# 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

This document presents information considered at the May 2022 regional peer review of Witch Flounder (*Glyptocephalus cynoglossus)* in Northwest Atlantic Fisheries Organization (NAFO) Divisions (Div.) 2J3KL. Information available to evaluate stock status consisted of commercial landings data (1960–2021) and information from Canadian fall Research Vessel (RV) trawl surveys (1977–2021). 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 abundance and biomass since the early-2000s, and indices indicate improved recruitment in recent years. In 2020 there is an 82% probability that the stock is below the Limit Reference Point (LRP), with biomass index at 89% of the LRP. Stock status in 2021 could not be determined as the RV survey in this year was incomplete.

# INTRODUCTION

Witch Flounder (*Glyptocephalus cynoglossus*) is a deepwater species of 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. This document presents information considered at the May 2022 regional peer review of Witch Founder in NAFO Div. 2J3KL.

# ECOSYSTEM CONTEXT

## PHYSICAL OCEANOGRAPHY

The Newfoundland and Labrador (NL) shelf and the Northwest Atlantic ocean climate experience important fluctuations at decadal time scales (Figure 1). These climate variations can have impacts on ecosystem productivity. For example, the groundfish collapse in 1990–91 and more recent declines (~2015 – 17) were associated with cold periods, while the modest stock improvement between the mid-2000s to mid-2010s were observed in generally warm periods. The NL Climate Index (Cyr and Galbraith 2021) is used to compile various aspects of the ocean climate (e.g., sea ice, air and water temperature, etc.). Since 2018 a warming trend has been observed, with 2021 being among the warmest years on record (tied with 1966 and 2010) with a value of +1.3 standard deviation (SD) above the 1991–2020 average for the NL climate index (Figure 1) (Cyr et al. 2022).

Bottom temperatures in Div. 2J3KL are influenced by cold water originating from the north and advected via the Labrador Current system. Temperature fluctuates on decadal time scales (Figure 2), generally mirroring the harshness of the previous winter conditions. While the mid-1980s to mid-1990s were relatively cold, this period was followed by a warming trend that peaked in 2010–11. Recorded bottom temperature in 2021 was the second warmest of this time series which began in 1980, however as Div. 3LNO was not sampled in 2021 this year is a partial index.

## BIOLOGICAL OCEANOGRAPHY

Satellite observations of ocean colour indicated that mean spring bloom initiation timing has gradually shifted from earlier than normal during the mid-2010s, to later than normal in 2021. During the same period, changes in the copepod community composition characterized by a decrease in the abundance of small *Pseudocalanus* spp. and an increase in the abundance of large, energy-rich *Calanus finmarchicus* resulted in an overall increase in total zooplankton biomass with potential positive impact on energy transfer to upper trophic levels in the coming years (Bélanger et al. 2022).

## ECOSYSTEM STRUCTURE AND TRENDS

The NL bioregion can be described in terms of four Ecosystem Production Units (EPUs) which represent distinct, but still interconnected, functional ecosystems (NAFO 2014, 2015). The Witch Flounder stock expands over two of these EPUs; it inhabits the entirety of the Newfoundland Shelf (Div. 2J3K) EPU and the northern part (Div. 3L) of the Grand Bank (Div. 3LNO) EPU.

EPUs in the NL bioregion were subject to ecosystem overfishing at least from the 1960s to the 1980s (Koen-Alonso et al. 2022). This fishing pressure, in conjunction with the environmental changes indicated above, led to a regime shift in the early 1990s (Buren et al. 2014). This

regime shift changed the structure of these ecosystems, with the collapse of the groundfish community and a key forage species Capelin *Mallotus villosus*, and significant increases in shellfish across ecosystems, and leading to a shellfish-dominated community structure on the Newfoundland Shelf (Div. 2J3K) EPU. These increases in shellfish did not compensate for the loss of groundfish biomass (Koen-Alonso and Cuff 2018).

Consistent signals of groundfish rebuilding and a return to a groundfish-dominated community started in the mid-2000s, coinciding with modest improvements in Capelin and the beginning of the shellfish decline. The finfish biomass plateaued in the early-2010s and showed declines in the mid-2010s, but recent years indicate improvements from the relative lows in 2016–17 (Figure 3). It is worth noticing that while the declines in the mid-2010s are clear at the EPU level in both the Newfoundland Shelf and Grand Bank EPUs (Koen-Alonso and Cuff 2018), the contributions from the northern part of the Grand Bank EPU provided some degree of buffering of this overall decline within the Div. 2J3KL Witch Flounder stock area (Figure 3). Within Div. 2J3KL, biomass trends for groundfish functional group mostly plateaued after the mid-2010s, with only plank-piscivores showing a clear decline signal during this period; however, the decline remains clear in functional groups containing forage species like planktivores and shellfish.

Overall, and despite the groundfish increases observed since the collapse in the 1990s, ecosystems in the NL bioregion remain at a low overall productivity state at the present time, likely linked to simultaneous reductions in Capelin and Shrimp *Pandalus spp*.

While overall ecosystem dynamics appear mostly driven by bottom-up mechanisms associated to the availability of key forage species like Capelin and Shrimp, Witch Flounder dynamics seem at least partially decoupled from this overarching trend. Witch Flounder followed the general decline pattern observed in medium to large groundfishes during the late-1980s and early-1990s, but has shown a steady increasing trend since the regime shift (Figure 4). This divergence could be related to Witch Flounder diet, which is dominated by benthic invertebrates like polychaetes and amphipods.

## FISHERY

## DESCRIPTION OF THE FISHERY

The directed fishery for Witch Flounder in NAFO Div. 2J3KL began in the early-1960s and increased steadily from <1,000 t prior to 1964 to a peak of nearly 24,000 t in 1973 (Table 1; Figure 5). TAC (Total allowable catch) regulation for this stock began in 1974 with a TAC of 22,000 t. Catches declined rapidly reaching 2,800 t by 1980, fluctuating between 3,000 and 4,500 t through to 1991, and declining further to 137 t in 1994. 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 1,400 m.

A moratorium on directed fishing was put in place within Canadian waters (within the 200 nautical miles Exclusive Economic Zone) in 1995, and extended to the NAFO Regulatory Area in 1998. There has been no directed fishing on this stock since. Landings from bycatch have remained low since the moratorium, and averaged 134 t across the last five years (2017–21).

Sampling (length measurements) of Witch Flounder landings occurs by at-sea observers and port sampling. Measured catches have generally ranged from 30–60 cm total length, with a

mode near 40 cm (Wheeland et al. 2019); however, measurements from commercial landings are limited in number and scope, and are not from directed effort for Witch Flounder. These are therefore not considered to be representative of the stock as a whole.

# RESEARCH VESSEL SURVEYS

Fall survey results are overviewed here, with details on indices of biomass and abundance by strata from 2010–21 provided in Table 2 through Table 9. Earlier parts of the series are detailed in Wheeland et al. (2019) and references therein.

## SURVEY DETAILS AND COVERAGE

Stratified-random research vessel surveys have been conducted in the fall in Div. 2J, 3K and 3L since 1977, 1978, and 1981 respectively. Until 1994, the surveys in Div. 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 Div. 2J3KL was changed to a Campelen 1800 shrimp trawl. Details of the stratified random trawl survey design and changes in gear are described in previous documents (see Lilly et al. 2005, 2006; Brodie 2005, Brodie and Stansbury 2007, Brattey et al. 2008).

Survey coverage within Div. 2J3KL has varied through the available time series. Surveys prior to 1996 covered only a part of the stock area; biomass and abundance estimates from the early part of the survey series are most likely underestimated. 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 (>1,000 m in Div. 2J, 3K; >730 m in Div. 3L) were introduced to the survey throughout Div. 2J3KL in 1996. Following a period of consistent coverage from 1996–2006 (1999 excluded), inshore strata have been largely incomplete each year to 2010, and are no longer allocated in the survey. Coverage of deep water in 3L has also been limited, with complete coverage of this area in just 4 years since 2004 (2007, 2009, 2010, 2014). In addition, the majority of deep strata (>750 m) in Div. 2J and 3K were also incomplete in 2008, 2018, 2019, and 2021. From 2019 through 2021 the fall survey was allocated at 70% (i.e., 70% of the typically planned survey sets were assigned, with set reductions applied proportionally by strata size though maintaining a minimum of 2 sets per strata). Further details of survey performance statistics, timing, and spatial coverage are summarized in Rideout et al. (2021) and references therein.

Despite coverage reductions, surveys up to and including 2020 are considered representative for this stock, though it is noted that changes in coverage add an as yet unquantified layer of uncertainty in indices presented here. Issues with the 2021 survey are detailed below:

## 2021 Fall Survey

The survey was incomplete in 2021 – missing all of Div. 3L and significant portions of Div. 3K – therefore total survey indices cannot be determined for this stock in the terminal year. The 2021 fall survey did not extend into Div. 3L. Due to vessel warp limitations (inability to fish >1,000 m) and survey reductions related to vessel availability, strata ≥1,000 m in Div. 2J and ≥750 m in Div. 3K were not sampled. Three strata shallower than 1000 m were also missed in Div. 3K (stratum 650, 400–500 m; and strata 646 and 651, 500–750 m) due to limited vessel availability. Deep strata have been shown previously to not have a significant impact on the recent indices for 2J3KL Witch Flounder (see Wheeland et al. 2019), therefore the index for Div 2J is considered to be representative. However, the index for Div. 3K is not considered representative, as the missed strata in the 400–750 m range have accounted for a variable and

significant amount of the survey biomass in Div. 3K (9–59%, average = 28%) and the total survey biomass index (4–33%, average = 15%) for this stock over 2010 – 20.

## DISTRIBUTION

The spatial distribution of Witch Flounder catch numbers per set in the RV fall survey from 2018 – 21 (Div 2J3K only in 2021) is presented in Figure 6, with distribution of catch weight per set showing a similar pattern. Earlier survey data can be found in previous reports (Bowering 1998, Maddock Parsons et al. 2016, Wheeland et al. 2019). Distributional data from surveys in Div. 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 index has increased in the last several years, a redistribution of the stock has been observed, with the stock once again spread across portions of the shelf and deeper channels, primarily in Div. 3K, in addition to the slope waters (Figure 7).

This contraction and subsequent redistribution of the stock is apparent in indices of area occupied. The design weighted area occupied (DWAO) was calculated following Busby et al. (2007).

For analyses of area occupied, inshore strata and 3L deep were excluded due to inconsistency in coverage. Changes in area occupied have mirrored trends in stock size, with contraction of areas associated with stock declines, and increasing area occupied with stock growth since the early-2000s (Figure 8).

Witch Flounder distribution has been shown to have a stronger association to temperature than depth in this stock (Wheeland et al. 2019), with average temperature occupied near 3.2–3.6°C, and depth used increasing towards the northern extent of the stock (median ~430 m in Div. 3L to ~510 m in Div. 2J). Very little Witch Flounder biomass is observed in the survey at depths <200 m or >1,000 m across Div. 2J3KL.

## BIOMASS AND ABUNDANCE INDICES

The survey biomass index (Figure 9) for this stock peaked in 1984 and then rapidly declined through the late-1980s and early-1990s, reaching a time series minimum in 1995 and remaining at a very low level to the early-2000s. Biomass indices for this stock have been increasing since 2003, and in 2020 were at the highest level since 1990. A total survey biomass index for Div. 2J3KL is unavailable for 2021 due to incomplete survey coverage; however, biomass indices by division, including partial indices for 2021, are presented in Figure 10. These indices for 2021 indicate a minimum survey biomass level and are used here to assess whether any significant change in stock status or trajectory to 2021 is evident. Biomass in Div. 2J in 2021 was lower than that observed in 2020, while there was an increase in Div. 3K from 2020–2021 despite missed strata in Div. 3K that have accounted for up to 10% of the survey biomass (range: <1%–10%, mean=4%) since 2010. Biomass in Div. 3L in unknown in 2021. However, considering available data in Div. 2J3K there is no evidence of a significant divergence from ongoing rebuilding trends to 2021 and total survey biomass in 2021 for Div. 2J3KL would be expected to be at or above the level observed in 2020.

The abundance index (Figure 11) for this stock have followed similar trends as the biomass indices. However, a lack of coverage of inshore strata since 2006 may have resulted in underestimates of stock abundance in these years, with up to 27.6% of the overall abundance index located in inshore strata, particularly in strata from Trinity Bay (Wheeland et al. 2019).

## Stock Status

A Limit Reference Point (LRP) within the DFO decision-making framework was set at the 2018 stock assessment for Witch Flounder in NAFO Div. 2J3KL, with a survey-based proxy for Bmsy (Biomass Maximum Sustainable Yield) based on the average survey biomass of 1983 and 1984 (DFO 2019). The LRP is set at 40% of this Bmsy proxy. In 2020 the stock was at 89% of the LRP (Figure 12), below the LRP with an 82% probability. The survey in 2021 was incomplete therefore stock status in that year cannot be determined. However, given the available information in Div. 2J and 3K, the stock is expected to be at or above the survey biomass level observed in 2020.

## MOVEMENT

A project was initiated in 2021 to track the movements of Witch Flounder in Div. 2J3KL. Acoustic transmitters (INNOVASEA V9) were attached externally to Witch Flounder captured by trawl outfit with a modified codend box specifically designed for flatfish capture and release (as in Albert and Vollen 2015). Surgical implantation of tags in Witch Flounder is restricted by their small body cavity. An external attachment method was used, and supported by recent research on tag retention, growth, and fish welfare (Runde et al. 2022). In 2021, 133 Witch Flounder in Div. 2J3KL were caught at fishing depths ranging from 278–516 m and released with transmitters (Figure 13). Tagged fish ranged in size from 31–55 cm. These transmitters have a battery life of approximately 18 months, therefore detections are possible into 2023. Results of this movement study are expected to be available for the next assessment of this stock.

