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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. Note that due to operational difficulties there was no fall survey of NAFO Divs. 3NO in 2014. Indices from the Canadian fall survey series for NAFO Divs. 3NO were less variable with an increasing trend in biomass from about 1997 until 2005, a decline to 2007, then sharp 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.

From 2013 to 2014 spring survey indices within NAFO Divs. 3NO underwent a sharp decline. Biomass values in 2014 declined from a time series high in 2013 to a value just above the time series mean. Abundance values in 2014 declined from a time series high in 2013 to a value which although significantly lower is still approximately two times the time series mean. 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 2011-2014.

The survey series generally exhibit wide confidence limits, are not consistent between survey seasons or 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.

A surplus production model in a Bayesian framework was used for the assessment of this stock. Input data were catch from 1960-2014, Canadian spring survey series from 1984-1990, Canadian spring survey series from 1991-2014 (no 2006) and the Canadian autumn survey series from 1990-2013. The surplus production model results indicate that stock size decreased from the late 1960s to the early 1990s and has increased since the late 1990s. The model suggests that a maximum sustainable yield (*MSY*) of 3 760 (2423-5832) tons can be produced by total stock biomass of 59 680 (37 150-82 630) tons (B_{MSY}) at a fishing mortality rate (F_{MSY}) of 0.06 (0.04-0.12). Relative population size (median B/B_{MSY}) was below $B_{lim}=30\%B_{MSY}$ from 1993-1998. Biomass has since increased to a level of 81% B_{MSY} in 2014 (Figure 16). The probability of being below B_{lim} in 2014 is very low. Relative fishing mortality rate (median F/F_{msy}) was above 1.0 from the late 1960s to

the mid-1990s (Figure 17). F has been below F_{MSY} since 1995. From 2010-2014 F averaged about 13% of F_{MSY}. The probability of being above F_{lim} in 2014 is very low.

Fisheries and Management

As noted in previous reports, most recently Lee et.al. (2014) and Brodie et.al. (2011), 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 (Table1; 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 NAFO Fisheries Commission introduced a complete moratorium for directed fishing in 1995, which has continued through 2014. The NAFO Fisheries Commission introduced a 1,000 ton quota for 2015.

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 335 t in 2014 (Table 1; Fig. 1). Preliminary data, available only for Canada, indicates that from January to May 2015 Canada had landed 168 t in NAFO Divs. 3NO. This is an increase above Canada's total landings from 1994-2014 which were less than 70 t annually. This increase is a result of directed fishing for witch flounder under the 2015 TAC of 1,000 t introduced by the NAFO Fisheries Commission in NAFO Divs. 3NO (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 1994 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 (1994-2014), the estimated catch for NAFO Divs. 3NO has been taken as by-catch in directed fisheries for other species in the NRA. Due to the 1000 t quota adopted for NAFO Divs. 3NO in 2015 there will now be directed fisheries for witch flounder.

Data from commercial fisheries

Length sampling was available from by-catches in directed fisheries for other species by Spain, Portugal, and Russia in 2014 (Fig. 2). The Spanish data (Gonzalez-Costas et. al. 2015), from Div. 3NO G. halibut, redfish and skate fisheries, showed most of the witch flounder catch was between 30 and 44 cm in length, with a peak at 35. In the Portuguese data (Vargas et. al. 2015) for Div. 3N lengths between 46cm and 50cm dominated the catch, with a mode at 46cm (mean length of 49.4 cm). In Div. 3O the Portuguese catch was dominated by lengths between 28cm and 38cm, with a mode at 32 cm (mean length of 33.1 cm) (Fig. 2). For Russia (Fomin et. al. 2015), 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).For Russia (Fomin et. al. 2015) sampling of witch by-catch indicates a length range of 38-60 cm and mean length of 50.1 in Div. 3N and a length range of 30-40 cm with a mean length of 36.7 cm in Div. 3O.

No data from Canadian by-catches of witch in Div. 3NO were collected from 2011 to 2014.

Research Vessel Surveys

Canadian RV surveys

Spring 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 2014 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 2014 to a depth of 731 m except for 2011 which was missing one stratum (Tables 2 and 3).

Fall Surveys

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). Note that due to operational difficulties there was no fall survey of NAFO Divs. 3NO in 2014. 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 6-9) 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 2014 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 and another sharp increase from 2013 to 2014 to the highest biomass levels of the entire time series (Fig 3). Spring stock indices in NAFO Div. 3O, which are also highly variable, indicate a downward trend from 2004 to 2010, a sharp increase from 2010 to 2013 equivalent to the highest levels of the time series. This is followed by a sharp decline in spring stock indices from 2013 to 2014 back to levels at or below the mean levels for the time series (Fig. 3).

Due to operational difficulties there was no fall survey of NAFO Divs. 3NO in 2014. 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 (Fig. 3; Tables 6 and 18). This was followed by a sharp decline from 2011 to 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). This was followed by a sharp increase from 2013 to 2014 to the highest estimates of the time series for biomass (2500 t) and mean weight per tow (1.0 kg) (Fig. 3; Tables 6 and 18).

The estimates for abundance and mean number per tow in NAFO Div. 3N were highly variable over the time series but show an increasing trend from 2008 to 2011 followed by a marked decline from 2011 to 2013 (Fig. 3; Tables 10 and 14). This was followed by a sharp increase from 2013 to 2014 to values approaching the highest estimates of the time series observed in 2011 Estimates for 2011 were an abundance of 6 million fish and mean number per tow of 2.5.

In most years (1989-2004) of the time series the spring stock 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, 7 of the 8 survey years 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. Indices increased sharply from 2013 to 2014 to the highest values of the time series for biomass and approaching the highest values of the time series for abundance (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 than 3N. 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 6 million fish in 1998 (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 2010 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). From 2013 to 2014 there were sharp decreases in indices of biomass to values near the time series mean and abundance to approximately 50% above the time series mean. All 2013 and 2014 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

Due to operational difficulties there was no fall survey of NAFO Divs. 3NO in 2014. Stock indices means of biomass (3,000 t), mean weight per tow (1 kg), abundance (3 million fish), and mean number per tow (# 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, ands 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. The NAFO Divs. 3NO-combined indices for spring show a slow 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 had occurred from 1998 to 2003 until a decline in levels from 2003 to 2005. Values from 2007-2010 have fluctuated around the long-term mean, however from 2010 to 2013 estimates of both biomass and abundance increased substantially, with the time series highest values in 2013 peaking at about 3 times the long term mean (Fig. 5). This increase from 2010 to 2013 was followed by a sharp decline in both biomass and abundance from 2013 to 2014 to levels approaching the time series mean for biomass and to levels approximately 1.5 times the time series means for abundance. All 2013 and 2014 spring stock index estimates in NAFO Divs. 3NO were associated with wide confidence intervals which extended below zero

Due to operational difficulties there was no fall survey of NAFO Divs. 3NO in 2014. 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 highest 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).

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 indicated more witch flounder are distributed on the shelf area of the Grand Banks in some years, especially in Div. 3O and especially in the fall. Therefore, it seems likely that the RV survey coverage does adequately cover the depth distribution of witch flounder, particularly in the fall. The variation in the survey indices may be due to the movement of 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 2011-2014 (no fall survey in 2014), the spring and fall distribution plots are presented in Figures 6 and 7. 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 rv surveys are fairly flat and evenly distributed from 1996 to 2002, with few fish > 45 cm (Figure 8). Length frequencies of 30-50 cm fish increase from 2002 to 2005, decrease to pre-2002 levels from 2006 to 2007, and are then consistently higher from 2008 to 2014 (note there was no survey data collected in the fall of 2014) with a mode generally within the mode of 40 cm (Figure 8). The increase in 30-50 cm fish is generally more pronounced in the fall survey data as opposed to the flatter distributions of the spring surveys.

There have been a few identifiable peaks in the time series (presumably year classes) that could be followed in successive years (e.g. 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 peak at 12 cm was not observed subsequently. It should be noted that no ageing information for this stock has been available since the mid 1990's, making the tracking of cohorts from length frequency data all but impossible given the relatively slow growth of witch flounder.

Figure 9 shows the abundance index for fish less than 21 cm for NAFO Divs. 3NO combined, as measured in the spring and fall Campelen surveys. Highest spring levels were in 1997, highest fall levels were in 1998 and 1999. Values since 2002 for the fall have been consistently below the mean of the time series. Spring values were occasionally above the time series mean in 2003, 2005, 2009, and 2013.

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 10 and 11). It is also possible that the weak pattern may be related to the distributions previously presented (Figs. 6 and 7) for the entire population which indicated a movement of fish to the shallower, larger strata during the fall.

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 12 and biomass estimates are provided in Figure 13 for the latter series, as data prior to 2000 have not yet been converted. Index values peaked in 2004 and 2010, declined in 2011, increased in 2012 and then declined sharply from 2012 to 2014 to the lowest values reported over the time series. Length frequency comparisons between Canadian and Spanish spring research vessel surveys from 2011 to 2014 are presented in Figure 14. From 2011 to 2013 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. Although Canadian length frequencies were relatively stable in 2014, Spanish length frequencies shifted slightly to a smaller range. In 2014 Spanish length frequencies ranged from about 20 cm to 47 cm with a modal frequency of approximately 33 cm (Figure 14).

Surplus production model

A surplus production model in a Bayesian framework was used for the assessment of this stock. This model was developed using data to 2012 (Morgan et al 2015). The approved model was updated with catch from 1960-2014, Canadian spring survey series from 1984-1990, Canadian spring survey series from 1991-2014 (no 2006) and the Canadian autumn survey series from 1990-2013.

The priors used in the model were:

Initial population size	Pin~dunif(0.5, 1)	uniform(0.5 to 1)
Intrinsic rate of natural increase	r ~ dlnorm(-1.763,3.252)	lognormal (mean, precision)
Carrying capacity	K~dlnorm(4.562,11.6)	lognormal (mean, precision)
Survey catchability	pq ~dgamma(1,1)	gamma(shape, rate)
q <-1/pq		
Process error	sigma ~ dunif(0,10)	uniform(0 to 10)
isigma2 <- pow(sigma, -2)		
Observation error	tau~dgamma(1,1)	gamma(shape, rate)
itau2 <- 1/tau		

Model diagnostics are given in Appendix A and indicated no issues with model fit or convergence.

Resource Status

Recruitment (defined as fish less than 21cm) in both the spring and fall Canadian surveys although somewhat variable has generally been low since 2002. Recruitment since 2005 has generally been lower than the time series average, although there were above average peaks indicated for spring recruitment in 2009 and 2013.

The surplus production model results indicate that stock size decreased from the late 1960s to the early 1990s and has increased since the late 1990s. The model suggests that a maximum sustainable yield (*MSY*) of 3 760 (2423-5832) tons can be produced by total stock biomass of 59 680 (37 150-82 630) tons (B_{MSY}) at a fishing mortality rate (F_{MSY}) of 0.06 (0.04-0.12). Relative population size (median B/B_{MSY}) was below $B_{lim}=30\%B_{MSY}$ from 1993-1998. Biomass has since increased to a level of 81% B_{MSY} in 2014 (Figure 16). The probability of being below B*lim* in 2014 is very low. Relative fishing mortality rate (median F/F_{msy}) was above 1.0 from the late 1960s to the mid-1990s (Figure 17). *F* has been below F_{MSY} since 1995. From 2010-2014 *F* averaged about 13% of F_{MSY}. The probability of being above F_{lim} in 2014 is very low.

The posterior distributions (13500 samples) for *r*, *K*, *sigma*, and biomass and the production model equation were used to project the population to 2018. All projections assumed that the catch in 2015 was equal to the TAC of 1 000 t. This was followed by constant fishing mortality for 2016 and 2017 at several levels of *F* (*F2015*, *75% F2015*, *125% F2015*, *2/3* F_{MSY}, *75%* F_{MSY}, and *85%* F_{MSY}). *F2015* was taken as $F_{statusquo}$ as *F* in the reopened fishery is likely to be higher than that while the stock was under moratorium.

The probability that $F > F_{lim}$ in 2015 was less than 1% at a catch of 1,000 t (Table 22). The probability of $F > F_{lim}$ increases to 26% at an F of *85%* F_{MSY}. The population is projected to grow and the probability that the biomass in 2018 is greater than the biomass in 2014 is high under all scenarios. The population is projected to remain below B_{MSY} for all levels of *F* examined with a probability of greater than 50% (Table 23).

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Table 1. Catches and TACs (t) of Witch Flounder in Div. 3NO from 1960 to 2015*.

Year	Canada	USSR (Russia)	Other	Total	TAC
1960	-	-	-	5799	0
1961	-	-	-	4627	0
1962	-	-	-	1228	0
1963	895	485	803	2183	0
1964	1055	-	11	1066	0
1965	1324	849	4	2177	0
1966	3644	3828	50	7522	0
1967	2863	8565	75	11503	0
1968	1503	9078	18	10599	0
1969	479	4215	6	4700	0
1970	723	6039	1	6763	0
1971	178	14774	13	14965	0
1972	3419	5738	20	9177	0
1973	4943	1714	34	6691	0
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	303	315	0
2013	62	54	212	328	0
2014	11	57	267	335	0
2015	168			168	1000

Note: Although a TAC of 3000 tons was agreed by the FC, it was also agreed that no directed fishing be conducted in 1994 due to the poor state of the stock.
The catch for Other sources in 2003 is the mean of a range of catch information.
*Preliminary catch data available only for Canada in 2015.
A 1,000 ton quota for 3NO witch was adopted by the Fisheries Commission for 2015.

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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<=56	1593	1593	375																															
	1499	1499	376																															
57-92	2992	2992	360																															
	1853	1853	361																															
	2520	2520	362																															
	2520	2520	373																															
	931	931	374																															
	674	674	383																															
93-183	421	421	359																															
	100	100	377																															
	647	647	382																															
184-274	225	225	358																															
	139	139	378																															
	182	182	381																															
275-366	164	164	357																															
	106	106	379																															
	116	116	380																															
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																															

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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
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	92	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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<=56	1593	1593	375																									
	1499	1499	376																									
57-92	2992	2992	360																									
	1853	1853	361																									
	2520	2520	362																									
	2520	2520	373																									
	931	931	374																									
	674	674	383																									
93-183	421	421	359																									
	100	100	377																									
	647	647	382																									
184-274	225	225	358																									
	139	139	378																									
	182	182	381																									
275-366	164	164	357																									
	106	106	379																									
	116	116	380																									
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																									
915-1097	.	138	753																									
	.	102	757																									
	.	171	761																									
1098-1280	.	180	754																									
	.	99	758																									
	.	212	762																									
1281-1463	.	385	755																									
	.	127	759																									
	.	261	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	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
57-92	2089	2089	330																									
	456	456	331																									
	4898	4898	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	151	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																									
	.	99	768																									
	.	135	772																									
915-1097	.	124	765																									
	.	138	769																									
	.	128	773																									
1098-1280	.	144	766																									
	.	128	770																									
	.	135	774																									
1281-1463	.	158	767																									
	.	175	771																									
	.	155	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 1984-2014. (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	14
<=56	1593	1593	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	35	0	21	0	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	0	89	0	0	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	135
	1853	1853	361	119	0	0	39	50	0	20	0	0	0	0	39	0	0	0	0	242	45	0	0	0	35	139	0	18	72	0	131	0	92	75
	2520	2520	362	0	82	23	18	147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133	0	0	0	0	17	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	15	20	0	0
	931	931	374	0	0	0	0	0	0	0	0	0	18	34	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0	0	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	23	0	0	0
93 - 183	421	421	359	231	47	99	43	306	121	0	0	0	19	0	0	0	0	0	67	149	58	13	0	0	334		52	0	593	719	1365	299	83	835
	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	38	0	0
	647	647	382	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40		0	0	0	0	0	0	0	42
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	135
	139	139	378	22	19	32	155	31	42	0	0	29	0	0	0	0	3	0	0	0	5	8	1	0	0		0	0	0	0	14	55	0	0
	182	182	381	21	7	32	101	69	0	28	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0		53	13	18	0	0	30	0	23
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	42
	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	237
	116	116	380	6	53	0	134	24	7	4	0	0	0	0	0	0	0	0	6	0	0	0	3	0	0		0	5	0	0	0	22	5	12
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	245
	105	105	725								62		40	44	0	5	28	4	20	32	8	3	7	0	103		15	3	36	4	18	28	8	68
	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	43
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	150
	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	77
	156	156	728								92	19	82	22	152	21		15	32	45	98	43	53	75	42		34	175	748	164	117	142	187	371
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	2489
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	953
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	38.3

Table 7. Estimated biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2014. (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	14
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	294
	456	456	331	1912	302	36	18	444	0		0	0	0	0	0	74	0	36	537	28	375	102	0	0	292		1301	425	1124	17	212	81	10	352
	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	455
	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	45
	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	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	85
	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	1264
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	66
	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	4888
	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	140
	585	585	339	335	0	16	223	136	0	0	0	0	0	0	0	1	0	0	1	0	5	2	0	0	189	825	4	37	284	2	58	0	14	56
	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	429
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	0
	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	18
	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	3
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	4
	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	8
	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	2
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	7
	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	3
	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	3
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	38
	105	105	720								217	134	182	95	15	21	150	32	21	40	38	7	23	9	69		9	9	9	9		4	6	43
	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	9
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	8212
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	102
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	1.3

Table 8. Estimated biomass (tons) of Witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2014 (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	14
<=56	1593	1593	375	0	73		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	11991	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	
	674	674	383	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	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	1	0	0	0	7	0	0	0	0	0	0	0	3	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	
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	13432	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 1990-2014 (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	14
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	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	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 1984-2014 (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	14
<=56	1593	1593	375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73	44	0	44	0	0	0	0	
	1499	1499	376	0	0	0	26	0	0	0	0	0	0	0	0	0	0	34	34	0	0	0	0	0	0	0	88	0	0	0	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	206
	1853	1853	361	153	0	0	32	36	0	28	0	0	0	0	36	0	0	0	0	212	85	0	0	0	36	255	0	51	85	0	203	0	170	64
	2520	2520	362	0	95	25	27	173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	173	0	0	0	0	39	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	39	39	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	46	0	46	0	0	
93 - 183	421	421	359	405	58	232	58	985	203	0	0	0	29	0	0	0	0	0	203	405	58	29	0	0	695		87	0	1448	1953	3475	608	115	1371
	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	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	89		0	0	0	0	0	0	0	45
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	230
	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	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	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	64
	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	515
	116	116	380	8	88	0	247	32	8	8	0	0	0	0	0	0	0	0	8	0	0	0	8	0	0		0	7	0	0	0	54	11	21
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	582
	105	105	725								166		101	87	0	13	235	26	51	72	19	6	17	0	264		40	10	110	13	26	51	18	154
	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	69
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	395
	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	178
	156	156	728								182	21	139	29	172	134		64	158	145	258	136	143	161	64		70	319	1409	383	225	268	326	558
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	4489
Abundance >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	1937
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	43.2

Table 11. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2014 (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	14
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	575
	456	456	331	3555	376	94	31	1004	0		0	0	0	0	0	63	0	94	1104	63	721	94	0	0	784	0	2885	1129	2478	63	526	188	28	784
	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	1044
	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	79
	2520	2520	351	924	231	495	267	1317	240	116	0	0	0	0	0	0	0	0	39	43	0	0	0	0	0	0	0	87	0	0	43	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	142
	1282	1282	353	9347	1234	1713	2146	13050	3880	2910	0	265	353	0	35	35	265	459	5055	2539	901	831	1102	957	872	7616	794	1058	309	573	2405	6393	2214	2381
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	158
	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	25717
	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	848
	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	241
	474	474	354	1174	239	3282	456	619	196	359	261	261	1663	0	0	98	33	563	3208	2739	2100	1467	359	913	1960		1239	2282	1043	406	2402	652	1076	1345
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	30
	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	92
	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	21
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	46
	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	60
	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	17
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	85
	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	16
	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	21
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	387
	105	105	720								361	376	1026	498	43	101	518	186	104	351	309	50	104	41	765		62	75	72	75		22	25	508
	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	65
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	34654
Abundance >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	1081
Percent >366 m				0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.3	21.3	28.7	22.0	17.5	27.6	61.7	30.3	5.2	8.4	7.2	13.0	3.3	0.8	7.9	0.0	4.6	3.2	12.6	5.0	7.0	1.5	2.7	3.1

Table 12. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2014 (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	14
<=56	1593	1593	375	0	55		0	0	0	0	0	0	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	
	1499	1499	376	0	0	0	0	0	23	0	19	0	0	0	0	59	59	0	0	0	0	0	69	0	0	103	258	
57 - 92	2992	2992	360	382	206	1646	320	103	1232	41	672	755	360	926	514	1080	1022	1132	4888	154	0	9290	17639	3224	2381	22490	17384	
	1853	1853	361	32	425	701	0	42	0	0	23	0	306	51	204	255	102	0	211	51	1020	85	0	561	249	262	153	
	2520	2520	362	441	277	116	0	0	0	0	0	0	50	0	0	0	198	0	0	50	0	0	58	297	99	149	149	
	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	
	674	674	383	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	0	93	
93 - 183	421	421	359	0	0	608	0	0	87	0	0	2722	29	0	405	116	232	203	87	145	524	1216	2635	869	956	331	270	
	100	100	377	0		0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	44	21	110	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	46	108	31	0	234	0	31	93	46	69	136	0	307	31	251	252	31	230	190	174	155	650	120	
	139	139	378	0	105	19	0	0	0	0	8	10	0	0	8	10	0	0	0	200	9	19	8		38	112	359	
	182	182	381		0		0	0	0	0	7	13	0	0	11	0	0	0	0	0	0	0	11	0	0	0	0	
275 - 366	164	164	357	0	384	23	338	135	180	0	60	0		124	33	20	102	34	98	242	116	259	29	72	11	143	68	
	106	106	379	7		15	0	0	0	19	22	0	0	6	296	91	26	1915	13	6	15	350	24	81	1500	51	10	
	116	116	380		0		0	0	0	0	0	8	8	24	0	0	0	16	24	0	0	0	0	0	0	0	0	
367 - 549	155	155	723		53		330	394	117	21	88	313	85	104	190	57	347	43	299	72	38	227	239	94	153	87	96	
	105	105	725			36	701	173	49	0	237	29	101	71	22	14	29		21	15	32	58	91		37	29	155	
	160	160	727				0	44	11	0	55	11	11	0	13	0	11	11	59	0	0	307	163	66	57	77	33	
550 - 731	124	124	724		443		1126	512	223	178	571	326	640	337	264	270		177	247	629	384	1651	771	381	432	245	213	
	72	72	726				669	114	119	99	40	92	125	40	37	176	129	84	42	106	125	102	91	20	44	78	11	
	156	156	728					268	195	129	212	215	311	417	223	633	351	161	73	204	343	428	303	860	118	245	354	
732 - 914	.	134	752									165		28	0	74					9							
	.	106	756									255		149	182	22			175		185							
	.	154	760									244		229	409	530			53		339		618					
915 -1097	.	138	753									0		9	0	33					0							
	.	102	757									0		0	96	92			7		0							
	.	171	761									106		578	202	24			412		24		277					
1098 -1280	.	180	754									0		0	0	12					0			0				
	.	99	758									0		0	0	8			0		0							
	.	212	762											0	483	0			58		97		204					
1281 -1463	.	385	755									0		0	0	0					0							
	.	127	759									0		0	9	0			0		0							
	.	261	763											72	18	88			0		0		18					
Grand Total				863	1995	3272	3515	1793	2470	488	2046	5355	2073	3233	3756	3717	2912	3806	7017	2126	3289	14269	23473	6742	6251	25163	19725	
Abundance >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	3.0	4.4	

