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An assessment 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 since 1984. In most years the biomass and abundance indices were estimated to be less than 1,000 tons or 2 million fish. Similarly mean weights and numbers per tow in the spring surveys have been variable since 1984, not exceeding 2 fish or 1 kg per tow. For Div. 3O, estimates of stock size also exhibited considerable annual fluctuations on average between 3,000 and 24,000 tons or 6-44 million fish particularly in the late 1980s. Mean weight and number per tow in Div. 3O showed the same variability ranging from 3-18 fish per tow at 1-10 kg per tow. Large variations in years may be due to large sets (possible aggregations of witch flounder) or the timing of the survey and movements of witch flounder into and out of survey areas. The values in 2006 and 2007 show no large changes in Div. 3N or Div. 3O. The data for Div. 3NO combined suggest in general an overall declining trend in stock size with the estimates for the spring 1998 survey at the lowest level observed since 1984. From 1998-2003, indices increased, with the most recent data points down again slightly.

Indices from Canadian fall surveys for Div. 3N are similar to the spring in that stock size estimates are very low and lack trend. Indices are highly variable for Div. 3O in the fall surveys and also lack any overall trend. Nonetheless, the estimates for each seasonal series are generally within the same numeric range. The data for Div. 3NO combined appear to show a general increasing trend in stock size from 1990-2005, with a decline in recent years.

Fisheries and Management

Species specific catch statistics for flatfish prior to 1973 were largely developed from breakdowns of unspecified flounders and therefore should be quoted with caution. Catches in the 1960s peaked at 11,000-12,000 tons in 1967-68 and remained relatively high during the next several years (Table 1; Fig. 1). From 1971 to 1984 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.

As a result of an increase in fishing effort in the NRA during 1985 and 1986, 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. 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 a moratorium being introduced on fishing this stock (Table 1; Fig. 1). The catch dropped to 300 tons in 1995 likely as a result of a substantial reduction in fishing effort for Greenland halibut where witch flounder comprises a by-catch. Since then catches have increased steadily and by 1999 was about 800 tons although declined again to an estimated 450 tons in 2002 (Table 1; Fig. 1). In 2003 several sources of

catch data were available and a single source could not be considered more valid. As a result, catches were estimated to range between 850 and 2239 tons (Table 1; Fig 1). Catch was estimated to be about 480 t in 2006 and 220 t in 2007.

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). The increase in 1992 and 1993 was essentially the result of a quota transfer to Canada by the Russian Federation. Canada has taken very little catch since then due to the moratorium. Catches by the USSR/Russian vessels declined from between 1,000 and 2,000 tons in the period 1982-88 and has not exceeded 112 t in any year 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 2007.

Research Vessel Surveys

Canadian RV 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. 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 145* 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.

During the course of the 2006 Canadian spring survey, operational difficulties lead to incomplete coverage of the survey in NAFO Divisions 3LNO. This should be noted anywhere that 2006 spring estimates are discussed. The lack of coverage can be noted in Tables 2-3 and 6-7 but values are removed from relevant figures.

Survey Biomass and Abundance Indices

Biomass (Tables 2-5) and abundance (Tables 6-9) estimates by stratum are presented for the spring and fall surveys in NAFO Division 3N and 3O, respectively. Mean numbers (Tables 10-13) and weights (Tables 14-17) per tow are also presented by stratum and division for the spring and fall surveys. 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.

All indices derived from spring surveys (which are the longer time series) in Div. 3N have been at very low levels throughout the period since 1984. Biomass and mean weight per tow has been extremely low from 1989 – 2004, but somewhat higher in the past 3 years. Abundance and mean number per tow is inconsistent but generally on a par with the index at the beginning of the time series. In most years stock size was estimated to be less than 1 000 tons or 2 million fish, and less than 1.5 fish (0.60 kg) per tow were caught in the surveys (Fig. 2; Tables 2, 6, 10 and 14). However, two of the past three years have been higher than average. For Div. 3O, where the majority of the stock resides, estimates of stock size showed considerable annual fluctuations on average between 8,000 and 24,000 tons or 6-44 million fish particularly in the late 1980s (Fig. 2; Tables 3 and 7). Mean weight and number per tow also

varied annually, ranging from about 10 kg (18 fish) per tow in 1985 to a low of less than 1 kg or 3 fish per tow in 1998 (Fig. 2; Tables 11 and 15). From 2005-2007, there has been a decrease in abundance and biomass for Div. 3O.

Indices derived from the fall surveys in Div. 3N are, similar to the spring series, very low and lack trend (Fig. 3; Tables 4, 8, 12, and 16); however, the highest estimate in the time series occurred in 2005. The data trends for Div. 3O in the fall surveys are different than in the spring series (Fig. 3; Tables 5, 9, 13 and 17). 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). Confidence limits depicted in Fig. 3 are wide for this time period as well, arguing against any significant trend in the indices. Nonetheless, the estimates for each seasonal series are generally within the same numeric range.

Overall, the Div. 3NO index combined for the spring shows a decline since 1984 to the mid- to late-1990s and although fluctuations continue to occur, some improvement in the estimates have occurred since 1998, though the past three years have been low (Fig. 4). The fall survey series for Divisions 3NO combined is also quite variable but there is an increasing trend from about 1997 until 2005 and the most recent years have shown a decline.

Catch /Biomass Ratio

Catch divided by the index of spring survey biomass (C/B) gives a proxy for fishing mortality, and the time series of C/B ratios for witch flounder in Div. 3NO is shown in Fig. 5. Biomass estimates are Campelen equivalents for Div. 3NO combined and catches agreed reported data for Div. 3NO combined. Prior to the moratorium in 1995, there were two peaks of high C/B ratios, in the mid-1980s and then in early-1990s. After the moratorium C/B ratios were lower, with small peaks reaching 0.2 in 1998 and in 2003. These peaks likely correspond to low biomass in 1998, and slightly higher catch in 2003.

Depth

Witch flounder have been described as relatively deep water species, having been captured at depths of up to 1500 m. However, in the Newfoundland-Labrador area, they are thought to prefer depths of 184-366 m (Bowering 1991). Because it was previously thought that witch flounder are not adequately covered by the survey depths, it was examined in this paper. When RV biomass is plotted by depth, it can be seen that the preferred depth of Div. 3NO witch flounder differs by division and by time of year (Figure 6). A higher percentage of the biomass in 3N is found in deeper strata, but there is still a large percentage found in depths of less than 100m especially in the fall. In Div. 3O where the main component of the stock is distributed, a large proportion of the biomass is found in depths less than 183 m in either spring or fall. This is in spite of the fact that in a number of years, the survey covered depths of up to 1500 m in the fall. The percent abundance by depth shows similar patterns.

Depths covered by the survey have changed over the years as stated above in Research Vessel Surveys section. Only 1994 was surveyed to 914 m and almost 20% of the population was found in these strata (Figure 6). For the fall, however, from 1990, the survey reaches depths of 1097 m, and 1500 m in 2000-2003 (1 strata per depth range), 2005 and 2007. There are very few fish found in these depth ranges.

These trends can be seen in distribution plots whereby more witch flounder are distributed on the shelf area of the Grand Banks in some years especially in Div. 3O and especially in the fall (Figures 7-9). Therefore, it seems likely that the RV survey coverage does adequately cover the depth distribution of witch flounder, at least for the majority of the year. The variation in the survey indices may be due to the movement of the flounder onto and off of the shelf areas depending on water temperatures and spawning aggregations. Bowering (1996) suggested that the movement of witch flounder onto the shallow parts of the bank in large strata cause the high variability in annual stock size estimates.

Distribution Plots

Geographic distribution of witch flounder from spring and fall surveys (mean weight (kg) per tow) are plotted in Figures 7-9 from 1996-2007. As stated, the witch flounder stock for Div. 3NO is mainly distributed in Div. 3O along the southwestern slope of the Grand Bank. In most years the distribution is concentrated along this slope but in certain years, it is distributed in shallower parts of the bank in larger strata. It is this variation in distribution from

smaller to larger strata that is often responsible for the high variability in the annual biomass estimates (Bowering 1996).

Length frequencies

Length frequencies appear to be fairly consistent since 1995, with few fish > than 50 cm (Figure 10). There have been a few strong peaks (presumably year classes) that could be followed in successive years (eg. peak at 12 cm in 1995 – 20 cm in 1996; peak at 9 cm in 1997-11 cm in 1998 – 20 cm in 1999) but then in 2002, a large peak at 12 cm stopped tracking after that year. There have been no strong peaks representing large year classes since 2002.

Spanish Div. 3NO surveys

Since 1995, Spain has carried out a random stratified spring bottom trawl survey in Div. 3NO of the NAFO Regulatory Area. In 2001, the trawl vessel (C/V *Playa de Menduiña*) and gear (*Pedreira*) were replaced by the R/V *Vizconde de Eza* using a *Campelen* trawl. Biomass estimates are given in Figure 12; data prior to 2000 has not been converted and there are two values for 2001. In the *Pedreira* gear time series, the biomass showed an increasing trend from 1995-2001; in the *Campelen* gear time series, the biomass index has been variable but has decreased slightly in the most recent years (Fig. 12), which is similar to the trends in the Canadian spring RV survey.

Assessment Results

Surplus production model (ASPIC)

In 2006, a non-equilibrium surplus production model incorporating covariates (ASPIC; Prager, 1994, 1995) was applied to catch and survey biomass indices in order to investigate the usefulness of this method in quantitative assessment of this stock. Several model formulations were explored using the biomass index series and mean weight per tow series for both the Canadian spring surveys (1984-2004) and the Canadian autumn surveys from 1990-2004 (Campelen equivalents prior to 1995). None of the model formulations fit the data well. Indicators of poor model suitability included unreasonably high B/Bmsy ratio, poor observed to estimated CPUE relationship, and strong residual patterns. These results suggest that this data should not be modeled using ASPIC. The model was not run on this year's data as it would not be expected to change in a short time period.

Precautionary limit reference points

Some attempts at producing limit reference points, in particular Blim, concluded that for this stock, this is difficult to do because the two survey series that provide biomass estimates cover different time periods, and both series are highly variable, with trends in biomass or abundance that are less clear than for other stocks (e.g. 2J3KL witch). In addition, the autumn survey estimates are often higher than the spring estimates in the same year. As well, the highest observed biomass estimates are in the early part of the time series when the survey covered less of the entire stock area. As a result, B_{lim} may be underestimated using this method. Using this proxy for B_{lim} may not be appropriate. Again, no more progress has been made on this topic.

Resource Status

The spring survey indices indicate that the resource was at its lowest levels in the mid to late 90s, from higher levels in the 80s. The general trend in this longer survey series suggests that the stock showed some slight improvement since then but may be declining again. It is difficult to comment on any recruitment prospects for the resource since there has been no ageing data available for some years. Population abundance at length from true *Campelen 1800* surveys in the fall of 1995-2007 indicated a higher proportion of smaller fish in the 1998-2000 surveys, which may be contributing to the apparent improvement in the stock in recent years. The peak of smaller fish seen in most years was absent from the 2001 and 2003-2005 fall surveys; 2002 showed a significant peak at about 12 cm but this has not been tracked through since. Stock size remains low.

References

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Table 1. Catches and TACs (t) of Witch Flounder in Div. 3NO from 1960-2007.

Year	Canada	USSR (Russia)	Other	Total	TAC
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	4414	5000
1994	2	-	1117	1119	3000
1995	-	-	300	300	0
1996	64	-	294	358	0
1997	19	-	493	512	0
1998	2	5	605	612	0
1999	6	86	671	763	0
2000	12	50	483	545	0
2001	13	34	647	694	0
2002	26	112	312	450	0
2003	62	59	1423*	1544*	0
2004	58	60	509	627	0
2005	49	8	200	257	0
2006	94	2	385	481	0
2007	21	27	174	222	0
2008					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.

*The catch for Other sources in 2003 is the mean of a range of catch information.

Table 2. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	35
	1499	1499	376	0	0	0	19	0	0	0	0	0	0	0	0	0	0	8	18	0	0	0	0	0	0	0	89
57 - 92	2992	2992	360	1715	89	629	461	1519	175	0	0	29	165	0	0	0	115	33	120	266	0	0	19	97	983	264	543
	1853	1853	361	119	0	0	39	50	0	20	0	0	0	0	39	0	0	0	0	242	45	0	0	0	35	139	0
	2520	2520	362	0	82	23	18	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133	0
	2520	2520	373	0	0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	931	931	374	0	0	0	0	0	0	0	0	0	18	34	0	0	0	0	0	0	0	30	0	0	0	0	0
	674	674	383	0	57	0	37	0	0	0	0	0	0	0	0	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	67	149	58	13	0	0	334		52
	100	100	377	8	0	0	72	3	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	647	647	382	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40		0
184 - 274	225	225	358	40	308	42	137	20	29	57	0	44	132	106	7	51	49	134	6	9	154	14	168	0	42		316
	139	139	378	22	19	32	155	31	42	0	0	29	0	0	0	0	3	0	0	0	5	8	1	0	0		0
	182	182	381	21	7	32	101	69	0	28	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0		53
275 - 366	164	164	357	8	87	154		4	60	21	0	31	49	81	20	36	12	159	21	75	17	26	65	42	0		19
	106	106	379	36	12	23	173	44	20	35	3	18	0	4	0	0	9	2	26	4	4	0	4	0	6		0
	116	116	380	6	53	0	134	24	7	4	0	0	0	0	0	0	0	0	6	0	0	0	3	0	0		0
367 - 549	155	155	723								90	102	79	36	51	16	25	53	33	36	23	130	60	34	108		50
	105	105	725								62		40	44	0	5	28	4	20	32	8	3	7	0	103		15
	160	160	727								0	5	38	17	0	0	3	9	13	12	3	0	0	23	41		11
550 - 731	124	124	724								327	181	218	51	36	29	157	53	105	106	127	96	101	54	65		207
	72	72	726								81	25	22	28	3	12	42	96	59	65	84	18	50	21	8		19
	156	156	728								92	19	82	22	152	21		15	32	45	98	43	53	75	42		34
732 - 914	.	134	752											27													
	.	106	756											33													
	.	154	760											26													
Grand Total				2205	761	1078	1401	2218	485	164	655	484	862	510	308	170	443	566	525	1042	632	380	532	346	1807	577	1442
Biomass >366 m				0	0	0	0	0	0	0	652	333	480	284	242	84	255	230	262	296	343	289	272	207	366	0	335
Percent >366 m				0	0	0	0	0	0	0	99.5	68.8	55.7	55.7	78.6	49.2	57.6	40.6	49.9	28.4	54.2	76.0	51.0	59.9	20.3	0.0	23.2

