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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 Divs. 3NO declined from 1984 to 1996, showed some improvement to 2003-2004 then fluctuated around the long-term mean prior to a sharp increase from 2011 to 2013. The Canadian fall survey series for NAFO Divs. 3NO was less variable with an increasing trend in biomass from about 1997 until 2005, a decline to 2007, then large increases in the 2008-10 estimates, to levels 2-3 times higher than the long-term mean. From 2010 to 2013 there is a decline in values although they are still well above the mean of the time series. Indices from Spanish surveys in the Regulatory Area of Div. 3NO show no clear trend throughout the period 2002 to 2013. Index values peaked in 2004 and 2010 but have declined again since then from 2011-2013.

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 survey seasons across years, and cannot be readily explained from data on recruitment (fish < 21 cm) and length composition. There are no ageing data for this stock since the early 1990's. Recent estimates of recruitment are generally below the time series average. Estimated catches have remained below 500 tons per year since 2005, and catch/biomass ratio (as a proxy for fishing mortality) remains relatively low with a mean of 0.04 since 2004.

Fisheries and Management

As noted in previous reports, most recently Brodie et.al. (2011) and Dwyer (2008), species-specific catch statistics for flatfish prior to 1973 were largely developed from breakdowns of unspecified flounders and therefore should be considered 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). Catch peaked at a time series high of 15,000 tons in 1971 and subsequently declined over the next decade to levels between 2000 and 4000 tons in the early 1980s (Table 1; Fig 1).

The first total allowable catch (TAC) for witch flounder was introduced by ICNAF in 1974 at a level of 10,000 tons, largely based on average historical catches (Table 1; 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 to permit rebuilding due to the poor state of the stock. The Fisheries Commission introduced a complete moratorium for directed fishing in 1995, which has continued through 2014.

Annual catches rose rapidly to around 9,000 tons in 1985 and 1986 as a result of an increase in fishing effort in the NAFO Regulatory Area, primarily on the "tail" of the Grand Bank in Division 3N. Catches remained relatively high in 1987 and 1988 at 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 be 1544 t in 2003 (midpoint of a range of estimates) which declined to about 200 t in 2007, increased to 421 t in 2010 then declined slightly to about 320 t in 2013 (Table 1; Fig. 1).

Historically, the fishery was conducted primarily by Canada and the former Soviet Union. 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; Fig. 1). Canadian catches since the moratorium have averaged 31 t per year. Catches by the USSR/Russian vessels declined from between 1,000 and 2,000 tons in the period 1982-88 and have averaged 29 t per year since the 1994 moratorium. Combined catch from other countries since 1994 has been in the range of 170 (2007) to 1500 t (2003) with an average annual catch of about 330 t (Table 1; Fig. 1). In recent years, most of the estimated catches have been taken as by-catch of directed fisheries for other species in the NRA.

Data from commercial fisheries

Length sampling was available from by-catches in directed fisheries for other species by Spain, Portugal, and Russia in 2013 (Fig. 2). The Spanish data (Gonzalez-Costas et al. 2014), from Div. 3NO G. halibut, redfish and skate fisheries, showed most of the witch flounder catch was between 35 and 49 cm in length, with a peak at 40. In the Portuguese data (Vargas et al. 2014) for Div. 3N (130 mm mesh size) lengths between 36cm and 42cm dominated the catch, with a mode at 40cm (mean length of 35.1 cm). In Div. 3N, with 280 mm mesh size, lengths between 30 cm and 38 cm dominated the catch, with a mode at 34 cm (mean length of 34.9 cm) (Fig. 2). In Div. 3O (130 mm mesh size) the Portuguese catch was dominated by lengths between 28cm and 36cm, with a mode at 32 cm (mean length of 34.6 cm) (Fig. 2). For Russia (Fomin and Khlivnoy 2014), sampling of witch by-catch in Div. 3NO showed the length of witch flounder ranged from 26 to 50 cm. Individuals from 32 to 44 cm in length made up the bulk of catches (Fig. 2).

No data from Canadian by-catches of witch in Div. 3NO were collected from 2011 to 2013.

Research Vessel Surveys

Canadian RV surveys

Stratified-random research vessel surveys have been carried out by Canada on the Grand Bank in NAFO Divs. 3NO during spring since 1971, although during the early period coverage was limited and, in fact, for most years up to 1990, only surveyed depths to 366 meters (Tables 2 and 3). However, since 1991, depth coverage was extended to 731 meters. In 1993 only, spring surveys were completed to a depth of 914 m. During the course of the 2006 Canadian spring survey, operational difficulties lead to incomplete coverage of the survey in Divs. 3NO (Tables 2 and 3). Otherwise, spring surveys in Div. 3N were completed for all strata in all years from 1991 to 2013 to a depth of 731 m except for 1997, 2008, and 2012 which were each missing one stratum (Tables 2 and 3). Spring surveys in Div. 3O were completed for all strata in all years from 1991 to 2013 to a depth of 731 m except for 2011 which was missing one stratum (Tables 2 and 3).

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 (Tables 4 and 5). From fall 1998 the survey depth range in Div. 3N was further extended occasionally from the previous maximum depth range of 731 m to 1463 m (Table 4). Only four fall surveys have covered the Div. 3N deeper strata completely (2000, 2001, 2002, and 2007) or partially (2 missing in 1998, 4 missing in 2005, 8 missing in 2009, and 11 missing in 2010) (Table 4). Fall surveys in Div. 3N were limited to 366 m in 1990, and limited to 731 m from 1991 to 1997, in 1999, 2003, 2004,

and 2008, and from 2010 to 2013 (Table 4). From fall 2000 the survey depth range in Div. 3O was extended occasionally from the previous maximum depth range of 1097 m to 1463 m (Table 5). Only six fall surveys since then have covered the Div. 3O deeper strata completely (2000 to 2002, 2005, 2007, and 2009) or partially (8 missing in 2003) (Table 5). Except for 1990 (549 m) and 1998 (1097 m) Div. 3O fall surveys have primarily been limited to a depth range of 731 m (1991 to 1996, 1999, 2003, 2004, 2006, 2008, and 2010 to 2013) (Table 5).

Beginning with the fall survey in 1995, 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 been converted to Campelen 1800 trawl catch equivalents. Only the converted survey data are presented but some caution should be used in comparing converted Engel data with data from the Campelen trawl series.

Survey Stock Indices 3N and 3O

Biomass (Tables 6-10) and abundance (Tables 10-13) estimates by stratum are presented for the spring and fall surveys in NAFO Divs. 3N and 3O respectively. Mean numbers (Tables 14-17) and weights (Tables 18-21) 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, abundance, and mean numbers/weights per tow by season/year are presented for NAFO Divs. 3N and 3O separately and combined, in Figures 3-5. The time series from 1984 to 2013 indicates that the majority of the stock resides in NAFO Div. 3O, with biomass and abundance estimates up to 10 times the estimates for NAFO Div. 3N during spring surveys and approximately 1.5 to 2.5 times the estimates for NAFO Div. 3N during fall surveys.

Spring stock indices in NAFO Div. 3N indicate a high degree of variability over the time series with a recent upward trend from 2008 to 2011 followed by a sharp decline to 2013 (Fig. 3). Spring stock indices in NAFO Div. 3O indicate a downward trend from 2008 to 2010 followed by a sharp increase to 2013 (Fig. 3). Fall stock indices in NAFO Div. 3N were for the most part consistently low from 1990 to 2006 followed by a sharp increase from 2007 to 2009, a steep decrease from 2010 to 2011, a steep increase in 2012, and a slight decrease in 2013 (Fig. 4). Fall stock indices in NAFO Div. 3O were quite variable from 1990 to 2004 followed by a moderate decline from 2005 to 2007, followed by a sharp increase to 2009, and a fairly consistent moderate decline from 2010 to 2013 (Fig. 5).

Spring Surveys 3N and 3O

Indices of biomass and mean weight per tow derived from spring surveys (which are the longer time series) in NAFO Div. 3N were at fairly low levels from 1988 to 2004 but have generally been higher (except for a sharp decrease in 2008) since then. The highest estimates of biomass (2500 t) and mean weight per tow (1.0 kg) for the 1984-2013 3N-spring time series were observed in 2011 (Fig. 3; Tables 6 and 18). This was followed by a sharp decline in 2012 and 2013 to estimates which, although reduced, were still 2 times the range of the 1989-2004 "low" period and were slightly above the previous highest levels reported in 1984 and 1988 (Fig. 3; Tables 6 and 18). The estimates for abundance and mean number per tow in NAFO Div. 3N were more variable over the time series but also show an increasing trend from 2009 to 2011 followed by a marked decline in 2012 and 2013 (Fig. 3; Tables 10 and 14). The highest estimates of abundance (6 million fish) and mean number per tow (2.5) for the 1984-2013 time series were observed in 2011. In most years of the time series the spring stock size indices in NAFO Div. 3N were estimated to be less than 1000 tons or 2 million fish, (Fig. 3; Tables 10 and 14). However, from 2005 onward, 6 of the 7 surveys in NAFO Div. 3N have produced higher than average index values for biomass and abundance, and the 2009, 2010 and 2011 values for both 3N indices are more than double the time series averages, however, this was followed by a decline in 2012 and 2013 back to levels that are still 1.5-2 times the mean of the time series (Fig. 3; Tables 10 and 14).

For NAFO Div. 3O, where the majority of the stock resides, the indices from the spring surveys are more variable over the time series. Indices of stock size showed considerable annual fluctuations particularly in the 1980s and 1990's where biomass estimates ranged from about 24000 t in 1985 to about 2000 t in 1998 while abundance estimates ranged from about 43 million fish in 1994 to about 7 million fish in 1995 (Fig. 3; Tables 7 and 11). From

2003-2010, there was an overall decline in the spring indices for NAFO Div. 3O. The biomass index in 2010 (5,000 t) is about half the long term mean and the 2010 abundance index (15 million) is about 25% below the long term mean (Fig. 3; Tables 7 and 11). From 2011 to 2013 indices of stock size have indicated a substantial upward trend to levels approaching the previous time series high for biomass and mean weight (kg) per tow in 1985 and 1988 and exceeding the previous time series high for abundance and mean number per tow in 1994 and 2004 (Fig. 3; Tables 11 and 15). In 2013 the highest abundance and mean number per tow estimates of the time series (about 66 million and 26 fish respectively) were encountered (Fig. 3; Tables 11 and 15). In 2013 the second highest estimates of the time series (in comparison to 1984-1985) of biomass (24,000 t) and mean weight per tow (7 kg) were encountered (Fig. 3; Tables 7 and 19). All 2013 spring stock index estimates in NAFO Div. 3O were associated with wide confidence intervals which extended below zero (Fig. 3; Tables 7, 11, 15, and 19).

Fall RV Surveys 3N and 3O

Stock indices means of biomass (3,000 t), mean weight per tow (1 kg), abundance (3 million fish), and mean number per tow (1 fish) derived from the fall surveys in NAFO Div. 3N were consistently low from 1990 to 2007 (Fig. 4; Tables 8, 12, 16, and 20). From 2007 to 2009 there was an increase in stock indices of biomass (24,000 t), mean weight per tow (5 kg), abundance (25 million fish), and mean number per tow (10 fish) to levels 5 to 10 times the mean of the previous time series. In 2010 and 2011, the stock indices in NAFO Div. 3N declined sharply, but were still about 2 times the 1990 to 2007 time series mean. In 2012 stock indices again increased to the highest levels of the time series which were comparable to the levels (5 to 10 times the time series mean) observed from 2007 to 2009. Stock indices in NAFO Div. 3N decreased slightly in 2013 although the indices were still comparable to those of 2009 and 2011 which represented the maximums for the entire time series (Fig. 4; Tables 8, 12, 16, and 20).

Stock indices for the fall surveys in NAFO Div. 3O from 1990 to 2007 exhibited a higher degree of variability over the time series in comparison to fall surveys in NAFO Div. 3N (Fig. 4; Tables 9, 13, 17, and 21). Stock indices from 1990 to 2007 ranged about 2 times above and below the time series means for biomass (10000 t), abundance (23 million fish), mean number per tow (7 fish), and mean weight per tow (3 kg). Stock indices for the fall surveys in NAFO Div. 3N increased sharply from 2008 to 2010 to about 2 to 3 times the highest levels of the time series from previous years for biomass (25000 t), abundance (60 million fish), mean number per tow (24 fish), and mean weight per tow (7 kg). From 2011 to 2013 stock indices indicated a decreasing trend approaching the mean levels of the 1990 to 2007 time series (Fig. 4; Tables 9, 13, 17, and 21).

3NO Combined

For spring surveys in NAFO Divs. 3NO the stock indices trends are primarily driven by the significantly higher (approximately 10 times) overall numbers estimated for NAFO Div. 3O. Overall, the Div. 3NO-combined indices for spring show a decline in biomass and abundance from 1984 to the late-1990s (Fig. 5) and although fluctuations continue to occur, some minor improvement in the estimates has occurred from 1998 to 2003. Values from 2007-2010 have fluctuated around the long-term mean, however from 2011 to 2010 estimates of both biomass and abundance have increased substantially, with 2013 values peaking at about 3 times the long term mean (Fig. 5).

The fall survey series for Divisions 3NO combined is less variable with a generally increasing trend in biomass and abundance from about 1997 until 2005 (Fig. 5). Variability increases substantially from 2006 to 2013. There was a decline in 2006 and 2007, and a large increase in the 2008-2010 estimates, to levels between 1.7 and 2.8 times the mean. This peak (the largest in the time series) is followed by a decrease in 2011, an increase in 2012 and a decrease in 2013. Although the values from 2008 to 2013 exhibit substantial variability the overall mean from this period is still 1.5 to 2 times greater than the mean for the time series, however it should be noted that confidence intervals around these estimates are often quite wide (Fig 5).

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. 6. Biomass estimates are Campelen equivalents for Div. 3NO combined and catches are agreed estimates for Divs. 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 (Fig. 6). After the 1995 moratorium C/B ratios were much lower, with small peaks reaching 0.2 in 1998 and 0.1 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 2010 to 0.06 and decreasing in 2011 and 2012 to levels of 0.04 and 0.02 respectively. Since 2004 the C/B ratio has remained low at an average of 0.04 (Fig. 6).

