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An assessment of the witch flounder resource in NAFO Divisions 3NO

by

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Abstract

Indices of abundance and biomass for witch flounder from Canadian spring surveys in Div. 3NO combined show some improvement since 1998, following a decline from 1984 to the mid- to late-1990s. Values from 2007-2010 have fluctuated around the long-term mean. The Canadian fall survey series for Divisions 3NO combined is also quite variable but there is an increasing trend in biomass from about 1997 until 2005, a decline in 2007, and a large increase in the 2008-10 estimates, to levels between 1.7 and 2.8 times the mean. However, confidence intervals around these estimates are quite wide. Indices from Spanish surveys in the Regulatory Area of Div. 3NO show an increase in 2010, to levels similar to those of 2003-04.

There are signs of improvement in stock status, however, the recent increased estimates from the survey series generally have wide confidence limits, are not consistent between surveys across years, and cannot be readily explained from data on recruitment and length frequencies. There are no ageing data for this stock since the early 1990's. Recent estimates of recruitment are generally below average. Estimated catches have remained below 500 tons per year since 2004, and catch/biomass ratio (as a proxy for fishing mortality) remains relatively low.

Fisheries and Management

As noted in previous reports, most recently Dwyer (2008), 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, annual catches rose rapidly to around 9,000 tons in 1985 and 1986. 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 around 7,500 tons. 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. Catch then increased steadily and by 1999 was about 800 tons, although it declined again to an estimated 450 tons in 2002. In 2003 several sources of catch data were available and a single source could not be considered as

the most valid. As a result, catches were estimated to range between 850 and 2239 tons. Catch declined to about 222 t in 2007, but has increased each year since, reaching an estimated 421 t in 2010.

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 1993 (Table 1). This increase 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 have not exceeded 112 t in any year since then. In recent years, most of the estimated catches have been taken as by-catch of directed fisheries for other species in the NRA.

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. Fisheries Commission introduced a complete moratorium for directed fishing in 1995, which has continued through 2011.

Length frequency data from commercial fisheries

Length sampling was available from by-catches in directed fisheries for other species by Spain, Portugal, and Russia in 2010. The Spanish data (Gonzalez-Costas et al. 2011), from Div. 3N G. halibut and skate fisheries, showed most of the catch was between 36 and 43 cm in length, with a peak at 39. In the Portuguese data (Vargas et al. 2011) for Div. 3N (130 mm mesh size), lengths between 28cm and 46cm dominated the catch, with a modal class at 40cm (mean length of 38.9 cm). In Div. 3O (130 mm mesh size) the Portuguese catch showed more small fish, as lengths between 26cm and 34cm dominated the catch, with a modal class at 32 cm (mean length of 31.5 cm). In Div. 3O, with 280 mm mesh size, lengths between 28cm and 44cm dominated the catch, with no modal class (mean length of 37.7 cm). For Russia (Skryabin and Pochtar 2011), sampling of witch by-catch in Div. 3N showed the length of witch flounder ranged from 31 to 52 cm, with mean length 42.5 cm. Individuals from 37 to 43 cm in length made up the bulk of catches.

No data from Canadian by-catches of witch in Div. 3NO were collected in 2009 or 2010.

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 up to 1990, only surveyed to 366 meters. However, since 1990, depth coverage was extended to 731 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 1990-92, all strata in depths from 366 to 731 m were not surveyed, but have been since then. In fall 1998 the survey depth range was further extended to 1500 meters, although only a few surveys since then have covered the deeper strata completely (2000 to 2002, 2007), or even partially (1998, 2003, 2005, 2009). In 2005 and 2009, all strata in Div. 3O were surveyed, and in Div. 3N in 1998 only 2 of the deeper strata were not covered by the fall survey. Summary details of the Canadian surveys can be found in Brodie and Stansbury 2007, and tables of survey coverage by vessel, area, depth, and time have been updated in Parsons (2011).

Beginning with the fall survey in1995, 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 the earlier Engel surveys have now been converted to Campelen 1800 trawl catch equivalents. Only the converted survey data are

presented here, but some caution should be used in comparing converted Engel data with data from the Campelen trawl series.

During the course of the 2006 Canadian spring survey, operational difficulties lead to incomplete coverage of the survey in Divisions 3LNO. This should be noted anywhere that 2006 spring estimates are discussed. The lack of coverage can be noted in Tables 2, 6, 10, and 14, and values have been removed from the 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 Divisions 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 Divisions 3N and 3O separately and combined, in Figures 2-4.

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 were extremely low from 1989 – 2004, but have been somewhat higher since then. Abundance and mean number per tow are variable, but higher in 2009 and 2010. In most years the stock size indices in Div. 3N were estimated to be less than 1 000 tons or 2 million fish, (Fig. 2; Tables 2, 6, 10 and 14). However, from 2005 onward, 4 of the 5 complete surveys in Div. 3N have produced higher than average index values for biomass and abundance, and the 2009 and 2010 values for both 3N indices are more than double the 1991-2010 averages. For Div. 3O, where the majority of the stock resides, the picture from spring surveys does not appear to be as clear. Indices of stock size showed considerable annual fluctuations between 2,000 and 24,000 tons, or 6 to 46 million fish, particularly in the late 1980s (Fig. 2; Tables 3 and 7). From 2003-2010, there have been decreases in the spring indices for Div. 3O, particularly for biomass. The biomass index in 2010 is about half the long term mean, and 2010 abundance is about 25% below the mean, with both indices declining from above-average levels in 2008 and 2009.

Indices derived from the fall surveys in Div. 3N were, similar to the spring series, very low and lacking trend up to 2007 (Fig. 3; Tables 4, 8, 12, and 16). However, the biomass indices in 2008-09 increased to a level several times the 1990-2010 average, with a peak in 2009. In 2010, the biomass index in Div 3N declined, but was still above the mean by about 40%. The fall abundance index in Div. 3N showed a similar trend, with the exception that the 2008-2010 values were higher relative to the mean than the values from the same years in the biomass index. As noted by Dwyer (2008), 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). Nonetheless, the estimates for each seasonal series are generally within the same numeric range. The fall abundance and biomass indices in Div. 3O both increased in 2009 to well above the mean (2X for biomass, 4X for abundance), and remained at that level in 2010.

Overall, the Div. 3NO-combined indices for the spring show a decline in biomass and abundance since 1984 to the mid- to late-1990s (Fig. 4) and although fluctuations continue to occur, some improvement in the estimates has occurred since 1998. Values from 2007-2010 have fluctuated around the long-term mean. The fall survey series for Divisions 3NO combined is also quite variable but there is an increasing trend in biomass from about 1997 until 2005, a decline in 2007, and a large increase in the 2008-10 estimates, to levels between 1.7 and 2.8 times the mean. However, confidence intervals around these estimates are quite wide.

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 are agreed estimates 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 much 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. Since 2004, the ratio has remained low, increasing slightly in the last few years with the increased catch.

Depth distribution

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 and Brodie 1991). Because it was previously thought that witch flounder are not adequately covered by the survey depths, Dwyer (2008) examined the issue by analyzing the Canadian survey data. She concluded that the preferred depth of Div. 3NO witch flounder differs by division and by time of year. 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 despite 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 showed similar patterns.

Depths covered by the surveys have changed over the years as stated above. In the spring series, only 1994 was surveyed to 914 m, but only 1.4% of the Div 3NO biomass index value was found in these strata (Tables 2 and 3), although it was 17% for Div. 3N alone. For the fall surveys, in years and Divisions where coverage was complete in depths 731 to 1462 m, between 15 and 25% of biomass estimates in Div. 3N were contained in these depths. However, in Div 3O, there were very few fish found in this depth range, generally less than 5%. Because Div. 3O contains the majority of the biomass estimate in the fall surveys (83% on average, from Tables 4 and 5), the percentage of the total Div. 3NO biomass in the deeper strata is similarly low.

As discussed in Dwyer (2008), distribution plots clearly show 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. Therefore, it seems likely that the RV survey coverage does adequately cover the depth distribution of witch flounder, particularly in the fall. 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 and Orr (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. It is also likely that some witch flounder may be distributed outside the survey area, particularly in the spring, following spawning in deeper waters, and this may also contribute to variability in survey estimates.

Distribution Plots

Geographic distributions of witch flounder from 1996-2007 spring and fall surveys (mean weight per tow) were plotted in Dwyer (2008). For recent years, the distribution plots are contained in Parsons (2011). As stated previously, 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 the larger strata. It is this variation in distribution from smaller to larger strata that is often responsible, in part, for the high variability in the annual biomass and abundance indices (Bowering and Orr 1996).

Length frequencies

Length frequencies from surveys appear to be fairly consistent since 1995, with few fish > than 50 cm (Figure 6), and a mode generally around 40 cm. There have been a few strong peaks (presumably year classes) that could be followed in successive years (eg. peak at 12 cm in 1995 and 20 cm in 1996; peak at 9 cm in 1997, 11 cm in 1998, and 20 cm in 1999) but then in 2002, a large peak at 12 cm did not appear after that year. There have been no strong peaks representing large year classes since 2002. Fig.7 shows the abundance index for fish less than 21 cm, Div. 3NO combined, as measured in the fall Campelen surveys. Highest levels were in the late 1990's, and values since 2002 have been below the mean. The higher abundance of smaller fish in the 1998-2000 surveys may be contributing to the apparent improvement in the stock in recent years. It should be noted that no ageing information for this stock has been available since the mid 1980's, making the tracking of cohorts from LF data all but impossible given the relatively slow growth of witch flounder.