Table 13. Abundance (000s) of witch flounder (M+F) in each stratum from surveys in Div. 3O during fall of 1990-2014 (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	14
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	24415.3	
Abundance >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	1009.3	
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 1984-2014 (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	14
<=56	1593	1593	375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.20	0.00	0.20	0.00	0.00	0.00	0.00	0.00
	1499	1499	376	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57 - 92	2992	2992	360	5.43	0.31	1.77	1.80	6.42	0.53	0.00	0.00	0.14	0.55	0.00	0.00	0.00	0.32	0.16	0.55	1.49	0.00	0.00	0.20	0.30	3.78	1.17	1.80	0.25	0.00	2.00	0.70	0.40	0.80	0.50
	1853	1853	361	0.60	0.00	0.00	0.13	0.14	0.00	0.11	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.83	0.33	0.00	0.00	0.00	0.14	1.00	0.00	0.20	0.33	0.00	0.80	0.00	0.67	0.25
	2520	2520	362	0.00	0.27	0.07	0.08	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
	2520	2520	373	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.11	0.11	0.00	0.00
	931	931	374	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	674	674	383	0.00	0.67	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00
93 - 183	421	421	359	7.00	1.00	4.00	1.00	17.00	3.50	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	3.50	7.00	1.00	0.50	0.00	0.00	12.00		1.50	0.00	25.00	33.71	60.00	10.50	2.00	23.67
	100	100	377	1.00	0.00	0.00	13.50	0.50	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00
	647	647	382	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
184 - 274	225	225	358	2.50	18.00	3.00	9.00	1.00	1.50	3.00	0.00	3.00	9.50	7.50	1.00	2.50	2.67	8.44	0.50	1.33	10.50	0.89	9.57	0.00	3.56		22.00	4.89	17.50	9.78	18.29	6.00	10.67	7.43
	139	139	378	2.50	1.50	2.50	18.50	4.50	6.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.44	1.71	0.44	0.00	0.89		0.00	0.00	0.00	0.00	1.02	5.83	0.00	0.00
	182	182	381	1.00	0.50	1.67	6.50	3.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.44	0.00	0.00	0.00	0.00		3.22	1.00	1.33	0.00	0.89	2.03	1.50	1.50
275 - 366	164	164	357	1.00	8.00	24.50		0.50	10.50	2.50	0.00	4.00	5.50	4.50	1.00	1.78	1.33	16.56	11.50	13.00	2.78	2.44	6.67	2.00	0.00		1.00	0.00	1.00	4.33	16.00	14.07	2.00	2.83
	106	106	379	4.50	2.50	4.67	29.00	7.00	3.00	7.50	0.50	3.00	0.00	1.50	0.00	0.00	1.24	0.44	7.00	1.94	0.89	0.00	1.07	0.00	2.73		0.00	0.00	0.50	29.16	3.37	19.50	13.07	35.33
	116	116	380	0.50	5.50	0.00	15.50	2.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00		0.00	0.44	0.00	0.00	0.00	3.36	0.67	1.33
367 - 549	155	155	723								13.50	16.00	12.00	2.50	8.50	2.13	2.40	7.00	4.50	8.00	4.11	15.11	7.11	4.50	14.67		5.00	11.49	1.56	17.06	4.64	5.00	16.53	27.30
	105	105	725								11.50		7.00	6.00	0.00	0.89	16.30	1.78	3.50	5.00	1.33	0.44	1.14	0.00	18.28		2.78	0.67	7.60	0.90	1.83	3.50	1.24	10.67
	160	160	727								0.00	0.50	2.50	1.00	0.00	0.00	0.50	1.50	1.50	0.94	0.44	0.00	0.00	1.40	3.11		1.39	3.33	0.00	0.89	3.75	3.50	8.13	3.14
550 - 731	124	124	724								66.50	34.00	35.00	11.00	7.00	7.50	25.35	8.44	32.22	29.33	30.22	15.67	16.61	8.50	10.00		37.83		23.87	15.36	10.30		12.10	23.17
	72	72	726								21.50	6.00	3.00	11.50	0.50	3.33	18.49	32.50	21.50	20.00	34.94	6.58	13.50	6.35	1.78		6.00	7.33	11.36	24.00	12.93	7.50	6.29	18.00
	156	156	728								8.50	1.00	6.50	1.33	8.00	6.22		3.00	7.37	6.76	12.00	6.33	6.67	7.50	3.00		3.28	14.86	65.65	17.83	10.50	12.50	15.21	26.00
732 - 914	.	134	752											2.00																				
	.	106	756											6.00																				
	.	154	760											4.50																				
Grand Total				1.33	0.54	0.80	1.14	1.82	0.42	0.14	0.83	0.58	0.79	0.45	0.24	0.20	0.50	0.62	0.81	1.12	0.75	0.43	0.54	0.28	1.43	0.63	1.12	0.44	1.79	1.87	2.43	1.03	0.99	1.87

Table 15. Mean numbers per tow for witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2014 (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	14
57 - 92	2089	2089	330	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	0.73	0.84	0.00	0.00	0.00	0.51	0.71	5.19	0.00	1.42	0.00	3.13	6.25	0.43	0.29	2.00
	456	456	331	56.67	6.00	1.50	0.50	16.00	0.00		0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	17.60	1.00	11.50	1.50	0.00	0.00	12.50		46.00	18.00	39.50	62.28	8.39	3.00	0.44	12.50
	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	4.00
	1716	1716	340	0.25	0.89	0.00	0.11	0.00	0.00	0.22	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.20	0.50	1.00	0.00	1.40	0.59	0.00	0.00	0.40	0.33
	2520	2520	351	2.67	0.67	1.43	0.77	3.80	0.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.44	0.13	0.00	0.00	0.00
	2580	2580	352	0.29	5.09	1.21	5.77	5.18	2.62	5.00	0.14	0.25	0.14	0.13	0.20	0.22	0.56	0.10	5.11	0.56	0.13	5.50	0.13	3.33	3.00	7.00	3.38	2.38	0.43	10.46	3.53	12.39	1.50	0.40
	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	13.50
93 - 183	1721	1721	329	0.00	0.00	0.00	0.00	6.14	0.22	0.14	3.22	0.00	0.00	51.80	2.20	0.00	0.15	0.29	2.63	0.20	0.00	0.00	22.40	0.00	3.13		5.46	3.00	9.80	1.27	7.47	12.29	77.00	0.67
	1047	1047	332	76.50	115.20	45.33	50.20	111.25	19.80	73.40	31.33	40.00	3.50	3.00	27.25	20.32	39.33	7.54	35.03	15.50	58.00	47.00	228.33	170.24	35.00		17.33	89.33	60.07	40.06	40.30	29.33	217.33	178.50
	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	6.50
	585	585	339	5.50	0.00	1.00	3.33	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.44	1.00	0.44	1.00	3.50	3.00	0.00	0.00	5.50	21.78	10.57	4.00	20.00	71.50	0.89	0.00	3.50	3.00
	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	20.64
184 - 274	151	147	333	1.00	7.50	1.67	0.00	7.00	2.50	16.00	65.50	9.00	14.50	665.00	21.00	1.50	13.72	6.93	13.20	12.93	28.50	46.50	10.61	11.14	13.50		8.61	3.56	12.50	2.67	2.67	1.81	9.50	1.50
	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	5.50
	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	1.50
275 - 366	92	96	334	0.00	7.50	13.00	5.00	7.50	3.50	4.00	3.00	21.50	5.00	169.50	3.00	35.00	66.67	0.50	12.18	12.67	2.28	28.50	40.39	18.00	1.50		5.22	2.50	10.00	1.33	2.89	2.40	4.00	3.50
	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	7.50
	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	2.00
367 - 549	93	166	717								2.50	29.00	13.00	261.00	10.00	59.67	506.49	31.11	10.40	7.11	11.94	28.50	20.50	2.00	7.93		4.00	5.14	29.87	4.39	2.60	2.00	12.17	3.71
	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	1.50
	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	2.00
550 - 731	111	134	718								18.50	8.00	33.50	63.00	29.00	28.09	27.52	28.02	17.56	7.50	28.50	64.50	31.33	3.56	9.59		13.00	19.36	111.24	56.34	35.39	9.24	70.00	21.00
	105	105	720								25.00	26.00	71.00	34.50	3.00	6.98	35.83	12.84	7.20	24.28	21.39	3.43	7.22	2.83	52.94		4.31	5.21	5.00	1.00		1.50	1.71	35.17
	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	5.07
732 - 914	.	105	764											15.00																				
	.	135	772											27.00																				
Grand Total				11.01	17.41	7.04	7.43	17.96	5.61	8.55	5.25	6.97	3.54	16.00	3.33	3.78	9.30	2.53	9.78	5.58	9.68	7.55	17.98	12.83	7.05	10.65	6.11	10.11	9.89	23.52	8.32	12.69	25.84	13.58

Table 16. Mean numbers per tow for witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2014 (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	14
<=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	
	674	674	383	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	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	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	0.00	0.44	0.50	0.00	0.00	0.44	0.50	0.00	0.00	0.00	10.44	0.44	1.00	0.44		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	0.44	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	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	0.00	1.00	1.50	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	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		0.50					
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 1990-2014 (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	14
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 1984-2014 (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	14
<=56	1593	1593	375	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.16		0.10	0.00	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	0.00	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	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	0.33
	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	0.03
	2520	2520	362	0.00	0.24	0.07	0.05	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.05	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	0.04	0.03	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	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	0.00
93 - 183	421	421	359	3.99	0.81	1.71	0.75	5.28	2.09	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	1.15	2.58	1.00	0.23	0.00	0.00	5.78		0.90	0.00	10.23	12.42	23.56	5.16	1.43	14.43
	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	2.80	0.00	0.00
	647	647	382	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
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	4.35
	139	139	378	1.17	1.00	1.69	8.10	1.64	2.19	0.00	0.00	1.51	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.24	0.41	0.07	0.00	0.00		0.00	0.00	0.00	0.00	0.73	2.90	0.00	0.00
	182	182	381	0.82	0.28	1.27	4.04	2.77	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.27	0.00	0.00	0.00	0.00		2.10	0.50	0.71	0.00	0.01	1.19	0.01	0.92
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	1.87
	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	16.28
	116	116	380	0.40	3.34	0.00	8.38	1.52	0.43	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.20	0.00	0.00		0.00	0.33	0.00	0.00	0.00	1.39	0.33	0.75
367 - 549	155	155	723								4.21	4.80	3.71	1.68	2.41	0.77	1.16	2.48	1.53	1.70	1.08	6.08	2.80	1.58	5.04		2.34	3.87	0.62	6.43	2.55	1.96	5.86	11.49
	105	105	725								4.26		2.78	3.08	0.00	0.37	1.91	0.31	1.40	2.20	0.56	0.20	0.51	0.00	7.15		1.01	0.23	2.51	0.27	1.22	1.92	0.53	4.68
	160	160	727								0.00	0.24	1.73	0.76	0.00	0.00	0.15	0.42	0.60	0.56	0.14	0.00	0.00	1.04	1.84		0.49	1.23	0.00	0.64	1.47	1.57	4.49	1.98
550 - 731	124	124	724								19.18	10.63	12.81	3.02	2.11	1.73	9.22	3.11	6.17	6.22	7.47	5.62	5.91	3.18	3.80		12.15		8.55	4.78	3.60		4.47	8.79
	72	72	726								8.21	2.52	2.24	2.81	0.35	1.20	4.25	9.65	5.93	6.58	8.46	1.78	5.07	2.15	0.82		1.90	2.49	4.14	10.59	4.60	3.23	2.31	7.73
	156	156	728								4.31	0.88	3.84	1.02	7.07	0.97		0.70	1.51	2.08	4.56	2.01	2.49	3.51	1.95		1.57	8.17	34.83	7.64	5.43	6.62	8.70	17.28
732 - 914	.	134	752											1.47																				
	.	106	756											2.29																				
	.	154	760											1.22																				
Grand Total				0.96	0.33	0.47	0.62	0.97	0.21	0.07	0.27	0.20	0.36	0.21	0.13	0.07	0.19	0.24	0.22	0.43	0.26	0.16	0.23	0.14	0.75	0.37	0.60	0.21	0.81	0.76	1.00	0.48	0.49	1.04

Table 19. Mean weights (kg) per tow for witch flounder (M+F) in each stratum from surveys in Div. 3O during spring of 1984-2014 (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	14
57 - 92	2089	2089	330	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.42	0.39	0.00	0.00	0.00	0.41	0.45	1.98	0.00	0.97	0.00	0.00	3.04	0.19	0.13	1.02
	456	456	331	30.49	4.82	0.58	0.29	7.09	0.00		0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.58	8.56	0.45	5.98	1.63	0.00	0.00	4.65		20.74	6.77	17.93	0.26	3.37	1.29	0.16	5.62
	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	1.74
	1716	1716	340	0.17	0.62	0.00	0.09	0.00	0.00	0.07	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.11	0.38	0.00	0.00	0.77	0.00	0.00	0.00	0.02	0.19
	2520	2520	351	1.99	0.61	1.11	0.64	2.82	0.63	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.06	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	0.24
	1282	1282	353	25.63	6.36	6.05	9.12	40.87	14.10	9.28	0.00	1.38	1.19	0.00	0.24	0.13	0.01	1.54	12.53	7.37	2.66	3.90	2.66	3.24	2.44	19.22	3.27	3.00	0.98	1.70	6.11	16.91	7.17	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	0.28
	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	33.94
	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	1.07
	585	585	339	4.17	0.00	0.20	2.78	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.01	0.06	0.02	0.00	0.00	2.35		0.05	0.47	3.53	0.03	0.72	0.00	0.18	0.70
	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	6.58
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	0.01
	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	1.10
	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	0.23
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	0.32
	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	0.98
	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	0.27
367 - 549	93	166	717								0.83	9.41	2.77	104.01	2.32	20.37	190.65	1.91	0.82	0.76	1.80	8.80	6.23	0.24	0.73		0.43	0.53	2.40	0.54	0.26	0.69	0.69	0.29
	76	76	719								14.16	97.97	4.65	1.31	1.74	13.13	57.44	1.44	1.49	2.39	1.16	9.12	3.70	0.26	1.33		1.44	1.07	0.53	0.65	3.60	0.79	0.70	0.28
	76	76	721								7.24	4.64	2.93	6.91	1.76	1.55	1.80	3.65	3.50	2.64	8.17	3.60	2.47	0.85	0.40		0.98	1.01	2.35	1.03	1.45	0.58	0.38	0.28
550 - 731	111	134	718								2.27	1.89	6.80	11.97	4.34	3.88	1.99	1.79	2.08	0.82	3.10	3.00	2.34	0.69	0.70		1.10	2.34	8.50	1.17	1.94	0.98	3.37	2.08
	105	105	720								15.00	9.28	12.60	6.56	1.03	1.48	10.41	2.19	1.42	2.79	2.60	0.51	1.57	0.65	4.81		0.63	0.62	0.60	0.63		0.27	0.45	2.96
	93	93	722								1.42	3.86	11.72	16.93	16.11	6.94	6.78	2.42	5.54	3.69	9.42	4.84	4.97	0.94	2.13		0.86	1.62	1.36	1.16	2.31	1.41	0.63	0.67
732 - 914	.	105	764											4.17																				
	.	135	772											4.07																				
Grand Total				4.92	9.67	3.30	3.98	9.11	3.45	4.41	2.53	3.05	1.33	6.10	1.47	1.53	2.62	0.83	3.30	1.74	3.44	2.81	6.00	4.50	1.98	4.44	2.25	3.26	2.82	1.89	2.90	4.59	9.09	3.22

Table 20. Mean weights (kg) per tow for witch flounder (M+F) in each stratum from surveys in Div. 3N during fall of 1990-2014 (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	14
<=56	1593	1593	375	0.00	0.33		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	1499	1499	376	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.11	0.00	0.00	0.00	0.00	0.19	0.13	0.00	0.00	0.00	0.00	0.00	0.33	0.00	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	0.00	0.09	0.00	0.00	0.00	0.39	0.00	0.00	0.11	0.00	0.00	0.13	0.55	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	
	674	674	383	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	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	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	0.00	0.05	0.01	0.00	0.00	0.14	0.27	0.00	0.00	0.00	4.85	0.20	0.38	22.00		1.14	2.92	9.97	
	182	182	381		0.00		0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	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	0.55	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			0.00				
	.	99	758									0.00		0.00	0.00	0.01			0.00		0.00							
	.	212	762											0.00	3.74	0.00			0.50		0.97		1.38					
1281 -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							
	.	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 1990-2014 (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	14
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		0.13		0.11					
	.	175	771											0.00	0.73	0.00			0.41		0.00		0.00					
	.	155	775											0.00	0.00	0.00	1.29		0.98		0.13		0.60					
Grand Total				5.96	1.62	2.80	3.08	2.76	4.10	4.89	1.46	1.64	5.04	2.30	2.03	3.47	3.35	6.47	5.37	5.333	2.248	6.29	8.96	9.30	5.83	5.33	3.56	

Table 22. Yield (t) and risk of F> F_{lim}, B<B_{lim} and B<B_{MSY} for projected F values of F2015, 75% F2015, 125% F2015 2/3 F_{MSY}, 75% F_{MSY}, and 85% F_{MSY}.

	Yield 2016	Yield 2017	p>F_{lim}		p<B_{lim}			p<B_{MSY}			p2018>2014
			2016	2017	2016	2017	2018	2016	2017	2018	
F2015=0.019	1048	1096	<1%	<1%	<1%	<1%	<1%	59%	55%	50%	73%
75%F2015 =0.014	784	822	<1%	<1%	<1%	<1%	<1%	60%	55%	50%	74%
125% F2015 =0.024	1307	1357	<5%	<5%	<1%	<1%	<1%	60%	56%	52%	72%
2/3 Fmsy=0.04	2172	2225	3%	3%	<1%	<1%	<1%	60%	57%	57%	69%
75%Fmsy=0.047	2549	2602	11%	11%	<1%	<1%	<1%	60%	58%	56%	68%
85% Fmsy=0.054	2936	2970	26%	26%	<1%	<1%	<1%	60%	58%	58%	67%

Table 23. Medium-term projections for witch flounder. Estimates and 80% confidence interval for yield and relative biomass B_y/B_{msy}, are shown, for projected F values of F_{2015}, 75% F2015, 125% F2015, 2/3 F_{msy}, 75% F_{msy} and 85%F_{msy}.

	Projections with catch in 2015 = 1 000 t	
	Projected Yield (t)	Projected Relative Biomass (B_y /B_{msy})
F2015=0.019	Median (80% CI)	Median (80% CI)
2016 2017 2018	1048 (932, 1175) 1096 (922, 1291)	0.95 (0.56, 1.52) 1.00 (0.59, 1.58) 1.04 (0.65, 1.63)
75% F2015=0.014		
2016 2017 2018	784 (696, 882) 822 (696, 970)	0.91 (0.56, 1.52) 0.96 (0.60, 1.58) 1.01 (0.63, 1.64)
125% F2015=0.024		
2016 2017 2018	1307 (1163, 1475) 1357 (1155, 1606)	0.91 (0.57, 1.51) 0.95 (0.59, 1.56) 0.99 (0.61, 1.60)
2/3 Fmsy=0.04		
2016 2017 2018	2172 (1384, 3267) 2225 (1433, 3327)	0.92 (0.56, 1.53) 0.94 (0.58, 1.54) 0.96 (0.60, 1.57)
75% Fmsy=0.047		
2016 2017 2018	2549 (1623, 3849) 2602 (1663, 3888)	0.91 (0.57, 1.52) 0.93 (0.58, 1.54) 0.94 (0.59, 1.54)
85% Fmsy=0.054		
2016 2017 2018	2936 (1878, 4429) 2970 (1893, 4412)	0.91 (0.56, 1.53) 0.92 (0.57, 1.52) 0.93 (0.58, 1.52)

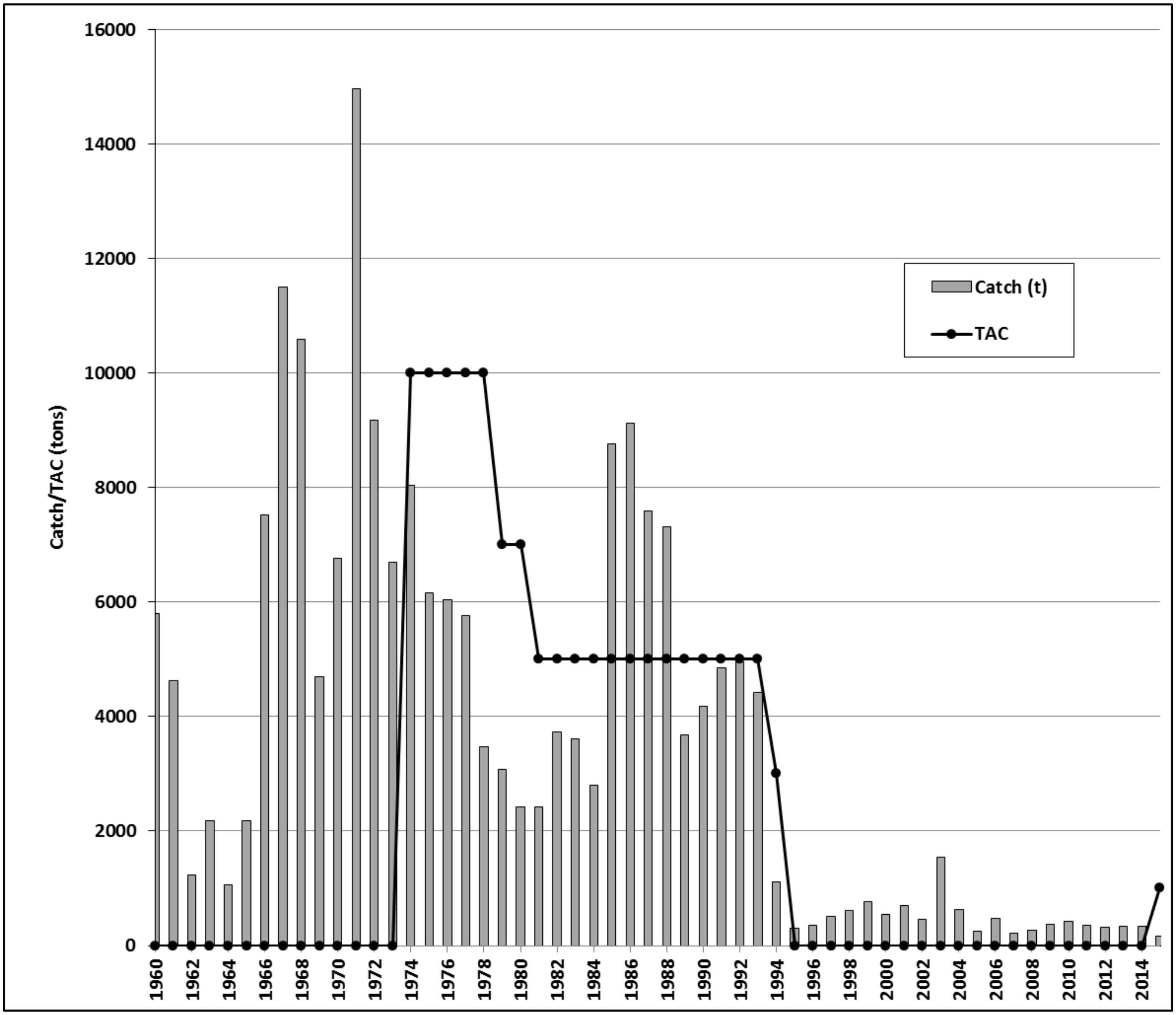


Figure 1. Commercial catches of witch flounder in NAFO Divs. 3NO from 1960-2015 and total allowable Catches (TACs).

