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Assessment of Witch Flounder (*Glyptocephalus cynoglossus*) in NAFO Divisions 2J3KL

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Information available to evaluate stock status of Witch Founder (*Glyptocephalus cynoglossus*) in NAFO Divisions 2J3KL consisted of commercial landings data (1960-2017) and information from Canadian fall RV trawl surveys (1977-2017). This stock has been under moratorium in Canadian waters since 1995, and in the NAFO regulatory area since 1998. Following a contraction of the stock to shelf slope areas through the 1990s, the distribution of the stock has expanded in recent years, returning to deep channels occupied in the mid-1980s. A general increase has been observed in indices of both abundance and biomass since the early 2000s, however variability in RV survey coverage has resulted in increased uncertainty in indices, particularly given recent coverage issues in the deep water of Div. 3L. A series of positive pre-recruit anomalies indicate improved recruitment in this stock since 2013, with a time series high in 2016. Bivariate habitat associations indicate that distribution of this stock is largely driven by temperature, with Witch Flounder consistently seeking out waters warmer (i.e. within 3.2 to 3.6°C, across Divs. 2J, 3K and 3L) than the median available (-0.3 to 2.7°C). A Limit Reference Point was set for this stock at 40% B_{MSY}, with a proxy for B_{MSY} calculated as the mean of survey biomass indices from 1983-1984.

INTRODUCTION

Witch Flounder (*Glyptocephalus cynoglossus*) is a deepwater flatfish that reaches its northern limit of distribution in the Northwest Atlantic near Hamilton Bank off Labrador, and extends to the east coast of the southern United States of America. Canada has managed Witch Flounder in NAFO Divisions 2J3KL within the Canadian Exclusive Economic Zone (EEZ) since the establishment of this EEZ. At the 1997 NAFO Annual Meeting, NAFO adopted a Canadian proposal to implement a moratorium on 3L Witch Flounder in the NAFO Regulatory Area (NRA), consistent with the management measures taken by Canada in 1995 as the coastal state. The stock has remained under moratoria and NAFO has maintained management measures consistent with Canadian management measures for Division 3L within the NAFO Regulatory Area. This stock has been assessed by NAFO Scientific Council (SC) on a 3-year schedule, with the most recent full assessment occurring in 2016 (Maddock Parsons et al. 2016). However, in 2018, DFO Science was asked by Resource Management Branch (NL Region) to provide an assessment of stock status, and to determine a limit reference point (LRP) within the DFO decision-making framework. The present assessment is the result of this request for science advice. Participants included Fisheries and Oceans Canada (DFO) scientists and fisheries managers, an Indigenous group, a representative from the provincial government of NL, academia, and fishing industry representatives.

COMMERCIAL FISHERY

DESCRIPTION OF THE FISHERY

The fishery for Witch Flounder in NAFO Divs. 2J+3KL began in the early 1960s and increased steadily from about 1,000 t in 1963 to a peak of over 24,000 t in 1973 (Table 1; Fig. 1). The regulated fishery began in 1974 with a TAC of 22,000 t. Catches declined rapidly, with 2,800 t by 1980, and subsequently fluctuate d between 3,000 and 4,500 t to 1991. Landings declined further to 137 t by 1994 (Table 1). During 1988-92, the Canadian fishery was particularly successful by fishing on pre-spawning concentrations in the deep slopes of Div. 3K, especially in depths beyond 700 m. Between 1988 and 1993, however, the area fished had become increasingly smaller and substantially deeper as the resource became depleted. The fishery during the winter of 1993 was very poor with the best catch rates occurring in depths greater than 1400 m.

A moratorium on directed fishing was put in place within Canadian waters (within 200 nm) in 1995, and extended to the NAFO regulatory area for this stock in 1998. There has been no directed fishing since this time. During the height of the fishery from the mid-1960s to late-1980s, fishing was conducted primarily by Poland, USSR, and Canada (Table 1), mainly in Div. 3K (Fig. 2).

Since 1998, when the moratorium was extended from Canadian waters to include the NAFO regulatory area, landings ranged from 68 to 633 t, with 2007 being the lowest in the time series. Catches in this period have primarily been from by-catch in the Canadian Greenland Halibut fishery (Fig. 3). Logbook records indicate that Witch Founder catches have been primarily from the shelf slope area in Divs. 2J and 3L (Fig. 4). Landings averaged 182 t across the last five years (2013-17).

LENGTH COMPOSITION

Sampling (length measurements) of Witch Flounder landings occurs by at-sea observers and through port sampling. Currently, length frequencies are available from bycatch in otter trawl fisheries, with the number of available frequencies since 2000 varying between 0 and 20 annually. Measured catches have generally ranged from 30-60 cm, with a mode near 40 cm

(Fig. 5), with the exception of 2006 when the peak of the length distribution spanned 30-35 cm. Length frequencies in the most recent year available (2016) indicated a second peak near 48 cm. As measurements from commercial landings are limited in number and scope, and are not from directed effort for Witch Flounder, they are not considered to be representative of the stock as a whole.

RESEARCH VESSEL SURVEYS

SURVEY BIOMASS AND ABUNDANCE INDICES

Stratified-random research vessel surveys have been conducted in the fall in Divs. 2J, 3K and 3L since 1977, 1978 and 1981 respectively. Until 1994, the surveys in Divs. 2J and 3K were conducted using an Engel 145' highrise groundfish trawl. In Div. 3L, surveys were conducted with a Yankee 41.5 bottom trawl in 1981-82, and the Engel 145' trawl from 1983-94. In 1995 the survey trawl in Divs. 2J+3KL was changed to a Campelen 1800 shrimp trawl. Details of the stratified random trawl survey design and changes in gear, including the introduction of the Campelen trawl, are described in previous documents (see Lilly et al. 2005, 2006; Brodie 2005, Brodie and Stansbury 2007, Brattey et al. 2008).

Survey coverage within Divs. 2J+3KL has varied through the available time series. Figure 6 shows the stratification scheme for Divs. 2J+3KL, and indicates the strata considered as "inshore" and "deep". Until 1995, surveys did not cover inshore strata along the eastern coast of the island of Newfoundland from the Northern Peninsula, to the southern Avalon Peninsula. Deep strata (>1000 m in Divs. 2J, 3K; >730 m in Div. 3L) were introduced to the survey throughout Divs. 2J3KL in 1996. Surveys prior to 1996 covered only a part of the stock area and biomass estimates from the early part of the survey series are most likely underestimated. Following a period of consistent coverage from 1996-2006 (1999 excluded), inshore strata have been largely incomplete each year to 2017, though the majority of inshore strata were sampled in 2010. Coverage of deep water in 3L has also been inconsistent, with complete coverage of this area in just 4 years since 2004 (2007, 2009, 2010, 2014). In addition, the majority of deep strata in Divs. 2J and 3K were also incomplete in 2008. Further details of survey performance statistics, timing, and spatial coverage are summarized in Rideout et al. (2017) and references therein.

Survey data presented in this assessment are from 1983-2017; during this period surveys covered Divs. 2J, 3K and 3L, with conversions available to Campelen 1800 trawl catch equivalents for the Engel time period (1983-95).

For Div. 2J, biomass indices (Tables 2 and 3) ranged from as high as 5,900 t in 1986 to a low of less than 200 t in 2003. This biomass index in 2J has shown an overall increasing trend since 2004, reaching a high in 2015 at 3,719 t, and then declining to a stable value near 3,100 t across 2016/17.

Div. 3K, generally accounts for the majority of the biomass index for this stock, with an average of 51% being located in this division from 1983-2017 (Fig. 7). Biomass indices in 3K were highest in the time series during 1983-84, where annual biomass index estimates were near 50,000 t (Tables 4 and 5). Estimates declined considerably to 435 t in 1995, the lowest in the time series, and fluctuated at a low level around 1000 t until 2003. Estimates increased to 2,641 t in 2004 and continued an increasing trend to 2016, with an index value of 10,241 t, declining to 8,591 t in 2017.

In Div. 3L, biomass index estimates varied generally between 7,000 and 13,000 t from 1984 to 1990 but then declined rapidly to a low of 418 t in 1995 (Tables 6 and 7). There has been a general increasing trend in Div. 3L since 2004. Indices of survey biomass in this Division are

likely to be underestimates in the most recent years, given the lack of survey coverage in deep water strata in this area since 2014, and in 6 of the 10 years prior to that.

Overall, survey biomass index (Fig. 8) for this stock peaked in 1984 at 65,151 t, and then rapidly declined through the late 1980s and early 1990s, reaching a time series low of 1,117 t in 1995 and remaining at a very low level to the early 2000s. Since 2003, a general increase has been observed in the biomass index this stock, reaching 17,599 t in 2016 and then declining slightly to 17,190 t in 2017.

The abundance indices for this stock have followed similar trends as the biomass indices (Fig. 8; Tables 8-13). However, limited coverage of inshore strata since 2006 may have resulted in underestimates of stock abundance in these years. In years where inshore survey strata were completed, up to 27.6% of the overall abundance index has been located in these strata (Fig. 9), particularly in strata from Trinity Bay (Fig. 16).

DISTRIBUTION

The spatial distribution of Witch Flounder in the RV fall survey from 1983-2017 is presented as distribution maps of biomass indices by survey strata (Figs. 10-13) and numbers per survey tow (Figs. 14-17).Survey data from 2J (1977-82) and 3K in (1978-82 can be found in previous reports (Bowering 1995, Maddock Parsons 2011; Maddock Parsons 2011; Maddock Parsons et al. 2016). Distributional data from surveys in Divs. 2J and 3K in the late 1970s and early 1980s indicated that witch flounder were widely distributed throughout the shelf area and in deeper channels, primarily in Div. 3K. By the mid-1980s, however, abundance was declining in these areas, and by the early 1990s distribution was limited to very small catches along the continental shelf slope, and more to the southern area of the stock boundary. As the biomass indices have increased in the last several years, a redistribution of the stock has been observed, with biomass once again spread across portions of the shelf and deeper channels, primarily in 3K, in addition to the slope waters.

The distribution of Witch Flounder biomass by depth favors deep water towards the northern extent of the stock area (Figure 18). In Div. 2J, biomass is typically highest in the 400-750 m strata. In Div. 3K, biomass was highest in the 200-400 m strata at the start of the time series, shifting to a higher amount of biomass in the 400-750 m strata around 1990. Recently, a more equal distribution of biomass between 200-400 and 400-750 m has been observed in this division. In Div. 3L, biomass of Witch Flounder was historically highest in the 184-367 m strata, with a decline in these depth strata also observed around 1990, with biomass then concentrated at depths >368 m. A recent increase to 2017 has been observed in the amount of biomass in the 184-367 m strata. Within the survey, very little biomass is observed across Divs. 2J3KL at depths <200 m or >1000 m.

HABITAT ASSOCIATIONS

Habitat associations of 2J+3KL Witch Flounder were investigated using the non-parametric approach developed by Perry and Smith (1994). This methodology uses abundance data from stratified surveys to develop cumulative distribution functions (CDF) of fish abundance in relation to certain habitat covariates (here, temperature and depth).

Quantifying associations between Witch Flounder catch and environmental data was a multi-step process. The basic premise behind this methodology is to test the differences between two CDFs, one for hydrographic variable (temperature and depth) and one for species catch. First, the hydrographic CDF is constructed (while incorporating the survey design) as

$$f(t) = \sum_{\mathrm{h}} \sum_{\mathrm{i}} \frac{W_{\mathrm{h}}}{n_{\mathrm{h}}} I(x_{\mathrm{hi}})$$

with the indicator function

$$I(x_{\mathrm{hi}}) = \begin{cases} 1, & \text{if } x_{\mathrm{hi}} \leq t; \\ 0, & \text{otherwise.} \end{cases}$$

where W_h is the proportion of the survey area in stratum h, n_{h} is the number of sets in stratum h, x_{hi} is the measurement of hydrographic variable in set i of stratum h, and t is the index ranging from the lowest to the highest value of the hydrographic variable at a step size appropriate for the desired resolution (i.e. 0.1°C or 1 m). Inclusion of terms ($W_{\mathrm{h}}/n_{\mathrm{h}}$) to describe the stratification scheme ensured that the estimate of the frequency distribution for the hydrographic variable was unbiased (Perry and Smith, 1994). Without the inclusion of the $W_{\mathrm{h}}/n_{\mathrm{h}}$ term, the number of sets allocated per stratum would not be included. This means that analyses would assume that the number of sets allocated to each stratum is proportional to the size of that stratum, which is untrue in this case. While the set allocation in the RV survey is theoretically assumed to be proportional this is not the case in practice due to the minimum sampling requirements of two sets per stratum, which leads to oversampling of small strata relative to large strata.

Next, catch-weighted CDF is calculated to associate the number of fish in each set with the hydrographic conditions at that set:

$$g(t) = \sum_{\mathrm{h}} \sum_{\mathrm{i}} \frac{W_{\mathrm{h}}}{n_{\mathrm{h}}} \frac{y_{\mathrm{hi}}}{y_{\mathrm{st}}} I(x_{hi})$$

where y_{hi} is the number of fish caught in set i and stratum h and y_{st} is the estimated stratified mean abundance of fish calculated using

$$y_{\mathrm{st}} = \sum_{\mathrm{h}=1}^{\mathrm{L}} W_{\mathrm{h}} y_{\mathrm{h}}$$

where y_h is the estimated mean abundance of fish in stratum h ($y_{\mathrm{h}} = \sum_{\mathrm{i}=1}^{\mathrm{n_h}} y_{\mathrm{hi}}/n_{\mathrm{h}}$; Smith, 1990; 1997).

The maximum vertical distance between the hydrographic CDF and the catch-weighted CDF can then be calculated using

$$D = \max|g(t) - f(t)|$$

$$= \max\left|\sum_h \sum_i \frac{W_h}{n_h}\left(\frac{y_{\mathrm{hi}} - y_{\mathrm{st}}}{y_{\mathrm{st}}}\right) I(x_{\mathrm{hi}})\right|$$

where D is the test statistic used to determine whether or not the association between hydrographic variables and fish catch is significant (modified Kolmogorov-Smirnov test statistic; Conover, 1980). To test the significance of D, Monte-Carlo simulation using randomized pairings of ($W_{\mathrm{h}}/n_{\mathrm{h}}$) [($y_{\mathrm{hi}}$-$y_{\mathrm{st}}$)/$y_{\mathrm{st}}$] and x_{hi} for all h and i within the survey and then calculating the test statistic for those pairs (Perry and Smith 1994; Rogers 2016). The procedure was repeated K times (generally K >1000) to establish a pseudo-population (D'; includes the original test statistic; Rogers 2016) of test statistics. Significance levels were assessed using the formula for Kolmogorov-Smirnov tests

$$p = \frac{\sum D' \geq D}{K + 1}$$

where *D'* = maximum vertical difference between the randomized curves and *K* = number of times resampling occurred (*K*+1 was used to account for the original *D*). A similar methodology was used to investigate bivariate habitat association.

Significance of randomization tests for associations between Witch Flounder catch and the hydrographic variables (temperature, depth, bivariate) area presented in Table 18.

Temperatures occupied by Witch Flounder were generally much warmer than the median available, with temperature occupied averaging 3.6°C (± SD = 0.32) in Div 2J, 3.3°C ± 0.47 in Div. 3K and 3.2°C ± 0.77 in Div. 3L (Fig. 19). Median temperature available was lowest in Div. 3L (averaging -0.3°C ± 0.5, compared to 1.9°C ± 0.9 in 2J and 2.7°C ± 0.5 in 3K).

Witch Flounder showed wide variation in median depth used although they were always distributed at depths deeper than the median available (Fig. 20). Average median depth used by Witch Flounder increased the southern portion of the stock, northward, ranging from 430 m ± 101 in Div. 3L to 475 m ± 119 in Div. 3K, to 510 m ± 101 in Div. 2J. A shift towards deeper waters was observed in all Divisions from the late 1980s to early 1990s. During the 1990s and 2000s, Witch Flounder showed a preference for deeper water, relative to the previous period. However, it should be noted that some of the observed differences may be reflective of changes in survey strata sampled.

Results of bivariate analyses indicated that significant Witch Flounder depth associations were actually driven by temperature. This was assessed by comparing test results from both the univariate and bivariate analyses under the assumption that the variable with the strongest association was that for which the co-ordinates of the test statistic changed the least between univariate and bivariate tests (Perry & Smith, 1994). In most cases, there was a smaller difference in the location of the D statistic between the univariate and bivariate analyses for temperature than that observed for depth, indicating a stronger association to temperature than depth in this stock.

LENGTH COMPOSITION

Survey numbers at length from the 1983-2017 RV surveys are presented in Fig. 21. At the beginning of the time series length distributions were generally bimodal, with peaks near 26 cm and 45 cm, and lengths spanning approximately 10 cm to 70 cm. From around 1992 to 2003 populations were at their lowest level, with few fish over 40 cm present in the survey catches, though small pulses of fish between 10-20 cm appear to enter the length frequencies in most years during this period.

Length distributions have returned to a multi-modal distribution in recent years, with an abundance of older fish forming a group over 30 cm, and presumed cohorts entering at modes as low as 6 cm moving through. Younger pulses of fish grow relatively quickly, tracking through the length frequencies year over year before joining the larger mass >30 cm. However, as Witch Flounder are considered to be a slow-growing, long-lived fish, data do not allow reliable tracking of individual cohorts through length frequencies beyond this entry small fish. Numbers at length are expected to be composed of individuals from multiple cohorts.

AGE COMPOSITION

Age data has been unavailable for this stock since 1994.

MATURITY

Length at 50% mature (L50) was calculated based on maturity staging of catches from RV surveys from 1996-2017 (Fig. 22). L50 values for both males and females have generally varied without trend throughout this time series. Males in this stock typically reach maturity nearly 10 cm smaller than females, with female L50 near 38 cm, and males near 28 cm

As aging data are unavailable, age at 50% mature, growth rates, and size at age cannot be examined in this stock.

PRE-RECRUIT INDEX

An index of pre-recruit fish is calculated as the abundance of fish <23 cm in the fall RV survey. This index is used as an indicator of the strength of incoming cohorts within the stock. Index values were above the long term (1996-2017) mean from 2013 to 2016 (Fig. 23), with the 2016 value being the highest in the time series. Pre-recruit abundance was below the long term average in 2017.

A lack of coverage of inshore strata for the latter half of this pre-recruit index has likely resulted in an underestimation of the abundance of fish <23 cm, as fish caught in inshore strata sampled from 1996-2006 and in 2010 were almost exclusively within this pre-recruit size range (Fig. 24).

TRINITY BAY LARVAE

Data were examined from annual larval index surveys from Trinity Bay since 2002. Full methods are described in Nakashima and Mowbray (2014). Witch Flounder larvae have been detected in surveys across the time series (2002-17), with numbers of observed Witch Flounder larvae in 2014-16 well above average (Figure 25). Witch Flounder larvae are also known to occur in Notre Dame Bay and White Bay, Newfoundland (Shikon 2018).

Links between these larval abundances and stock status or recruitment are not yet understood, and it is noted that larval samples here are from a small subset of the stock area and therefore may not be representative of the area as a whole.

LIMIT REFERENCE POINT

A Limit Reference Point (LRP) within the DFO decision-making framework was set at the 2018 stock assessment for Witch Flounder in NAFO Divs. 2J3KL (DFO 2019). As no analytical assessment model is available for this stock, a survey-based LRP was set based on biomass indices from the fall RV surveys.

The survey index for the stock begins in 1983, as this is the point at which Campelen equivalent series of survey biomass and abundance are available for all three divisions within the stock. However, in Divs. 2J and 3K, Campelen-equivalent survey indices are available since 1977 and 1978, respectively (Fig. 26). Given that the bulk of the stock has historically been in Div. 3K, these earlier values provide information on trends in a major portion of the stock before the complete (2J3KL) index was established. From 1978 to 1985, biomass index values for Divs. 2J and 3K appear to have varied without trend, suggesting a relatively stable period of stock size. Similar stability was observed in Div. 3L from 1983-90. From 1979-91, annual landings were also relatively steady, with average catches near 4,000 t (range: 2,800 to 4,900 t).

Given the combined stability in biomass indices and annual landings from the late-1970s through the early-1980s (following the earlier peak in the fishery), the survey indices at the start of the combined time series are considered to be a proxy for a B_{MSY} level. This B_{MSY} proxy was therefore defined as the mean survey biomass from 1983-84 (the first two years of the combined 2J3KL index). Consistent with the DFO decision-making framework incorporating the

precautionary approach, an LRP of B_{LIM} = 40% B_{MSY} was adopted. The stock is currently below the LRP (Figure 8), and therefore in the critical zone.

However, it should be noted that the true B_{MSY} for this stock is likely to vary from this proxy value, though it cannot be determined given the current data available and the survey index based assessment of the stock.

SUMMARY

This stock has been under moratorium in Canadian waters since 1995, and in the NAFO regulatory area since 1998. Bycatch of Witch Flounder has been relatively stable, averaging 174 t annually from 2013-17, primarily taken in the Canadian Greenland Halibut fishery.

This stock is assessed using fall DFO research vessel (RV) survey indices. In 2016 and 2017, indices of abundance and biomass reached the highest levels since 1990, but remained below the levels of the mid-1980s.

The abundance index of fish <23 cm indicates improved recruitment since 2013.

Following a contraction of the stock to shelf slope areas through the 1990s, the distribution of the stock has expanded in recent years, returning to deep channels occupied in the mid-1980s.

A proxy for B_{MSY} was accepted as the mean of the survey biomass indices from the 1983-84 fall RV surveys. Consistent with the DFO decision-making framework incorporating the precautionary approach, a Limit Reference Point (LRP) of 40% B_{MSY} was adopted. The stock is currently in the critical zone.

A variable proportion of the population inhabits the deep water of Div. 3L which has only been surveyed in 3 of the last 10 years. In years with incomplete coverage the survey index may underestimate stock size. The magnitude of this cannot be determined, but is not considered to impact stock status relative to the LRP.

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TABLES

Table 1. Landings (t) of Witch flounder in NAFO divisions 2J3KL. 2017 values are preliminary.