To further investigate the large increases in the 2008-2010 fall survey indices, the length frequency data for Div. 3NO were examined in further detail. Peaks in the length frequencies occurred at 40.5 cm in 2008 and 2009, and at

38.5 in 2010. The mean lengths in the frequencies in these three years were 37.4 cm, 38.5 cm, and 37.6 cm. So the increases in abundance and biomass do not appear to be from incremental growth of a strong cohort or cohorts, particularly given the below average recruitment estimates since 2002. It is possible that stronger cohorts from the late 1990s may be contributing to increased abundance and biomass, but if so, these cohorts could not be seen consistently in surveys prior to 2008. Numbers at the largest lengths in 2008-10, as well as maximum length observed in each year, were not out of the ordinary.

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. Mean weight and numbers per tow series are given in Figure 8 for the latter series, as data prior to 2000 have not yet been converted. 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 decreased slightly up to 2007, before increasing up to 2010 to levels similar to 2003-04. Based on the length frequencies in the Spanish surveys, the best recruitment values occurred in 2002-2005, but since 2008 they have been very poor (González-Troncoso et. al, 2011).

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 (as reported in Dwyer, 2008). 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 these data could not be modeled using ASPIC. The model was not attempted on this year's data as results would not be expected to change in a short time period, particularly given the divergence in the spring and fall survey indices observed since 2007.

Precautionary limit reference points

As reported by Dwyer (2008) some attempts have been made at producing limit reference points, in particular B_{lim}. However, it was 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. It was concluded that using the proxy for B_{lim} of 15% of the maximum value from survey data may not be appropriate.

Resource Status

The spring survey indices indicate that the resource was at its lowest levels in the mid to late 90s, down from higher levels in the 80s. The general trend in this longer survey series suggests that the stock showed some slight improvement since then, followed by a period of relative stability. However, the fall survey shows a different pattern in recent years. It is difficult to measure and track recruitment for the resource since there has been no ageing data available for some years. Population abundance at length from surveys in the fall 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, although this is not seen consistently in the length frequency data and is largely speculative without ageing data. There is no sign of above-average recruitment (fish <21 cm) in recent fall survey data.

There are signs of improvement in stock status, notably the increases in fall survey indices in 2008-2010, and to a lesser extent, increases in the Div. 3N spring indices in 2009 and 2010. The Spanish 3NO survey in the NRA also indicated an increase in 2010, but only to levels seen in 2003-04. However, the increased estimates from the survey series generally have wide confidence limits, and cannot be readily explained from data on recruitment and length frequencies. Catch/biomass ratio (as a proxy for fishing mortality) remains relatively low, increasing slightly in recent years with the increased catch.

References

Bowering, W.R. and W.B. Brodie. 1991. Distribution of commercial flatfishes in the Newfoundland-Labrador region of the Canadian Northwest Atlantic and changes in certain biological parameters since exploitation. Netherlands J. Sea Res. 27(3/4): 407-422.

Bowering, W. R. and D. Orr. 1996. Distribution and trends in stock size of witch flounder in NAFO Divisions 3NO. NAFO SCR Doc. 96/70.

Dwyer, K. 2008. An assessment of witch flounder in NAFO Divisions 3NO. NAFO SCR Doc. 08/39.

González-Costas, F.[1], D. González-Troncoso[1] , G. Ramilo[1], E. Román[1] , J. Lorenzo[1], M. Casas[1], C. Gonzalez[1], A. Vázquez [2], and M. Sacau[1]. 2011. Spanish Research Report for 2010. NAFO SCS Doc. 11/07, Ser. No. N5884.

González-Troncoso, Diana, Concepción González and Xabier Paz. 2011. Yellowtail flounder, redfish (*Sebastes spp*) and Witch flounder indices from the Spanish Survey conducted in Divisions 3NO of the NAFO Regulatory Area. NAFO SCR Doc.11/06, Ser. No. N5886.

Maddock Parsons, D. 2011. Witch Flounder, American Plaice and Yellowtail Flounder in Canadian Spring and Autumn Surveys: Time Series Stock Distribution Maps. NAFO SCR Doc.11/37, Ser. No. N5922.

Prager, M.H. 1994. A suite of extensions to a nonequilibrium surplus-production model. Fish. Bull. 92: 374-389.

Prager, M.H. 1995. Users manual for ASPIC: a stock-production model incorporating covariates. SEFSC Miami Lab Doc. MIA-92/93-55.

Skryabin, I.A, and M.V. Pochtar. 2011. Russian Research Report for 2010. NAFO SCS Doc.11/11, Ser. No. N5902.

Vargas, J., R. Alpoim, E. Santos and A. M. Ávila de Melo. 2011. Portuguese Research Report for 2010. NAFO SCS Doc. 11/05, Ser. No. N5881.

Table 1. Catches and TACs (t) of Witch Flounder in Div. 3NO from 1960-2010.

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	46	17	201	264	0
2009	41	22	313	376	0
2010	39	28	354	421	0
2011					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 estimates

Table 2. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2010. (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	08	09	10
<=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	0	21	0
	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	0	0	0
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	85	0	395
	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	18	72	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	0	0	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	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	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	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	0	593	719
	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	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	0	0	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	68	237	156
	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	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	13	18	0
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	0	4	31
	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	0	7	12
	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	5	0	0
367 - 549	155	155	723								90	102	79	36	51	16	25	53	33	36	23	130	60	34	108		50	82	13	137
	105	105	725								62		40	44	0	5	28	4	20	32	8	3	7	0	103		15	3	36	4
	160	160	727								0	5	38	17	0	0	3	9	13	12	3	0	0	23	41		11	27	0	14
550 - 731	124	124	724								327	181	218	51	36	29	157	53	105	106	127	96	101	54	65		207		146	82
	72	72	726								81	25	22	28	3	12	42	96	59	65	84	18	50	21	8		19	25	41	105
	156	156	728								92	19	82	22	152	21		15	32	45	98	43	53	75	42		34	175	748	164
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	502	1936	1818
Biomass >366 m											652	333	480	284	242	84	255	230	262	296	343	289	272	207	366		335	313	984	505
Percent >366 m											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		23.2	62.4	50.8	27.8

Table 3. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2010. (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	08	09	10
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	278	0	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	425	1124	17
	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	450	990	769
	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	0	182	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	65	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	555	102	562
	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	529	172	299
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	215	983	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	3188	2005	1669
	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	1211	563	630
	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	37	284	2
	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	1148	430	147
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	9	32	20
	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	61	16	16
	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	34	67	44
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	5	14	6
	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	1	4	3
	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	6	6	5
367 - 549	93	166	717								11	120	35	2375	53	465	4353	44	19	17	41	201	142	5	17		10	12	55	12
	76	76	719								148	1024	49	14	18	137	601	15	16	25	12	95	39	3	14		15	11	6	7
	76	76	721								76	48	31	72	18	16	19	38	37	28	85	38	26	9	4		10	11	25	11
550 - 731	111	134	718								35	29	104	221	80	71	37	33	38	15	57	55	43	13	13		20	43	157	22
	105	105	720								217	134	182	95	15	21	150	32	21	40	38	7	23	9	69		9	9	9	9
	93	93	722								18	49	150	217	206	89	87	31	71	47	121	62	64	12	27		11	21	17	15
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	8323	7243	4821
Biomass >366 m											504	1405	550	3128	390	800	5247	192	201	172	354	459	336	51	144		75	107	268	75
Percent >366 m											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		1.3	1.3	3.7	1.6