## LENGTH COMPOSITION

Witch Flounder numbers at length from the 1983–2020 RV surveys are presented in Figure 14. At the beginning of the time series length distributions were generally bimodal with peaks near 26 cm and 45 cm, and ranged from approximately 10–70 cm. Coinciding with the period when the stock was at its lowest level, few fish over 40 cm were present in the survey catches from around 1992–2003.

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. Younger pulses of fish grow relatively quickly, tracking through the length frequencies year over year before joining the mode >30 cm. However, as Witch Flounder are considered to be a slow-growing, long-lived fish, data do not allow consistent tracking of individual cohorts through length frequencies beyond the entry of 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, and no age validation studies have been completed on Witch Flounder age reading methods. A research project is ongoing to validate aging for this species using bomb radiocarbon. Preliminary results suggest that whole otolith aging likely led to underestimation of Witch Flounder ages historically, but further work is needed to quantify any bias.

## MATURITY

Bootstrapped estimates of length at 50% mature (L50) were calculated based on maturity staging of catches from RV surveys from 1983–2020 (Figure 15). L50 values for both males and females declined from the start of the series to the late-1990s/early-2000s. Males have generally varied without trend; at or above average with lower variation from around 2008

through 2017, values were below average the last three years. Female L50 has been generally increasing since the mid-2000s. Males in this stock typically reach maturity nearly 10 cm smaller than females, with recent L50 near 39.5 cm for females, and males near 27.5 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

Improving the definition of the pre-recruit index used for this stock was identified as a research recommendation at the 2019 assessment (see DFO 2020). The previously defined pre-recruit index was based on the abundance of fish <23 cm in the survey, excluding inshore strata in years when they were sampled (Wheeland et al 2019). However, as discussed above, this length range includes multiple cohorts.

Options for a revised pre-recruit index were considered based on abundance at length which could act as a proxy for single incoming cohorts. A new pre-recruit index was defined at the youngest identified "cohort" approximated by modes in the length frequencies (10–18 cm) and a recruitment index (18–26 cm) covering the length frequency mode of sizes just prior to entering the fishery. At this time, the age represented by each of these length frequency modes/"cohorts" cannot be determined.

Pre-recruit and recruitment indices (Figure 16) suggest that since 2010, positive anomalies (i.e., difference from series mean) have been more frequent and of a larger magnitude than earlier in the time series, indicating improved recent recruitment.

## DIET

Diet composition of Witch Flounder in the fall RV survey is available since 2015. Witch Flounder diet is limited by their small gape size, with the vast majority of Witch Flounder diet recorded in the fall survey is composed of polychaete worms, with amphipods and other benthic invertebrates also contributing (Figure 17). This reliance on benthic invertebrates as their principal food source is likely contributing to a divergence in trends between Witch Flounder compared to many other finfish in Div. 2J3KL which are primarily driven by trends in Capelin and *Pandalus* Shrimps and main forage species (see ECOSYSTEM STRUCTURE AND TRENDS above).

## EXPLOITABLE BIOMASS

An index of exploitable biomass is defined for this stock as biomass of Witch Flounder >30 cm. This size range has been informed by Fisheries Management small fish protocol size limits, and an examination of commercial length frequencies. Annual fall RV Surveys of Div. 2J3KL result in stratified estimates of abundance at length in 2 cm intervals.

As no significant differences in weight-at-length in available RV survey data has been observed over time in this stock, all measurements of length and weight across the time series were pooled to calculate a length-weight regression to convert abundance at length to weight at length, as follows:

$$w_L = \alpha L^{\beta} \qquad (2.1)$$

Where $w_L$ is weight (kg) at length $L$ (cm). For Witch Flounder in Div. 2J3KL, parameters were estimated as follows: $\alpha = 1.212e^{-6}$, $\beta = 3.464$ (Figure 18) using the nos function in R version 4.1.0 (R Core Team 2021).

Biomass at length was then summed across exploitable sizes to obtain exploitable biomass ($B_{exploit}$), as follows:

$$\mathbf{B}_{exploit} = \textstyle\sum_{L \geq 30} \mathbf{A_L} \times \mathbf{w_L} = \textstyle\sum_{L \geq 30} \mathbf{A_L} \times \left( (\mathbf{1.212}\, e^{-6})\mathbf{L^{3.464}} \right) \tag{2.2}$$

Where L is the fish total length (cm), $A_L$ is the stratified estimate of survey abundance at length in 2 cm length bins, α and β are length weight regression parameters described above.

A three year weighted average of exploitable biomass was calculated with $B_{exploit}$ inversely weighted by the width of the 95% confidence intervals (CI) on estimates of total survey biomass. Variance on estimates of $B_{exploit}$ cannot currently be directly estimated, however there was no evidence that variance in total survey biomass estimates were being driven by particular length classes; CIs from total indices are therefore considered an applicable measure of variance on $B_{exploit}$ for index weighting. Exploitable biomass is calculated in kilograms using the length weight relationship above, and then scaled for presentation.

The weighted average exploitable biomass ($\overline{\mathbf{B}}_{exploit}$) in each year is therefore calculated as:

$$\overline{\mathbf{B}}_{exploit,y} = \frac{\sum_{y:(y-2)}\left( \mathbf{B}_{exploit,y} \times \frac{1}{CI_y} \right)}{\sum_{y:(y-2)}\left( \frac{1}{CI_y} \right)} \tag{2.3}$$

Where $CI$ is the width of the 95% confidence interval on the estimate of survey biomass in year $y$.

Trends in exploitable biomass reflect trends in total survey biomass. $\overline{\mathbf{B}}_{exploit}$ which has been increasing since the early-2000s (Figure 19).

## FISHING MORTALITY

Total fishing mortality cannot be estimated for this stock in the absence of a population model. However, a survey-based proxy for fishing mortality (F) has been calculated as:

$$F_y = \frac{landings_y}{\overline{\mathbf{B}}_{exploit,y}} \tag{3}$$

The proxy for fishing mortality peaked in 1995 and has been low since the early-2000s (Figure 20).

## CONCLUSION

This stock continues to show signs of rebuilding. Indices of biomass, abundance, and distribution have been increasing since the early-2000s, and recent recruitment levels have reached the highest in the time series (1995–2020). However, stock size remains well below historic levels, and survey biomass has been consistently below the LRP since 1991, with the stock remaining in the Critical Zone in 2020. Stock status in 2021 cannot be determined.

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# TABLES

*Table 1: Landings (t) of Witch Flounder in NAFO Div. 2J3KL from NAFO STATLANT 21A. The last 5 years (2017 – 21) are considered preliminary. "-" indicates no reported landings. "n/a" indicates years prior to TAC regulation.*

| Year | Canada | Estonia | Germany | Japan | Poland | Portugal | Russia | Spain | USSR | Other | Total | TAC |
|------|--------|---------|---------|-------|--------|----------|--------|-------|------|-------|-------|-----|
| 1960 | 40 | - | 267 | - | - | - | - | - | - | 47 | 354 | n/a |
| 1961 | 12 | - | 89 | - | - | - | - | - | - | 31 | 132 | n/a |
| 1962 | 29 | - | 27 | - | - | - | - | - | - | 22 | 78 | n/a |
| 1963 | 17 | - | 3 | - | 259 | - | - | - | 89 | 577 | 945 | n/a |
| 1964 | 103 | - | - | - | 752 | - | - | - | 164 | 25 | 1044 | n/a |
| 1965 | 41 | - | 29 | - | 1876 | - | - | - | 2056 | 58 | 4060 | n/a |
| 1966 | 187 | - | 1054 | - | 559 | - | - | - | 1868 | 29 | 3697 | n/a |
| 1967 | 901 | - | 332 | - | 926 | - | - | - | 1933 | 9 | 4101 | n/a |
| 1968 | 446 | - | 358 | - | 1990 | - | - | - | 7834 | 38 | 10666 | n/a |
| 1969 | 1355 | - | 546 | - | 957 | - | - | - | 9726 | 1 | 12585 | n/a |
| 1970 | 4020 | - | 508 | - | 3566 | - | - | - | 9934 | 2 | 18030 | n/a |
| 1971 | 8030 | - | 583 | 1 | 5404 | - | - | - | 2018 | 17 | 16053 | n/a |
| 1972 | 5520 | - | 654 | - | 4013 | - | - | - | 7016 | 225 | 17428 | n/a |
| 1973 | 3761 | - | 3675 | - | 11802 | 1235 | - | - | 2834 | 314 | 23621 | n/a |
| 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 |

| Year | Canada | Estonia | Germany | Japan | Poland | Portugal | Russia | Spain | USSR | Other | Total | TAC |
|------|--------|---------|---------|-------|--------|----------|--------|-------|------|-------|-------|-----|
| 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 |
| 2018 | 138 | - | - | 1 | - | 9 | 2 | 28 | - | - | 178 | 0 |
| 2019 | 34 | - | - | 4 | - | - | 1 | 17 | - | - | 56 | 0 |
| 2020 | 83 | 1 | - | 3 | - | 10 | 1 | 16 | - | - | 114 | 0 |
| 2021 | 151 | 2 | - | - | - | - | - | 29 | 0 | 0 | 182 | 0 |

*Table 2: Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV in NAFO Div 2J from 2010–21. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---------|----------------|------|------|------|------|------|------|------|------|------|------|------|------|
| 201 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 205 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 206 | 200 | 0 | 35 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 207 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 |
| 237 | 200 | 0 | n.s. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 238 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 |
| 202 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. |
| 209 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 165 | 116 |
| 213 | 300 | 0 | 49 | 0 | 0 | 47 | 9 | 0 | 8 | 0 | 0 | 75 | 0 |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 214 | 300 | 7 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 48 | 0 |
| 215 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| 228 | 300 | 105 | 150 | 77 | 131 | 264 | 298 | 0 | 459 | 250 | 114 | 1063 | 345 |
| 234 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 203 | 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 15 |
| 208 | 400 | 80 | 0 | 92 | 358 | 616 | 60 | 0 | 0 | 0 | 0 | 313 | 505 |
| 211 | 400 | 0 | 0 | 107 | 0 | 123 | 311 | 0 | 0 | 12 | 0 | 178 | 178 |
| 216 | 400 | 0 | 4 | 50 | 61 | 69 | 61 | 7 | 10 | 26 | 0 | 0 | 10 |
| 222 | 400 | 9 | 23 | 11 | 9 | 0 | 31 | 28 | 59 | 55 | 117 | 52 | 41 |
| 229 | 400 | 14 | 66 | 135 | 176 | 113 | 226 | 283 | 149 | 153 | 341 | 257 | 88 |
| 204 | 500 | 6 | 0 | 19 | 0 | 0 | 0 | 0 | 9 | 18 | 7 | 0 | 0 |
| 217 | 500 | 0 | 25 | 0 | 6 | 10 | 25 | 13 | 0 | 26 | 0 | 12 | 0 |
| 223 | 500 | 6 | 0 | 0 | 4 | 42 | 81 | 27 | 0 | 7 | 8 | 15 | 12 |
| 227 | 500 | 132 | 50 | 189 | 88 | 19 | 346 | 70 | 262 | 140 | 293 | 301 | 54 |
| 235 | 500 | 341 | 658 | 208 | 396 | 696 | 1180 | 36 | 612 | 181 | 172 | 283 | 362 |
| 240 | 500 | 48 | 6 | 29 | 47 | 48 | 320 | 176 | 150 | 253 | 78 | 74 | 47 |
| 212 | 750 | 467 | 74 | 75 | 193 | 382 | 722 | 1704 | 1296 | 1779 | 679 | 608 | 693 |
| 218 | 750 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 11 | 16 | 63 | 11 | 0 |
| 224 | 750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 47 | 112 | 0 | 0 |
| 230 | 750 | 13 | 0 | 25 | 12 | 20 | 28 | 685 | 104 | 328 | 1089 | 52 | 36 |
| 239 | 750 | 13 | 3 | 12 | 12 | 0 | 7 | 9 | 0 | 4 | 0 | 12 | 8 |
| 219 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 6 | 0 |
| 231 | 1000 | 0 | 10 | 0 | 0 | 5 | 0 | 0 | 5 | 11 | n.s. | 13 | 6 |
| 236 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 15 | 0 |
| 220 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. |
| 225 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. |
| 232 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 221 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. |
| 226 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. |
| 233 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |

*Table 3: Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV in NAFO Div. 3K from 2010–21. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 608 | 200 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 612 | 200 | 0 | n/a | n/a | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 616 | 200 | n.s. | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 618 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 619 | 200 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 609 | 300 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 611 | 300 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 615 | 300 | 0 | n/a | n/a | 1 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 620 | 300 | 0 | 85 | 43 | 27 | 0 | 5 | 0 | 2 | 0 | 0 | 0 | 50 |
| 621 | 300 | 0 | 29 | 50 | 36 | 5 | 7 | 2 | 1 | 2 | 6 | 51 | 240 |
| 624 | 300 | 0 | 0 | 31 | 110 | 29 | 17 | 0 | 328 | 19 | 0 | 135 | 53 |
| 632 | 300 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 634 | 300 | 15 | 0 | 67 | 21 | 33 | 59 | 0 | 154 | 27 | 0 | 220 | 410 |
| 635 | 300 | 0 | 93 | 4 | 57 | 68 | 0 | 0 | 4 | 46 | 0 | 126 | 120 |
| 636 | 300 | 1 | 28 | 82 | 193 | 37 | 0 | 25 | 135 | 70 | 6 | 692 | 1 |
| 637 | 300 | 9 | 4 | 0 | 98 | 329 | 0 | 2 | 144 | 1 | 5 | 719 | 884 |
| 610 | 400 | 2 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 614 | 400 | 0 | n/a | n/a | 5 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 617 | 400 | 14 | 0 | 38 | 27 | 43 | 4 | 11 | 29 | 5 | 5 | 25 | 21 |
| 623 | 400 | 0 | 7 | 122 | 35 | 0 | 0 | 2 | 0 | 0 | 0 | 10 | 335 |
| 625 | 400 | 0 | 201 | 7 | 61 | 36 | 16 | 7 | 88 | 73 | 4 | 14 | 369 |
| 626 | 400 | 21 | 219 | 144 | 559 | 271 | 47 | 134 | 335 | 158 | 75 | 516 | 469 |
| 628 | 400 | 7 | 210 | 251 | 813 | 128 | 13 | 52 | 306 | 668 | 1 | 519 | 92 |
| 629 | 400 | 0 | 55 | 57 | 57 | 123 | 151 | 7 | 168 | 181 |  | 91 | 29 |
| 630 | 400 | 3 | 11 | 16 | 52 | 40 | 20 | 13 | 92 | 61 | 14 | 7 | 28 |
| 633 | 400 | 200 | 109 | 126 | 473 | 222 | 231 | 149 | 742 | 379 | 373 | 639 | 427 |
| 638 | 400 | 438 | 192 | 657 | 1175 | 1961 | 1110 | 898 | 2138 | 652 | 2768 | 2801 | 7720 |
| 639 | 400 | 63 | 215 | 56 | 249 | 423 | 503 | 137 | 305 | 132 | 678 | 593 | 792 |
| 613 | 500 | 0 | n/a | n/a | 3 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 622 | 500 | 0 | 98 | 58 | 29 | 143 | 244 | 33 | 0 | 7 | 18 | 106 | 87 |
| 627 | 500 | 162 | 288 | 373 | 915 | 1083 | 678 | 935 | 1010 | 2133 | 356 | 1576 | 461 |
| 631 | 500 | 99 | 48 | 258 | 161 | 894 | 709 | 396 | 1031 | 399 | 67 | 325 | 502 |
| 640 | 500 | 170 | 26 | 55 | 77 | 173 | 274 | 114 | 128 | 215 | 225 | 349 | 217 |
| 645 | 500 | 228 | 82 | 234 | 254 | 108 | 216 | 517 | 59 | 186 | n.s. | 248 | 141 |
| 650 | 500 | 333 | 207 | 179 | 268 | 118 | 1004 |  | 498 | 1578 | 559 | 728 | n.s. |
| 641 | 750 | 740 | 511 | 730 | 223 | 506 | 1207 | 1776 | 274 | 1431 | 1438 | 464 | 711 |
| 646 | 750 | 184 | 372 | 108 | 51 | 39 | 70 | 1157 | 67 | 409 | n.s. | 1241 | n.s. |
| 651 | 750 | 2689 | 714 | 609 | 255 | 479 | 1056 | 3874 | 551 | 3992 | 1397 | 39 | n.s. |
| 642 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 647 | 1000 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 10 | n.s. |
| 652 | 1000 | 29 | 0 | 30 | 0 | 0 | 0 | 1 | 0 | n.s. | n.s. | 0 | 0 |
| 643 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 648 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 653 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 644 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 649 | 1500 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 654 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. | n.s. | 0 | n.s. |

*Table 4: Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV in NAFO Div. 3L from 2010–21. There was no survey coverage of Div. 3L in 2021. For 3L deep (>731 m) see next table. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 784 | 55 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 350 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 363 | 91 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 371 | 91 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 372 | 91 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 384 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 785 | 91 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 328 | 183 | 0 | 13 | 25 | 0 | 0 | 0 | 0 | 26 | 0 | 33 | 0 | n.s. |
| 341 | 183 | 89 | 66 | 1 | 1411 | 1 | 35 | 0 | 0 | 115 | 24 | 0 | n.s. |
| 342 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | n.s. |
| 343 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 348 | 183 | 0 | 0 | 0 | 120 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | n.s. |
| 349 | 183 | 32 | 37 | 0 | 311 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | n.s. |
| 364 | 183 | 14 | 1 | 36 | 0 | 0 | 1 | 0 | 48 | 0 | 0 | 0 | n.s. |
| 365 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | 141 | n.s. |
| 370 | 183 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 385 | 183 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 68 | n.s. |
| 390 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 786 | 183 | n.s. | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 787 | 183 | n.s. | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 788 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 790 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 793 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 794 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 797 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 799 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 344 | 274 | 0 | 1 | 0 | 11 | 0 | 6 | 49 | 0 | 22 | 35 | 466 | n.s. |
| 347 | 274 | 17 | 51 | 249 | 21 | 0 | 0 | 0 | 0 | 28 | 2 | 104 | n.s. |
| 366 | 274 | 19 | 51 | 36 | 154 | 32 | 0 | 280 | 0 | 115 | 1 | 269 | n.s. |
| 369 | 274 | 0 | 1 | 47 | 78 | 0 | 0 | 81 | 0 | 53 | 43 | 119 | n.s. |
| 386 | 274 | 0 | 42 | 3 | 71 | 4 | 0 | 0 | 0 | 0 | 0 | 113 | n.s. |
| 389 | 274 | 0 | 0 | 3 | 17 | 4 | 0 | 0 | 17 | 1 | 0 | 32 | n.s. |
| 391 | 274 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 15 | 2 | 38 | 0 | n.s. |
| 795 | 274 | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 345 | 366 | 160 | 78 | 751 | 492 | 21 | 20 | 46 | 354 | 1082 | 9 | 1336 | n.s. |
| 346 | 366 | 12 | 444 | 522 | 613 | 280 | 247 | 733 | 2146 | 1301 | 2493 | 2266 | n.s. |
| 368 | 366 | 0 | 2 | 47 | 102 | 0 | 0 | 64 | 38 | 45 | 166 | 39 | n.s. |
| 387 | 366 | 101 | 76 | 53 | 14 | 0 | 215 | 182 | 1394 | 321 | 1062 | 400 | n.s. |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 388 | 366 | 6 | 4 | 8 | 141 | 3 | 84 | 137 | 61 | 176 | 87 | 104 | n.s. |
| 392 | 366 | 1 | 0 | 0 | 11 | 0 | 48 | 0 | 12 | 9 | 1 | 7 | n.s. |
| 789 | 366 | n.s. | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 791 | 366 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 796 | 366 | 1 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 798 | 366 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 800 | 366 | 6 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 729 | 549 | 195 | 80 | 18 | 52 | 23 | 108 | 30 | 50 | 57 | 126 | 57 | n.s. |
| 731 | 549 | 92 | n.s. | 23 | 143 | 94 | 126 | 82 | 73 | 44 | 86 | 122 | n.s. |
| 733 | 549 | 226 | 436 | 399 | 383 | 97 | 104 | 660 | 0 | 61 | 307 | 660 | n.s. |
| 735 | 549 | 298 | 539 | 754 | 232 | 823 | 248 | 1367 | 897 | 350 | 298 | 293 | n.s. |
| 792 | 549 | 25 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 730 | 731 | 68 | 47 | 59 | 70 | 2 | 0 | 39 | 0 | 10 | 83 | 10 | n.s. |
| 732 | 731 | 336 | 138 | 74 | 91 | 220 | 212 | 59 | 138 | 59 | 174 | 39 | n.s. |
| 734 | 731 | 219 | 653 | 49 | 64 | 70 | 0 | 41 | 19 | n.s. | 5 | 0 | n.s. |
| 736 | 731 | 956 | 548 | 387 | 319 | 840 | 850 | 411 | 145 | 214 | 537 | 257 | n.s. |

Table 5: Biomass estimates (tons) of Witch Flounder by stratum for DFO fall RV in the deep portion (>731 m) of NAFO Div. 3L from 2010–21. There was no survey coverage of Div. 3L in 2021. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 737 | 914 | 80 | n.s. | n.s. | n.s. | 530 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 741 | 914 | 0 | n.s. | n.s. | n.s. | 218 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 745 | 914 | 22 | n.s. | n.s. | n.s. | 12 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 748 | 914 | 5 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 738 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 742 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 746 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 749 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 739 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 743 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 747 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 750 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 740 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 744 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 751 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

*Table 6: Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys in NAFO Div. 2J from 2010–21. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 201 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 205 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 548 | 0 | 0 |
| 206 | 200 | 0 | 51 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 207 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 | 0 |
| 237 | 200 | 34 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 238 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 0 |
| 202 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | n.s |
| 209 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 210 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 190 | 142 |
| 213 | 300 | 0 | 131 | 0 | 0 | 87 | 31 | 0 | 36 | 0 | 0 | 109 | 0 |
| 214 | 300 | 37 | 0 | 0 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 141 | 0 |
| 215 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 |
| 228 | 300 | 345 | 352 | 151 | 189 | 437 | 541 | 0 | 629 | 554 | 242 | 1873 | 604 |
| 234 | 300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 203 | 400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 33 |
| 208 | 400 | 162 | 0 | 202 | 647 | 1132 | 81 | 0 | 0 | 0 | 0 | 607 | 1011 |
| 211 | 400 | 0 | 0 | 234 | 0 | 265 | 570 | 0 | 0 | 52 | 0 | 380 | 380 |
| 216 | 400 | 0 | 25 | 177 | 138 | 149 | 124 | 25 | 33 | 76 | 0 | 0 | 25 |
| 222 | 400 | 31 | 62 | 31 | 31 | 0 | 66 | 62 | 93 | 217 | 195 | 128 | 93 |
| 229 | 400 | 49 | 184 | 406 | 495 | 258 | 458 | 537 | 400 | 553 | 893 | 590 | 111 |
| 204 | 500 | 20 | 0 | 40 | 0 | 0 | 0 | 0 | 20 | 23 | 20 | 0 | 0 |
| 217 | 500 | 0 | 66 | 0 | 17 | 22 | 52 | 39 | 0 | 61 | 0 | 17 | 0 |
| 223 | 500 | 12 | 0 | 0 | 11 | 87 | 130 | 43 | 0 | 29 | 11 | 23 | 11 |
| 227 | 500 | 411 | 123 | 247 | 165 | 55 | 411 | 165 | 494 | 247 | 768 | 517 | 123 |
| 235 | 500 | 940 | 1643 | 456 | 826 | 1281 | 2079 | 114 | 1139 | 484 | 370 | 456 | 626 |
| 240 | 500 | 27 | 46 | 73 | 106 | 552 | 265 | 223 | 490 | 159 | 117 | 61 | n.s |
| 212 | 750 | 1120 | 153 | 153 | 460 | 690 | 1110 | 3317 | 1916 | 2950 | 1188 | 777 | 1034 |
| 218 | 750 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 25 | 28 | 199 | 28 | 0 |
| 224 | 750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 78 | 220 | 0 | 0 |
| 230 | 750 | 27 | 0 | 47 | 17 | 47 | 44 | 1336 | 191 | 631 | 2323 | 95 | 64 |
| 239 | 750 | 41 | 8 | 33 | 33 | 0 | 8 | 17 | 0 | 8 | 0 | 17 | 8 |
| 219 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 19 | 0 |
| 231 | 1000 | 0 | 51 | 0 | 0 | 13 | 0 | 0 | 17 | 13 | n.s | 29 | 15 |
| 236 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 40 | 0 |
| 220 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 0 | n.s |
| 225 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 0 | n.s |
| 232 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | n.s | 0 | n.s |
| 221 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 0 | n.s |
| 226 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | 0 | n.s |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 233 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s | n.s | 0 | n.s |