Year	Canada	Estonia	Germany	Japan	Poland	Portugal	Russia	Spain	USSR	Other	Total	TAC
1960	40	-	267	-	-	-	-	-	-	47	354	-
1961	12	-	89	-	-	-	-	-	-	31	132	-
1962	29	-	27	-	-	-	-	-	-	22	78	-
1963	17	-	3	-	259	-	-	-	89	577	945	-
1964	103	-		-	752	-	-	-	164	25	1044	-
1965	41	-	29	-	1876	-	-	-	2056	58	4060	-
1966	187	-	1054	-	559	-	-	-	1868	29	3697	-
1967	901	-	332	-	926	-	-	-	1933	9	4101	-
1968	446	-	358	-	1990	-	-	-	7834	38	10666	-
1969	1355	-	546	-	957	-	-	-	9726	1	12585	-
1970	4020	-	508	-	3566	-	-	-	9934	2	18030	-
1971	8030	-	583	1	5404	-	-	-	2018	17	16053	-
1972	5520	-	654	-	4013	-	-	-	7016	225	17428	-
1973	3761	-	3675	-	11802	1235	-	-	2834	314	23621	-
1974	1868	-	1354	-	5302	485	-	-	6917	37	15963	22000
1975	1352	-	820	-	4583	685	-	-	4763	2	12205	17000
1976	2081	-	716	-	3828	975	-	-	3022	3	10625	17000
1977	4371	-	503	-	3052	-	-	-	392	-	8318	17000
1978	1979	-	81	5	3490	-	-	-	1345	4	6904	17000
1979	1392	-	22	-	1855	655	-	-	150	23	4097	17000
1980	1459	-	16	-	1235	68	-	-	45	-	2823	17000
1981	2661	-	32	25	1385	6	-	-	85	-	4194	8000
1982	1206	-	4	21	1151	46	-	-	552	1	2981	8000
1983	1483	-	50	-	1005	34	-	-	516		3088	8000
1984	2082	-	27	47	1617	38	-	-	1000	2	4813	8000
1985	1305	-	59	64	565	4	-	-	1006	-	3003	8000
1986	1199	-	9	63	3	2477	-	143	21	1	3916	8000
1987	854	-	56	25	765	1138	-	574	1057	6	4475	6000
1988	3270	-	10	9	760	-	-	101	4	-	4154	5000
1989	4059	-	4	4	691	7	-	135	5	1	4906	5000
1990	3272	-	-	6	-	657	-	31	-	1	3967	4000
1991	2805	-	-	9	-	963	-	236	-	2	4015	4000
1992	1736	-	5	44	-	285	-	625	-	7	2702	4000
1993	343	-	-	1	-	21	-	37	-	-	402	3500
1994	11	-	-		-	20	-	106	-	-	137	1000
1995	10	-	-	5	-	10	-	754	-	-	779	0
1996	5	-	-	11	-	103	-	1252	-	-	1371	0
1997	8	-	-	4	-	140	-	701	-	1	854	0
1998	0	-	-	2	-	90	37	292	-	13	434	0
1999	1	-	-	2	-	102	20	229	-	5	359	0
2000	90	-	-	4	-	69	14	299	-	-	476	0
2001	159	2	-	4	-	99	31	335	-	3	633	0
2002	167	1	-	38	-	73	15	231	-	-	525	0
2003	110	15	-	12	-	38	6	309	-	-	490	0
2004	26	28	-	7	-	51	12	166	-	-	290	0
2005	40	5	-	4	-	17	2	134	-	1	203	0
2006	53	8	-	2	-	11	3	-	-	-	77	0
2007	23	1	-	5	-	6	2	28	-	3	68	0
2008	7	6	-	8	-	16	9	38	-	-	84	0
2009	42	1	-	-	-	9	-	48	-	-	100	0
2010	158	2	-	-	-	15	2	59	-	-	236	0
2011	140	0	-	-	-	26	2	52	-	-	220	0
2012	92	4	-	-	-	12	19	63	-	2	192	0
2013	182	1	-	-	-	3	10	21	-	-	217	0
2014	178	3	-	-	-	5	8	26	-	-	220	0
2015	187	1	-	-	-	2	17	10	-	-	217	0
2016	73	1	-	5	-	2	7	29	-	-	117	0
2017	97	2	-	5	-	9	-	28	-	-	141	0

Table 2. Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 2J.

Depth (m)	**Stratum**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
<=200	201	0	61	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
<=200	205	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
<=200	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	237	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
<=200	238	-	-	-	-	-	-	-	-	-	-	-	0	-	0	0	0	0
201-300	202	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
201-300	209	123	19	152	0	0	0	0	14	0	0	0	0	0	0	0	0	0
201-300	210	0	286	0	0	38	0	22	0	0	0	0	0	0	0	0	0	0
201-300	213	197	118	102	130	98	21	56	0	0	0	0	0	0	0	0	8	0
201-300	214	74	21	106	71	0	16	14	19	0	0	0	0	0	0	0	0	0
201-300	215	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	228	264	467	79	728	93	123	151	76	0	44	35	0	0	0	0	0	0
201-300	234	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
301-400	203	112	0	0	19	0	0	20	0	0	0	0	0	0	0	0	0	0
301-400	208	80	95	608	91	0	0	27	0	0	0	0	0	0	0	0	0	0
301-400	211	12	99	72	27	38	0	34	0	0	0	0	0	0	0	0	0	0
301-400	216	85	0	0	54	13	10	16	0	0	0	0	0	0	2	0	0	0
301-400	222	69	26	45	0	0	173	46	0	10	0	0	0	0	6	0	17	10
301-400	229	155	103	52	857	70	145	596	32	31	28	15	13	0	0	0	0	0
401-500	204	13	91	0	71	14	42	58	14	0	0	0	0	0	0	0	0	0
401-500	217	0	-	0	54	64	44	72	6	0	0	0	13	0	7	8	6	0
401-500	223	0	31	0	139	116	59	64	18	18	8	8	14	0	7	5	5	0
401-500	227	211	85	147	329	411	203	228	1837	207	125	132	0	0	0	86	84	125
401-500	235	908	517	399	121	168	0	62	149	37	20	0	41	0	16	3	22	0
401-500	240	-	-	-	-	-	-	-	-	-	-	36	19	0	17	16	11	24
501-750	212	1390	822	1253	3139	834	392	588	639	111	272	44	52	71	96	90	184	261
501-750	218	0		15	0	44	114	79	58	13	0	8	19	1	17	10	12	9
501-750	224	0	0	0	32	48	120	125	17	49	32	0	23	1	18	23	16	1
501-750	230	0	17	0	57	15	101	396	771	1711	346	85	105	69	126	176	26	161
501-750	239	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
751-1000	219	0	-	0	0	0	0	0	0	0	0	15	8	3	13	9	14	0
751-1000	231	0	0	0	0	0	0	-	0	457	176	197	118	115	6	36	228	143
751-1000	236	0	0	0	0	0	9	-	23	25	51	51	37	3	28	3	11	16
1001-1250	220	-	-	-	-	-	-	-	-	-	-	-	-	-	10	0	0	-
1001-1250	225	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	2
1001-1250	232	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1251-1500	221	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1251-1500	226	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1251-1500	233	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	6	0

Table 3. Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 2000-2017) in NAFO division 2J.

Depth (m)	**Stratum**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
<=200	201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	206	0	0	0	0	0	0	0	0	0	0	0	35	0	0	16	0	0	0
<=200	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	237	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0
<=200	238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	213	0	0	0	0	0	0	0	0	0	0	0	49	0	0	47	9	0	8
201-300	214	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	13	0	0
201-300	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
201-300	228	0	0	3	0	0	30	0	0	12	0	105	150	77	131	264	298	0	459
201-300	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301-400	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
301-400	208	0	0	0	0	13	0	0	0	0	0	80	0	92	358	616	60	0	0
301-400	211	0	0	0	0	0	0	0	0	0	7	0	0	107	0	123	311	0	0
301-400	216	0	0	3	0	0	0	5	5	0	0	0	4	50	61	69	61	7	10
301-400	222	0	0	0	0	0	0	11	0	0	4	9	23	11	9	0	31	28	59
301-400	229	6	4	0	11	4	55	22	81	0	74	14	66	135	176	113	226	283	149
401-500	204	0	0	0	0	0	0	0	0	0	0	6	0	19	0	0	0	0	9
401-500	217	0	0	0	2	14	8	4	0	0	6	0	25	0	6	10	25	13	0
401-500	223	0	4	1	3	0	9	13	13	10	4	6	0	0	4	42	81	27	0
401-500	227	0	26	4	0	41	32	68	105	80	107	132	50	189	88	19	346	70	262
401-500	235	0	0	46	0	63	20	16	28	118	10	341	658	208	396	696	1180	36	612
401-500	240	11	9	0	3	14	31	43	62	18	102	48	6	29	47	48	320	176	150
501-750	212	125	8	38	52	193	341	599	983	1568	758	467	74	75	193	382	722	1704	1296
501-750	218	4	0	0	3	20	12	6	14	9	65	0	0	0	0	0	0	43	11
501-750	224	15	13	1	0	0	3	32	15	29	16	0	0	0	0	0	0	0	33
501-750	230	36	21	2	48	60	108	137	55	88	199	13	0	25	12	20	28	685	104
501-750	239	0	0	0	0	0	0	0	0	6	0	13	3	12	12	0	7	9	0
751-1000	219	3	4	6	12	11	0	0	0	-	0	0	0	0	0	0	0	0	0
751-1000	231	283	59	257	12	43	35	0	7	9	0	0	10	0	0	5	0	0	5
751-1000	236	13	38	27	29	0	0	6	0	-	0	0	0	0	0	0	0	0	0
1001-1250	220	0	0	6	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1001-1250	225	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1001-1250	232	0	23	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1251-1500	221	0	0	3	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1251-1500	226	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1251-1500	233	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4. Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3K.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<=200	608	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
<=200	612	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
<=200	616	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
<=200	618	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	619	-	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
201-300	609	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
201-300	611	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
201-300	615	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
201-300	620	133	126	64	198	0	0	0	0	0	0	0	0	0	0	0	0	0
201-300	621	788	329	445	26	62	0	63	0	0	0	0	0	0	0	0	1	0
201-300	624	121	367	90	66	19	0	0	7	0	0	12	0	0	0	9	0	6
201-300	632	447		210	89	34	38	82	0	3	8	-	-	-	-	-	-	-
201-300	634	177	860	388	256	209	373	131	0	0	25	4	0	0	0	0	0	0
201-300	635	538	2211	775	15	136	338	166	21	0	31	0	0	1	0	46	17	0
201-300	636	711	2898	848	314	520	824	355	63	0	0	0	0	2	2	37	0	0
201-300	637	3668	2724	2490	702	841	215	158	0	0	57	17	0	0	0	3	2	32
301-400	610	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	3	-
301-400	614	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
301-400	617	-	-	-	-	-	-	-	-	-	-	0	0	0	0	4	13	0
301-400	623	601	343	650	164	199	30	10	0	0	0	0	0	0	0	0	0	0
301-400	625	1588	1416	1101	50	165	104	12	0	0	0	0	0	3	4	0	7	2
301-400	626	3477	1248	1110	57	174	32	56	0	0	22	0	0	0	0	1	0	9
301-400	628	4882	2070	2324	954	523	39	214	0	0	20	0	0	0	0	0	0	5
301-400	629	2253	1016	998	225	510	196	63	66	0	10	2	6	4	2	2	8	18
301-400	630	727	549	363	168	182	155	28	0	0	11	18	0	0	7	1	0	3
301-400	633	2661	3092	2072	1599	1105	1931	1186	365	162	117	94	47	3	33	39	74	21
301-400	638	4381	8608	7033	8275	5506	7317	3393	327	340	91	81	4	4	5	17	79	60
301-400	639	3637	4062	2121	1744	779	2637	544	487	83	13	0	36	40	14	4	41	0
401-500	613	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
401-500	622	946	640	1152	263	653	21	20	37	10	28	14	0	5	1	6	18	0
401-500	627	10560	7849	4541	1598	1378	1341	738	243	6	47	69	23	32	8	48	81	42
401-500	631	5887	6448	4570	2929	1553	598	358	73	338	313	63	280	77	7	85	80	16
401-500	640		436	1074	1669	2280	1347	1145	176	184	18	0	0	0	8	3	10	0
401-500	645	281	1519	238	-	3079	571	252	991	99	15	15	8	0	18	15	3	23
401-500	650	-	-	-	-	-	-	-	-	-	-	21	4	2	9	17	20	25
501-750	641	171	0	813	-	1657	-	-	11071	937	0	12	8	9	45	36	108	114
501-750	646	615	94	108	-	102	-	-	275	173	49	36	79	3	431	42	40	36
501-750	651	-	-	-	-	-	-	-	-	-	-	25	23	19	52	202	127	179
751-1000	642	-	131	89	-	83	-	-	2496	1213	790	81	65	17	7	0	6	35
751-1000	647	-	-	26	-	-	-	-	390	724	198	67	108	30	50	118	103	193
751-1000	652	-	-	-	-	-	-	-	-	-	-	266	154	52	149	382	408	39
1001-1250	643	-	-	-	-	-	-	-	-	-	-	-	-	66	0	0	0	12
1001-1250	648	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1001-1250	653	-	-	-	-	-	-	-	-	-	-	429		66	0	0	0	12
1251-1500	644	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
1251-1500	649	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1251-1500	654	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	4	0

Table 5. Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3K.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<=200	608	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
<=200	612	0	0	0	0	0	0	0	-	-	-	0	-	-	0	-	-	-	-
<=200	616	0	0	0	0	0		0	-	-	-	-	-	-	-	-	-	-	-
<=200	618	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<=200	619	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0
201-300	609	0	0	0	0	0	0	0	-	-	0	0	-	-	-	-	-	-	-
201-300	611	0	0	0	0	0	0	6	-	-	-	0	-	-	-	-	-	-	-
201-300	615	1	0	0	0	0	0	1	-	-	-	0	-	-	1	-	-	-	-
201-300	620	0	0	0	0	0	0	0	0	0	0	0	85	43	27	0	5	0	2
201-300	621	0	0	0	0	0	0	0	0	0	0	0	29	50	36	5	7	2	1
201-300	624	5	24	0	0	9	0	0	0	0	0	0	0	31	110	29	17	0	328
201-300	632	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201-300	634	0	0	0	0	0	3	0	0	0	12	15	0	67	21	33	59	0	154
201-300	635	6	0	0	0	0	16	-	0	0	0	0	93	4	57	68	0	0	4
201-300	636	0	5	0	0	0	1	0	0	78	0	1	28	82	193	37	0	25	135
201-300	637	-	1	0	0	0	1	0	0	63	2	9	4	0	98	329	0	2	144
301-400	610	1	1	3	0	0	2	7	-	-	-	2	-	-	-	-	-	-	-
301-400	614	1	1	0	0	0	0	0	-	-	-	0	-	-	5	-	-	-	-
301-400	617	0	0	0	0	0	0	0	0	0	18	14	0	38	27	43	4	11	29
301-400	623	0	0	0	0	0	0	0	0	0	0	0	7	122	35	0	0	2	0
301-400	625	0	2	0	0	2	9	26	0	4	0	0	201	7	61	36	16	7	88
301-400	626	8	5	0	0	2	1	13	119	25	24	21	219	144	559	271	47	134	335
301-400	628	12	3	0	0	15	0	8	0	35	1	7	210	251	813	128	13	52	306
301-400	629	14	1	0	0	24	1	27	4	104	4	0	55	57	57	123	151	7	168
301-400	630	5	8	0	0	0	14	2	7	8	8	3	11	16	52	40	20	13	92
301-400	633	26	13	11	1	3	82	37	108	12	91	200	109	126	473	222	231	149	742
301-400	638	79	75	14	11	59	39	240	411	725	58	438	192	657	1175	1961	1110	898	2138
301-400	639	0	0	3	0	0	21	0	133	20	42	63	215	56	249	423	503	137	305
401-500	613	3	0	0	0	0	0	0	-	-	-	0	-	-	3	-	-	-	-
401-500	622	48	42	0	0	6	7	0	27	0	2	0	98	58	29	143	244	33	0
401-500	627	98	40	13	2	50	11	73	265	227	96	162	288	373	915	1083	678	935	1010
401-500	631	66	18	17	3	150	165	43	125	102	57	99	48	258	161	894	709	396	1031
401-500	640	12	14	0	0	30	2	52	22	62	39	170	26	55	77	173	274	114	128
401-500	645	7	9	5	0	0	80	79	61	17	309	228	82	234	254	108	216	517	59
401-500	650	-	15	9	9	51	13	162	173	300	105	333	207	179	268	118	1004	-	498
501-750	641	-	162	25	61	595	74	476	430	310	1413	740	511	730	223	506	1207	1776	274
501-750	646	173	118	154	16	72	107	5	631	76	247	184	372	108	51	39	70	1157	67
501-750	651	-	447	134	17	1309	809	1596	1637	1162	2244	2689	714	609	255	479	1056	3874	551
751-1000	642	208	11	14	141	17	476	32	158	16	115	0	0	0	0	0	0	0	0
751-1000	647	0	280	9	102	232	238	4	0	-	0	0	2	0	0	0	0	0	0
751-1000	652	412	112	59	218	14	657	0	360	30	701	29	0	30	0	0	0	1	0
1001-1250	643	18	0	0	37	0	7	0	0	-	0	0	0	0	0	0	0	0	0
1001-1250	648	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1001-1250	653	0	18	0	33	0	8	0	0	0	0	0	0	0	0	0	0	0	0
1251-1500	644	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1251-1500	649	0	0	0	0	0	0	0	0	-	0	10	0	0	0	0	0	0	0
1251-1500	654	0	0	0	0	0	0	0	0	-	52	0	0	0	0	0	0	-	0

Table 6. Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3L.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
30-55	784	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
56-91	350	0	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	363	0	85	0	50	0	0	0	264	33	41	0	0	0	0	0	0	0
56-91	371	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	372	0	144	0	0	0	16	0	38	8	0	0	0	27	0	0	0	0
56-91	384	120	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	785	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	328	-	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	341	0	230	0	0	34	34	0	0	0	0	0	0	0	0	0	1	0
92-183	342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	343	0	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	348	26	334	0	0	0	44	0	0	0	0		0	0	0	0	0	0
92-183	349	0	306	0	155	0	36	0	145	0	0	0	0	0	0	0	0	0
92-183	364	50	202	0	143	0	39	0	27	0	0	0	0	0	0	0	0	0
92-183	365	0	100	0	68	29	18	0	0	36	0	0	0	0	0	0	0	0
92-183	370	0	190	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0
92-183	385	0	340	0	79	58	27	0	0	0	0	0	0	0	0	0	0	0
92-183	390	0	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	786	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0	-
92-183	787	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	788	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	790	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	1	-
92-183	793	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	794	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	797	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	799	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
184-274	344	159	159	37	29	127	0	0	0	0	0	0	0	0	0	0	0	0
184-274	347	41	467	0	42	0	154	66	0	0	0	0	0	0	0	0	0	0
184-274	366	0	186	355	307	171	110	187	27	0	7	0	0	0	0	0	0	0
184-274	369	181	374	570	706	320	1061	429	473	162	0	0	0	0	0	0	0	0
184-274	386	-	168	519	1082	1518	1750	442	218	307	875	0	0	0	0	0	0	0
184-274	389	-	196	133	760	250	138	21	79	0	27	0	0	38	0	0	0	0
184-274	391	0	0	32	0	9	0	0	0	70	22	0	0	36	0	25	0	0
184-274	795	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-

Table 6 (cont.). Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3L.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
275-366	345	5808	4484	1227	617	3693	2099	2358	750	0	61	73	0	10	3	5	35	3
275-366	346	2134	1423	2240	3321	1201	1823	1287	1863	203	40	14	0	0	12	3	1	20
275-366	368	-	47	29	386	23	64	144	106	39	14	0	0	22	0	0	0	0
275-366	387	-	169	404	276	572	1775	1546	3668	159	52	32	12	63	8	2	0	5
275-366	388	-	1229	48	-	589	92	126	0	125	173	0	14	0	0	0	12	0
275-366	392	17	55	13	-	50	13	0	0	0	0	0	4	0	0	0	0	0
184-366	798	-	-	-	-	-	-	-	-	-	-	-	-	-	0	2	21	-
184-366	789	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
184-366	791	-	-	-	-	-	-	-	-	-	-	-	-	-	6	0	0	-
275-366	796	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1	2	-
275-366	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	3	-
367-549	729	-	146	127	280	-	-	-	48	274	246	42	131	2	-	24	0	0
367-549	731	-	498	248		-	-	-	465	178	356	38	79	19	-	0	7	19
367-549	733	-	328	1164		-	-	-	1618	2110	610	183	60	23	12	0	41	54
367-549	735	-	367	34	1714	-	-	-	-	222	216	40	12	3	20	23	18	12
367-549	792	-	-	-	-	-	-	-	-	-	-	-	-	-	55	37	11	-
550-731	730	-	104	16	-	-	-	-		130	6	140	88	83	0	21	11	10
550-731	732	-	282	235	-	-	-	-	29	207	283	41	194	16	147	121	440	252
550-731	734	-	30	184	-	-	-	-	168	100	11	106	49	37	127	15	149	95
550-731	736	546	-	268	709	-	-	-	355	913	90	70	20	10	261	41	135	93
732-914	737	-	-	-	-	-	-	-	-	-	-	-	-	19	130	104	438	151
732-914	741	-	-	-	-	-	-	-	-	-	-	-	-	-	115	164	313	7
732-914	745	-	-	-	-	-	-	-	-	-	-	-	-	-	154	212	123	65
732-914	748	-	-	-	-	-	-	-	-	-	-	-	-	-	87	0	0	40
915-1097	738	-	-	-	-	-	-	-	-	-	-	-	-	10	331	127	24	0
915-1097	742	-	-	-	-	-	-	-	-	-	-	-	-	-	31	3	9	0
915-1097	746	-	-	-	-	-	-	-	-	-	-	-	-	-	120	126	0	0
915-1097	749	-	-	-	-	-	-	-	-	-	-	-	-	-	33	29	0	-
1098-1280	739	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1098-1280	743	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1098-1280	747	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	107	0
1098-1280	750	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1281-1463	740	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1281-1463	744	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
1281-1463	751	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-

Table 7. Biomass estimates (tons)) of Witch Flounder by stratum for DFO fall RV surveys (Campelen units 2000-2017) in NAFO division 3L.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
30-55	784	1	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
56-91	350	0	0	0	0	0	18	0	0	34	0	0	0	0	0	0	0	0	0
56-91	363	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	0
56-91	371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0
56-91	372	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0
56-91	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	785	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
92-183	328	0	0	0	0	0	0	0	0	0	0	0	13	25	0	0	0	0	26
92-183	341	0	0	0	0	0	25	393	0	37	0	89	66	1	1411	1	35	0	0
92-183	342	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
92-183	343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	348	1	0	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0
92-183	349	2	0	0	17	0	117	0	0	82	1	32	37	0	311	1	0	7	0
92-183	364	0	0	0	0	0	0	0	0	0	0	14	1	36	0	0	1	0	48
92-183	365	-	0	0	0	-	21	0	0	0	0	0	0	0	0	0	0	0	0
92-183	370	0	0	0	0	-	0	0	0	0	0	0	1	0	0	0	0	0	0
92-183	385	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
92-183	390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	786	0	1	0	1	0	1	-	-	-	-	-	-	-	-	-	-	-	-
92-183	787	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92-183	788	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
92-183	790	0	1	0	0	0	0	-	-	-	-	0	-	-	-	-	-	-	-
92-183	793	0	0	2	0	0	3	-	-	-	-	0	-	-	-	-	-	-	-
92-183	794	-	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
92-183	797	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
92-183	799	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
184-274	344	1	0	3	3	2	0	0	30	57	3	0	1	0	11	0	6	49	0
184-274	347	0	4	0	0	0	0	0	0	1	0	17	51	249	21	0	0	0	0
184-274	366	0	0	0	6	-	0	0	6	0	0	19	51	36	154	32	0	280	0
184-274	369	0	0	0	0	-	0	1	0	26	0	0	1	47	78	0	0	81	0
184-274	386	0	0	0	0	-	1	0	0	0	0	0	42	3	71	4	0	0	0
184-274	389	11	0	0	0	0	0	5	0	0	0	0	0	3	17	4	0	0	17
184-274	391	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	15
184-274	795	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-