Table 4. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2010. (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	08	09	10
<=56	1593	1593	375	0	73		0	0	0	0	0	0	0	0	0	35	0	0	0	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	0	67	0
57 - 92	2992	2992	360	265	171	1297	173	75	888	23	427	431	177	535	326	520	586	836	2364	100	0	4788	10335	1627
	1853	1853	361	28	467	463	0	32	0	0	14	0	268	28	170	148	99	0	168	38	584	25	0	410
	2520	2520	362	400	221	87	0	0	0	0	0	0	32	0	0	0	136	0	0	40	0	0	46	192
	2520	2520	373	0	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	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	25	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	442	1080	288
	100	100	377	0		0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	31
	647	647	382	0	0	0	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	141	86	83
	139	139	378	0	41	15	0	0	0	0	1	0	0	0	3	5	0	0	0	93	4	7	4	
	182	182	381		0		0	0	0	0	1	0	0	0	7	0	0	0	0	0	0	0	3	0
275 - 366	164	164	357	0	234	9	187	43	85	0	27	0		52	18	21	41	27	37	103	59	90	17	39
	106	106	379	4		4	0	0	0	1	7	0	0	2	111	33	8	867	0	3	0	156	13	29
	116	116	380		0		0	0	0	0	0	1	2	5	0	0	0	9	11	0	0	0	0	0
367 - 549	155	155	723		41		163	180	57	15	28	74	27	28	66	16	123	20	98	38	17	98	93	27
	105	105	725			15	376	46	19	0	135	10	33	19	7	5	10		7	7	11	21	40	
	160	160	727				0	38	0	0	29	7	4	0	10	0	0	7	21	0	0	143	82	21
550 - 731	124	124	724		172		414	180	104	60	197	72	181	87	70	90		70	95	206	127	455	204	117
	72	72	726				310	54	48	40	21	38	34	16	22	59	52	32	19	49	45	42	105	6
	156	156	728					153	35	21	76	78	106	153	103	286	178	93	19	122	191	269	404	434
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		221	
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		102	
1098 -1280	.	180	754									0		0	0	0					0			0
	.	99	758									0		0	0	0			0		0			
	.	212	762											0	109	0			15		28		40	
1281 -1463	.	385	755									0		0	0	0					0			
	.	127	759									0		0	2	0			0		0			
	.	261	763											19	5	10			0		0		3	
Grand Total				696	1441	2235	1647	808	1346	160	993	2333	884	1244	1435	1511	1516	2122	3221	1093	1475	6703	12986	3306
Biomass >366 m					213	15	1263	651	263	137	485	657	385	582	634	669	363	222	491	423	609	1029	1294	606
Percent >366 m					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	15.4	10.0	18.3
Percent >731 m												16.2		22.5	24.8	14.1			7.2		14.8		2.8	

Table 5. Estimated Biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2010. (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	08	09	10
57 - 92	2089	2089	330	122	67	79	0	0	247	0	72	168	208	48	284	342	438	74	312	383	362	508	1087	344
	456	456	331	22	315	134	0	0	108	0	0	256	946	243	468	775	306	14	394	108	144	114	564	1219
	1898	1898	338	2226	438	837	3966	2193	4684	503	1329	483	2736	375	943	976	2666	3899	1931	604	543	1407	2044	5483
	1716	1716	340	173	280	63	0	0	204	0	22	0	415	104	172	123	57	28	116	654	1	494	116	81
	2520	2520	351	1690	284	72	0	0	0	0	0	37	205	0	172	0	25	35	54	369	158	165	28	75
	2580	2580	352	1415	896	1352	946	228	379	273	573	374	1491	920	430	789	964	3377	1663	1109	558	1409	5915	2305
	1282	1282	353	2405	343	477	0	732	538	789	168	1066	2996	2379	1360	1490	1204	2657	3710	1587	1121	1431	8037	8234
93 - 183	1721	1721	329	99	85	0	18	0	417	0	173	305	0	0	282	732	97	484	250	2974	0	4484	1977	171
	1047	1047	332	2102	155	1724	813	321	1114	4569	190	245	1664	544	343	1155	807	1512	2061	3887	708	2453	500	1393
	948	948	337	1333	188	954	563	2132	421	492	322	479	978	344	67	211	352	114	1721	190	576	1592	352	989
	585	585	339	1132	224	651	119	742	1911	0	481	261		344	338	1927	457	3755	1854	1070	1060	1147	2405	2693
	474	474	354	1291	23	316	75	210	191	4647	215	201	103	766	258	470	967	438	316	505	694	306	1320	544
184 - 274	151	147	333	221	11	22	30	92	26		4	6	33	4	20	17	48	0	3	24	3	2	5	6
	121	121	336	82	151	76	298	13	35	32	19	19	67	31	37	23	10	5	35	3	53	142		22
	103	103	355		497	93	120	25	16	343	6	14	110	35	5	6	6	21	2	5	17	72	23	20
275 - 366	92	96	334	24	16	0	9	17	4		5	1	7	5	14	9	8	0	16	0	0	0	10	2
	58	58	335	194	25	25	30	18	1	23	0	1	23	8	3	9	1	5	3	3	1	6	0	0
	61	61	356		11	7	430	98	7	60	3	4	32	22	7	3	6	2	7	0	0	0	10	1
367 - 549	93	166	717	30			0	32	37		12	42	260	0	13	11	54	9	2	14	9	102	40	14
	76	76	719	110	2		65	6	1	226	19	9	10	14	29	6	15	3	6	10	4	8	16	4
	76	76	721		18		169	67	21	54	6	14	67	17	2	14	17	2	15	3	30	11	1	7
550 - 731	111	134	718				22	68	8		68	47	53	34	50	54	161	48	130		68	162	80	110
	105	105	720				73	0	13	68		2	17	4	83	26	31	10	39	1	1	12	1	4
	93	93	722		9		81	21	14	39	12	12	26	8	15	5	7	14	29	8	9	11	15	11
732 - 914	.	105	764									75		12	21	36			4		11		41	
	.	99	768									18		7	18	38			4		1		5	
	.	135	772									173		62		49	29		50		22		26	
915 -1097	.	124	765									24		3	20	55			10		11		25	
	.	138	769									17		5	28	59			20		16		26	
	.	128	773									4		13	32	89	12		8		10		5	
1098 -1280	.	144	766											24	2	37			57		24		29	
	.	128	770											4	23	67			13		16		2	
	.	135	774											4	31	15	27		43		4		0	
1281 -1463	.	158	767											15	0	0			0		3		2	
	.	175	771											0	17	0			10		0		0	
	.	155	775											0	0	0	28		21		3		13	
Grand Total				14671	4036	6884	7827	7013	10397	12117	3698	4356	12446	6396	5586	9619	8798	16510	14911	13512	6240	16042	24721	23733
Biomass >366 m				140	29	0	410	193	95	386	116	436	433	224	384	562	381	87	460	35	241	306	328	150
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	1.9	1.3	0.6
Percent >731 m												7.2		2.3	3.4	4.6	1.1		1.6		1.9		0.7	

Table 6. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2010. (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	08	09	10
<=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	0	44	0
	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	0	0	0
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	103	0	823
	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	51	85	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	0	0	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	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	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	0	46	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	0	1448	1953
	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	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	0	0	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	151	542	303
	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	0	0	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	25	33	0
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	0	23	98
	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	0	7	29
	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	7	0	0
367 - 549	155	155	723								288	341	256	53	181	45	51	149	96	171	88	322	152	96	313		107	245	33	364
	105	105	725								166		101	87	0	13	235	26	51	72	19	6	17	0	264		40	10	110	13
	160	160	727								0	11	55	22	0	0	11	33	33	21	10	0	0	31	68		31	73	0	20
550 - 731	124	124	724								1134	580	597	188	119	128	432	144	550	500	516	267	283	145	171		645		407	262
	72	72	726								213	59	30	114	5	33	183	322	213	198	346	65	134	63	18		59	73	112	238
	156	156	728								182	21	139	29	172	134		64	158	145	258	136	143	161	64		70	319	1409	383
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	1057	4299	4484
Total >366 m											1984	1013	1178	712	477	353	913	738	1100	1107	1236	797	728	496	898		952	719	2071	1279
Percent >366 m											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		35.3	68.1	48.2	28.5

Table 7. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2010. (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	08	09	10
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	411	0	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	1129	2478	63
	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	870	1915	1480
	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	0	330	0
	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	87	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	843	152	1020
	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	1058	309	573
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	710	2320	1357
	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	12866	8652	6273
	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	3912	2434	2536
	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	322	1609	80
	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	2282	1043	406
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	72	253	117
	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	275	214	158
	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	85	173	120
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	33	132	71
	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	7	18	30
	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	15	24	20
367 - 549	93	166	717								32	371	166	5960	228	1362	11566	710	237	162	273	651	468	46	181		91	117	682	167
	76	76	719								288	2535	267	37	42	364	1161	150	112	228	97	268	89	19	131		81	80	28	28
	76	76	721								235	209	94	193	42	42	63	214	152	112	204	139	84	31	19		60	56	251	26
550 - 731	111	134	718								282	122	512	1161	535	518	507	517	324	138	525	1189	578	66	177		240	357	2050	345
	105	105	720								361	376	1026	498	43	101	518	186	104	351	309	50	104	41	765		62	75	72	75
	93	93	722								45	166	512	518	601	274	819	177	364	207	361	198	210	53	154		176	133	96	106
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	25796	25236	15051
Total >366 m											1243	3779	2576	9086	1491	2661	14634	1954	1293	1198	1769	2495	1533	255	1425		711	819	3179	747
Percent >366 m											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		4.6	3.2	12.6	5.0