*Table 7: Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys in NAFO Div. 3K from 2010–21. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 608 | 200 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 612 | 200 | 0 | n/a | n/a | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 616 | 200 | n.s. | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 618 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 619 | 200 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 46 | 0 | 0 | 0 |
| 609 | 300 | 27 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 611 | 300 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 615 | 300 | 0 | n/a | n/a | 17 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 620 | 300 | 0 | 102 | 35 | 66 | 0 | 85 | 0 | 32 | 0 | 0 | 0 | 50 |
| 621 | 300 | 0 | 407 | 44 | 63 | 190 | 454 | 63 | 105 | 78 | 226 | 146 | 1652 |
| 624 | 300 | 0 | 0 | 61 | 182 | 61 | 35 | 0 | 486 | 76 | 0 | 152 | 101 |
| 632 | 300 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 634 | 300 | 41 | 0 | 122 | 53 | 61 | 92 | 0 | 288 | 43 | 0 | 354 | 835 |
| 635 | 300 | 0 | 175 | 40 | 146 | 171 | 0 | 0 | 35 | 105 | 0 | 433 | 175 |
| 636 | 300 | 33 | 67 | 214 | 300 | 38 | 0 | 76 | 185 | 157 | 100 | 817 | 100 |
| 637 | 300 | 62 | 36 | 0 | 200 | 446 | 0 | 31 | 196 | 52 | 112 | 852 | 934 |
| 610 | 400 | 18 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 614 | 400 | 0 | n/a | n/a | 314 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 617 | 400 | 31 | 0 | 136 | 109 | 109 | 27 | 27 | 82 | 22 | 82 | 82 | 163 |
| 623 | 400 | 0 | 30 | 340 | 78 | 0 | 0 | 23 | 0 | 0 | 0 | 102 | 612 |
| 625 | 400 | 0 | 525 | 41 | 95 | 92 | 183 | 31 | 195 | 233 | 61 | 93 | 634 |
| 626 | 400 | 389 | 697 | 429 | 1597 | 857 | 714 | 3041 | 2487 | 783 | 2105 | 2339 | 4032 |
| 628 | 400 | 186 | 533 | 473 | 1693 | 597 | 318 | 667 | 925 | 1255 | 33 | 1111 | 1128 |
| 629 | 400 | 0 | 146 | 136 | 363 | 738 | 681 | 151 | 880 | 723 | | 757 | 311 |
| 630 | 400 | 78 | 23 | 23 | 251 | 457 | 183 | 183 | 467 | 320 | 228 | 427 | 183 |
| 633 | 400 | 691 | 384 | 320 | 853 | 384 | 370 | 369 | 1634 | 1158 | 1219 | 1462 | 846 |
| 638 | 400 | 1625 | 649 | 1711 | 2738 | 4721 | 2039 | 1349 | 3801 | 1058 | 4676 | 5215 | 12321 |
| 639 | 400 | 134 | 365 | 134 | 456 | 843 | 835 | 371 | 724 | 291 | 1148 | 1119 | 1035 |
| 613 | 500 | 8 | n/a | n/a | 205 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 622 | 500 | 0 | 143 | 190 | 104 | 453 | 1521 | 404 | 0 | 63 | 333 | 301 | 760 |
| 627 | 500 | 3128 | 1770 | 1416 | 4454 | 9564 | 5835 | 14410 | 7540 | 10335 | 3088 | 19182 | 6708 |
| 631 | 500 | 575 | 195 | 878 | 545 | 2695 | 2844 | 3421 | 5394 | 1854 | 480 | 1296 | 3972 |
| 640 | 500 | 451 | 90 | 133 | 190 | 351 | 532 | 165 | 243 | 373 | 342 | 540 | 331 |
| 645 | 500 | 481 | 198 | 461 | 460 | 193 | 317 | 949 | 113 | 490 | n.s. | 431 | 238 |
| 650 | 500 | 747 | 553 | 470 | 704 | 258 | 1942 | | 1275 | 2919 | 1090 | 1560 | n.s. |
| 641 | 750 | 1548 | 1070 | 1894 | 522 | 823 | 1724 | 3028 | 395 | 2332 | 1772 | 802 | 1044 |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 646 | 750 | 425 | 854 | 291 | 103 | 67 | 119 | 1766 | 89 | 671 | n.s. | 2005 | n.s. |
| 651 | 750 | 6748 | 1506 | 1411 | 593 | 1235 | 2178 | 6815 | 1717 | 8165 | 2642 | 71 | n.s. |
| 642 | 1000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 647 | 1000 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 33 | n.s. |
| 652 | 1000 | 106 | 0 | 81 | 0 | 0 | 0 | 35 | 0 | n.s. | n.s. | 0 | 0 |
| 643 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 648 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 653 | 1250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 644 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 649 | 1500 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | n.s. | 0 | n.s. |
| 654 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. | 0 | n.s. | n.s. | 0 | n.s. |

*Table 8: Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV surveys in NAFO Div. 3L from 2010–21. There was no survey coverage of Div. 3L in 2021. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).*

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 784 | 55 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 350 | 91 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 363 | 91 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 371 | 91 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 372 | 91 | 0 | 0 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 384 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 785 | 91 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 328 | 183 | 42 | 37 | 42 | 0 | 0 | 0 | 0 | 42 | 0 | 84 | 0 | n.s. |
| 341 | 183 | 173 | 130 | 130 | 5379 | 130 | 49 | 0 | 0 | 130 | 43 | 0 | n.s. |
| 342 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 46 | 0 | 0 | 0 | n.s. |
| 343 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 348 | 183 | 0 | 0 | 48 | 42 | 42 | 0 | 0 | 49 | 0 | 97 | 0 | n.s. |
| 349 | 183 | 42 | 83 | 0 | 595 | 42 | 0 | 48 | 0 | 0 | 0 | 0 | n.s. |
| 364 | 183 | 344 | 166 | 437 | 0 | 0 | 172 | 0 | 43 | 0 | 0 | 0 | n.s. |
| 365 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 48 | 255 | 191 | n.s. |
| 370 | 183 | 0 | 61 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | n.s. |
| 385 | 183 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 108 | n.s. |
| 390 | 183 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | n.s. |
| 786 | 183 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 787 | 183 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 788 | 183 | 41 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 790 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 793 | 183 | 8 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 794 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 797 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 799 | 183 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 344 | 274 | 0 | 218 | 0 | 39 | 0 | 62 | 566 | 0 | 131 | 109 | 636 | n.s. |
| 347 | 274 | 81 | 90 | 496 | 280 | 0 | 0 | 0 | 0 | 103 | 225 | 255 | n.s. |
| 366 | 274 | 31 | 48 | 78 | 358 | 72 | 0 | 482 | 0 | 247 | 192 | 447 | n.s. |
| 369 | 274 | 0 | 132 | 166 | 201 | 0 | 0 | 176 | 0 | 101 | 59 | 235 | n.s. |
| 386 | 274 | 0 | 135 | 97 | 80 | 45 | 0 | 0 | 0 | 0 | 0 | 263 | n.s. |
| 389 | 274 | 0 | 0 | 113 | 67 | 38 | 0 | 0 | 38 | 71 | 0 | 56 | n.s. |
| 391 | 274 | 0 | 0 | 19 | 0 | 0 | 19 | 0 | 39 | 39 | 86 | 19 | n.s. |
| 795 | 274 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 345 | 366 | 1791 | 396 | 1525 | 1593 | 368 | 197 | 514 | 664 | 1944 | 93 | 2709 | n.s. |
| 346 | 366 | 299 | 984 | 982 | 1309 | 453 | 499 | 1224 | 3020 | 2305 | 3980 | 3855 | n.s. |
| 368 | 366 | 0 | 23 | 152 | 253 | 0 | 0 | 161 | 79 | 138 | 299 | 79 | n.s. |
| 387 | 366 | 296 | 691 | 646 | 176 | 0 | 626 | 404 | 2815 | 543 | 1714 | 757 | n.s. |
| 388 | 366 | 22 | 206 | 50 | 563 | 25 | 185 | 316 | 103 | 472 | 209 | 298 | n.s. |
| 392 | 366 | 30 | 0 | 9 | 20 | 0 | 60 | 0 | 63 | 20 | 40 | 50 | n.s. |
| 789 | 366 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 791 | 366 | 0 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 796 | 366 | 84 | n/a | n/a | 879 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 798 | 366 | 9 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 800 | 366 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 729 | 549 | 534 | 256 | 102 | 199 | 49 | 188 | 98 | 175 | 151 | 448 | 537 | n.s. |
| 731 | 549 | 322 | n.s. | 89 | 431 | 234 | 312 | 206 | 255 | 89 | 385 | 335 | n.s. |
| 733 | 549 | 916 | 1642 | 1343 | 1062 | 367 | 409 | 1214 | 0 | 221 | 715 | 1259 | n.s. |
| 735 | 549 | 871 | 1291 | 1954 | 736 | 1740 | 492 | 3230 | 2114 | 1036 | 592 | 617 | n.s. |
| 792 | 549 | 1032 | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a |
| 730 | 731 | 114 | 79 | 147 | 135 | 16 | 0 | 140 | 0 | 13 | 104 | 27 | n.s. |
| 732 | 731 | 681 | 313 | 182 | 222 | 381 | 340 | 145 | 182 | 120 | 222 | 79 | n.s. |
| 734 | 731 | 471 | 1689 | 105 | 112 | 146 | 0 | 36 | 18 | n.s. | 18 | 0 | n.s. |
| 736 | 731 | 2077 | 1276 | 923 | 1001 | 1990 | 1683 | 1055 | 433 | 614 | 1038 | 698 | n.s. |

Table 9: Abundance estimates (000s) of Witch Flounder by stratum for DFO fall RV in the deep portion (>731 m) of NAFO Div. 3L from 2010 to 2021. There was no survey coverage of Div. 3L in 2021. "n.s." indicates strata was not sampled, "n/a" indicates strata was not allocated (i.e., strata historically sampled but not in current survey design).

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 737 | 914 | 203 | n.s. | n.s. | n.s. | 1035 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 741 | 914 | 0 | n.s. | n.s. | n.s. | 409 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 745 | 914 | 48 | n.s. | n.s. | n.s. | 96 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 748 | 914 | 11 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 738 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 742 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 746 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |

| Stratum | Max. depth (m) | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 749 | 1097 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 739 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 743 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 747 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 750 | 1280 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 740 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 744 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
| 751 | 1463 | 0 | n.s. | n.s. | n.s. | 0 | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. | n.s. |
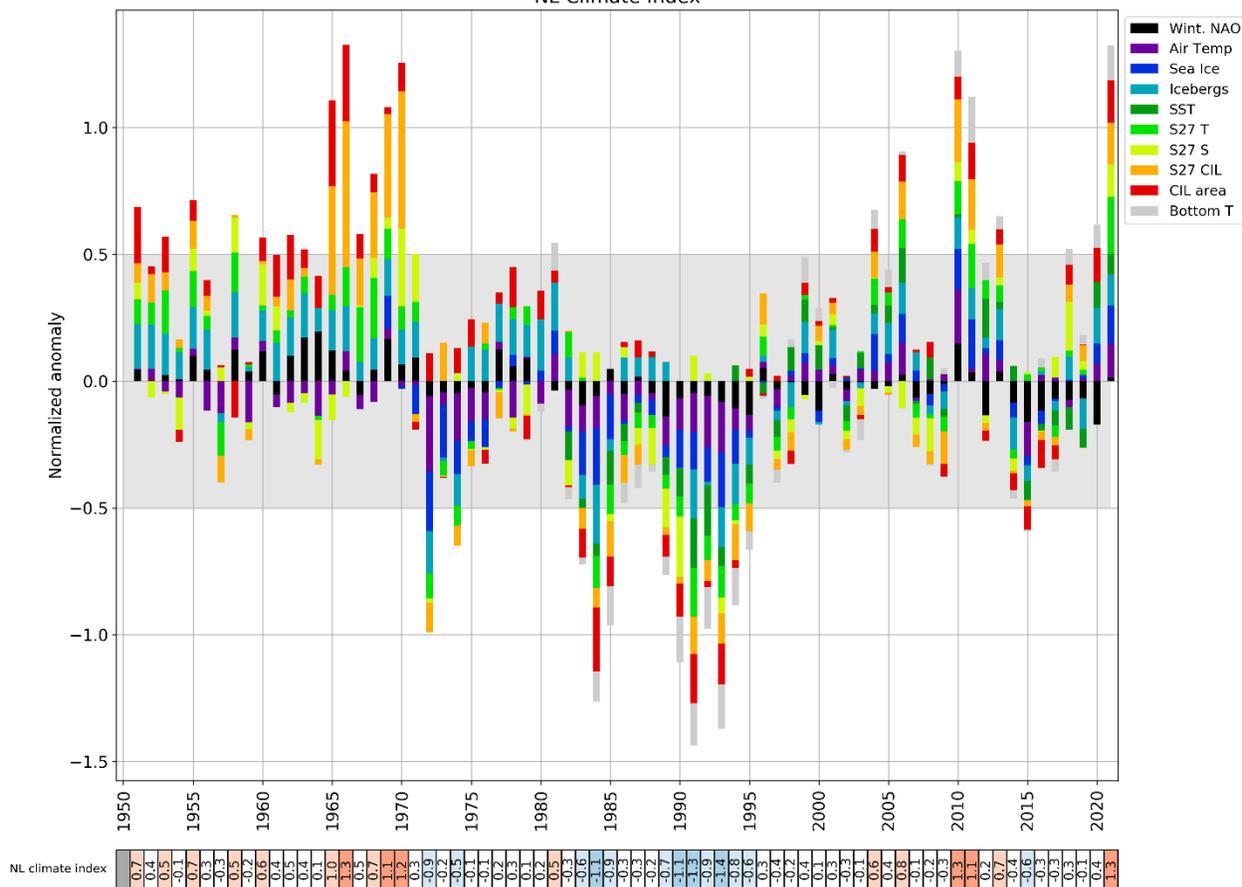
*Figure 1: Newfoundland and Labrador Climate Index from year 1950–2021. This normalized index is made of the average of 10 sub-indices representing different aspect of the ocean climate across the NL region (see legend and detailed descriptions in Cyr and Galbraith 2021; Wint. NAO = Winter North Atlantic Oscillation, SST = Sea surface temperature; S27 = Station 27, T = Temperature, S = Salinity, CIL = Cold intermediate layer). A positive index is generally indicative of a warmer climate, while a negative index is indicative of a colder climate. Values within the grayed area (±0.5 SD) are considered normal.*
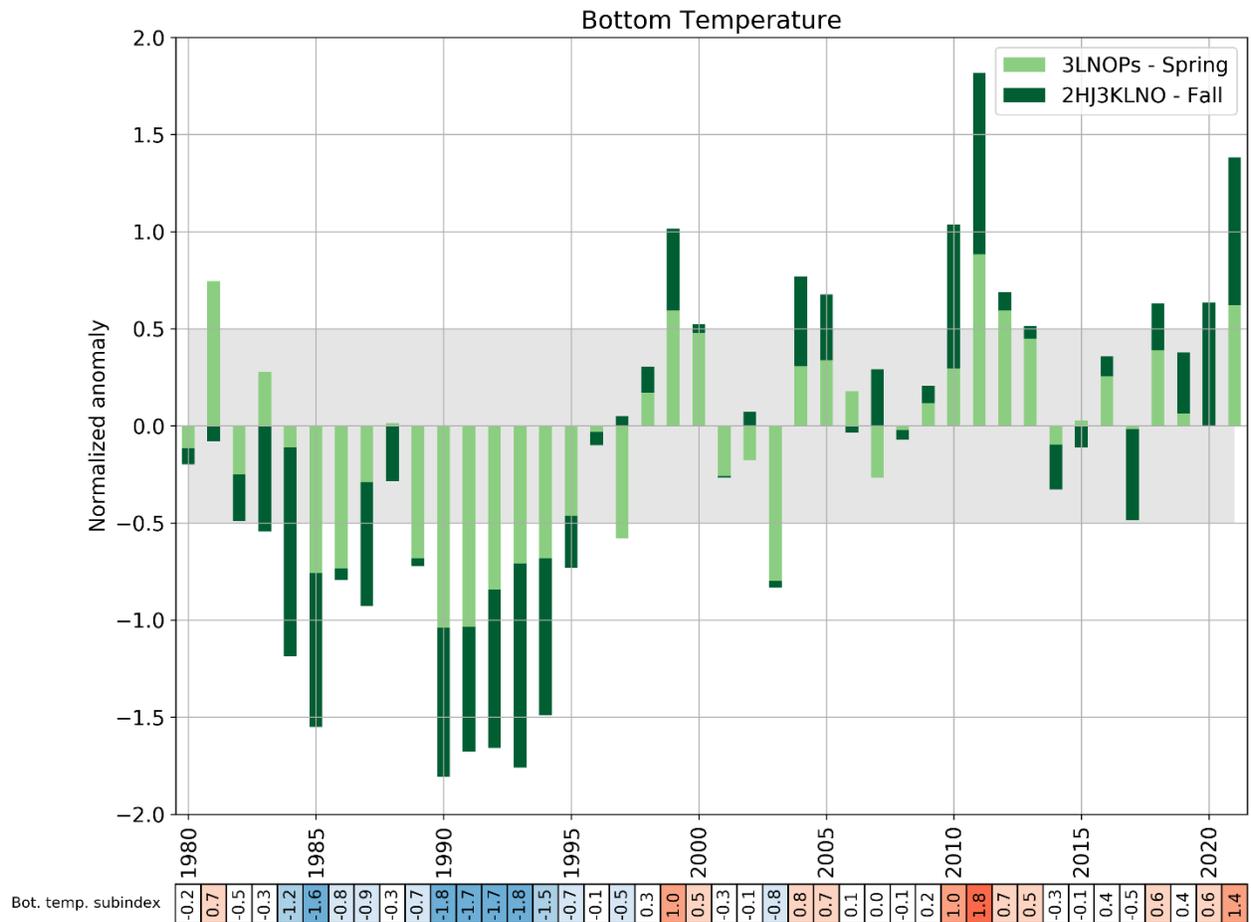
*Figure 2: Normalized anomalies of bottom temperature in NAFO Div. 3LNO3Ps (spring; light green) and Div. 2HJ3KLNO (fall; dark green). The shaded area corresponds to the 1991–2020 average ±0.5 SD. The numerical values of this time series are reported in a colour-coded scorecard at the bottom of the figure. Detailed description of this index is found in Cyr and Galbraith 2021.*
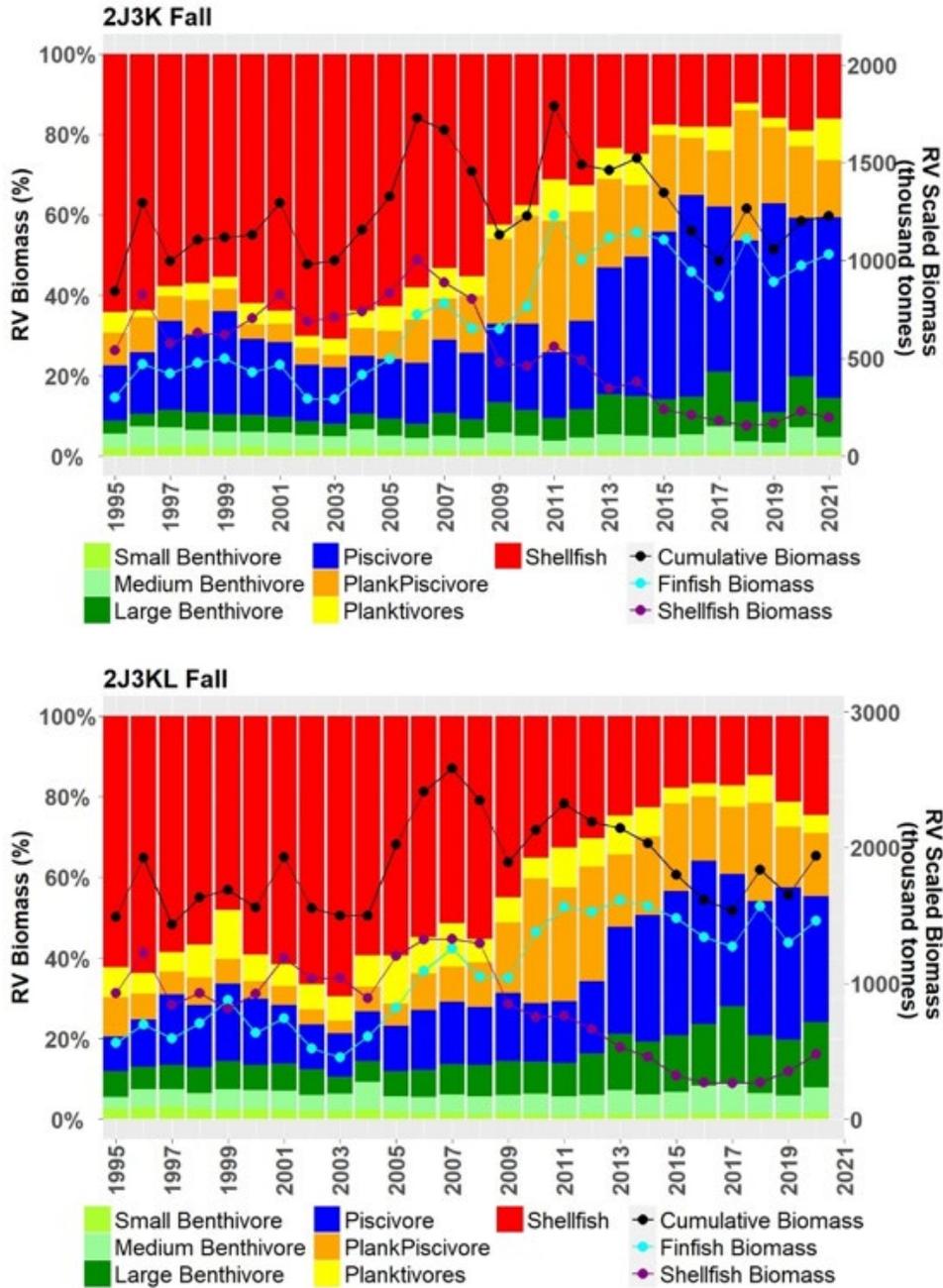
*Figure 3: Structure and trends in the fish community of the Newfoundland Shelf (Div. 2J3K) EPU (top), and in the Div. 2J3KL Witch Flounder stock area (bottom), which encompasses the Newfoundland Shelf (Div. 2J3K) EPU and the northern portion of the Grand Bank (Div. 3LNO) EPU. Bars show RV biomass percentage and are stacked by functional group from bottom to top: small benthivore, medium benthivore, large benthivore, piscivore, plankpiscivore, planktivores, and shellfish. Lines with annual dots show RV scaled biomass.*
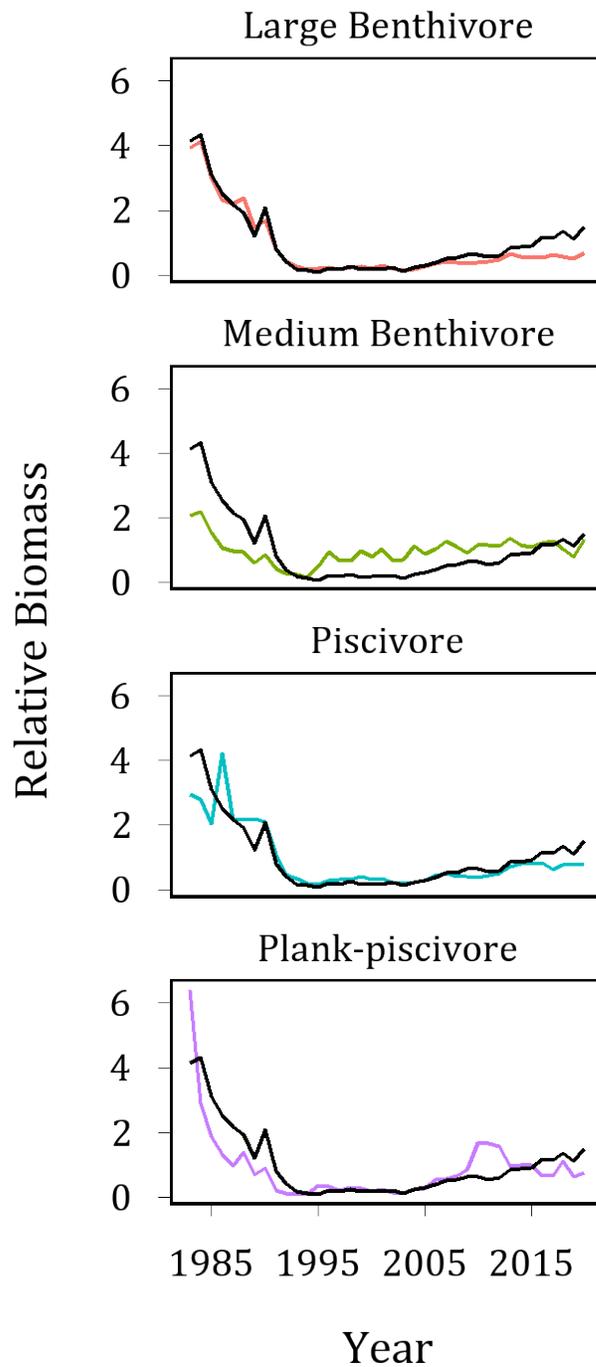
*Figure 4: Trends in relative biomass (biomass in year y / average biomass) of Witch Flounder (black line) compared to finfish functional groups that encapsulate medium and large-bodied groundfishes in Div. 2J3KL. Witch Flounder is a component of the medium benthivore functional group.*
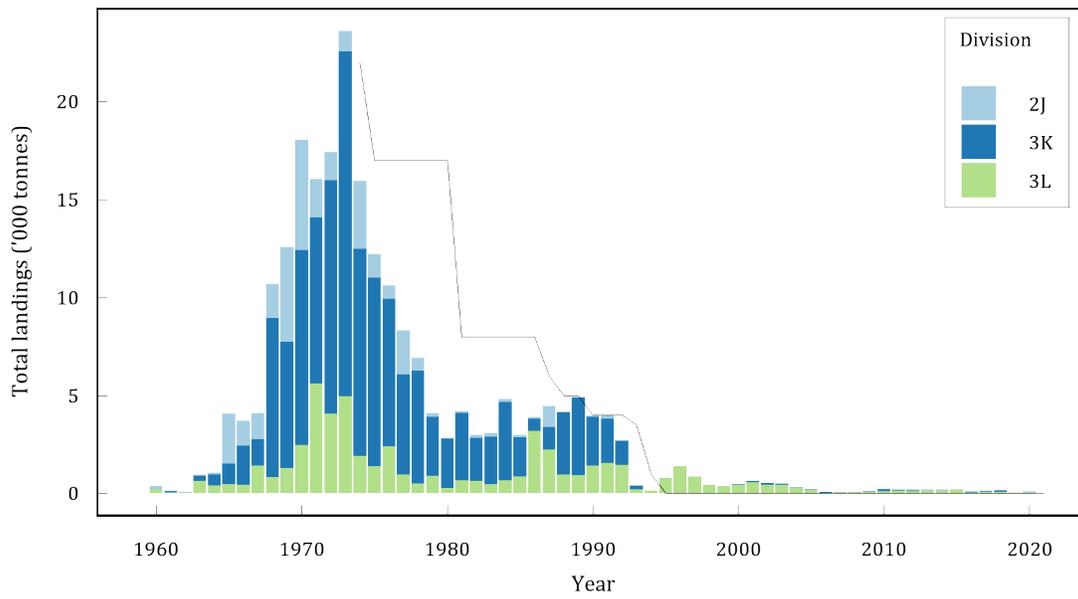
*Figure 5: Total landings of Witch Flounder in Div. 2J3KL to 2021. Data from [NAFO STATLANT 21A](NAFO STATLANT 21A).*
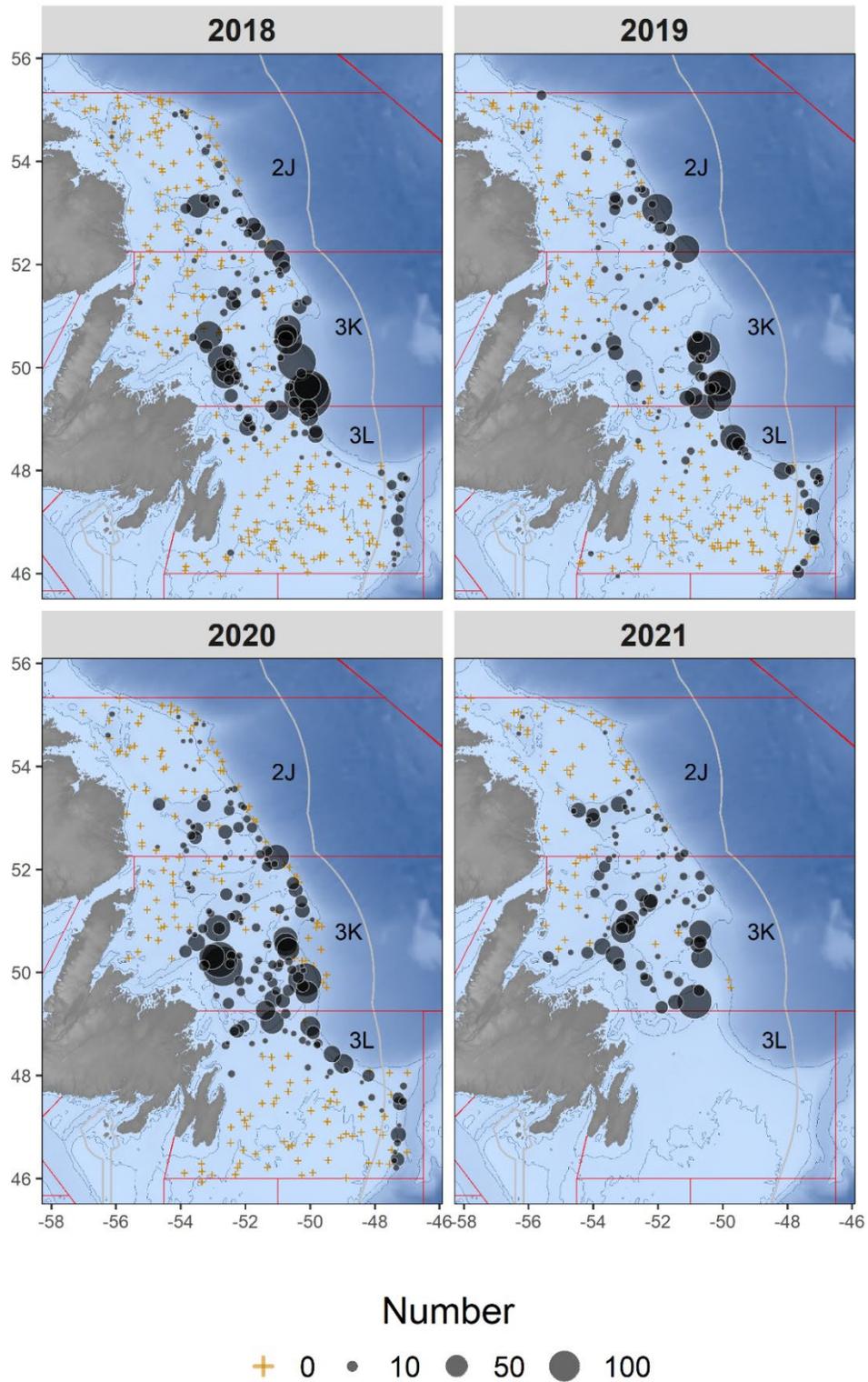
*Figure 6: Set by set catch numbers of Witch Flounder for the fall RV survey in NAFO Div. 2J3K from 2018–21. Note there was no coverage of Div. 3L in 2021.*
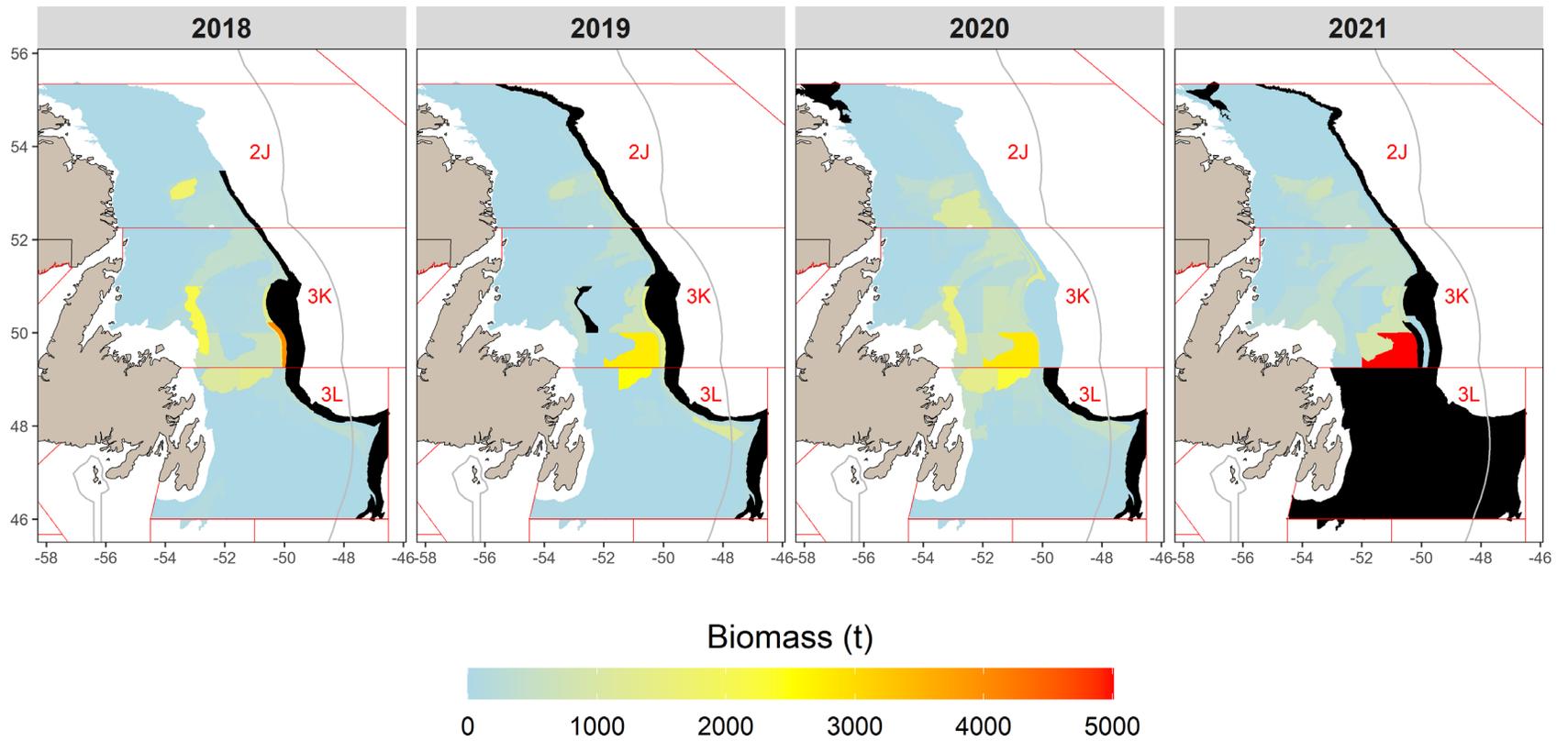
*Figure 7: Estimates of Witch Flounder survey biomass by strata in the RV fall survey show distribution of Witch Flounder within the survey area. Strata in black were incomplete.*
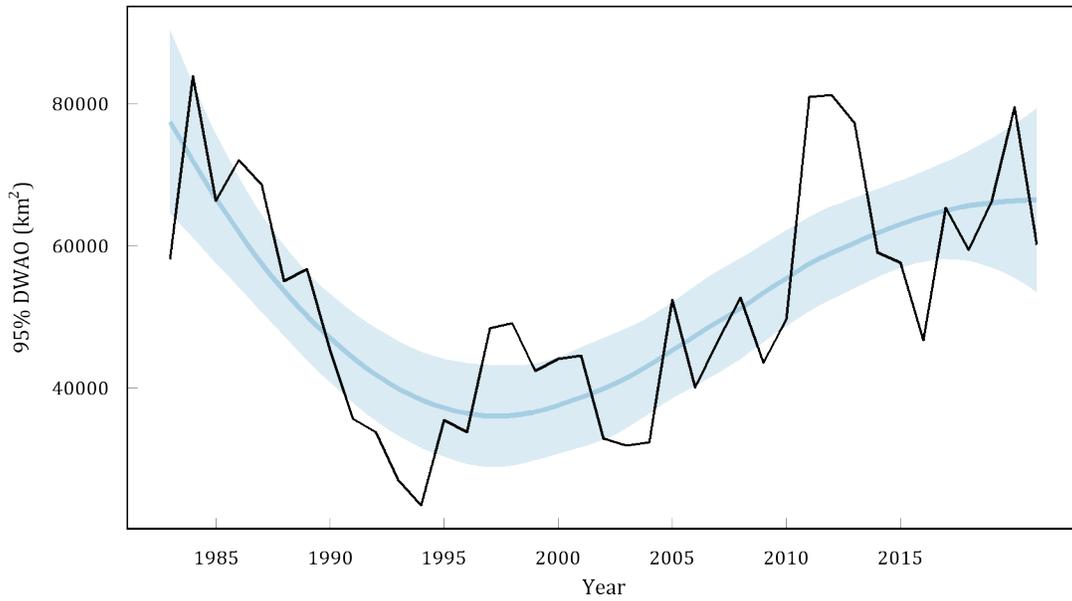
*Figure 8: Design Weighted Area Occupied (DWAO) for Witch Flounder in Div. 2J3KL. Black line shows the 95% DWAO estimate, blue line is a loess smoother with 95% confidence interval.*
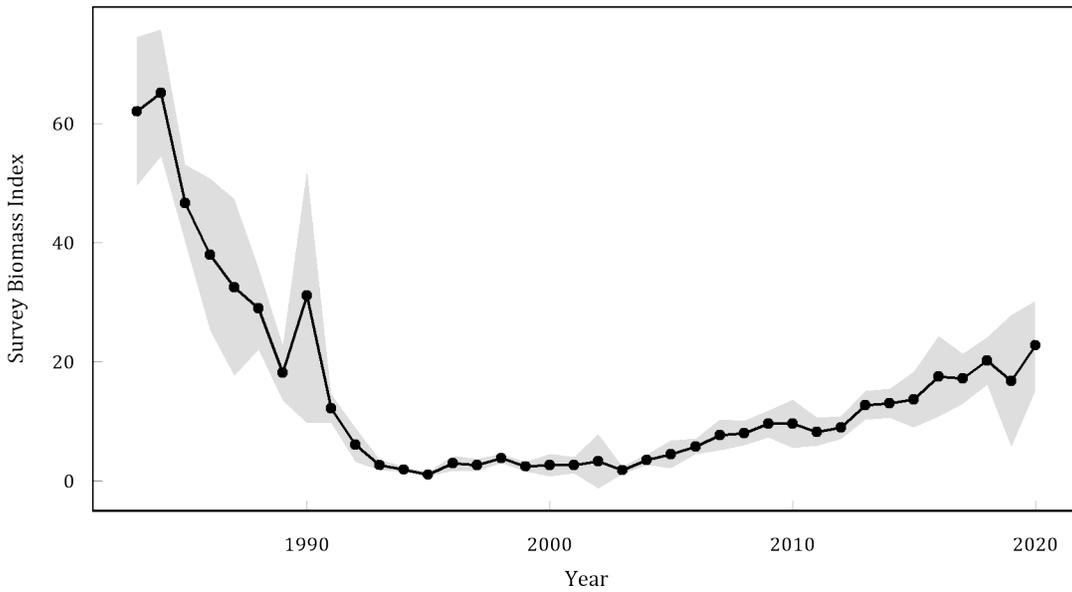


