in Div. 3L during fall of 1983-2006.  
 (Engel 145 data converted to Campelen Units for 1983-94).

Depth Range (m)	Old Strata m Area	New Stratum Area	Stratum	Year																									
				84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06			
30 - 56	.	268	784																										
57 - 92	2071	2071	350	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.06	0.00			
	1780	1780	363	0.35	0.00	0.20	0.00	0.00	0.00	1.08	0.13	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1121	1121	371	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	2460	2460	372	0.43	0.00	0.00	0.05	0.00	0.00	0.11	0.02	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	.	1120	384	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		
93 - 183	.	465	785																										
	1519	1519	328	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1574	1574	341	1.06	0.00	0.00	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.11	1.81			
	585	585	342	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	525	525	343	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	2120	2120	348	1.14	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	2114	2114	349	1.05	0.00	0.53	0.00	0.12	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.00	0.40	0.00	0.00			
	2817	2817	364	0.52	0.00	0.37	0.00	0.10	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1041	1041	365	0.70	0.00	0.47	0.21	0.13	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00			
	1320	1320	370	1.05	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	2356	2356	385	1.05	0.00	0.24	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	1481	1481	390	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
	.	84	786																	0.05	0.02	0.03	0.03	0.11	0.01	0.05	0.02	0.10	
	.	613	787																	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	.	261	788																	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	
	.	89	790																	0.02	0.01	0.11	0.00	0.10	0.01	0.00	0.00	0.00	
	.	72	793																	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.01	0.29	
	.	216	794																	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	.	98	797																	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	.	72	799																	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
184 - 274	1494	1582	344	0.77	0.18	0.14	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00		
	983	983	347	3.45	0.00	0.31	0.00	1.14	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	1394	1394	366	0.97	1.85	1.60	0.89	0.57	0.97	0.14	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00			
	961	961	369	2.83	4.31	5.34	2.42	8.02	3.25	3.58	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01			
	983	983	386	1.24	3.84	8.00	11.23	12.94	3.27	1.61	2.27	6.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	821	821	389	1.74	1.17	6.73	2.22	1.22	0.19	0.70	0.00	0.24	0.00	0.00	0.34	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04		
	282	282	391	0.00	0.83	0.00	0.23	0.00	0.00	1.80	0.56	0.00	0.00	0.93	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
184 - 366	.	164	795																	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	
	.	72	789																	0.00	0.01	0.01	0.02	0.01	0.04	0.01	0.01	0.03	
	.	227	791																	0.14	0.02	0.00	0.00	0.01	0.02	0.00	0.15	0.00	
	.	100	798																	0.01	0.14	1.56	0.24	0.00	0.25	0.00	0.13	0.00	
275 - 366	1432	1432	345	22.76	6.23	3.13	18.75	10.66	11.97	3.81	0.00	0.31	0.37	0.00	0.05	0.02	0.02	0.18	0.01	0.02	0.00	0.04	0.03	0.00	0.00	0.00	0.18	0.22	
	865	865	346	11.96	18.82	27.91	10.09	15.32	10.81	15.66	1.70	0.34	0.12	0.00	0.00	0.10	0.03	0.01	0.17	0.14	0.06	0.03	0.01	0.00	0.61	0.81	0.00		
	334	334	368	1.03	0.64	8.40	0.49	1.40	3.13	2.31	0.84	0.31	0.00	0.00	0.48	0.00	0.01	0.00	0.13	0.00	0.00	0.01	0.00	0.00	0.08	0.27	0.00		
	718	718	387	1.71	4.09	2.79	5.79	17.97	15.65	37.14	1.61	0.53	0.32	0.12	0.63	0.08	0.02	0.00	0.05	0.38	0.04	0.06	0.00	0.01	0.17	0.00	0.00		
	361	361	388	24.75	0.97		11.87	1.85	2.54	0.00	2.51	3.48	0.00	0.28	0.00	0.00	0.00	0.25	0.00	0.11	0.34	0.13	0.07	0.00	0.06	0.05	0.65	0.00	
	.	145	392	2.74	0.64	0.99	2.50	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	.	175	796	800																0.71	0.24	0.56	0.21	0.06	0.34	0.66	0.00	0.00	
367 - 549	186	186	729	5.71	4.95	10.94					1.88	10.69	9.63	1.62	5.11	0.09	5.92	0.93	0.00	0.04	0.53	1.29	0.45	0.00	0.11	1.27	0.00		
	216	216	731	16.75	8.34						15.66	5.98	11.98	1.28	2.67	0.63	0.00	0.25	0.62	0.55	0.13	0.09	0.45	0.74	0.84	1.58	0.00	0.00	