Table 3. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0	0	0	0	22	0	0	0	0	0	0	0	0	0	21	121	111	0	0	0	117	129	569	0
	456	456	331	1912	302	36	18	444	0		0	0	0	0	0	74	0	36	537	28	375	102	0	0	292		1301
	1898	1898	338	134	7806	1108	1184	3075	1827	434	0	109	295	0	228	870	0	357	780	183	1354	121	320	1171	646	1675	1016
	1716	1716	340	40	146	0	21	0	0	15	0	147	0	0	0	0	0	0	0	83	0	0	0	0	26	90	0
	2520	2520	351	688	211	385	222	978	217	109	0	0	0	0	0	0	0	0	21	22	0	0	0	0	0	0	0
	2580	2580	352	82	951	225	1275	1330	664	1426	40	105	60	40	63	59	100	53	1196	130	53	693	27	628	551	1199	733
	1282	1282	353	4519	1122	1067	1609	7208	2486	1637	0	243	209	0	42	23	2	272	2209	1300	469	688	470	572	430	3390	576
93 - 183	1721	1721	329	0	0	0	0	789	48	27	494	0	0	5071	193	0	11	51	240	26	0	0	2209	0	147		559
	1047	1047	332	3779	8589	2485	3367	6829	1485	4599	2426	2182	359	58	1791	1180	235	460	981	407	3025	2458	10236	7945	1075		641
	948	948	337	50	4129	1415	1506	1061	1543	1627	1581	580	675	50	654	330	163	321	879	936	1823	752	715	233	655		333
	585	585	339	335	0	16	223	136	0	0	0	0	0	0	0	1	0	0	1	0	5	2	0	0	189	825	4
	474	474	354	495	105	1231	233	345	47	240	144	149	841	0	0	36	0	226	1062	826	914	553	163	496	640		393
184 - 274	151	147	333	10	48	10	0	67	16	129	498	79	80	5196	162	7	109	25	27	30	122	375	63	36	39		27
	121	121	336	12	7	43	25	63	0	53	492	1374	100	1057	62	180	293	23	47	27	163	598	211	61	51		44
	103	103	355	45	181	38	71	0	97	126	136	16	34	129	43	86	48	50	18	14	87	193	340	117	12		27
275 - 366	92	96	334	0	42	42	18	22	23	26	20	108	20	860	15	150	362	4	7	11	2	143	133	29	3		11
	58	58	335	0	98	18	2	51	22	92	42	1107	65	103	43	78	109	2	62	128	8	8	53	10	11		2
	61	61	356	5	83	17	23	18	29	55	39	129	77	75	62	40	11	29	23	14	34	38	49	13	18		3
367 - 549	93	166	717								11	120	35	2375	53	465	4353	44	19	17	41	201	142	5	17		10
	76	76	719								148	1024	49	14	18	137	601	15	16	25	12	95	39	3	14		15
	76	76	721								76	48	31	72	18	16	19	38	37	28	85	38	26	9	4		10
550 - 731	111	134	718								35	29	104	221	80	71	37	33	38	15	57	55	43	13	13		20
	105	105	720								217	134	182	95	15	21	150	32	21	40	38	7	23	9	69		9
	93	93	722								18	49	150	217	206	89	87	31	71	47	121	62	64	12	27		11
732 - 914	.	105	764											60													
	.	135	772											75													
Grand Total				12108	23820	8136	9799	22438	8503	10594	6415	7734	3364	15769	3748	3915	6691	2121	8411	4448	8786	7182	15323	11479	5057	7747	5746
Biomass >366 m				0	0	0	0	0	0	0	504	1405	550	3128	390	800	5247	192	201	172	354	459	336	51	144	0	75
Percent >366 m				0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	18.2	16.4	19.8	10.4	20.4	78.4	9.1	2.4	3.9	4.0	6.4	2.2	0.4	2.9	0.0	1.3

Table 4. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0	73		0	0	0	0	0	0	0	0	0	35	0	0	0	0	0
	1499	1499	376	0	0	0	0	0	14	0	22	0	0	0	0	38	28	0	0	0	0
57 - 92	2992	2992	360	265	171	1297	173	75	888	23	427	431	177	535	326	520	586	836	2364	100	0
	1853	1853	361	28	467	463	0	32	0	0	14	0	268	28	170	148	99	0	168	38	584
	2520	2520	362	400	221	87	0	0	0	0	0	0	32	0	0	0	136	0	0	40	0
	2520	2520	373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	931	931	374	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	674	674	383	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183	421	421	359	0	0	278	0	0	22	0	0	1213	1	0	121	42	110	139	43	151	192
	100	100	377	0		0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
	647	647	382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
184 - 274	225	225	358	0	20	66	24	0	74	0	11	30	19	40	45	0	145	22	107	144	28
	139	139	378	0	41	15	0	0	0	0	1	0	0	0	3	5	0	0	0	93	4
	182	182	381		0		0	0	0	0	1	0	0	0	7	0	0	0	0	0	0
275 - 366	164	164	357	0	234	9	187	43	85	0	27	0		52	18	21	41	27	37	103	59
	106	106	379	4		4	0	0	0	1	7	0	0	2	111	33	8	867	0	3	0
	116	116	380		0		0	0	0	0	0	1	2	5	0	0	0	9	11	0	0
367 - 549	155	155	723		41		163	180	57	15	28	74	27	28	66	16	123	20	98	38	17
	105	105	725			15	376	46	19	0	135	10	33	19	7	5	10		7	7	11
	160	160	727				0	38	0	0	29	7	4	0	10	0	0	7	21	0	0
550 - 731	124	124	724		172		414	180	104	60	197	72	181	87	70	90		70	95	206	127
	72	72	726				310	54	48	40	21	38	34	16	22	59	52	32	19	49	45
	156	156	728					153	35	21	76	78	106	153	103	286	178	93	19	122	191
732 - 914	.	134	752									120		23	0	1					6
	.	106	756									124		51	83	9			82		67
	.	154	760									88		41	78	173			18		110
915 -1097	.	138	753									0		0	0	3					0
	.	102	757									0		0	37	7			0		0
	.	171	761									46		147	42	10			118		7
1098 -1280	.	180	754									0		0	0	0					0
	.	99	758									0		0	0	0			0		0
	.	212	762											0	109	0			15		28
1281 -1463	.	385	755									0		0	0	0					0
	.	127	759									0		0	2	0			0		0
	.	261	763											19	5	10			0		0
Grand Total				696	1441	2235	1647	808	1346	160	993	2333	884	1244	1435	1511	1516	2122	3221	1093	1475
Biomass >366 m				0	213	15	1263	651	263	137	485	657	385	582	634	669	363	222	491	423	609
Percent >366 m				0.0	14.8	0.7	76.7	80.5	19.5	85.6	48.8	28.2	43.5	46.8	44.2	44.3	23.9	10.5	15.2	38.7	41.3

Table 5. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	122	67	79	0	0	247	0	72	168	208	48	284	342	438	74	312	383	362
	456	456	331	22	315	134	0	0	108	0	0	256	946	243	468	775	306	14	394	108	144
	1898	1898	338	2226	438	837	3966	2193	4684	503	1329	483	2736	375	943	976	2666	3899	1931	604	543
	1716	1716	340	173	280	63	0	0	204	0	22	0	415	104	172	123	57	28	116	654	1
	2520	2520	351	1690	284	72	0	0	0	0	0	37	205	0	172	0	25	35	54	369	158
	2580	2580	352	1415	896	1352	946	228	379	273	573	374	1491	920	430	789	964	3377	1663	1109	558
	1282	1282	353	2405	343	477	0	732	538	789	168	1066	2996	2379	1360	1490	1204	2657	3710	1587	1121
93 - 183	1721	1721	329	99	85	0	18	0	417	0	173	305	0	0	282	732	97	484	250	2974	0
	1047	1047	332	2102	155	1724	813	321	1114	4569	190	245	1664	544	343	1155	807	1512	2061	3887	708
	948	948	337	1333	188	954	563	2132	421	492	322	479	978	344	67	211	352	114	1721	190	576
	585	585	339	1132	224	651	119	742	1911	0	481	261		344	338	1927	457	3755	1854	1070	1060
	474	474	354	1291	23	316	75	210	191	4647	215	201	103	766	258	470	967	438	316	505	694
184 - 274	151	147	333	221	11	22	30	92	26		4	6	33	4	20	17	48	0	3	24	3
	121	121	336	82	151	76	298	13	35	32	19	19	67	31	37	23	10	5	35	3	53
	103	103	355		497	93	120	25	16	343	6	14	110	35	5	6	6	21	2	5	17
275 - 366	92	96	334	24	16	0	9	17	4		5	1	7	5	14	9	8	0	16	0	0
	58	58	335	194	25	25	30	18	1	23	0	1	23	8	3	9	1	5	3	3	1
	61	61	356		11	7	430	98	7	60	3	4	32	22	7	3	6	2	7	0	0
367 - 549	93	166	717	30			0	32	37		12	42	260	0	13	11	54	9	2	14	9
	76	76	719	110	2		65	6	1	226	19	9	10	14	29	6	15	3	6	10	4
	76	76	721		18		169	67	21	54	6	14	67	17	2	14	17	2	15	3	30
550 - 731	111	134	718				22	68	8		68	47	53	34	50	54	161	48	130		68
	105	105	720				73	0	13	68		2	17	4	83	26	31	10	39	1	1
	93	93	722		9		81	21	14	39	12	12	26	8	15	5	7	14	29	8	9
732 - 914	.	105	764									75		12	21	36			4		11
	.	99	768									18		7	18	38			4		1
	.	135	772									173		62		49	29		50		22
915 -1097	.	124	765									24		3	20	55			10		11
	.	138	769									17		5	28	59			20		16
	.	128	773									4		13	32	89	12		8		10
1098 -1280	.	144	766											24	2	37			57		24
	.	128	770											4	23	67			13		16
	.	135	774											4	31	15	27		43		4
1281 -1463	.	158	767											15	0	0			0		3
	.	175	771											0	17	0			10		0
	.	155	775											0	0	0	28		21		3
Grand Total				14671	4036	6884	7827	7013	10397	12117	3698	4356	12446	6396	5586	9619	8798	16510	14911	13512	6240
Biomass >366 m				140	29	0	410	193	95	386	116	436	433	224	384	562	381	87	460	35	241
Percent >366 m				1.0	0.7	0.0	5.2	2.8	0.9	3.2	3.1	10.0	3.5	3.5	6.9	5.8	4.3	0.5	3.1	0.3	3.9

Table 6. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	44
	1499	1499	376	0	0	0	26	0	0	0	0	0	0	0	0	0	0	34	34	0	0	0	0	0	0	0	88
57 - 92	2992	2992	360	2234	129	728	741	2641	220	0	0	59	224	0	0	0	132	65	224	613	0	0	82	123	1555	480	741
	1853	1853	361	153	0	0	32	36	0	28	0	0	0	0	36	0	0	0	0	212	85	0	0	0	36	255	0
	2520	2520	362	0	95	25	27	173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173	0
	2520	2520	373	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	931	931	374	0	0	0	0	0	0	0	0	0	43	43	0	0	0	0	0	0	0	85	0	0	0	0	0
	674	674	383	0	62	0	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
93 - 183	421	421	359	405	58	232	58	985	203	0	0	0	29	0	0	0	0	0	203	405	58	29	0	0	695		87
	100	100	377	14	0	0	186	7	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
	647	647	382	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89		0
184 - 274	225	225	358	77	557	93	279	31	46	93	0	93	294	232	31	77	83	261	15	41	325	28	296	0	110		681
	139	139	378	48	29	48	354	86	115	0	0	96	0	0	0	0	8	0	0	0	8	33	8	0	17		0
	182	182	381	25	13	42	163	75	0	25	0	0	0	0	0	0	0	13	0	0	11	0	0	0	0		81
275 - 366	164	164	357	23	180	553		11	237	56	0	90	124	102	23	40	30	373	259	293	63	55	150	45	0		23
	106	106	379	66	36	68	423	102	44	109	7	44	0	22	0	0	18	6	102	28	13	0	16	0	40		0
	116	116	380	8	88	0	247	32	8	8	0	0	0	0	0	0	0	0	8	0	0	0	8	0	0		0
367 - 549	155	155	723								288	341	256	53	181	45	51	149	96	171	88	322	152	96	313		107
	105	105	725								166		101	87	0	13	235	26	51	72	19	6	17	0	264		40
	160	160	727								0	11	55	22	0	0	11	33	33	21	10	0	0	31	68		31
550 - 731	124	124	724								1134	580	597	188	119	128	432	144	550	500	516	267	283	145	171		645
	72	72	726								213	59	30	114	5	33	183	322	213	198	346	65	134	63	18		59
	156	156	728								182	21	139	29	172	134		64	158	145	258	136	143	161	64		70
732 - 914	.	134	752											37													
	.	106	756											87													
	.	154	760											95													
Grand Total				3053	1246	1837	2595	4180	954	320	1991	1394	1892	1110	567	470	1184	1491	1947	2701	1799	1027	1289	664	3440	981	2696
Biomass >366 m				0	0	0	0	0	0	0	1984	1013	1178	712	477	353	913	738	1100	1107	1236	797	728	496	898	0	952
Percent >366 m				0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.6	72.7	62.3	64.1	84.1	75.0	77.1	49.5	56.5	41.0	68.7	77.6	56.5	74.6	26.1	0	35.3

Table 7. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0	0	0	0	32	0	0	0	0	0	0	0	0	73	36	210	242	0	0	0	146	205	1490	0
	456	456	331	3555	376	94	31	1004	0		0	0	0	0	0	63	0	94	1104	63	721	94	0	0	784	0	2885
	1898	1898	338	209	11894	1509	1944	5418	2480	587	0	131	479	0	305	1417	0	671	1973	348	2263	305	609	2990	2089	5106	1697
	1716	1716	340	59	210	0	26	0	0	52	0	142	0	0	0	0	0	0	0	142	0	0	0	0	47	118	236
	2520	2520	351	924	231	495	267	1317	240	116	0	0	0	0	0	0	0	0	39	43	0	0	0	0	0	0	0
	2580	2580	352	101	1807	431	2048	1839	928	1775	51	89	51	44	71	79	197	35	1814	197	44	1952	44	1183	1065	2484	1198
	1282	1282	353	9347	1234	1713	2146	13050	3880	2910	0	265	353	0	35	35	265	459	5055	2539	901	831	1102	957	872	7616	794
93 - 183	1721	1721	329	0	0	0	0	1454	53	34	763	0	0	12263	521	0	35	68	623	47	0	0	5303	0	742		1292
	1047	1047	332	11018	16592	6529	7230	16023	2852	10572	4513	5761	504	432	3925	2927	5665	1085	5045	2232	8354	6769	32886	24519	5041		2496
	948	948	337	130	9181	2634	3543	2641	2556	2608	3182	815	2087	87	1239	826	469	848	3709	3260	6738	1826	1565	764	2454		1565
	585	585	339	443	0	80	268	134	0	0	0	0	0	0	0	161	36	80	36	80	282	241	0	0	443	1753	851
	474	474	354	1174	239	3282	456	619	196	359	261	261	1663	0	0	98	33	563	3208	2739	2100	1467	359	913	1960		1239
184 - 274	151	147	333	21	156	35	0	145	52	332	1361	187	301	13447	425	30	277	140	267	261	576	940	215	225	273		174
	121	121	336	25	17	175	67	208	0	158	1365	3287	266	3029	125	432	682	150	173	219	583	1273	524	258	368		233
	103	103	355	92	418	128	135	0	383	510	340	28	99	340	99	168	195	157	38	41	220	569	945	246	57		106
275 - 366	92	96	334	0	95	165	63	95	44	51	38	272	63	2238	40	462	880	7	161	167	30	376	533	238	20		69
	58	58	335	0	203	40	8	148	68	331	109	2340	223	215	108	192	243	12	169	368	60	47	131	35	78		22
	61	61	356	17	214	38	55	109	80	126	92	348	319	189	126	88	40	90	54	50	67	78	131	25	82		16
367 - 549	93	166	717								32	371	166	5960	228	1362	11566	710	237	162	273	651	468	46	181		91
	76	76	719								288	2535	267	37	42	364	1161	150	112	228	97	268	89	19	131		81
	76	76	721								235	209	94	193	42	42	63	214	152	112	204	139	84	31	19		60
550 - 731	111	134	718								282	122	512	1161	535	518	507	517	324	138	525	1189	578	66	177		240
	105	105	720								361	376	1026	498	43	101	518	186	104	351	309	50	104	41	765		62
	93	93	722								45	166	512	518	601	274	819	177	364	207	361	198	210	53	154		176
732 - 914	.	105	764											217													
	.	135	772											501													
Grand Total				27114	42867	17347	18286	44236	13811	20520	13317	17705	8983	41372	8508	9639	23724	6449	24969	14238	24707	19265	45880	32754	18004	18567	15584
Biomass >366 m				0	0	0	0	0	0	0	1243	3779	2576	9086	1491	2661	14634	1954	1293	1198	1769	2495	1533	255	1425	0	711
Percent >366 m				0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	21.3	28.7	22.0	17.5	27.6	61.7	30.3	5.2	8.4	7.2	13.0	3.3	0.8	7.9	0	4.6