Table 7 (cont.). Biomass estimates (tons)) of Witch Flounder by stratum for DFO fall RV surveys (Campelen units 2000-2017) in NAFO division 3L.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
275-366	345	5	0	8	5	1	36	43	14	255	33	160	78	751	492	21	20	46	354
275-366	346	16	8	4	1	0	72	97	75	609	39	12	444	522	613	280	247	733	2146
275-366	368	6	0	0	0	-	3	12	0	28	0	0	2	47	102	0	0	64	38
275-366	387	38	4	6	0	-	1	17	35	132	0	101	76	53	14	0	215	182	1394
275-366	388	5	17	6	4	0	3	32	11	17	21	6	4	8	141	3	84	137	61
275-366	392	0	14	0	0	0	0	0	0	0	0	1	0	0	11	0	48	0	12
184-366	798	3	23	0	0	3	2	-	-	-	-	0	-	-	-	-	-	-	-
184-366	789	0	0	0	0	0	0	0	-	-	-		-	-	-	-	-	-	-
184-366	791	0	0	1	3	0	5	-	-	-	-	0	-	-	-	-	-	-	-
275-366	796	0	4	1	0	0	9	2	-	-	-	1	-	-	44	-	-	-	-
275-366	800	6	24	22	1	4	7	-	-	-	10	6	-	-	-	-	-	-	-
367-549	729	1	13	33	12	0	3	32	28	74	11	195	80	18	52	23	108	30	50
367-549	731	16	4	3	13	22	25	47	10	41	84	92		23	143	94	126	82	73
367-549	733	62	50	106	8	248	230	166	370	26	207	226	436	399	383	97	104	660	0
367-549	735	3	3	12	0	-	61	45	188	334	509	298	539	754	232	823	248	1367	897
367-549	792	29	54	49	45	49	79	-	-	-	-	25	-	-	-	-	-	-	-
550-731	730	59	274	113	0	14	0	48	14	4	39	68	47	59	70	2	0	39	0
550-731	732	230	207	115	107	106	36	183	120	149	252	336	138	74	91	220	212	59	138
550-731	734	47	17	79	4	-	0	84	44	19	468	219	653	49	64	70	0	41	19
550-731	736	415	185	1196	104	-	195	758	777	832	932	956	548	387	319	840	850	411	145
732-914	737	11	124	502	68	-	48	11	0	-	0	80	-	-	-	530	-	-	-
732-914	741	0	3	159	15	-	-	10	0	-	15	0	-	-	-	218	-	-	-
732-914	745	0	0	0	7	-	-	0	0	-	0	22	-	-	-	12	-	-	-
732-914	748	0	0	0	37	-	-	0	0	-	0	5	-	-	-	0	-	-	-
915-1097	738	0	7	6	423	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	742	0	0	0	117	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	746	0	0	0	7	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	749	0	0	0	0	-	-		0	-	0	0	-	-	-	0	-	-	-
1098-1280	739	0	0	0	0	-	0	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	743	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	747	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	750	0	0	0	0	-	-	-	0	-	0	0	-	-	-	0	-	-	-
1281-1463	740	0	0	0	0	-	0	0	0	-	0	0	-	-	-	0	-	-	-
1281-1463	744	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1281-1463	751	0	0	0	0	-	-	-	0	-	0	0	-	-	-	0	-	-	-

Table 8. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 2J.

Depth (m)	**Stratum**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
200	201	0	65	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
200	205	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
200	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	237	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
200	238	-	-	-	-	-	-	-	-	-	-		0	-	0	0	0	0
300	202	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
300	209	158	32	147	0	0	0	0	37	0	0	0	0	0	0	0	0	0
300	210	0	373	0	0	53	0	53	0	0	0	0	0	0	0	0	0	0
300	213	308	190	185	185	158	30	53	0	0	0	0	0	0	0	0	36	0
300	214	101	40	134	81	0	27	54	32	0	0	0	0	0	0	0	0	0
300	215	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	228	295	421	56	1080	112	196	393	229	0	79	101	0	0	0	0	0	0
300	234	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0
400	203	154	0	0	33	0	0	22	0	0	0	0	0	0	0	0	0	0
400	208	123	144	965	123	0	0	123	0	0	0	0	0	0	0	0	0	0
400	211	23	136	106	23	45	0	68	0	0	0	0	0	0	0	0	0	0
400	216	123	0	0	79	26	26	26	0	0	0	0	0	0	25	0	0	0
400	222	101	40	61	0	0	394	61	0	20	0	0	0	0	58	0	62	62
400	229	214	130	52	1846	260	364	1664	78	26	130	221	25	0	0	0	0	0
500	204	16	122	0	97	24	73	97	24	0	0	0	0	0	0	0	0	0
500	217	0	-	0	74	92	74	92	18	0	0	0	155	0	33	66	31	0
500	223	0	50	0	248	161	124	111	37	66	33	76	145	0	75	43	19	0
500	227	283	126	212	409	684	220	354	4404	661	330	329	0	0	0	206	329	535
500	235	1358	770	520	376	289	0	202	173	96	19	0	304	0	51	28	85	0
500	240	-	-	-	-	-	-	-	-	-	-	348	140	0	146	55	45	137
750	212	1705	1127	1621	4658	1302	685	891	1218	411	365	77	281	306	217	268	690	536
750	218	0	-	29	0	58	173	144	87	29	0	100	199	17	199	75	50	47
750	224	0	0	0	56	56	204	186	19	111	74	0	146	31	78	141	84	16
750	230	0	16	0	65	16	147	782	1695	4548	880	471	382	827	582	865	102	674
750	239	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
1000	219	0	-	0	0	0	0	0	0	0	0	156	58	39	58	39	78	0
1000	231	0	0	0	0	0	0	-	0	939	401	512	375	563	26	90	832	461
1000	236	0	0	0	0	0	8	-	59	34	151	199	159	25	133	13	38	66
1250	220	-	-	-	-	-	-	-	-	-	-	-	-	-	42	0	0	-
1250	225	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	13
1250	232	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1500	221	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1500	226	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1500	233	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	23	0

Table 9. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 2000-2017) in NAFO division 2J.

Depth (m)	**Stratum**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
200	201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	206	0	0	0	0	0	0	0	0	0	0	0	51	0	0	37	0	0	0
200	207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	237	0	0	0	0	0	0	0	0	0	0	34	-	0	0	0	0	0	0
200	238	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300	213	0	0	0	0	0	0	0	0	0	0	0	131	0	0	87	31	0	36
300	214	0	0	0	0	0	0	0	0	0	0	37	0	0	0	0	37	0	0
300	215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	0
300	228	0	0	38	0	0	38	0	0	49	0	345	352	151	189	437	541	0	629
300	234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	208	0	0	0	0	81	0	0	0	0	0	162	0	202	647	1132	81	0	0
400	211	0	0	0	0	0	0	0	0	0	17	0	0	234	0	265	570	0	0
400	216	0	0	25	0	0	0	25	25	0	0	0	25	177	138	149	124	25	33
400	222	0	0	0	0	0	0	31	0	0	35	31	62	31	31	0	66	62	93
400	229	37	33	0	37	37	147	111	184	0	295	49	184	406	495	258	458	537	400
500	204	0	0	0	0	0	0	0	0	0	0	20	0	40	0	0	0	0	20
500	217	0	0	0	19	66	50	17	0	0	17	0	66	0	17	22	52	39	0
500	223	0	43	12	22	0	36	54	54	42	11	12	0	0	11	87	130	43	0
500	227	0	206	47	0	129	165	329	329	219	247	411	123	247	165	55	411	165	494
500	235	0	0	65	0	342	114	57	85	304	28	940	1643	456	826	1281	2079	114	1139
500	240	37	76	0	18	46	82	119	106	49	312	115	27	46	73	106	552	265	223
750	212	460	68	115	115	575	996	1396	2271	3317	1724	1120	153	153	460	690	1110	3317	1916
750	218	50	0	0	22	149	50	50	25	25	171	0	0	0	0	0	0	75	25
750	224	94	72	16	0	0	16	110	31	81	31	0	0	0	0	0	0	0	75
750	230	165	130	29	216	153	407	394	153	191	509	27	0	47	17	47	44	1336	191
750	239	0	0	0	0	0	0	0	0	11	0	41	8	33	33	0	8	17	0
1000	219	17	16	62	71	58	0	0	0	-	0	0	0	0	0	0	0	0	0
1000	231	1011	205	951	44	234	154	0	26	26	0	0	51	0	0	13	0	0	17
1000	236	80	173	80	133	0	0	27	0	-	0	0	0	0	0	0	0	0	0
1250	220	0	0	19	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1250	225	13	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1250	232	0	63	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1500	221	0	0	23	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1500	226	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1500	233	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 10. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3K.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
200	608	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
200	612	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
200	616	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
200	618	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	619	-	0	0	0	0	0	0	0	0	0	0	0	54	0	0	0	0
300	609	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
300	611	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
300	615	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
300	620	112	115	80	124	0	0	0	0	0	0	0	0	0	0	0	0	0
300	621	688	253	393	28	66	0	486	0	0	0	0	0	0	0	0	187	0
300	624	184	368	161	92	31	0	0	23	0	0	22	0	0	0	30	0	57
300	632	492		225	92	31	31	61	0	6	57							
300	634	223	890	544	267	283	482	254	0	0	240	13	0	0	0	0	0	0
300	635	584	2432	1127	29	146	456	175	29	0	58	0	0	29	0	70	105	0
300	636	634	2927	976	400	486	767	240	29	0	0	0	0	29	33	67	0	0
300	637	4765	3530	3315	740	960	195	156	0	0	52	52	0	0	0	31	62	145
400	610	-	-	-	-	-	-	-	-	-	-	-	-	-	104	18	53	-
400	614	-	-	-	-	-	-	-	-	-	-	-	-	-	36	18	0	-
400	617	-	-	-	-	-	-	-	-	-	-	0	0	41	0	27	51	0
400	623	871	565	918	283	537	311	47	0	0	0	0	0	0	0	0	0	0
400	625	2222	2081	1684	78	322	292	88	0	0	0	0	0	41	24	0	31	31
400	626	4867	2865	1618	63	582	126	329	0	0	42	0	0	0	0	122	0	575
400	628	6567	2708	4229	1692	896	269	634	0	0	149	0	0	27	0	30	0	179
400	629	3638	1373	2094	526	732	755	412	103	0	46	182	136	306	34	34	68	375
400	630	898	798	917	299	274	249	125	0	0	25	30	0	0	46	46	23	114
400	633	3047	3627	2848	3559	1853	3485	3687	1063	360	552	600	57	67	221	284	348	63
400	638	6849	14417	12385	11330	7534	11400	5047	535	612	317	368	13	78	150	157	661	602
400	639	4025	5459	2792	2381	1236	3321	503	489	67	24	0	226	115	34	101	168	0
500	613	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	14	-
500	622	2260	978	1934	696	1478	203	290	130	58	261	238	0	28	23	32	95	0
500	627	22232	18690	17311	7753	3882	7199	6271	1954	434	271	3625	367	792	127	1343	2244	660
500	631	8863	12666	11433	8019	3417	2563	1819	276	2563	2260	727	2453	537	178	569	485	84
500	640		572	1716	2465	4017	2274	1648	245	245	91	0	0	0	38	19	62	5
500	645	295	2020	393	-	5837	1108	463	2357	196	47	188	119	0	149	45	13	104
500	650	-	-	-	-	-	-	-	-	-	-	25	5	37	28	147	313	179
750	641	241	0	1004	-	2437			17031	1366	0	53	74	79	253	190	506	378
750	646	710	92	122	-	115			527	366	290	209	462	22	2209	156	156	156
750	651	-	-	-	-	-	-	-	-	-	-	49	111	247	444	771	444	571
1000	642	-	128	128	-	128	-	-	4013	2177	1089	383	173	86	29	0	29	173
1000	647	-	-	38	-	-	-	-	534	1594	506	281	264	50	173	198	272	743
1000	652	-	-	-	-	-	-	-	-	-	-	899	355	390	745	1207	1526	177
1250	643	-	-	-	-	-	-	-	-	-	-	-	-	235	0	0	0	34
1250	648	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1250	653	-	-	-	-	-	-	-	-	-	-	974	-	256	0	0	0	37
1500	644	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
1500	649	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1500	654	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	38	0

Table 11. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3K.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
200	608	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
200	612	31	0	0	0	0	0	0	-	-	-	0	-	-	0	-	-	-	-
200	616	0	0	0	0	0	-	0	-	-	-	-	-	-	-	-	-	-	-
200	618	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	619	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0
300	609	0	0	0	0	0	0	0	-	-	0	27	-	-	-	-	-	-	-
300	611	0	0	0	0	0	39	39	-	-	-	0	-	-	-	-	-	-	-
300	615	17	0	0	0	0	0	35	-	-	-	0	-	-	17	-	-	-	-
300	620	0	0	0	0	0	0	0	0	0	0	0	102	35	66	0	85	0	32
300	621	0	0	0	0	0	0	0	0	0	0	0	407	44	63	190	454	63	105
300	624	30	30	0	0	30	0	0	0	0	0	0	0	61	182	61	35	0	486
300	632	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300	634	0	0	0	0	0	61	0	0	0	36	41	0	122	53	61	92	0	288
300	635	80	0	0	0	0	52	-	0	0	0	0	175	40	146	171	0	0	35
300	636	0	71	0	0	0	40	0	0	100	0	33	67	214	300	38	0	76	185
300	637	-	31	0	0	0	31	0	0	147	39	62	36	0	200	446	0	31	196
400	610	35	55	106	16	0	53	65	-	-	-	18	-	-	-	-	-	-	-
400	614	163	36	0	0	0	0	0	-	-	-	0	-	-	314	-	-	-	-
400	617	0	0	0	0	0	0	0	0	0	41	31	0	136	109	109	27	27	82
400	623	0	0	0	0	0	0	0	0	0	0	0	30	340	78	0	0	23	0
400	625	0	35	0	0	31	31	31	0	54	0	0	525	41	95	92	183	31	195
400	626	364	306	0	0	38	54	170	1990	531	995	389	697	429	1597	857	714	3041	2487
400	628	269	114	0	30	30	0	94	0	203	37	186	533	473	1693	597	318	667	925
400	629	280	45	0	0	34	34	511	61	291	34	0	146	136	363	738	681	151	880
400	630	101	15	20	0	0	23	43	46	188	91	78	23	23	251	457	183	183	467
400	633	190	135	72	32	63	284	71	352	101	308	691	384	320	853	384	370	369	1634
400	638	1020	617	252	328	678	552	560	2490	2098	750	1625	649	1711	2738	4721	2039	1349	3801
400	639	0	0	93	0	0	161	0	335	67	140	134	365	134	456	843	835	371	724
500	613	220	14	9	6	2	10	10	-	-	-	8	-	-	205	-	-	-	-
500	622	63	158	0	0	63	60	0	32	0	36	0	143	190	104	453	1521	404	0
500	627	2012	773	362	134	475	387	1098	2676	1435	1906	3128	1770	1416	4454	9564	5835	14410	7540
500	631	628	314	212	121	500	682	165	575	554	654	575	195	878	545	2695	2844	3421	5394
500	640	47	138	9	5	160	14	157	81	194	166	451	90	133	190	351	532	165	243
500	645	74	110	74	0	0	292	253	223	53	852	481	198	461	460	193	317	949	113
500	650	-	166	99	166	424	57	571	565	951	339	747	553	470	704	258	1942	-	1275
750	641	-	791	156	301	1946	232	1171	1130	1086	2832	1548	1070	1894	522	823	1724	3028	395
750	646	797	536	786	89	313	291	22	1406	250	536	425	854	291	103	67	119	1766	89
750	651	-	1552	1242	222	4864	2796	4889	4157	3185	6675	6748	1506	1411	593	1235	2178	6815	1717
1000	642	597	33	58	316	29	1294	86	288	29	230	0	0	0	0	0	0	0	0
1000	647	0	867	25	347	672	718	25	0	-	0	0	25	0	0	0	0	0	0
1000	652	887	238	177	1278	71	1810	0	674	71	1463	106	0	81	0	0	0	35	0
1250	643	45	0	0	123	0	34	0	0	-	0	0	0	0	0	0	0	0	0
1250	648	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1250	653	0	37	0	146	0	37	0	0	0	0	0	0	0	0	0	0	0	0
1500	644	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0
1500	649	0	0	0	0	0	0	0	0	-	0	15	0	0	0	0	0	0	0
1500	654	0	0	0	0	0	0	0	0	-	33	0	0	0	0	0	0	-	0

Table 12. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3L.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
30-55	784	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
56-91	350	0	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	363	0	92	0	35	0	0	0	306	43	39	0	0	0	0	0	0	0
56-91	371	0	44	0	0	0	0	0	0	0	0	0	0	0	0	44	0	0
56-91	372	0	182	0	0	0	26	0	34	13	0	0	0	34	0	0	0	0
56-91	384	103	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	785	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	328	-	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	341	0	217	0	0	24	27	0	0	0	0	0	0	0	0	0	43	0
92-183	342	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40
92-183	343	0	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	348	27	292	0	0	0	58	0	0	0	0	-	0	0	0	0	49	0
92-183	349	0	291	0	162	0	32	0	166	0	0	0	0	0	0	42	0	0
92-183	364	35	271	0	155	0	55	0	32	0	0	0	0	0	0	0	43	43
92-183	365	0	143	0	57	48	29	0	0	48	0	0	0	0	0	0	0	0
92-183	370	0	233	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
92-183	385	0	324	0	122	36	25	0	0	0	0	0	0	0	0	0	0	0
92-183	390	0	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	786	-	-	-	-	-	-	-	-	-	-	-	-	-	90	36	23	-
92-183	787	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	788	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	18	-
92-183	790	-	-	-	-	-	-	-	-	-	-	-	-	-	6	18	55	-
92-183	793	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	794	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
92-183	797	-	-	-	-	-	-	-	-	-	-	-	-	-	7	0	0	-
92-183	799	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
184-274	344	308	206	46	117	154	0	0	0	0	0	0	0	0	0	0	0	0
184-274	347	23	586	0	34	0	135	108	0	0	0	0	0	0	0	0	0	0
184-274	366	0	157	362	431	219	110	164	32	0	8	0	0	0	0	38	0	38
184-274	369	176	359	507	661	330	1348	529	463	162	0	0	0	39	0	0	0	0
184-274	386	-	186	568	1082	1792	1974	352	237	270	1262	0	0	0	0	0	0	0
184-274	389	-	169	158	875	226	169	28	75	0	38	0	0	33	0	0	0	0
184-274	391	0	0	39	0	19	0	0	0	91	26	0	0	34	0	19	0	0
184-274	795	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-

Table 12 (cont.). Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen equivalents for 1983-1995; Campelen units 1996-1999) in NAFO division 3L.

Depth (m)	Stratum	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
275-366	345	7239	6895	1488	739	4531	2589	3180	2088	0	345	394	0	113	70	223	439	149
275-366	346	3356	2380	3498	3927	1487	2427	1606	2340	389	170	76	0	0	35	317	178	282
275-366	368	-	46	46	459	23	69	207	115	69	14	0	0	23	0	23	0	20
275-366	387	-	165	444	247	691	2025	1679	4971	198	66	33	77	99	49	44	0	44
275-366	388	-	1440	50	-	819	149	149	0	116	199	0	14	0	0	0	149	0
275-366	392	20	80	20	20	70	20	0	0	0	0	0	7	0	0	0	0	0
184-366	798	-	-	-	-	-	-	-	-	-	-	-	-	-	7	7	172	-
184-366	789	-	-	-	-	-	-	-	-	-	-	-	-	-	0	5	5	-
184-366	791	-	-	-	-	-	-	-	-	-	-	-	-	-	42	62	0	-
275-366	796	-	-	-	-	-	-	-	-	-	-	-	-	-	0	107	24	-
275-366	800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156	178	-
367-549	729	-	217	192	409	-	-	-	64	341	422	51	290	34	375	115	0	0
367-549	731	-	877	371	-	-	-	-	520	248	604	99	200	45	-	0	74	56
367-549	733	-	338	1609	-	-	-	-	2221	2983	665	258	136	32	19	0	114	129
367-549	735	-	661	37	2320	-	-	-	-	349	249	37	14	75	58	75	168	50
367-549	792	-	-	-	-	-	-	-	-	-	-	-	-	-	901	423	279	-
550-731	730	-	105	23	-	-	-	-	-	117	12	195	171	108	0	47	19	21
550-731	732	-	365	302	-	-	-	-	32	270	397	48	339	78	280	413	969	508
550-731	734	-	21	267	-	-	-	-	251	110	16	141	146	44	467	70	380	173
550-731	736	746	-	373	987	-	-	-	506	1613	217	241	34	75	782	277	1037	433
732-914	737	-	-	-	-	-	-	-	-	-	-	-	-	78	468	297	1109	390
732-914	741	-	-	-	-	-	-	-	-	-	-	-	-	-	291	460	892	14
732-914	745	-	-	-	-	-	-	-	-	-	-	-	-	-	311	479	168	202
732-914	748	-	-	-	-	-	-	-	-	-	-	-	-	-	186	0	0	50
915-1097	738	-	-	-	-	-	-	-	-	-	-	-	-	61	532	347	56	0
915-1097	742	-	-	-	-	-	-	-	-	-	-	-	-	-	43	14	14	13
915-1097	746	-	-	-	-	-	-	-	-	-	-	-	-	-	216	168	0	0
915-1097	749	-	-	-	-	-	-	-	-	-	-	-	-	-	61	43	0	-
1098-1280	739	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1098-1280	743	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1098-1280	747	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	100	0
1098-1280	750	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1281-1463	740	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
1281-1463	744	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	-
1281-1463	751	-	-	-	-	-	-	-	-	-	-	-	-	-	0	14	0	-

Table 13. Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys (Campelen units 2000-2017) in NAFO division 3L.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
30-55	784	74	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
56-91	350	0	0	0	0	0	41	0	47	47	0	0	0	41	0	0	0	0	0
56-91	363	0	0	0	0	0	0	0	0	0	0	0	49	0	0	0	0	0	0
56-91	371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0	0
56-91	372	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0
56-91	384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56-91	785	0	32	0	0	0	37	-	-	-	-	-	-	-	-	-	-	-	-
92-183	328	0	0	0	0	0	0	0	0	0	0	42	37	42	0	0	0	0	42
92-183	341	0	0	0	0	0	49	606	0	99	38	173	130	130	5379	130	49	0	0
92-183	342	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	40	46
92-183	343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	348	73	0	0	0	48	42	42	0	0	0	0	0	48	42	42	0	0	49
92-183	349	42	0	0	125	42	148	0	42	97	43	42	83	0	595	42	0	48	0
92-183	364	0	43	0	0	0	0	0	0	0	0	344	166	437	0	0	172	0	43
92-183	365	-	0	0	0	-	48	0	0	0	0	0	0	0	0	0	0	0	0
92-183	370	0	0	0	0	-	0	0	0	0	0	0	61	0	0	0	45	0	0
92-183	385	0	0	0	0	0	0	0	0	0	0	41	0	0	0	0	0	0	0
92-183	390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92-183	786	40	164	29	64	40	204	-	-	-	-	-	-	-	-	-	-	-	-
92-183	787	0	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92-183	788	18	0	0	0	0	0	0	-	-	-	41	-	-	-	-	-	-	-
92-183	790	0	37	6	0	0	0	-	-	-	-	0	-	-	-	-	-	-	-
92-183	793	0	0	50	0	7	6	-	-	-	-	8	-	-	-	-	-	-	-
92-183	794	-	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
92-183	797	0	0	0	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
92-183	799	0	0	6	0	0	0	0	-	-	-	0	-	-	-	-	-	-	-
184-274	344	64	0	87	131	50	0	44	381	169	54	0	218	0	39	0	62	566	0
184-274	347	0	45	0	0	0	0	0	0	45	0	81	90	496	280	0	0	0	0
184-274	366	0	0	0	77	-	34	0	38	0	0	31	48	78	358	72	0	482	0
184-274	369	0	0	0	0	-	32	39	0	44	0	0	132	166	201	0	0	176	0
184-274	386	0	0	80	0	-	52	0	0	0	0	0	135	97	80	45	0	0	0
184-274	389	301	0	0	0	38	0	151	0	0	0	0	0	113	67	38	0	0	38
184-274	391	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	19	0	39
184-274	795	56	0	0	0	0	0	10	-	-	-	0	-	-	-	-	-	-	-

Table 13 (cont.). Abundance estimates (000s)) of Witch Flounder by stratum for DFO fall RV surveys (Campelen units 2000-2017) in NAFO division 3L.