Table 14. Estimates of biomass (tons) of witch flounder from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-2006.

	2J	3K	3L	2J3KL
1977	5123			
1978	1302	30353		
1979	2218	49789		
1980	3494	44962		
1981	2581	43406		
1982	4909	32429		
1983	3693	49251		
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	263	435	418	1117
1996	370	855	1806	3031
1997	465	1116	1095	2676
1998	649	1255	1906	3810
1999	752	881	826	2460
2000	498	1200	968	2667
2001	209	1427	1042	2678
2002	404	471	2428	3303
2003	178	651	1010	1839
2004	476	2641	451	3568
2005	684	2842	1003	4529
2006	962	2889	1987	5838

Table 16. Estimates of abundance (000s) of witch flounder from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-2006.

	2J	3K	3L	2J3KL
1977	7106			
1978	1962	59729		
1979	3016	84955		
1980	4503	72872		
1981	3190	70058		
1982	6486	52146		
1983	4963	75267		
1984	3840	79553	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	36114
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	1808	3546	1004	6358
1996	1724	5081	5297	12102
1997	1890	5716	4383	11989
1998	2505	7955	6755	17214
1999	2548	5441	2655	10644
2000	1964	7952	5361	15276
2001	1096	7220	7316	15631
2002	1497	3752	10776	16025
2003	715	3659	6090	10464
2004	1870	10424	3990	16284
2005	2254	10129	7023	19406
2006	2719	10065	5091	17875

Table 15. Mean weights (kg) of witch flounder per tow from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-2006.

	2J	3K	3L	2J3KL
1977	1.56			
1978	0.39	7.08		
1979	0.72	12.33		
1980	1.11	11.48		
1981	0.80	11.09		
1982	1.52	8.44		
1983	1.13	13.30		
1984	0.93	11.63	2.49	5.15
1985	0.93	8.24	1.48	3.61
1986	1.82	5.35	2.11	3.08
1987	0.63	5.08	1.72	2.58
1988	0.49	4.50	1.84	2.36
1989	0.83	2.23	1.31	1.48
1990	1.13	3.94	1.96	2.42
1991	0.82	0.99	0.99	0.95
1992	0.34	0.43	0.59	0.47
1993	0.20	0.30	0.15	0.22
1994	0.14	0.20	0.12	0.15
1995	0.09	0.09	0.08	0.09
1996	0.11	0.17	0.28	0.20
1997	0.13	0.22	0.17	0.18
1998	0.19	0.25	0.30	0.25
1999	0.22	0.19	0.14	0.18
2000	0.14	0.25	0.16	0.18
2001	0.06	0.28	0.16	0.18
2002	0.12	0.09	0.38	0.22
2003	0.05	0.13	0.16	0.12
2004	0.14	0.52	0.10	0.27
2005	0.20	0.56	0.17	0.31
2006	0.28	0.59	0.33	0.40

Table 17. Mean numbers of witch flounder per tow from Canadian fall surveys in Div. 2J, 3K and 3L during 1977-2006.