Table 8. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0	55		0	0	0	0	0	0	0	0	0	55	0	0	0	0	0
	1499	1499	376	0	0	0	0	0	23	0	19	0	0	0	0	59	59	0	0	0	0
57 - 92	2992	2992	360	382	206	1646	320	103	1232	41	672	755	360	926	514	1080	1022	1132	4888	154	0
	1853	1853	361	32	425	701	0	42	0	0	23	0	306	51	204	255	102	0	211	51	1020
	2520	2520	362	441	277	116	0	0	0	0	0	0	50	0	0	0	198	0	0	50	0
	2520	2520	373	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	931	931	374	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	674	674	383	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93 - 183	421	421	359	0	0	608	0	0	87	0	0	2722	29	0	405	116	232	203	87	145	524
	100	100	377	0		0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
	647	647	382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
184 - 274	225	225	358	0	46	108	31	0	234	0	31	93	46	69	136	0	307	31	251	252	31
	139	139	378	0	105	19	0	0	0	0	8	10	0	0	8	10	0	0	0	200	9
	182	182	381		0		0	0	0	0	7	13	0	0	11	0	0	0	0	0	0
275 - 366	164	164	357	0	384	23	338	135	180	0	60	0		124	33	20	102	34	98	242	116
	106	106	379	7		15	0	0	0	19	22	0	0	6	296	91	26	1915	13	6	15
	116	116	380		0		0	0	0	0	0	8	8	24	0	0	0	16	24	0	0
367 - 549	155	155	723		53		330	394	117	21	88	313	85	104	190	57	347	43	299	72	38
	105	105	725			36	701	173	49	0	237	29	101	71	22	14	29		21	15	32
	160	160	727				0	44	11	0	55	11	11	0	13	0	11	11	59	0	0
550 - 731	124	124	724		443		1126	512	223	178	571	326	640	337	264	270		177	247	629	384
	72	72	726				669	114	119	99	40	92	125	40	37	176	129	84	42	106	125
	156	156	728					268	195	129	212	215	311	417	223	633	351	161	73	204	343
732 - 914	.	134	752									165		28	0	74					9
	.	106	756									255		149	182	22			175		185
	.	154	760									244		229	409	530			53		339
915 -1097	.	138	753									0		9	0	33					0
	.	102	757									0		0	96	92			7		0
	.	171	761									106		578	202	24			412		24
1098 -128	.	180	754									0		0	0	12					0
	.	99	758									0		0	0	8			0		0
	.	212	762											0	483	0			58		97
1281 -146	.	385	755									0		0	0	0					0
	.	127	759									0		0	9	0			0		0
	.	261	763											72	18	88			0		0
Grand Total				863	1995	3272	3515	1793	2470	488	2046	5355	2073	3233	3756	3717	2912	3806	7017	2126	3289
Biomass >366 m				0	497	36	2825	1506	714	427	1203	1755	1274	2033	2148	2032	866	475	1446	1026	1575
Percent >366 m				0.0	24.9	1.1	80.4	84.0	28.9	87.6	58.8	32.8	61.5	62.9	57.2	54.7	29.7	12.5	20.6	48.3	47.9

Table 9. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	131	144	72	0	0	517	0	96	335	383	192	575	588	766	123	479	718	671
	456	456	331	42	502	125	0	0	408	0	0	596	4799	533	1066	1850	1004	31	1098	345	439
	1898	1898	338	3264	627	1436	6893	4700	8459	522	2872	1723	7572	609	1984	2245	6893	11652	4774	1567	1044
	1716	1716	340	262	330	118	0	0	295	0	47	0	1652	189	378	189	94	47	243	1416	47
	2520	2520	351	1837	347	58	0	0	0	0	0	50	347	0	198	0	50	50	99	495	297
	2580	2580	352	1597	1242	2011	1115	355	371	355	1141	754	1825	1668	1065	1448	2296	6584	2484	1787	811
	1282	1282	353	2822	485	941	0	1176	999	882	573	5467	5996	6172	2954	9523	3395	5291	6525	3357	1950
93 - 183	1721	1721	329	132	101	0	47	0	663	0	616	852	0	0	805	1989	379	703	710	8181	0
	1047	1047	332	3625	396	5281	2064	960	5233	11954	1248	2544	7393	3249	1392	4342	3738	6145	8381	13093	2939
	948	948	337	2347	424	2347	1043	5216	1434	717	1130	1613	3738	1623	348	714	1434	397	5067	696	1956
	585	585	339	1556	241	724	121	966	2776	0	1086	356		3943	563	3822	684	7559	4507	2374	4064
	474	474	354	1891	33	685	359	424	489	8955	489	782	391	2478	630	1415	1989	1150	978	1206	2195
184 - 274	151	147	333	582	52	83	62	312	187		192	147	152	27	118	90	243	30	51	153	81
	121	121	336	222	466	216	633	42	549	208	100	215	300	141	150	58	75	50	300	150	422
	103	103	355		1459	298	425	85	63	768	28	170	411	85	21	28	21	92	35	27	50
275 - 366	92	96	334	76	70	0	21	57	56		33	20	58	18	36	35	53	65	122	0	7
	58	58	335	371	100	112	68	52	64	64	4	40	48	37	8	39	12	18	7	24	18
	61	61	356		25	8	1254	252	40	113	13	34	75	55	19	17	34	31	45	0	7
367 - 549	93	166	717	122			0	96	703		46	833	2166	0	91	203	351	117	10	93	41
	76	76	719	209	42		277	10	52	612	183	178	99	75	183	37	96	96	78	95	14
	76	76	721		47		444	183	102	131	17	125	311	98	10	84	81	11	135	9	273
550 - 731	111	134	718				107	428	164		535	618	581	396	488	1432	1483	575	1040		479
	105	105	720				339	0	105	316		29	202	39	762	298	302	206	336	6	6
	93	93	722		26		243	58	64	134	51	103	122	70	94	34	50	90	199	51	61
732 - 914	.	105	764									357		72	144	217			29		72
	.	99	768									217		24	163	374			34		6
	.	135	772									1514		669		383	190		390		111
915 -1097	.	124	765									165		31	119	289			77		64
	.	138	769									180		38	237	380			142		133
	.	128	773									35		136	346	708	94		62		79
1098 -128	.	144	766											113	11	146			307		158
	.	128	770											36	185	460			88		132
	.	135	774											28	241	119	244		297		35
1281 -146	.	158	767											65	0	0			0		10
	.	175	771											0	132	0			60		0
	.	155	775											0	0	0	213		107		28
Grand Total				21086	7158	14515	15517	15369	23795	25731	10499	20054	38620	22908	15520	33557	26262	41114	39294	35843	18702
Biomass >366 m				331	114	0	1411	774	1191	1193	831	4354	3480	1890	3210	5163	3103	1095	3390	254	1704
Percent >366 m				1.6	1.6	0.0	9.1	5.0	5.0	4.6	7.9	21.7	9.0	8.3	20.7	15.4	11.8	2.7	8.6	0.7	9.1

Table 10. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	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	0.33	0.20
	1499	1499	376	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
57 - 92	2992	2992	360	5.43	0.31	1.77	1.80	6.42	0.53	0.00	0.00	0.14	0.55	0.00	0.00	0.00	0.32	0.16	0.55	1.49	0.00	0.00	0.20	0.30	3.78	1.17	1.80
	1853	1853	361	0.60	0.00	0.00	0.13	0.14	0.00	0.11	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.83	0.33	0.00	0.00	0.00	0.14	1.00	0.00
	2520	2520	362	0.00	0.27	0.07	0.08	0.50	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	0.50	0.00
	2520	2520	373	0.00	0.00	0.14	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
	931	931	374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00
	674	674	383	0.00	0.67	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	0.00	0.00	0.00		0.00
93 - 183	421	421	359	7.00	1.00	4.00	1.00	17.00	3.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	3.50	7.00	1.00	0.50	0.00	0.00	12.00		1.50
	100	100	377	1.00	0.00	0.00	13.50	0.50	6.00	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
	647	647	382	0.00	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	0.00	0.00	1.00		0.00
184 - 274	225	225	358	2.50	18.00	3.00	9.00	1.00	1.50	3.00	0.00	3.00	9.50	7.50	1.00	2.50	2.67	8.44	0.50	1.33	10.50	0.89	9.57	0.00	3.56		22.00
	139	139	378	2.50	1.50	2.50	18.50	4.50	6.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.44	1.71	0.44	0.00	0.89		0.00
	182	182	381	1.00	0.50	1.67	6.50	3.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.44	0.00	0.00	0.00	0.00		3.22
275 - 366	164	164	357	1.00	8.00	24.50		0.50	10.50	2.50	0.00	4.00	5.50	4.50	1.00	1.78	1.33	16.56	11.50	13.00	2.78	2.44	6.67	2.00	0.00		1.00
	106	106	379	4.50	2.50	4.67	29.00	7.00	3.00	7.50	0.50	3.00	0.00	1.50	0.00	0.00	1.24	0.44	7.00	1.94	0.89	0.00	1.07	0.00	2.73		0.00
	116	116	380	0.50	5.50	0.00	15.50	2.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00		0.00
367 - 549	155	155	723								13.50	16.00	12.00	2.50	8.50	2.13	2.40	7.00	4.50	8.00	4.11	15.11	7.11	4.50	14.67		5.00
	105	105	725								11.50		7.00	6.00	0.00	0.89	16.30	1.78	3.50	5.00	1.33	0.44	1.14	0.00	18.28		2.78
	160	160	727								0.00	0.50	2.50	1.00	0.00	0.00	0.50	1.50	1.50	0.94	0.44	0.00	0.00	1.40	3.11		1.39
550 - 731	124	124	724								66.50	34.00	35.00	11.00	7.00	7.50	25.35	8.44	32.22	29.33	30.22	15.67	16.61	8.50	10.00		37.83
	72	72	726								21.50	6.00	3.00	11.50	0.50	3.33	18.49	32.50	21.50	20.00	34.94	6.58	13.50	6.35	1.78		6.00
	156	156	728								8.50	1.00	6.50	1.33	8.00	6.22		3.00	7.37	6.76	12.00	6.33	6.67	7.50	3.00		3.28
732 - 914	.	134	752											2.00													
	.	106	756											6.00													
	.	154	760											4.50													
Grand Total				1.33	0.54	0.80	1.14	1.82	0.42	0.14	0.83	0.58	0.79	0.45	0.24	0.20	0.50	0.62	0.81	1.12	0.75	0.43	0.54	0.28	1.43	0.63	1.12

Table 11. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	0.73	0.84	0.00	0.00	0.00	0.51	0.71	5.19	0.00
	456	456	331	56.67	6.00	1.50	0.50	16.00	0.00		0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	17.60	1.00	11.50	1.50	0.00	0.00	12.50		46.00
	1898	1898	338	0.80	45.56	5.78	7.44	20.75	9.50	2.25	0.00	0.50	1.83	0.00	1.17	5.43	0.00	2.57	7.56	1.33	8.67	1.17	2.33	11.45	8.00	19.56	6.50
	1716	1716	340	0.25	0.89	0.00	0.11	0.00	0.00	0.22	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.20	0.50	1.00
	2520	2520	351	2.67	0.67	1.43	0.77	3.80	0.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2580	2580	352	0.29	5.09	1.21	5.77	5.18	2.62	5.00	0.14	0.25	0.14	0.13	0.20	0.22	0.56	0.10	5.11	0.56	0.13	5.50	0.13	3.33	3.00	7.00	3.38
	1282	1282	353	53.00	7.00	9.71	12.17	74.00	22.00	16.50	0.00	1.50	2.00	0.00	0.20	0.20	1.50	2.60	28.66	14.40	5.11	4.71	6.25	5.43	4.94	43.19	4.50
93 - 183	1721	1721	329	0.00	0.00	0.00	0.00	6.14	0.22	0.14	3.22	0.00	0.00	51.80	2.20	0.00	0.15	0.29	2.63	0.20	0.00	0.00	22.40	0.00	3.13		5.46
	1047	1047	332	76.50	115.20	45.33	50.20	111.25	19.80	73.40	31.33	40.00	3.50	3.00	27.25	20.32	39.33	7.54	35.03	15.50	58.00	47.00	228.33	170.24	35.00		17.33
	948	948	337	1.00	70.40	20.20	27.17	20.25	19.60	20.00	24.40	6.25	16.00	0.67	9.50	6.33	3.59	6.50	28.44	25.00	51.67	14.00	12.00	5.86	18.82		12.00
	585	585	339	5.50	0.00	1.00	3.33	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.44	1.00	0.44	1.00	3.50	3.00	0.00	0.00	5.50	21.78	10.57
	474	474	354	18.00	3.67	50.33	7.00	9.50	3.00	5.50	4.00	4.00	25.50	0.00	0.00	1.50	0.50	8.64	49.20	42.00	32.21	22.50	5.50	14.00	30.06		19.00
184 - 274	151	147	333	1.00	7.50	1.67	0.00	7.00	2.50	16.00	65.50	9.00	14.50	665.00	21.00	1.50	13.72	6.93	13.20	12.93	28.50	46.50	10.61	11.14	13.50		8.61
	121	121	336	1.50	1.00	10.50	4.00	12.50	0.00	9.50	82.00	197.50	16.00	182.00	7.50	25.93	41.00	9.00	10.40	13.14	35.00	76.50	31.50	15.50	22.11		14.00
	103	103	355	6.50	29.50	9.00	9.50	0.00	27.00	36.00	24.00	2.00	7.00	24.00	7.00	11.83	13.78	11.11	2.67	2.89	15.50	40.13	66.67	17.36	4.00		7.50
275 - 366	92	96	334	0.00	7.50	13.00	5.00	7.50	3.50	4.00	3.00	21.50	5.00	169.50	3.00	35.00	66.67	0.50	12.18	12.67	2.28	28.50	40.39	18.00	1.50		5.22
	58	58	335	0.00	25.50	5.00	1.00	18.50	8.50	41.50	13.67	293.33	28.00	27.00	13.50	24.06	30.40	1.50	21.22	46.14	7.50	5.94	16.44	4.36	9.78		2.78
	61	61	356	2.00	25.50	4.50	6.50	13.00	9.50	15.00	11.00	41.50	38.00	22.50	15.00	10.50	4.80	10.67	6.44	6.00	7.94	9.33	15.56	3.00	9.78		1.94
367 - 549	93	166	717								2.50	29.00	13.00	261.00	10.00	59.67	506.49	31.11	10.40	7.11	11.94	28.50	20.50	2.00	7.93		4.00
	76	76	719								27.50	242.50	25.50	3.50	4.00	34.84	111.07	14.33	10.67	21.80	9.27	25.67	8.50	1.80	12.50		7.78
	76	76	721								22.50	20.00	9.00	18.50	4.00	4.00	6.04	20.50	14.55	10.67	19.56	13.33	8.00	3.00	1.78		5.71
550 - 731	111	134	718								18.50	8.00	33.50	63.00	29.00	28.09	27.52	28.02	17.56	7.50	28.50	64.50	31.33	3.56	9.59		13.00
	105	105	720								25.00	26.00	71.00	34.50	3.00	6.98	35.83	12.84	7.20	24.28	21.39	3.43	7.22	2.83	52.94		4.31
	93	93	722								3.50	13.00	40.00	40.50	47.00	21.44	64.06	13.83	28.44	16.21	28.22	15.49	16.44	4.14	12.00		13.78
732 - 914	.	105	764											15.00													
	.	135	772											27.00													
Grand Total				11.01	17.41	7.04	7.43	17.96	5.61	8.55	5.25	6.97	3.54	16.00	3.33	3.78	9.30	2.53	9.78	5.58	9.68	7.55	17.98	12.83	7.05	10.65	6.11