Although a TAC of 3 000 tons was agreed by the Fisheries Commission (FC), 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.
Preliminary catch data was available only for Canada in 2015.
A 1,000 ton quota for witch flounder in 3NO, beginning in 2015 was adopted by the FC.

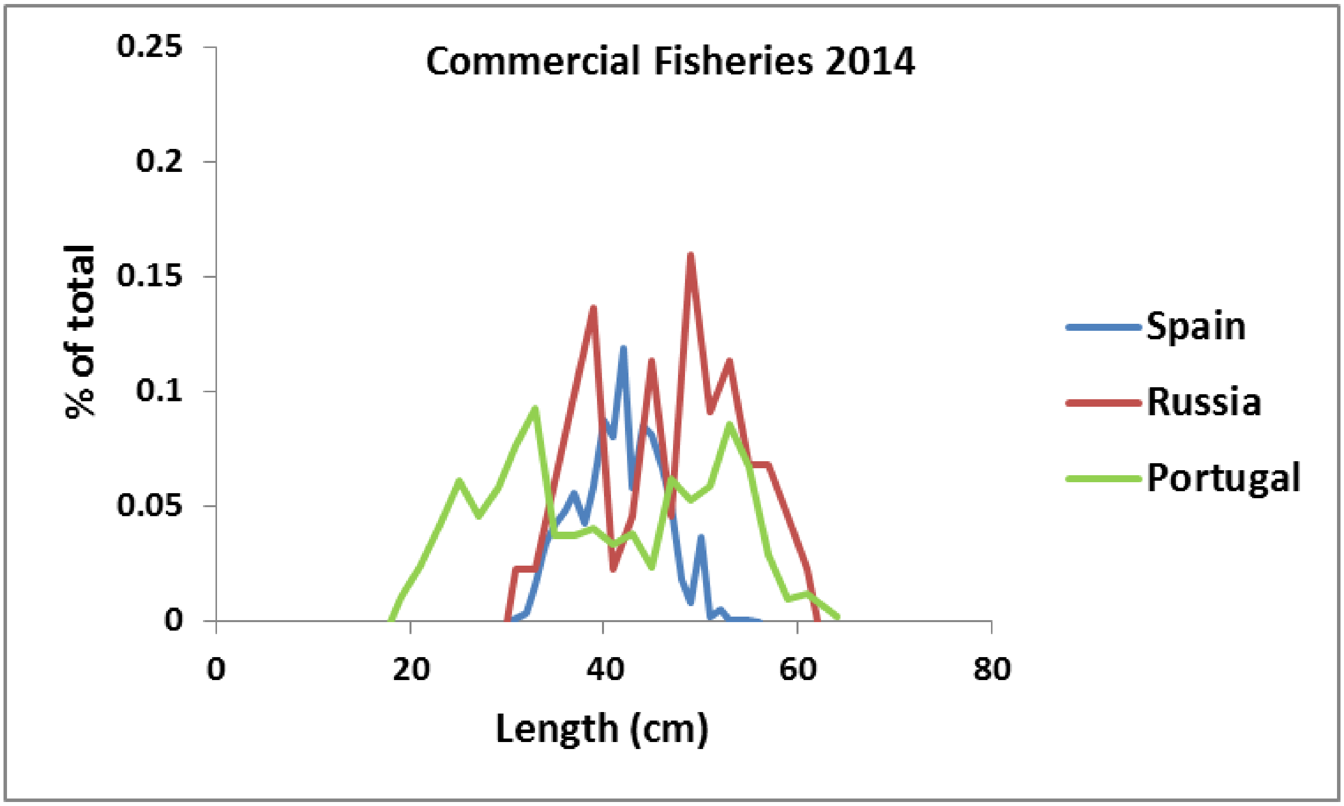


Figure 2. Witch flounder length frequency (cm) distributions for Spain, Russia, and Portugal commercial fisheries in NAFO Divs. 3NO in 2014.

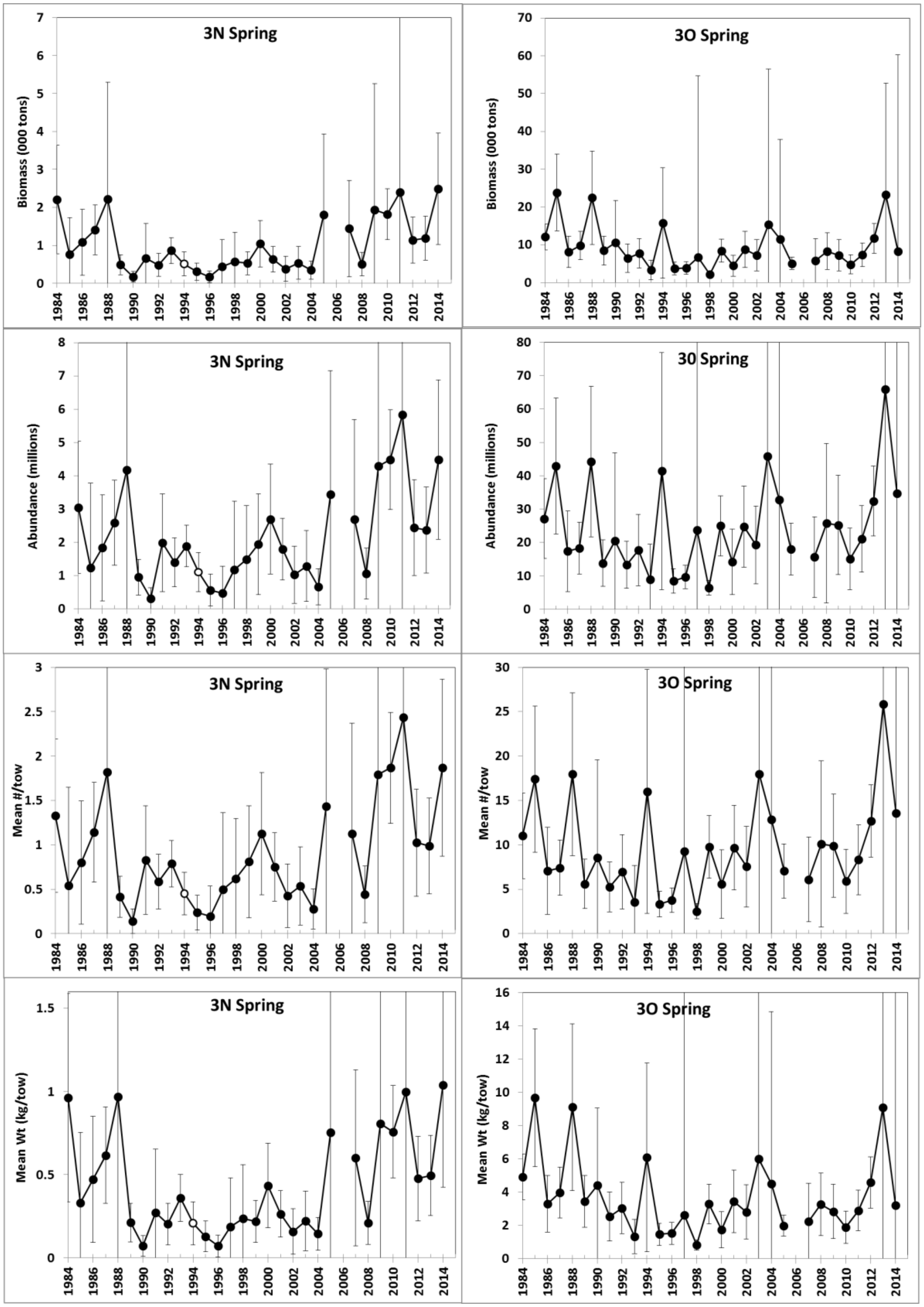


Figure 3. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian spring rv surveys in NAFO Divs. 3N and 3O during 1984-2014. Vertical lines represent 95% confidence intervals. White markers represent years where >50% of deep-water strata were surveyed.

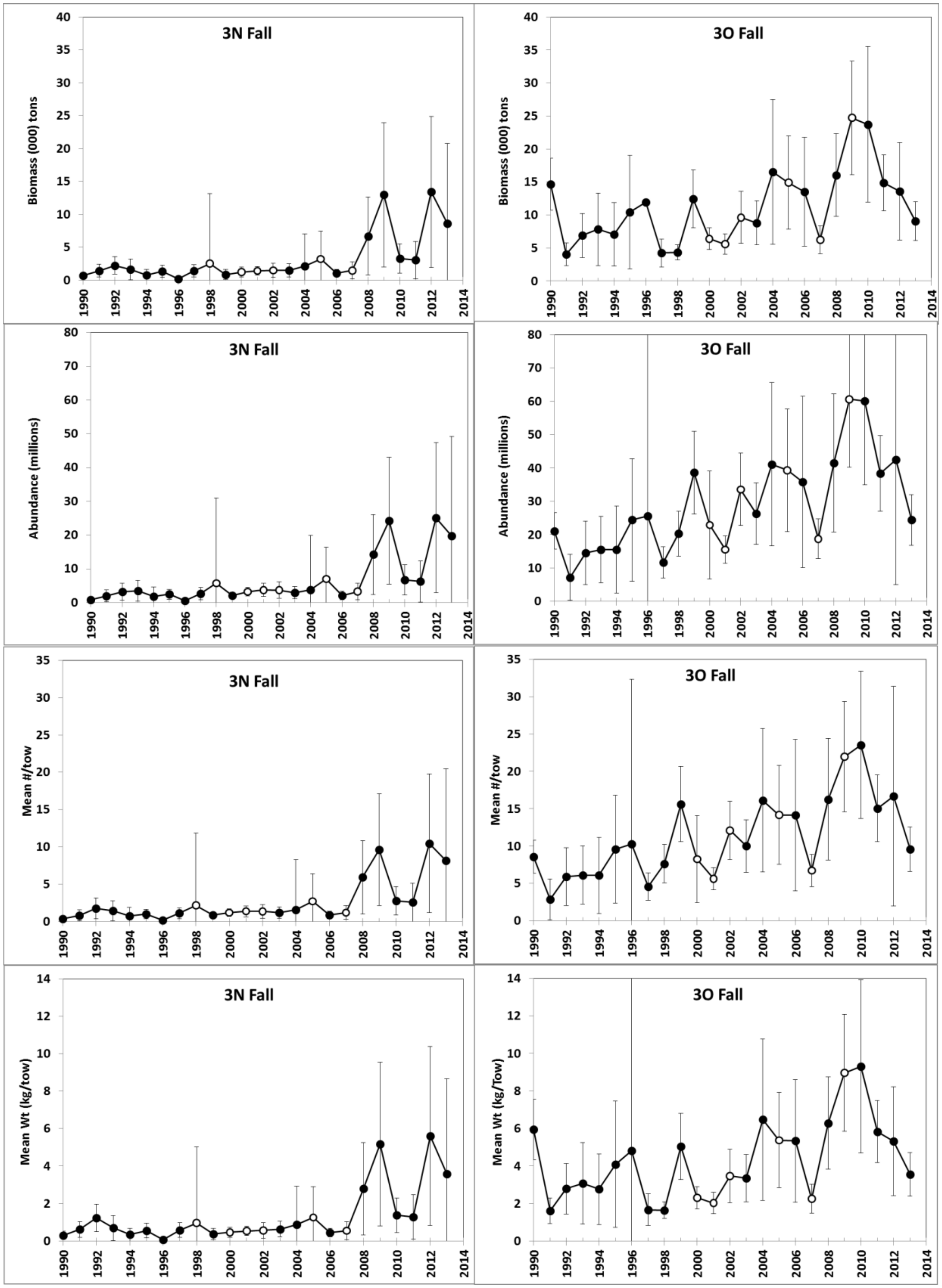


Figure 4. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian fall surveys in NAFO Divs. 3N and 3O during 1990-2013 (no data was available for fall 2014). Vertical lines represent 95% confidence intervals. White markers represent years where >50% of deep-water strata were surveyed.

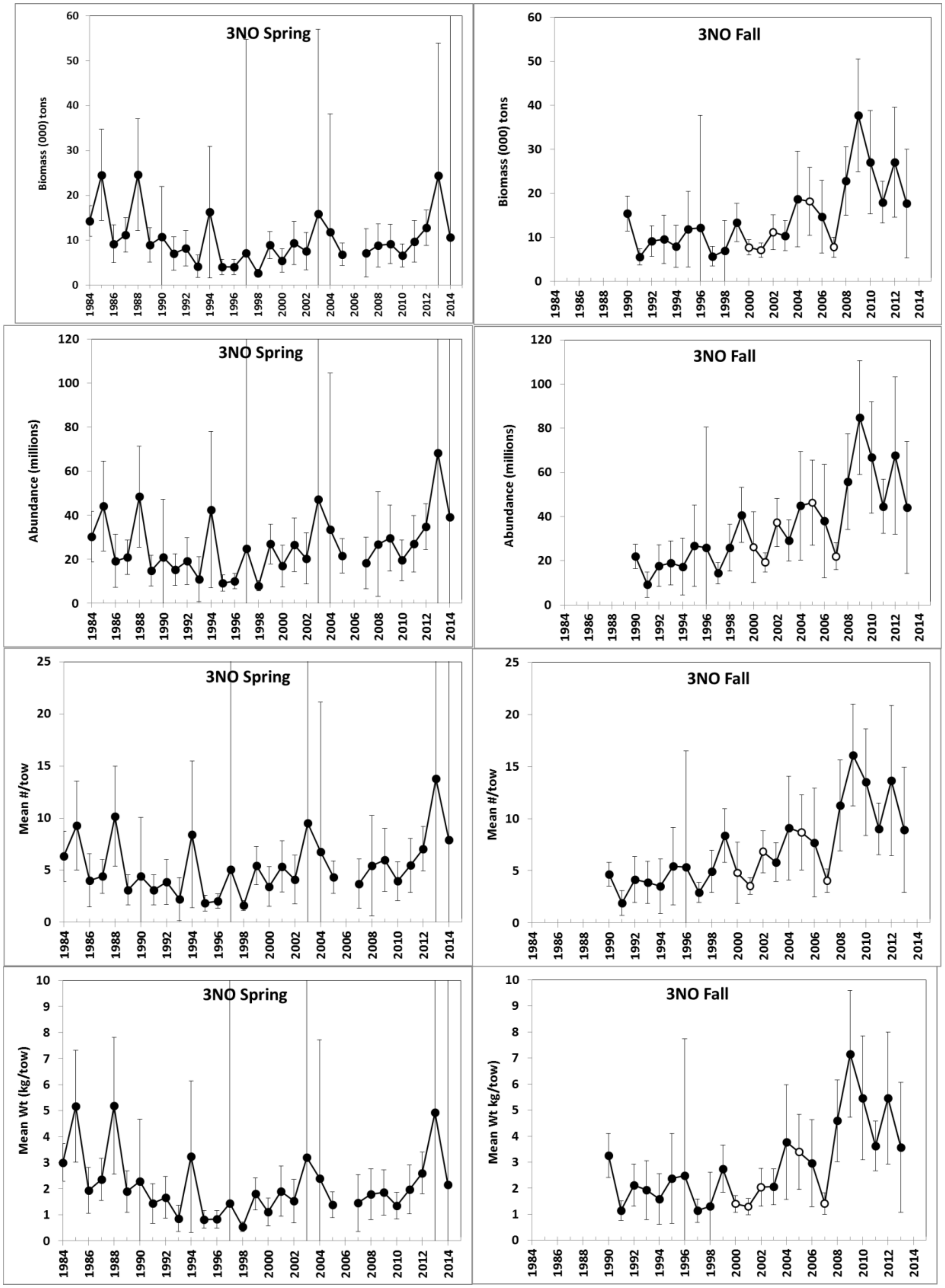


Figure 5. Biomass (tons), abundance (millions), and mean numbers and weights (kg) per tow for witch flounder from Canadian spring and fall surveys in NAFO Divs. 3NO combined during 1984-2014 (no data was available for fall 2014). Vertical lines represent 95% confidence intervals. White markers represent years where >50% of deep-water strata were surveyed.

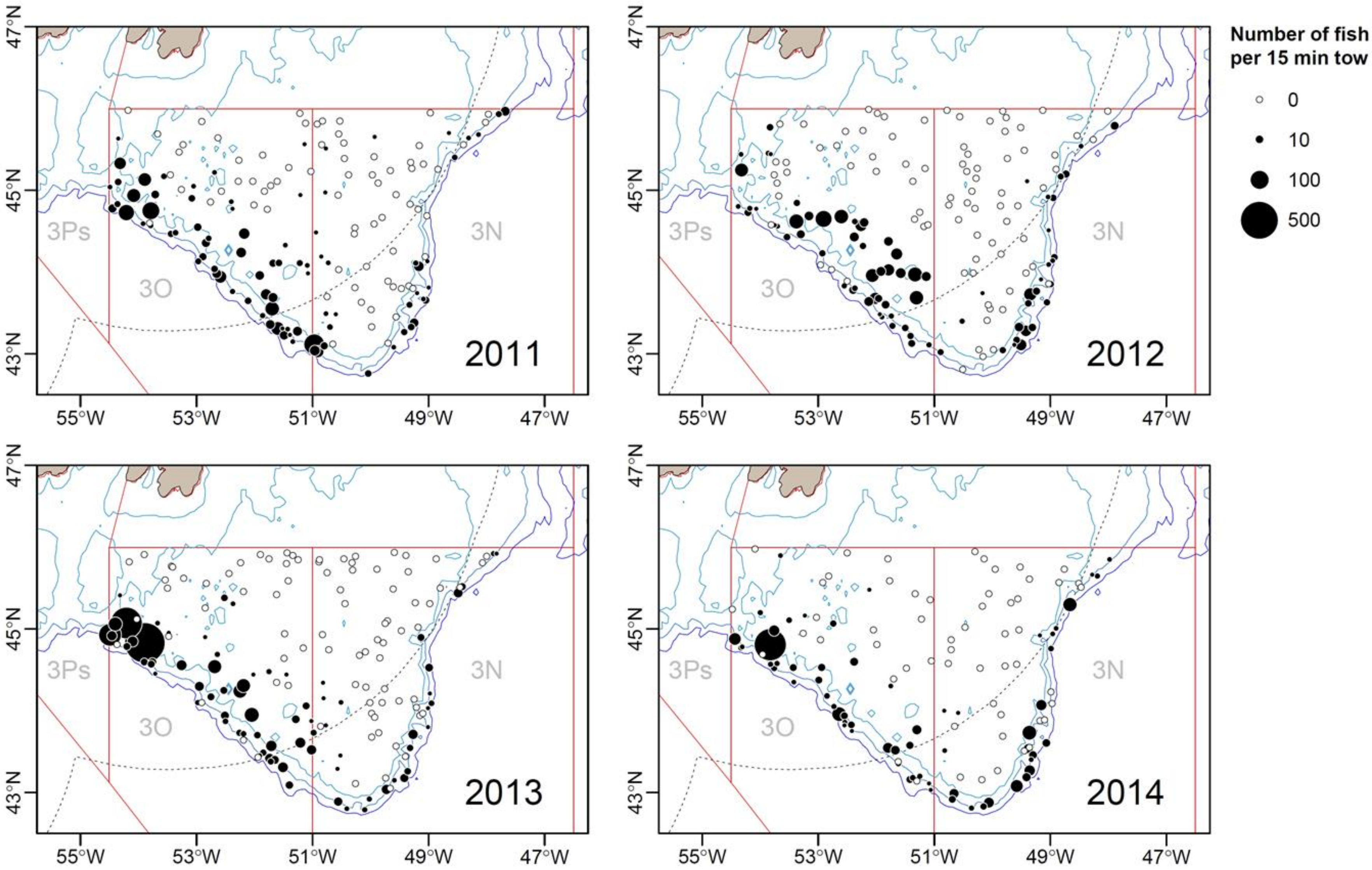


Figure 6. Distribution of witch flounder (numbers per tow) from Canadian spring surveys in NAFO Divs. 3NO during 2011 to 2014.