	2J	3K	3L	2J3KL
1977	2.16			
1978	0.59	13.93		
1979	0.97	21.04		
1980	1.42	18.61		
1981	0.99	17.89		
1982	2.01	13.58		
1983	1.52	20.32		
1984	1.23	18.87	3.38	8.01
1985	1.26	16.24	1.95	6.57
1986	2.90	10.24	2.52	5.12
1987	1.03	8.71	2.08	4.06
1988	0.86	8.82	2.23	4.03
1989	1.67	5.65	1.58	2.94
1990	2.49	6.77	2.74	4.04
1991	2.13	2.32	1.39	1.89
1992	0.76	1.47	0.89	1.05
1993	0.82	2.03	0.31	1.04
1994	0.72	1.12	0.27	0.67
1995	0.65	0.77	0.19	0.50
1996	0.50	1.00	0.83	0.81
1997	0.54	1.12	0.69	0.80
1998	0.72	1.56	1.06	1.15
1999	0.74	1.17	0.45	0.76
2000	0.57	1.64	0.86	1.05
2001	0.32	1.42	1.15	1.05
2002	0.43	0.74	1.69	1.07
2003	0.21	0.72	0.96	0.70
2004	0.54	2.05	0.84	1.22
2005	0.65	2.00	1.20	1.35
2006	0.78	2.05	0.84	1.24

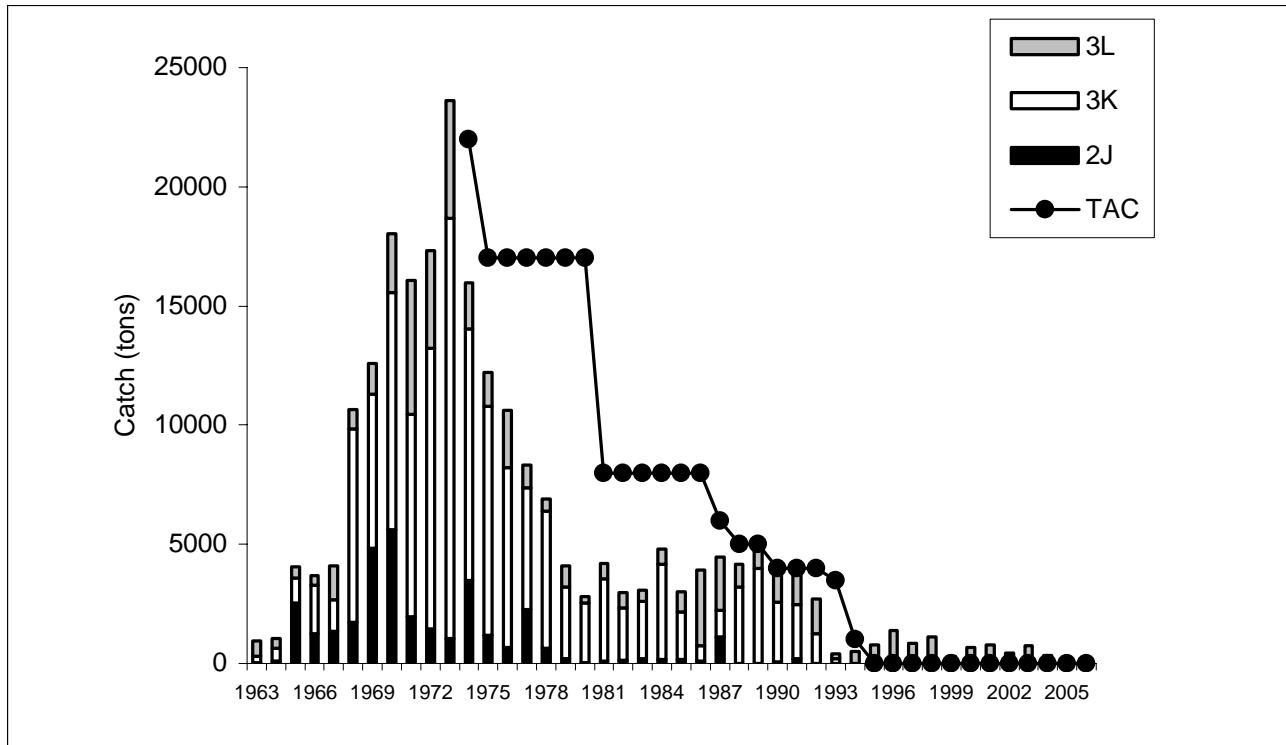


Fig. 1. Commercial catches and TACs of witch flounder in Divisions 2J, 3K and 3L during 1963-2006.