Depth distribution

Witch flounder have been described as a 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 may not be adequately covered by the survey depths, the issue was examined by analyzing the Canadian survey data (Dwyer 2008). It was concluded that the preferred depth of Divs. 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 Divs. 3NO biomass index value was found in these strata (Tables 6 and 7), 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 (Tables 8 and 9). However, in Div. 3O, there were very few fish found in this depth range, generally less than 5% (Table 9). Because Div. 3O contains the majority of the biomass estimate in the fall surveys (83% on average), 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 (Figures 7 and 8). 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 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 2004-2013, the distribution plots are presented in Figures 7 and 8. 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 indicate an increase in the number of fish from 30-50 cm from about 2004-2013.

Length frequencies from surveys appear to be fairly consistent from 1995 to 2004, with few fish > 50 cm and a mode generally around 40 cm (Figure 9). Length frequencies from surveys from 2004 to 2013 indicate an increase in the number of fish from 30 to 50 cm although the mode stays fairly consistently in range of 40 cm. There have been a few strong peaks (presumably year classes) that could be followed in successive years (e.g. 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; peak at 13 cm in 2011, 20 cm 2013) in 2002, a large peak at 12 cm did not appear after that year. Figure 10 shows the abundance index for fish less than 21 cm, Divs. 3NO combined, as measured in the spring and fall Campelen surveys. Highest spring levels were in 1997, highest fall levels were from 1998 to 2002. Values since 2002 for both spring and fall have been near or below the mean for the time series. The distributions of juvenile (< 21 cm) witch flounder over the spring and fall Canadian surveys reveal a marginal pattern of fish being more widely distributed over the shallower depths in the larger strata during the fall (Figs 11 and 12). It is also possible that the weak pattern may be related to the distributions previously presented (Figs. 7 and 8) for the entire population which indicated a fairly strong movement of fish to the shallower, larger strata during the fall. The higher abundance of smaller fish in the 1998-2002 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 length frequency data all but impossible given the relatively slow growth of witch flounder.

Spawning Stock Biomass (SSB)

An SSB index was developed from Canadian spring survey (Campelen or Campelen equivalent) data from 1984 to 2012 by combining length frequency data for females with corresponding maturity at length estimates, and applying annual length-weight relationships to give estimates of female SSB (NAFO SC 2013). The index indicated an increase from the lowest values of the mid 1990's, but remained well below the peak values from 1985 to 1990 and was not considered to be a viable method at this time. Although no index of exploitable biomass was calculated, Scientific Council noted that it would likely be very similar to the index of total biomass from the surveys, given the relatively low proportion of young fish in the datasets (NAFO SC 2013).

Spanish Div. 3NO surveys

Since 1995, Spain has carried out a stratified random 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 provided in Figure 13 and biomass estimates are provided in Figure 14 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 witch flounder indices show no clear trend throughout the period 2002 to 2013. Index values peaked in 2004 and 2010 but have declined again since then. Length frequency comparisons between Canadian and Spanish spring research vessel surveys in 2011, 2012, and 2013 are presented in Figure 15. There is a high degree of overlap between Canadian and Spanish length frequencies in each survey year. Length frequencies range from approximately 25-50 cm with modal frequencies around 40 cm and low numbers of fish greater than 50 cm or below 25 cm.

Assessment Results

Bayesian surplus production model

The application of a surplus production model in a Bayesian framework was explored for witch flounder in Divs. 3NO. A variety of combinations of input data and prior distributions on the parameters was tested. Model results were found to be sensitive to the choice of the prior on survey catchabilities. Although the model shows promise, it was not considered to be acceptable for use in the assessment at this time.

Precautionary limit reference points

A variety of approaches were examined to determine limit reference points or proxies. The best approach was

determined to be to use the Canadian spring survey series, adjusted for depth coverage from 1984- 1990 (by a factor of 1.25), to produce biomass limit reference point proxies. The series is highly variable with large uncertainty in some years. However, it is the only index that extends from a period of higher stock size to the present. The average of the two highest Canadian spring research vessel surveys from biomass index values between 1984-2013 is considered to be a proxy for B_{msy} . 30% of this average is considered to be a proxy for B_{lim} (SCS Doc. 04/12). Following the same logic, a proxy for F_{msy} (= F_{lim}) can be derived based on the catch/biomass ratio. Given uncertainties about the true status of the stock relative to B_{msy} in the 1980s, the choice of the two highest points to provide a B_{msy} proxy was considered as the most precautionary approach. Reference point proxies were calculated as:

B_{msy} proxy:	30654
B_{lim} proxy:	9200
F_{lim} proxy:	0.26

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 suggests that the stock showed some slight improvement from 1998 to 2004, experienced a decline from 2005 to 2006, and remained relatively stable at low levels from 2006 to 2011 after which there was a significant increase in levels from 2011 to 2013. The fall survey shows a similar pattern of generally increasing levels from 1990 to 2007. Fall surveys then diverge from the spring results in that the largest increase in stock levels occurs from 2007 to 2009 with levels generally decreasing (although still 1.5 to 2 times the mean for the time series) from 2010 to 2013. It is difficult to measure and track recruitment for the resource since there has been no ageing data available since the mid 1980's. 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. Length-frequencies in recent years 2004 to 2013 were primarily in the 40 cm mode with small numbers of fish greater than 50 cm. There is no sign of above-average recruitment (fish <21 cm) in recent spring and fall survey data.

There are signs of improvement in stock status in recent years (2008-2013) albeit with a high degree of between-year, between season, and between NAFO division variability. This is exemplified by recent strong increases in the 3NO spring surveys and to a lesser extent more inconsistent increases in 3NO fall surveys. The Spanish 3NO survey in the NRA also indicated an increase in 2010, but only to levels seen in 2003-04 followed by a decrease in values from 2010 to 2013. Estimates of stock indices from the survey series can exhibit wide confidence limits that cannot be readily explained from data on recruitment and length frequencies. The ratio of catch over biomass index, a proxy for F , suggests fishing mortality has been low since a moratorium on directed fishing was imposed in 1994. A proxy for F_{lim} was calculated to be 0.26. Analysis of the time-series data indicates that the catch/biomass ratio has been below this value since 1994. The biomass has increased since 2010 and the 2013 point estimate is above B_{lim} . The probability that the 2013 biomass is below B_{lim} is 0.14.

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Table 1. Catches and TACs (t) of Witch Flounder in Div. 3NO from 1960-2013.

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	11	2	337	350	0
2012	2	10	309	321	0
2013	62	54	207	323	0

Note: Although a TAC of 3000 tons was agreed by the FC, it was also agreed in 1994 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. Canadian spring research vessel surveys in NAFO Division 3N, 1984-2013.

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	11	12	13
<=56	1593 1499	1593 1499	375 376																														
57 - 92	2992 1853 2520 2520 931 674	2992 1853 2520 2520 931 674	360 361 362 373 374 383																														
93 - 183	421 100 647	421 100 647	359 377 382																														
184 - 274	225 139 182	225 139 182	358 378 381																														
275 - 366	164 106 116	164 106 116	357 379 380																														
367 - 549	155 105 160	155 105 160	723 725 727																														
550 - 731	124 72 156	124 72 156	724 726 728																														
732 - 914	.	134 106 154	752 756 760																														

Note dark grey indicates that a stratum was sampled. White indicates that a stratum was not sampled.

Table 3. Canadian spring research vessel surveys in NAFO Division 3O, 1984-2013.

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	11	12	13
57 - 92	2089	2089	330																														
	456	456	331																														
	1898	1898	338																														
	1716	1716	340																														
	2520	2520	351																														
	2580	2580	352																														
	1282	1282	353																														
93 - 183	1721	1721	329																														
	1047	1047	332																														
	948	948	337																														
	585	585	339																														
	474	474	354																														
184 - 274	151	147	333																														
	121	121	336																														
	103	103	355																														
275 - 366	92	96	334																														
	58	58	335																														
	61	61	356																														
367 - 549	93	166	717																														
	76	76	719																														
	76	76	721																														
550 - 731	111	134	718																														
	105	105	720																														
	93	93	722																														
732 - 914	.	105	764																														
	.	135	772																														

Note dark grey indicates that a stratum was sampled. White indicates that a stratum was not sampled.

Table 4. Canadian fall research vessel surveys in NAFO Division 3N, 1990-2013.

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	11	12	13
<=56	1593 1499	1593 1499	375 376																								
57 - 92	2992 1853 2520 2520 931 674	2992 1853 2520 2520 931 674	360 361 362 373 374 383																								
93 - 183	421 100 647	421 100 647	359 377 382																								
184 - 274	225 139 182	225 139 182	358 378 381																								
275 - 366	164 106 116	164 106 116	357 379 380																								
367 - 549	155 105 160	155 105 160	723 725 727																								
550 - 731	124 72 156	124 72 156	724 726 728																								
732 - 914	.	134 106 154	752 756 760																								
915 -1097	.	138 102 171	753 757 761																								
1098 -1280	.	180 99 212	754 758 762																								
1281 -1463	.	385 127 261	755 759 763																								

Note dark grey indicates that a stratum was sampled. White indicates that a stratum was not sampled.

Table 5. Canadian fall research vessel surveys in NAFO Division 3O, 1990-2013.

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	11	12	13
57 - 92	2089 456 1898 1716 2520 2580 1282	2089	330 331 338 340 351 352 353																								
93 - 183	1721 1047 948 585 474	1721	329 332 337 339 354																								
184 - 274	151 121 103	147	333 336 355																								
275 - 366	92 58 61	96	334 335 356																								
367 - 549	93 76 76	166	717 719 721																								
550 - 731	111 105 93	134	718 720 722																								
732 - 914	.	105 99 135	764 768 772																								
915 -1097	.	124 138 128	765 769 773																								
1098 -1280	.	144 128 135	766 770 774																								
1281 -1463	.	158 175 155	767 771 775																								

Note dark grey indicates that a stratum was sampled. White indicates that a stratum was not sampled.

Table 6. Estimated biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2013. (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	11	12	13			
<=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	41	35	0	21	0	0	0	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	89	0	0	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	156	72	188			
	1853	1853	361	119	0	0	39	50	0	20	0	0	0	39	0	0	0	0	0	242	45	0	0	0	35	139	0	18	72	0	131	0	92			
	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	0	0	0	0	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	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	0	0	0	0	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	0	0	0	0			
93 - 183	421	421	359	231	47	99	43	306	121	0	0	0	19	0	0	0	0	67	149	58	13	0	0	0	334	52	0	593	719	1365	299	83				
	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	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	0	0	0	0	0	0	0	0	0			
184 - 274	225	225	358	40	308	42	137	20	29	57	0	44	132	106	7	51	49	134	6	9	154	14	168	0	42	316	68	237	156	241	86	189				
	139	139	378	22	19	32	155	31	42	0	0	29	0	0	0	3	0	0	0	0	5	8	1	0	0	0	0	0	0	0	14	55	0			
	182	182	381	21	7	32	101	69	0	28	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	53	13	18	0	0	0	30	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	83	134	25					
	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	23	101	88				
	116	116	380	6	53	0	134	24	7	4	0	0	0	0	0	0	0	6	0	0	0	3	0	0	0	0	5	0	0	0	22	5				
367 - 549	155	155	723							90	102	79	36	51	16	25	53	33	36	23	130	60	34	108	50	82	13	137	54	42	125					
	105	105	725							62	40	44	0	5	28	4	20	32	8	3	7	0	103	15	3	36	4	18	28	8						
	160	160	727							0	5	38	17	0	0	3	9	13	12	3	0	0	23	41	11	27	0	14	32	34	99					
550 - 731	124	124	724							327	181	218	51	36	29	157	53	105	106	127	96	101	54	65	207	146	82	61	76							
	72	72	726							81	25	22	28	3	12	42	96	59	65	84	18	50	21	8	19	25	41	105	46	32	23					
	156	156	728							92	19	82	22	152	21	15	32	45	98	43	53	75	42	34	175	748	164	117	142	187						
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	2395	1135	1188			
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	313	984	505	328	278	517			
Percent>366 m				0.0	0.0	0.0	0.0	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	62.4	50.8	27.8	13.7	24.5	43.5			

Table 7. Estimated biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2013. (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	11	12	13							
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	875	55	36							
	456	456	331	1912	302	36	18	444	0	0	0	0	0	0	0	74	0	36	537	28	375	102	0	0	292	1301	425	1124	17	212	81	10								
	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	948	2569	2641							
	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	0	0	4							
	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	21	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	791	1754	298							
	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	1078	2982	1265							
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	752	1117	7541								
	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	1270	911	9766								
	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	198	1958	1007								
	585	585	339	335	0	16	223	136	0	0	0	0	0	0	0	1	0	0	0	1	0	5	2	0	0	0	189	825	4	37	284	2	58	0	14					
	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	968	164	378								
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	6	9	42								
	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	26	10	38								
	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	12	26	14								
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	6	1	10								
	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	3	17	12								
	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	0	4	29								
367 - 549	93	166	717							11	120	35	2375	53	465	4353	44	19	17	41	201	142	5	17	10	12	55	12	6	16	16									
	76	76	719							148	1024	49	14	18	137	601	15	16	25	12	95	39	3	14	15	11	6	7	38	8	7									
	76	76	721							76	48	31	72	18	16	19	38	37	28	85	38	26	9	4	10	11	25	11	15	6	4									
550 - 731	111	134	718							35	29	104	221	80	71	37	33	38	15	57	55	43	13	13	20	43	157	22	36	18	62									
	105	105	720							217	134	182	95	15	21	150	32	21	40	38	7	23	9	69	9	9	9	9	4	6										
	93	93	722							18	49	150	217	206	89	87	31	71	47	121	62	64	12	27	11	21	17	15	30	18	8									
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	7349	11727	23208							
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	107	268	75	124	70	104							
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	0.0	1.3	1.3	3.7	1.6	1.7	0.6	0.4

Table 8. Estimated biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2013 (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	11	12	13		
<=56	1593	1593	375	0	73	0	0	0	0	0	0	0	0	0	0	35	0	0	0	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	0	59	202		
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	1311	1192	7294		
	1853	1853	361	28	467	463	0	32	0	0	14	0	268	28	170	148	99	0	168	38	584	25	0	410	190	188	78		
	2520	2520	362	400	221	87	0	0	0	0	0	0	32	0	0	0	136	0	0	40	0	0	46	192	55	70	90		
	2520	2520	373	0	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	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	0	25	0	0	0	0	27		
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	398	190	156		
	100	100	377	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	31	10	94	0		
	647	647	382	0	0	0	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	104	374	98		
	139	139	378	0	41	15	0	0	0	0	1	0	0	0	3	5	0	0	0	93	4	7	4	22	56	191			
	182	182	381	0	0	0	0	0	0	1	0	0	0	0	7	0	0	0	0	0	0	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	90	17	39	5	93	31			
	106	106	379	4	4	0	0	0	1	7	0	0	2	111	33	8	867	0	3	0	156	13	29	662	18	4			
	116	116	380	0	0	0	0	0	0	1	2	5	0	0	0	9	11	0	0	0	0	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	62	37	38				
	105	105	725		15	376	46	19	0	135	10	33	19	7	5	10		7	7	11	21	40		12	12	71			
	160	160	727		0	38	0	0	29	7	4	0	10	0	0	7	21	0	0	143	82	21	22	32	17				
550 - 731	124	124	724	172	414	180	104	60	197	72	181	87	70	90		70	95	206	127	455	204	117	143	72	79				
	72	72	726		310	54	48	40	21	38	34	16	22	59	52	32	19	49	45	42	105	6	17	23	4				
	156	156	728		153	35	21	76	78	106	153	103	286	178	93	19	122	191	269	404	434	51	125	213					
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	3064	2633	8590		
Biomass >366 m				0	213	15	1263	651	263	137	485	657	385	582	634	669	363	222	491	423	609	1029	1294	606	307	300	420		
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	15.4	10.0	18.3	10.0	11.4	4.9		

Table 9. Estimated biomass (tons) of witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2013 (Engel 145 data converted to Campelen units for 1990-94.