*Figure 9: Biomass index (black line with annual points) with 95% confidence intervals (grey area) from annual fall DFO RV survey in Div. 2J3KL.*
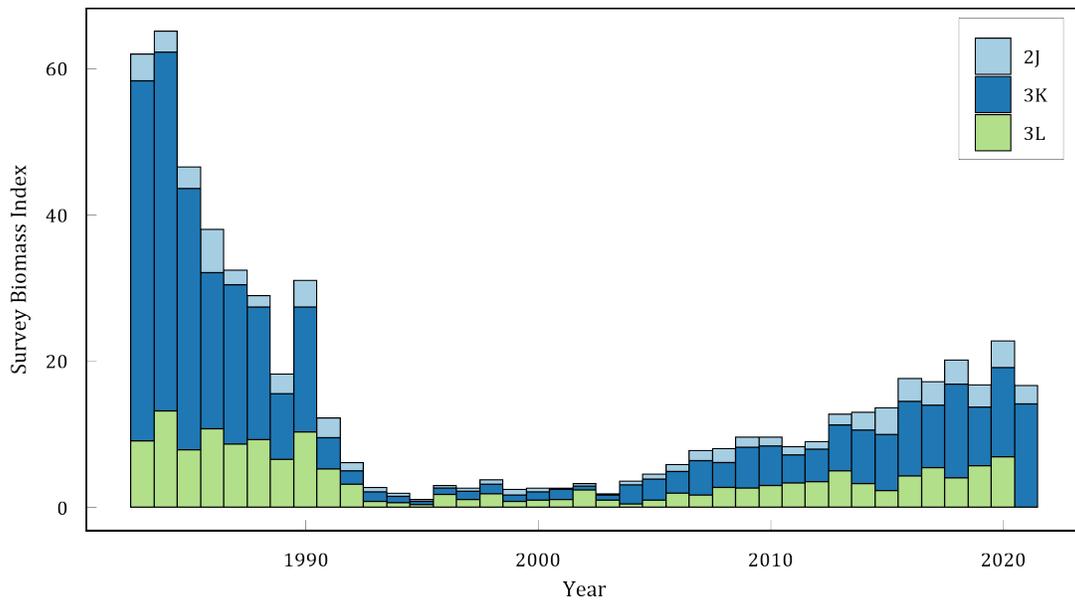
*Figure 10: Biomass indices by division, with bars stacked from Div. 2J (top), 3K (middle), to 3L (bottom). In 2021 there was no coverage of Div. 3L and strata were missed in Div. 3K therefore 2021 is an incomplete index and stock status in this year cannot be determined.*
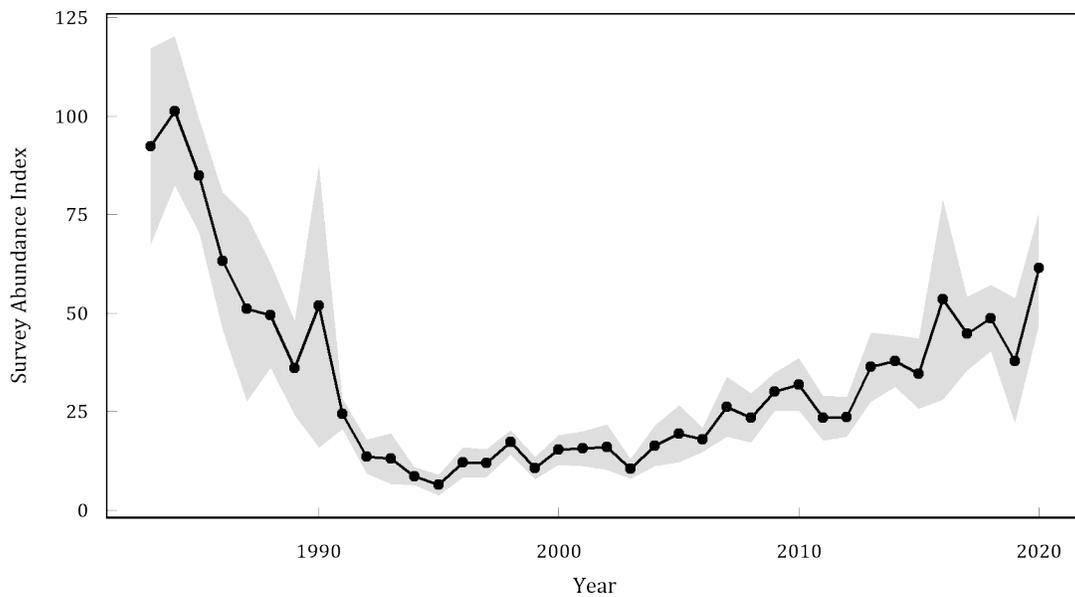