Table 12. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0.00	0.25		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00
	1499	1499	376	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.09	0.00	0.00	0.00	0.00	0.29	0.29	0.00	0.00	0.00	0.00
57 - 92	2992	2992	360	0.93	0.50	4.00	0.78	0.25	2.99	0.10	1.63	1.83	0.88	2.25	1.25	2.63	2.48	2.75	11.88	0.38	0.00
	1853	1853	361	0.13	1.67	2.75	0.00	0.17	0.00	0.00	0.09	0.00	1.20	0.20	0.80	1.00	0.40	0.00	0.83	0.20	4.00
	2520	2520	362	1.27	0.80	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.57	0.00	0.00	0.14	0.00
	2520	2520	373	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
	931	931	374	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
	674	674	383	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
93 - 183	421	421	359	0.00	0.00	10.50	0.00	0.00	1.50	0.00	0.00	47.00	0.50	0.00	7.00	2.00	4.00	3.50	1.50	2.50	9.06
	100	100	377	0.00		0.00	0.00	0.50	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
	647	647	382	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
184 - 274	225	225	358	0.00	1.50	3.50	1.00	0.00	7.56	0.00	1.00	3.00	1.50	2.22	4.39	0.00	9.91	1.00	8.11	8.14	1.00
	139	139	378	0.00	5.50	1.00	0.00	0.00	0.00	0.00	0.44	0.50	0.00	0.00	0.44	0.50	0.00	0.00	0.00	10.44	0.44
	182	182	381		0.00		0.00	0.00	0.00	0.00	0.30	0.50	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00
275 - 366	164	164	357	0.00	17.00	1.00	15.00	6.00	8.00	0.00	2.67	0.00		5.50	1.44	0.89	4.50	1.50	4.33	10.72	5.14
	106	106	379	0.50		1.00	0.00	0.00	0.00	1.33	1.50	0.00	0.00	0.44	20.33	6.21	1.78	131.36	0.89	0.44	1.00
	116	116	380		0.00		0.00	0.00	0.00	0.00	0.00	0.50	0.50	1.50	0.00	0.00	0.00	1.00	1.50	0.00	0.00
367 - 549	155	155	723		2.50		15.50	18.50	5.50	1.00	4.12	14.67	4.00	4.89	8.93	2.67	16.28	2.00	14.00	3.38	1.78
	105	105	725			2.50	48.50	12.00	3.40	0.00	16.40	2.00	7.00	4.89	1.50	1.00	2.00		1.44	1.02	2.22
	160	160	727				0.00	2.00	0.50	0.00	2.50	0.50	0.50	0.00	0.57	0.00	0.50	0.50	2.67	0.00	0.00
550 - 731	124	124	724		26.00		66.00	30.00	13.07	10.44	33.50	19.11	37.50	19.73	15.50	15.82		10.35	14.49	36.89	22.50
	72	72	726				67.50	11.50	12.00	10.00	4.00	9.33	12.67	4.00	3.71	17.78	13.00	8.50	4.28	10.73	12.57
	156	156	728					12.50	9.07	6.00	9.90	10.00	14.50	19.43	10.40	29.50	16.33	7.50	3.42	9.50	16.00
732 - 914	.	134	752									8.94		1.50	0.00	4.00					0.50
	.	106	756									17.50		10.21	12.50	1.50			12.00		12.67
	.	154	760									11.50		10.79	19.29	25.00			2.50		16.00
915 -1097	.	138	753									0.00		0.50	0.00	1.71					0.00
	.	102	757									0.00		0.00	6.86	6.57			0.50		0.00
	.	171	761									4.50		24.57	8.57	1.00			17.50		1.00
1098 -128	.	180	754									0.00		0.00	0.00	0.50					0.00
	.	99	758									0.00		0.00	0.00	0.57			0.00		0.00
	.	212	762											0.00	16.57	0.00			2.00		3.33
1281 -146	.	385	755									0.00		0.00	0.00	0.00					0.00
	.	127	759									0.00		0.00	0.50	0.00			0.00		0.00
	.	261	763											2.00	0.50	2.44			0.00		0.00
Grand Total				0.38	0.87	1.79	1.48	0.75	1.03	0.20	0.85	2.04	0.87	1.20	1.40	1.38	1.22	1.59	2.73	0.89	1.22

Table 13. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2005. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0.46	0.50	0.25	0.00	0.00	1.80	0.00	0.33	1.17	1.33	0.67	2.00	2.05	2.67	0.43	1.67	2.50	2.33
	456	456	331	0.67	8.00	2.00	0.00	0.00	6.50	0.00	0.00	9.50	76.50	8.50	17.00	29.50	16.00	0.50	17.50	5.50	7.00
	1898	1898	338	12.50	2.40	5.50	26.40	18.00	32.40	2.00	11.00	6.60	29.00	2.33	7.60	8.60	26.40	44.63	18.29	6.00	4.00
	1716	1716	340	1.11	1.40	0.50	0.00	0.00	1.25	0.00	0.20	0.00	7.00	0.80	1.60	0.80	0.40	0.20	1.03	6.00	0.20
	2520	2520	351	5.30	1.00	0.17	0.00	0.00	0.00	0.00	0.00	0.14	1.00	0.00	0.57	0.00	0.14	0.14	0.29	1.43	0.86
	2580	2580	352	4.50	3.50	5.67	3.14	1.00	1.05	1.00	3.21	2.13	5.14	4.70	3.00	4.08	6.47	18.55	7.00	5.04	2.29
	1282	1282	353	16.00	2.75	5.33	0.00	6.67	5.67	5.00	3.25	31.00	34.00	35.00	16.75	54.00	19.25	30.00	37.00	19.04	11.06
93 - 183	1721	1721	329	0.56	0.43	0.00	0.20	0.00	2.80	0.00	2.60	3.60	0.00	0.00	3.40	8.40	1.60	2.97	3.00	34.56	0.00
	1047	1047	332	25.17	2.75	36.67	14.33	6.67	36.33	83.00	8.67	17.67	51.33	22.56	9.67	30.15	25.95	42.67	58.19	90.91	20.41
	948	948	337	18.00	3.25	18.00	8.00	40.00	11.00	5.50	8.67	12.37	28.67	12.44	2.67	5.48	11.00	3.05	38.86	5.33	15.00
	585	585	339	19.33	3.00	9.00	1.50	12.00	34.50	0.00	13.50	4.43		49.00	7.00	47.50	8.50	93.93	56.00	29.50	50.50
	474	474	354	29.00	0.50	10.50	5.50	6.50	7.50	137.33	7.50	12.00	6.00	38.00	9.67	21.70	30.50	17.64	15.00	18.50	33.67
184 - 274	151	147	333	28.00	2.50	4.00	3.00	15.00	9.00		9.50	7.28	7.50	1.33	5.83	4.44	12.00	1.50	2.50	7.56	4.00
	121	121	336	13.33	28.00	13.00	38.00	2.50	33.00	12.50	6.00	12.94	18.00	8.50	9.00	3.50	4.50	3.00	18.00	9.00	25.33
	103	103	355		103.00	21.00	30.00	6.00	4.44	54.20	2.00	12.00	29.00	6.00	1.50	2.00	1.50	6.50	2.44	1.89	3.56
275 - 366	92	96	334	6.00	5.50	0.00	1.67	4.50	4.43		2.50	1.50	4.43	1.33	2.72	2.67	4.00	4.89	9.22	0.00	0.50
	58	58	335	46.50	12.50	14.00	8.50	6.50	8.00	8.00	0.50	5.00	6.00	4.61	1.00	4.89	1.50	2.22	0.89	3.00	2.22
	61	61	356		3.00	1.00	149.50	30.00	4.78	13.50	1.50	4.00	8.89	6.50	2.28	2.00	4.00	3.71	5.33	0.00	0.89
367 - 549	93	166	717	9.50			0.00	7.50	54.95		2.00	36.50	94.83	0.00	4.00	8.89	15.39	5.14	0.44	4.06	1.78
	76	76	719	20.00	4.00		26.50	1.00	5.00	58.50	17.50	17.00	9.50	7.15	17.50	3.56	9.14	9.14	7.50	9.07	1.33
	76	76	721		4.50		42.50	17.50	9.80	12.50	1.60	12.00	29.71	9.33	1.00	8.00	7.72	1.02	12.89	0.89	26.10
550 - 731	111	134	718				7.00	28.00	10.72		29.00	33.50	31.50	21.50	26.50	77.67	80.44	31.20	56.40		26.00
	105	105	720				23.50	0.00	7.28	21.89		2.00	14.00	2.67	52.76	20.62	20.89	14.29	23.24	0.44	0.40
	93	93	722		2.00		19.00	4.50	5.00	10.50	4.00	8.06	9.50	5.50	7.33	2.67	3.89	7.06	15.56	4.00	4.79
732 - 914	.	105	764									24.71		5.00	10.00	15.00			2.00		5.00
	.	99	768									15.94		1.78	12.00	27.43			2.50		0.44
	.	135	772									81.50		36.00		20.63	10.22		21.00		6.00
915 -1097	.	124	765									9.67		1.83	7.00	16.93			4.50		3.78
	.	138	769									9.50		2.00	12.50	20.00			7.50		7.00
	.	128	773									2.00		7.71	19.67	40.20	5.35		3.50		4.50
1098 -128	.	144	766											5.71	0.57	7.39			15.50		8.00
	.	128	770											2.07	10.50	26.14			5.00		7.50
	.	135	774											1.50	13.00	6.43	13.14		16.00		1.89
1281 -146	.	158	767											3.00	0.00	0.00			0.00		0.44
	.	175	771											0.00	5.50	0.00			2.50		0.00
	.	155	775											0.00	0.00	0.00	10.00		5.00		1.33
Grand Total				8.56	2.87	5.89	6.11	6.05	9.37	10.39	4.14	7.56	15.63	8.25	5.63	12.09	9.99	16.11	14.16	14.15	6.74

Table 14. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	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	0.19	0.16
	1499	1499	376	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
57 - 92	2992	2992	360	4.17	0.22	1.53	1.12	3.69	0.43	0.00	0.00	0.07	0.40	0.00	0.00	0.00	0.28	0.08	0.29	0.65	0.00	0.00	0.05	0.24	2.39	0.64	1.32
	1853	1853	361	0.47	0.00	0.00	0.15	0.20	0.00	0.08	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.95	0.18	0.00	0.00	0.00	0.14	0.55	0.00
	2520	2520	362	0.00	0.24	0.07	0.05	0.42	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	0.38	0.00
	2520	2520	373	0.00	0.00	0.12	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
	931	931	374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
	674	674	383	0.00	0.62	0.00	0.40	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
93 - 183	421	421	359	3.99	0.81	1.71	0.75	5.28	2.09	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	1.15	2.58	1.00	0.23	0.00	0.00	5.78		0.90
	100	100	377	0.58	0.00	0.00	5.25	0.21	2.31	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
	647	647	382	0.00	0.00	0.00	0.14	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	0.45		0.00
184 - 274	225	225	358	1.29	9.94	1.37	4.42	0.64	0.95	1.86	0.00	1.44	4.26	3.42	0.24	1.65	1.58	4.33	0.21	0.29	4.98	0.47	5.43	0.00	1.36		10.23
	139	139	378	1.17	1.00	1.69	8.10	1.64	2.19	0.00	0.00	1.51	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.24	0.41	0.07	0.00	0.00		0.00
	182	182	381	0.82	0.28	1.27	4.04	2.77	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.27	0.00	0.00	0.00	0.00		2.10
275 - 366	164	164	357	0.35	3.85	6.83		0.18	2.65	0.91	0.00	1.36	2.16	3.61	0.89	1.58	0.53	7.04	0.95	3.33	0.77	1.14	2.87	1.85	0.00		0.85
	106	106	379	2.48	0.83	1.60	11.84	3.00	1.38	2.38	0.21	1.27	0.00	0.29	0.00	0.00	0.60	0.15	1.75	0.25	0.26	0.00	0.28	0.00	0.40		0.00
	116	116	380	0.40	3.34	0.00	8.38	1.52	0.43	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.20	0.00	0.00		0.00
367 - 549	155	155	723								4.21	4.80	3.71	1.68	2.41	0.77	1.16	2.48	1.53	1.70	1.08	6.08	2.80	1.58	5.04		2.34
	105	105	725								4.26		2.78	3.08	0.00	0.37	1.91	0.31	1.40	2.20	0.56	0.20	0.51	0.00	7.15		1.01
	160	160	727								0.00	0.24	1.73	0.76	0.00	0.00	0.15	0.42	0.60	0.56	0.14	0.00	0.00	1.04	1.84		0.49
550 - 731	124	124	724								19.18	10.63	12.81	3.02	2.11	1.73	9.22	3.11	6.17	6.22	7.47	5.62	5.91	3.18	3.80		12.15
	72	72	726								8.21	2.52	2.24	2.81	0.35	1.20	4.25	9.65	5.93	6.58	8.46	1.78	5.07	2.15	0.82		1.90
	156	156	728								4.31	0.88	3.84	1.02	7.07	0.97		0.70	1.51	2.08	4.56	2.01	2.49	3.51	1.95		1.57
732 - 914	.	134	752											1.47													
	.	106	756											2.29													
	.	154	760											1.22													
Grand Total				0.96	0.33	0.47	0.62	0.97	0.21	0.07	0.27	0.20	0.36	0.21	0.13	0.07	0.19	0.24	0.22	0.43	0.26	0.16	0.23	0.14	0.75	0.37	0.60