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Campelen Units (1990-94)																							
				90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13
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	708	49	837
	456	456	331	22	315	134	0	0	108	0	0	256	946	243	468	775	306	14	394	108	144	114	564	1219	793	75	688
	1898	1898	338	2226	438	837	3966	2193	4684	503	1329	483	2736	375	943	976	2666	3899	1931	604	543	1407	2044	5483	2554	643	1222
	1716	1716	340	173	280	63	0	0	204	0	22	0	415	104	172	123	57	28	116	654	1	494	116	81	142	575	959
	2520	2520	351	1690	284	72	0	0	0	0	37	205	0	172	0	25	35	54	369	158	165	28	75	65	234	0	
	2580	2580	352	1415	896	1352	946	228	379	273	573	374	1491	920	430	789	964	3377	1663	1109	558	1409	5915	2305	2597	1335	1635
	1282	1282	353	2405	343	477	0	732	538	789	168	1066	2996	2379	1360	1490	1204	2657	3710	1587	1121	1431	8037	8234	3098	4323	1446
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	1616	1518	1096
	1047	1047	332	2102	155	1724	813	321	1114	4569	190	245	1664	544	343	1155	807	1512	2061	3887	708	2453	500	1393	284	3372	283
	948	948	337	1333	188	954	563	2132	421	492	322	479	978	344	67	211	352	114	1721	190	576	1592	352	989	158	328	150
	585	585	339	1132	224	651	119	742	1911	0	481	261	344	338	1927	457	3755	1854	1070	1060	1147	2405	2693	2359	882	320	
	474	474	354	1291	23	316	75	210	191	4647	215	201	103	766	258	470	967	438	316	505	694	306	1320	544	312	78	294
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	14	0	3	
	121	121	336	82	151	76	298	13	35	32	19	19	67	31	37	23	10	5	35	3	53	142	22	18	8	13	
	103	103	355	497	93	120	25	16	343	6	14	110	35	5	6	6	21	2	5	17	72	23	20	15	41	3	
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	4	4	8	
	58	58	335	194	25	25	30	18	1	23	0	1	23	8	3	9	1	5	3	3	1	6	0	0	0	7	0
	61	61	356	11	7	430	98	7	60	3	4	32	22	7	3	6	2	7	0	0	0	0	10	1	8	4	3
367 - 549	93	166	717	30	0	32	37	12	42	260	0	13	11	54	9	2	14	9	102	40	14	37	52	59			
	76	76	719	110	2	65	6	1	226	19	9	10	14	29	6	15	3	6	10	4	8	16	4	8	0	12	
	76	76	721	18	169	67	21	54	6	14	67	17	2	14	17	2	15	3	30	11	1	7	8	13	2		
550 - 731	111	134	718		22	68	8	68	47	53	34	50	54	161	48	130	68	162	80	110	63	50	11				
	105	105	720		73	0	13	68	2	17	4	83	26	31	10	39	1	1	12	1	4	10	0	20			
	93	93	722	9	81	21	14	39	12	12	26	8	15	5	7	14	29	8	9	11	15	11	4	8	13		
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	16036	24721	23733	14876	13601	9077
Biomass >366 m				140	29	0	410	193	95	386	116	436	433	224	384	562	381	87	460	35	241	306	328	150	131	124	116
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	0.9	0.9	1.3

Table 10. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2013 (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	11	12	13		
<=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	73	44	0	44	0	0	0	0			
	1499	1499	376	0	0	0	26	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	88	0	0	0	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	288	165	329		
	1853	1853	361	153	0	0	32	36	0	28	0	0	0	0	36	0	0	0	0	212	85	0	0	0	0	36	255	0	51	85	0	203	0	170	
	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	0	0	0	0	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	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	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	0	0	46	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	3475	608	115			
	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	0	0	55	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	0	89	0	0	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	566	186	330			
	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	0	19	112	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	22	51	38			
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	361	317	45				
	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	49	284	192			
	116	116	380	8	88	0	247	32	8	8	0	0	0	0	0	0	0	8	0	0	0	8	0	0	0	0	7	0	0	0	54	11			
367 - 549	155	155	723										288	341	256	53	181	45	51	149	96	171	88	322	152	96	313	107	245	33	364	99	107	353	
	105	105	725										166	101	87	0	13	235	26	51	72	19	6	17	0	264	40	10	110	13	26	51	18		
	160	160	727										0	11	55	22	0	0	11	33	33	21	10	0	0	31	68	31	73	0	20	82	77	179	
550 - 731	124	124	724										1134	580	597	188	119	128	432	144	550	500	516	267	283	145	171	645	407	262	176	206			
	72	72	726										213	59	30	114	5	33	183	322	213	198	346	65	134	63	18	59	73	112	238	128	74	62	
	156	156	728										182	21	139	29	172	134	64	158	145	258	136	143	161	64	70	319	1409	383	225	268	326		
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	5844	2446	2374		
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	719	2071	1279	737	577	1144		
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	0.0	35.3	68.1	48.2	28.5	12.6	23.6	48.2		

Table 11. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2013 (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	11	12	13	
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	1797	12	82	
	456	456	331	3555	376	94	31	1004	0	0	0	0	0	0	0	63	0	94	1104	63	721	94	0	0	784	0	2885	1129	2478	63	526	188	28	
	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	2166	5669	6397	
	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	0	0	94	
	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	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	843	152	1020	1252	4396	532	
	1282	1282	353	9347	1234	1713	2146	13050	3680	2910	0	265	353	0	35	35	265	459	5055	2539	901	831	1102	957	872	7616	794	1058	309	573	2405	6393	2214	
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	1768	2909	18229		
	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	5803	4225	31302		
	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	1043	7079	3086		
	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	72	0	282	
	474	474	354	1174	239	3282	456	619	196	359	261	261	1663	0	98	33	563	3208	2739	2100	1467	359	913	1960	1239	2282	1043	406	2402	652	1076			
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	54	37	192		
	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	144	33	226		
	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	53	74	156		
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	38	32	53		
	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	57	68	35		
	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	53	17	194		
367 - 549	93	166	717						32	371	166	5960	228	1362	11566	710	237	162	273	651	468	46	181	91	117	682	167	59	46	278				
	76	76	719						288	2535	267	37	42	364	1161	150	112	228	97	268	89	19	131	81	80	28	28	284	102	50				
	76	76	721						235	209	94	193	42	42	63	214	152	112	204	139	84	31	19	60	56	251	26	244	42	52				
550 - 731	111	134	718						282	122	512	1161	535	518	507	517	324	138	525	1189	578	66	177	240	357	2050	345	652	170	1290				
	105	105	720						361	376	1026	498	43	101	518	186	104	351	309	50	104	41	765	62	75	72	75	22	25					
	93	93	722						45	166	512	518	601	274	819	177	364	207	361	198	210	53	154	176	133	96	106	245	102	73				
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	21160	32266	65947	
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	819	3179	747	1484	483	1769	
Percent >366 m				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	4.6	0.0	4.6	3.2	12.6	5.0	7.0	1.5	2.7		

Table 12. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2013 (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	11	12	13
<=56	1593 1499	1593 1499	375 376	0 0	55 0	0 0	0 0	0 0	0 23	0 19	0 0	0 0	0 0	0 0	0 0	55 59	0 59	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	
57 - 92	2992 1853 2520 2520 931 674	2992 1853 361 362 373 931 674	360 361 441 0 0 0 383	382 32 277 0 0 0 0	206 425 116 0 0 0 0	1646 701 0 0 0 0 0	320 42 116 0 0 0 0	103 42 0 0 0 0 0	1232 0 0 0 0 0 0	41 0 0 0 0 0 0	672 23 0 0 0 0 0	755 306 50 0 0 0 0	360 51 0 0 0 0 0	926 204 0 0 0 0 0	514 255 102 0 0 0 0	1080 0 0 0 0 0 0	1022 211 51 0 0 0 0	1132 1020 1020 0 0 0 0	4888 85 297 0 0 0 0	154 0 99 0 0 0 0	0 9290 297 0 0 0 0	9290 17639 99 0 0 0 0	3224 561 249 262 149 149 103 258	2381 249 249 153 149 149 103 258	22490 22490 17384		
93 - 183	421 100 647	421 100 647	359 377 382	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 7 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	405 0 0 0 0 0 0	116 0 0 0 0 0 0	232 0 0 0 0 0 0	203 0 0 0 0 0 0	87 0 0 0 0 0 0	145 0 0 0 0 0 0	524 0 0 0 0 0 0	1216 0 0 0 0 0 0	2635 34 44 21 110 0	869 34 44 21 110 0	956 34 44 21 110 0	331 331 270
184 - 274	225 139 182	225 139 182	358 378 381	0 0 0	46 105 0	108 19 0	31 0 0	0 0 0	234 0 0	0 8 0	31 10 0	93 10 0	46 8 0	69 10 0	136 8 0	0 0 0	307 0 0 0	31 0 0 0	251 0 0 0	252 0 0 0	31 0 0 0	230 9 19 8	190 8 38 38	174 112 112	155 112 359	650 112 359	120
275 - 366	164 106 116	164 106 116	357 379 380	0 7 0	384 15 0	23 0 0	338 0 0	135 0 0	180 19 0	0 22 0	60 0 0	0 0 0	124 6 24	33 296 8	20 91 8	102 26 0	34 1915 0	98 13 0	242 6 16	116 15 24	259 350 0	29 24 0	72 81 0	11 1500 0	143 51 0	68 10 0	
367 - 549	155 105 160	155 105 160	723 725 727	53 36 0	330 701 44	394 173 11	117 49 0	21 237 11	88 29 0	313 101 55	85 71 11	104 22 11	190 14 0	57 0 13	347 14 0	43 29 11	299 21 59	72 15 0	38 32 0	227 58 0	239 91 0	94 37 0	153 29 0	87 155 0	96 33 0		
550 - 731	124 72 156	124 72 156	724 726 728	443 669 268	1126 114 195	512 119 129	223 99 121	178 40 212	571 92 215	326 125 311	640 40 417	337 37 223	264 176 633	270 129 351	177 84 161	247 42 73	629 42 204	384 106 343	1651 578 428	771 202 303	381 412 860	432 245 118	245 213 245	213			
732 - 914	.	134 106 154	752 756 760									165 255 244	28 149 229	0 182 409	74 22 530										9 185 618		
915 - 1097	.	138 102 171	753 757 761									0 0 106	9 0 578	0 96 202	33 92 24										0 0 277		
1098 - 1280	.	180 99 212	754 758 762									0 0 0	0 0 483	0 8 0	12 0 58										0 0 204		
1281 - 1463	.	385 127 261	755 759 763									0 0 72	0 9 18	0 0 88	0 0 0										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	6251	25163	19725
Biomass >366 m				0	497	36	2825	1506	714	427	1203	1755	1274	2033	2148	2032	866	475	1446	1026	1575	2773	2775	1421	841	762	863
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	19.4	11.8	21.1	13.5	4.4	

Table 13. Abundance (000s) of witch flounder (M=F) in each stratum from surveys in Div. 3O during fall of 1990-2013 (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	11	12	13
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	1197	144	2086
	456	456	331	42	502	125	0	0	408	0	0	596	4799	533	1066	1850	1004	31	1098	345	439	345	1296	3907	2729	215	2164
	1898	1898	338	3264	627	1436	6893	4700	8459	522	2872	1723	7572	609	1984	2245	6893	11652	4774	1567	1044	3220	5817	13606	7989	1816	3290
	1716	1716	340	262	330	118	0	0	295	0	47	0	1652	189	378	189	94	47	243	1416	47	1014	320	140	236	1054	2041
	2520	2520	351	1837	347	58	0	0	0	0	0	50	347	0	198	0	50	50	99	495	297	231	99	154	99	347	0
	2580	2580	352	1597	1242	2011	1115	355	371	355	1141	754	1825	1668	1065	1448	2296	6584	2484	1787	811	2419	11915	3712	4817	2789	2563
	1282	1282	353	2822	485	941	0	1176	999	882	573	5467	5996	6172	2954	9523	3395	5291	6525	3357	1950	2469	16690	17768	7186	11243	4144
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	4972	4856	2736
	1047	1047	332	3625	396	5281	2064	960	5233	11954	1248	2544	7393	3249	1392	4342	3738	6145	8381	13093	2939	8910	2603	5770	1509	14968	1632
	948	948	337	2347	424	2347	1043	5216	1434	717	1130	1613	3738	1623	348	714	1434	397	5067	696	1956	3775	1546	4482	782	1198	729
	585	585	339	1556	241	724	121	966	2776	0	1086	356	3943	563	3822	684	7559	4507	2374	4064	2070	4529	5754	4547	1927	885	
	474	474	354	1891	33	685	359	424	489	8955	489	782	391	2478	630	1415	1989	1150	978	1206	2195	663	4492	1992	978	261	978
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	57	30	18	
	121	121	336	222	466	216	633	42	549	208	100	215	300	141	150	58	75	50	300	150	422	518	72	83	50	72	
	103	103	355	1459	298	425	85	63	768	28	170	411	85	21	28	21	92	35	27	50	246	94	64	50	101	16	
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	65	75	47	
	58	58	335	371	100	112	68	52	64	64	4	40	48	37	8	39	12	18	7	24	18	18	0	11	0	27	0
	61	61	356	25	8	1254	252	40	113	13	34	75	55	19	17	34	31	45	0	7	0	37	4	56	8	4	
367 - 549	93	166	717	122	0	96	703	46	833	2166	0	91	203	351	117	10	93	41	1214	360	100	340	670	434			
	76	76	719	209	42	277	10	52	612	183	178	99	75	183	37	96	96	78	95	14	41	167	50	43	12	132	
	76	76	721	47	444	183	102	131	17	125	311	98	10	84	81	11	135	9	273	68	19	62	38	161	24		
550 - 731	111	134	718		107	428	164	535	618	581	396	488	1432	1483	575	1040	479	2013	959	1039	507	489	126				
	105	105	720		339	0	105	316	29	202	39	762	298	302	206	336	6	6	141	7	14	31	0	165			
	93	93	722	26	243	58	64	134	51	103	122	70	94	34	50	90	199	51	61	117	89	65	77	44	128		
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 - 1280	.	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 - 1463	.	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	38388	42483	24415
Biomass >366 m				331	114	0	1411	774	1191	1193	831	4354	3480	1890	3210	5163	3103	1095	3390	254	1704	3593	2879	1331	1036	1376	4.1
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	2.7	3.2	4.1