Table 8. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2010. (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	08	09	10
<=56	1593	1593	375	0	55		0	0	0	0	0	0	0	0	0	55	0	0	0	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	0	69	0
57 - 92	2992	2992	360	382	206	1646	320	103	1232	41	672	755	360	926	514	1080	1022	1132	4888	154	0	9290	17639	3224
	1853	1853	361	32	425	701	0	42	0	0	23	0	306	51	204	255	102	0	211	51	1020	85	0	561
	2520	2520	362	441	277	116	0	0	0	0	0	0	50	0	0	0	198	0	0	50	0	0	58	297
	2520	2520	373	0	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	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	46	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	1216	2635	869
	100	100	377	0		0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	44
	647	647	382	0	0	0	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	230	190	174
	139	139	378	0	105	19	0	0	0	0	8	10	0	0	8	10	0	0	0	200	9	19	8	
	182	182	381		0		0	0	0	0	7	13	0	0	11	0	0	0	0	0	0	0	11	0
275 - 366	164	164	357	0	384	23	338	135	180	0	60	0		124	33	20	102	34	98	242	116	259	29	72
	106	106	379	7		15	0	0	0	19	22	0	0	6	296	91	26	1915	13	6	15	350	24	81
	116	116	380		0		0	0	0	0	0	8	8	24	0	0	0	16	24	0	0	0	0	0
367 - 549	155	155	723		53		330	394	117	21	88	313	85	104	190	57	347	43	299	72	38	227	239	94
	105	105	725			36	701	173	49	0	237	29	101	71	22	14	29		21	15	32	58	91	
	160	160	727				0	44	11	0	55	11	11	0	13	0	11	11	59	0	0	307	163	66
550 - 731	124	124	724		443		1126	512	223	178	571	326	640	337	264	270		177	247	629	384	1651	771	381
	72	72	726				669	114	119	99	40	92	125	40	37	176	129	84	42	106	125	102	91	20
	156	156	728					268	195	129	212	215	311	417	223	633	351	161	73	204	343	428	303	860
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		618	
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		277	
1098 -128	.	180	754									0		0	0	12					0			0
	.	99	758									0		0	0	8			0		0			
	.	212	762											0	483	0			58		97		204	
1281 -146	.	385	755									0		0	0	0					0			
	.	127	759									0		0	9	0			0		0			
	.	261	763											72	18	88			0		0		18	
Grand Total				863	1995	3272	3515	1793	2470	488	2046	5355	2073	3233	3756	3717	2912	3806	7017	2126	3289	14269	23473	6742
Total >366 m					497	36	2825	1506	714	427	1203	1755	1274	2033	2148	2032	866	475	1446	1026	1575	2773	2775	1421
Percent >366 m					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	19.4	11.8	21.1
Percent >731 m												14.4		32.9	37.2	23.7			10.0		19.9		4.8	

Table 9. Abundance (000s) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2010. (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	08	09	10
57 - 92	2089	2089	330	131	144	72	0	0	517	0	96	335	383	192	575	588	766	123	479	718	671	1149	2062	899
	456	456	331	42	502	125	0	0	408	0	0	596	4799	533	1066	1850	1004	31	1098	345	439	345	1296	3907
	1898	1898	338	3264	627	1436	6893	4700	8459	522	2872	1723	7572	609	1984	2245	6893	11652	4774	1567	1044	3220	5817	13606
	1716	1716	340	262	330	118	0	0	295	0	47	0	1652	189	378	189	94	47	243	1416	47	1014	320	140
	2520	2520	351	1837	347	58	0	0	0	0	0	50	347	0	198	0	50	50	99	495	297	231	99	154
	2580	2580	352	1597	1242	2011	1115	355	371	355	1141	754	1825	1668	1065	1448	2296	6584	2484	1787	811	2419	11915	3712
	1282	1282	353	2822	485	941	0	1176	999	882	573	5467	5996	6172	2954	9523	3395	5291	6525	3357	1950	2469	16690	17768
93 - 183	1721	1721	329	132	101	0	47	0	663	0	616	852	0	0	805	1989	379	703	710	8181	0	10750	6155	300
	1047	1047	332	3625	396	5281	2064	960	5233	11954	1248	2544	7393	3249	1392	4342	3738	6145	8381	13093	2939	8910	2603	5770
	948	948	337	2347	424	2347	1043	5216	1434	717	1130	1613	3738	1623	348	714	1434	397	5067	696	1956	3775	1546	4482
	585	585	339	1556	241	724	121	966	2776	0	1086	356		3943	563	3822	684	7559	4507	2374	4064	2070	4529	5754
	474	474	354	1891	33	685	359	424	489	8955	489	782	391	2478	630	1415	1989	1150	978	1206	2195	663	4492	1992
184 - 274	151	147	333	582	52	83	62	312	187		192	147	152	27	118	90	243	30	51	153	81	108	27	54
	121	121	336	222	466	216	633	42	549	208	100	215	300	141	150	58	75	50	300	150	422	518		72
	103	103	355		1459	298	425	85	63	768	28	170	411	85	21	28	21	92	35	27	50	246	94	64
275 - 366	92	96	334	76	70	0	21	57	56		33	20	58	18	36	35	53	65	122	0	7	0	24	18
	58	58	335	371	100	112	68	52	64	64	4	40	48	37	8	39	12	18	7	24	18	18	0	11
	61	61	356		25	8	1254	252	40	113	13	34	75	55	19	17	34	31	45	0	7	0	37	4
367 - 549	93	166	717	122			0	96	703		46	833	2166	0	91	203	351	117	10	93	41	1214	360	100
	76	76	719	209	42		277	10	52	612	183	178	99	75	183	37	96	96	78	95	14	41	167	50
	76	76	721		47		444	183	102	131	17	125	311	98	10	84	81	11	135	9	273	68	19	62
550 - 731	111	134	718				107	428	164		535	618	581	396	488	1432	1483	575	1040		479	2013	959	1039
	105	105	720				339	0	105	316		29	202	39	762	298	302	206	336	6	6	141	7	14
	93	93	722		26		243	58	64	134	51	103	122	70	94	34	50	90	199	51	61	117	89	65
732 - 914	.	105	764									357		72	144	217			29		72		355	
	.	99	768									217		24	163	374			34		6		34	
	.	135	772									1514		669		383	190		390		111		162	
915 -1097	.	124	765									165		31	119	289			77		64		157	
	.	138	769									180		38	237	380			142		133		218	
	.	128	773									35		136	346	708	94		62		79		37	
1098 -128	.	144	766											113	11	146			307		158		188	
	.	128	770											36	185	460			88		132		18	
	.	135	774											28	241	119	244		297		35		0	
1281 -146	.	158	767											65	0	0			0		10		12	
	.	175	771											0	132	0			60		0		0	
	.	155	775											0	0	0	213		107		28		96	
Grand Total				21086	7158	14515	15517	15369	23795	25731	10499	20054	38620	22908	15520	33557	26262	41114	39294	35843	18702	41498	60585	60036
Biomass >366 m				331	114	0	1411	774	1191	1193	831	4354	3480	1890	3210	5163	3103	1095	3390	254	1704	3593	2879	1331
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	8.7	4.8	2.2
Percent >731 m												12.3		5.3	10.2	9.2	2.8		4.1		4.4		2.1	

Table 10. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2010. (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	08	09	10
<=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	0.00	0.20	0.00
	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	0.00	0.00	0.00
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	0.25	0.00	2.00
	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	0.20	0.33	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	0.00	0.00	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	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	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	0.00	0.50	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	0.00	25.00	33.71
	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	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	0.00	0.00	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	4.89	17.50	9.78
	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	0.00	0.00	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	1.00	1.33	0.00
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	0.00	1.00	4.33
	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	0.00	0.50	29.16
	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	0.44	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	11.49	1.56	17.06
	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	0.67	7.60	0.90
	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	3.33	0.00	0.89
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		23.87	15.36
	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	7.33	11.36	24.00
	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	14.86	65.65	17.83
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	0.44	1.79	1.87

Table 11. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2010. (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	08	09	10
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	1.42	0.00	3.13
	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	18.00	39.50	62.28
	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	3.33	7.33	52.11
	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	0.00	1.40	0.59
	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	0.25	0.00	0.44
	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	2.38	0.43	10.46
	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	6.00	1.75	100.75
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	3.00	9.80	1.27
	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	89.33	60.07	40.06
	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	30.00	18.67	34.37
	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	4.00	20.00	71.50
	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	35.00	16.00	30.56
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	3.56	12.50	2.67
	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	16.50	12.83	4.33
	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	6.00	12.22	4.50
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	2.50	10.00	1.33
	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	0.89	2.28	1.33
	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	1.78	2.89	0.44
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	5.14	29.87	4.39
	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	7.67	2.67	4.80
	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	5.39	24.00	5.94
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	19.36	111.24	56.34
	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	5.21	5.00	1.00
	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	10.39	7.50	5.11
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	10.11	9.89	23.52

Table 12. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2010. (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	08	09	10
<=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	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	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	22.57	42.86	7.83
	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	0.33	0.00	2.20
	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	0.00	0.17	0.86
	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	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	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	0.50	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	21.00	45.50	15.00
	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	0.00	34.39	3.22
	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	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	7.44	6.14	5.61
	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	1.00	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	0.00	0.44	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	11.50	1.29	3.20
	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	24.00	1.64	5.52
	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	0.00	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	10.67	11.20	4.40
	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	4.00	6.29	
	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	13.94	7.42	3.00
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	96.76	45.20	22.36
	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	10.33	30.60	2.00
	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	19.94	41.60	40.06
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		29.17	
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		11.79	
1098 -128	.	180	754									0.00		0.00	0.00	0.50					0.00			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		7.00	
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		0.50	
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	5.94	9.67	2.82