Table 15. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2007. (Engel 145 data converted to Campelen Units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0.00	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	0.07	0.42	0.39	0.00	0.00	0.00	0.41	0.45	1.98	0.00
	456	456	331	30.49	4.82	0.58	0.29	7.09	0.00		0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.58	8.56	0.45	5.98	1.63	0.00	0.00	4.65		20.74
	1898	1898	338	0.51	29.90	4.24	4.53	11.78	7.00	1.66	0.00	0.42	1.13	0.00	0.88	3.33	0.00	1.37	2.99	0.70	5.19	0.46	1.23	4.49	2.48	6.41	3.89
	1716	1716	340	0.17	0.62	0.00	0.09	0.00	0.00	0.07	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.11	0.38	0.00
	2520	2520	351	1.99	0.61	1.11	0.64	2.82	0.63	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2580	2580	352	0.23	2.68	0.63	3.59	3.75	1.87	4.02	0.11	0.30	0.17	0.11	0.18	0.17	0.28	0.15	3.37	0.37	0.15	1.95	0.08	1.77	1.55	3.38	2.07
	1282	1282	353	25.63	6.36	6.05	9.12	40.87	14.10	9.28	0.00	1.38	1.19	0.00	0.24	0.13	0.01	1.54	12.53	7.37	2.66	3.90	2.66	3.24	2.44	19.22	3.27
93 - 183	1721	1721	329	0.00	0.00	0.00	0.00	3.33	0.20	0.11	2.09	0.00	0.00	21.42	0.82	0.00	0.05	0.21	1.01	0.11	0.00	0.00	9.33	0.00	0.62		2.36
	1047	1047	332	26.24	59.64	17.26	23.38	47.42	10.31	31.93	16.84	15.15	2.49	0.41	12.44	8.20	1.63	3.19	6.81	2.83	21.00	17.07	71.07	55.16	7.46		4.45
	948	948	337	0.39	31.66	10.85	11.55	8.13	11.83	12.48	12.12	4.45	5.18	0.38	5.01	2.53	1.25	2.46	6.74	7.18	13.98	5.77	5.48	1.79	5.02		2.55
	585	585	339	4.17	0.00	0.20	2.78	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.01	0.06	0.02	0.00	0.00	2.35		0.05
	474	474	354	7.60	1.61	18.88	3.58	5.30	0.73	3.68	2.21	2.28	12.90	0.00	0.00	0.55	0.01	3.46	16.28	12.68	14.02	8.48	2.50	7.60	9.81		6.03
184 - 274	151	147	333	0.50	2.30	0.48	0.00	3.23	0.75	6.20	23.96	3.83	3.83	256.95	8.00	0.33	5.38	1.22	1.32	1.47	6.03	18.55	3.12	1.80	1.95		1.36
	121	121	336	0.75	0.43	2.60	1.48	3.79	0.00	3.16	29.55	82.55	6.00	63.53	3.73	10.83	17.58	1.38	2.82	1.65	9.78	35.90	12.65	3.65	3.07		2.62
	103	103	355	3.19	12.77	2.69	5.05	0.00	6.82	8.89	9.58	1.14	2.38	9.12	3.03	6.09	3.40	3.56	1.27	1.01	6.18	13.63	23.99	8.25	0.87		1.93
275 - 366	92	96	334	0.00	3.32	3.31	1.44	1.74	1.80	2.07	1.59	8.51	1.58	65.16	1.17	11.36	27.44	0.33	0.54	0.83	0.16	10.87	10.07	2.20	0.20		0.83
	58	58	335	0.00	12.26	2.27	0.30	6.40	2.72	11.50	5.27	138.78	8.20	12.91	5.44	9.78	13.71	0.22	7.81	16.03	0.95	1.01	6.64	1.25	1.33		0.31
	61	61	356	0.59	9.84	2.09	2.78	2.13	3.51	6.56	4.61	15.34	9.23	9.00	7.34	4.75	1.28	3.44	2.75	1.68	4.01	4.58	5.84	1.58	2.14		0.40
367 - 549	93	166	717								0.83	9.41	2.77	104.01	2.32	20.37	190.65	1.91	0.82	0.76	1.80	8.80	6.23	0.24	0.73		0.43
	76	76	719								14.16	97.97	4.65	1.31	1.74	13.13	57.44	1.44	1.49	2.39	1.16	9.12	3.70	0.26	1.33		1.44
	76	76	721								7.24	4.64	2.93	6.91	1.76	1.55	1.80	3.65	3.50	2.64	8.17	3.60	2.47	0.85	0.40		0.98
550 - 731	111	134	718								2.27	1.89	6.80	11.97	4.34	3.88	1.99	1.79	2.08	0.82	3.10	3.00	2.34	0.69	0.70		1.10
	105	105	720								15.00	9.28	12.60	6.56	1.03	1.48	10.41	2.19	1.42	2.79	2.60	0.51	1.57	0.65	4.81		0.63
	93	93	722								1.42	3.86	11.72	16.93	16.11	6.94	6.78	2.42	5.54	3.69	9.42	4.84	4.97	0.94	2.13		0.86
732 - 914	.	105	764											4.17													
	.	135	772											4.07													
Grand Total				4.92	9.67	3.30	3.98	9.11	3.45	4.41	2.53	3.05	1.33	6.10	1.47	1.53	2.62	0.83	3.30	1.74	3.44	2.81	6.00	4.50	1.98	4.44	2.25

Table 16. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
<=56	1593	1593	375	0.00	0.33		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00
	1499	1499	376	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.11	0.00	0.00	0.00	0.00	0.19	0.13	0.00	0.00	0.00	0.00
57 - 92	2992	2992	360	0.64	0.42	3.15	0.42	0.18	2.16	0.06	1.04	1.05	0.43	1.30	0.79	1.26	1.42	2.03	5.74	0.24	0.00
	1853	1853	361	0.11	1.83	1.82	0.00	0.13	0.00	0.00	0.06	0.00	1.05	0.11	0.67	0.58	0.39	0.00	0.66	0.15	2.29
	2520	2520	362	1.15	0.64	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.39	0.00	0.00	0.11	0.00
	2520	2520	373	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
	931	931	374	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
	674	674	383	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
93 - 183	421	421	359	0.00	0.00	4.81	0.00	0.00	0.39	0.00	0.00	20.95	0.01	0.00	2.10	0.73	1.90	2.40	0.75	2.60	3.31
	100	100	377	0.00		0.00	0.00	0.56	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
	647	647	382	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
184 - 274	225	225	358	0.00	0.65	2.14	0.76	0.00	2.40	0.00	0.36	0.98	0.63	1.29	1.45	0.00	4.69	0.73	3.44	4.64	0.90
	139	139	378	0.00	2.17	0.81	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.00	0.14	0.27	0.00	0.00	0.00	4.85	0.20
	182	182	381		0.00		0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
275 - 366	164	164	357	0.00	10.39	0.42	8.27	1.91	3.76	0.00	1.18	0.00		2.33	0.82	0.91	1.80	1.20	1.64	4.55	2.60
	106	106	379	0.27		0.25	0.00	0.00	0.00	0.04	0.45	0.00	0.00	0.13	7.59	2.24	0.58	59.46	0.00	0.20	0.01
	116	116	380		0.00		0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.30	0.00	0.00	0.00	0.55	0.68	0.00	0.00
367 - 549	155	155	723		1.93		7.65	8.44	2.69	0.73	1.31	3.48	1.25	1.33	3.09	0.77	5.77	0.95	4.58	1.80	0.78
	105	105	725			1.01	26.05	3.20	1.31	0.00	9.32	0.68	2.28	1.29	0.48	0.38	0.68		0.51	0.52	0.78
	160	160	727				0.00	1.71	0.01	0.00	1.30	0.30	0.20	0.00	0.46	0.00	0.02	0.33	0.97	0.00	0.00
550 - 731	124	124	724		10.11		24.29	10.57	6.09	3.54	11.58	4.21	10.60	5.08	4.13	5.28		4.09	5.54	12.09	7.45
	72	72	726				31.26	5.47	4.80	4.03	2.08	3.80	3.39	1.59	2.18	5.96	5.20	3.20	1.92	4.93	4.50
	156	156	728					7.11	1.62	1.00	3.53	3.65	4.95	7.11	4.80	13.33	8.31	4.34	0.90	5.70	8.91
732 - 914	.	134	752									6.54		1.23	0.00	0.03					0.30
	.	106	756									8.53		3.47	5.67	0.60			5.60		4.60
	.	154	760									4.18		1.93	3.67	8.18			0.83		5.20
915 -1097	.	138	753									0.00		0.01	0.00	0.17					0.00
	.	102	757									0.00		0.00	2.66	0.48			0.01		0.00
	.	171	761									1.94		6.23	1.80	0.41			5.00		0.30
1098 -128	.	180	754									0.00		0.00	0.00	0.01					0.00
	.	99	758									0.00		0.00	0.00	0.01			0.00		0.00
	.	212	762											0.00	3.74	0.00			0.50		0.97
1281 -146	.	385	755									0.00		0.00	0.00	0.00					0.00
	.	127	759									0.00		0.00	0.10	0.00			0.00		0.00
	.	261	763											0.53	0.15	0.28			0.00		0.00
Grand Total				0.31	0.63	1.22	0.69	0.34	0.56	0.07	0.41	0.89	0.37	0.46	0.53	0.56	0.64	0.89	1.25	0.46	0.55

Table 17. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2007. (Engel 145 data converted to Campelen Units for 1990-94).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
57 - 92	2089	2089	330	0.43	0.23	0.28	0.00	0.00	0.86	0.00	0.25	0.58	0.73	0.17	0.99	1.19	1.53	0.26	1.09	1.33	1.26
	456	456	331	0.35	5.02	2.14	0.00	0.00	1.73	0.00	0.00	4.08	15.08	3.88	7.46	12.35	4.88	0.23	6.28	1.73	2.30
	1898	1898	338	8.53	1.68	3.21	15.19	8.40	17.94	1.93	5.09	1.85	10.48	1.44	3.61	3.74	10.21	14.94	7.40	2.32	2.08
	1716	1716	340	0.73	1.19	0.27	0.00	0.00	0.86	0.00	0.09	0.00	1.76	0.44	0.73	0.52	0.24	0.12	0.49	2.77	0.01
	2520	2520	351	4.87	0.82	0.21	0.00	0.00	0.00	0.00	0.00	0.11	0.59	0.00	0.50	0.00	0.07	0.10	0.16	1.06	0.46
	2580	2580	352	3.99	2.52	3.81	2.66	0.64	1.07	0.77	1.62	1.06	4.20	2.59	1.21	2.22	2.72	9.51	4.69	3.13	1.57
	1282	1282	353	13.64	1.94	2.70	0.00	4.15	3.05	4.48	0.95	6.04	16.99	13.49	7.71	8.45	6.83	15.07	21.04	9.00	6.35
93 - 183	1721	1721	329	0.42	0.36	0.00	0.07	0.00	1.76	0.00	0.73	1.29	0.00	0.00	1.19	3.09	0.41	2.05	1.06	12.56	0.00
	1047	1047	332	14.59	1.08	11.97	5.65	2.23	7.74	31.73	1.32	1.70	11.55	3.77	2.38	8.02	5.60	10.50	14.31	26.99	4.92
	948	948	337	10.22	1.45	7.32	4.32	16.35	3.23	3.78	2.47	3.67	7.50	2.64	0.51	1.62	2.70	0.88	13.20	1.46	4.42
	585	585	339	14.07	2.78	8.10	1.48	9.22	23.75	0.00	5.98	3.25		4.27	4.20	23.95	5.68	46.66	23.04	13.30	13.18
	474	474	354	19.81	0.36	4.85	1.16	3.22	2.94	71.28	3.30	3.08	1.58	11.75	3.95	7.21	14.83	6.72	4.85	7.75	10.64
184 - 274	151	147	333	10.65	0.52	1.07	1.46	4.43	1.24		0.19	0.29	1.65	0.18	0.99	0.84	2.38	0.01	0.17	1.17	0.15
	121	121	336	4.92	9.10	4.57	17.93	0.78	2.08	1.93	1.13	1.14	4.03	1.88	2.20	1.36	0.58	0.33	2.10	0.15	3.16
	103	103	355		35.07	6.59	8.44	1.76	1.16	24.22	0.45	0.99	7.75	2.48	0.35	0.45	0.46	1.50	0.18	0.39	1.20
275 - 366	92	96	334	1.93	1.26	0.00	0.75	1.34	0.28		0.41	0.11	0.52	0.40	1.03	0.67	0.60	0.01	1.24	0.00	0.03
	58	58	335	24.31	3.09	3.20	3.76	2.23	0.10	2.89	0.01	0.17	2.92	1.00	0.37	1.07	0.09	0.67	0.36	0.35	0.10
	61	61	356		1.35	0.81	51.23	11.66	0.84	7.14	0.38	0.50	3.80	2.67	0.88	0.36	0.70	0.21	0.89	0.00	0.01
367 - 549	93	166	717	2.31			0.00	2.50	2.87		0.53	1.83	11.37	0.00	0.58	0.50	2.38	0.40	0.11	0.61	0.40
	76	76	719	10.53	0.23		6.24	0.58	0.13	21.58	1.78	0.85	0.93	1.29	2.80	0.56	1.46	0.32	0.55	0.92	0.35
	76	76	721		1.69		16.19	6.39	2.02	5.15	0.54	1.32	6.43	1.59	0.20	1.35	1.62	0.23	1.42	0.28	2.83
550 - 731	111	134	718				1.45	4.43	0.52		3.70	2.55	2.90	1.83	2.73	2.94	8.71	2.63	7.06		3.69
	105	105	720				5.02	0.00	0.91	4.68		0.12	1.15	0.24	5.72	1.78	2.16	0.70	2.67	0.04	0.09
	93	93	722		0.69		6.30	1.62	1.13	3.03	0.91	0.91	2.05	0.66	1.16	0.38	0.58	1.07	2.24	0.62	0.69
732 - 914	.	105	764									5.21		0.80	1.43	2.50			0.26		0.79
	.	99	768									1.34		0.49	1.35	2.80			0.27		0.06
	.	135	772									9.29		3.33		2.65	1.54		2.68		1.19
915 -1097	.	124	765									1.40		0.21	1.18	3.25			0.59		0.65
	.	138	769									0.92		0.26	1.45	3.13			1.08		0.83
	.	128	773									0.23		0.73	1.80	5.08	0.71		0.45		0.55
1098 -128	.	144	766											1.21	0.13	1.85			2.90		1.23
	.	128	770											0.23	1.29	3.79			0.73		0.90
	.	135	774											0.22	1.65	0.83	1.46		2.33		0.21
1281 -146	.	158	767											0.68	0.00	0.00			0.00		0.13
	.	175	771											0.00	0.73	0.00			0.41		0.00
	.	155	775											0.00	0.00	0.00	1.29		0.98		0.13
Grand Total				5.96	1.62	2.80	3.08	2.76	4.10	4.89	1.46	1.64	5.04	2.30	2.03	3.47	3.35	6.47	5.37	5.333	2.248