Table 14. Mean numbers per tow for witch flounder (M=F) in each stratum from surveys in Div. 3N during spring of 1984-2013 (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	11	12	13						
<=56	1593 1499	1593 1499	375 376	0.00 0.00	0.33 0.43	0.20 0.00	0.00 0.00	0.20 0.43	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00																										
57 - 92	2992 1853 2520 2520 931 674	2992 1853 2520 2520 931 674	360 361 362 373 374 383	5.43 0.60 0.00 0.00 0.00 0.00	0.31 0.00 0.27 0.00 0.00 0.67	1.77 0.13 0.07 0.14 0.00 0.00	1.80 0.14 0.08 0.00 0.00 0.33	6.42 0.14 0.50 0.00 0.00 0.33	0.53 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.14 0.14 0.00 0.00 0.00 0.00	0.55 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.32 0.16 0.55 0.00 0.00 0.00	0.16 0.55 1.49 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00	0.20 0.00 0.00 0.00 0.00 0.00	0.30 0.00 0.00 0.00 0.00 0.00	3.78 1.17 1.80 0.25 0.00 0.00	1.17 0.25 0.00 0.00 0.00 0.00	2.00 0.00 0.00 0.00 0.00 0.00	0.70 0.80 0.00 0.00 0.00 0.00	0.40 0.67 0.00 0.00 0.00 0.00	0.80 0.00 0.00 0.00 0.00 0.00													
93 - 183	421 100 647	421 100 647	359 377 382	7.00 1.00 0.00	1.00 0.00 0.00	4.00 13.50 0.00	1.00 13.50 0.00	17.00 5.00 0.00	3.50 6.00 0.00	0.00 0.00 0.00	3.50 7.00 1.00	7.00 1.00 0.00	0.50 0.00 0.00	0.00 0.00 0.00	0.00 0.00 0.00	12.00 0.00 1.00	1.50 0.00 0.00	25.00 0.00 0.00	33.71 0.00 0.00	60.00 0.00 0.00	10.50 0.00 0.00	2.00 0.00 0.00																	
184 - 274	225 139 182	225 139 182	358 378 381	2.50 2.50 1.00	18.00 1.50 0.50	3.00 2.50 1.67	9.00 2.50 6.50	1.00 0.00 0.00	1.50 0.00 3.00	3.00 0.00 0.00	0.00 0.00 0.00	3.00 0.00 0.00	9.50 0.00 0.00	7.50 0.00 0.00	1.00 0.00 0.00	2.50 0.00 0.00	2.67 0.44 0.00	8.44 0.00 0.00	0.50 0.00 0.00	1.33 0.44 0.44	10.50 1.71 0.00	0.89 0.44 0.00	0.00 0.00 0.00	3.56 0.89 0.00	22.00 0.00 3.22	4.89 0.00 1.00	17.50 0.00 1.00	9.78 0.00 1.33	18.29 0.00 0.89	6.00 1.02 2.03	10.67 0.00 1.50								
275 - 366	164 106 116	164 106 116	357 379 380	1.00 4.50 0.50	8.00 2.50 5.50	24.50 4.67 0.00	0.50 2.90 15.50	10.50 7.00 2.00	2.50 3.00 0.50	4.00 1.50 0.50	4.50 0.00 0.00	5.50 1.50 0.00	4.50 0.00 0.00	1.00 1.24 0.00	1.78 0.44 0.00	1.33 7.00 0.00	16.56 1.94 0.00	11.50 7.00 0.00	13.00 3.50 0.00	2.78 0.89 0.00	2.44 1.94 0.00	6.67 1.07 0.00	2.00 0.00 0.00	0.00 0.00 0.00	1.00 0.00 0.00	0.00 0.00 0.00	4.33 0.50 0.44	16.00 29.16 0.00	14.07 3.37 0.00	2.00 19.50 13.07	12.00 3.37 15.21								
367 - 549	155 105 160	155 105 160	723 725 727							13.50 11.50 0.00	16.00 7.00 0.50	12.00 6.00 0.00	2.50 3.50 2.50	8.50 1.78 1.00	2.13 1.33 0.00	2.40 1.33 0.00	7.00 16.56 0.00	4.50 11.50 0.50	8.00 5.00 0.50	4.11 1.33 0.44	15.11 0.44 1.14	7.11 0.44 1.14	4.50 1.14 0.00	14.67 18.28 3.11	5.00 2.78 1.39	11.49 0.67 3.33	1.56 7.60 0.00	17.06 9.00 0.89	4.64 1.83 3.75	5.00 3.50 3.50	16.53 1.24 8.13								
550 - 731	124 72 156	124 72 156	724 726 728							66.50 21.50 8.50	34.00 6.00 1.00	35.00 3.00 6.50	11.00 11.50 1.33	7.00 0.50 8.00	7.50 3.33 6.22	25.35 18.49 3.00	8.44 32.50 3.00	32.22 21.50 7.37	29.33 20.00 6.76	30.22 34.94 12.00	15.67 13.50 6.33	16.61 6.58 6.67	8.50 6.55 7.50	10.00 13.50 3.00	37.83 6.00 3.28	23.87 7.33 14.86	15.36 11.36 65.65	10.30 24.00 17.83	12.10 24.00 10.50	6.29 12.93 12.50									
732 - 914	.	134 106 154	752 756 760														2.00 6.00 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	2.43	1.03	0.99

Table 15. Mean numbers per tow for witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2013 (Engel 145 data converted to Campelen units for 1984-95).

Depth Range (m)	Old Stratum Area	New Stratum Area	Stratum	Mean numbers per tow (Engel 145 data converted to Campelen units for 1984-95)																																			
				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	11	12	13						
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	0.25	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	6.25	0.43	0.29							
	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	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	8.39	3.00	0.44							
	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	8.30	21.71	24.50						
	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	0.20	0.50	1.00	0.00	1.40	0.59	0.00	0.00	0.40							
	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	0.00	0.44	0.13	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	2.38	0.43	10.46	3.53	12.39	1.50						
	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	13.64	36.25	12.56						
	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	7.47	12.29	77.00							
93 - 183	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	40.30	29.33	217.33								
	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	30.00	18.67	34.37	8.00	54.29	23.67							
	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	0.00	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	0.89	0.00	3.50						
	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	36.83	10.00	16.50							
	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	2.67	1.81	9.50							
184 - 274	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	8.67	2.00	13.56							
	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	3.73	5.21	11.00							
	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	2.89	2.40	4.00							
275 - 366	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	7.10	8.50	4.44							
	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	1.24	2.00	23.17							
	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	2.60	2.00	12.17	
367 - 549	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	27.14	9.71	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	23.33	4.00	5.00
	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	35.39	9.24	70.00
550 - 731	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	1.50	1.71	
	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	19.14	8.00	5.71
	.	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	8.32	12.69	25.84						

Table 16. Mean numbers per tow for witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2013 (Engel 145 data converted to Campelen units for 1990-1994).

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	11	12	13
<=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	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	0.33	0.00	0.00	0.50	1.25
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	5.79	54.64	42.24
	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	0.98	1.03	0.60
	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	0.29	0.43	0.43
	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	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	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	0.00	0.50	0.00	0.00	0.00	0.00	1.00
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	16.50	5.71	4.67
	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	0.00	34.39	3.22	1.50	8.00	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	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	5.00	21.00	3.89
	139	139	378	0.00	5.50	1.00	0.00	0.00	0.00	0.44	0.50	0.00	0.00	0.44	0.44	0.50	0.00	0.00	0.00	0.00	10.44	0.44	1.00	0.44	2.00	5.86	18.78
	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	0.00	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	11.50	1.29	3.20	0.50	6.33	3.00	
	106	106	379	0.50	1.00	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	102.86	3.50	0.67		
	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	1.00	1.50	0.00	0.00	0.00	0.00	0.00	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	7.17	4.10	4.50		
	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	2.57	2.00	10.74				
	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	2.60	3.50	1.50			
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	25.33	14.39	12.50		
	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	10.33	30.60	2.00	4.40	7.91	1.14		
	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	5.50	11.43	16.49			
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 - 1280	.	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		0.00	16.57	0.00			2.00			3.33		7.00					
1281 - 1463	.	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			0.00		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	2.60	10.48	8.22

Table 17. Mean numbers per tow for witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2013 (Engel 145 data converted to Campelen units for 1990-1994).

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	11	12	13
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	4.17	0.50	7.26
	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	43.50	3.43	34.50
	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	30.60	6.96	12.60
	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	1.00	4.47	8.64
	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	0.29	1.00	0.00
	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	13.57	7.86	7.22
	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	40.75	63.75	23.50
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	21.00	20.51	11.56
	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	10.48	103.93	11.33
	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	6.00	9.19	5.59
	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	56.50	23.94	11.00	
	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	15.00	4.00	15.00
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	2.83	1.50	0.89	
	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	5.00	3.00	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	3.50	7.11	1.14	
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	4.89	5.67	3.56	
	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	0.00	3.33	0.00
	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	6.67	1.00	0.50	
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	14.90	29.33	19.00			
	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	4.11	1.17	12.64	
	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	3.67	15.36	2.29		
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	27.50	26.53	6.86		
	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	2.16	0.00	11.43		
	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	6.00	3.43	10.00	
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 - 1280	.	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 - 1463	.	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	15.04	16.65	9.57

Table 18. Mean weights (kg) per tow for witch flounder (M+F) in each stratum from surveys in Div. 3N during spring of 1984-2013 (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	11	12	13	
<=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	0.19	0.16	0.10	0.00	0.00	0.00	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	0.04	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	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	0.38	0.17	0.46	
	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	0.51	0.00	0.36	
	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	0.00	0.00	0.00	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	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	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	0.25	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	0.33	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	23.56	5.16	1.43				
	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	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	0.00	0.00	0.00	0.00	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	7.78	2.78	6.11		
	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	0.18	0.00	0.00	0.00	0.24	0.41	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.73	2.90	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	0.01	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	1.19	0.01		
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	3.68	5.95	1.10			
	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	1.55	6.92	6.07		
	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	0.35	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	1.39	0.33		
367 - 549	155	155	723																															
	105	105	725																															
	160	160	727																															
550 - 731	124	124	724																															
	72	72	726																															
	156	156	728																															
732 - 914	.	134	752																															
	.	106	756																															
	.	154	760																															
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	1.00	0.48	0.49	

Table 19. Mean weights (kg) per tow for witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2013 (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 11 12 13																													
				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	11	12	13
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	0.07	0.42	0.39	0.00	0.00	0.00	0.41	0.45	1.98	0.00	0.97	0.00	0.00	3.04	0.19	0.13	
	456	456	331	30.49	4.82	0.58	0.29	7.09	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	3.37	1.29	0.16			
	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	3.63	9.84	10.12
	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	0.35	0.00	0.00	0.00	0.11	0.38	0.00	0.00	0.77	0.00	0.00	0.00	0.02		
	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	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	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	2.23	4.89	0.84
	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	3.24	2.44	19.22	3.27	3.00	0.98	1.70	6.11	16.91	7.17		
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	3.18	4.72	31.85	
	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	8.82	6.32	67.81	
	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	1.52	15.01	7.72	
	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	0.02	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	0.72	0.00	0.18		
	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	14.84	2.52	5.79	
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	0.31	0.47	2.07	
	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	1.56	0.60	2.28	
	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	0.82	1.82	0.97	
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	0.44	0.09	0.73	
	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	0.42	2.11	1.48	
	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	0.04	0.53	3.41	
367 - 549	93	166	717																														
	76	76	719																														
	76	76	721																														
550 - 731	111	134	718																														
	105	105	720																														
	93	93	722																														
732 - 914	.	105	764																														
	.	135	772																														
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	2.90	4.59	9.09

Table 20. Mean weights (kg) per tow for witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2013 (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	11	12	13	
<=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	0.00	0.16	0.00	0.00	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	0.07	0.00	0.11	0.00	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	0.00	0.29	0.98	
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	3.19	29.14	17.72	
	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	0.75	0.74	0.31	
	2520	2520	362	1.15	0.64	0.25	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.11	0.00	0.00	0.13	0.55	0.16	0.20	0.26	
	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	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	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	0.00	0.28	0.00	0.00	0.00	0.00	0.29	
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	6.88	3.28	2.69	
	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	0.00	0.00	2.86	2.29	0.71	6.86	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	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	3.36	12.08	3.16	
	139	139	378	0.00	2.17	0.81	0.00	0.00	0.00	0.05	0.01	0.00	0.00	0.14	0.27	0.00	0.00	0.00	0.00	4.85	0.20	0.38	22.00	1.14	2.92	9.97		
	182	182	381	0.00	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	0.00	0.14	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	3.98	0.77	1.75	0.22	4.13	1.36		
	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	45.39	1.23	0.27		
	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	0.00	0.55	0.68	0.00	0.00	0.00	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	2.92	1.71	1.78			
	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	1.48	2.75	0.85	0.85	4.89					
	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	0.99	1.44	0.75				
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	8.40	4.20	4.65				
	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	1.69	2.35	0.35				
	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	2.37	5.82	9.91					
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			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 - 1280	.	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		0.00	3.74	0.00		0.50		0.97			1.38							
1281 - 1463	.	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			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	1.28	5.60	3.58	