Table 13. Mean numbers per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2010. (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	08	09	10
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	4.00	7.17	3.13
	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	5.50	20.67	62.28
	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	12.33	22.28	52.11
	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	4.30	1.36	0.59
	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	0.67	0.29	0.44
	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	6.81	33.57	10.46
	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	14.00	94.68	100.75
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	45.41	26.00	1.27
	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	61.87	18.07	40.06
	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	28.94	11.85	34.37
	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	25.72	56.29	71.50
	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	10.17	68.89	30.56
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	5.33	1.33	2.67
	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	31.11		4.33
	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	17.33	6.67	4.50
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	0.00	1.83	1.33
	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	2.22	0.00	1.33
	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	0.00	4.40	0.44
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	53.14	15.78	4.39
	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	3.94	16.00	4.80
	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	6.50	1.77	5.94
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	109.20	52.00	56.34
	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	9.78	0.50	1.00
	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	9.11	6.98	5.11
732 - 914	.	105	764									24.71		5.00	10.00	15.00			2.00		5.00		24.57	
	.	99	768									15.94		1.78	12.00	27.43			2.50		0.44		2.50	
	.	135	772									81.50		36.00		20.63	10.22		21.00		6.00		8.72	
915 -1097	.	124	765									9.67		1.83	7.00	16.93			4.50		3.78		9.22	
	.	138	769									9.50		2.00	12.50	20.00			7.50		7.00		11.50	
	.	128	773									2.00		7.71	19.67	40.20	5.35		3.50		4.50		2.10	
1098 -128	.	144	766											5.71	0.57	7.39			15.50		8.00		9.50	
	.	128	770											2.07	10.50	26.14			5.00		7.50		1.00	
	.	135	774											1.50	13.00	6.43	13.14		16.00		1.89		0.00	
1281 -146	.	158	767											3.00	0.00	0.00			0.00		0.44		0.57	
	.	175	771											0.00	5.50	0.00			2.50		0.00		0.00	
	.	155	775											0.00	0.00	0.00	10.00		5.00		1.33		4.50	
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	16.26	21.96	23.52

Table 14. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2010. (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	08	09	10
<=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		0.10	0.00
	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	0.00	0.00	0.00
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	0.21	0.00	0.96
	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	0.07	0.28	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	0.00	0.00	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	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	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	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	0.00	10.23	12.42
	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	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	0.00	0.00	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	2.20	7.67	5.03
	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	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	0.50	0.71	0.00
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	0.00	0.19	1.36
	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	0.00	0.45	0.85
	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	0.33	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	3.87	0.62	6.43
	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	0.23	2.51	0.27
	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	1.23	0.00	0.64
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		8.55	4.78
	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	2.49	4.14	10.59
	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	8.17	34.83	7.64
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	0.21	0.81	0.76

Table 15. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2010. (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	08	09	10
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	0.97	0.00	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	6.77	17.93	0.26
	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	1.73	3.79	2.94
	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	0.00	0.77	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	0.19	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	1.56	0.29	1.58
	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	3.00	0.98	1.70
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	0.91	4.15	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	22.13	13.92	11.59
	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	9.28	4.32	4.83
	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	0.47	3.53	0.03
	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	17.60	6.60	2.25
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	0.47	1.58	0.97
	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	3.65	0.96	0.94
	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	2.42	4.72	3.12
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	0.35	1.06	0.49
	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	0.12	0.52	0.34
	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	0.69	0.69	0.57
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	0.53	2.40	0.54
	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	1.07	0.53	0.65
	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	1.01	2.35	1.03
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	2.34	8.50	1.17
	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	0.62	0.60	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	1.62	1.36	1.16
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	3.26	2.82	1.89

Table 16. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2010. (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	08	09	10
<=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	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	0.00	0.33	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	11.63	25.11	3.95
	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	0.10	0.00	1.61
	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	0.00	0.13	0.55
	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	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	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	0.28	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	7.63	18.65	4.97
	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	0.00	2.86	2.29
	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	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	4.54	2.78	2.68
	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	0.38	22.00	
	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	0.00	0.14	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	3.98	0.77	1.75
	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	10.70	0.88	2.01
	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	0.00	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	4.60	4.34	1.29
	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	1.48	2.75	
	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	6.51	3.71	0.96
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	26.69	11.97	6.85
	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	4.24	10.63	0.63
	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	12.56	18.84	20.20
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		10.44	
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		4.33	
1098 -128	.	180	754									0.00		0.00	0.00	0.01					0.00			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		1.38	
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		0.09	
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	2.79	5.17	1.38

Table 17. Mean weights (kg) per tow for Witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2010. (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	08	09	10
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	1.77	3.78	1.20
	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	1.82	8.99	19.43
	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	5.39	7.86	21.00
	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	2.09	0.49	0.34
	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	0.48	0.08	0.22
	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	3.97	16.67	6.50
	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	8.12	45.57	46.69
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	18.94	8.35	0.72
	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	17.03	3.47	9.67
	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	12.21	2.70	7.59
	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	14.26	29.88	33.47
	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	4.69	20.24	8.34
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	0.10	0.25	0.32
	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	8.54		1.34
	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	5.10	1.61	1.42
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	0.00	0.76	0.18
	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	0.72	0.00	0.02
	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	0.00	1.14	0.07
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	4.45	1.76	0.59
	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	0.79	1.52	0.40
	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	1.05	0.09	0.67
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	8.78	4.36	5.98
	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	0.82	0.08	0.26
	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	1.32	1.16	0.87
732 - 914	.	105	764									5.21		0.80	1.43	2.50			0.26		0.79		2.81	
	.	99	768									1.34		0.49	1.35	2.80			0.27		0.06		0.38	
	.	135	772									9.29		3.33		2.65	1.54		2.68		1.19		1.41	
915 -1097	.	124	765									1.40		0.21	1.18	3.25			0.59		0.65		1.48	
	.	138	769									0.92		0.26	1.45	3.13			1.08		0.83		1.39	
	.	128	773									0.23		0.73	1.80	5.08	0.71		0.45		0.55		0.27	
1098 -128	.	144	766											1.21	0.13	1.85			2.90		1.23		1.48	
	.	128	770											0.23	1.29	3.79			0.73		0.90		0.13	
	.	135	774											0.22	1.65	0.83	1.46		2.33		0.21		0.00	
1281 -146	.	158	767											0.68	0.00	0.00			0.00		0.13		0.11	
	.	175	771											0.00	0.73	0.00			0.41		0.00		0.00	
	.	155	775											0.00	0.00	0.00	1.29		0.98		0.13		0.60	
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	6.29	8.96	9.30