Depth (m)	Stratum	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
275-366	345	117	79	468	184	105	569	214	197	919	621	1791	396	1525	1593	368	197	514	664
275-366	346	119	278	326	59	40	357	326	472	1503	282	299	984	982	1309	453	499	1224	3020
275-366	368	23	0	0	23	-	138	20	0	163	0	0	23	152	253	0	0	161	79
275-366	387	593	44	93	0	-	56	176	395	582	0	296	691	646	176	0	626	404	2815
275-366	388	124	309	44	94	0	174	50	265	132	110	22	206	50	563	25	185	316	103
275-366	392	0	16	0	0	0	27	0	0	0	0	30	0	9	20	0	60	0	63
184-366	798	135	530	21	0	123	41	-	-	-	-	9	-	-	-	-	-	-	-
184-366	789	22	5	24	5	20	12	25	-	-	-	-	-	-	-	-	-	-	-
184-366	791	0	28	10	16	0	45	-	-	-	-	0	-	-	-	-	-	-	-
275-366	796	21	638	96	0	0	385	120	-	-	-	84	-	-	879	-	-	-	-
275-366	800	136	953	574	28	166	195	-	-	-	1088	376	-	-	-	-	-	-	-
367-549	729	34	13	80	26	0	23	102	181	239	61	534	256	102	199	49	188	98	175
367-549	731	59	15	40	116	187	94	178	40	238	431	322		89	431	234	312	206	255
367-549	733	170	109	433	61	1506	869	526	1470	57	765	916	1642	1343	1062	367	409	1214	0
367-549	735	17	19	17	0	-	151	133	401	872	1478	871	1291	1954	736	1740	492	3230	2114
367-549	792	915	1829	2887	2298	1331	2368	-	-	-	-	1032	-	-	-	-	-	-	-
550-731	730	58	509	222	10	42	0	79	21	10	82	114	79	147	135	16	0	140	0
550-731	732	524	565	233	229	249	89	381	222	254	427	681	313	182	222	381	340	145	182
550-731	734	125	28	265	25	-	0	200	92	32	876	471	1689	105	112	146	0	36	18
550-731	736	1432	681	3295	631	-	614	1637	1601	2035	2022	2077	1276	923	1001	1990	1683	1055	433
732-914	737	16	281	1028	390	-	125	16	0	-	0	203	-	-	-	1035	-	-	-
732-914	741	0	31	291	70	-	-	15	0	-	31	0	-	-	-	409	-	-	-
732-914	745	24	24	0	48	-	-	0	0	-	0	48	-	-	-	96	-	-	-
732-914	748	0	0	0	55	-	-	0	0	-	0	11	-	-	-	0	-	-	-
915-1097	738	0	14	30	1049	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	742	0	0	0	264	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	746	27	0	0	13	-	-	0	0	-	0	0	-	-	-	0	-	-	-
915-1097	749	0	0	0	0	-	-	-	0	-	0	0	-	-	-	0	-	-	-
1098-1280	739	0	0	0	0	-	0	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	743	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	747	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1098-1280	750	0	0	0	0	-	-	-	0	-	0	0	-	-	-	0	-	-	-
1281-1463	740	0	0	0	0	-	0	0	0	-	0	0	-	-	-	0	-	-	-
1281-1463	744	0	0	0	0	-	-	0	0	-	0	0	-	-	-	0	-	-	-
1281-1463	751	0	0	0	0	-	-	-	0	-	0	0	-	-	-	0	-	-	-

Table 14.Proportion of abundance and biomass found in strata not included in 1984 strata (1983-2017)

Year	Survey Biomass (t)	Survey biomass 1984 strata (t)	Biomass outside of 1984 strata (t)	Proportion biomass outside of 1984 strata
1983	62026	61033	993	0.016
1984	65151	65151	n/a	n/a
1985	46605	46086	519	0.011
1986	38022	37170	852	0.022
1987	32488	32347	141	0.004
1988	28975	28778	197	0.007
1989	18234	18001	233	0.013
1990	31101	30293	808	0.026
1991	12215	10562	1654	0.135
1992	6095	5799	296	0.049
1993	2733	1795	938	0.343
1994	1971	1604	368	0.186
1995	1117	840	277	0.248
1996	3031	1380	1651	0.545
1997	2676	1058	1619	0.605
1998	3810	1896	1914	0.502
1999	2460	1608	852	0.346
2000	2667	1744	923	0.346
2001	2678	1338	1340	0.500
2002	3303	1129	2174	0.658
2003	1839	571	1268	0.689
2004	3568	1846	1721	0.482
2005	4529	2393	2136	0.472
2006	5838	3227	2612	0.447
2007	7762	4739	3023	0.389
2008	8080	5721	2358	0.292
2009	9616	5366	4250	0.442
2010	9645	5411	4234	0.439
2011	8297	6793	1504	0.181
2012	8975	7690	1285	0.143
2013	12757	11770	987	0.077
2014	13053	10754	2299	0.176
2015	13671	10405	3266	0.239
2016	17599	13061	4538	0.258
2017	17190	15805	1385	0.081

Table 15. Estimates of biomass (t) of Witch flounder from research surveys 1983-2017 by depth zones in NAFO division 2J.

YEAR	<=200	201-300	301-400	401-500	501-750	751-1000	1001-1250	1251-1500	Total
1983	0	658	513	1132	1390	0	-	-	3693
1984	61	956	323	724	840	0	-	-	2903
1985	0	439	777	546	1268	0	-	-	3030
1986	0	929	1049	714	3229	0	-	-	5920
1987	0	228	121	773	941	0	-	-	2063
1988	0	160	327	348	727	9	-	-	1571
1989	0	242	739	484	1188	0	-	-	2653
1990	0	109	32	2024	1485	23	-	-	3672
1991	0	0	42	261	1884	482	-	-	2669
1992	0	44	28	153	650	227	-	-	1102
1993	0	35	15	176	137	264	-	-	627
1994	0	0	13	87	200	162	-	-	462
1995	0	0	0	0	142	121	-	-	263
1996	0	0	8	48	257	47	10	0	370
1997	0	0	0	118	299	48	0	0	465
1998	0	8	17	129	238	252	0	6	649
1999	0	0	10	149	432	159	2	0	752
2000	0	0	6	11	180	299	1	0	498
2001	0	0	4	39	42	101	24	0	209
2002	0	3	3	51	42	289	6	9	404
2003	0	0	11	8	102	53	4	0	178
2004	0	0	17	131	273	54	0	0	476
2005	0	30	55	100	464	35	0	0	684
2006	0	0	38	143	775	6	0	0	962
2007	0	0	86	208	1068	7	0	0	1369
2008	0	12	0	225	1700	9	0	0	1947
2009	0	0	85	229	1037	0	0	0	1351
2010	0	111	103	534	493	0	0	0	1242
2011	35	199	93	738	76	10	0	0	1151
2012	0	77	395	445	112	0	0	0	1028
2013	0	131	605	542	217	0	0	0	1494
2014	16	311	920	815	402	5	0	0	2469
2015	0	320	690	1952	757	0	0	0	3719
2016	0	8	318	321	2441	0	0	0	3089
2017	0	467	218	1033	1444	5	0	0	3166

Table 16. Estimates of biomass (t) of Witch flounder from research surveys 1983-2017 by depth zones in NAFO division 3K.

YEAR	<=200	201-300	301-400	401-500	501-750	751-1000	1001-1250	1251-1500	Total
1983		6583	24207	17674	786	-	-	-	49251
1984	0	9515	22406	16892	94	131	-	-	49038
1985	0	5310	17772	11575	922	115	-	-	35694
1986	0	1667	13235	6458	-	-	-	-	21359
1987	0	1820	9142	8942	1759	83	-	-	21746
1988	0	1789	12441	3880	-	-	-	-	18110
1989	0	956	5506	2514	-	-	-	-	8976
1990	0	92	1245	1520	11345	2886	-	-	17088
1991	0	3	585	637	1110	1937	-	-	4272
1992	0	120	285	420	49	988	-	-	1863
1993	0	32	196	182	73	415	429	-	1327
1994	0	0	94	315	110	327	-	-	846
1995	1	3	55	116	31	98	132	0	435
1996	0	2	67	52	527	205	0	0	855
1997	0	95	69	173	280	499	0	0	1116
1998	0	20	226	213	275	517	0	4	1255
1999	0	38	118	106	328	267	24	0	881
2000	0	11	145	235	173	619	18	0	1200
2001	0	29	109	139	728	403	18	0	1427
2002	0	0	31	45	313	82	0	0	471
2003	0	0	13	15	93	461	70	0	651
2004	0	9	105	288	1976	263	0	0	2641
2005	0	21	167	277	991	1371	15	0	2842
2006	0	7	360	410	2077	36	0	0	2889
2007	0	0	781	672	2699	518	0	0	4671
2008	0	140	932	708	1548	46	0	-	3374
2009	0	14	246	607	3904	816	0	52	5639
2010	0	25	747	994	3613	29	0	10	5417
2011	0	238	1218	749	1598	2	0	0	3806
2012	0	276	1474	1157	1446	30	0	0	4384
2013	11	543	3506	1707	529	0	0	0	6295
2014	0	501	3247	2520	1024	0	0	0	7293
2015	0	87	2095	3125	2332	0	0	0	7639
2016	0	29	1408	1995	6808	1	0	0	10241
2017	0	768	4203	2726	893	0	0	0	8591

Table 17. Estimates of biomass (t) of Witch flounder from research surveys 1983-2017 by depth zones in NAFO division 3L.

YEAR	<= 55	56-91	92-183	184-275	276-366	367-549	550-731	732-914	915-1097	1098-1280	1281-1463	Total
1983	-	120	76	381	7959	-	546	-	-	-	-	9082
1984	-	510	1989	1550	7406	1339	416	-	-	-	-	13210
1985	-	0	0	1645	3961	1572	703	-	-	-	-	7881
1986	-	50	445	2926	4619	1994	709	-	-	-	-	10743
1987	-	0	156	2396	6127	-	-	-	-	-	-	8679
1988	-	16	199	3213	5866	-	-	-	-	-	-	9294
1989	-	0	0	1146	5460	-	-	-	-	-	-	6606
1990	-	302	172	797	6387	2131	552	-	-	-	-	10341
1991	-	41	36	539	525	2783	1350	-	-	-	-	5274
1992	-	41	0	931	340	1428	390	-	-	-	-	3131
1993	-	0	0	0	119	303	357	-	-	-	-	778
1994	-	0	0	0	30	282	352	-	-	-	-	663
1995	-	27	0	75	94	48	146	19	10	-	-	418
1996	0	0	1	0	29	239	535	486	515	0	0	1806
1997	0	0	1	26	21	84	198	480	285	0	0	1095
1998	0	0	4	0	75	78	735	874	33	107	0	1906
1999		0	1	0	28	84	450	262	0	0	0	826
2000	1	0	3	12	79	111	750	11	0	0	0	968
2001	0	0	3	4	94	124	683	128	7	0	0	1042
2002	0	0	3	4	48	203	1504	661	6	0	0	2428
2003	0	0	18	12	10	78	216	127	547	0	0	1010
2004	0	0	1	3	8	319	119	-	-	-	-	451
2005	0	18	167	6	133	398	232	48	-	0	0	1003
2006	-	0	393	7	204	290	1073	21	0	0	0	1987
2007	-	0	0	36	134	596	955	0	0	0	0	1723
2008	-	34	119	85	1040	476	1005	-	-	-	-	2759
2009	-	0	2	3	103	812	1691	15	0	0	0	2625
2010	-	0	141	36	287	836	1579	108	0	0	0	2986
2011	-	30	117	147	605	1055	1386	-	-	-	-	3339
2012	-	17	63	338	1381	1194	569	-	-	-	-	3562
2013	-	0	1841	352	1419	811	545	-	-	-	-	4968
2014	-	15	2	40	304	1037	1132	761	0	0	0	3291
2015	-	0	36	13	615	586	1062	-	-	-	-	2312
2016	-	0	8	409	1162	2139	551	-	-	-	-	4269
2017	-	0	75	32	4005	1020	302	-	-	-	-	5433

Table 18. P-values from the randomization test for associations between Witch Flounder catch and the hydrographic variables depth and temperature during autumn bottom trawl surveys of NAFO Divisions 2J, 3K, and 3L for years in which data were available. P-values represent the probability of obtaining, by chance, a test statistic as large or larger than that obtained by comparing available and catch-weighted bivariate surfaces.

Year	-	Temperature	-	-	Depth	-	-	Bivariate	-
-	2J	3K	3L	2J	3K	3L	2J	3K	3L
1977	<0.001	<0.001	-	<0.001	<0.001	-	<0.01	<0.05	-
1978	<0.001	<0.001	-	<0.001	<0.001	-	<0.05	0.438	-
1979	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.05	-
1980	<0.001	<0.001	-	<0.001	<0.001	-	<0.01	<0.01	-
1981	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1982	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1983	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1984	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
1985	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1986	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
1987	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1988	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1989	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1990	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1991	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
1992	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1993	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1994	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1995	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1996	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1997	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1998	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
1999	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2000	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
2008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
2011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001
2012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
2014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001	<0.001
2015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
2017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.05	<0.001	<0.001

FIGURES

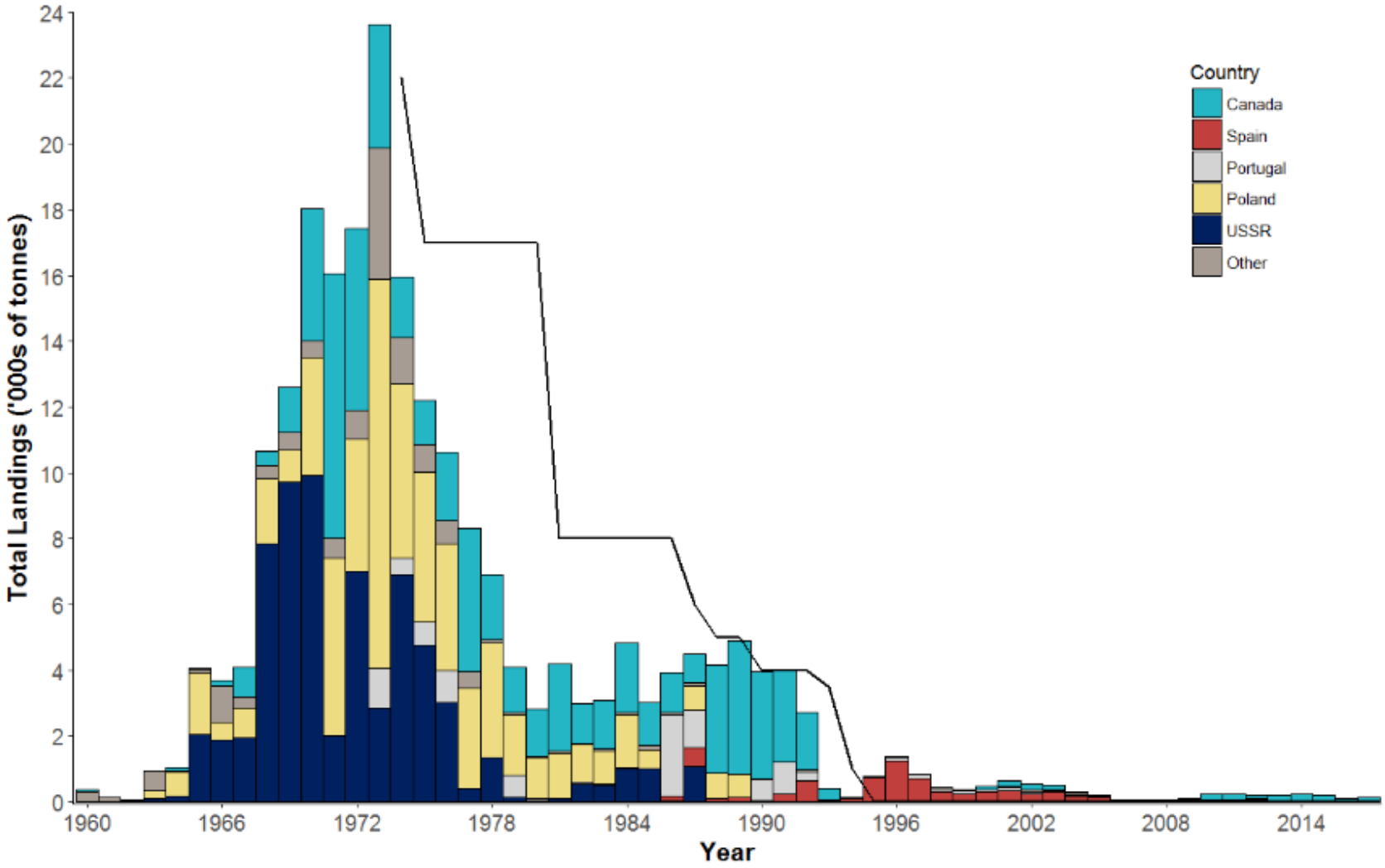


Figure 1: Total landings of Witch Flounder by country in NAFO divisions 2J3KL (Note: 2017 landings data are provisional).

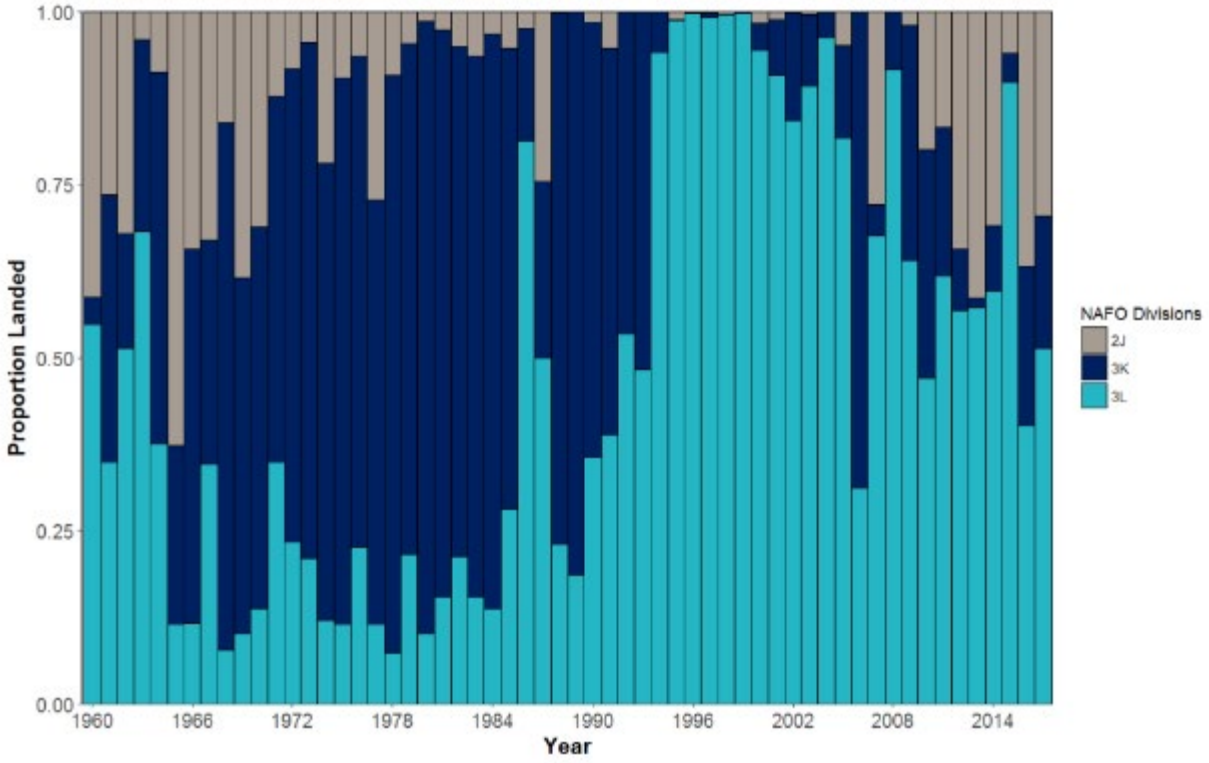


Figure 2: Proportion of total landings of Witch Flounder by NAFO division within area 2J3KL. There has been no directed fishing activity for Witch flounder in the Canadian regulatory area of 2J3KL since 1995, and in the NAFO regulatory area since 1998. (Note: 2017 landings data are provisional).