Table 21. 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	08	09	10	11	12	13
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	2.46	0.17	2.91
	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	12.64	1.20	10.98
	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	9.78	2.46	4.68
	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	0.60	2.43	4.06
	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	0.19	0.68	0.00
	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	7.32	3.76	4.61
	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	17.57	24.51	8.20
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	6.82	6.41	4.63
	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	1.97	23.41	1.96
	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	1.21	2.52	1.15
	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	29.32	10.96	3.98	
	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	4.79	1.20	4.52
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	0.71	0.01	0.16	
	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	1.06	0.51	0.76	
	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	1.09	2.88	0.18	
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	0.32	0.29	0.63	
	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	0.00	0.85	0.00
	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	1.01	0.52	0.35	
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	1.62	2.30	2.59			
	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	0.75	0.02	1.12	
	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	0.80	1.25	0.15		
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	3.44	2.73	0.59		
	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	0.72	0.00	1.41		
	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	0.34	0.61	1.00		
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 - 1280	.	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 - 1463	.	158	767							0.68	0.00	0.00		0.00			0.00	0.13	0.11								
	.	175	771							0.00	0.73	0.00		0.41			0.00	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	5.83	5.33	3.56

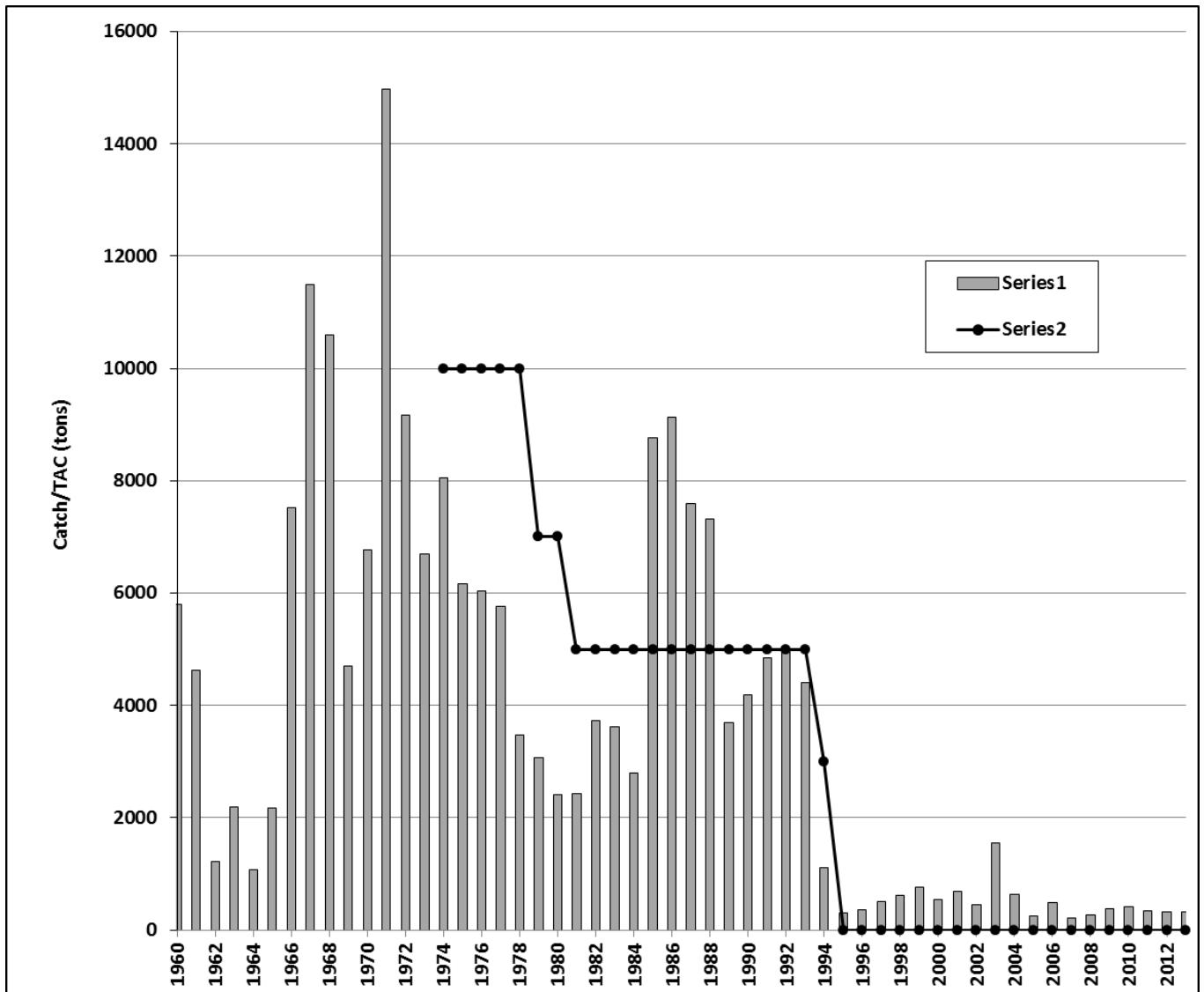


Figure 1. Commercial catches of witch flounder in NAFO Divs. 3NO from 1960-2012 and total allowable Catches (TACs). * Note: Although a TAC of 3000 tons was agreed by the Fisheries Commission, it was also agreed that no directed fishing on witch flounder in NAFO Divs. 3NO take place during 1994 due to the poor state of the stock. Estimated catch in 2003 is the mean of a range of catch from several sources.

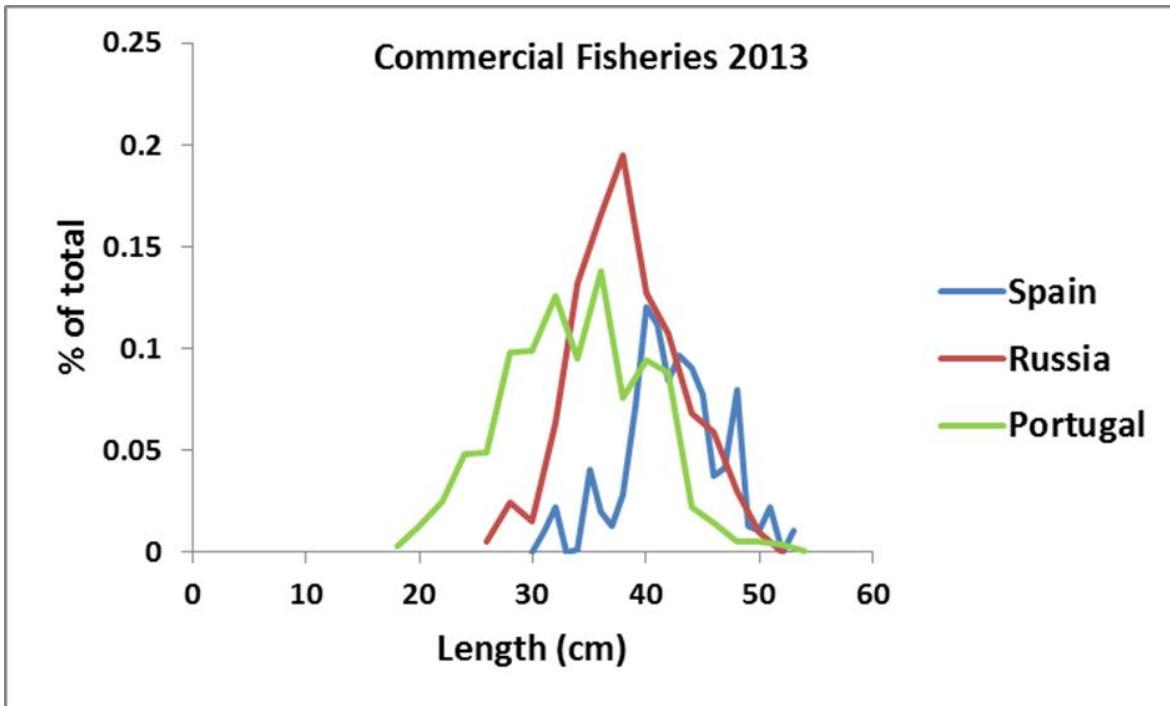


Figure 2. Witch flounder length frequency (cm) distributions for Spain, Russia, and Portugal commercial fisheries in NAFO Divs. 3NO in 2013.

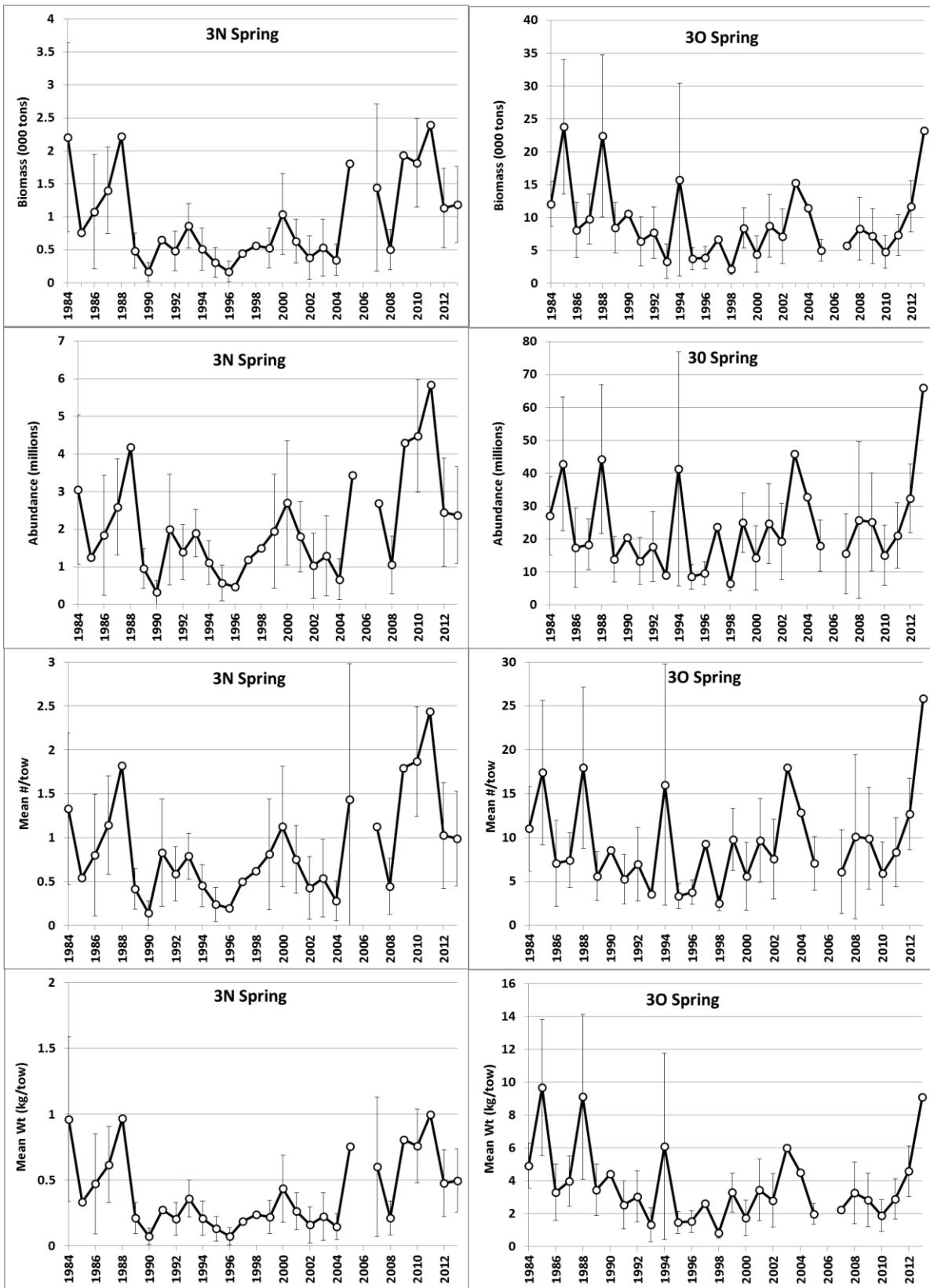


Figure 3. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian spring rv surveys in NAFO Divs. 3N and 3O during 1984-2013. 95% confidence intervals (CI) are not presented when intervals extend below zero.