*Figure 11: Abundance index (black line with annual points) with 95% confidence intervals (grey area) from annual fall DFO RV survey in Div. 2J3KL.*
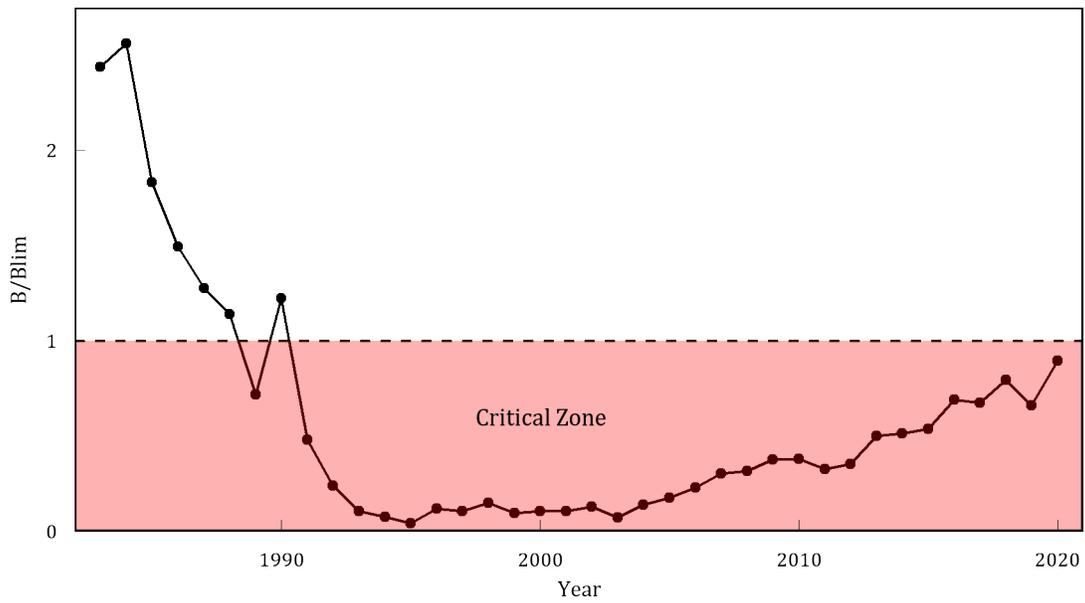
*Figure 12: B/Blim for Witch Flounder in Div. 2J3KL. B is total survey biomass index for all strata. Blim is the Limit Reference Point (LRP) set at 40% Bmsy-proxy as per DFO 2018. B/Blim = 1 indicates the level of the LRP, below which the stock is in the Critical Zone. In 2020 the stock was at 89% of the LRP, below the LRP with an 82% probability. The survey in 2021 was incomplete therefore stock status in that year cannot be determined.*
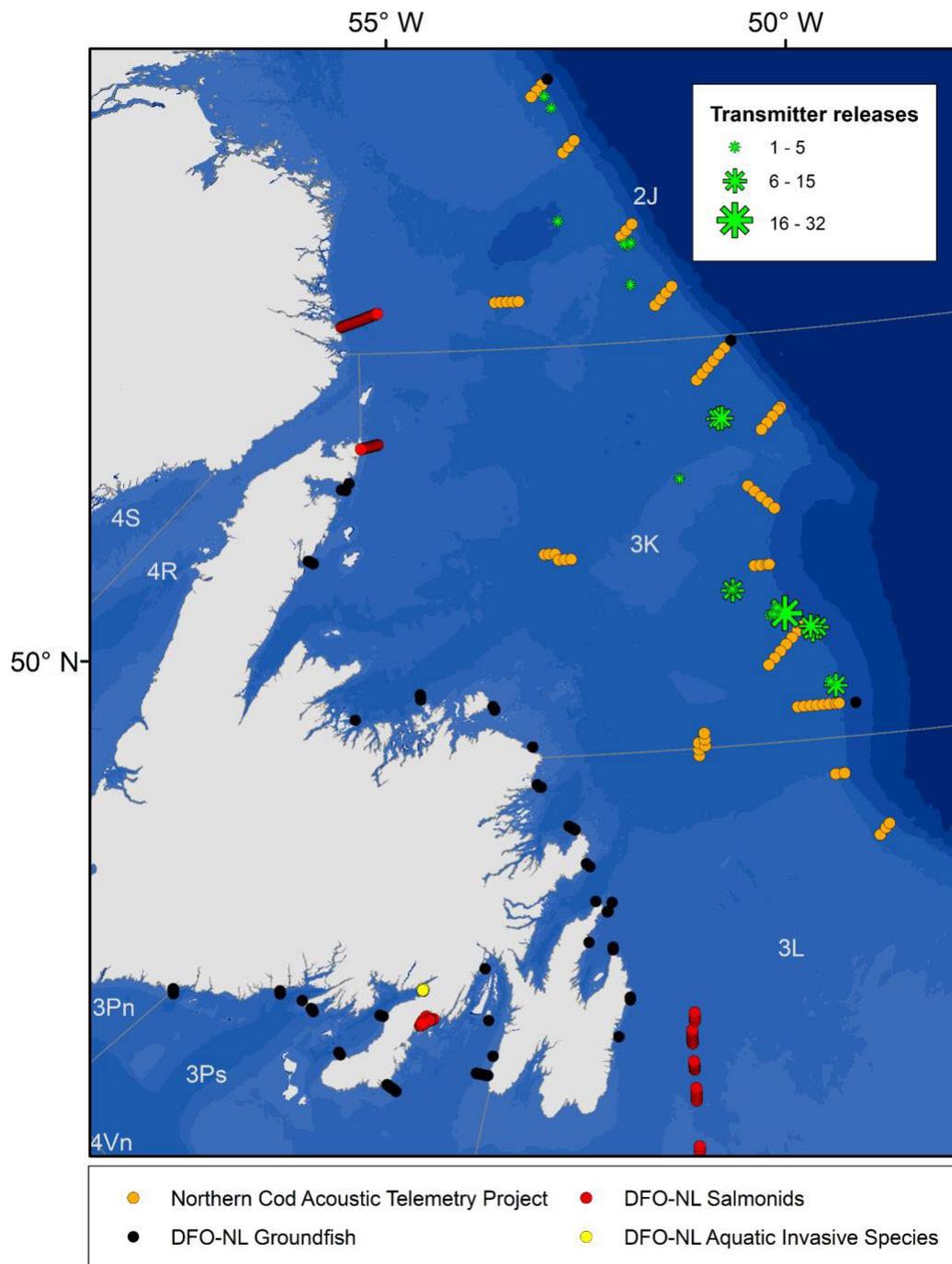
*Figure 13: Map of acoustic transmitter releases (green stars) on Witch Flounder in Div. 2J3L in 2021 (green stars), and currently deployed acoustic receivers (points) in the area maintained by DFO and the Northern Cod Acoustic Telemetry Project.*
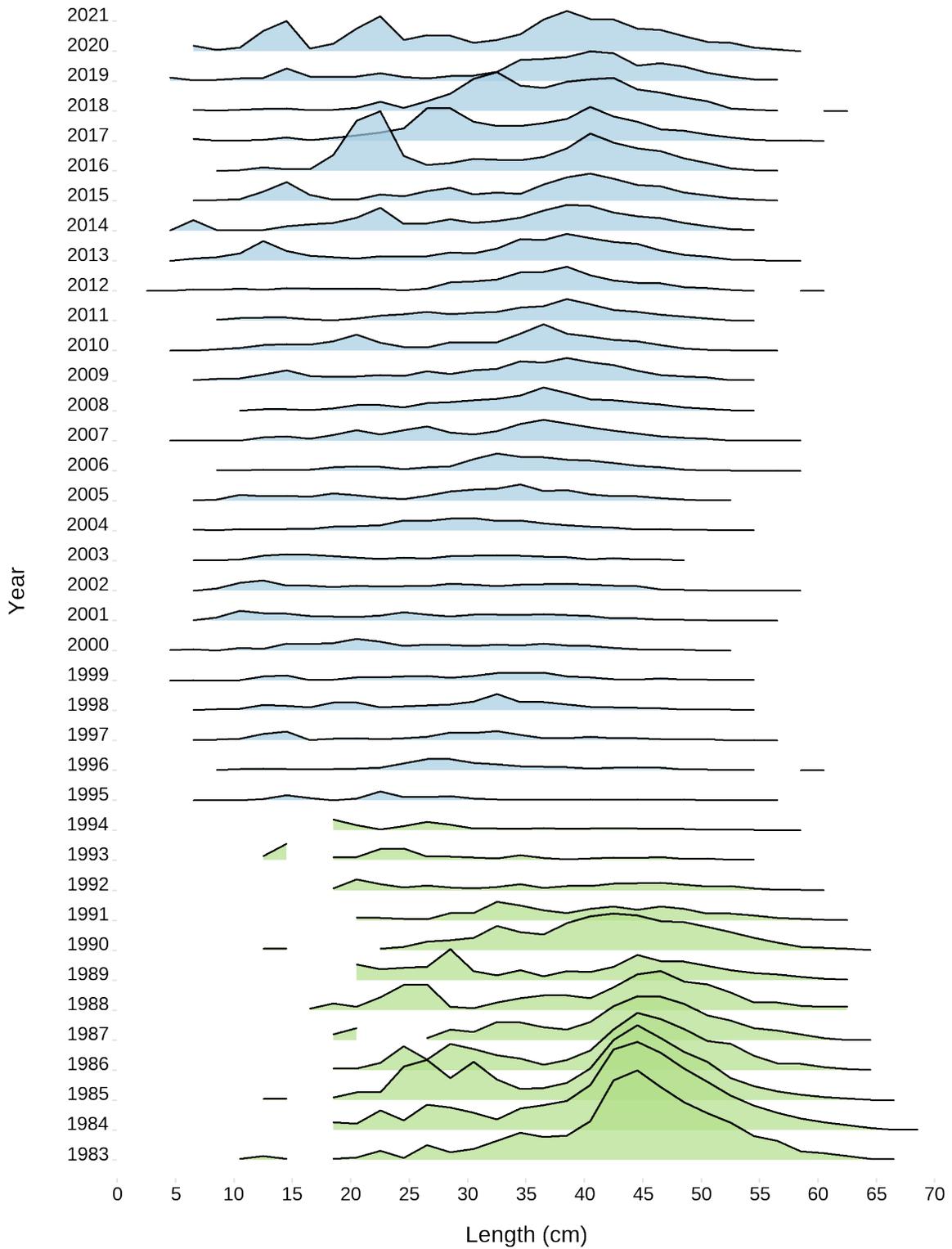
*Figure 14: Abundance-at-length for Witch Flounder in Div. 2J3KL from the fall DFO RV survey (1983–2020). The survey was incomplete in 2021. Green shows years converted to Campelen units from the Engel series (1983–1994), blue indicates the Campelen series (1995 onward).*
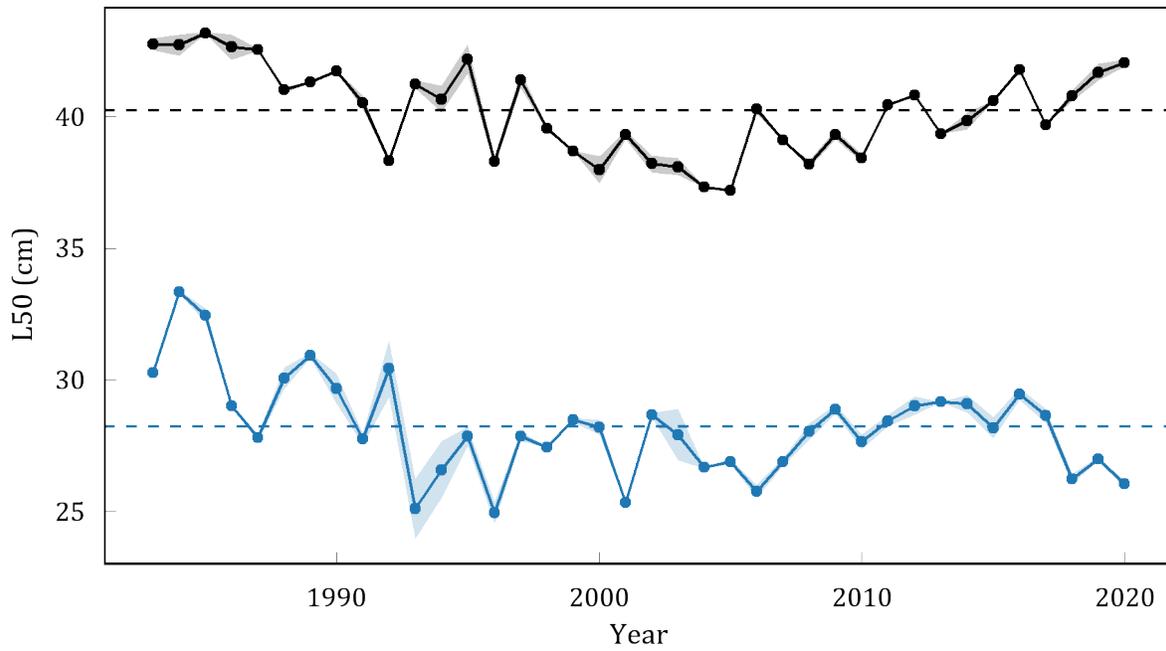
*Figure 15: Length at 50% mature (L50) for male (blue) and female (black) Witch Flounder in Div. 2J3KL with 95% confidence intervals, estimated from fall RV survey. Males mature at smaller size than females. Horizonal dashed lines indicate time series average values.*
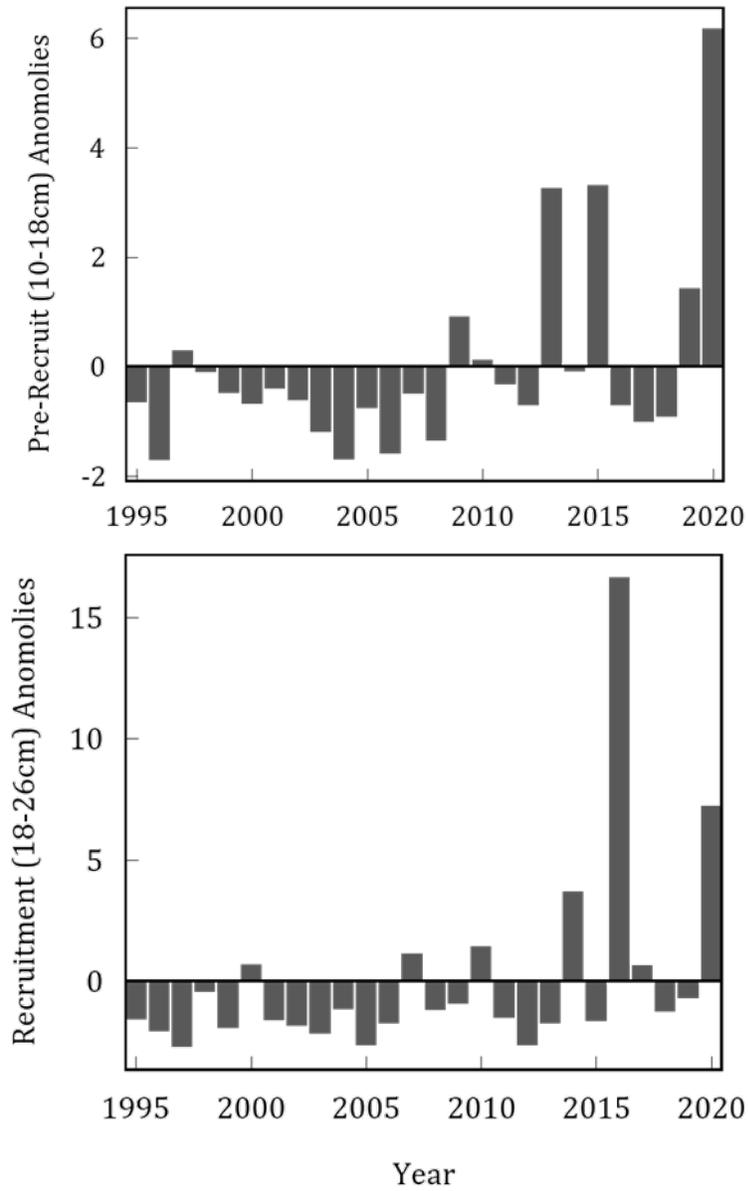
*Figure 16: Pre-recruit (10–18 cm) and Recruitment (18–26 cm) index anomalies (difference from time series mean) for the Campelen series. Positive anomalies indicate good pre-recruit or recruitment signals.*
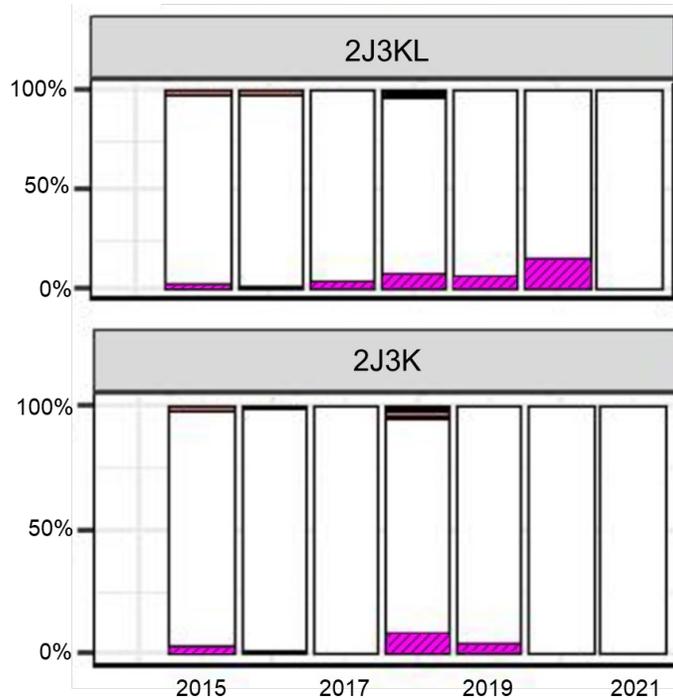
*Figure 17: Diet composition for Witch Flounder sampled in the Fall survey in Div. 2J3KL (top; Div. 3L not sampled in 2021) and Div. 2J3K only (bottom). Diet is primarily polychaetes (white) and amphipods (pink hatched). Other colours indicate small amounts of various other benthic invertebrates. Empty stomachs are excluded from this analysis.*
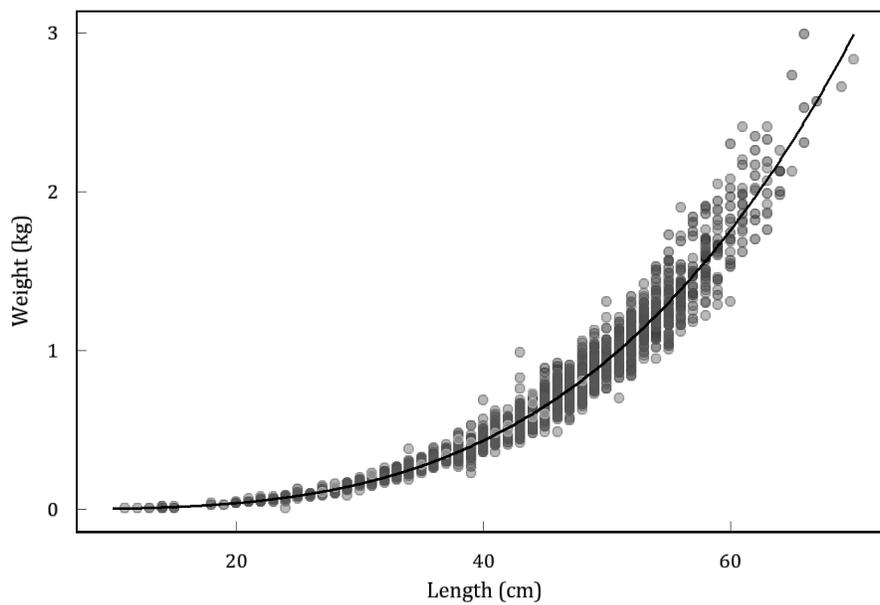