Catches in Div. 3M are included for 1998-2000. Although not included, the estimated catches in Div 3M from 2001-2004 averaged 360 tons.

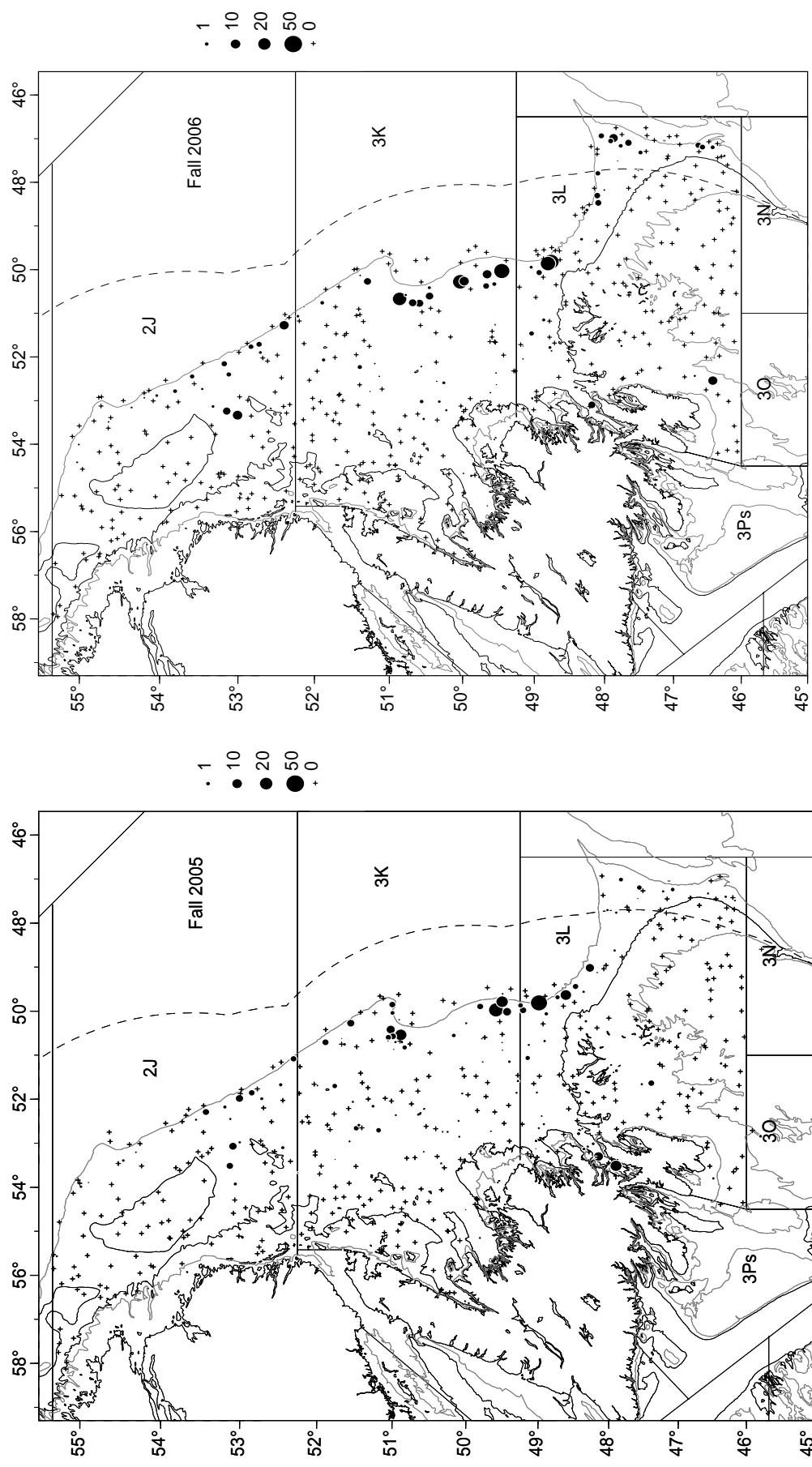
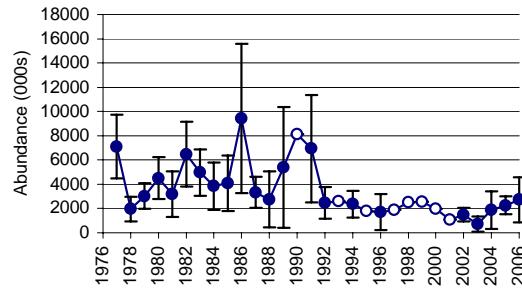
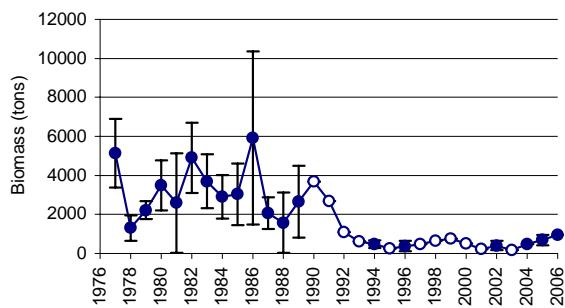
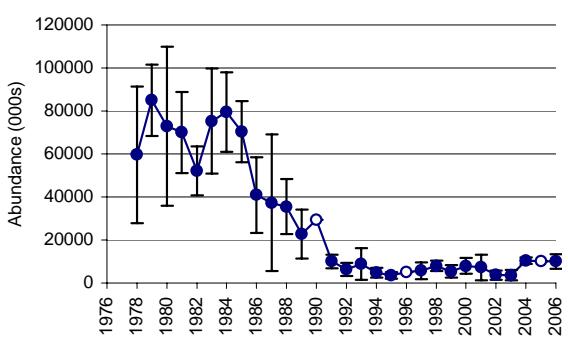
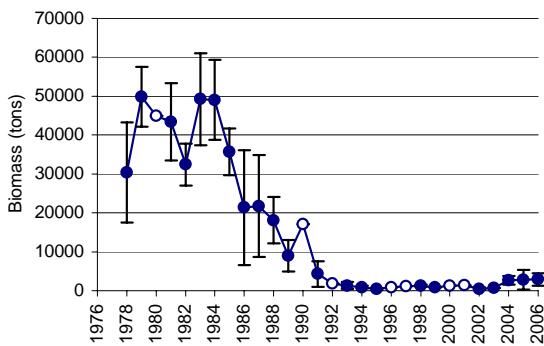