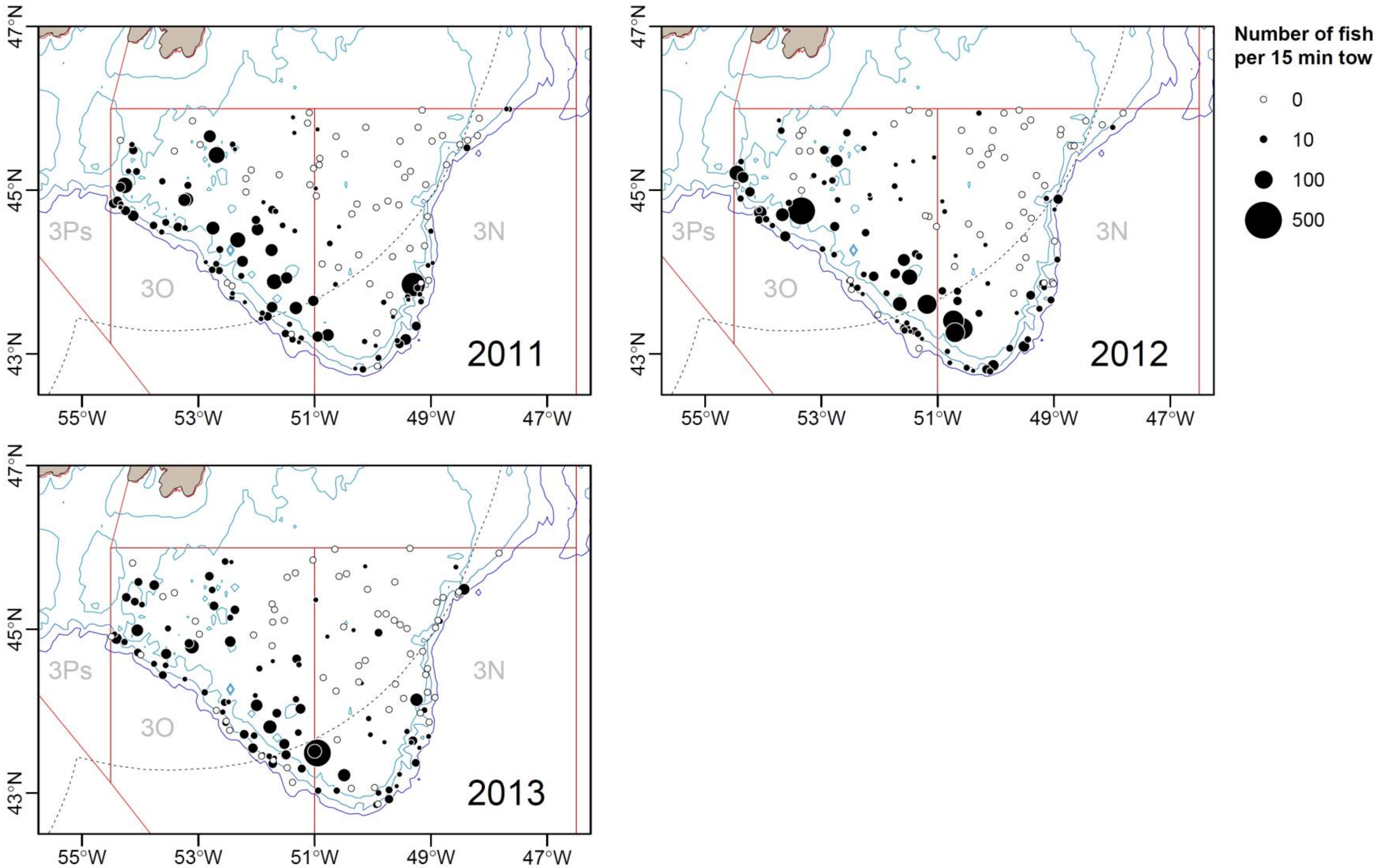


Figure 7. Distribution of witch flounder (numbers per tow) from Canadian fall surveys in NAFO Divs. 3NO during 2011 to 2013 (note there was no fall survey in 2014).

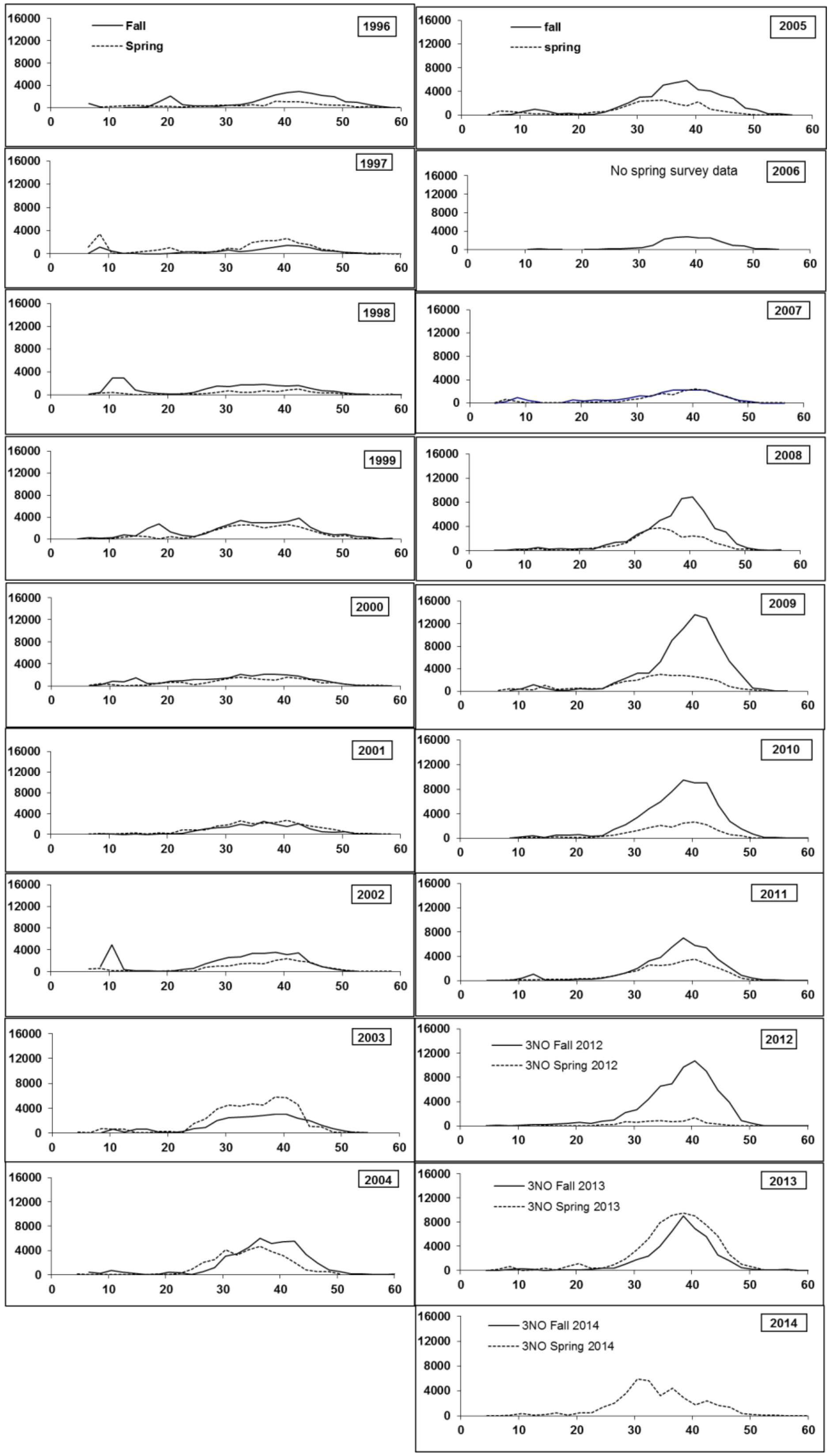


Figure 8. Length frequency distributions of witch flounder from Canadian spring and fall surveys using the Campelen 1800 shrimp trawl. Estimates represent abundance at length (cm) of the surveyed area. All distributions are for NAFO Divs. 3NO.

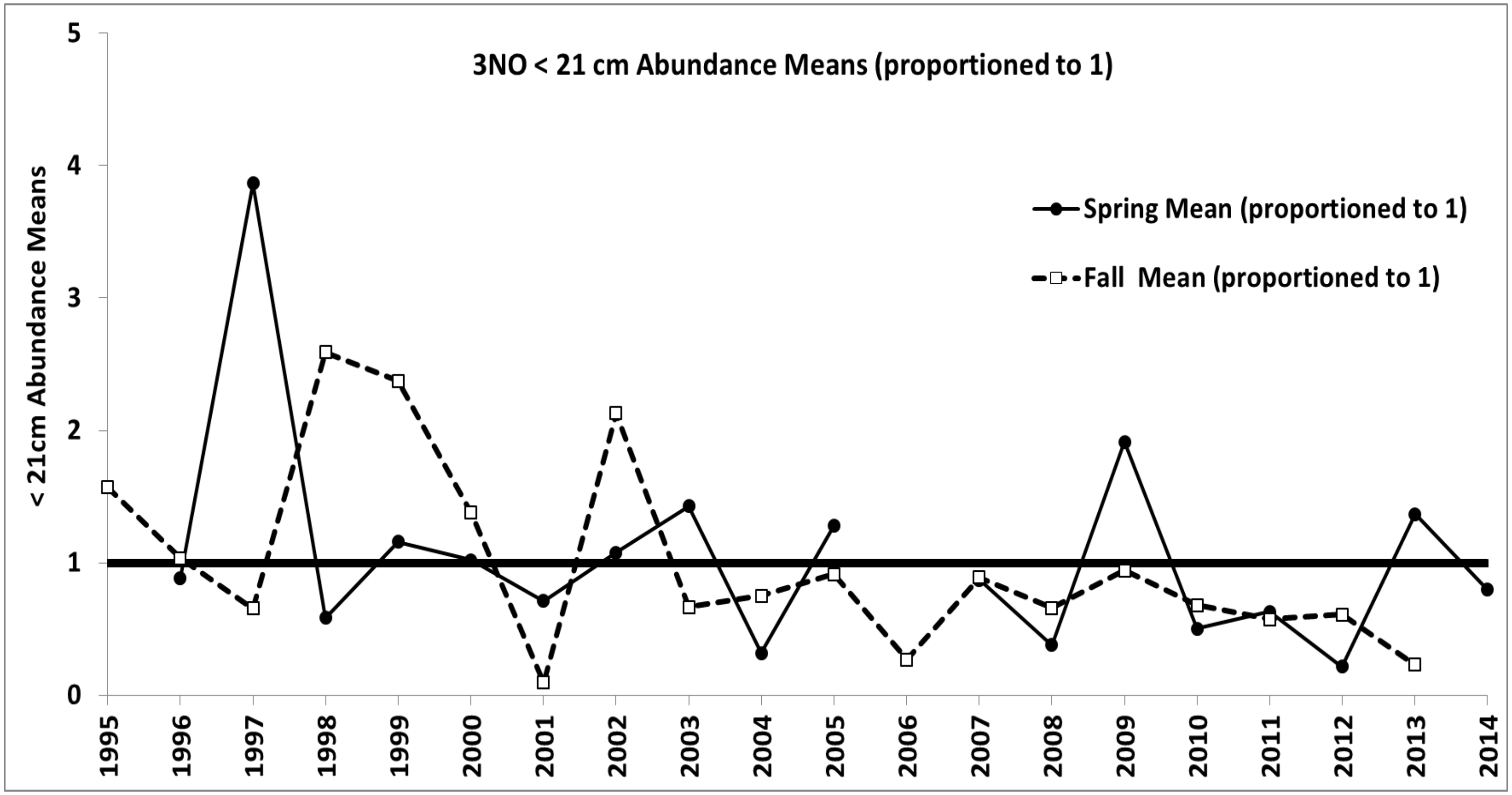


Figure 9. Abundance index means proportioned to 1 of witch flounder <21cm in length from spring and fall Canadian rv surveys in NAFO Divs. 3NO 1995-2014. Note there was no fall survey in 2014 or spring survey in 2006.

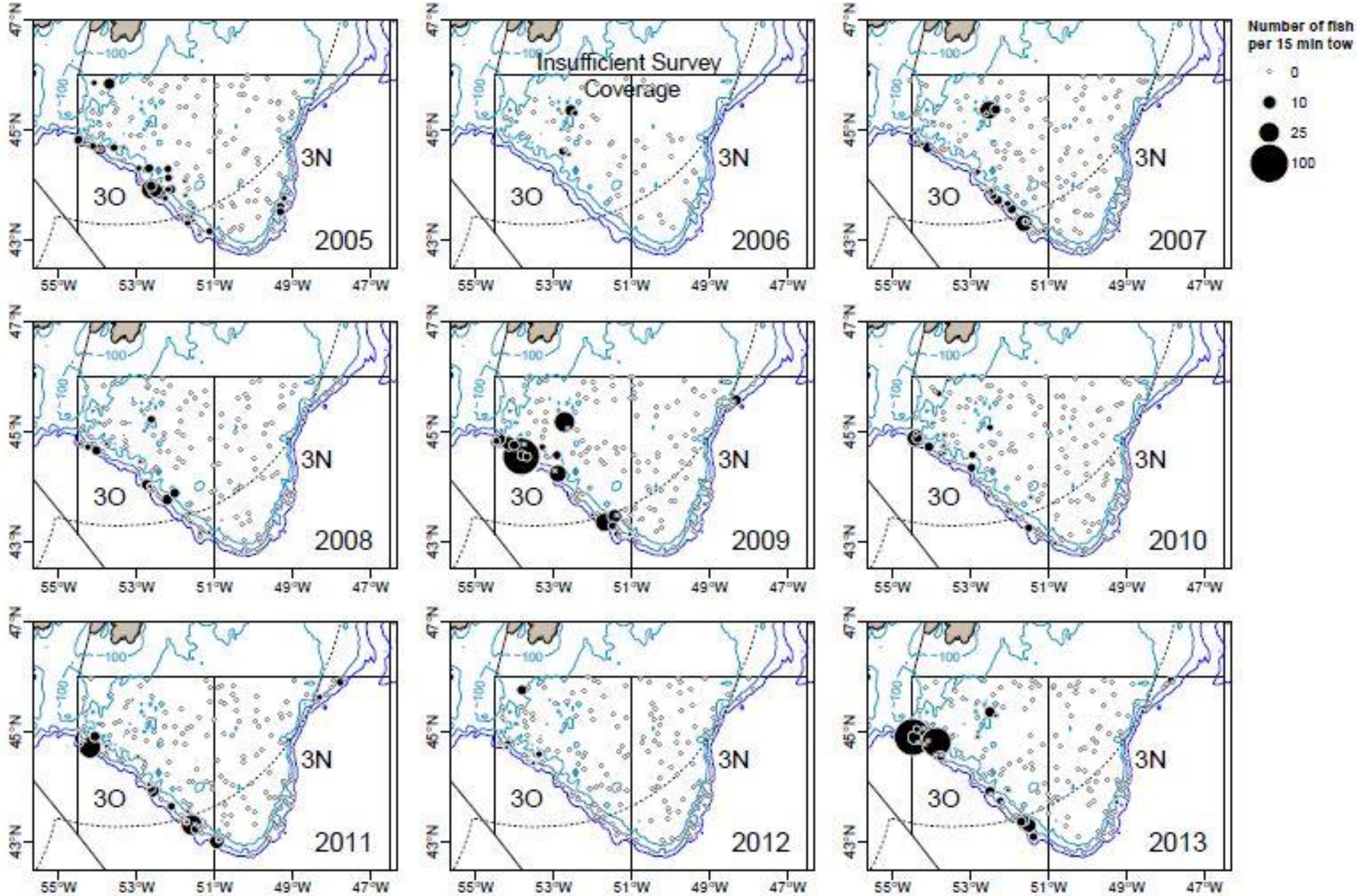


Figure 10. Distribution of juvenile (< 21 cm) witch flounder from Spring Canadian rv surveys in NAFO Divs. 3NO (2005-2013).

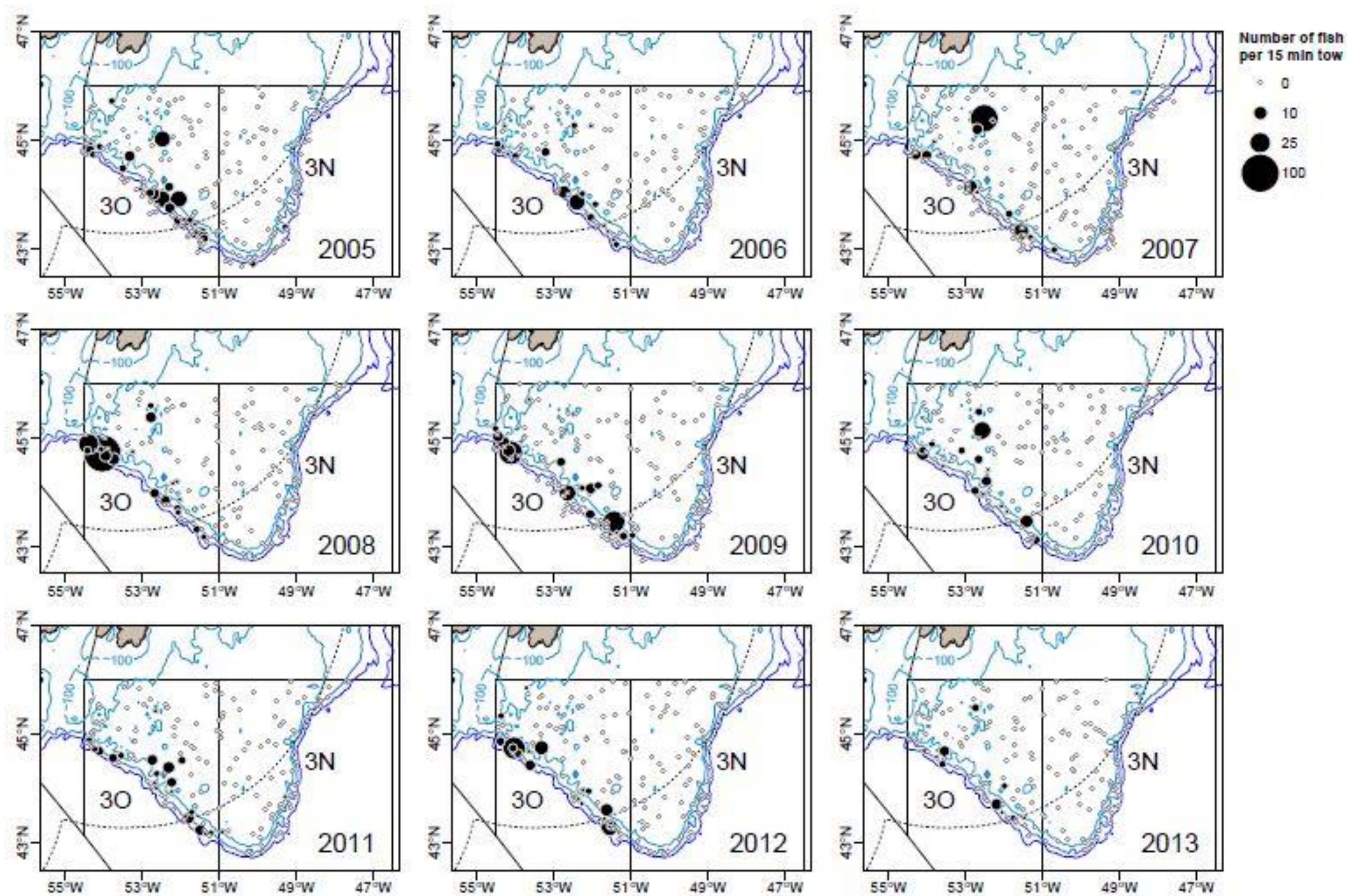


Figure 11. Distribution of juvenile (< 21 cm) witch flounder from fall Canadian rv surveys in NAFO Divs. 3NO (1995-2013).

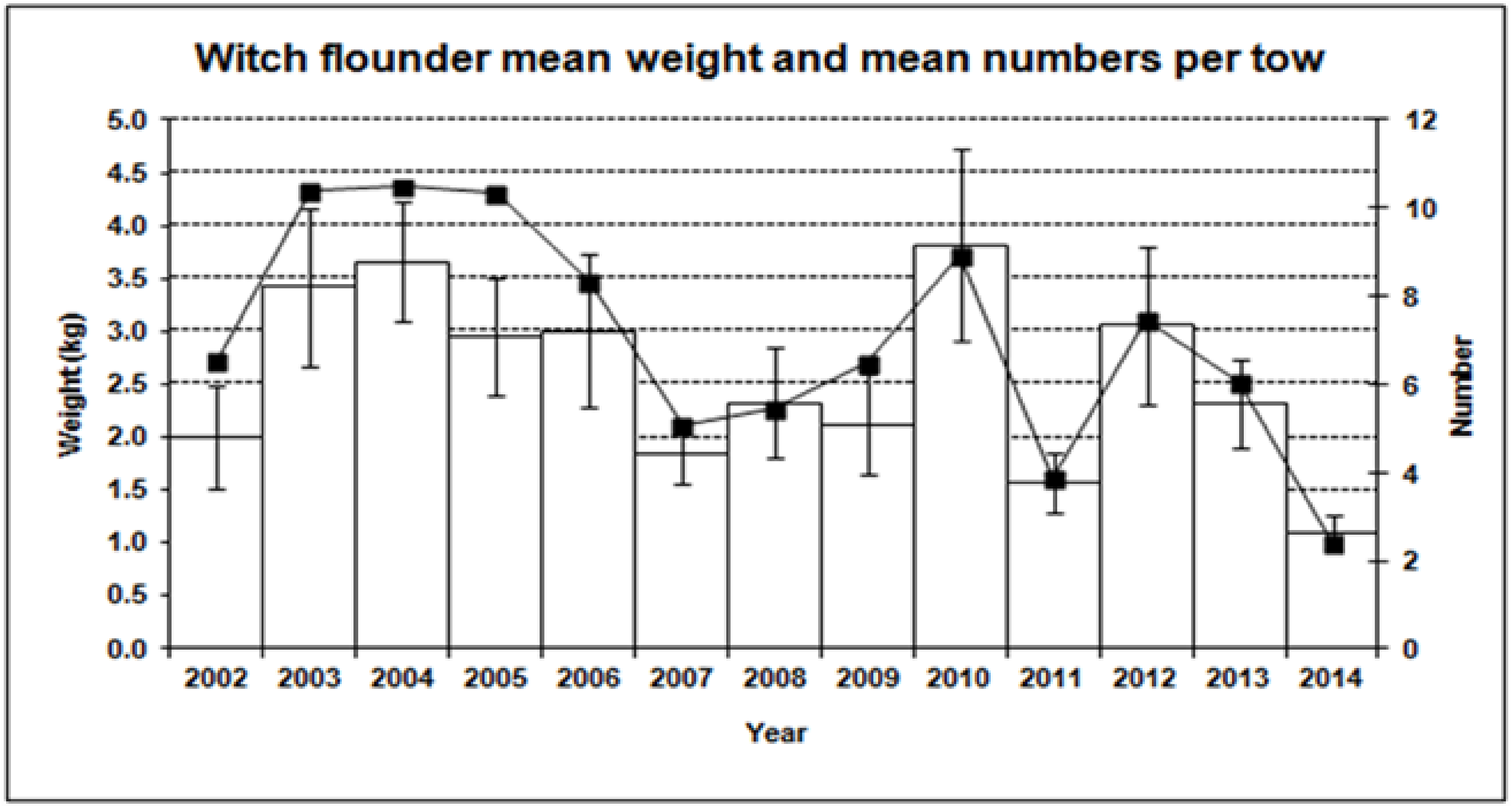


Figure 12. Witch flounder stratified mean catches (kg) and mean number by year. Spanish spring surveys in NAFO Divs. 3NO: 2002-2014.