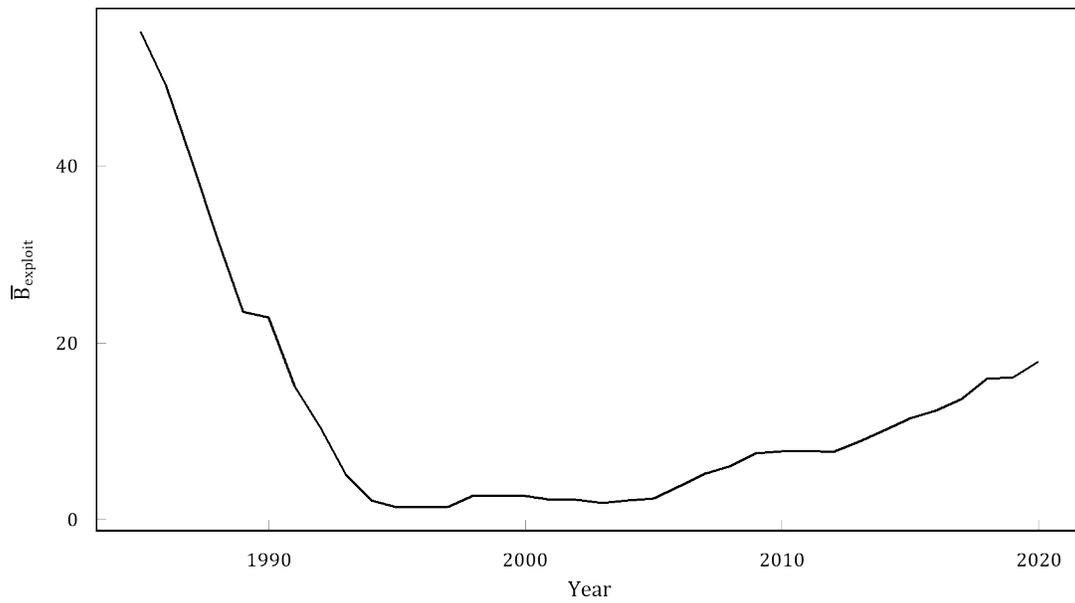*Figure 18: Length weight regression for Witch Flounder in Div. 2J3KL based on all available fall DFO RV survey measurements.*

*Figure 19: 3-year average exploitable biomass ($\overline{B}_{exploit}$), where annual exploitable biomass within the moving average is inversely weighted by the width of the confidence intervals of the total survey biomass index.*
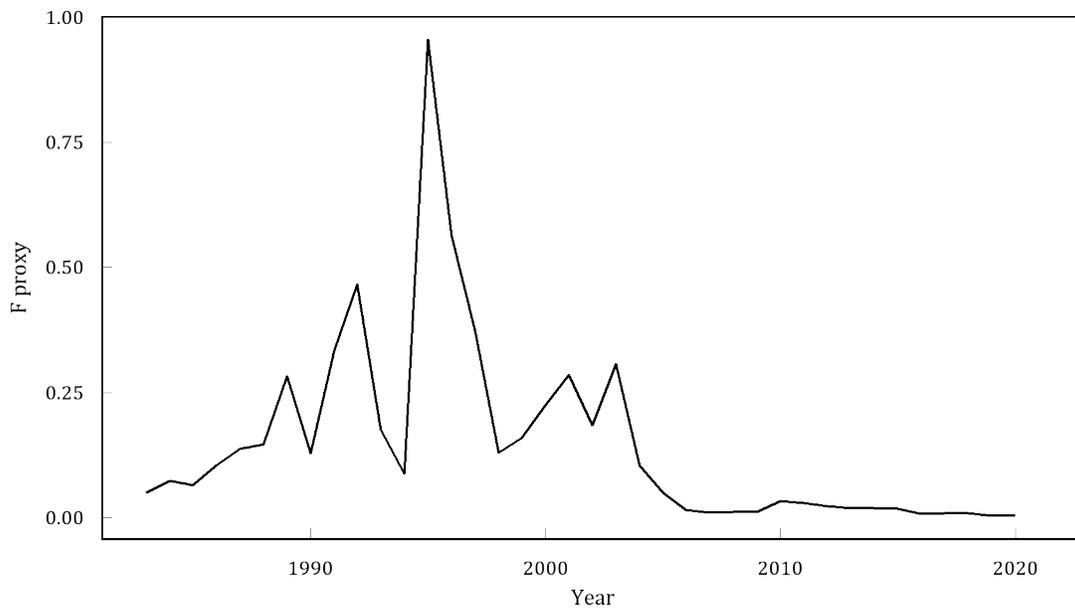


*Figure 20: Proxy for fishing mortality (F) calculated as a ratio of landings to the 3-year smoothed exploitable biomass index.*