Fig. 2. Weight (kg) per set of witch flounder from Canadian surveys in NAFO divisions 2J, 3K, and 3L during autumn 2005 and 2006.

2J



3K



3L

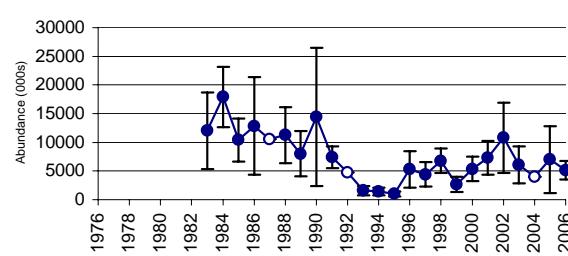
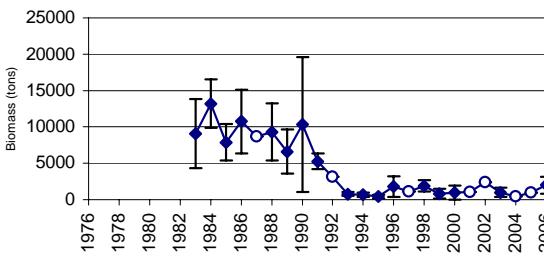
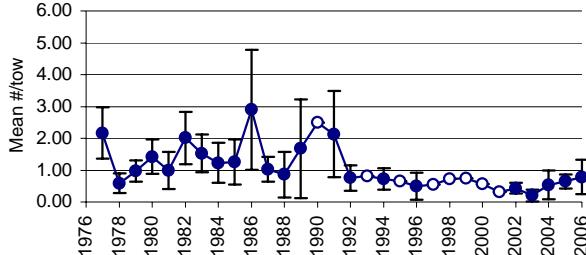
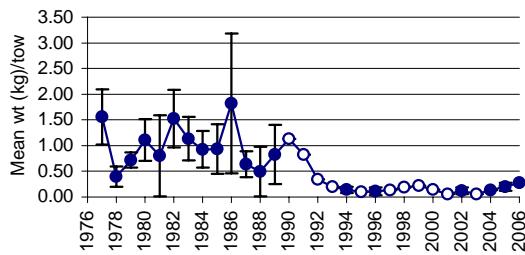