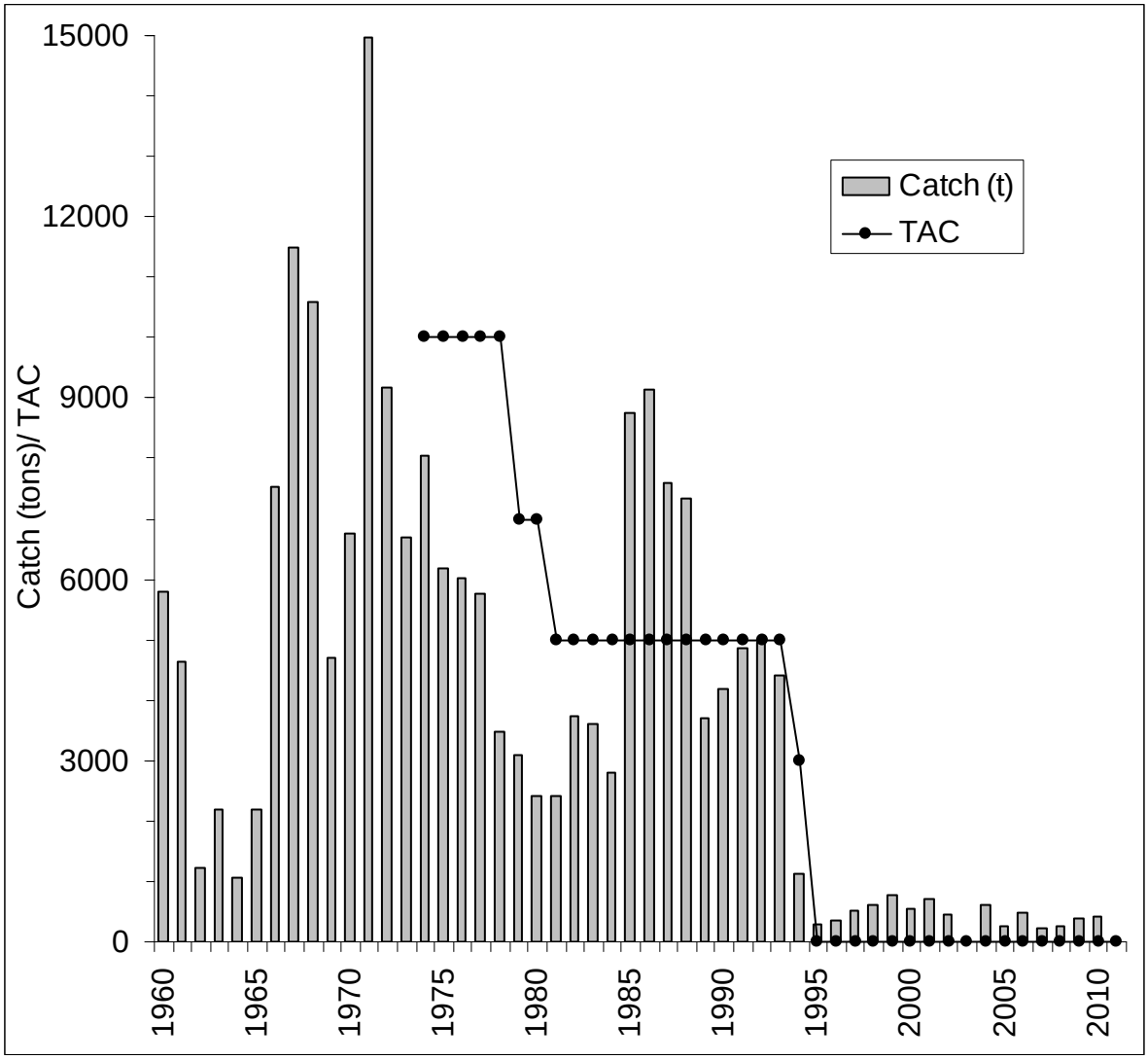

Figure 1. Commercial catches of witch flounder in Div. 3NO from 1960-2010 and TACs from 1974-2011. *Note: Although a TAC of 3000 tons was agreed by the Fisheries Commission for 1994, it was also agreed that no direct fishing on witch flounder in Div. 3NO take place during 1994 due to the poor state of the stock. Estimated catch in 2003 is the mean of a range of catch from several sources.

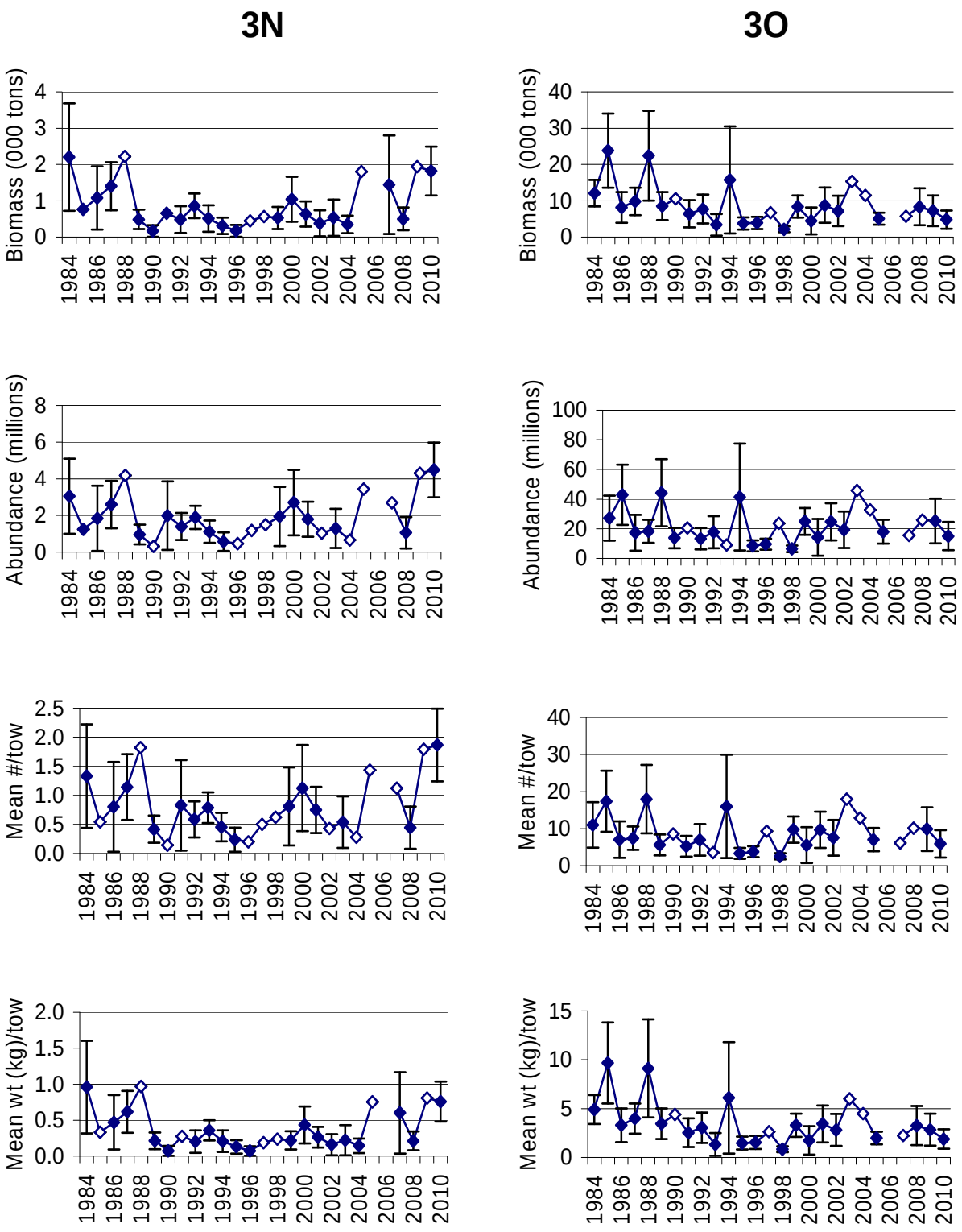

Figure 2. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder from Canadian Spring surveys in Div. 3N and 3O during 1984-2010. Open symbols (with no CI) are points where 95% CI's extend below zero.

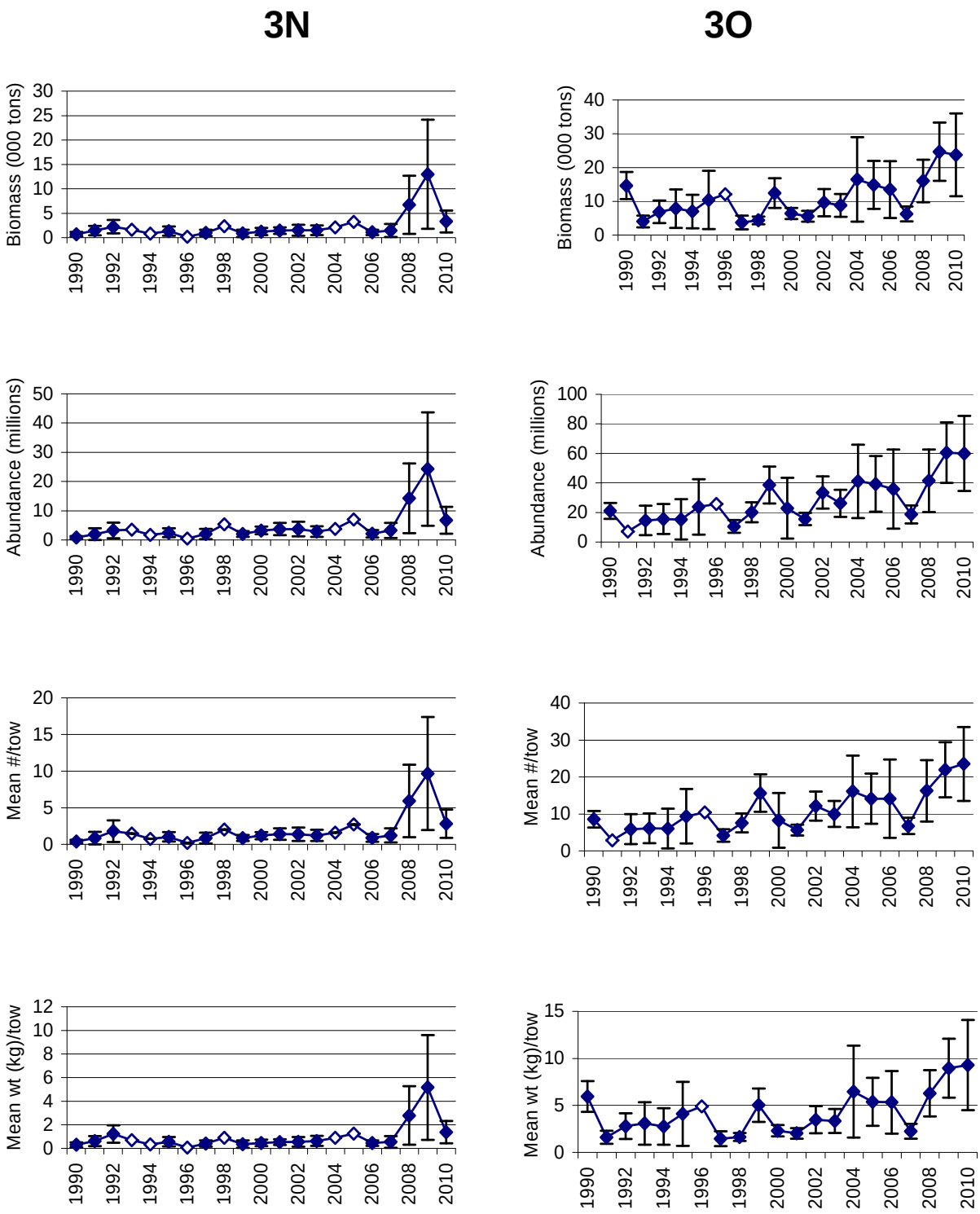

Figure 3. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder from Canadian fall surveys in Div. 3N and 3O during 1990-2010. Open symbols (with no CI) are points where 95% CI's extend below zero.