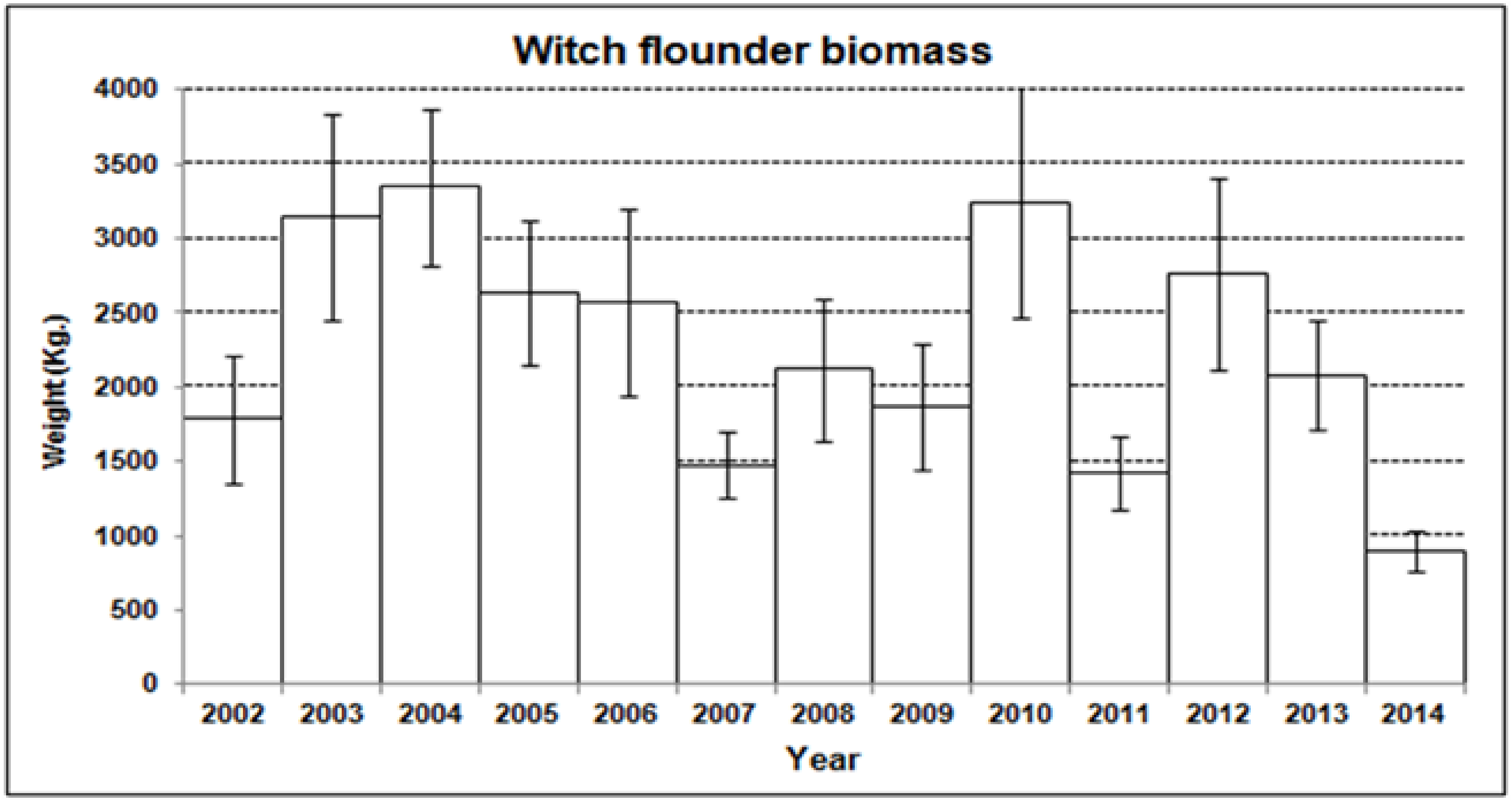


Figure 13. Witch flounder biomass calculated by the swept area method in tons ±SD by year. Spanish spring surveys in NAFO Divs. 3NO: 2001-2014.

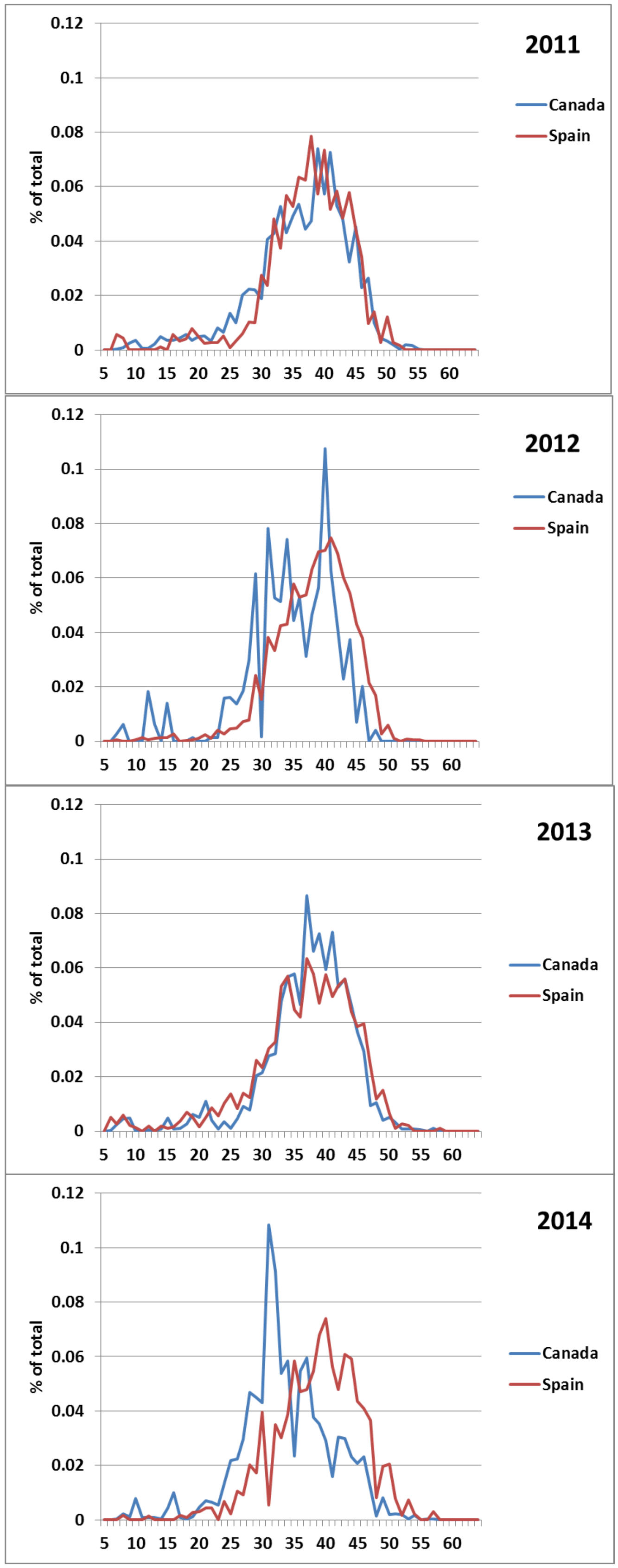


Figure 14. Witch flounder length-frequencies (cm) for Canadian and Spanish spring rv surveys in NAFO Divs. 3NO: 2012-2014.

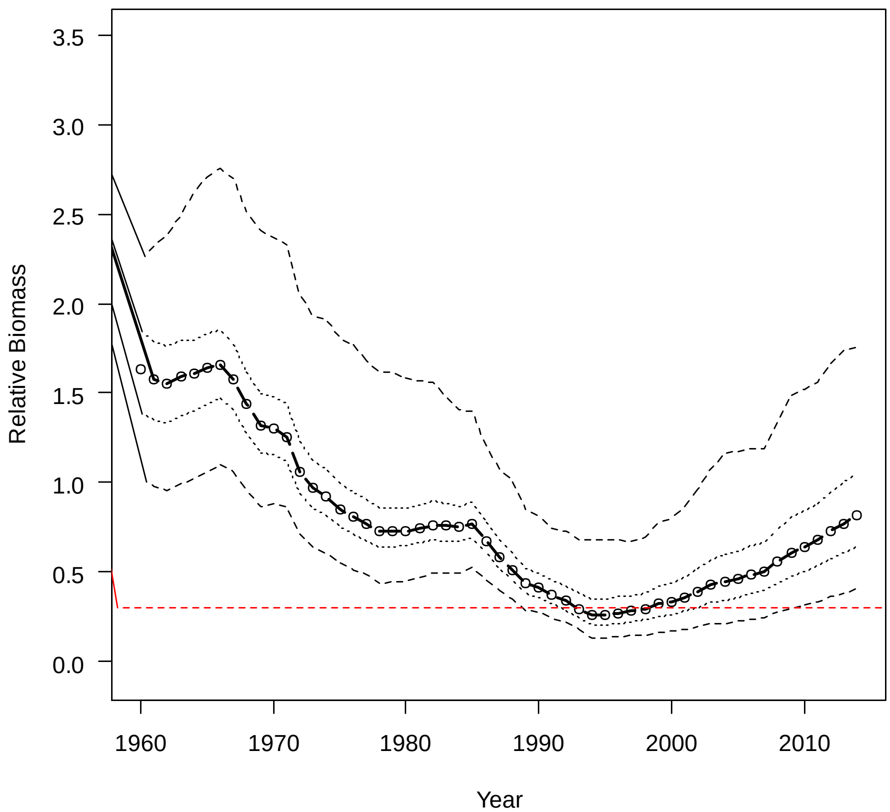


Figure 15. Witch flounder in Div. 3NO. Median relative biomass (*Biomass*/B_{MSY}) with 50% and 95% credible intervals. The horizontal line is $B_{lim}=30\%B_{MSY}$.

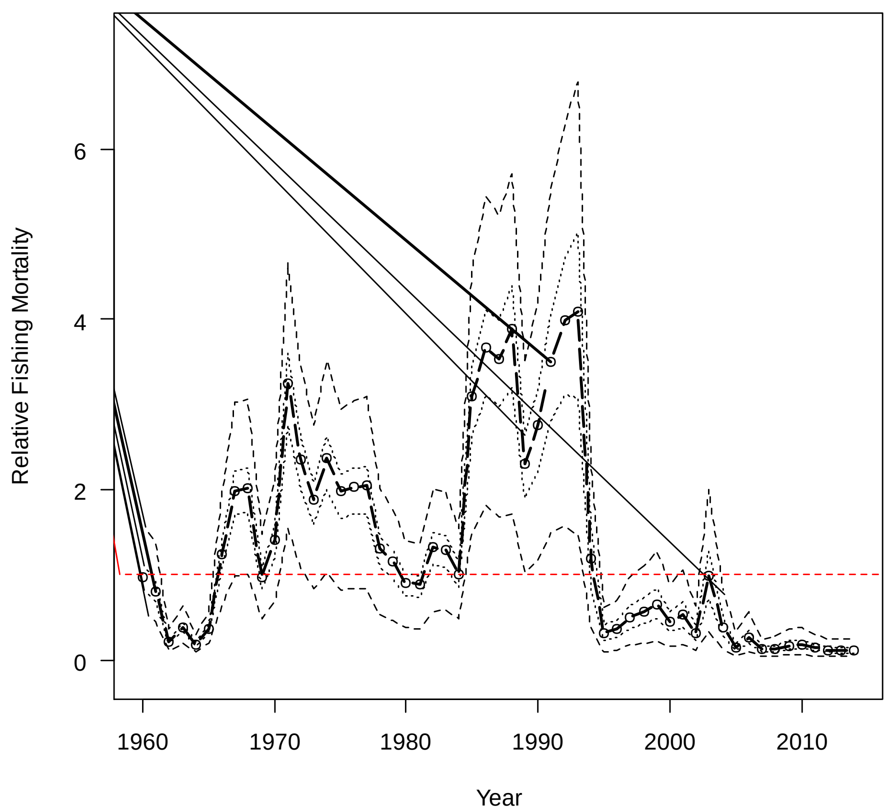


Figure 16. Witch flounder in Div. 3NO. Median relative fishing mortality (F/F_{MSY}) with 50% and 95% credible intervals. The horizontal line is $F_{lim}=F_{MSY}$.

Appendix A

Detailed model output

Node statistics

node	mean	sd	MC error	2.50%	median	97.50%
B[1]	95.76	23.54	0.2495	50.83	96.12	141.3
B[2]	93.43	24.07	0.2475	47.75	93.4	141.4
B[3]	92.41	24.37	0.2478	47.43	92.36	142.6
B[4]	94.94	24.4	0.2369	50.34	94.59	145.8
B[5]	96.28	24.83	0.2514	51.41	95.74	149.4
B[6]	98.75	24.33	0.2376	54.74	97.85	151.7
B[7]	100	24.08	0.2194	57.53	98.79	154
B[8]	95.89	23.57	0.2173	55.57	94.19	151.4
B[9]	87.64	23.03	0.2105	49.6	85.81	139.6
B[10]	80.72	21.81	0.1988	44.52	78.64	131.2
B[11]	80.16	21.35	0.1875	47	78.11	130.8
B[12]	77.49	20.41	0.1692	46.64	75.2	126.8
B[13]	66.22	19.17	0.1624	37.52	63.91	113.9
B[14]	60.89	18.13	0.1516	33.46	58.64	105.6
B[15]	58.13	18.03	0.1509	32.05	55.77	101.9
B[16]	53.86	17.49	0.1474	28.42	51.49	96.18
B[17]	51.25	16.64	0.142	26.95	49.01	92.55
B[18]	48.79	16.67	0.1412	25.65	46.61	88.08
B[19]	46.31	15.53	0.1363	23.73	44.21	84.22
B[20]	46.16	15.15	0.132	23.9	44.15	83.78
B[21]	46.2	14.54	0.1273	24.6	44.39	80.76
B[22]	46.98	13.58	0.1235	25.66	45.28	79.23
B[23]	47.7	12.63	0.1169	27.67	46.29	77.82
B[24]	46.95	11.32	0.1084	28.16	45.81	73.63
B[25]	46.16	9.864	0.09134	28.83	45.43	68.92
B[26]	46.96	8.9	0.08479	31.56	46.14	67.54
B[27]	41.08	7.779	0.07451	26.78	40.56	58.77
B[28]	35.71	7.079	0.07492	23.37	35.02	52.01
B[29]	31.84	6.96	0.08192	21.11	30.86	48.41
B[30]	26.94	6.175	0.07564	17.14	26.08	41.23
B[31]	25.64	5.851	0.0776	16.52	24.79	39.45
B[32]	23.4	5.644	0.07824	14.59	22.62	36.71
B[33]	21.36	5.759	0.08463	13.05	20.37	35.7
B[34]	18.79	5.913	0.08964	10.46	17.74	33.52
B[35]	16.74	6.428	0.1019	7.839	15.53	32.96
B[36]	16.77	6.435	0.1031	7.794	15.59	32.58
B[37]	17.45	6.479	0.1052	8.231	16.33	33.35
B[38]	17.89	6.533	0.1063	8.441	16.75	33.75
B[39]	18.68	6.806	0.1101	8.852	17.51	35.26
B[40]	20.52	7.424	0.1217	9.808	19.25	38.84
B[41]	21.31	7.752	0.1279	10.08	19.98	40.18
B[42]	22.93	8.321	0.139	10.93	21.48	43.38
B[43]	24.93	9.097	0.1512	11.94	23.36	47.06

B[44]	27.38	9.926	0.1669	13.14	25.6	51.16
B[45]	28.59	10.75	0.1811	13.28	26.65	54.64
B[46]	29.56	10.87	0.1817	13.82	27.6	55.76
B[47]	30.93	11.26	0.1879	14.55	28.95	58.25
B[48]	31.95	11.55	0.1876	14.87	30.07	59.66
B[49]	35.44	12.54	0.2075	16.96	33.36	65.81
B[50]	38.83	13.73	0.222	18.51	36.41	71.69
B[51]	40.46	13.88	0.227	19.56	38.16	73.67
B[52]	42.47	14.29	0.2332	20.84	40.19	76.18
B[53]	45.66	15.08	0.2443	22.75	43.29	80.95
B[54]	48.4	15.78	0.2496	24.18	46	84.92
B[55]	50.69	16.49	0.2523	24.75	48.45	87.84
BMSY	59.52	11.62	0.1578	37.15	59.68	82.63
Bratio[1]	1.622	0.3263	0.003562	1.03	1.633	2.241
Bratio[2]	1.584	0.355	0.003659	0.9808	1.579	2.319
Bratio[3]	1.569	0.3724	0.003817	0.9534	1.556	2.385
Bratio[4]	1.616	0.3972	0.004019	0.9946	1.593	2.499
Bratio[5]	1.642	0.4111	0.004219	1.015	1.606	2.63
Bratio[6]	1.688	0.4173	0.00426	1.062	1.643	2.711
Bratio[7]	1.712	0.4253	0.00414	1.096	1.655	2.76
Bratio[8]	1.642	0.4212	0.004262	1.06	1.579	2.7
Bratio[9]	1.501	0.4058	0.004247	0.9519	1.435	2.514
Bratio[10]	1.382	0.3849	0.003916	0.8612	1.316	2.409
Bratio[11]	1.376	0.3926	0.004254	0.8798	1.301	2.368
Bratio[12]	1.332	0.3872	0.004297	0.8636	1.253	2.328
Bratio[13]	1.137	0.3544	0.00375	0.7089	1.06	2.057
Bratio[14]	1.046	0.3404	0.003389	0.6381	0.97	1.934
Bratio[15]	0.9994	0.3395	0.003298	0.6058	0.9219	1.917
Bratio[16]	0.9264	0.3362	0.003296	0.5465	0.8492	1.804
Bratio[17]	0.8824	0.3239	0.003268	0.5124	0.8066	1.768
Bratio[18]	0.8409	0.3304	0.003369	0.4817	0.7656	1.684
Bratio[19]	0.7982	0.3059	0.00317	0.441	0.7277	1.62
Bratio[20]	0.7967	0.305	0.003138	0.442	0.7267	1.614
Bratio[21]	0.7983	0.2955	0.003103	0.4481	0.7315	1.588
Bratio[22]	0.8129	0.2849	0.003128	0.4698	0.746	1.565
Bratio[23]	0.8265	0.2754	0.003146	0.4921	0.7623	1.561
Bratio[24]	0.8137	0.2519	0.003018	0.4936	0.7566	1.483
Bratio[25]	0.7998	0.2259	0.002735	0.496	0.7505	1.404
Bratio[26]	0.8154	0.2209	0.002901	0.5268	0.7652	1.4
Bratio[27]	0.712	0.1866	0.002488	0.4539	0.6723	1.193
Bratio[28]	0.6199	0.1724	0.002392	0.3944	0.5806	1.075
Bratio[29]	0.5545	0.1732	0.002427	0.3485	0.512	1.008
Bratio[30]	0.4684	0.1464	0.002133	0.2875	0.434	0.8485
Bratio[31]	0.4464	0.1398	0.002186	0.2744	0.4126	0.8164
Bratio[32]	0.4066	0.1295	0.00207	0.2426	0.3763	0.7475
Bratio[33]	0.3727	0.134	0.002198	0.216	0.3388	0.729

Bratio[34]	0.3288	0.135	0.002211	0.1755	0.2943	0.6799
Bratio[35]	0.2948	0.1458	0.00243	0.1318	0.2574	0.677
Bratio[36]	0.2949	0.1445	0.002416	0.1288	0.2589	0.6766
Bratio[37]	0.306	0.1423	0.002432	0.138	0.2711	0.68
Bratio[38]	0.3122	0.1391	0.002405	0.1426	0.2801	0.6718
Bratio[39]	0.3254	0.142	0.00245	0.1488	0.2934	0.6954
Bratio[40]	0.3594	0.1625	0.002798	0.1629	0.3217	0.7792
Bratio[41]	0.3724	0.1659	0.002882	0.1694	0.3334	0.7996
Bratio[42]	0.401	0.1789	0.003104	0.1823	0.3597	0.8657
Bratio[43]	0.4373	0.2001	0.003433	0.1945	0.3902	0.9609
Bratio[44]	0.4819	0.224	0.003875	0.2121	0.4283	1.077
Bratio[45]	0.5046	0.2437	0.004204	0.2134	0.4434	1.166
Bratio[46]	0.5202	0.2425	0.004194	0.2239	0.4614	1.171
Bratio[47]	0.5426	0.2451	0.004243	0.2354	0.4843	1.185
Bratio[48]	0.5583	0.2438	0.004157	0.244	0.502	1.19
Bratio[49]	0.6221	0.2763	0.004757	0.2737	0.5577	1.344
Bratio[50]	0.6838	0.3118	0.005245	0.299	0.6098	1.489
Bratio[51]	0.7099	0.3055	0.005197	0.3149	0.6412	1.522
Bratio[52]	0.7439	0.3099	0.005293	0.3358	0.6764	1.557
Bratio[53]	0.8005	0.3313	0.005607	0.3609	0.7278	1.663
Bratio[54]	0.8482	0.3466	0.005782	0.3842	0.7723	1.739
Bratio[55]	0.8862	0.352	0.0058	0.4016	0.8142	1.757
F[1]	0.06489	0.01932	2.10E-04	0.04103	0.06033	0.1141
F[2]	0.05336	0.0168	1.82E-04	0.03272	0.04954	0.0969
F[3]	0.01434	0.004554	4.81E-05	0.008612	0.0133	0.02589
F[4]	0.02468	0.007563	7.68E-05	0.01498	0.02308	0.04336
F[5]	0.01185	0.003498	3.63E-05	0.007135	0.01113	0.02074
F[6]	0.02343	0.006396	6.48E-05	0.01435	0.02225	0.03977
F[7]	0.07952	0.0204	1.95E-04	0.04886	0.07614	0.1308
F[8]	0.1268	0.03164	3.05E-04	0.07596	0.1221	0.207
F[9]	0.1285	0.03341	3.17E-04	0.07591	0.1235	0.2137
F[10]	0.06215	0.01709	1.64E-04	0.03584	0.05976	0.1056
F[11]	0.08947	0.02237	2.12E-04	0.05169	0.08658	0.1439
F[12]	0.2042	0.04823	4.35E-04	0.118	0.199	0.3209
F[13]	0.1484	0.0396	3.57E-04	0.08056	0.1436	0.2446
F[14]	0.1183	0.03306	2.99E-04	0.06333	0.1141	0.1999
F[15]	0.1492	0.04159	3.71E-04	0.07892	0.1443	0.251
F[16]	0.1243	0.03634	3.37E-04	0.06413	0.1198	0.217
F[17]	0.128	0.03794	3.47E-04	0.06521	0.1231	0.2239
F[18]	0.1288	0.03927	3.56E-04	0.06539	0.1236	0.2245
F[19]	0.08221	0.02662	2.37E-04	0.04124	0.07856	0.1464
F[20]	0.0728	0.02301	2.12E-04	0.03673	0.0697	0.1287
F[21]	0.0568	0.0173	1.54E-04	0.02997	0.05452	0.09839
F[22]	0.05545	0.01577	1.47E-04	0.03061	0.05356	0.0945
F[23]	0.08315	0.0214	1.95E-04	0.04795	0.08062	0.1349
F[24]	0.08116	0.01942	1.80E-04	0.04911	0.07893	0.1284