Figure 3a. Biomass (tons) and Abundance (000's) for 2J, 3K and 3L fall surveys.  
Where lower confidence limit was negative, error bars were omitted (hollow symbol).

2J



3K

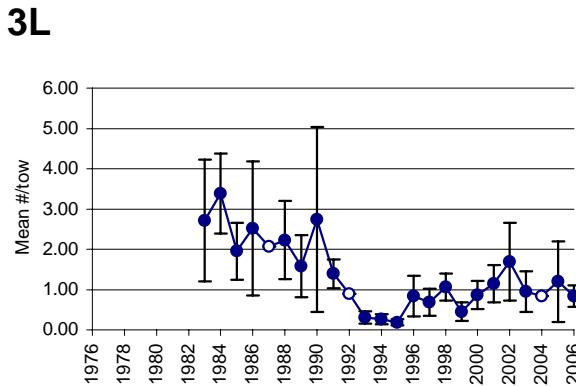
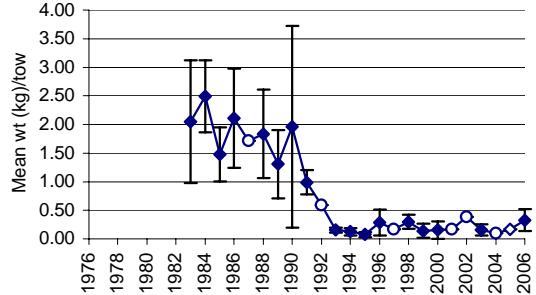
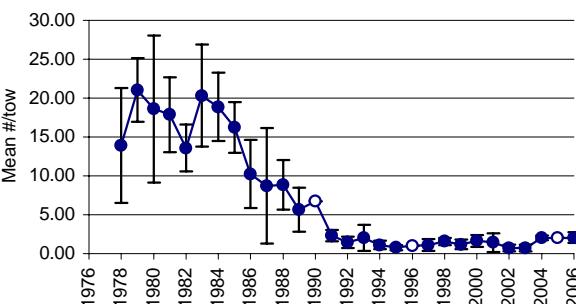
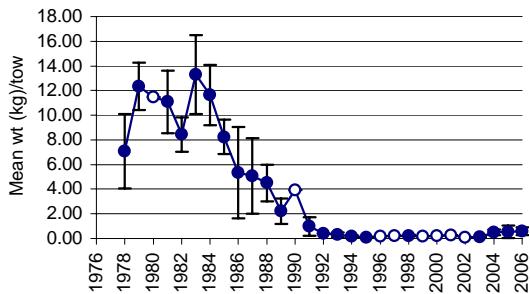


Figure 3b. Mean numbers and weights(kg) per tow for 2J, 3K and 3L fall surveys.  
Where lower confidence limit was negative, error bars were omitted (hollow symbol).