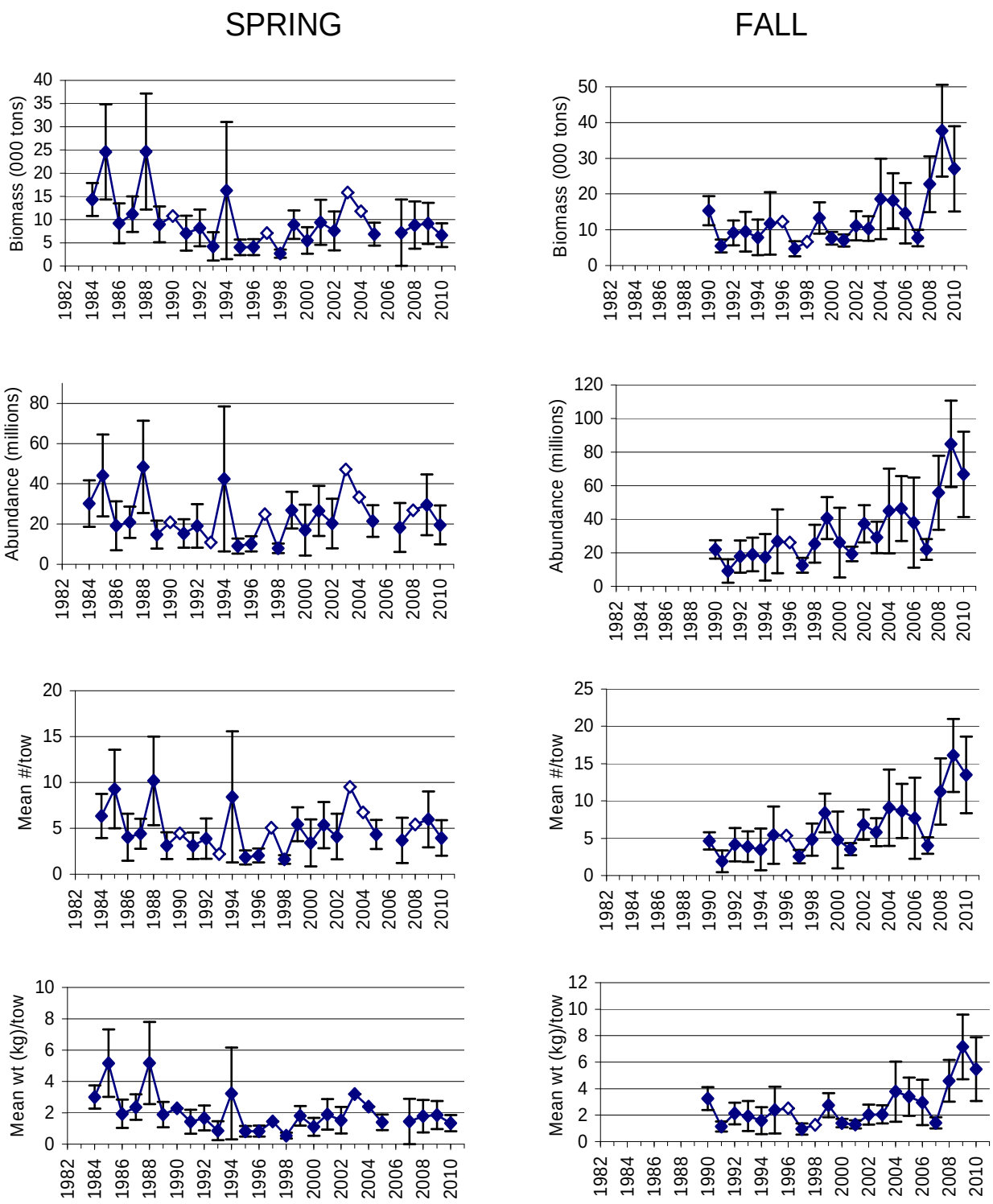

Figure 4. Biomass (tons), abundance (000s), and mean numbers and weights (kg) per tow for witch flounder in Divs. 3NO combined. Open symbols (with no CI) are points where 95% CI's extend below zero.

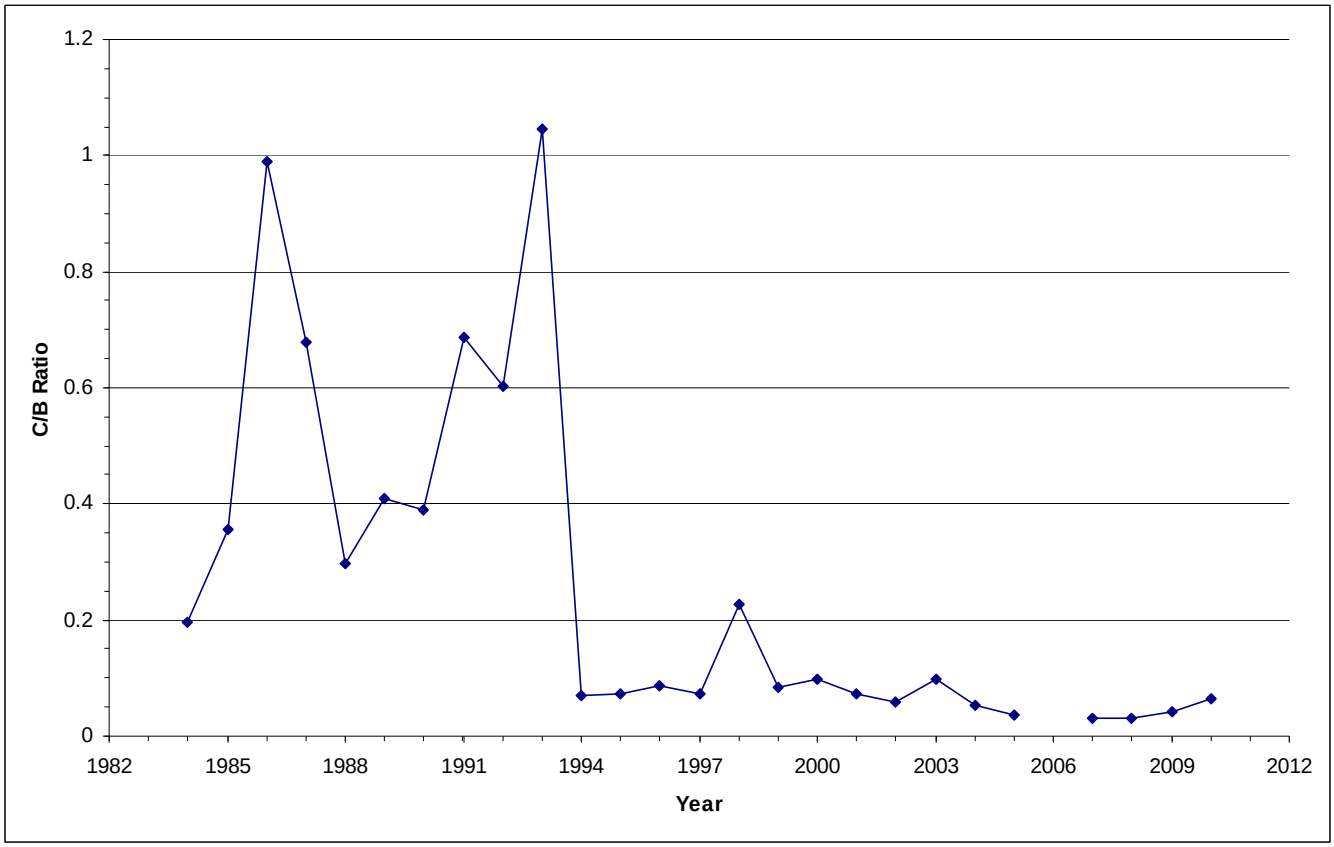

Figure 5. Catch divided by biomass estimates from the Canadian spring survey for 3NO witch flounder 1984-2010.