F[25]	0.06344	0.01408	1.31E-04	0.04066	0.06168	0.09719
F[26]	0.1932	0.03665	3.53E-04	0.1299	0.1901	0.2779
F[27]	0.2303	0.04552	4.37E-04	0.1554	0.2251	0.341
F[28]	0.2209	0.04396	4.49E-04	0.146	0.2169	0.3251
F[29]	0.2398	0.04827	5.76E-04	0.1513	0.2373	0.347
F[30]	0.1437	0.03179	3.89E-04	0.08945	0.1414	0.2151
F[31]	0.171	0.03736	4.85E-04	0.1059	0.1686	0.2529
F[32]	0.2189	0.05205	6.99E-04	0.132	0.2143	0.3323
F[33]	0.2478	0.06215	9.14E-04	0.1389	0.2435	0.38
F[34]	0.2564	0.07466	0.001162	0.1317	0.2489	0.422
F[35]	0.0763	0.02813	4.64E-04	0.03395	0.07206	0.1427
F[36]	0.02047	0.007697	1.29E-04	0.009208	0.01924	0.03849
F[37]	0.02329	0.008516	1.42E-04	0.01074	0.02193	0.0435
F[38]	0.03239	0.01177	1.88E-04	0.01517	0.03057	0.06066
F[39]	0.03708	0.0135	2.11E-04	0.01736	0.03495	0.06914
F[40]	0.04197	0.015	2.44E-04	0.01965	0.03963	0.07779
F[41]	0.02892	0.01043	1.70E-04	0.01357	0.02728	0.05405
F[42]	0.0342	0.01229	2.05E-04	0.016	0.03231	0.06347
F[43]	0.02042	0.007345	1.25E-04	0.009563	0.01927	0.03768
F[44]	0.06362	0.02253	3.94E-04	0.03018	0.06031	0.1175
F[45]	0.02498	0.009265	1.65E-04	0.01147	0.02353	0.04722
F[46]	0.009874	0.00365	6.30E-05	0.004609	0.00931	0.01859
F[47]	0.01763	0.006526	1.09E-04	0.008258	0.01662	0.03305
F[48]	0.007879	0.002955	4.65E-05	0.003721	0.007383	0.01493
F[49]	0.008394	0.003006	5.04E-05	0.004011	0.007915	0.01557
F[50]	0.0109	0.003863	6.49E-05	0.005245	0.01033	0.02032
F[51]	0.01166	0.004089	6.66E-05	0.005714	0.01103	0.02152
F[52]	0.009227	0.003204	5.14E-05	0.004608	0.008734	0.01684
F[53]	0.007648	0.002604	4.24E-05	0.003879	0.007254	0.0138
F[54]	0.007516	0.002536	4.06E-05	0.003862	0.00713	0.01357
F[55]	0.007344	0.002576	3.86E-05	0.003814	0.006915	0.01354
FMSY	0.06737	0.02193	2.65E-04	0.03884	0.06282	0.1218
Fratio[1]	1.003	0.274	0.002656	0.5663	0.9705	1.633
Fratio[2]	0.824	0.2355	0.002249	0.4489	0.7976	1.353
Fratio[3]	0.2216	0.06477	6.26E-04	0.1168	0.2155	0.3649
Fratio[4]	0.3825	0.1097	0.001064	0.199	0.3745	0.6267
Fratio[5]	0.1838	0.05108	4.91E-04	0.09383	0.1809	0.2975
Fratio[6]	0.3644	0.09856	9.64E-04	0.1859	0.3615	0.567
Fratio[7]	1.239	0.3207	0.003107	0.6353	1.238	1.928
Fratio[8]	1.976	0.5002	0.004853	0.9815	1.983	3.031
Fratio[9]	1.997	0.5045	0.005013	1.003	2.009	3.057
Fratio[10]	0.9651	0.2478	0.002315	0.4731	0.972	1.477
Fratio[11]	1.393	0.3491	0.003498	0.6839	1.413	2.104
Fratio[12]	3.185	0.7884	0.00829	1.548	3.245	4.665
Fratio[13]	2.305	0.5853	0.005796	1.07	2.357	3.446
Fratio[14]	1.835	0.475	0.00452	0.8287	1.877	2.764

Fratio[15]	2.317	0.6048	0.005823	1.025	2.372	3.517
Fratio[16]	1.93	0.52	0.005053	0.823	1.978	2.946
Fratio[17]	1.987	0.5367	0.00538	0.8406	2.038	3.048
Fratio[18]	1.999	0.5471	0.005841	0.8305	2.051	3.101
Fratio[19]	1.274	0.3604	0.003808	0.5259	1.304	2.018
Fratio[20]	1.131	0.3203	0.003435	0.4677	1.156	1.782
Fratio[21]	0.8841	0.2481	0.00266	0.3747	0.9008	1.387
Fratio[22]	0.8659	0.2394	0.002594	0.3706	0.881	1.377
Fratio[23]	1.303	0.3539	0.003843	0.5651	1.326	2.019
Fratio[24]	1.275	0.3438	0.003817	0.5853	1.292	1.959
Fratio[25]	0.9975	0.2624	0.002982	0.4773	1.008	1.538
Fratio[26]	3.049	0.7744	0.009529	1.487	3.089	4.574
Fratio[27]	3.626	0.915	0.01144	1.805	3.66	5.447
Fratio[28]	3.482	0.8919	0.01183	1.675	3.537	5.226
Fratio[29]	3.793	1.008	0.01396	1.716	3.88	5.703
Fratio[30]	2.269	0.6237	0.00889	1.018	2.309	3.481
Fratio[31]	2.709	0.7697	0.01133	1.173	2.753	4.201
Fratio[32]	3.462	1.014	0.01511	1.498	3.504	5.507
Fratio[33]	3.936	1.229	0.01935	1.574	3.99	6.317
Fratio[34]	4.08	1.408	0.02327	1.46	4.092	6.795
Fratio[35]	1.218	0.4964	0.008578	0.3741	1.192	2.261
Fratio[36]	0.3269	0.136	0.002364	0.09844	0.3165	0.623
Fratio[37]	0.3716	0.1519	0.002598	0.1169	0.3609	0.7018
Fratio[38]	0.5149	0.2069	0.003436	0.1695	0.4984	0.9685
Fratio[39]	0.5887	0.2368	0.003808	0.1991	0.5679	1.112
Fratio[40]	0.6702	0.2728	0.004506	0.2167	0.648	1.268
Fratio[41]	0.4613	0.1889	0.003098	0.1521	0.4459	0.8831
Fratio[42]	0.5462	0.2252	0.003726	0.1796	0.5264	1.05
Fratio[43]	0.3271	0.1367	0.002297	0.1048	0.3143	0.6363
Fratio[44]	1.023	0.432	0.007365	0.3205	0.9847	2
Fratio[45]	0.4029	0.1775	0.003078	0.1218	0.3837	0.8122
Fratio[46]	0.159	0.06964	0.001184	0.04952	0.1512	0.3208
Fratio[47]	0.283	0.1228	0.00204	0.08983	0.2684	0.5668
Fratio[48]	0.126	0.05429	8.70E-04	0.04173	0.1194	0.2518
Fratio[49]	0.1352	0.05884	9.66E-04	0.04361	0.1279	0.2716
Fratio[50]	0.1762	0.07781	0.001259	0.05599	0.1666	0.3587
Fratio[51]	0.1881	0.08238	0.001294	0.06249	0.1775	0.3798
Fratio[52]	0.1487	0.06465	0.001005	0.0506	0.1402	0.3012
Fratio[53]	0.1236	0.05419	8.38E-04	0.04197	0.116	0.2497
Fratio[54]	0.1216	0.05318	8.09E-04	0.04205	0.1139	0.249
Fratio[55]	0.1187	0.05316	7.76E-04	0.0419	0.1104	0.2479
Ifallcamm[31]	2.529	0.2064	0.003028	2.121	2.53	2.937
Ifallcamm[32]	2.434	0.1864	0.002706	2.071	2.433	2.801
Ifallcamm[33]	2.338	0.1626	0.002213	2.026	2.335	2.664
Ifallcamm[34]	2.198	0.1488	0.00163	1.913	2.195	2.507
Ifallcamm[35]	2.06	0.1723	0.00183	1.755	2.049	2.438

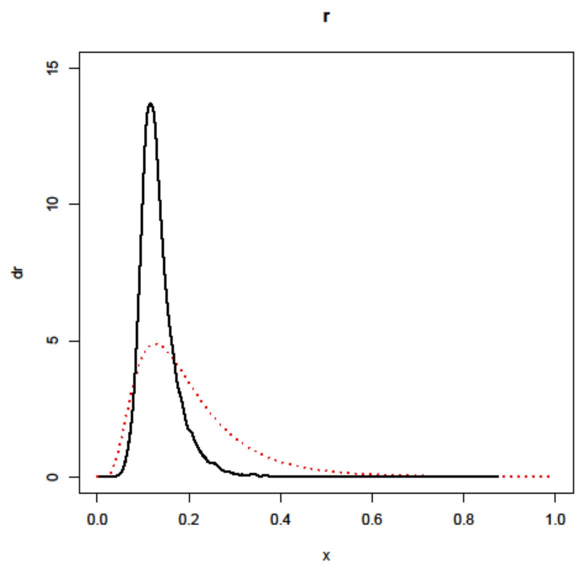
Ifallcamm[36]	2.061	0.1611	0.001701	1.765	2.054	2.404
Ifallcamm[37]	2.105	0.1471	0.001311	1.823	2.102	2.406
Ifallcamm[38]	2.132	0.146	0.001351	1.822	2.134	2.412
Ifallcamm[39]	2.175	0.1499	0.001437	1.842	2.185	2.452
Ifallcamm[40]	2.27	0.1389	0.001181	1.995	2.269	2.553
Ifallcamm[41]	2.307	0.1419	0.001311	2.012	2.311	2.582
Ifallcamm[42]	2.381	0.1411	0.001374	2.088	2.383	2.656
Ifallcamm[43]	2.464	0.1397	0.001236	2.194	2.461	2.753
Ifallcamm[44]	2.558	0.1424	0.001326	2.299	2.549	2.875
Ifallcamm[45]	2.597	0.1524	0.001653	2.322	2.588	2.941
Ifallcamm[46]	2.632	0.145	0.001486	2.355	2.628	2.929
Ifallcamm[47]	2.679	0.1462	0.001373	2.383	2.682	2.963
Ifallcamm[48]	2.712	0.1524	0.001465	2.38	2.721	2.987
Ifallcamm[49]	2.818	0.1438	0.001307	2.528	2.821	3.095
Ifallcamm[50]	2.91	0.1521	0.001379	2.616	2.908	3.222
Ifallcamm[51]	2.953	0.1508	0.001354	2.649	2.957	3.249
Ifallcamm[52]	3.004	0.1524	0.001324	2.692	3.007	3.292
Ifallcamm[53]	3.078	0.156	0.001427	2.767	3.08	3.386
Ifallcamm[54]	3.138	0.167	0.001572	2.806	3.139	3.459
Ispearlym[25]	2.943	0.2439	0.002211	2.478	2.933	3.469
Ispearlym[26]	2.965	0.2297	0.002076	2.539	2.953	3.46
Ispearlym[27]	2.83	0.2284	0.002096	2.399	2.821	3.318
Ispearlym[28]	2.689	0.223	0.00207	2.271	2.679	3.169
Ispearlym[29]	2.572	0.2253	0.00218	2.154	2.562	3.052
Ispearlym[30]	2.401	0.2312	0.002266	1.97	2.39	2.881
Ispearlym[31]	2.352	0.2389	0.002433	1.899	2.341	2.856
Isplatem[32]	2.003	0.1934	0.002705	1.622	2.004	2.387
Isplatem[33]	1.906	0.1699	0.002145	1.572	1.905	2.25
Isplatem[34]	1.767	0.1561	0.001549	1.462	1.765	2.085
Isplatem[35]	1.629	0.1776	0.001754	1.299	1.62	2.007
Isplatem[36]	1.63	0.1669	0.001707	1.314	1.625	1.981
Isplatem[37]	1.674	0.1547	0.00147	1.369	1.672	1.99
Isplatem[38]	1.7	0.1528	0.001499	1.382	1.705	1.994
Isplatem[39]	1.744	0.1576	0.00165	1.4	1.752	2.035
Isplatem[40]	1.839	0.1467	0.001382	1.545	1.84	2.132
Isplatem[41]	1.875	0.1498	0.001538	1.567	1.879	2.163
Isplatem[42]	1.949	0.1496	0.001608	1.644	1.952	2.241
Isplatem[43]	2.032	0.1476	0.001409	1.746	2.03	2.335
Isplatem[44]	2.127	0.1505	0.001449	1.849	2.119	2.45
Isplatem[45]	2.166	0.1608	0.001745	1.872	2.157	2.518
Isplatem[46]	2.201	0.1558	0.001612	1.904	2.195	2.524
Isplatem[47]	2.247	0.1583	0.001602	1.929	2.247	2.562
Isplatem[48]	2.28	0.1627	0.001706	1.932	2.287	2.578
Isplatem[49]	2.386	0.1554	0.001553	2.082	2.385	2.697
Isplatem[50]	2.478	0.1616	0.001499	2.173	2.472	2.817
Isplatem[51]	2.522	0.1595	0.001476	2.205	2.519	2.848

Isplatem[52]	2.572	0.1595	0.001499	2.253	2.57	2.888
Isplatem[53]	2.647	0.1627	0.001544	2.324	2.646	2.974
Isplatem[54]	2.706	0.171	0.001597	2.364	2.707	3.044
Isplatem[55]	2.752	0.1945	0.001852	2.349	2.756	3.127
K	119	23.23	0.3155	74.3	119.4	165.3
MSP	3.85	0.8333	0.007784	2.423	3.763	5.832
P.res[1]	0.01142	0.1133	9.62E-04	-0.2201	0.002903	0.2694
P.res[2]	0.01303	0.1138	9.80E-04	-0.2222	0.003868	0.2766
P.res[3]	0.01407	0.1146	0.001087	-0.2125	0.004217	0.2853
P.res[4]	0.01496	0.1144	9.08E-04	-0.2092	0.004299	0.2793
P.res[5]	0.01478	0.1145	0.001012	-0.2133	0.003833	0.2867
P.res[6]	0.0171	0.1141	0.001055	-0.2033	0.004235	0.2894
P.res[7]	0.01848	0.1161	9.99E-04	-0.2078	0.005222	0.2931
P.res[8]	0.02116	0.1123	9.97E-04	-0.1956	0.005421	0.2948
P.res[9]	0.01762	0.1159	0.001017	-0.2059	0.004229	0.2959
P.res[10]	0.01629	0.1128	9.02E-04	-0.2096	0.003801	0.2834
P.res[11]	0.0174	0.1133	9.89E-04	-0.2029	0.005131	0.283
P.res[12]	0.01692	0.1132	0.001001	-0.201	0.004253	0.2864
P.res[13]	0.01202	0.1127	0.001065	-0.2159	0.00256	0.2702
P.res[14]	0.009137	0.1139	9.61E-04	-0.2286	0.002282	0.2678
P.res[15]	0.008853	0.1127	9.18E-04	-0.2193	0.002062	0.2602
P.res[16]	0.006528	0.1128	9.52E-04	-0.2359	0.001387	0.2567
P.res[17]	0.004293	0.1119	9.42E-04	-0.2277	9.99E-04	0.254
P.res[18]	0.003965	0.1148	9.76E-04	-0.2416	7.72E-04	0.2566
P.res[19]	-1.92E-04	0.1141	9.91E-04	-0.2497	8.81E-05	0.2445
P.res[20]	0.001048	0.1157	9.09E-04	-0.2489	1.62E-05	0.2538
P.res[21]	-0.00242	0.1119	9.53E-04	-0.2492	-1.69E-04	0.2373
P.res[22]	-8.99E-04	0.1126	9.74E-04	-0.2503	1.04E-04	0.2427
P.res[23]	-0.002279	0.1135	9.45E-04	-0.2517	-2.66E-04	0.2416
P.res[24]	-0.005571	0.1146	9.15E-04	-0.2673	-0.001095	0.2324
P.res[25]	-0.009584	0.1141	0.001028	-0.2797	-0.001608	0.2171
P.res[26]	0.006295	0.108	9.61E-04	-0.2228	0.001213	0.2447
P.res[27]	-0.01153	0.1114	9.43E-04	-0.2662	-0.001642	0.2055
P.res[28]	0.01572	0.1111	9.81E-04	-0.2029	0.00366	0.2793
P.res[29]	0.0219	0.1156	0.001034	-0.1903	0.005486	0.3083
P.res[30]	-0.01407	0.1108	0.001002	-0.2774	-0.002342	0.2004
P.res[31]	-0.006199	0.1083	9.64E-04	-0.2501	-0.001499	0.2242
P.res[32]	-0.02435	0.1116	9.68E-04	-0.3037	-0.005634	0.1688
P.res[33]	0.02428	0.11	9.69E-04	-0.1749	0.005901	0.3001
P.res[34]	0.01262	0.1047	8.83E-04	-0.1965	0.003189	0.2567
P.res[35]	0.02241	0.1089	9.63E-04	-0.1719	0.004914	0.2977

P.res[36]	-0.035	0.1108	0.001069	-0.3128	-0.01147	0.1568
P.res[37]	-0.04443	0.1092	0.001069	-0.3241	-0.01724	0.1304
P.res[38]	-0.05882	0.1197	0.001237	-0.3817	-0.02348	0.1087
P.res[39]	-0.03322	0.1066	0.001112	-0.3096	-0.01163	0.1534
P.res[40]	0.02351	0.1077	9.44E-04	-0.1622	0.004857	0.3002
P.res[41]	-0.02769	0.1048	9.65E-04	-0.2983	-0.008402	0.1554
P.res[42]	-0.002179	0.09928	9.40E-04	-0.2245	-5.30E-05	0.2092
P.res[43]	0.01396	0.1012	8.45E-04	-0.1862	0.003897	0.2564
P.res[44]	0.01551	0.1002	8.94E-04	-0.1816	0.003847	0.2578
P.res[45]	0.00359	0.1015	9.27E-04	-0.2032	1.43E-04	0.2356
P.res[46]	-0.03532	0.107	0.001019	-0.3072	-0.01196	0.1426
P.res[47]	-0.03683	0.1096	0.001036	-0.32	-0.01303	0.1504
P.res[48]	-0.04233	0.1125	0.001057	-0.3375	-0.01523	0.1349
P.res[49]	0.02313	0.1082	0.001028	-0.1709	0.004776	0.295
P.res[50]	0.01367	0.1018	8.47E-04	-0.177	0.002463	0.2602
P.res[51]	-0.02764	0.1029	0.00106	-0.2859	-0.009183	0.1572
P.res[52]	-0.01896	0.1014	7.61E-04	-0.2702	-0.005547	0.1757
P.res[53]	0.004771	0.1003	9.77E-04	-0.2062	5.51E-04	0.2373
P.res[54]	-0.007442	0.1018	9.17E-04	-0.2387	-0.001962	0.2028
P.res[55]	-0.018	0.1107	9.79E-04	-0.2796	-0.00424	0.1891
deviance	317.5	5.892	0.0665	306.5	317.1	330
pq.fallcam	2.097	0.6797	0.01122	1.074	1.991	3.703
pq.spearly	2.464	0.6479	0.006425	1.383	2.4	3.939
pq.splate	3.233	1.062	0.01735	1.653	3.066	5.774
q.fallcam	0.5268	0.1699	0.002865	0.27	0.5024	0.9307
q.spearly	0.4349	0.1205	0.001195	0.2539	0.4168	0.723
q.splate	0.3428	0.1126	0.001876	0.1732	0.3261	0.6051
r	0.1347	0.04386	5.29E-04	0.07769	0.1256	0.2435
res.Ifallcam.rep[31]	0.2021	0.4815	0.004629	-0.7447	0.2041	1.145
res.Ifallcam.rep[32]	-0.7333	0.4664	0.004468	-1.663	-0.7293	0.1811
res.Ifallcam.rep[33]	-0.1293	0.4626	0.004611	-1.049	-0.1261	0.7639
res.Ifallcam.rep[34]	0.04876	0.4589	0.003775	-0.8631	0.05327	0.9566
res.Ifallcam.rep[35]	-0.003757	0.4639	0.003981	-0.9313	0.001088	0.9047
res.Ifallcam.rep[36]	0.4036	0.462	0.00439	-0.5127	0.4043	1.325
res.Ifallcam.rep[37]	0.4003	0.4574	0.003817	-0.5163	0.4035	1.3
res.Ifallcam.rep[38]	-0.5824	0.4624	0.003849	-1.504	-0.5806	0.3236
res.Ifallcam.rep[39]	-0.2766	0.4537	0.004222	-1.189	-0.277	0.599
res.Ifallcam.rep[40]	0.3206	0.4515	0.003686	-0.5817	0.3294	1.208
res.Ifallcam.rep[41]	-0.2793	0.46	0.004121	-1.206	-0.2806	0.6287
res.Ifallcam.rep[42]	-0.4302	0.4557	0.004413	-1.325	-0.4295	0.4621
res.Ifallcam.rep[43]	-0.05577	0.4478	0.003598	-0.9519	-0.05317	0.8228
res.Ifallcam.rep[44]	-0.2286	0.4591	0.004012	-1.132	-0.2259	0.6862
res.Ifallcam.rep[45]	0.3266	0.4625	0.004354	-0.5951	0.3264	1.244