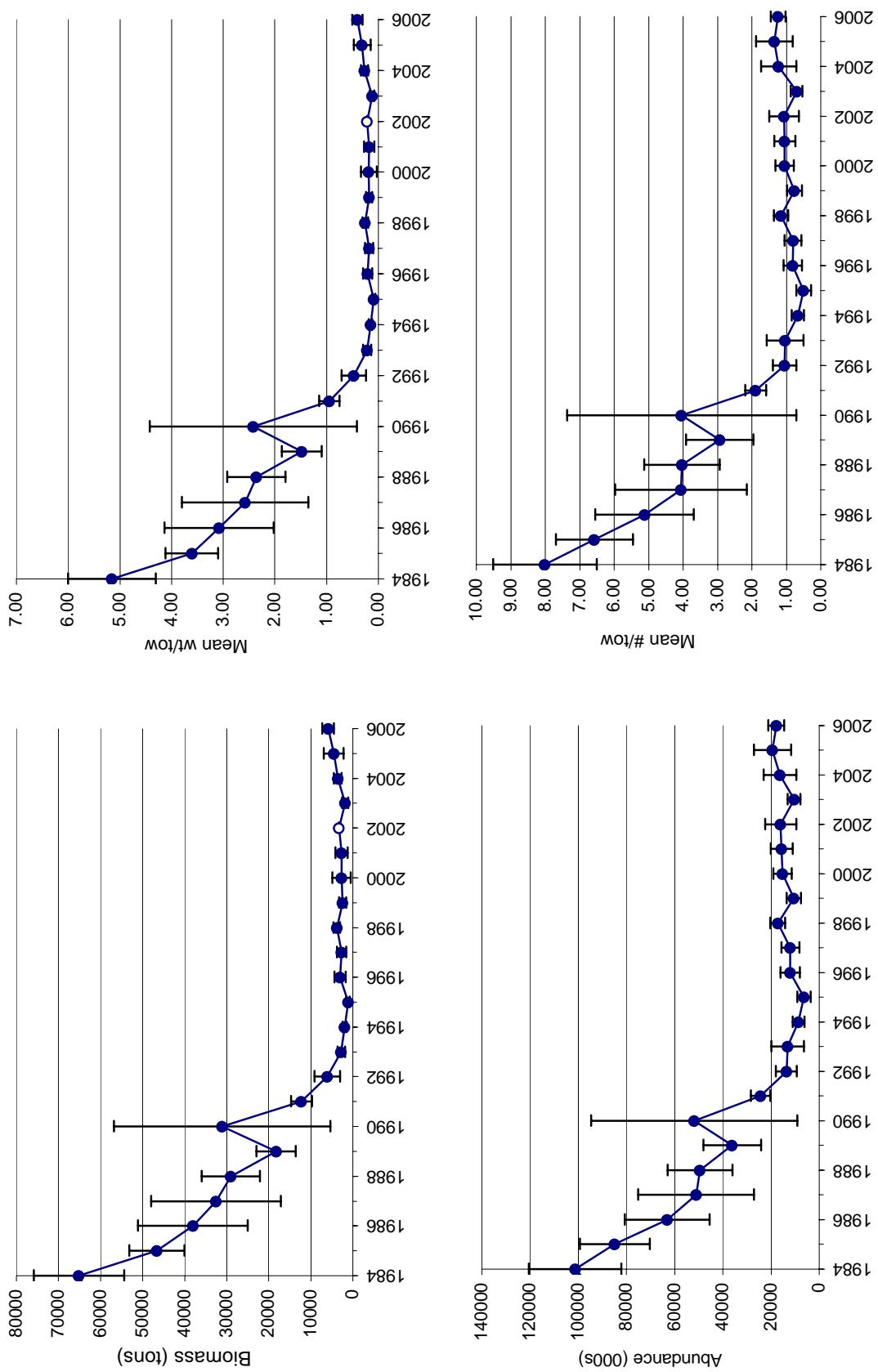


Fig. 4. Biomass ( $t$ ) and abundance (000s) estimates, mean numbers and weights (kg) per tow, of witch flounder from Canadian fall surveys in 2J3KL based on Campelen trawl catch equivalents during 1984-2006. Where lower confidence limit was negative, error bars were omitted (hollow symbol).