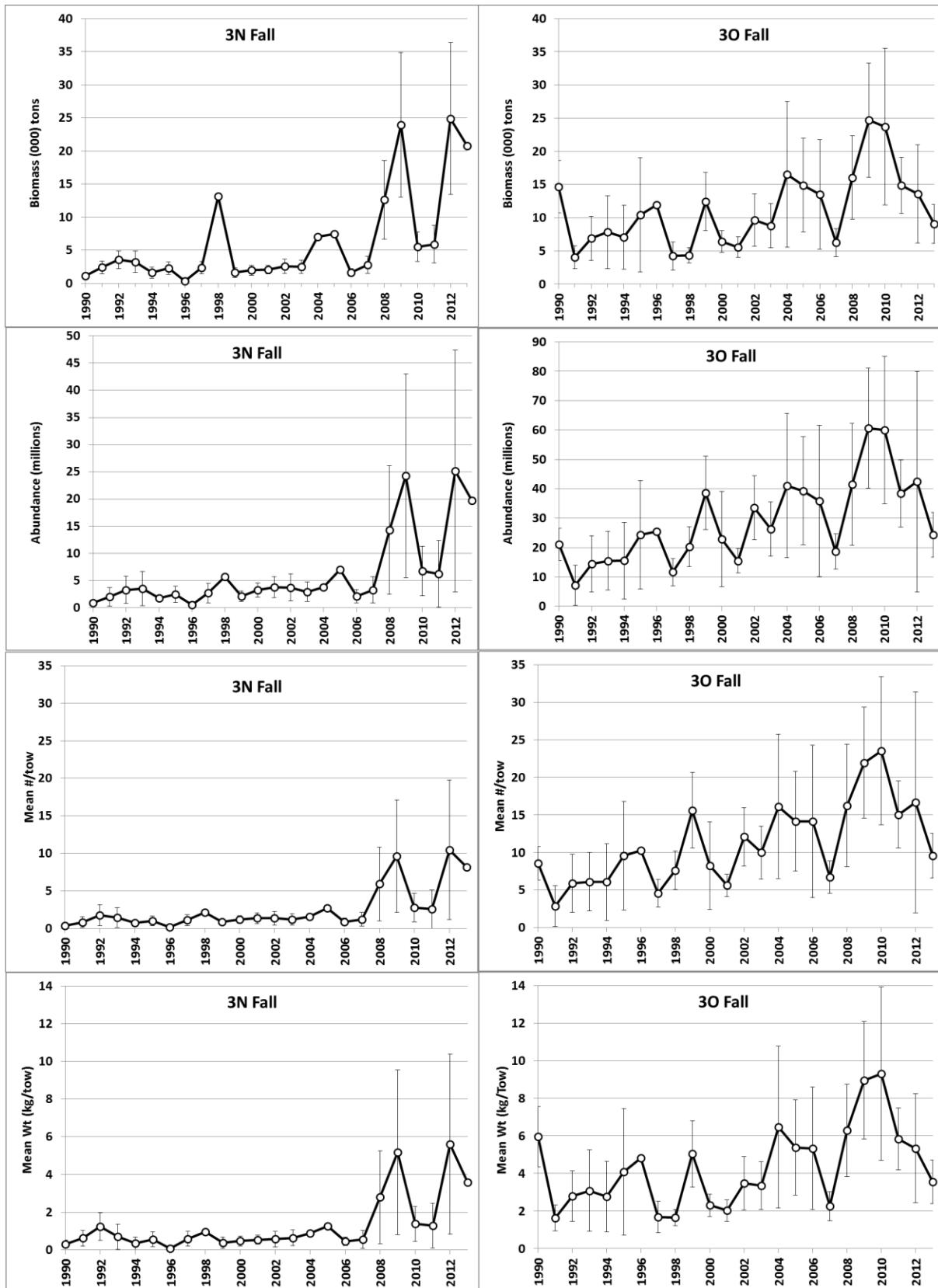


Figure 4. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian fall surveys in NAFO Divs. 3N and 3O during 1990-2013. 95% confidence intervals (CI) are not presented when intervals extend below zero.

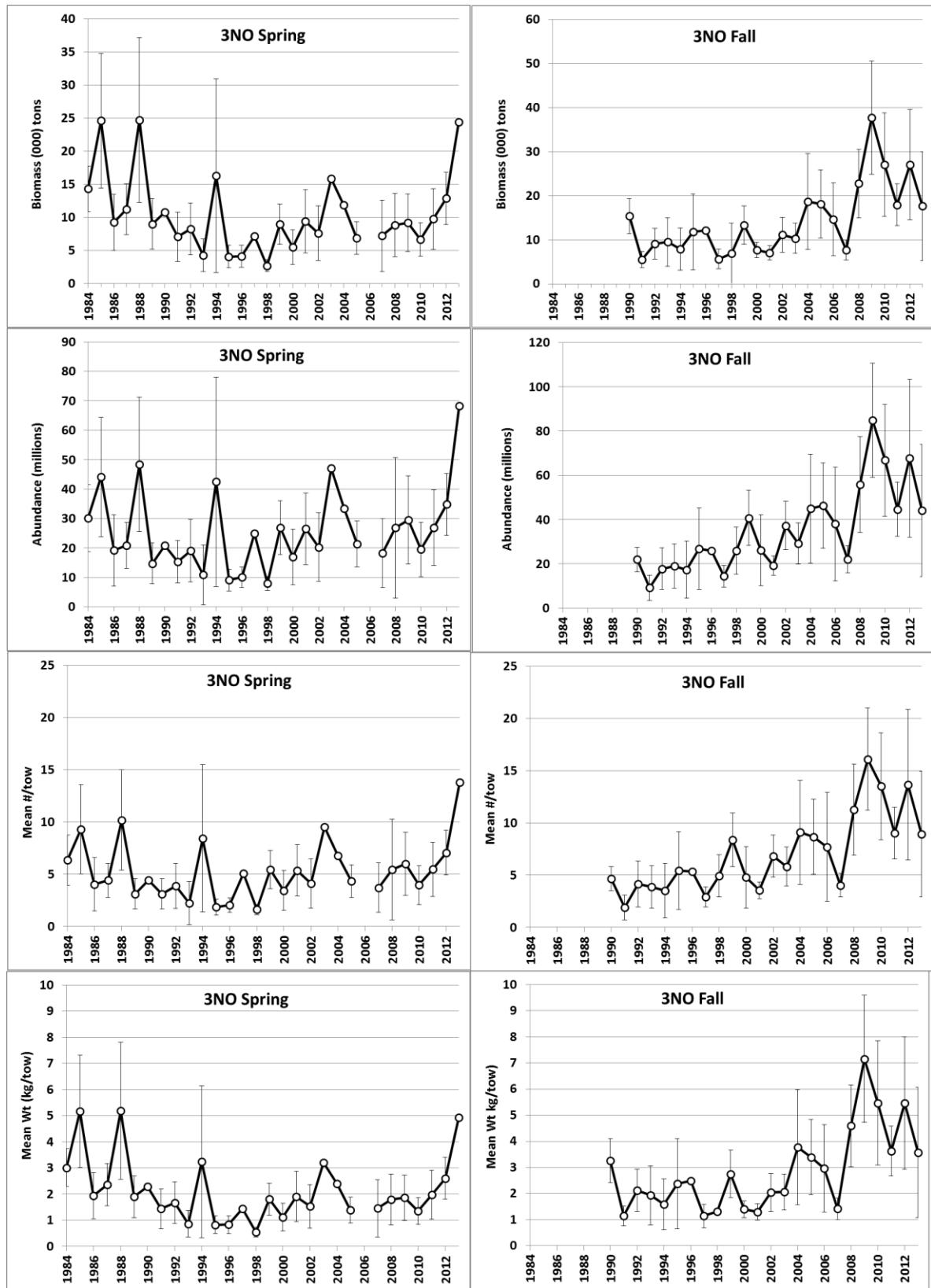


Figure 5. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian Fall surveys in NAFO Divs. 3NO combined during 1984-2013. 95% confidence intervals (CI) are not presented when intervals extend below zero.

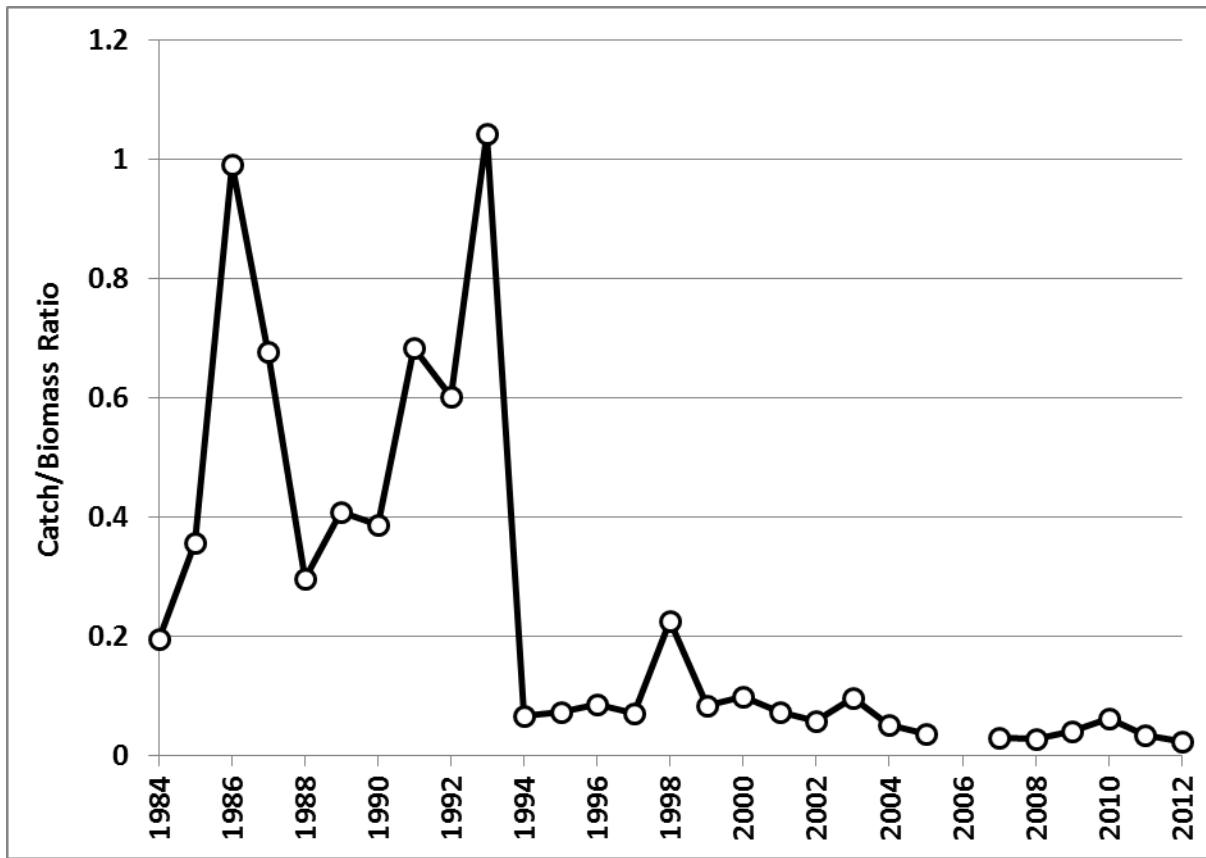


Figure 6. Commercial catch of witch flounder divided by biomass estimates from the Canadian spring rv survey for NAFO Divs. 3NO 1984-2012.

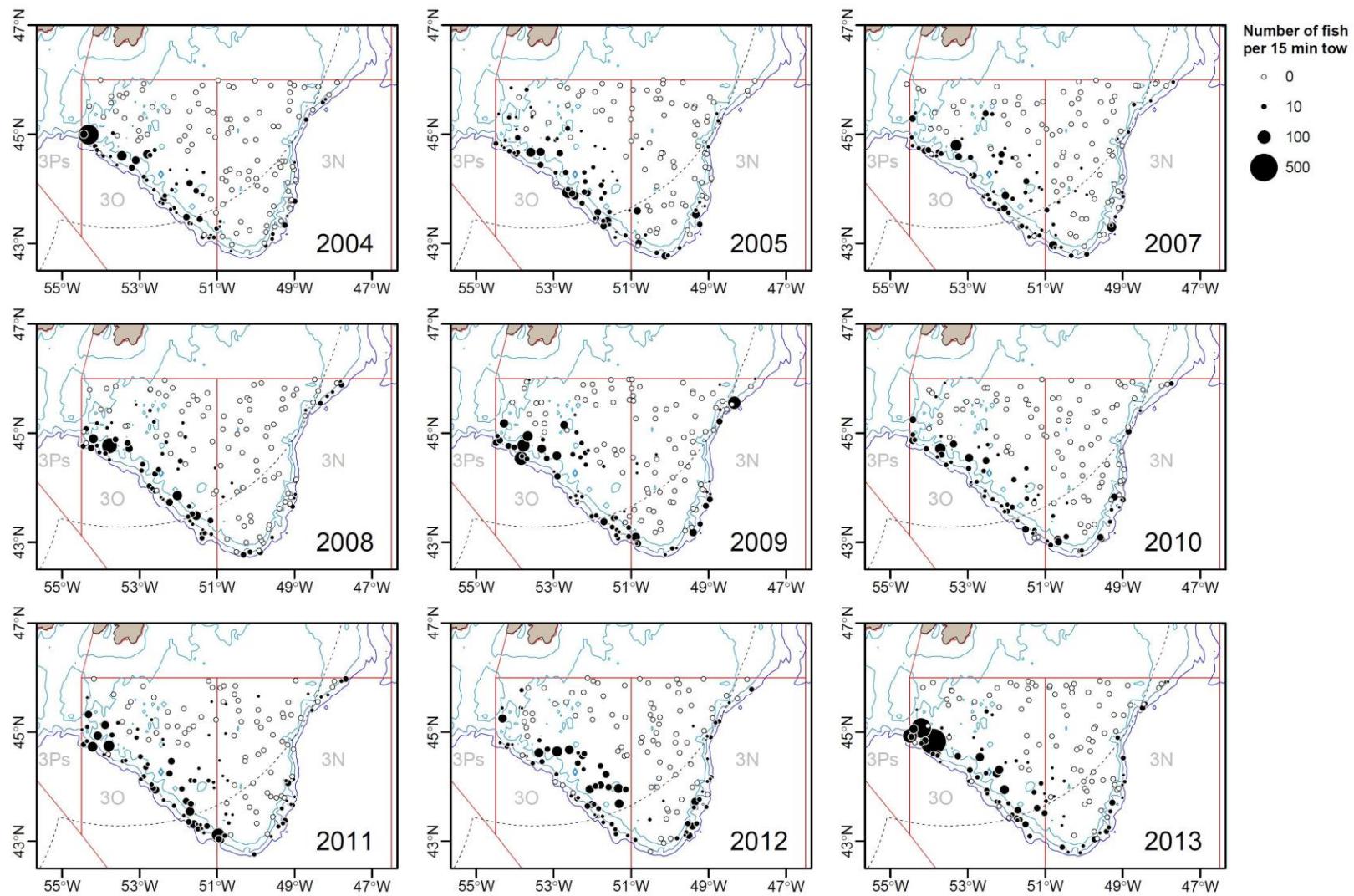


Figure 7. Distribution of witch flounder (numbers per tow) from Canadian spring surveys in NAFO Divs. 3NO during 2004 to 2013.