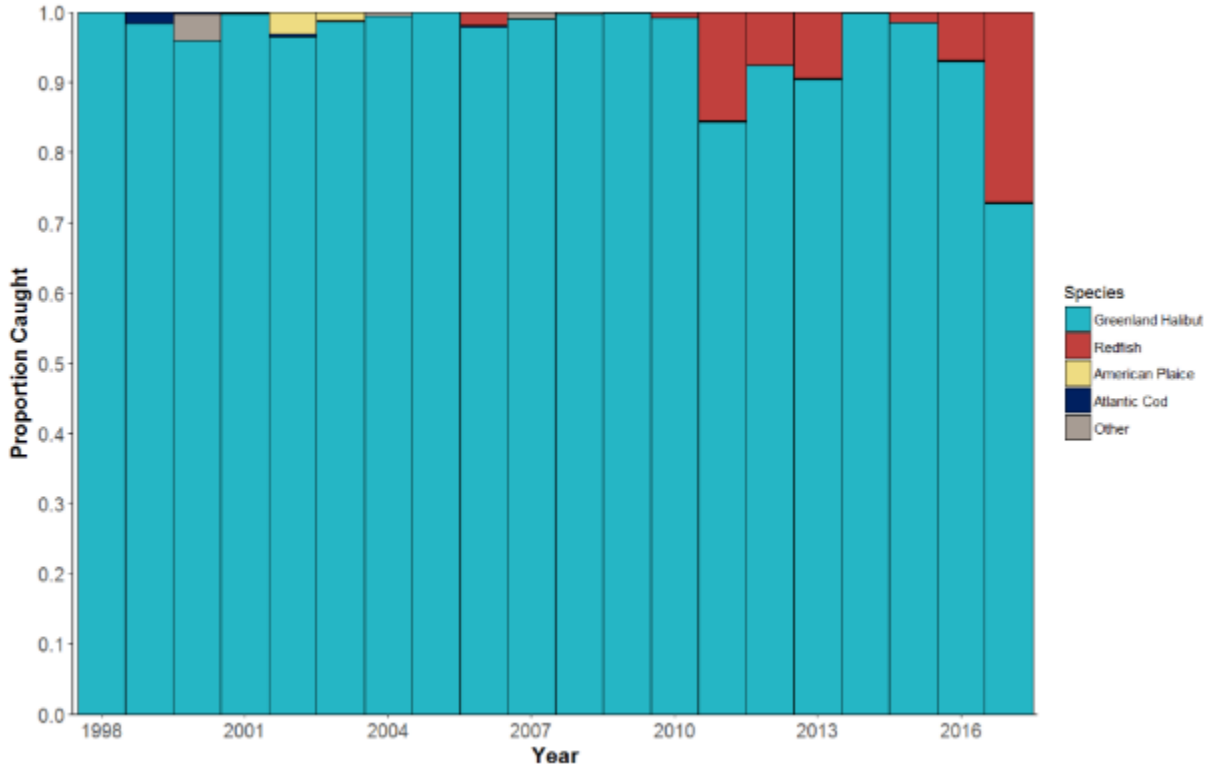


Figure 3: Proportion of Witch Flounder bycatch by targeted fishery landed by Canada-NL. (Note: 2017 data are provisional).

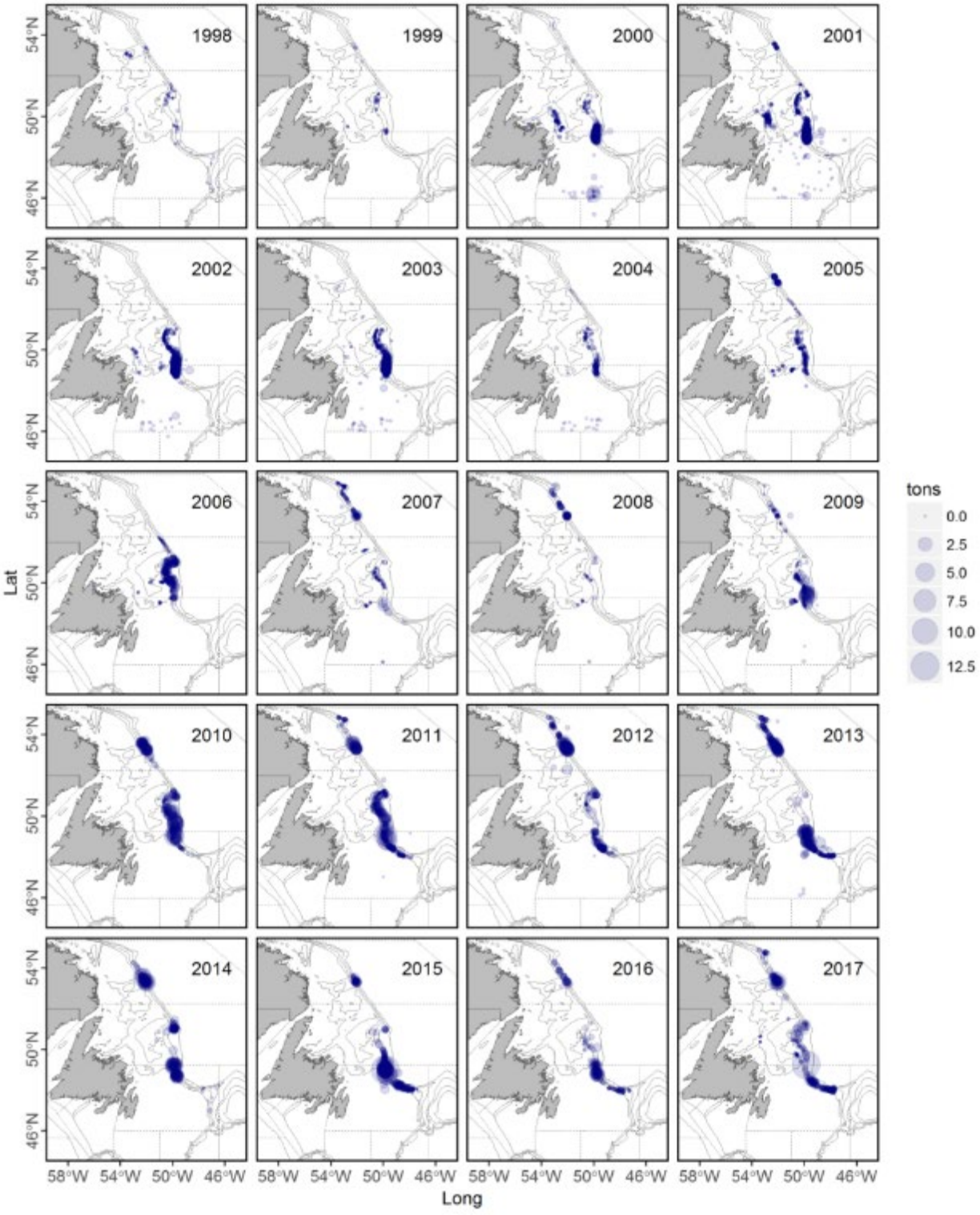

1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
54°N
50°N
46°N
58°W
54°W
50°W
46°W
Lat
Long
tons
0.0
2.5
5.0
7.5
10.0
12.5

Figure 4: Logbook records showing locations of Witch Flounder bycatch by weight (t) in NAFO divisions 2J3KL (1998-2017).

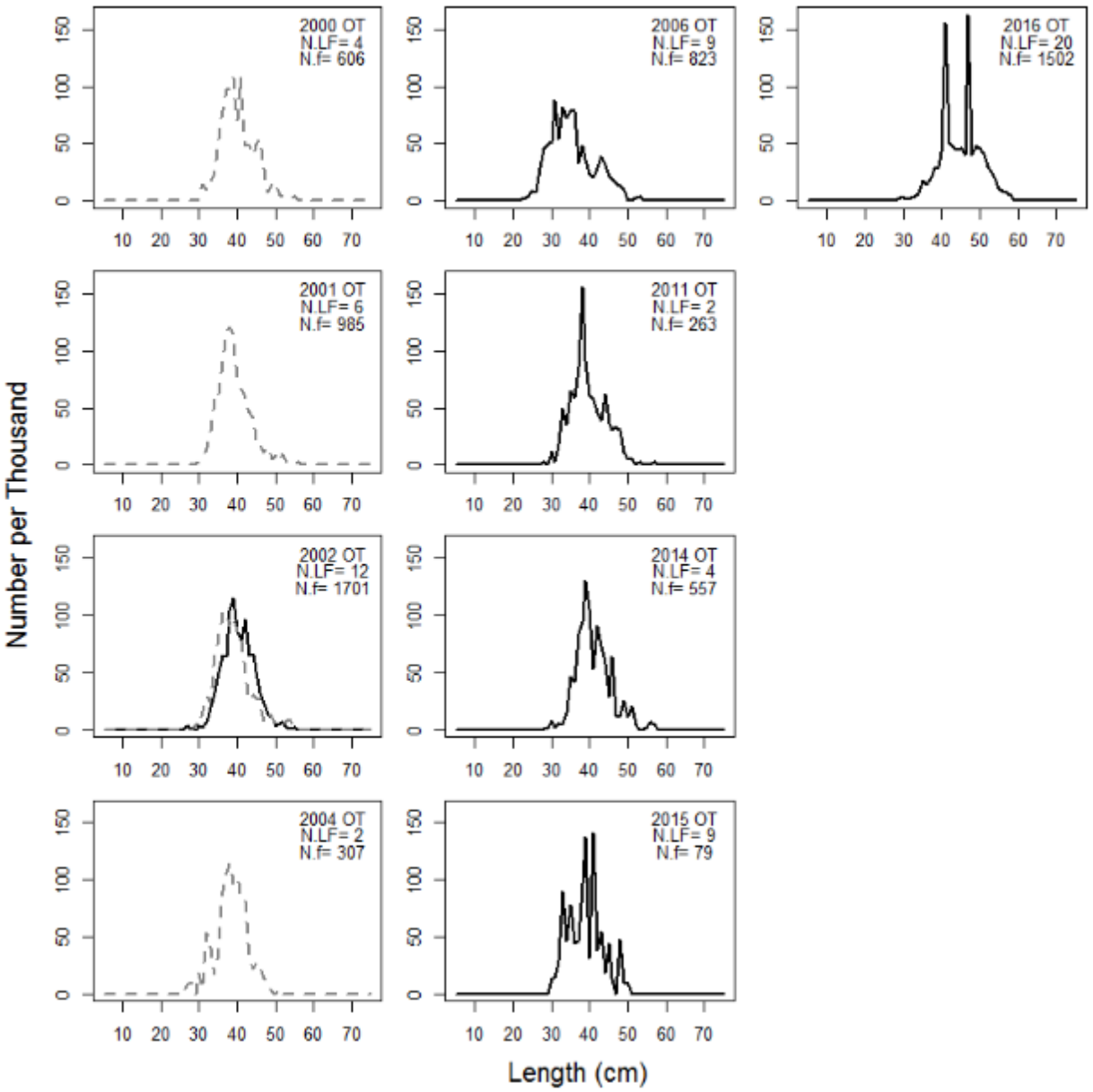


Figure 5: Witch Flounder caught at length (cm) from the Canada (NL) otter trawl (OT) commercial fishery in NAFO Divisions 2J3KL from 200017. Observer sampling = black lines; Port sampling = dashed lines. N.LF indicates the number of length frequencies recorded in that year. N.f denotes the number of individual fish measured each year.

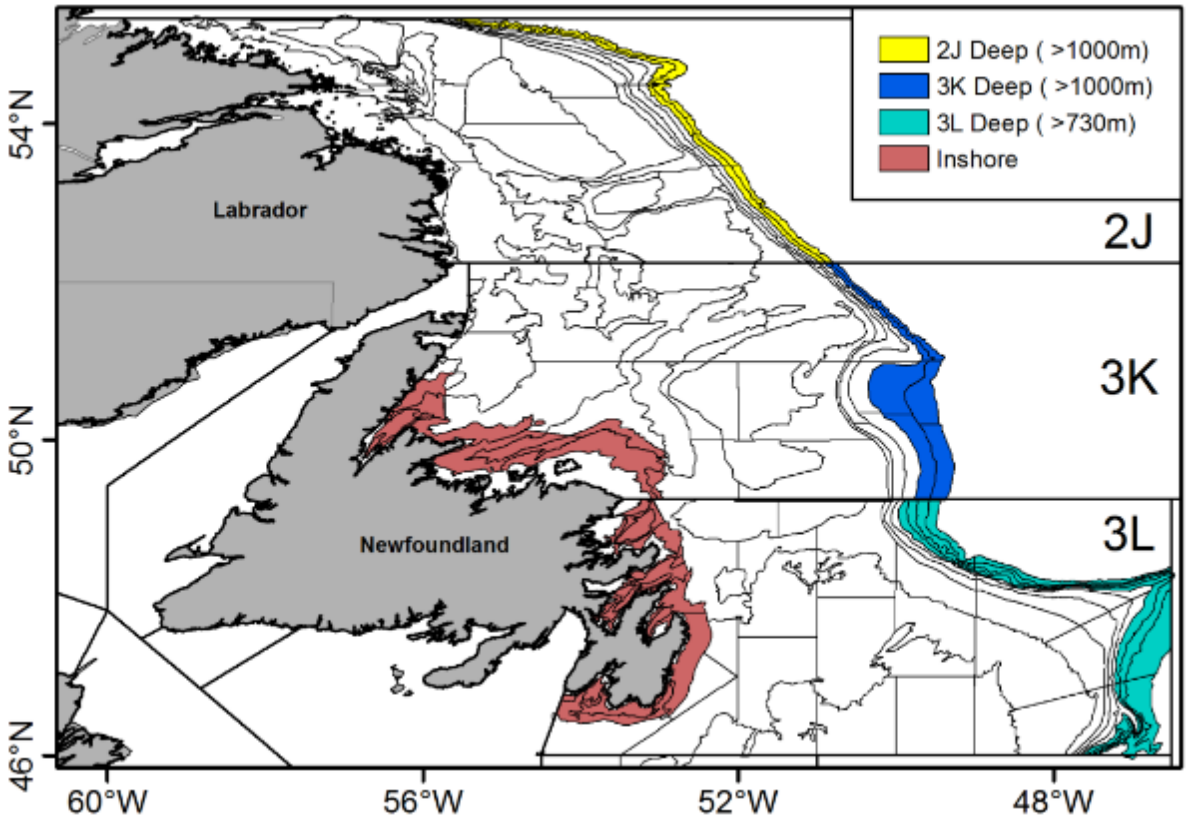


Figure 6: Stratification scheme for the fall RV survey in Divs. 2J+3KL.

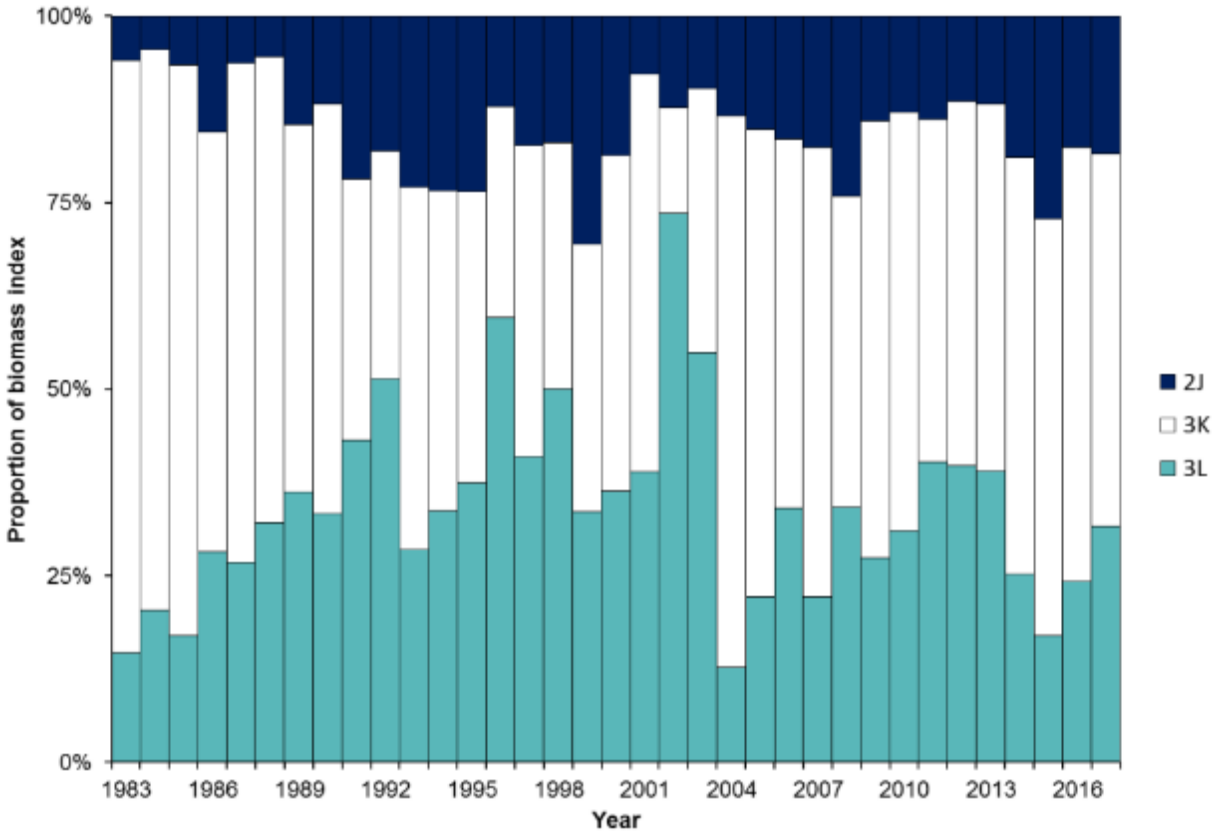


Figure 7: Proportion of Witch Flounder biomass index from annual fall DFO RV surveys by NAFO division.

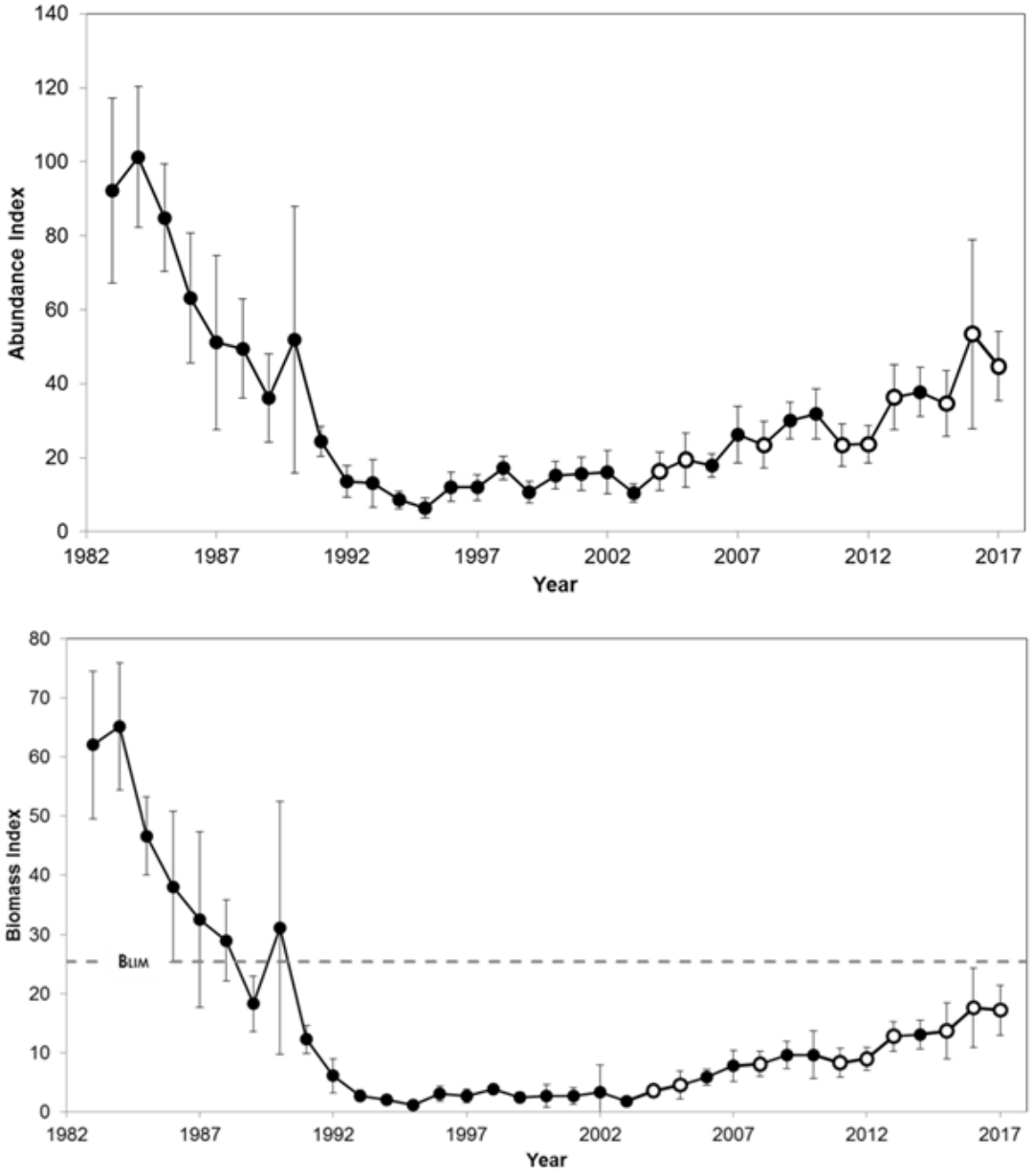


Figure 8: Abundance (top) and Biomass (bottom) indices from annual fall DFO RV survey in NAFO divisions 2J3KL. Values are in Campelen equivalent units 1983-95, and Campelen units from 1996-2017. Open circles indicate years where of 3L deep was not covered by the fall survey. Dashed line indicates the LRP at 40% BMSY.