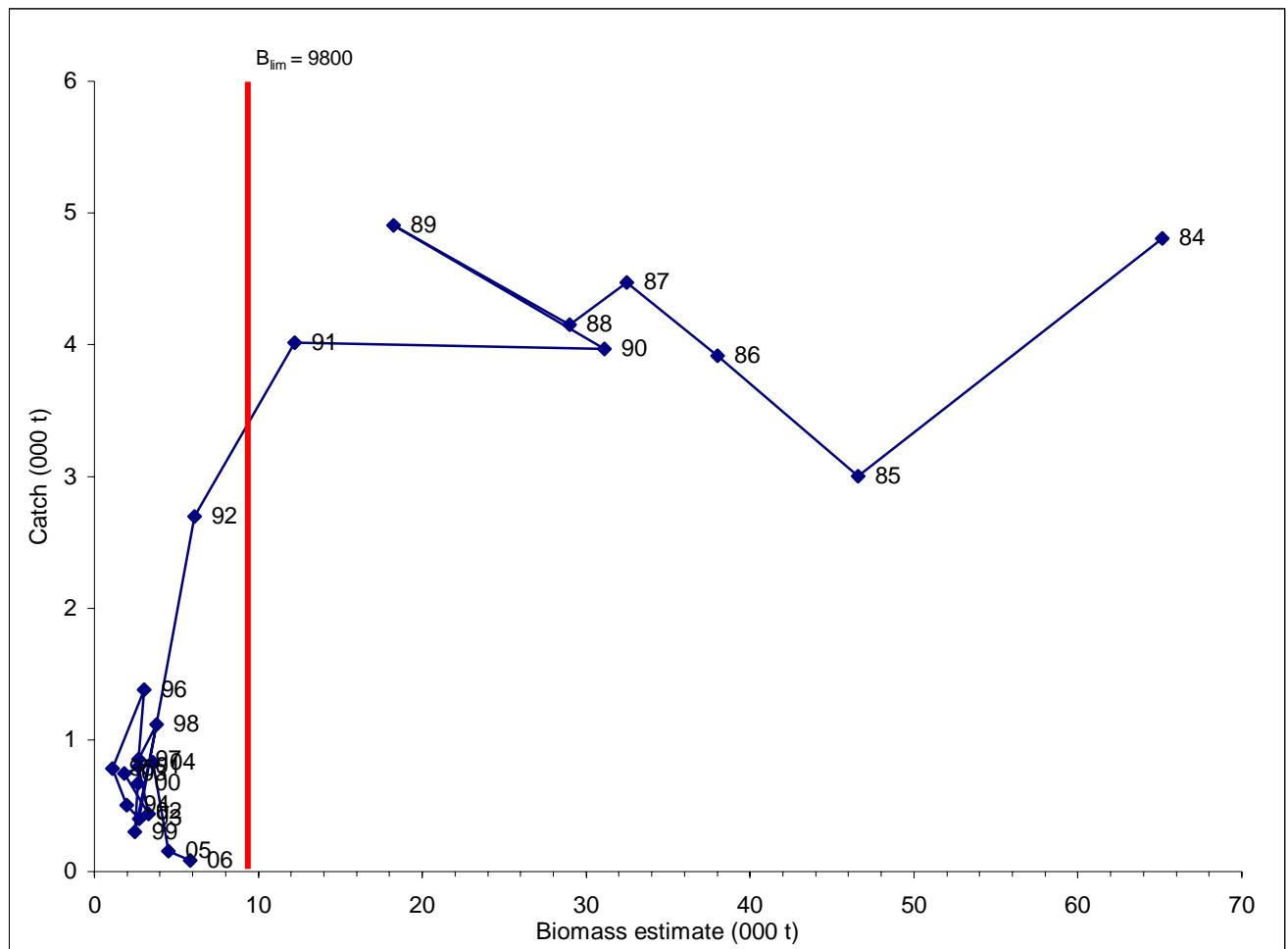


Figure 5. Catch (000 t) and biomass estimates (000 t) for 2J3KL witch flounder 1984-2006. Blim is given at 15% of the highest observed biomass estimate.