res.Ifallcam.rep[46]	0.2654	0.4539	0.003829	-0.6249	0.2623	1.177
res.Ifallcam.rep[47]	-8.16E-04	0.457	0.003912	-0.9097	-0.001482	0.8985
res.Ifallcam.rep[48]	-0.6692	0.462	0.004421	-1.579	-0.6698	0.2339
res.Ifallcam.rep[49]	0.3039	0.4581	0.003986	-0.5845	0.3057	1.226
res.Ifallcam.rep[50]	0.7243	0.4555	0.004139	-0.1723	0.7219	1.616
res.Ifallcam.rep[51]	0.3405	0.4579	0.003738	-0.5352	0.3353	1.272
res.Ifallcam.rep[52]	-0.1159	0.4557	0.003637	-1.006	-0.1187	0.787
res.Ifallcam.rep[53]	0.2194	0.4611	0.003713	-0.6844	0.2157	1.148
res.Ifallcam.rep[54]	-0.2688	0.4653	0.004068	-1.172	-0.2693	0.6331
res.Ispearly.rep[25]	-0.2839	0.6332	0.005606	-1.614	-0.2633	0.9162
res.Ispearly.rep[26]	0.2335	0.623	0.005463	-1.045	0.2466	1.48
res.Ispearly.rep[27]	-0.6159	0.6203	0.00596	-1.883	-0.6005	0.6062
res.Ispearly.rep[28]	-0.2747	0.6222	0.005898	-1.559	-0.2612	0.9331
res.Ispearly.rep[29]	0.6384	0.6239	0.005652	-0.6419	0.6496	1.873
res.Ispearly.rep[30]	-0.2097	0.6261	0.005869	-1.507	-0.1958	0.9922
res.Ispearly.rep[31]	0.02622	0.6328	0.00569	-1.268	0.03029	1.265
res.Isplate.rep[32]	-0.03959	0.5313	0.005077	-1.106	-0.04112	0.9897
res.Isplate.rep[33]	0.2018	0.5214	0.00446	-0.8222	0.1988	1.243
res.Isplate.rep[34]	-0.3236	0.5169	0.004658	-1.338	-0.328	0.697
res.Isplate.rep[35]	1.158	0.5213	0.004558	0.1157	1.16	2.186
res.Isplate.rep[36]	-0.2321	0.5206	0.004467	-1.245	-0.2321	0.8134
res.Isplate.rep[37]	-0.2594	0.5164	0.004668	-1.288	-0.252	0.7517
res.Isplate.rep[38]	0.2544	0.5166	0.004299	-0.7631	0.2541	1.27
res.Isplate.rep[39]	-0.7502	0.5152	0.004619	-1.772	-0.7521	0.2689
res.Isplate.rep[40]	0.3492	0.5126	0.004705	-0.6763	0.3524	1.358
res.Isplate.rep[41]	-0.1669	0.5182	0.004782	-1.203	-0.1654	0.8715
res.Isplate.rep[42]	0.2818	0.5139	0.004779	-0.7435	0.2815	1.289
res.Isplate.rep[43]	-0.01603	0.5146	0.004292	-1.048	-0.01884	0.9885
res.Isplate.rep[44]	0.6449	0.5184	0.00449	-0.367	0.6427	1.681
res.Isplate.rep[45]	0.3076	0.5125	0.004658	-0.7198	0.309	1.32
res.Isplate.rep[46]	-0.2583	0.5191	0.00493	-1.293	-0.2547	0.7761
res.Isplate.rep[47]	0.01314	0.6926	0.006114	-1.363	0.01758	1.378
res.Isplate.rep[48]	-0.3078	0.5216	0.005002	-1.359	-0.304	0.7196
res.Isplate.rep[49]	-0.2099	0.519	0.004736	-1.243	-0.2043	0.7967
res.Isplate.rep[50]	-0.2573	0.5223	0.004555	-1.317	-0.2501	0.7516
res.Isplate.rep[51]	-0.6245	0.5217	0.004675	-1.667	-0.612	0.3895
res.Isplate.rep[52]	-0.2905	0.5251	0.004251	-1.339	-0.2855	0.7359
res.Isplate.rep[53]	-0.09464	0.5225	0.004798	-1.145	-0.09324	0.9188
res.Isplate.rep[54]	0.4877	0.5233	0.004205	-0.5617	0.4916	1.513
res.Isplate.rep[55]	-0.3854	0.5366	0.005087	-1.458	-0.3854	0.6758
sigma	0.09055	0.07155	9.88E-04	0.003522	0.07535	0.2644
tau.fallcam	0.1876	0.06934	6.36E-04	0.09295	0.1744	0.3576
tau.spearly	0.3413	0.2739	0.002344	0.08454	0.2613	1.114
tau.splate	0.2439	0.08915	8.03E-04	0.1227	0.2268	0.4618

Priors and posteriors



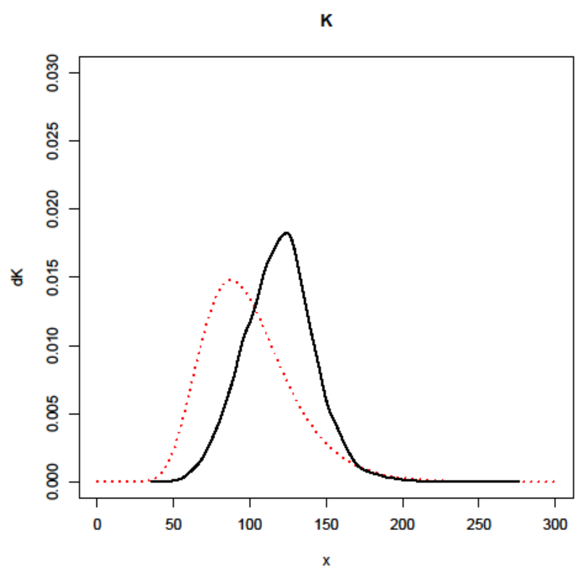


Figure A1. Prior (red) and posterior (black) for r and K.

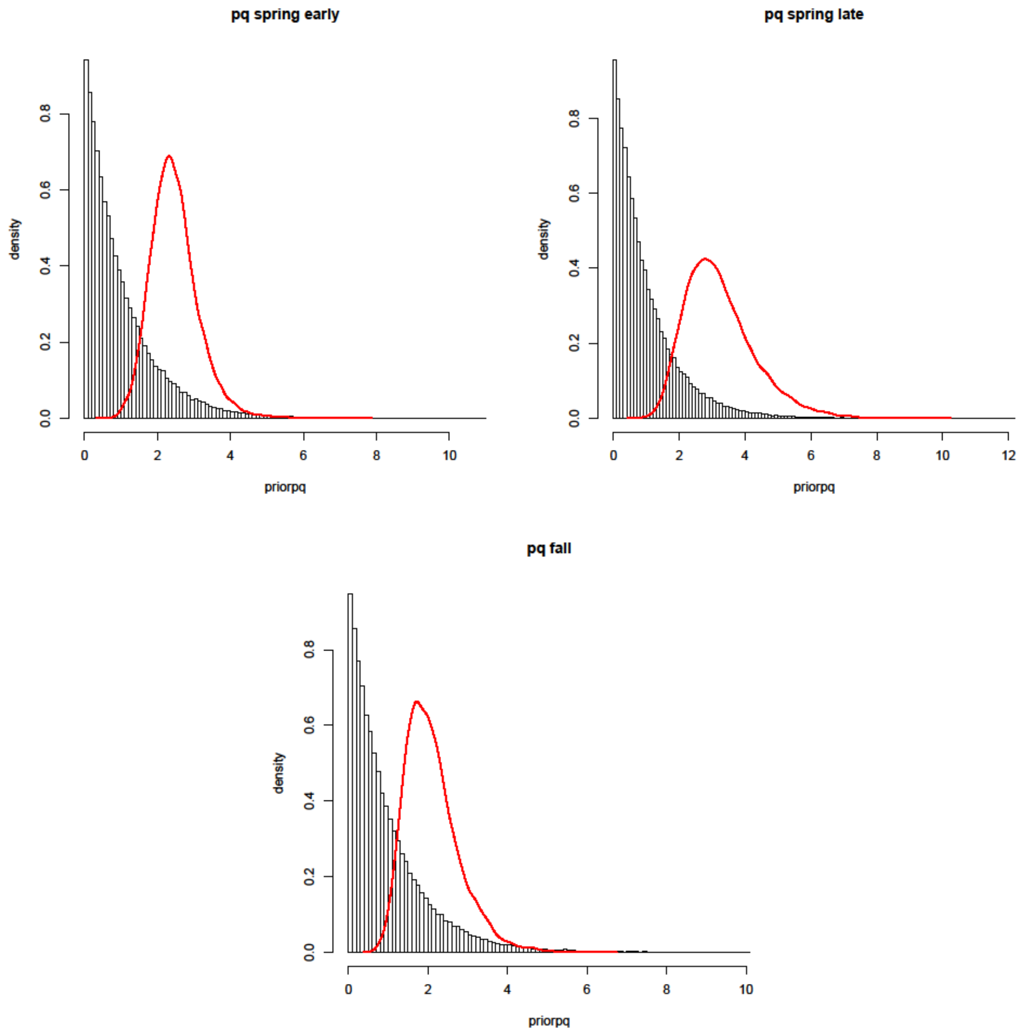


Figure A2. Prior (black histogram) and posterior (red line) on pq for the survey indices.

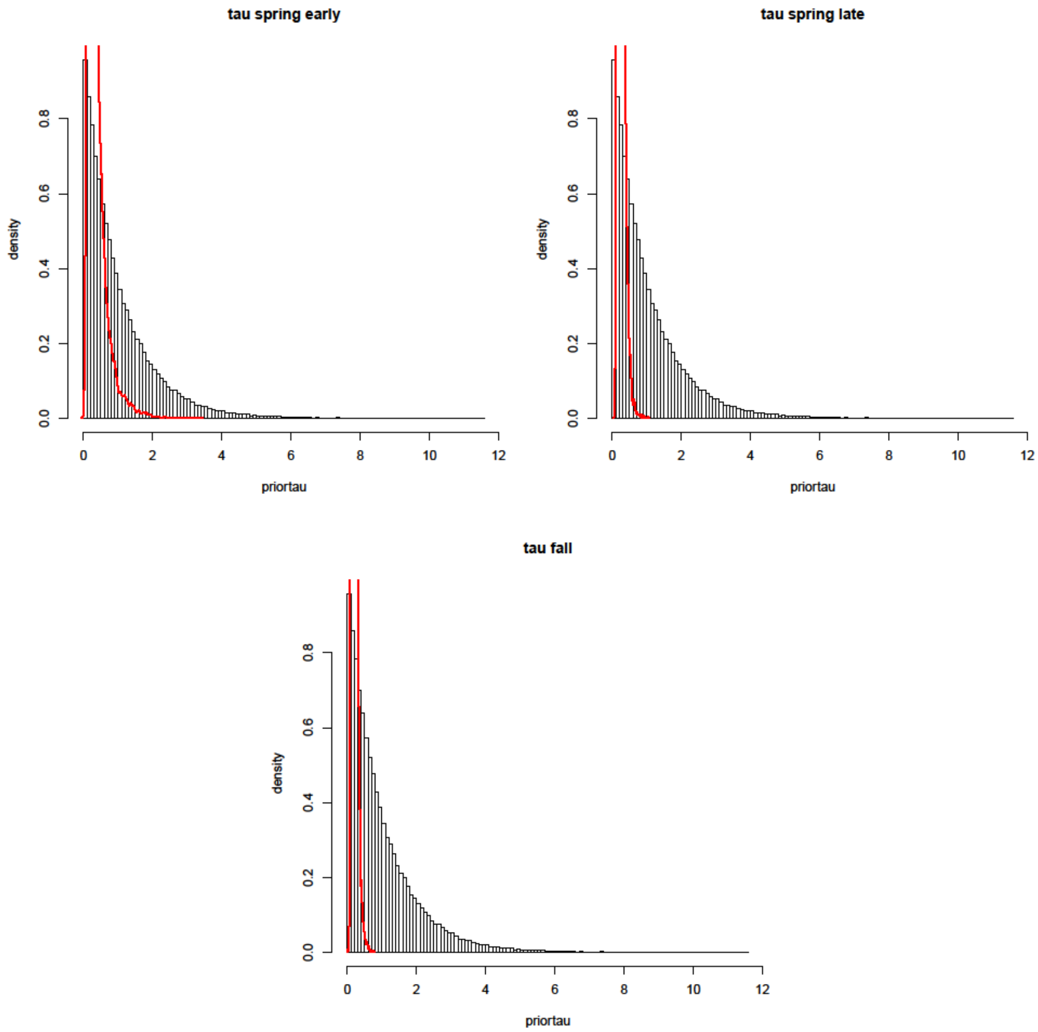


Figure A3. Prior (black histogram) and posterior (red line) for tau for the survey indices.

Fit to survey

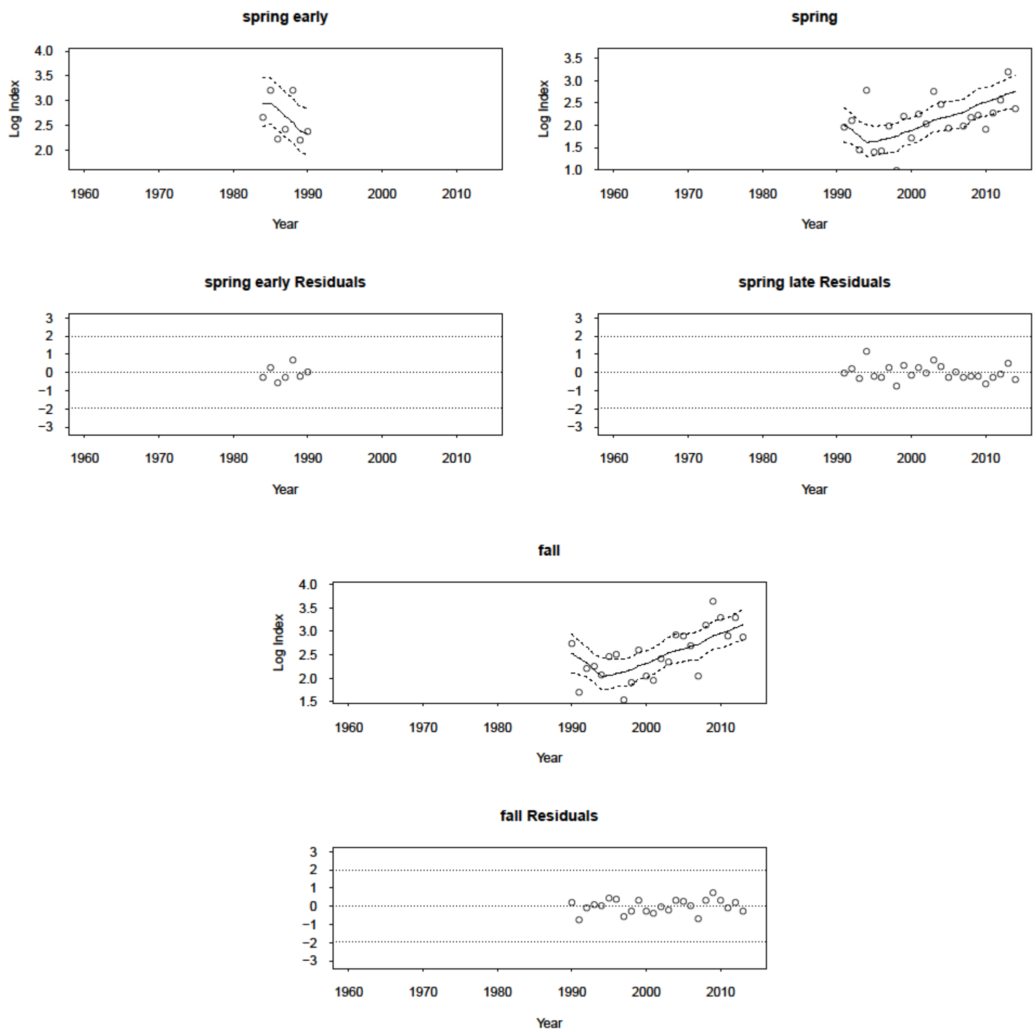


Figure A4. Observed (dots) and predicted (line with credible intervals) as well as standardized residuals for the survey indices.

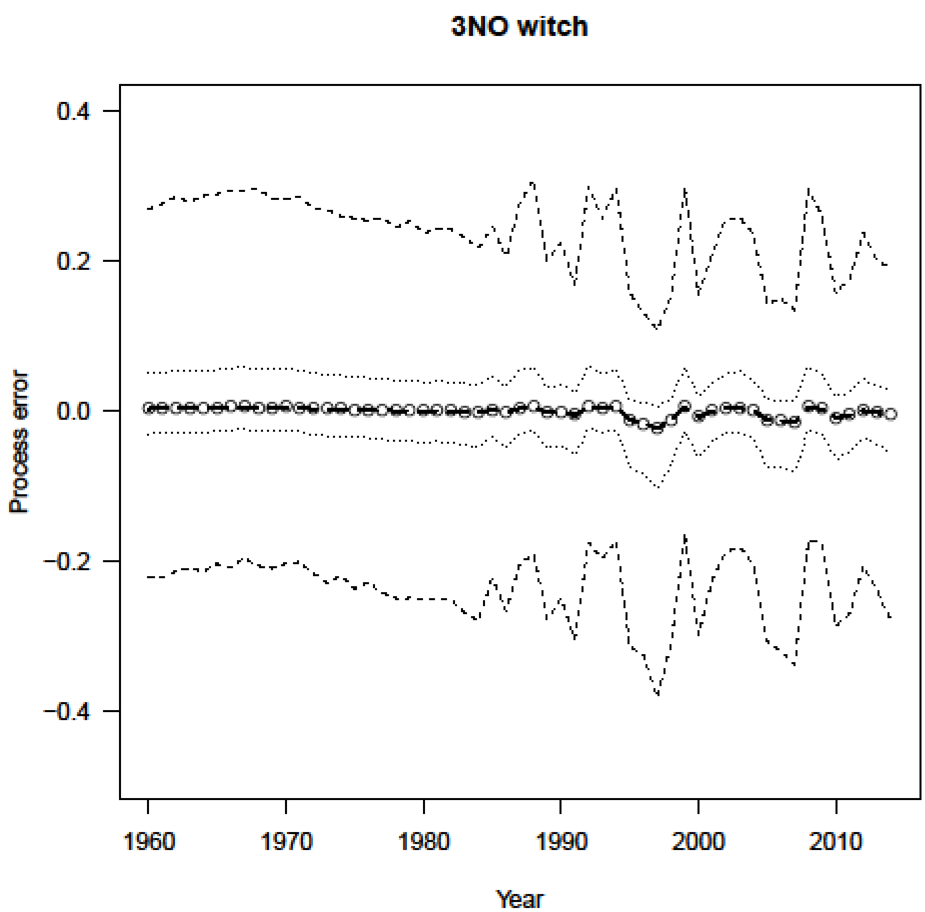


Figure A5. Process error

Convergence diagnostics

Diagnostics r

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.134	0.0419	0.0006	0.0009	0.0009	0.141	0.080	0.125	0.244

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.135	0.045	0.0006	0.001	0.001	0.196	0.076	0.125	0.246

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.134	0.043	0.0006	0.001	0.001	0.186	0.079	0.125	0.242

BROOKS, GELMAN, AND RUBIN CONVERGENCE DIAGNOSTICS:

==

Iterations used = 2251:4500

Potential Scale Reduction Factors

x

1.000487

Multivariate Potential Scale Reduction Factor = 1.000841

Corrected Scale Reduction Factors

Estimate 0.975

x 1.000919 1.002828

GEWEKE CONVERGENCE DIAGNOSTIC:

==============================

Fraction in first window = 0.1

Fraction in last window = 0.5

x

Z-Score 0.8128715

p-value 0.4162917

Chain: witchchain2

x

Z-Score 1.2244800

p-value 0.2207712

Chain: witchchain3

x

Z-Score 0.6373386

p-value 0.5239043

Diagnostics K

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
119.036	23.065	0.343	0.761	0.733	-0.021	73.902	119.5	164

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
118.747	23.641	0.352	1.034	0.897	0.300	72.429	118.5	165.65

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
119.187	23.320	0.347	0.786	0.7139	0.146	74.694	119.2	168.4

BROOKS, GELMAN, AND RUBIN CONVERGENCE DIAGNOSTICS:

===

Iterations used = 2251:4500

Potential Scale Reduction Factors

x

1.000831

Multivariate Potential Scale Reduction Factor = 1.001358

Corrected Scale Reduction Factors

Estimate 0.975

x 1.001207 1.004041

GEWEKE CONVERGENCE DIAGNOSTIC:

==============================

Fraction in first window = 0.1

Fraction in last window = 0.5

Chain: witchchain1

x

Z-Score 0.1355736

p-value 0.8921584

Chain: witchchain2

x

Z-Score -1.5334985

p-value 0.1251531

Chain: witchchain3

x

Z-Score -0.4249607

p-value 0.6708653

Diagnostics Sigma

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.089	0.0708	0.001	0.002	0.002	0.032	0.002	0.072	0.263

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.091	0.073	0.001	0.003	0.002	0.110	0.001	0.076	0.270

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.089	0.071	0.001	0.003	0.002	0.135	0.003	0.074	0.259

BROOKS, GELMAN, AND RUBIN CONVERGENCE DIAGNOSTICS:

===

Iterations used = 2251:4500

Potential Scale Reduction Factors

x

1.00687

Multivariate Potential Scale Reduction Factor = 1.010397

Corrected Scale Reduction Factors

	Estimate	0.975
x	1.007289	1.026162

GEWEKE CONVERGENCE DIAGNOSTIC:

==============================

Fraction in first window = 0.1

Fraction in last window = 0.5

Chain: witchchain1

x

Z-Score 0.3502450

p-value 0.7261549

Chain: witchchain2

x

Z-Score 0.9761999

p-value 0.3289654

Chain: witchchain3

x

Z-Score 2.0636881

p-value 0.0390473

diagnostics q spring late

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.346	0.110	0.001	0.005	0.004	0.069	0.175	0.332	0.612

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.344	0.107	0.001	0.004	0.003	0.153	0.175	0.33	0.582

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.336	0.110	0.001	0.005	0.004	0.109	0.171	0.321	0.592

BROOKS, GELMAN, AND RUBIN CONVERGENCE DIAGNOSTICS:

===

Iterations used = 2251:4500

Potential Scale Reduction Factors

x

1.002478

Multivariate Potential Scale Reduction Factor = 1.003825

Corrected Scale Reduction Factors

	Estimate	0.975
x	1.003239	1.010494

GEWEKE CONVERGENCE DIAGNOSTIC:

===============================

Fraction in first window = 0.1

Fraction in last window = 0.5

Chain: witchchain1

	x
Z-Score	1.1049802
p-value	0.2691682

Chain: witchchain2

	x
Z-Score	-1.2642693
p-value	0.2061334

Chain: witchchain3

x

Z-Score 1.84500909

p-value 0.06503622

diagnostics q spring early

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.435	0.118	0.001	0.002	0.002	0.173	0.254	0.418	0.708

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.435	0.120	0.001	0.001	0.001	0.042	0.258	0.416	0.720

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.436	0.123	0.001	0.002	0.002	0.046	0.257	0.417	0.734

GEWEKE CONVERGENCE DIAGNOSTIC:

==============================

Fraction in first window = 0.1

Fraction in last window = 0.5

Chain: witchchain1

x

Z-Score 0.4883165

p-value 0.6253257

Chain: witchchain2

x

Z-Score 0.001214059

p-value 0.999031321

Chain: witchchain3

x

Z-Score 0.7428410

p-value 0.4575779

diagnostics q fall

SUMMARY STATISTICS:

===================

Bin size for calculating Batch SE and (Lag 1) ACF = 50

Chain: witchchain1

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.533	0.168	0.002	0.008	0.007	0.068	0.272	0.513	0.928

Chain: witchchain2

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.530	0.162	0.002	0.006	0.005	0.157	0.273	0.512	0.880

Chain: witchchain3

Mean	SD	Naive SE	MC Error	Batch SE	Batch ACF	0.025	0.5	0.975
0.519	0.167	0.002	0.008	0.006	0.127	0.263	0.494	0.907

BROOKS, GELMAN, AND RUBIN CONVERGENCE DIAGNOSTICS:

==

Iterations used = 2251:4500

Potential Scale Reduction Factors

x

1.002062

Multivariate Potential Scale Reduction Factor = 1.003202

Corrected Scale Reduction Factors

Estimate 0.975

x 1.002702 1.008841

GEWEKE CONVERGENCE DIAGNOSTIC:

===============================

Fraction in first window = 0.1

Fraction in last window = 0.5

Chain: witchchain1

x

Z-Score 1.0372279

p-value 0.2996297

Chain: witchchain2

x

Z-Score -0.8740901

p-value 0.3820692

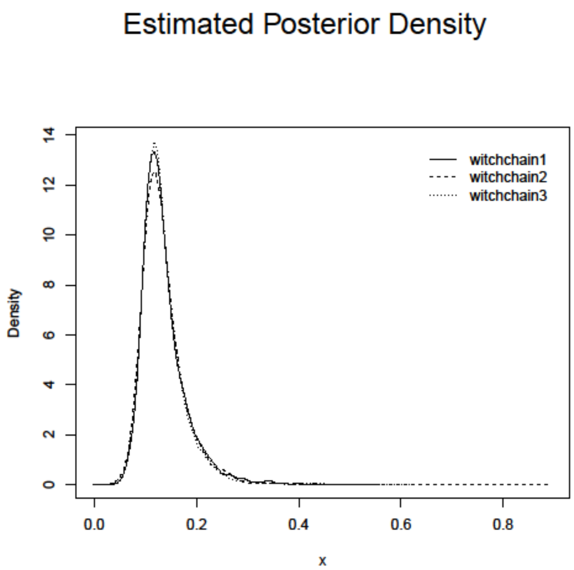
Chain: witchchain3

x

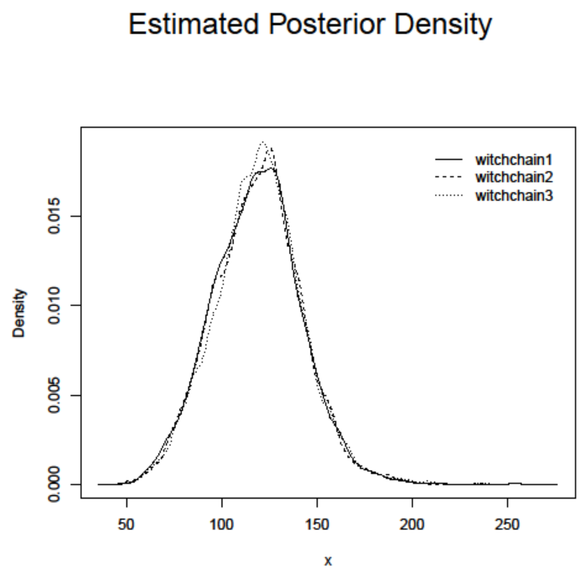
Z-Score 1.69454674

p-value 0.09016144

R



K



Sigma

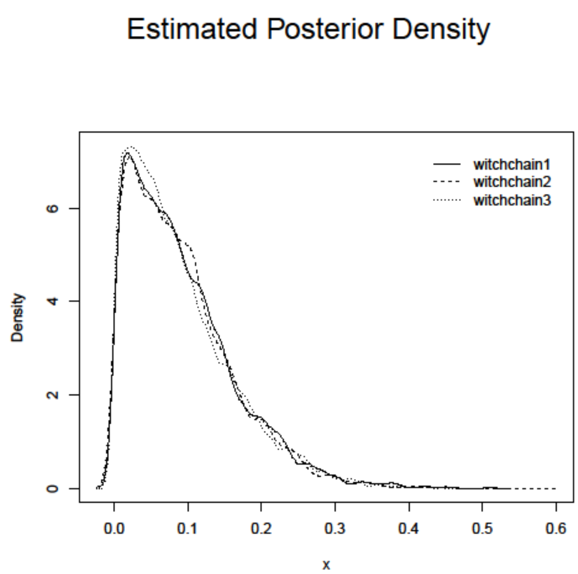
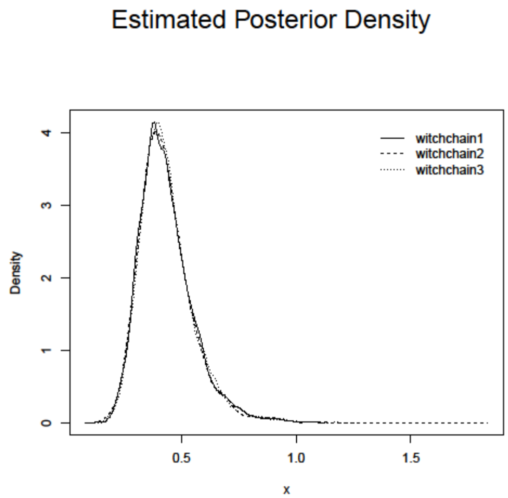
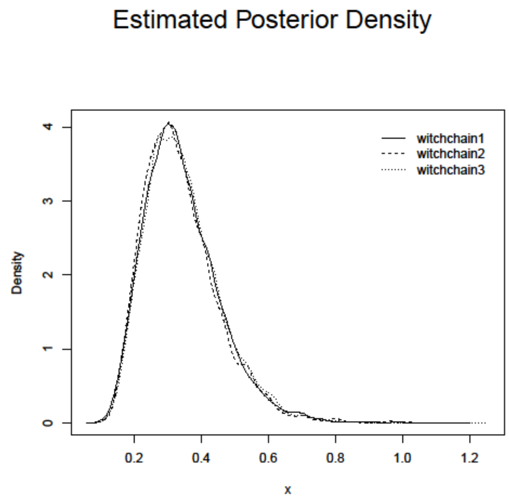


Figure A6. Posterior density for the 3 chains from the model for r, K and sigma.

Spring early



Spring late



Fall

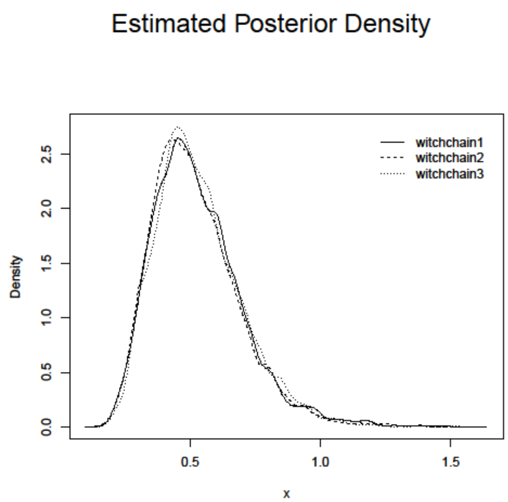
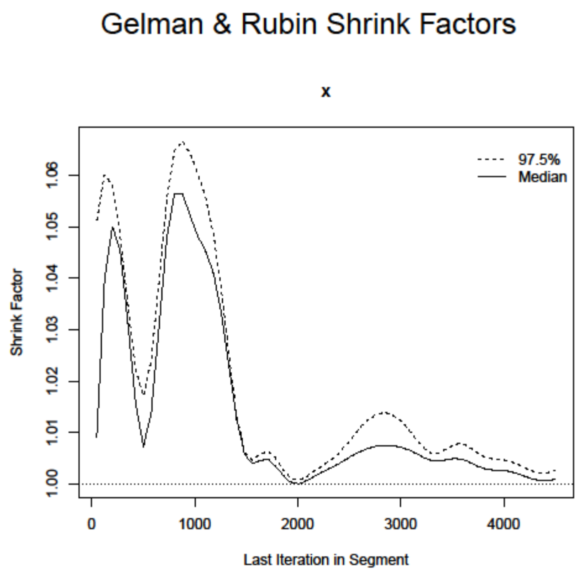
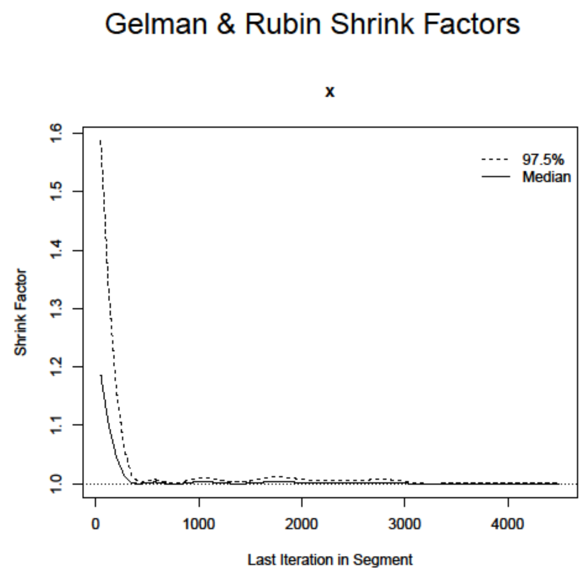


Figure A7. Posterior density for the 3 chains from the model for the q from the 3 survey series.

R



K



Sigma

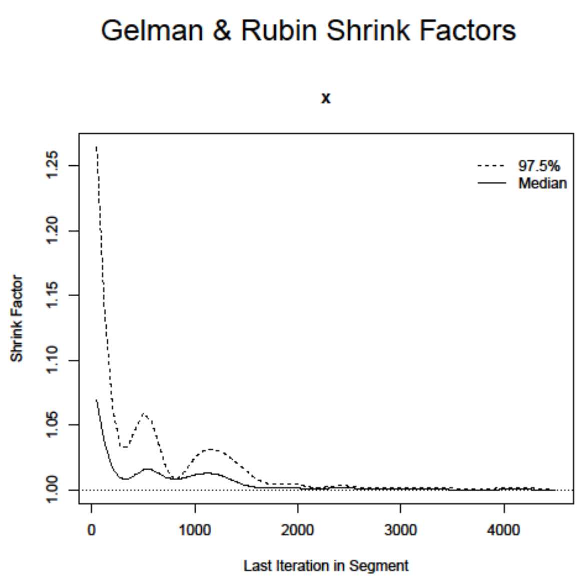
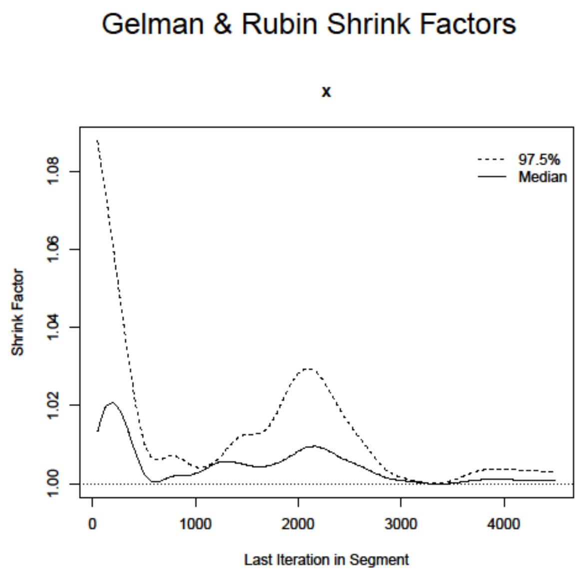
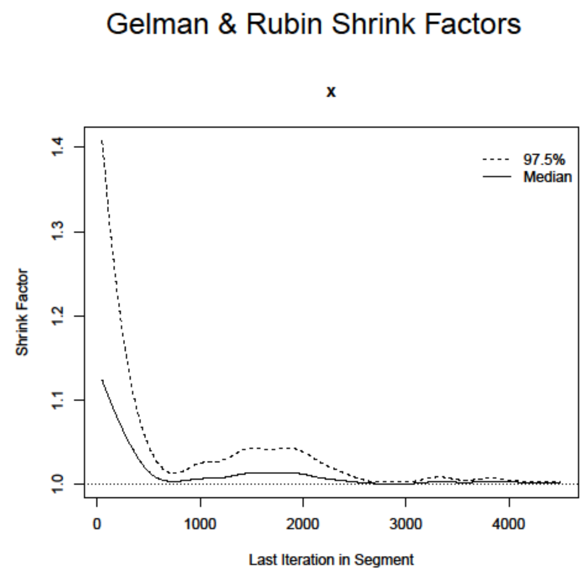


Figure A8. Gelman-rubin shrink factor for r, K and sigma.

Spring early



spring late



Fall

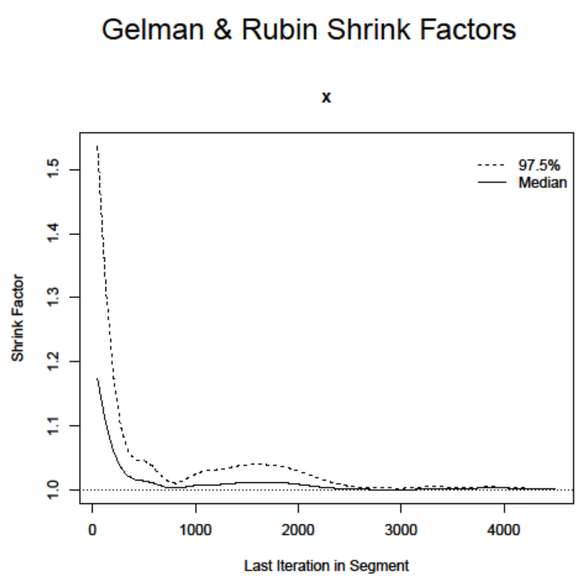
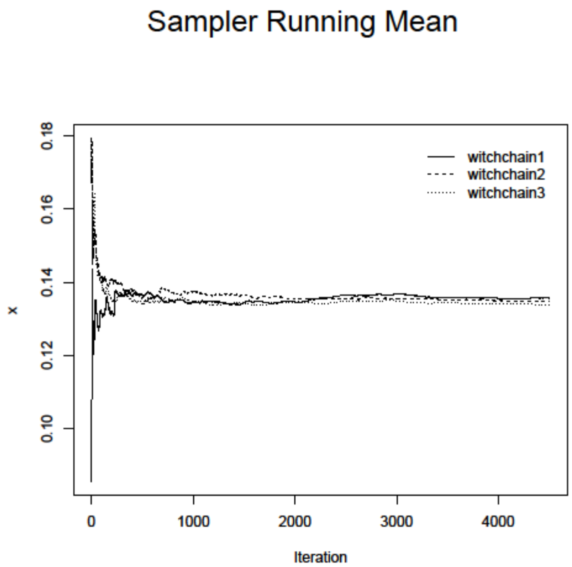
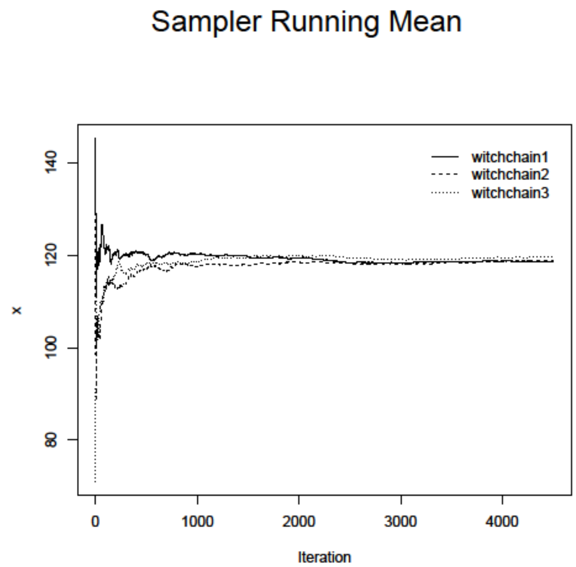


Figure A9. Gelman-rubin shrink factor for the q from the 3 survey indices.

R



K



Sigma

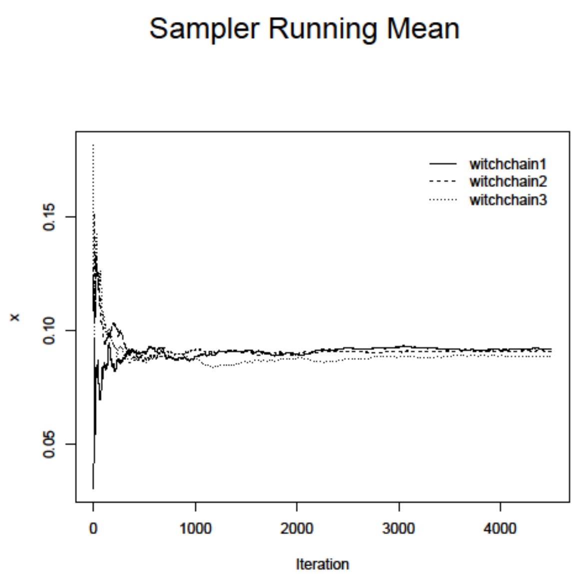
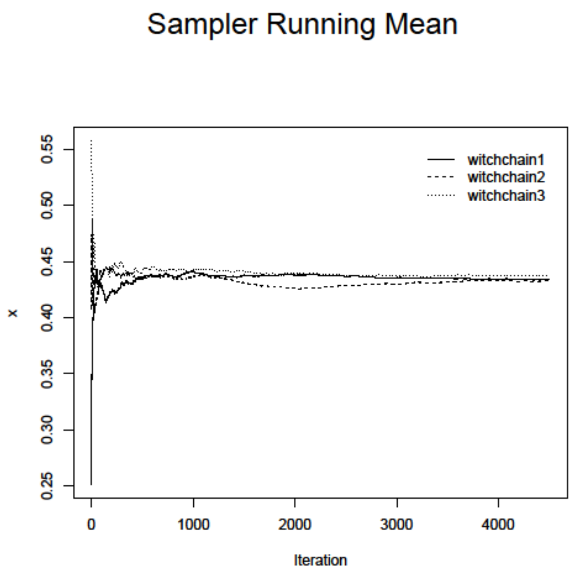
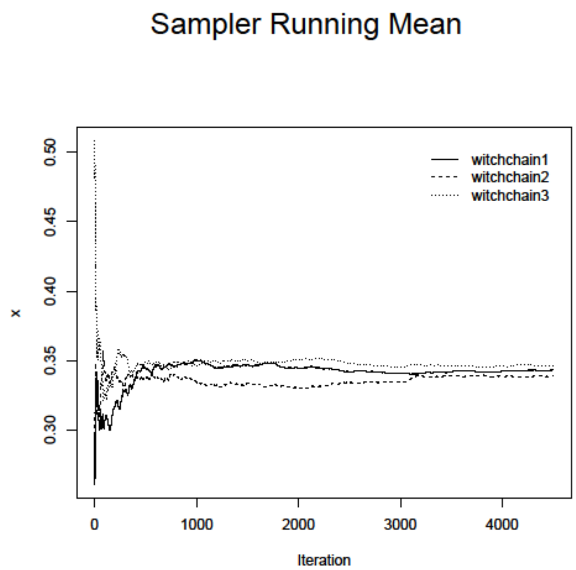


Figure A10. Sampler running mean for r, K and sigma.

Spring early



spring late



Fall

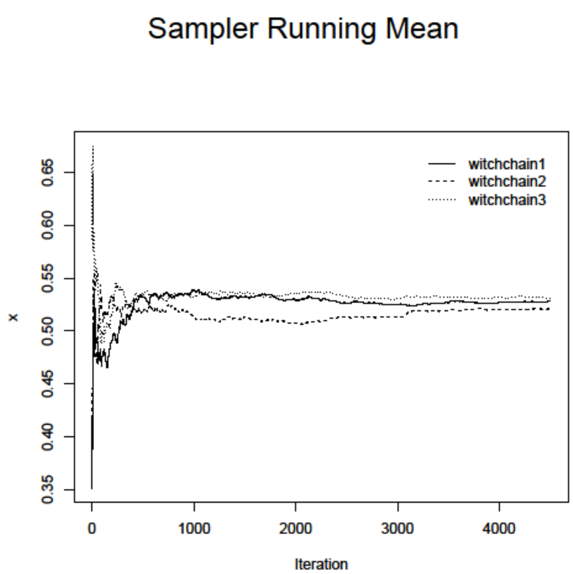


Figure A11. Sampler running mean for the 3 chains in the model for the q for the three survey indices.