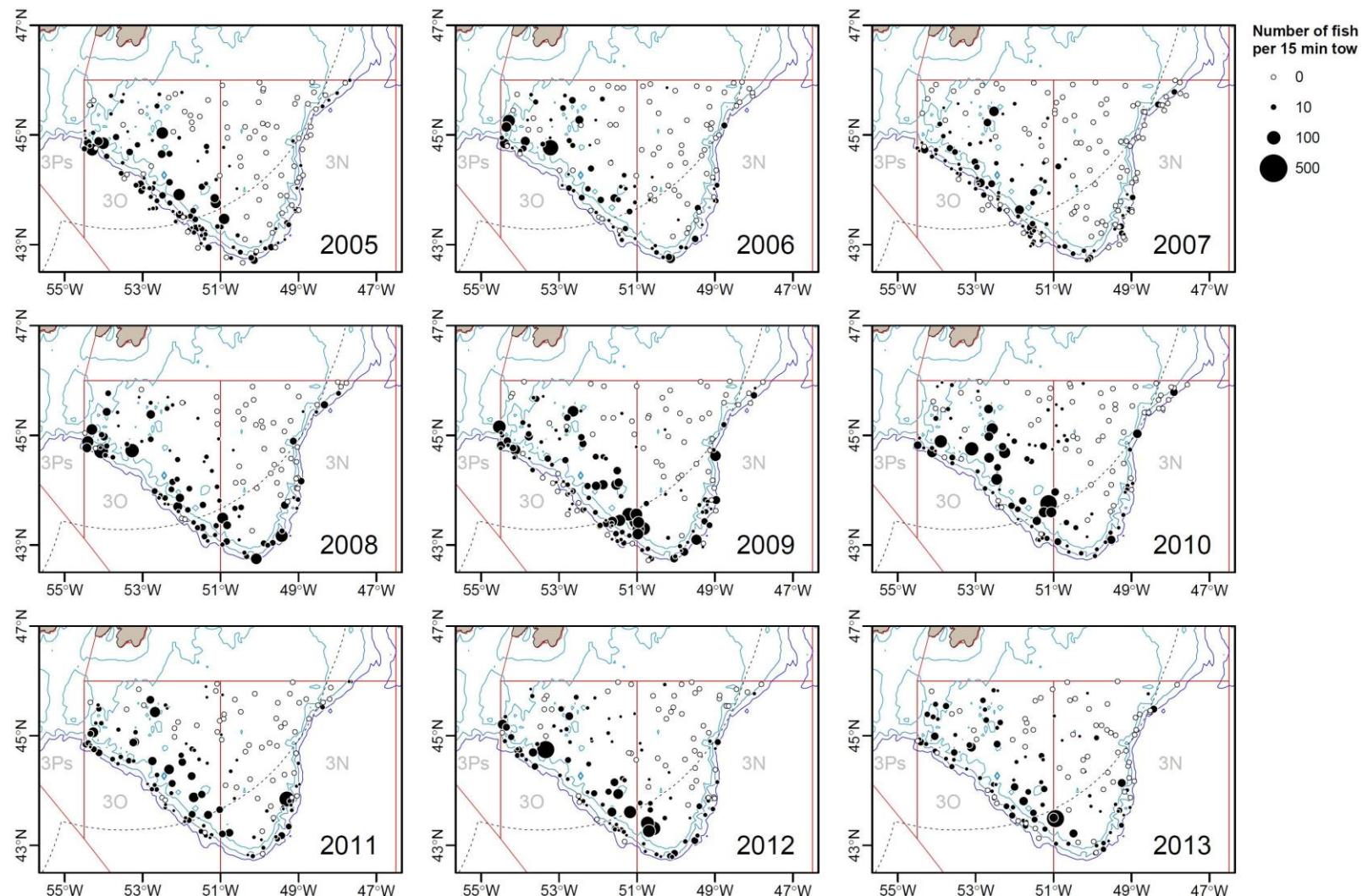


Figure 8. Distribution of witch flounder (numbers per tow) from Canadian fall surveys in NAFO Divs. 3NO during 2004 to 2013.

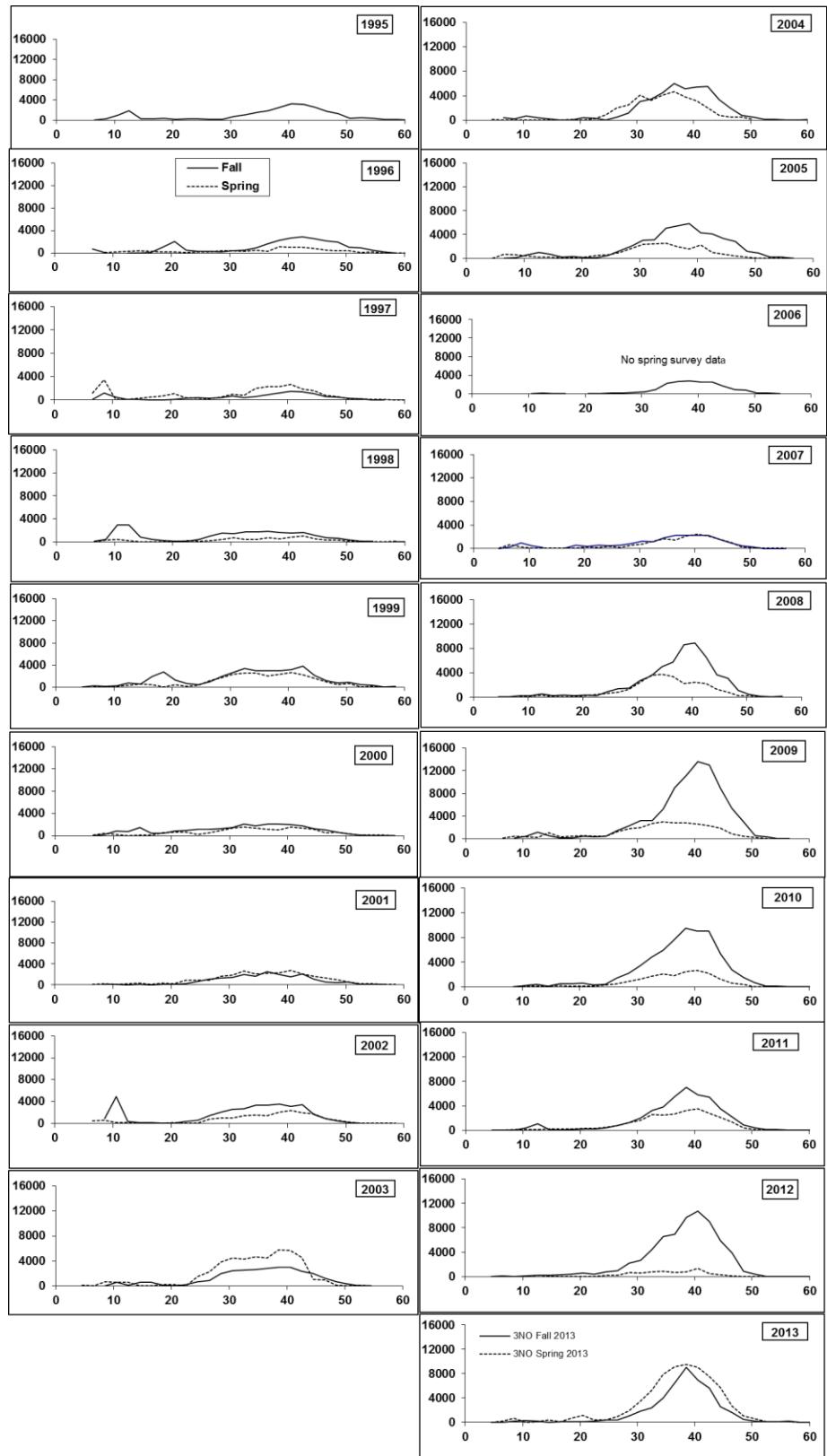


Figure 9. Length frequency distributions of witch flounder from Canadian spring and fall surveys using the Campelen 1800 shrimp trawl. Estimates represent abundance at length (cm) of the surveyed area. All distributions are for NAFO Divs. 3NO.

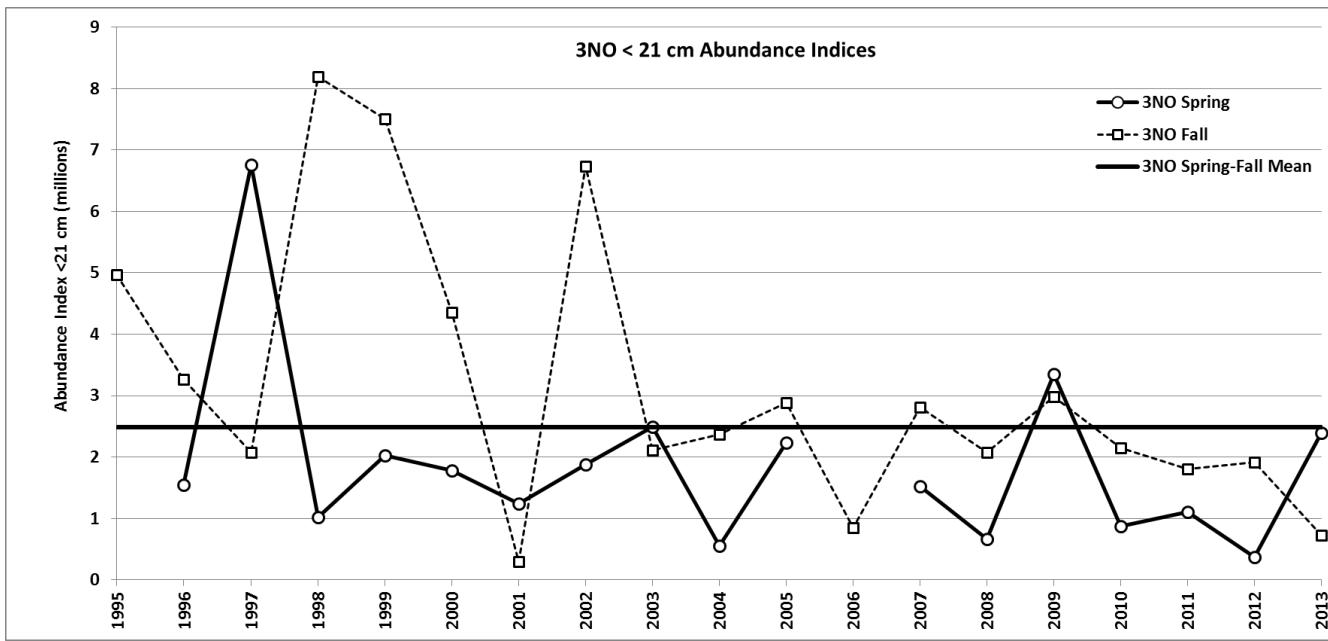


Figure 10. Abundance index of witch flounder <21cm in length from spring and fall Canadian rv surveys in NAFO Divs. 3NO (1995-2013).

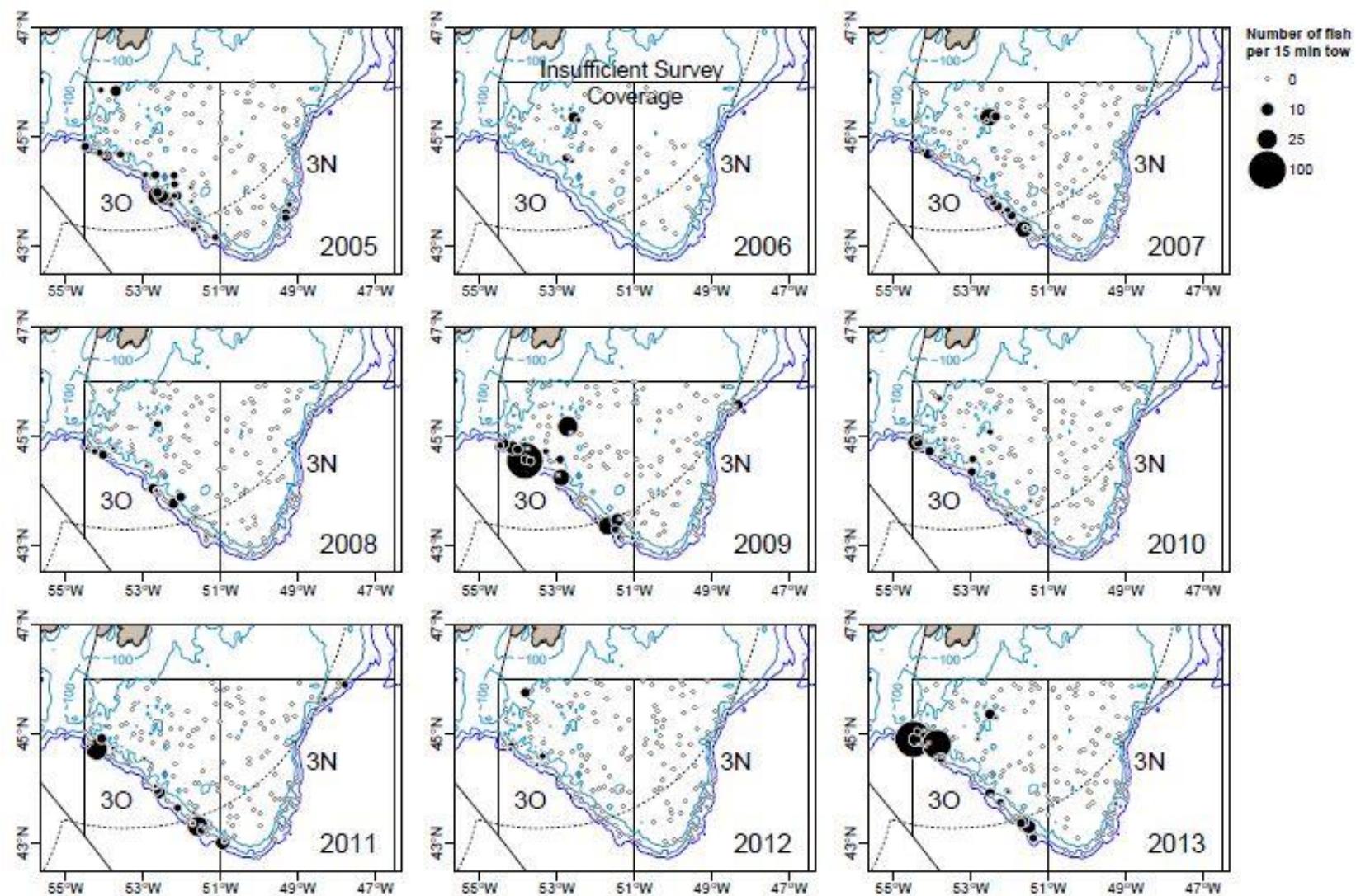


Figure 11. Distribution of juvenile (< 21 cm) witch flounder from Spring Canadian rv surveys in NAFO Divs. 3NO (1995-2013).