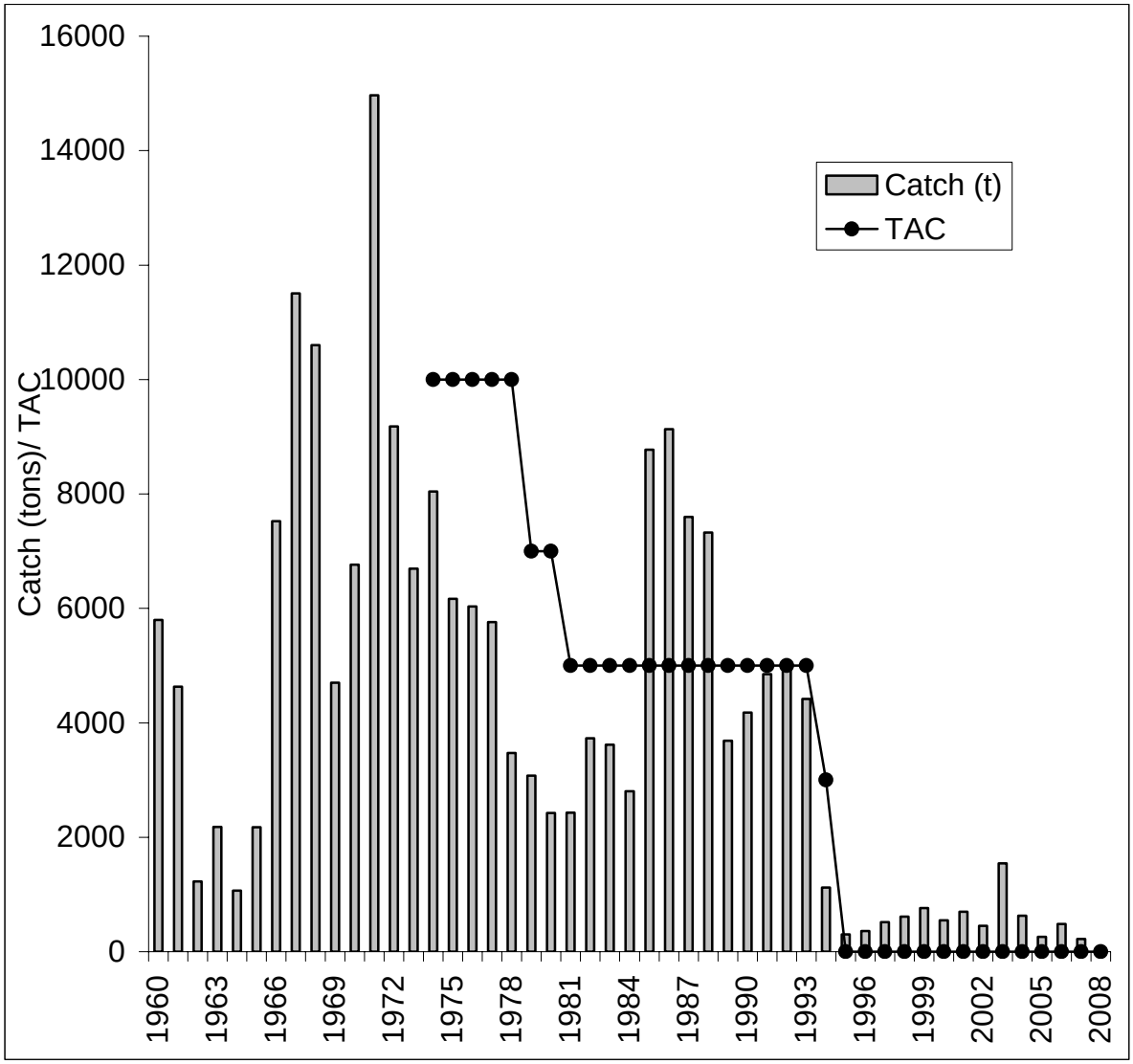


Figure 1. Commercial catches of witch flounder in Div. 3NO from 1960-2007 and TACs from 1974-2008. *Note: Although a TAC of 3000 tons was agreed by the Fisheries Commission, it was also agreed that no direct fishing on witch flounder in Div. 3NO take place during 1994 due to the poor state of the stock. Estimated catch in 2003 is the mean of a range of catch from several sources.

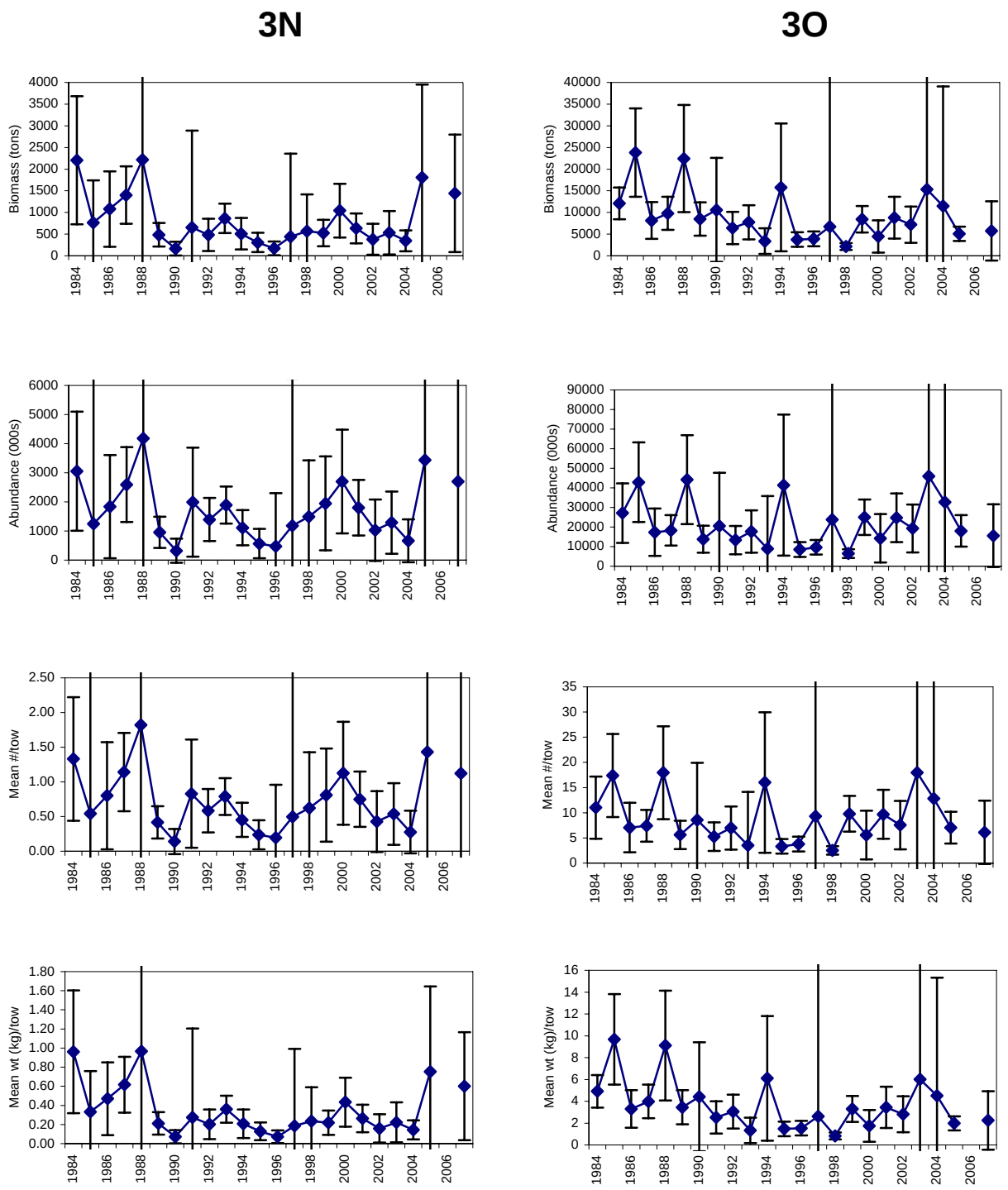


Figure 2. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder from Canadian Spring surveys in Div. 3N and 3O during 1984-2007. Note that the value for 2006 spring surveys is not included.

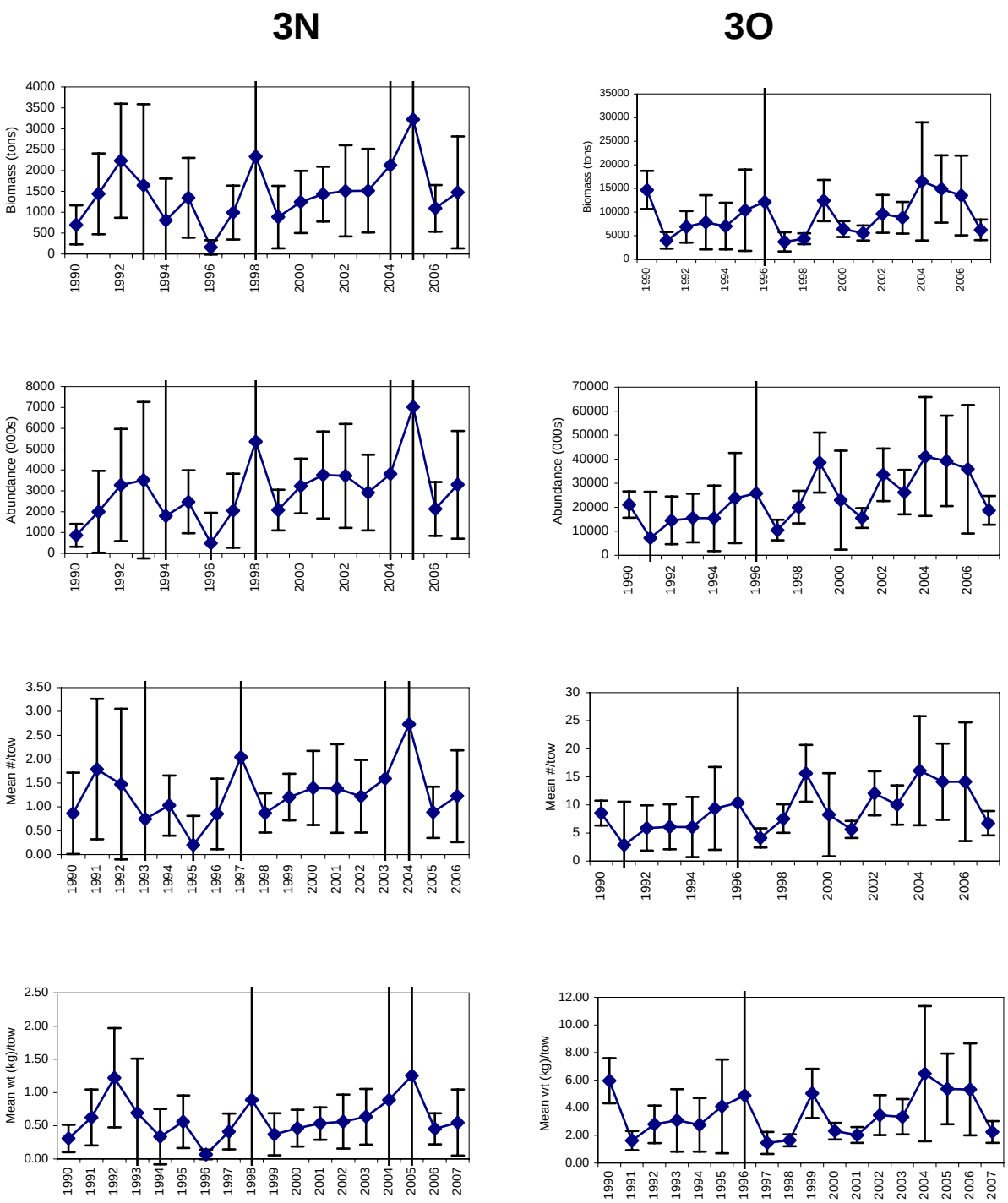


Figure 3. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder from Canadian fall surveys in Div. 3N and 3O during 1990-2007.

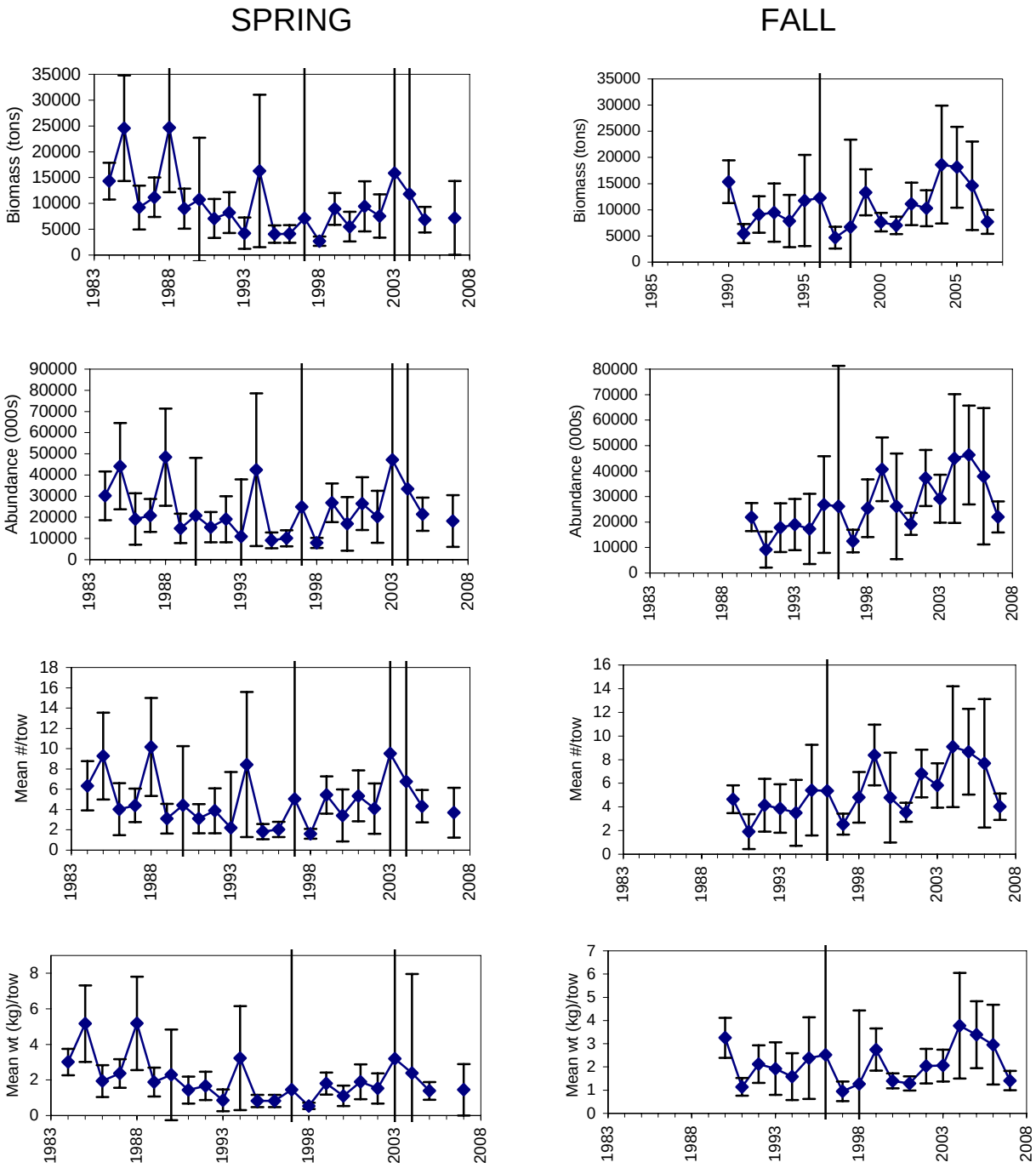


Figure 4. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder in Divs. 3NO combined. Note the 2006 spring survey value is not included.