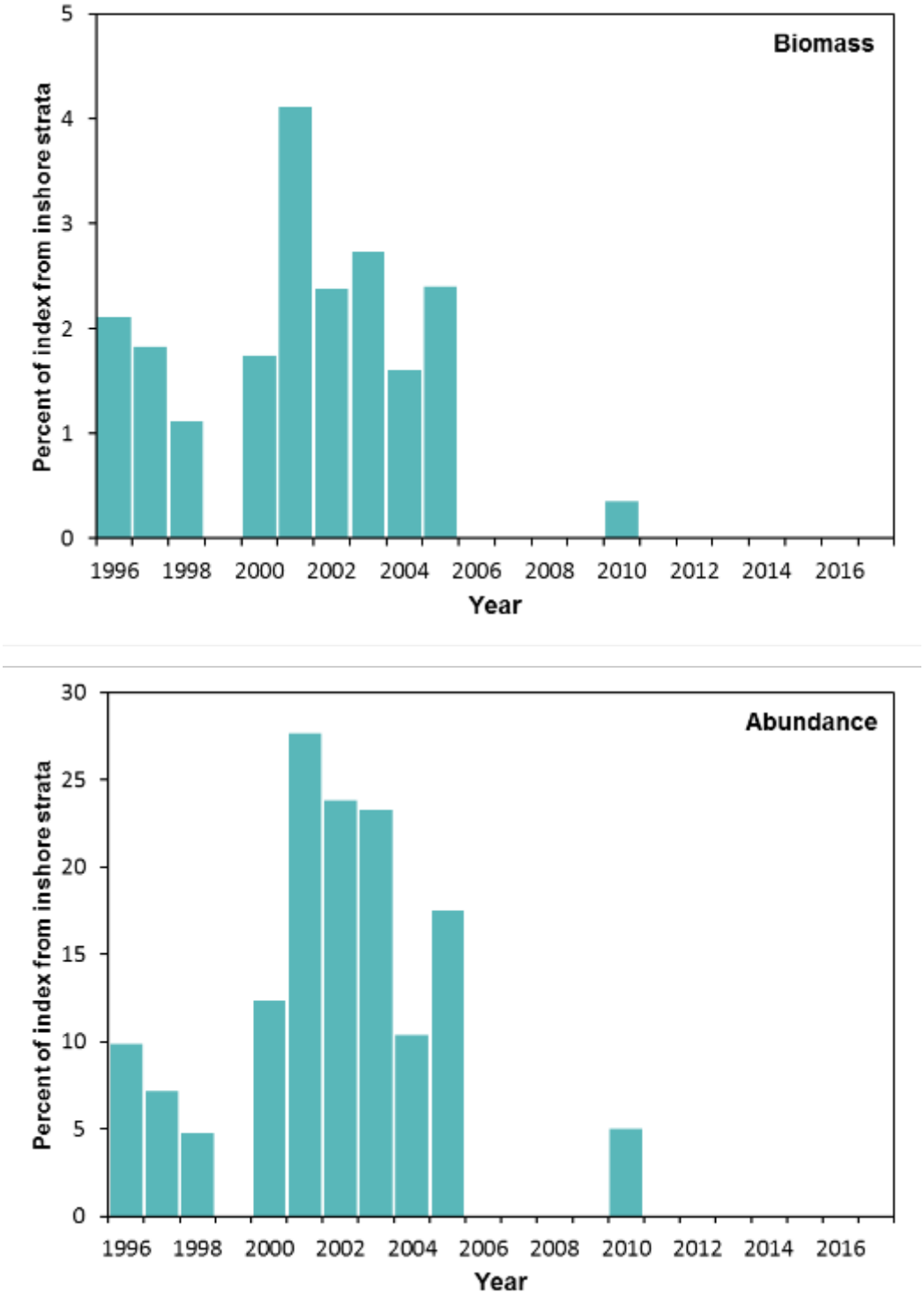


Figure 9: Proportion of the survey biomass (top) and abundance (bottom) indices that have been located in inshore strata since their introduction in 1996 (years with 0% were not covered in the survey).

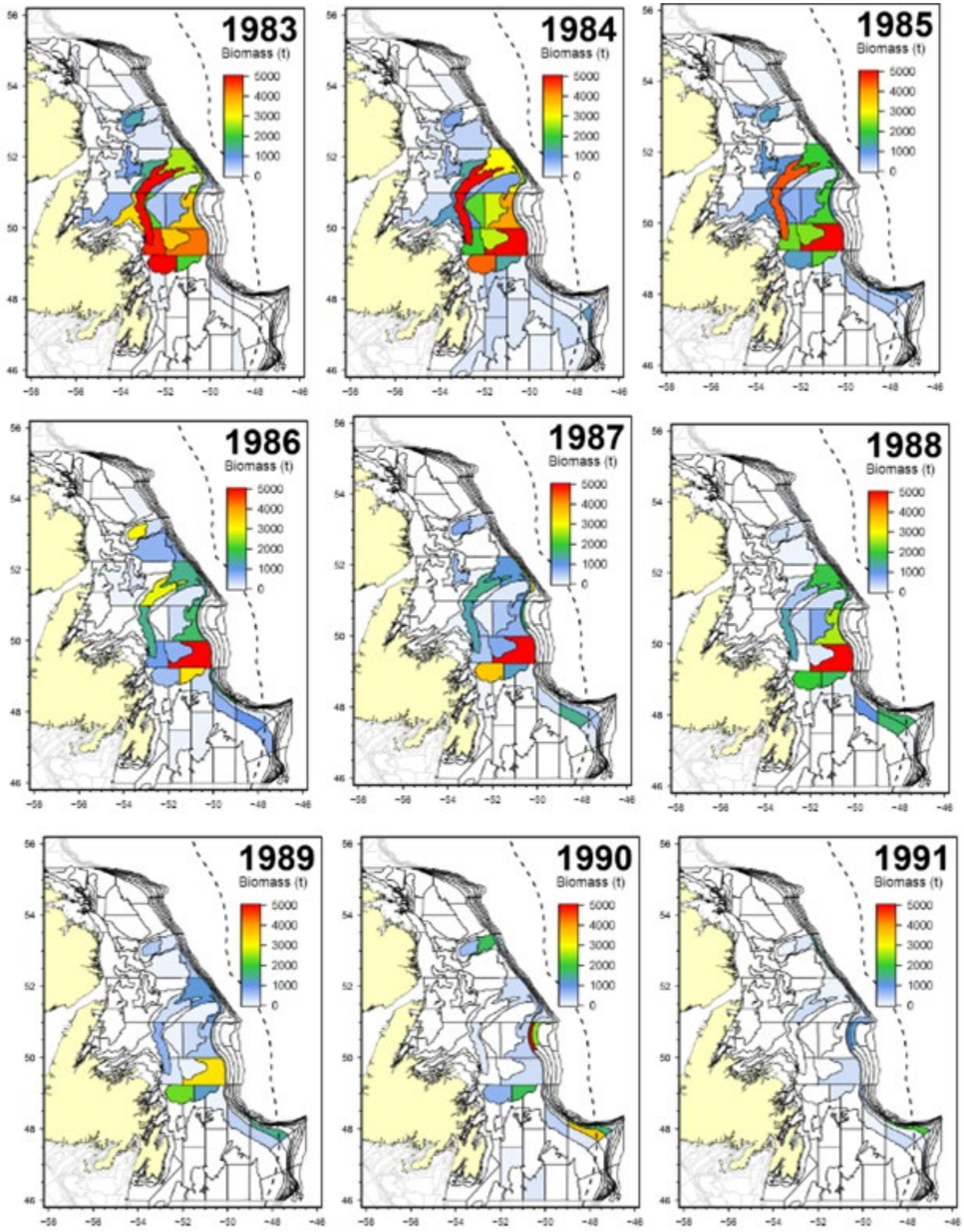


Figure 10: Distribution of Witch Flounder biomass by survey strata from DFO fall RV surveys 1983-91.

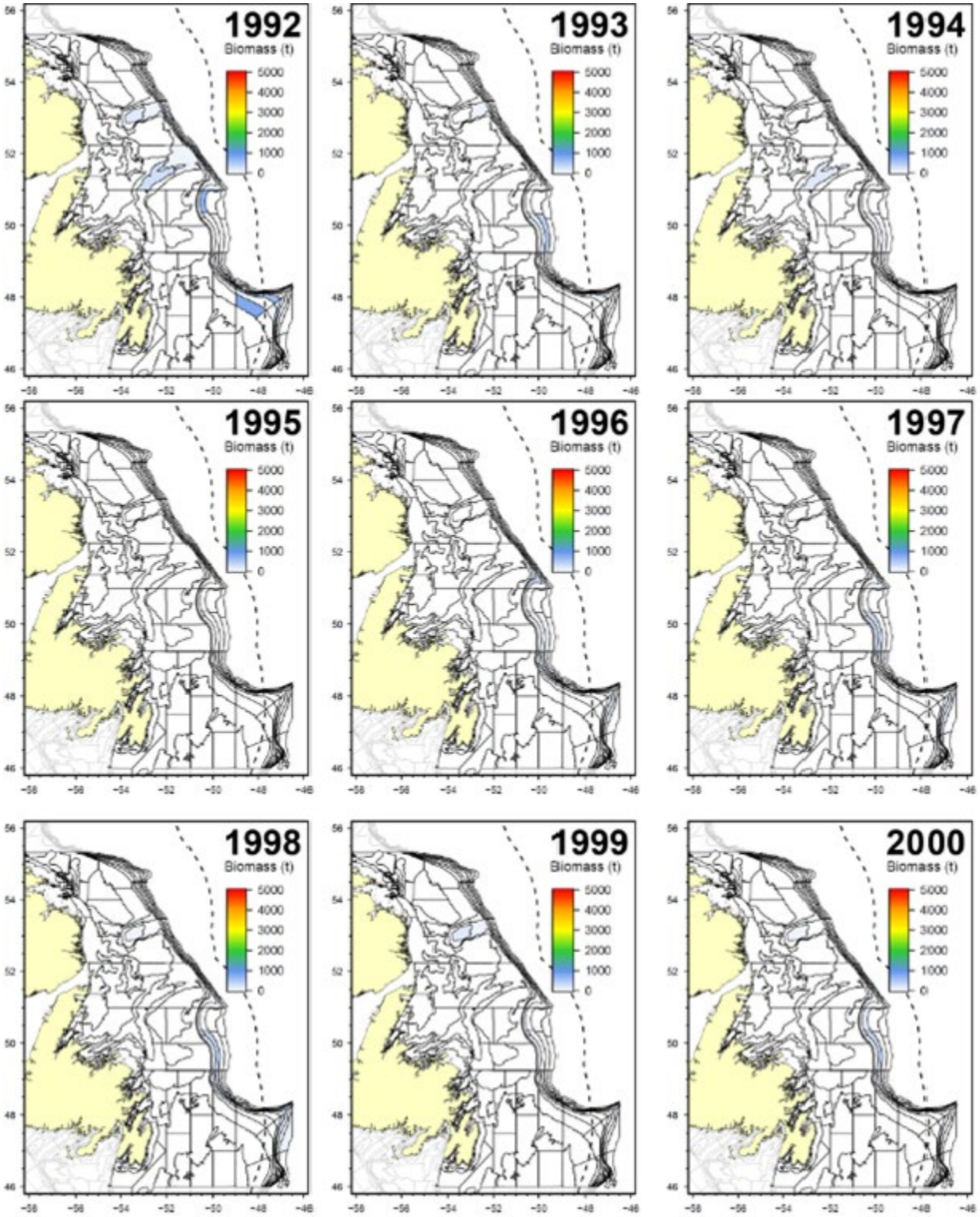


Figure 11: Distribution of Witch Flounder biomass by survey strata from DFO fall RV surveys 1992-2000.

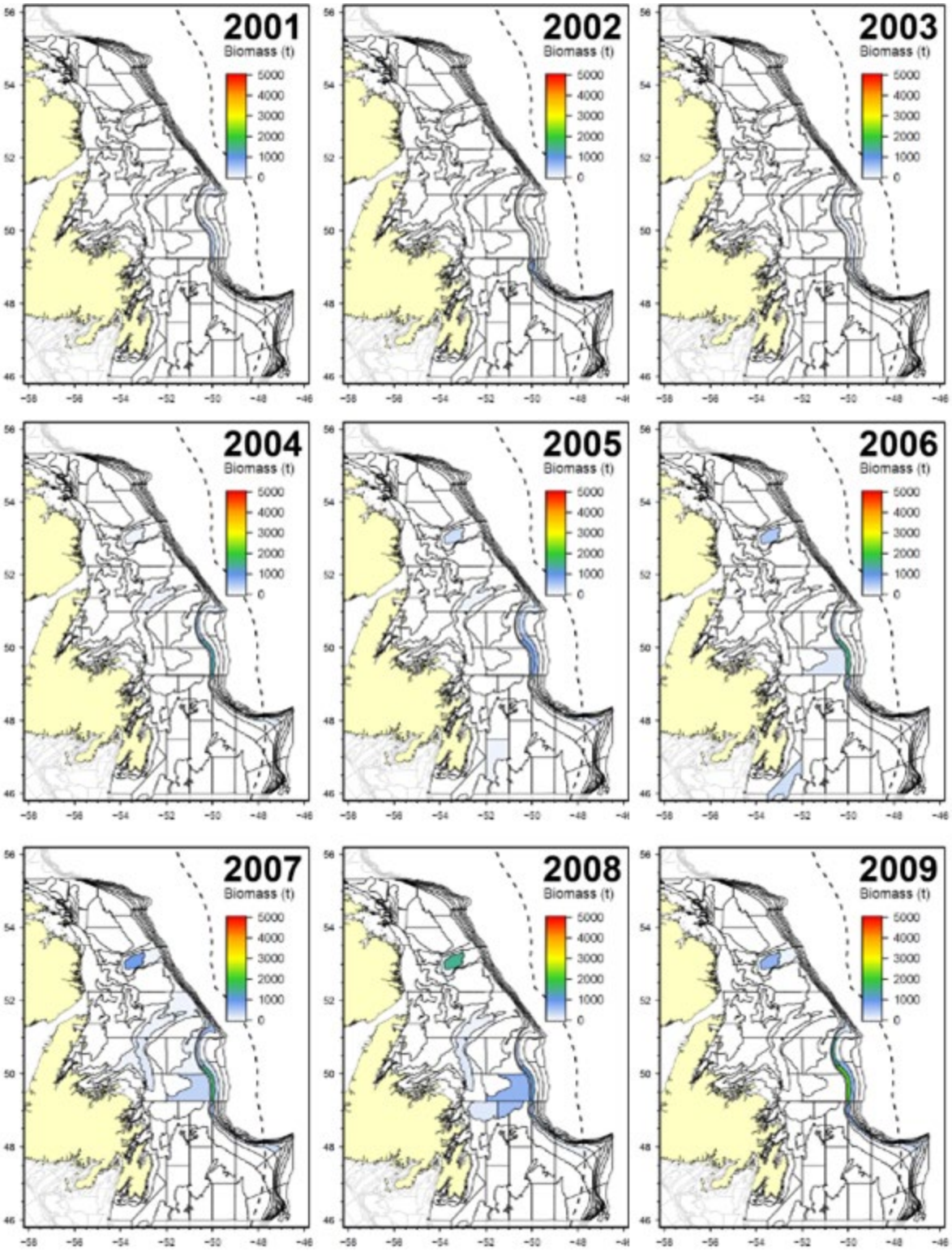


Figure 12: Distribution of Witch Flounder biomass by survey strata from DFO fall RV surveys 2001-09.

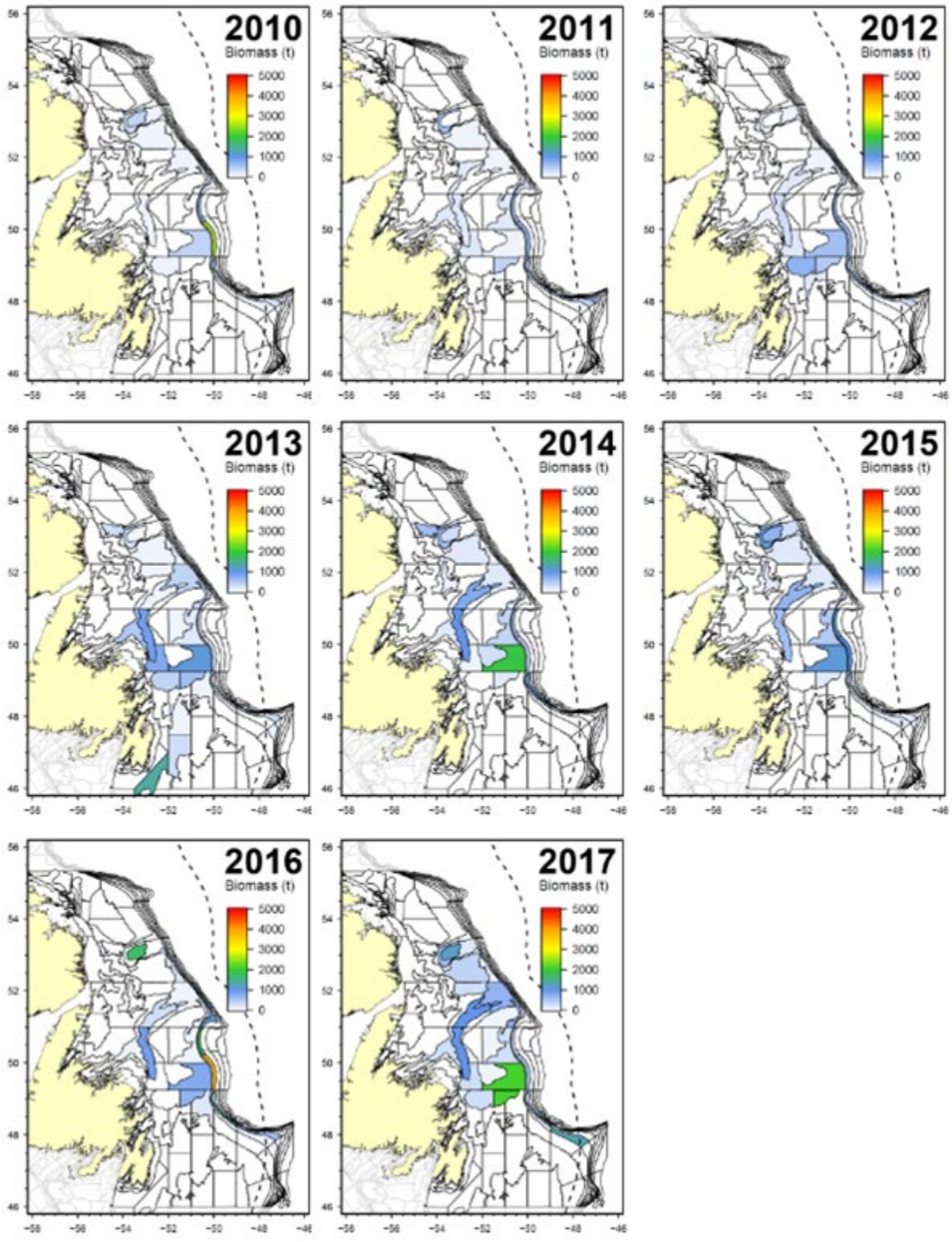


Figure 13: Distribution of Witch Flounder biomass by survey strata from DFO fall RV surveys 2010-17.

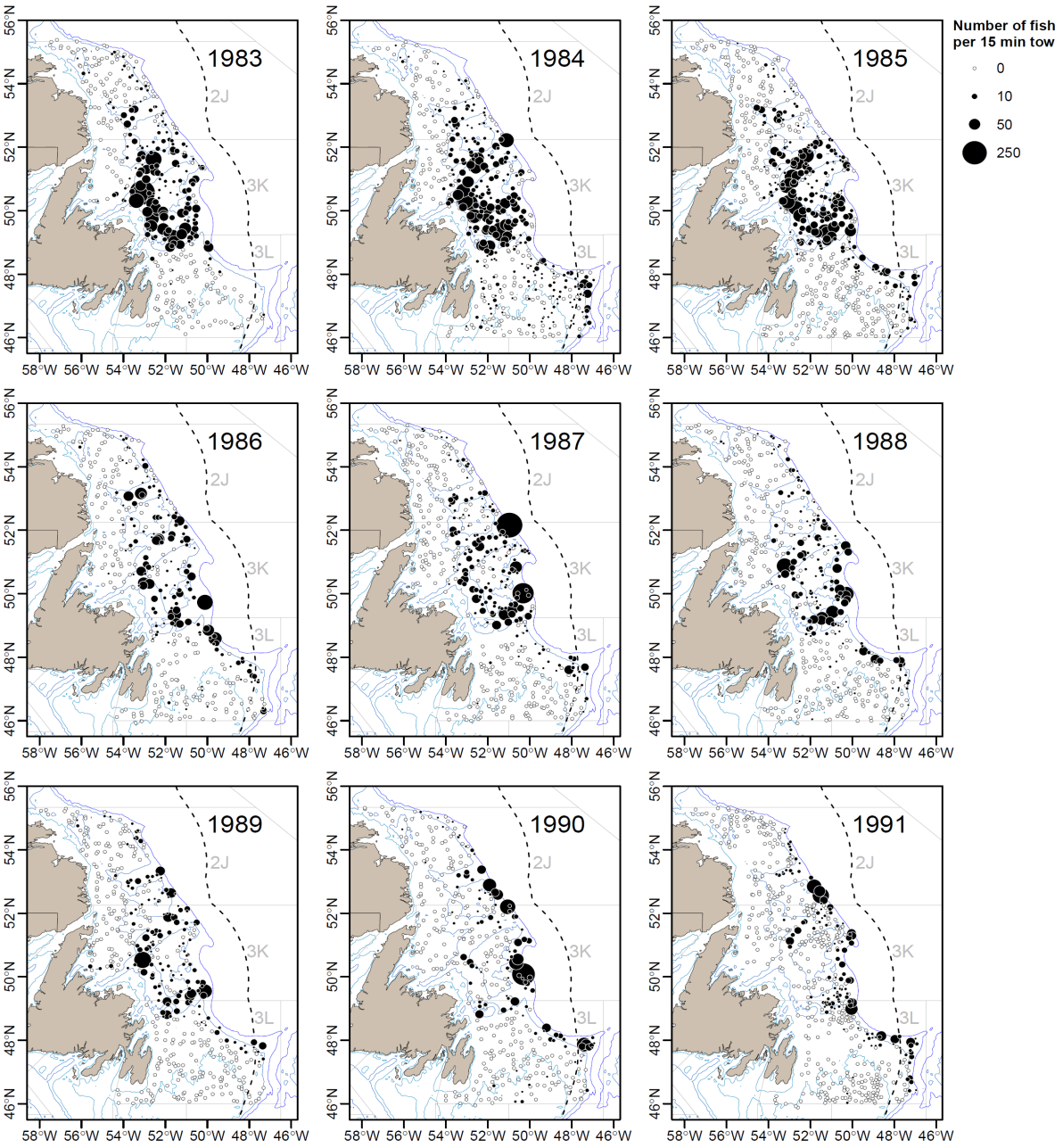


Figure 14: Set-by-set distribution of Witch Flounder catch by abundance (numbers) from DFO fall RV surveys (1983-91).