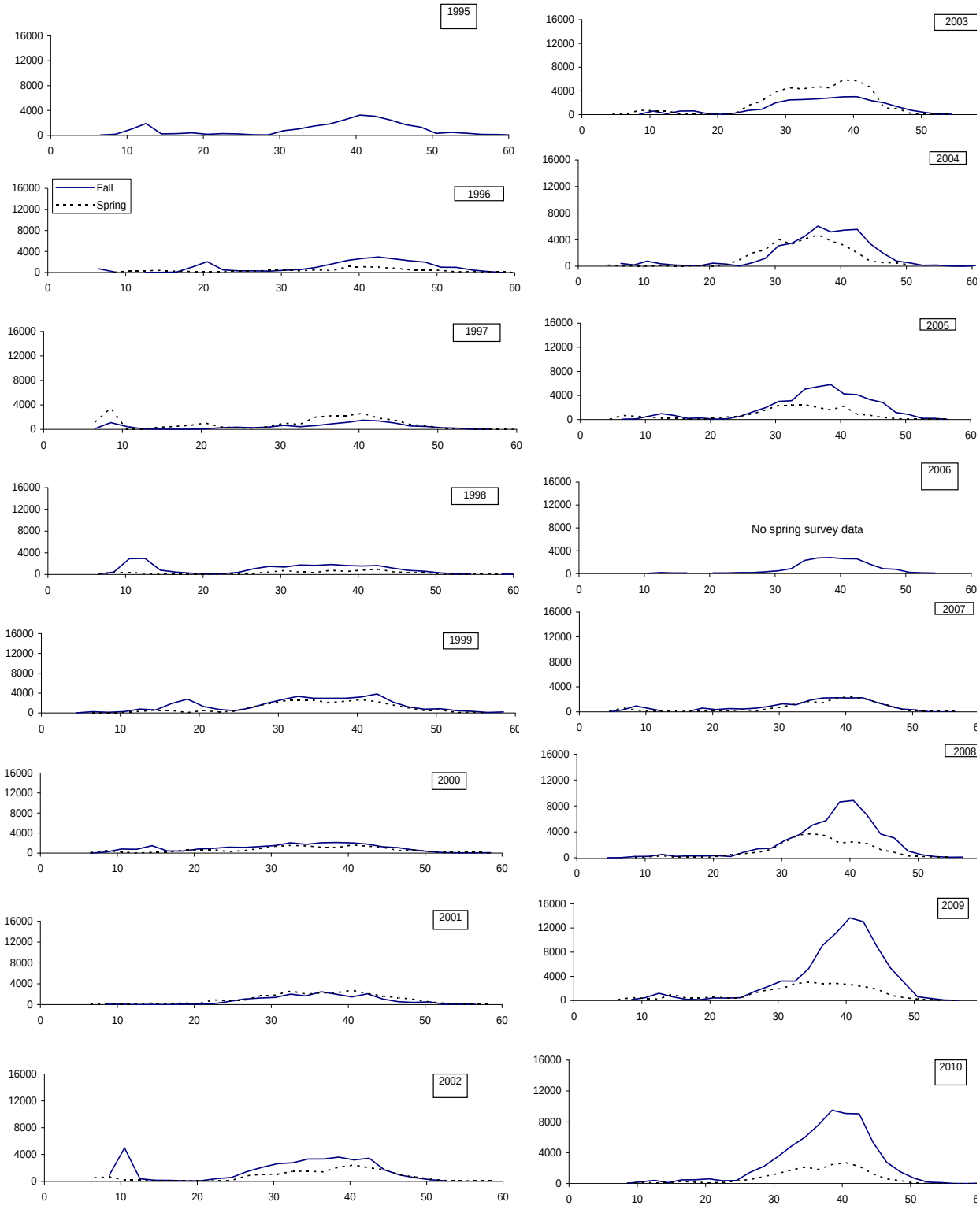

Figure 6. Length frequency distributions of witch flounder from Canadian spring and fall surveys using the Campelen 1800 shrimp trawl. Estimates represent abundance at length (cm) of the surveyed area. All distributions are for 3NO combined.

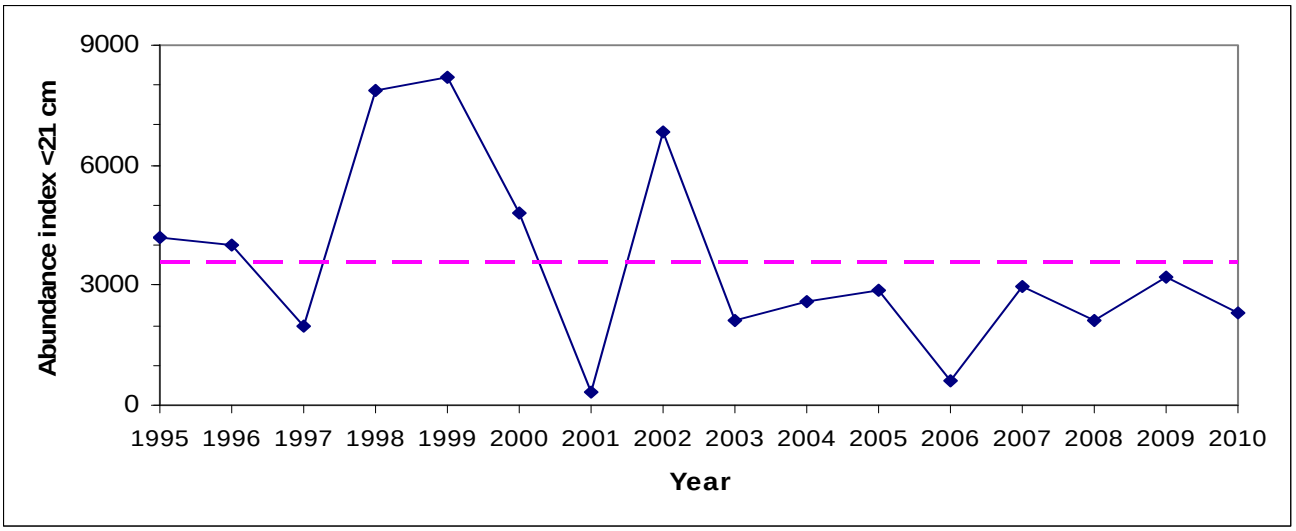

Fig. 7. Abundance index of witch <21 cm in length from fall Campelen surveys in Div. 3NO combined. Dashed line is the mean of the series.

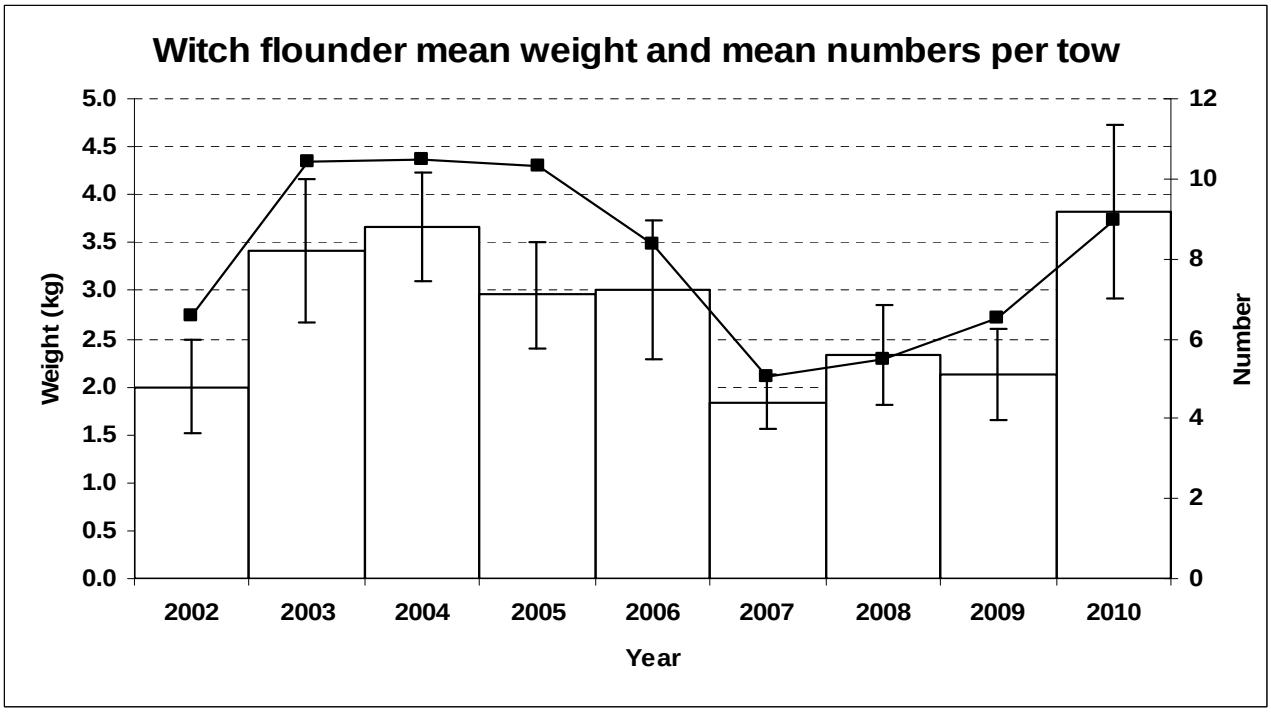

Figure 8. Indices of biomass and abundance from the Spanish Div. 3NO survey for witch flounder. Data are from *Campelen* surveys in the NRA.