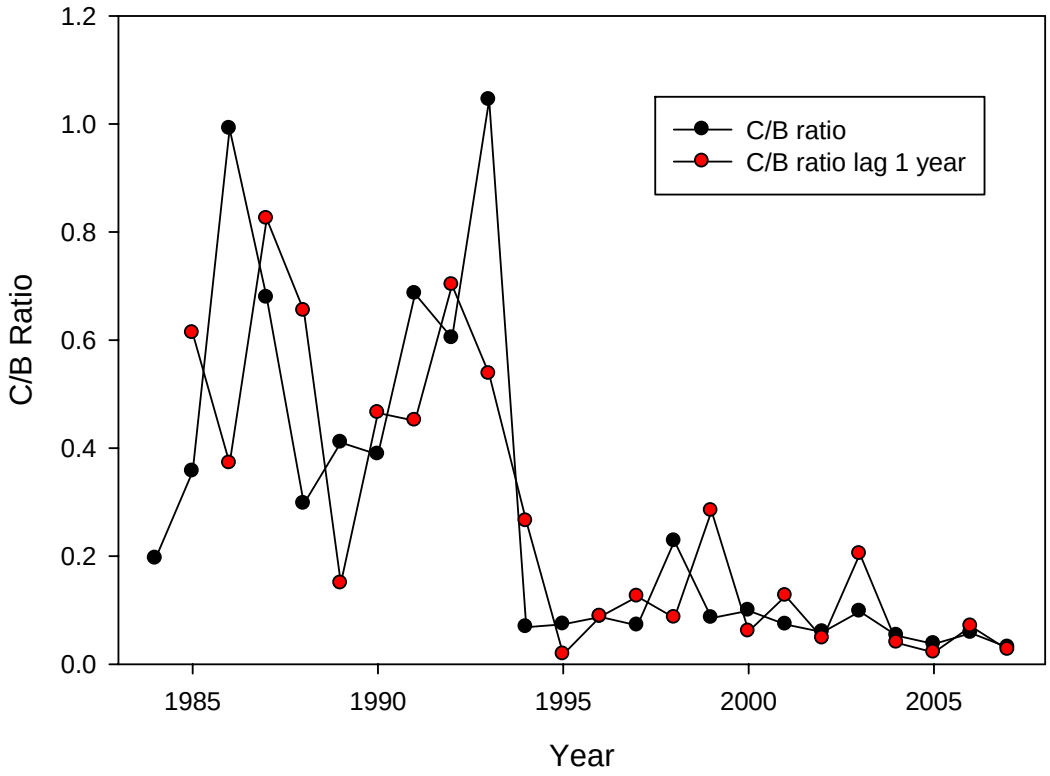


Figure 5. Ratio of catch/biomass (t) of witch flounder in Campelen units, from spring surveys for Div. 3NO. Black symbols indicate the C/B ratio by year; the red symbols indicate that catch is lagged by one year.

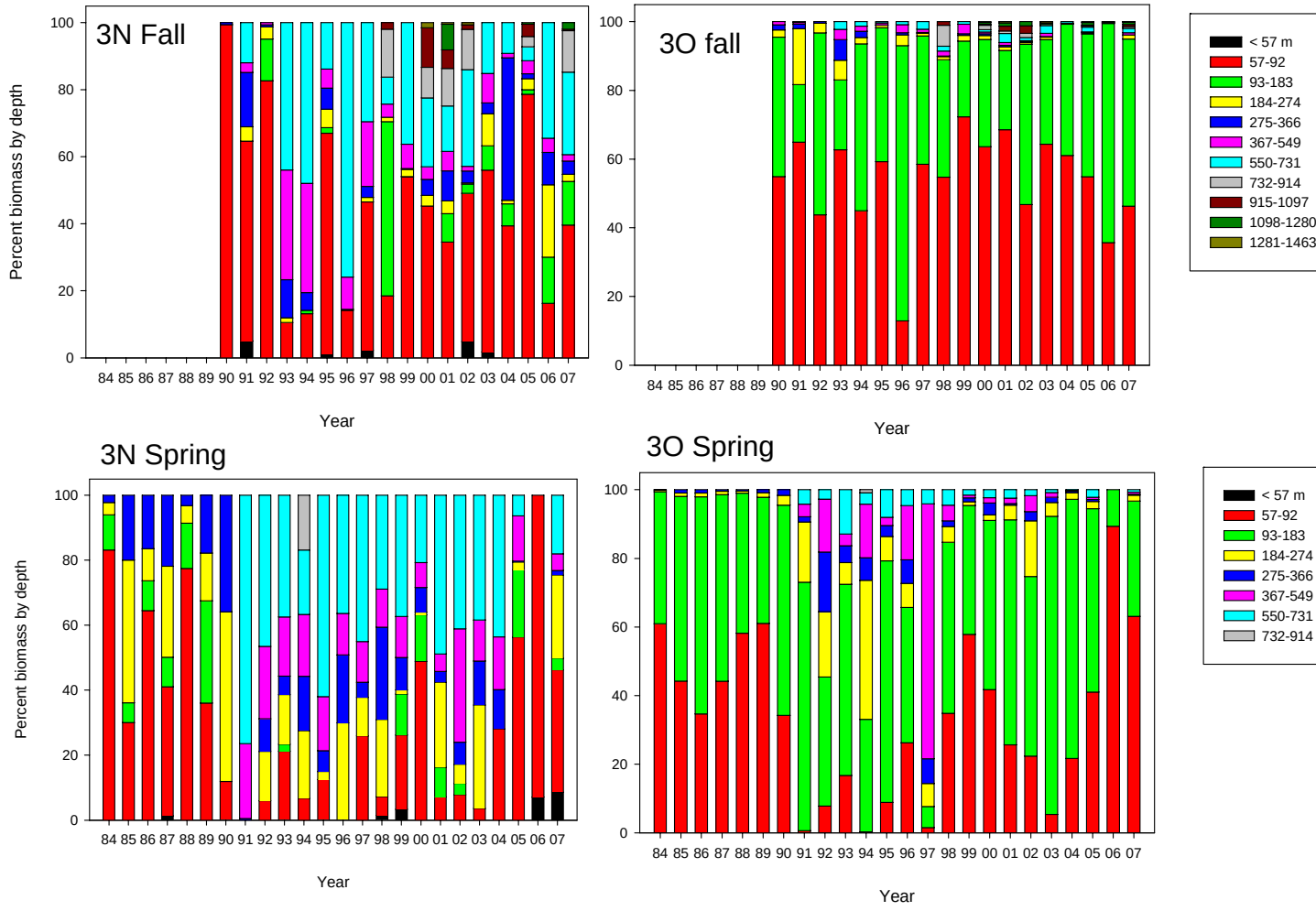


Figure 6. Biomass distribution of witch flounder by depth for Divisions 3NO for spring and fall. Note that in spring, 1991 onwards was surveyed every year to 731 m. Only 1994 was ever surveyed to 914 m. For fall, the survey covered up to 1097 m; and up to 1500 m in 2000, 2001, 2002, 2003 (1 strata per depth range), 2005 and 2007. Note results not accurate for spring 2006.

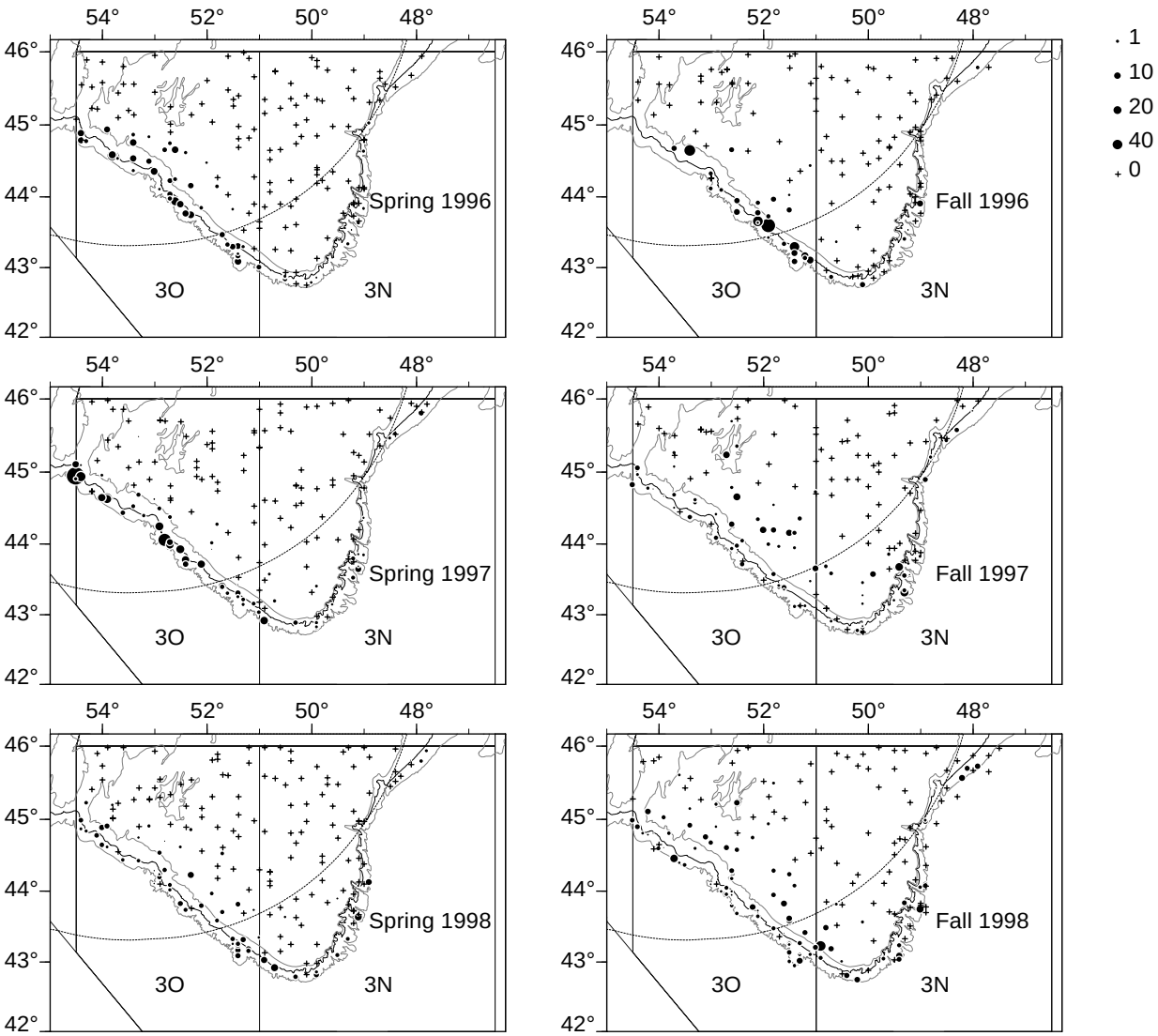


Figure 7. Distribution of witch flounder (weight (kg) per set) from spring and fall Canadian surveys in NAFO divisions 3NO during 1996-1998.

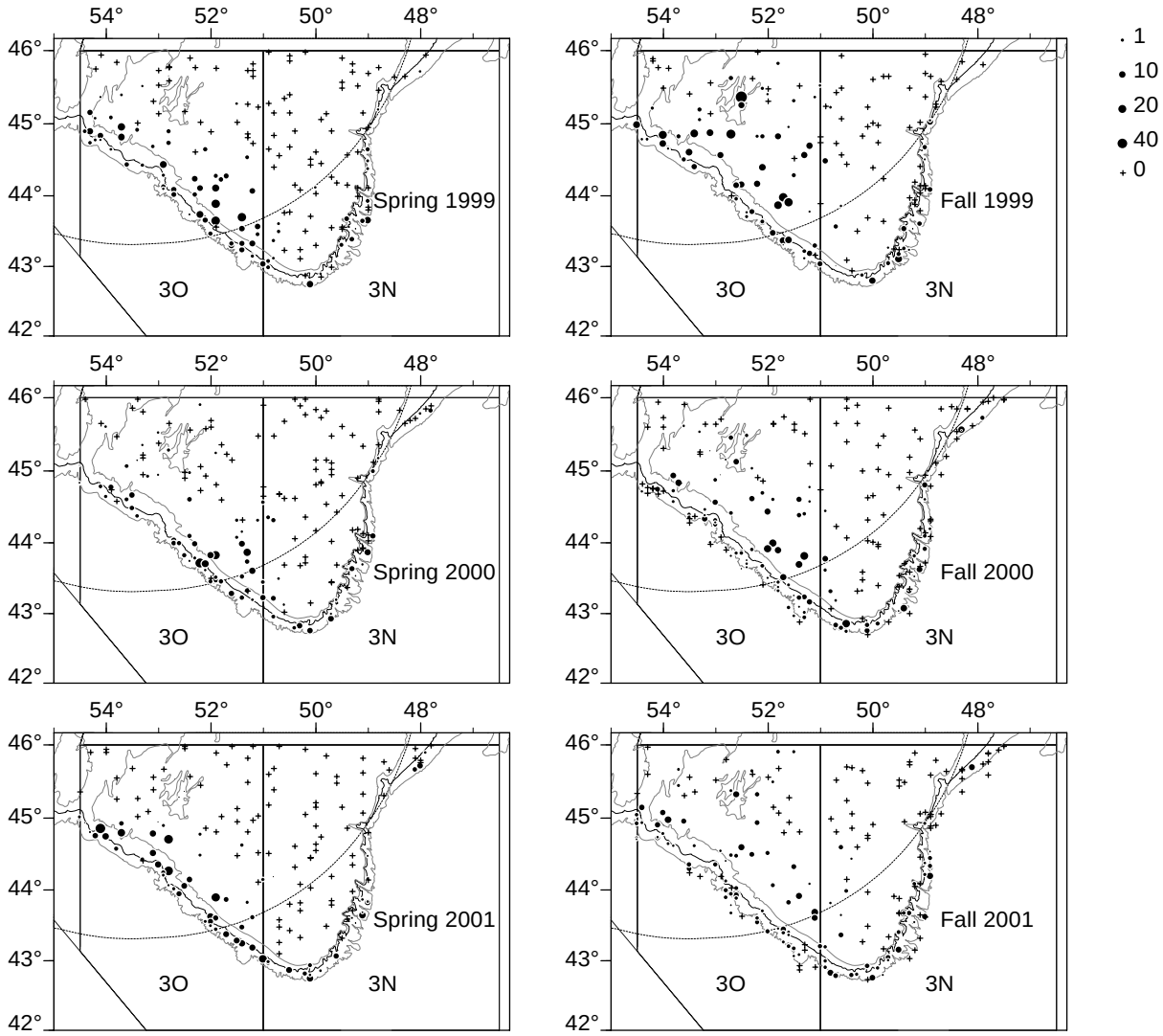


Figure 8. Distribution of witch flounder (weight (kg) per set) from spring and fall Canadian surveys in NAFO divisions 3NO during 1999-2001.