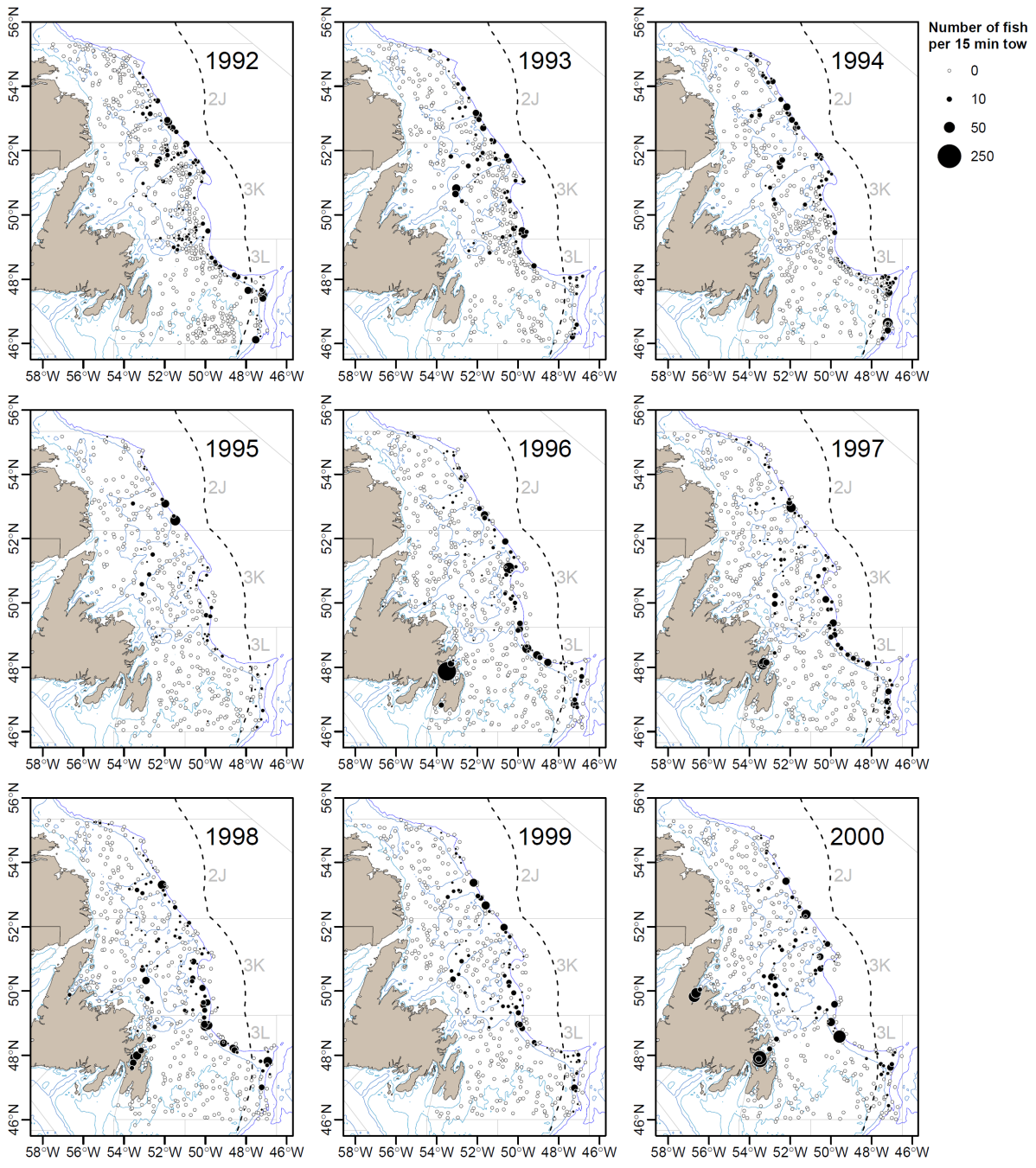


Figure 15: Set-by-set distribution of Witch Flounder catch by abundance (numbers) from DFO fall RV surveys (1992-2000).

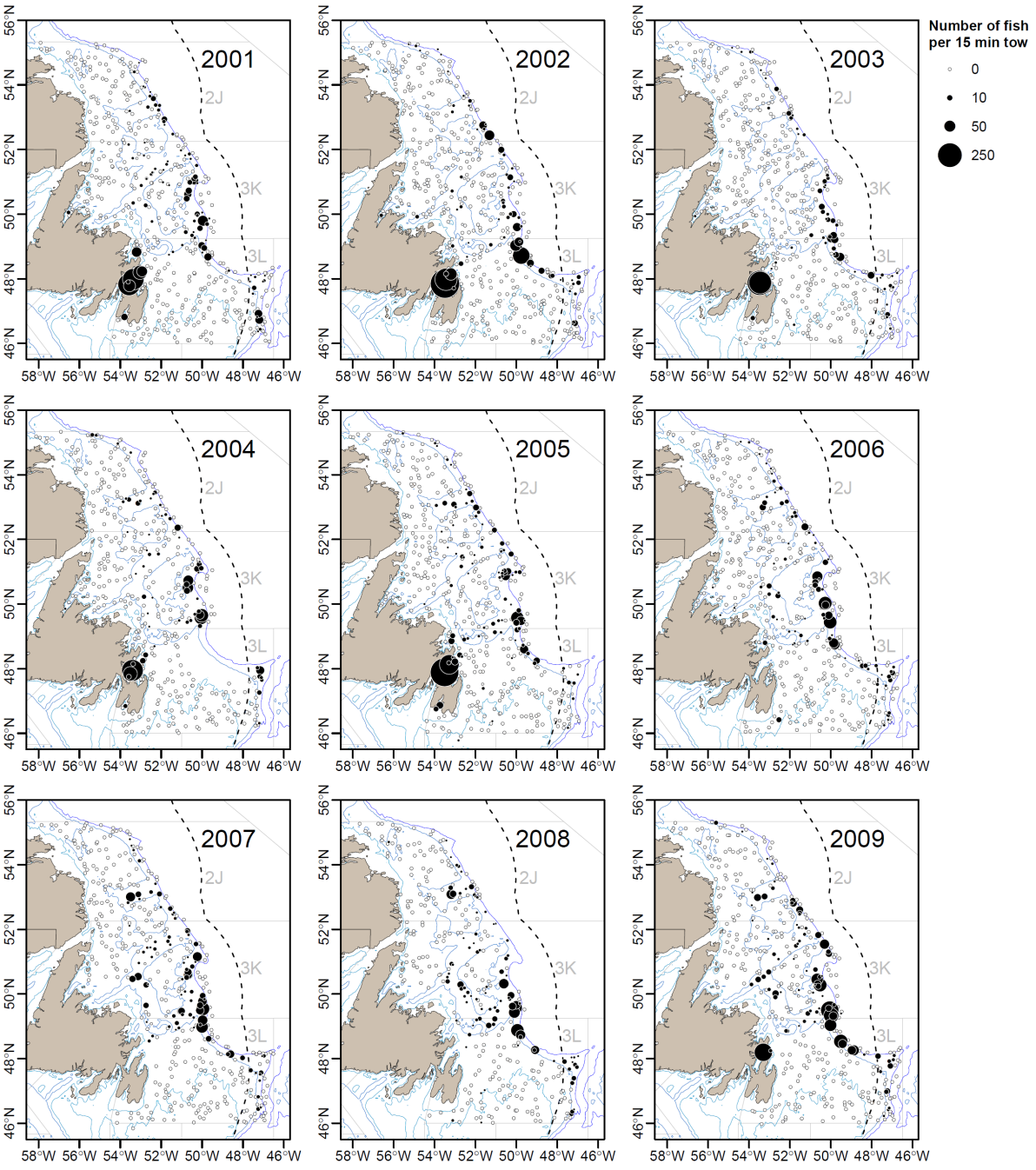


Figure 16: Set-by-set distribution of Witch Flounder catch by abundance (numbers) from DFO fall RV surveys (2001-09.)

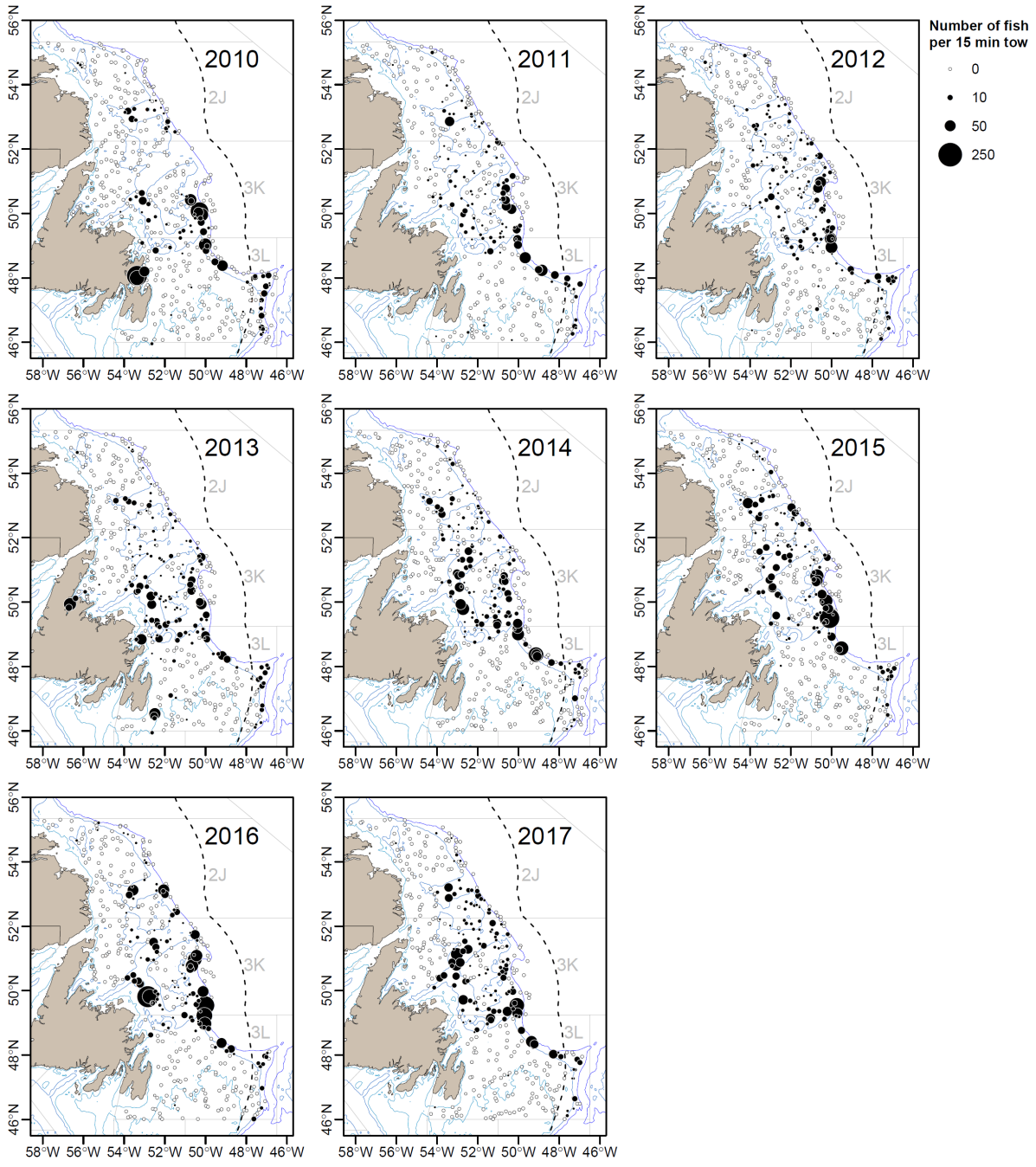
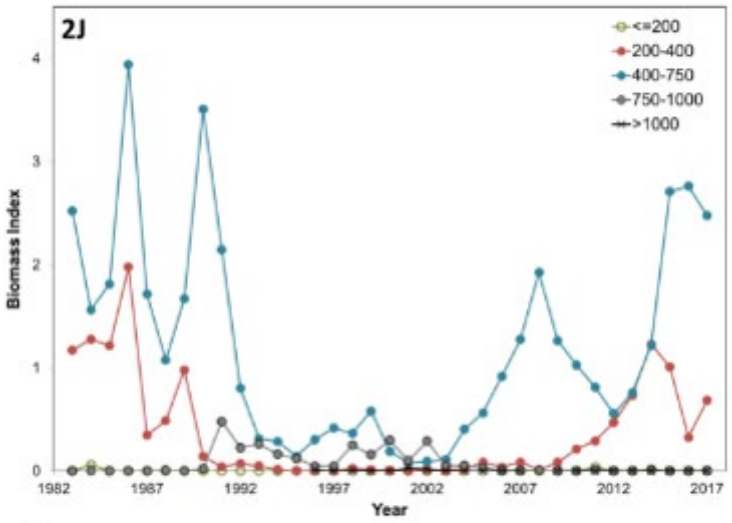
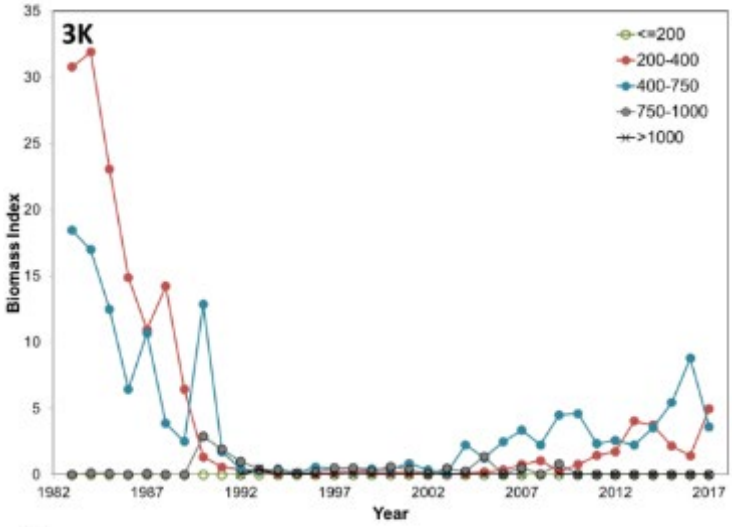


Figure 17: Set-by-set distribution of Witch Flounder catch by abundance (numbers) from DFO fall RV surveys (2010-17).


2J
<=200
200-400
400-750
750-1000
>1000
Biomass Index
Year
0
1
2
3
4
1982
1987
1992
1997
2002
2007
2012
2017


3K
<=200
200-400
400-750
750-1000
>1000
Biomass Index
Year
0
5
10
15
20
25
30
35
1982
1987
1992
1997
2002
2007
2012
2017

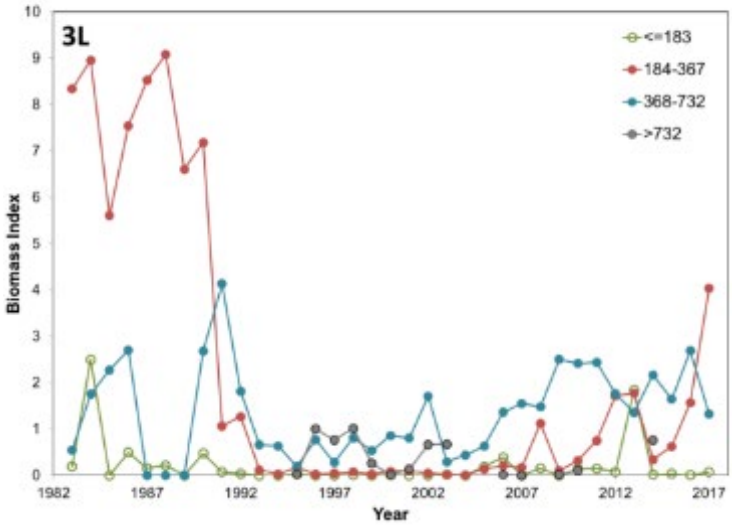

3L
<=183
184-367
368-732
>732
Biomass Index
Year
0
1
2
3
4
5
6
7
8
9
10
1982
1987
1992
1997
2002
2007
2012
2017

Figure 18. Survey biomass indices by depth grouping (2J/3K: ≤200m, 200-400m, 400-750m, 750-1000m, >1000m; 3L: ≤183m, 184-367m, 368-732m, >732m) per division from the RV surveys. Note that divisions are independently scaled.

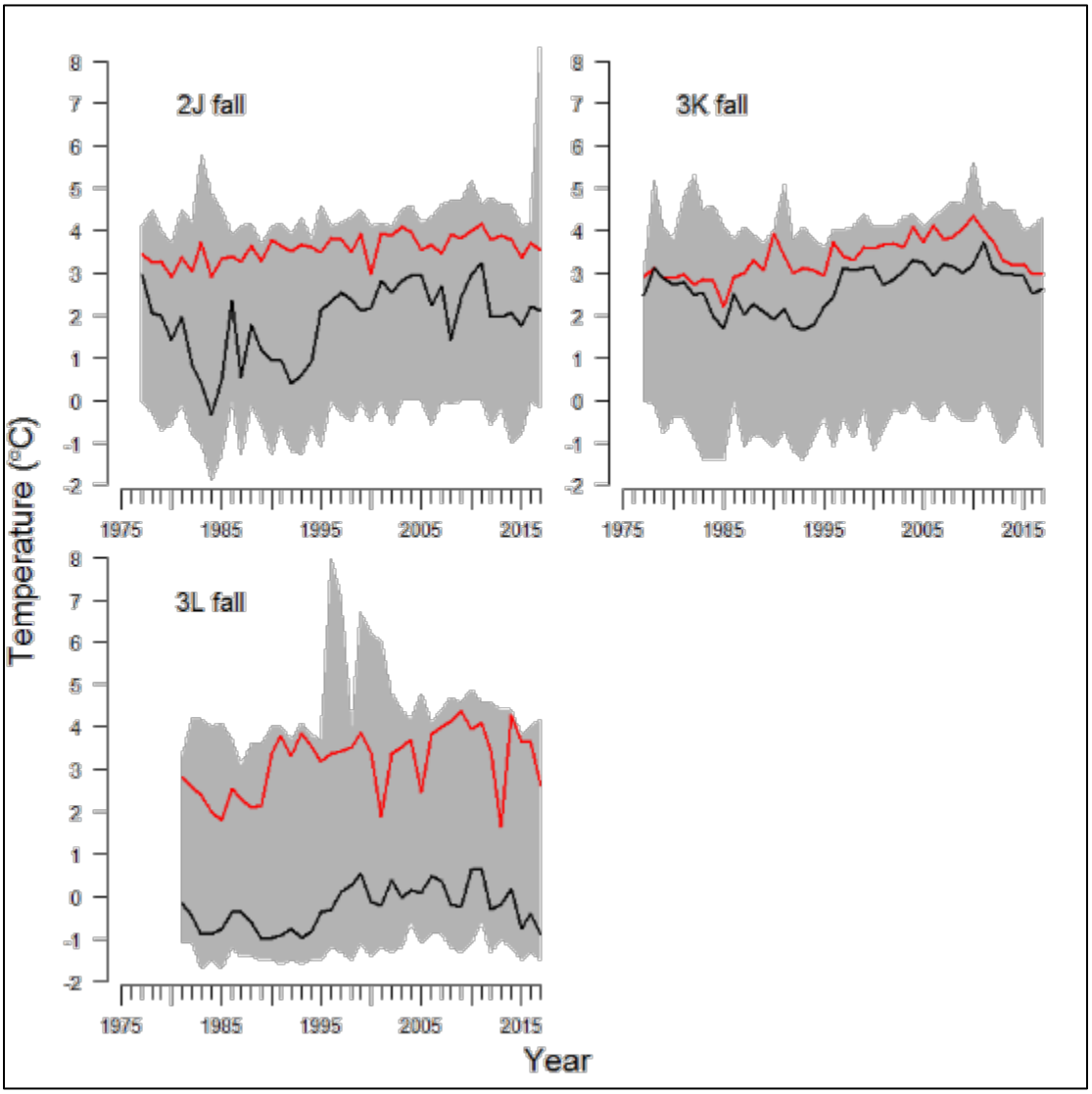


Figure 19: Temperature occupied (red) and available to (black) of Witch Flounder by NAFO division from Fall surveys. Grey areas indicate the 95% confidence interval of the available temperatures.

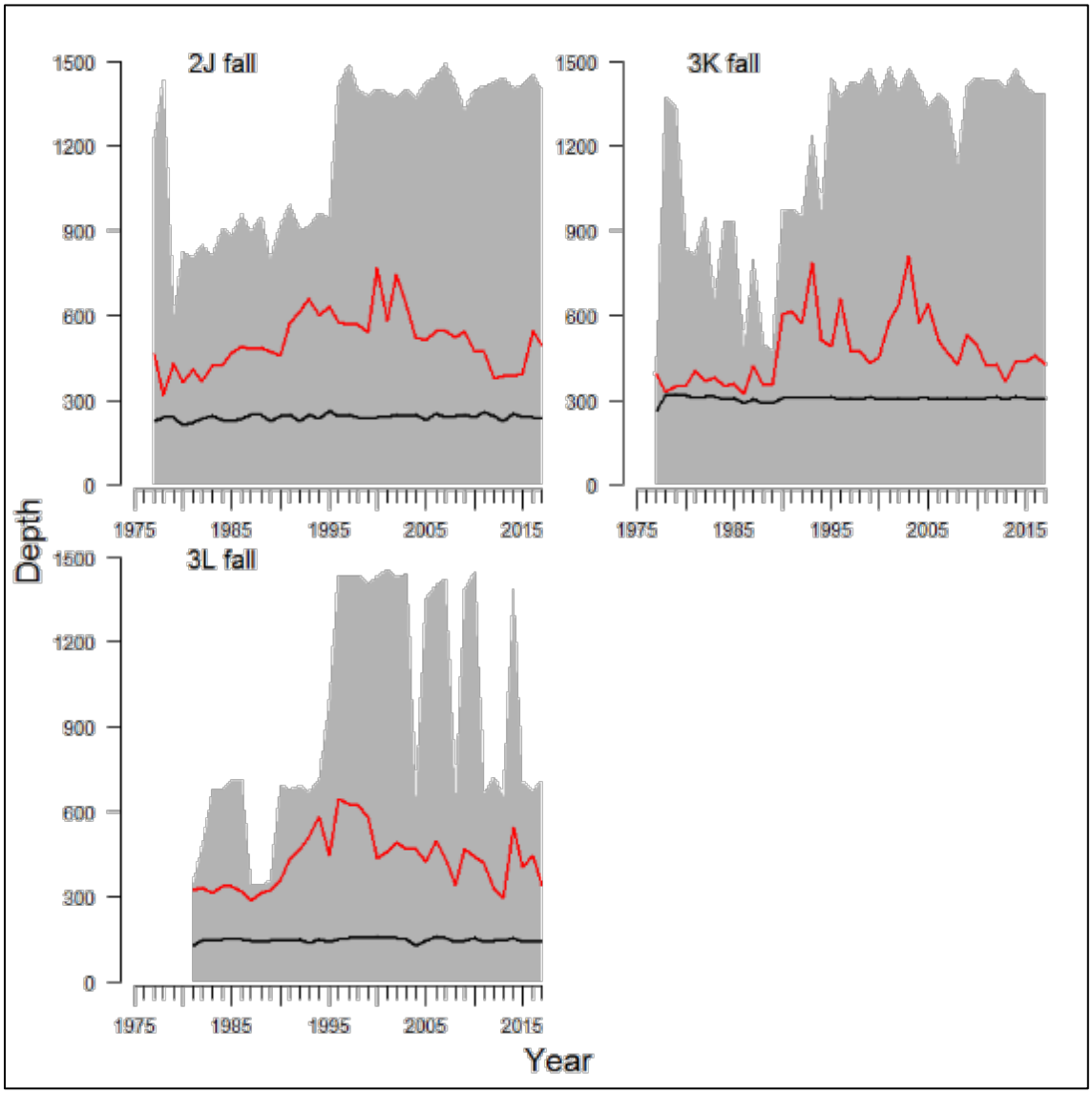


Figure 20: Depths occupied (red) and available to (black) of Witch Flounder by NAFO division from Fall surveys. Grey areas indicate confidence interval of the available depths.