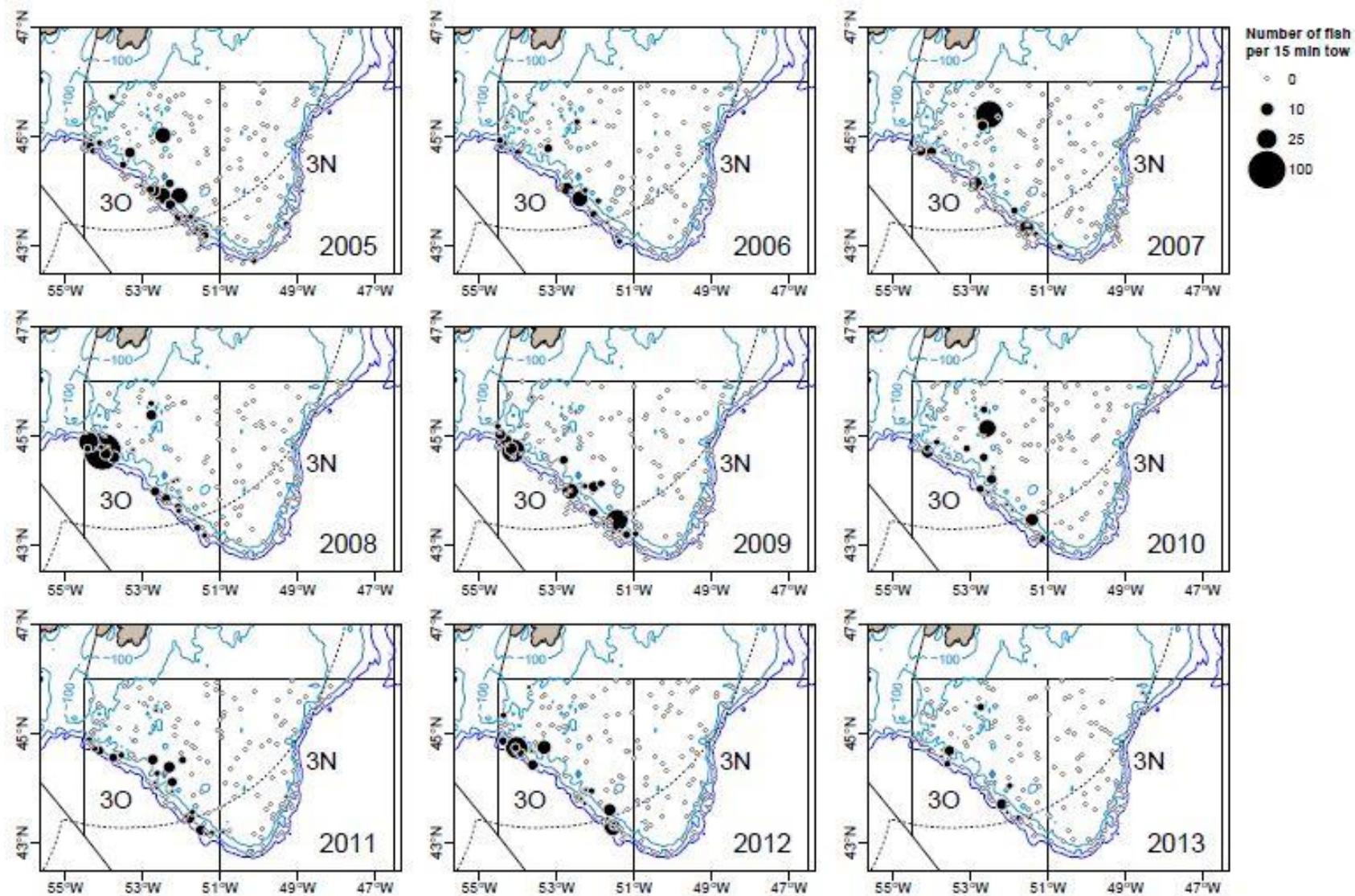


Figure 12. Distribution of juvenile (< 21 cm) witch flounder from spring Canadian rv surveys in NAFO Divs. 3NO (1995-2013).

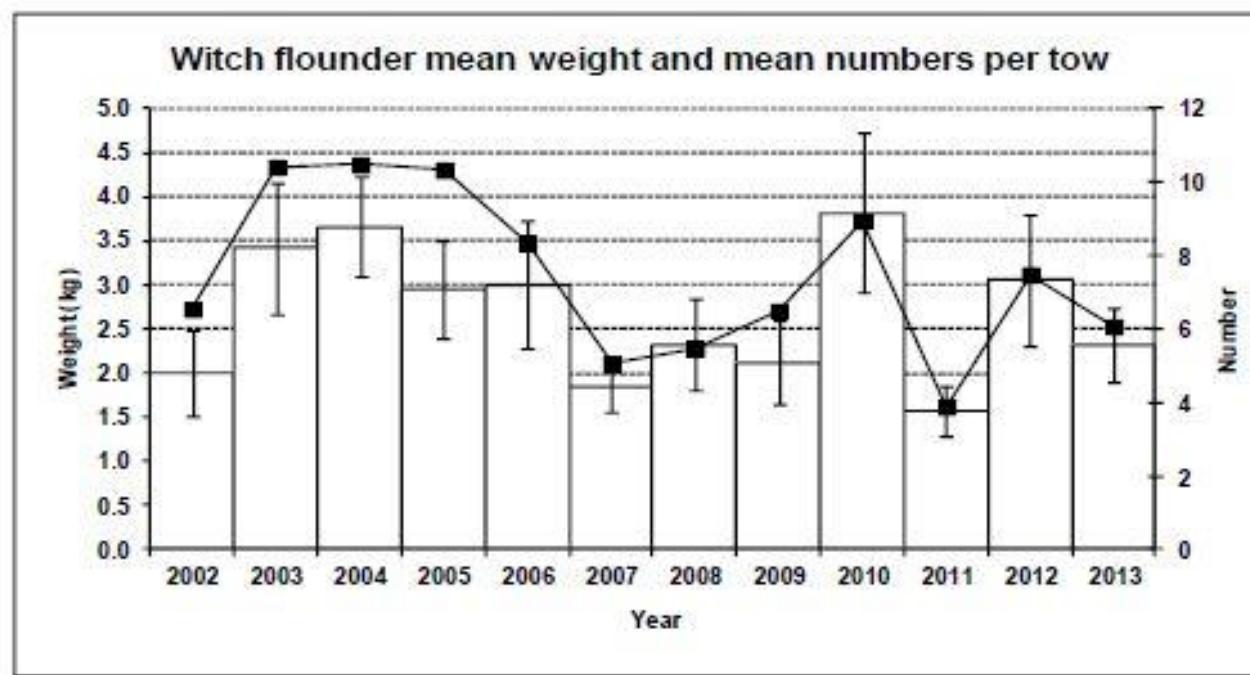


Figure 13. Witch flounder stratified mean catches (kg) and mean number by year. Spanish spring surveys in NAFO Divs. 3NO: 2002-2013.

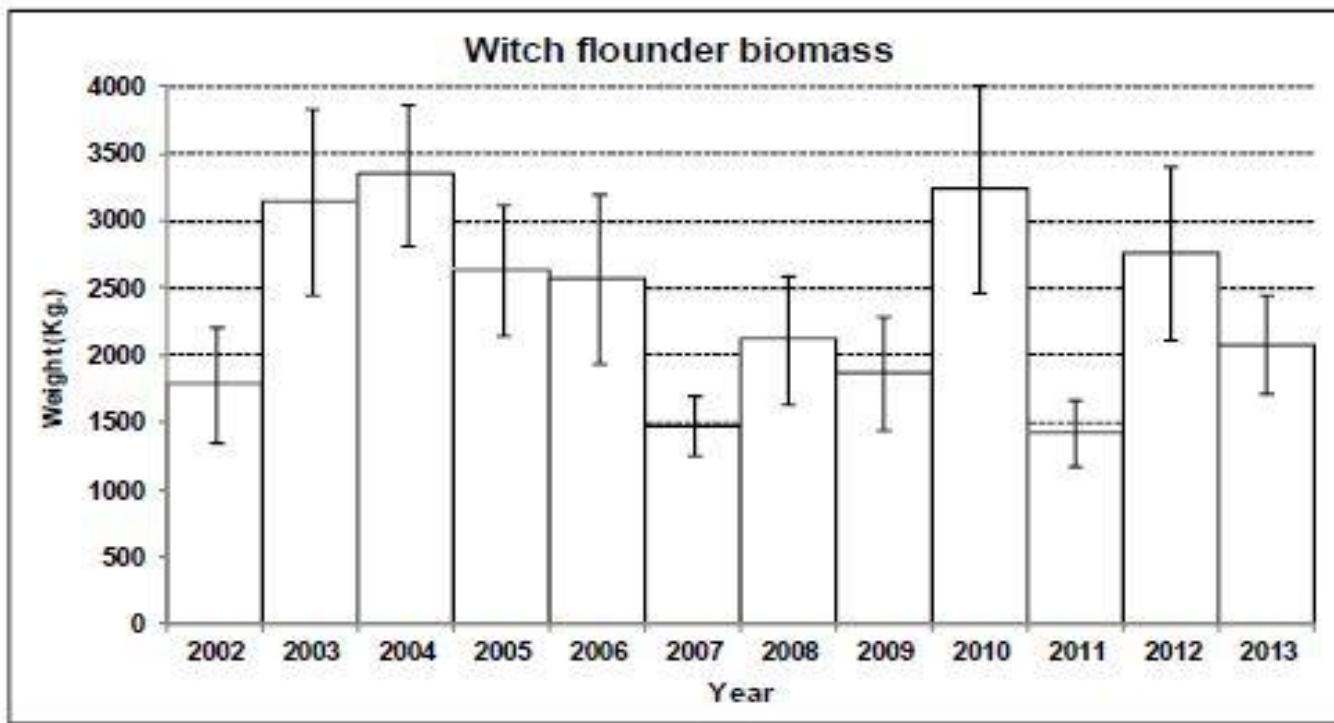


Figure 14. Witch flounder biomass calculated by the swept area method in tons \pm SD by year. Spanish spring surveys in NAFO Divs. 3NO: 2001-2013.

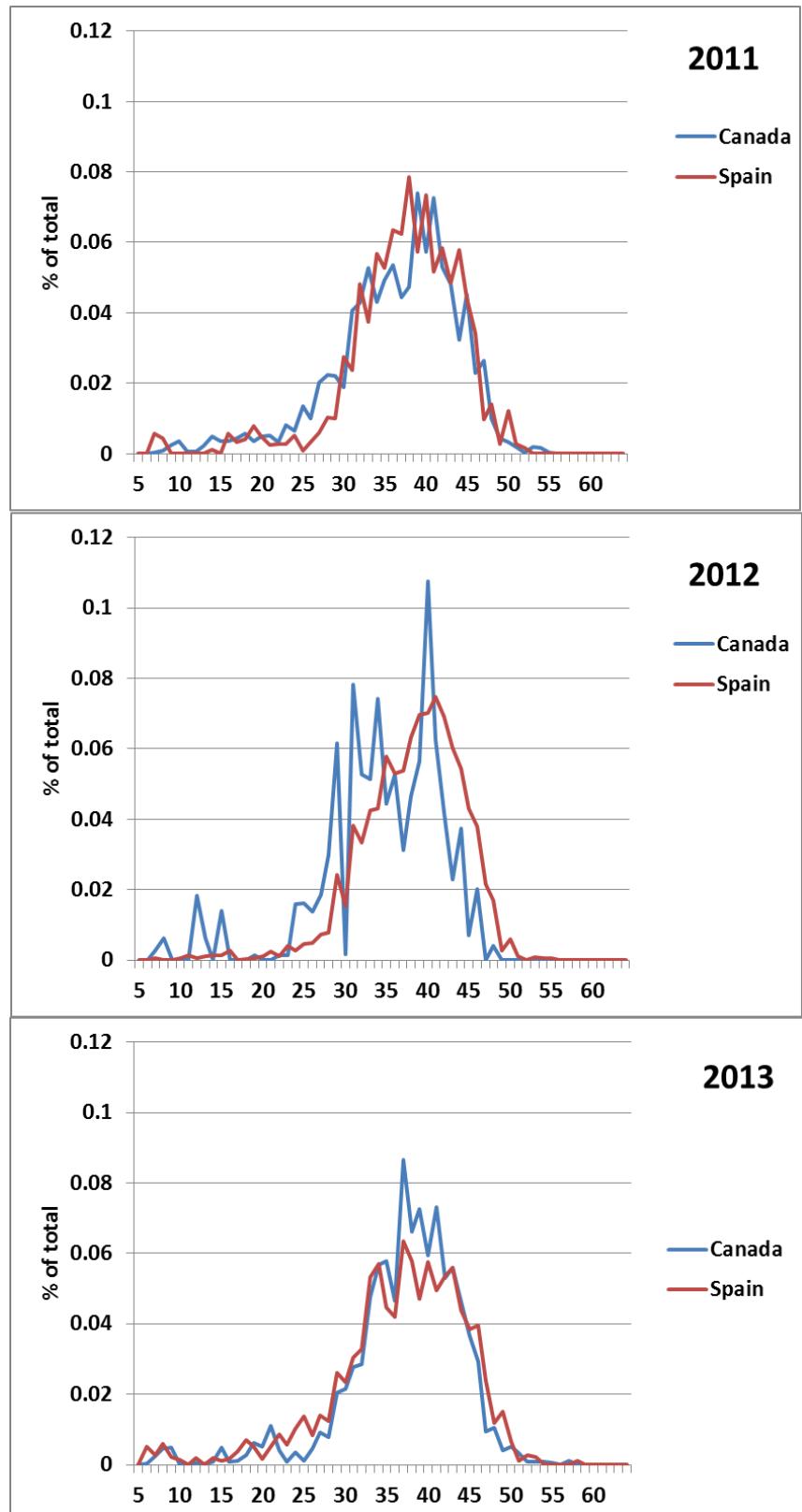


Figure 15. Witch flounder length-frequencies (cm) for Canadian and Spanish spring rv surveys in NAFO Divs. 3NO: 2012-2013.