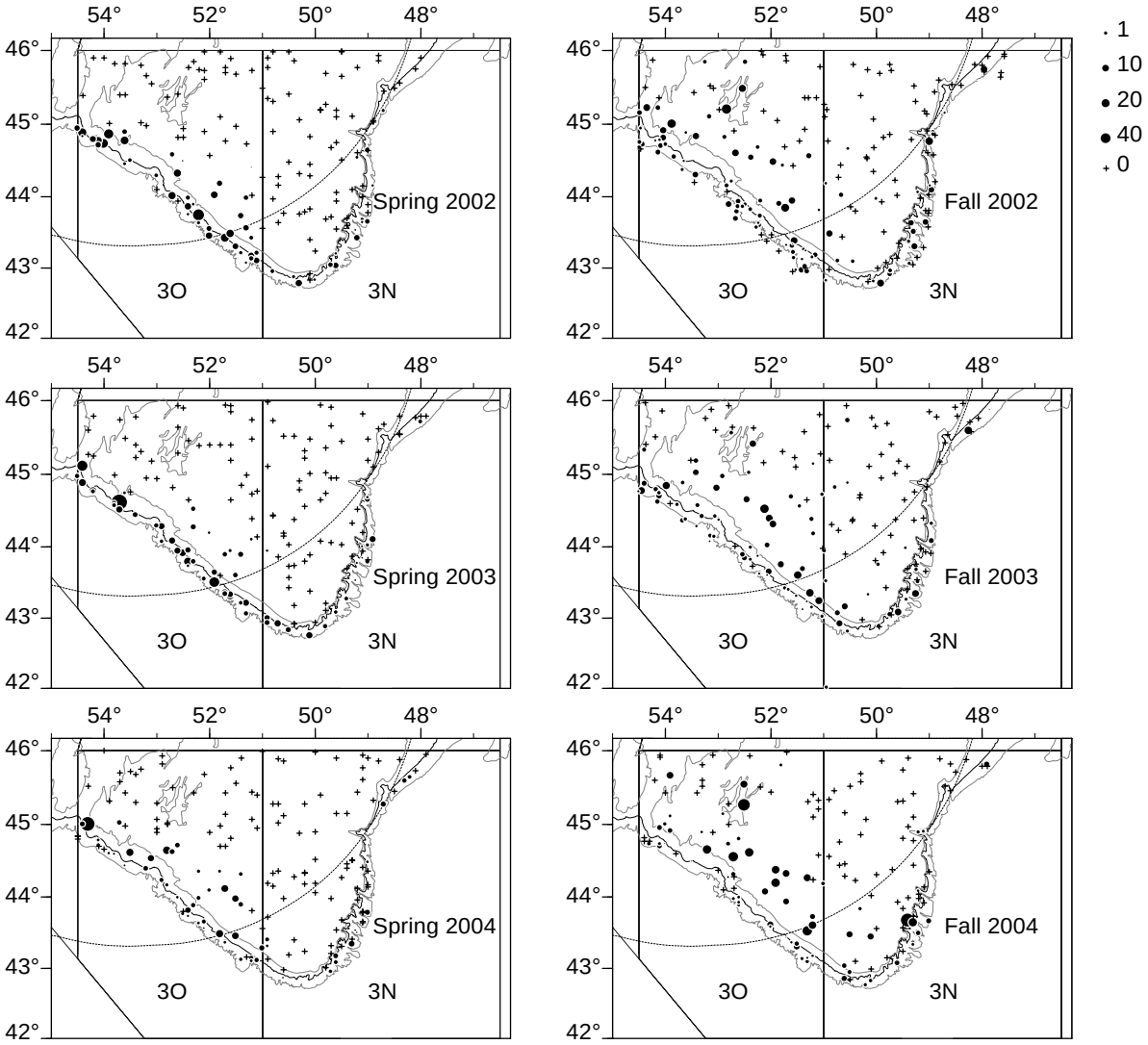
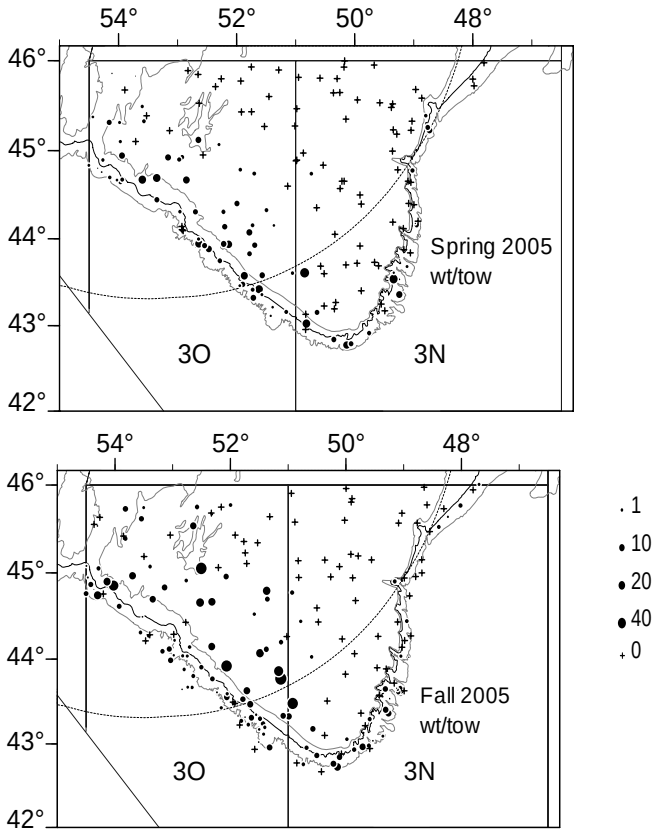


Figure 9. Distribution of witch flounder (weight (kg) per set) from spring and fall Canadian surveys in NAFO divisions 3NO during 2002-2004.


54°
52°
50°
48°
46°
45°
44°
43°
42°
Spring 2005
wt/tow
3O
3N
Fall 2005
wt/tow
1
10
20
40
0

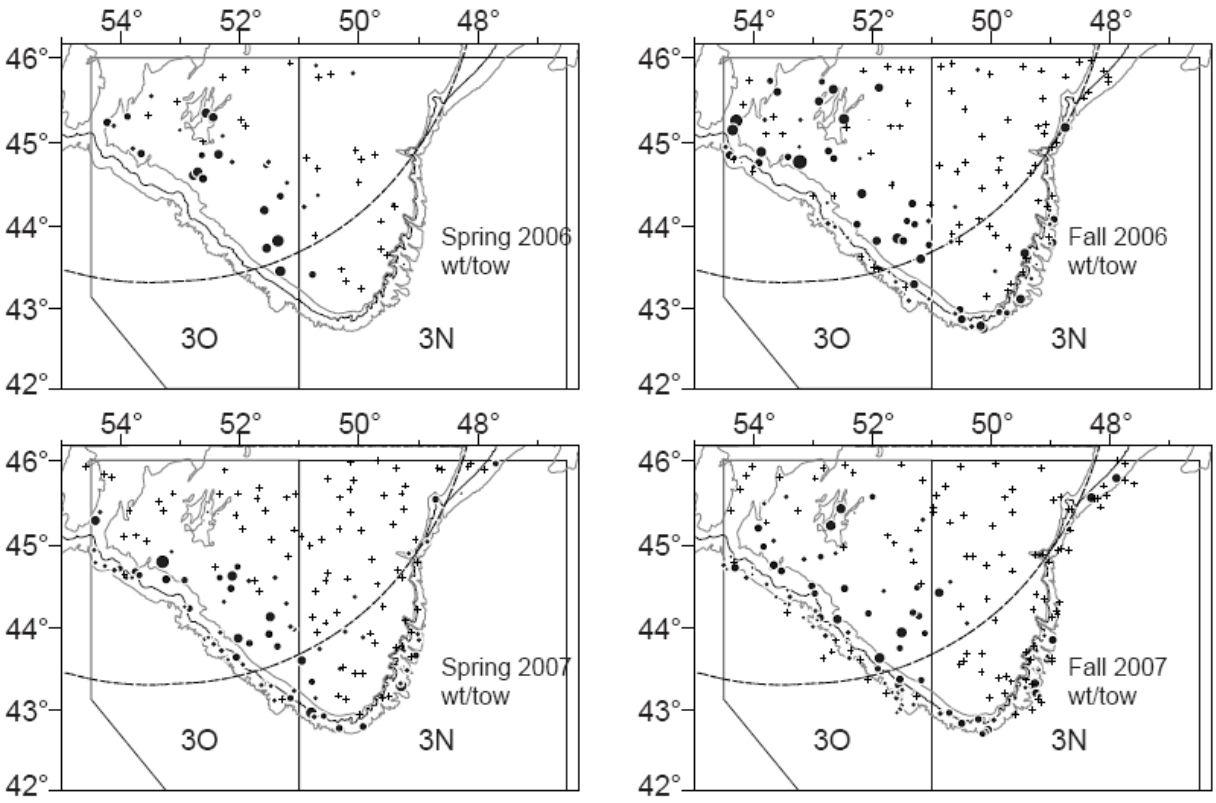


Figure 10. Distribution of witch flounder (weights (kg) per set) from spring and fall Canadian surveys in NAFO divisions 3NO during 2005-2007. Note poor survey coverage in spring 2006.

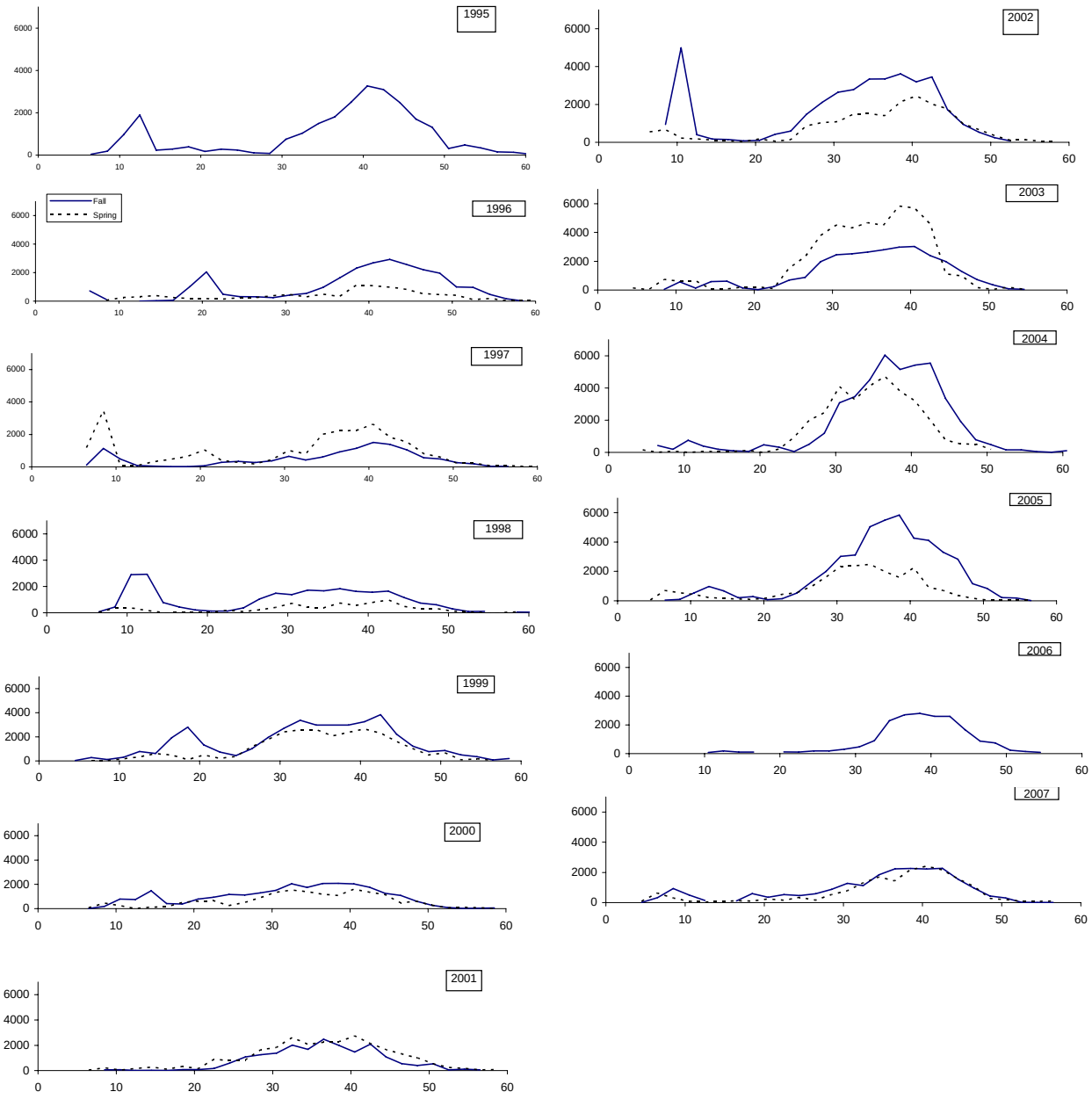


Figure 11. Length frequency distributions of witch flounder from both spring and fall surveys using the Campelen 1800 shrimp trawl. Estimates represent abundance at length (cm) of the surveyed area. All distributions are for Div. 3NO combined. Note 2006 spring length frequency distribution not included.

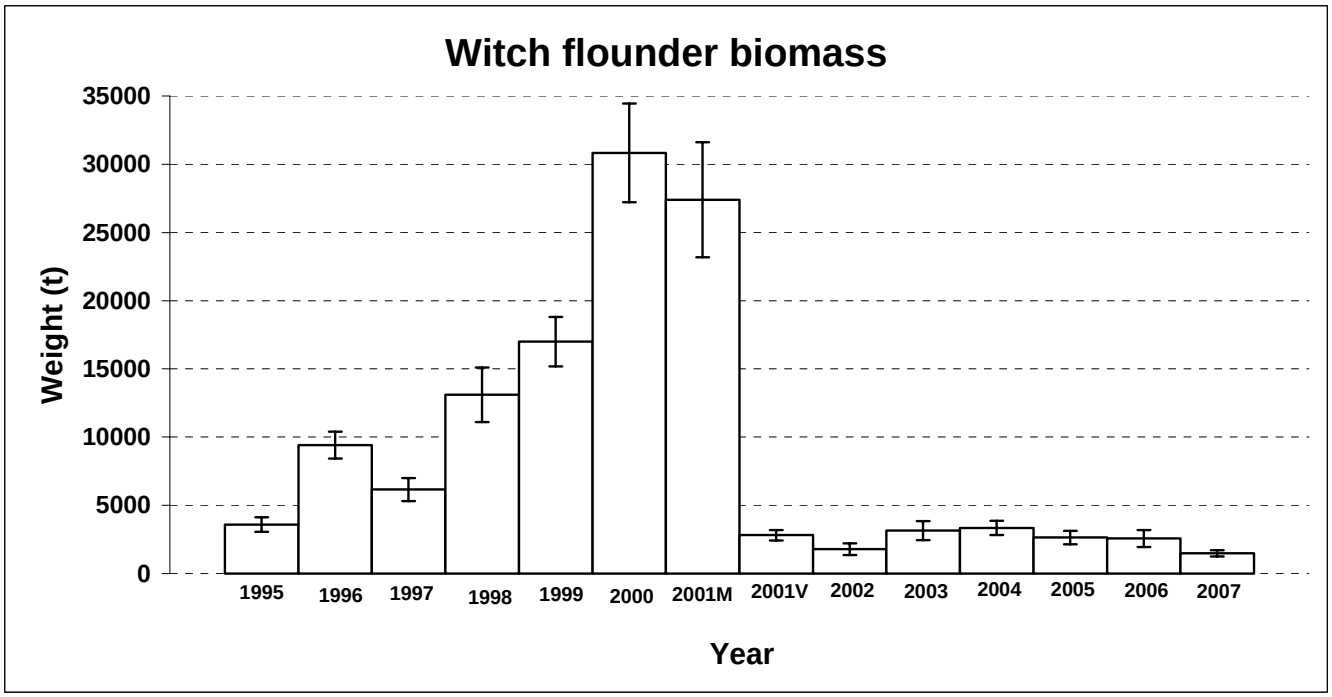


Figure 12. Biomass estimates from the Spanish Div. 3NO survey for witch flounder. Data up to 2001 is in *Pedreira* units; data afterwards is *Campelen* units. Both estimates are present for 2001.