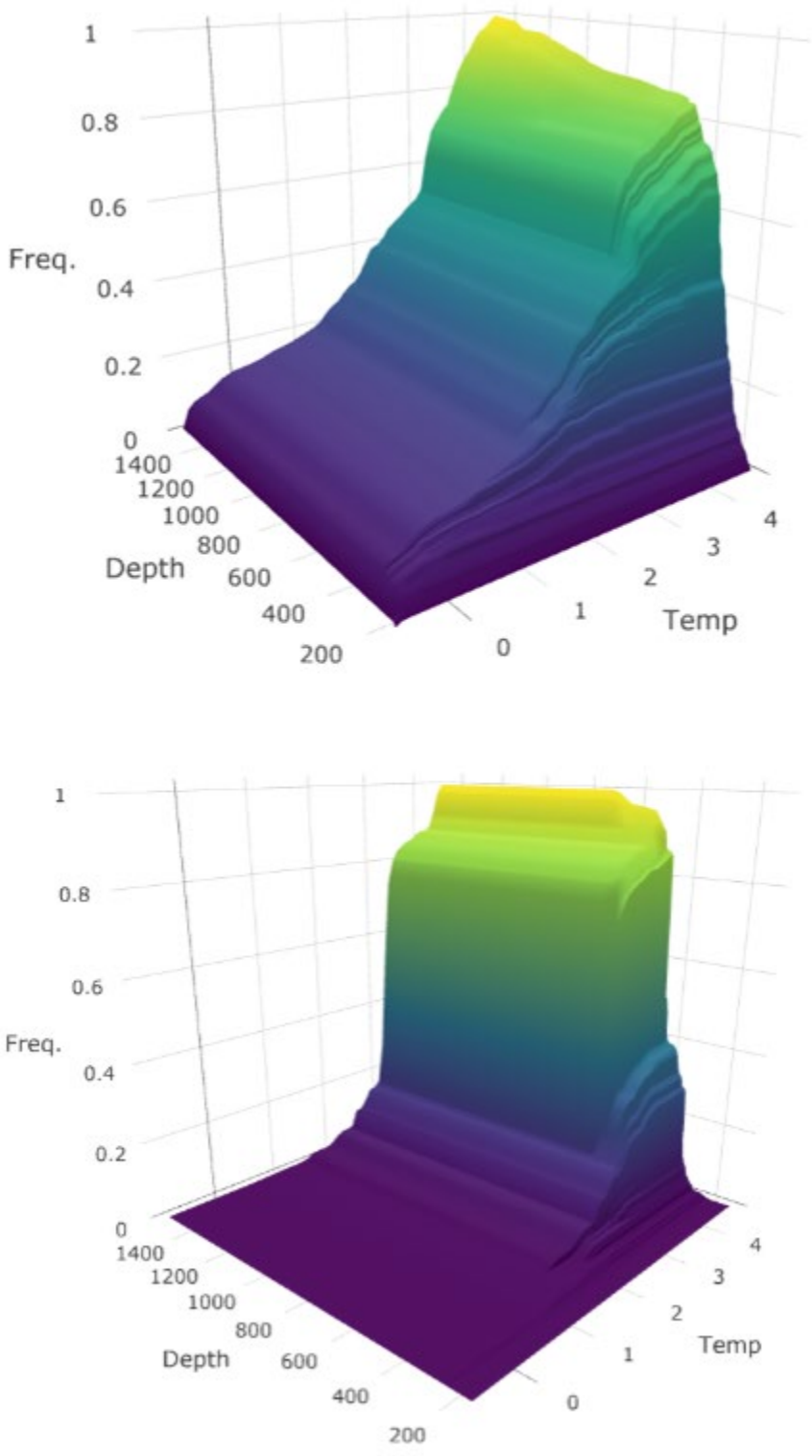


Figure 21: Bivariate (temperature and depth) surfaces of both available (top) and used (bottom) habitat.

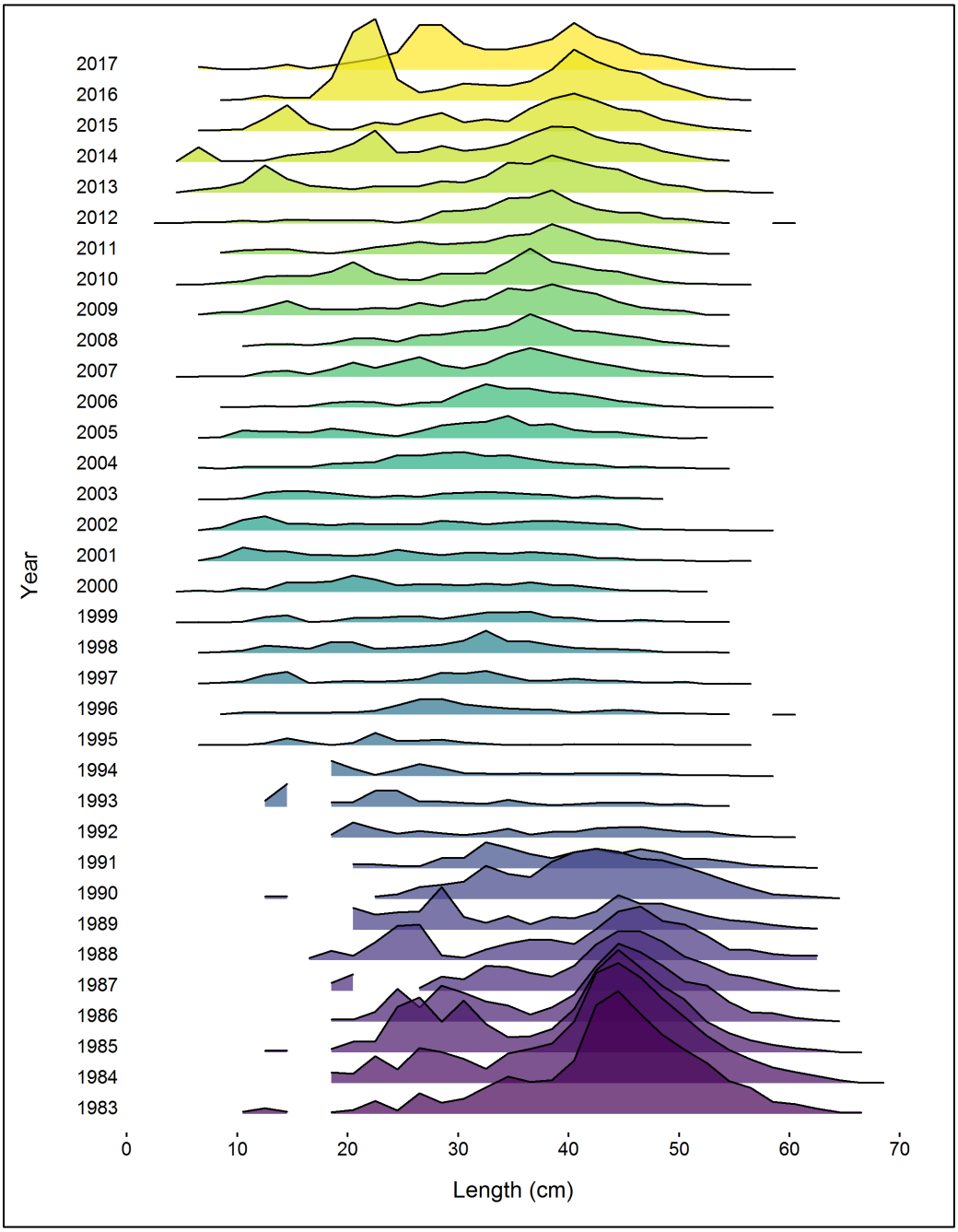


Figure 22: Abundance at length for Witch Flounder (male, female & unsexed) from the fall DFO RV survey (1984-2017).

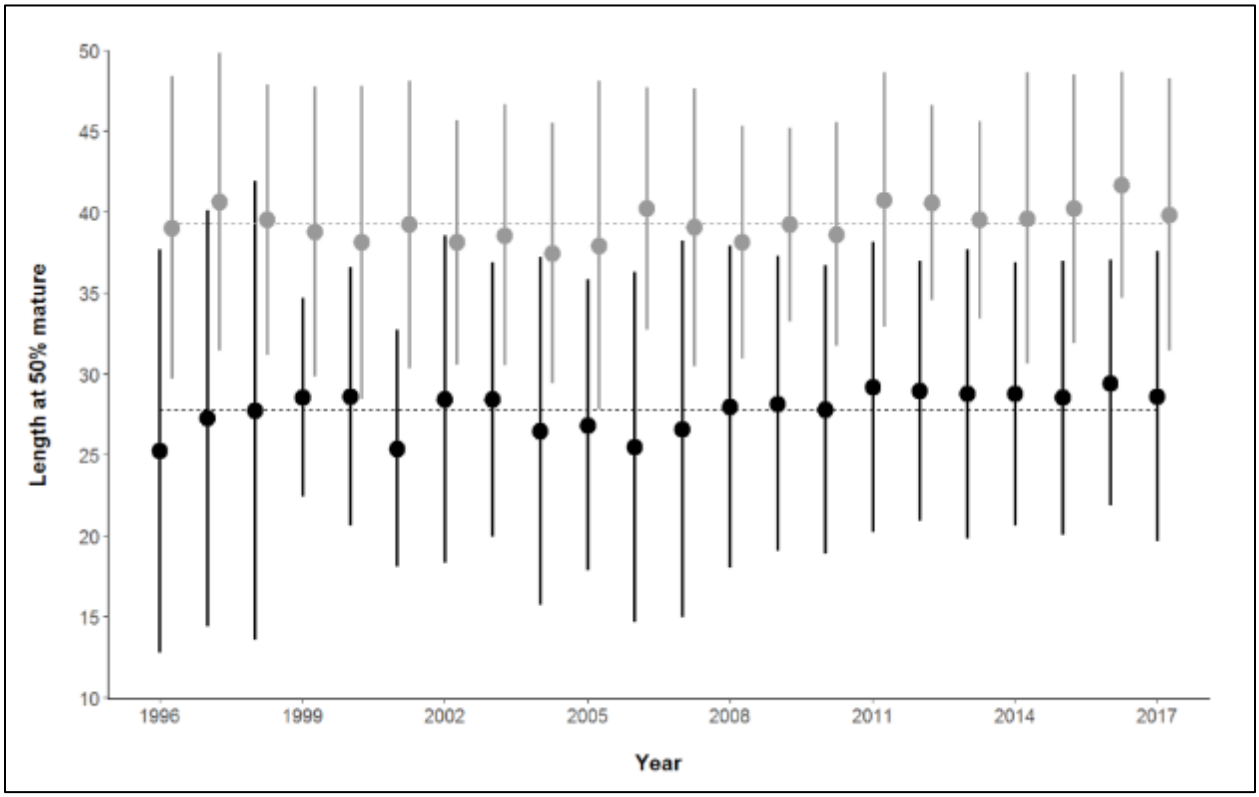


Figure 23: Length at 50% mature for male (black) and female (grey) Witch Flounder in NAFO division 2J3KL, as measured during the fall RV survey.

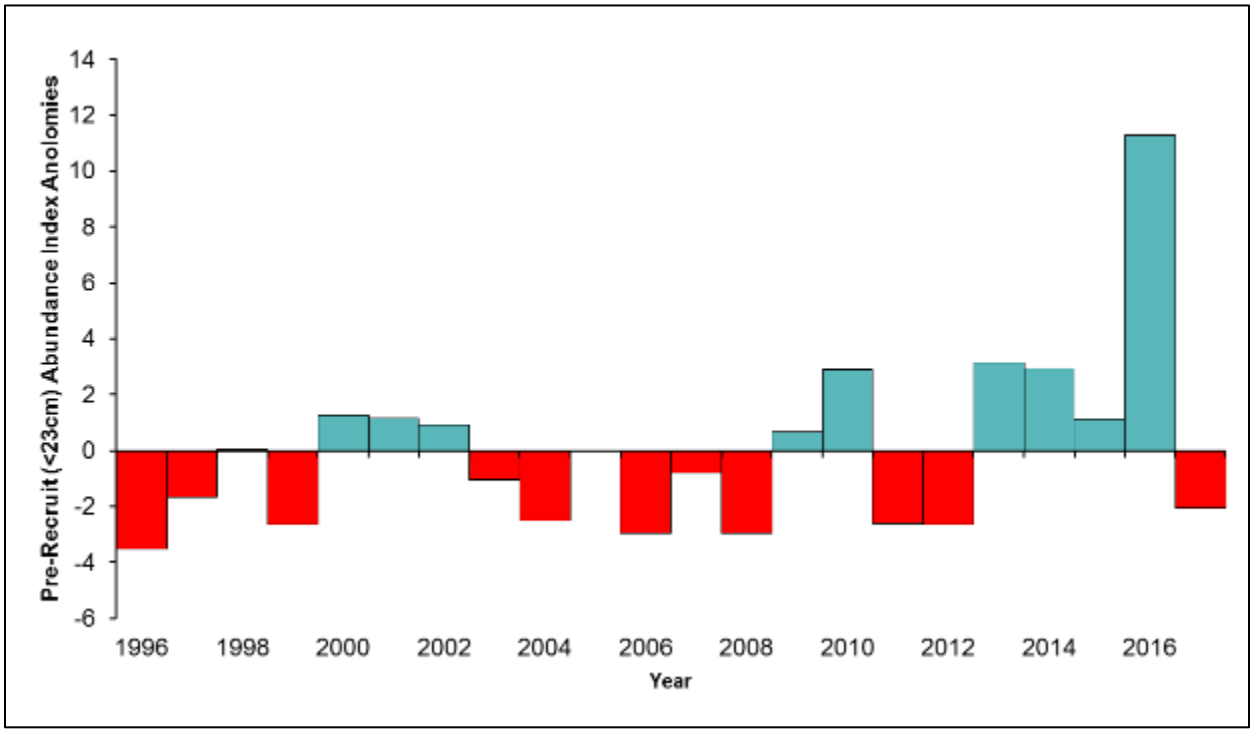


Figure 24: Anomalies (difference from long term mean) in pre-recruit (<23 cm) abundance from the fall RV survey.

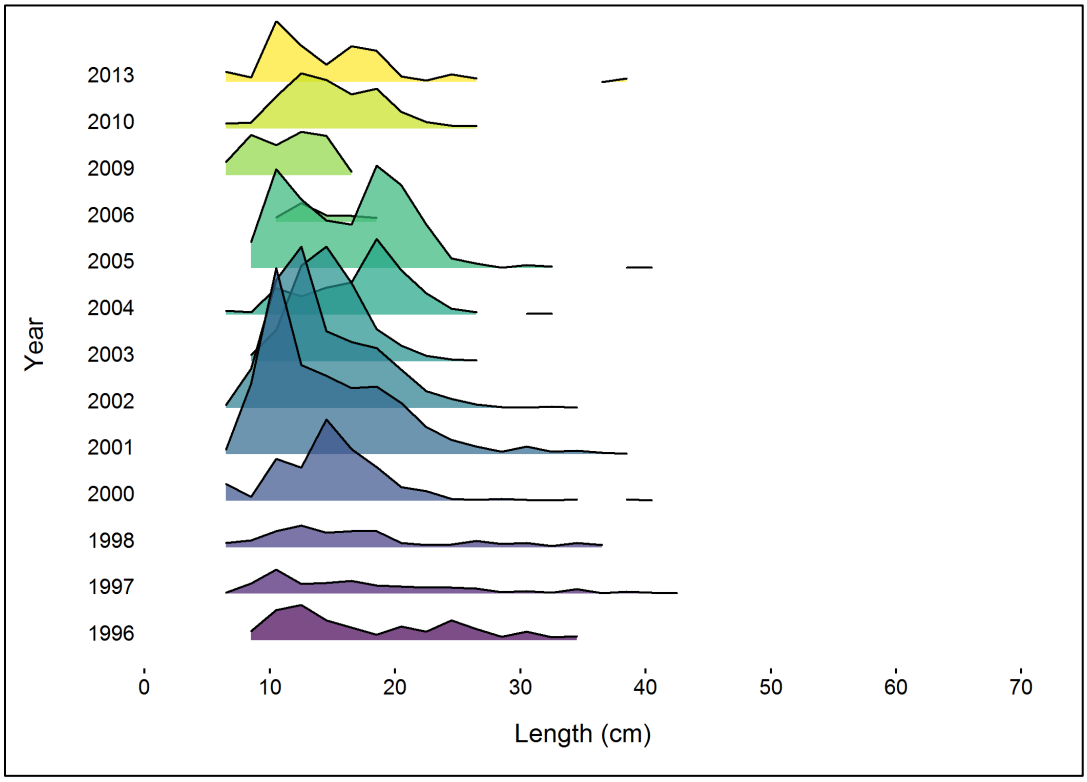


Figure 25: Abundance at length for Witch Flounder (male, female & unsexed) from inshore strata in the fall DFO RV survey, for years when some or all of these strata were covered, since their introduction to the survey in 1996.

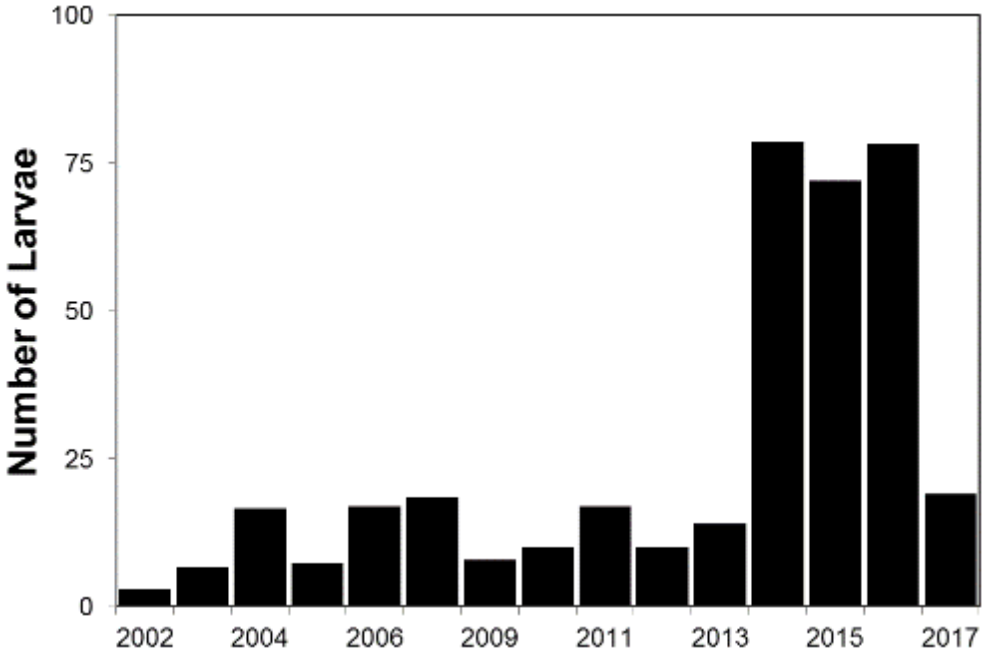


Figure 26: Total number of Witch Flounder larvae caught in surveys in Trinity Bay, 2002-17.

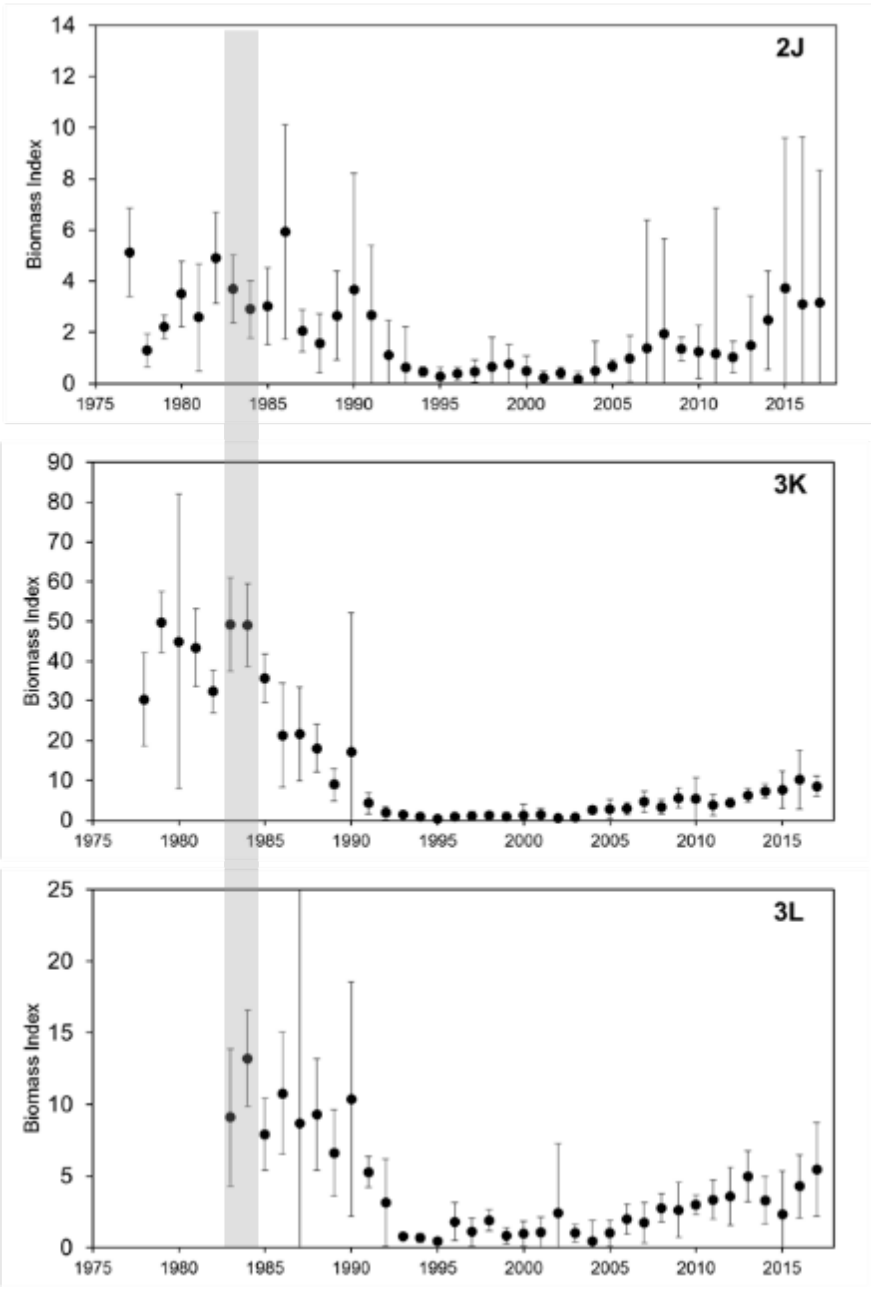


Figure 27. Survey biomass indices, by NAFO Division, since the start of the Campelen equivalent series in Divs. 2J (1977-2017), 3K (1978-2017), and 3L (1983-2017). Grey bars indicate the 1983-84 period from which the LRP was defined.