Fisheries and Oceans   Pêches et Océans
Canada   Canada

Ecosystems and   Sciences des écosystèmes
Oceans Science   et des océans

Maritimes Region

Canadian Science Advisory Secretariat
Science Response 2020/032

2019 MARITIMES WINTER RESEARCH VESSEL SURVEY TRENDS ON GEORGES BANK

Context

Fisheries and Oceans Canada (DFO) has conducted winter Research Vessel (RV) surveys in the Maritimes Region, Northwest Atlantic Fisheries Organization (NAFO) Area 5Z (Georges Bank) using a standardized protocol since 1987. Results from these surveys provide information on trends in abundance for groundfish species in the Maritimes. While these data reflect trends in biomass and abundance and are a critical part of science-based stock assessments, a full assessment, including other sources of data, would be required to evaluate the impacts of management measures on population status.

The 2019 Winter RV Survey was conducted on the *CCGS Alfred Needler.* Fisheries Management (FM) requested a review of the DFO Winter RV Survey information on the following species in Strata 5Z1–5Z4: Cod, Haddock, Pollock, Yellowtail Flounder, Smooth Skate, Thorny Skate, Barndoor Skate, Winter Skate, Little Skate, Longhorn Sculpin, and Ocean Pout. The survey information will be used by FM as background for discussions with various industry stakeholders on recommendations for management measures, and to determine which stocks should be reviewed in more detail in 2020.

This Science Response Report results from the Science Response Process of May 31, 2019, on the Maritimes Research Vessel Survey Trends on Georges Bank.

Background

The Winter RV Survey has covered a standard set of strata on Georges Bank (5Z) annually since 1987. The survey follows a stratified random sampling design, and includes sampling of fish and invertebrates using a bottom otter trawl. These surveys are the primary data source for monitoring trends in species distribution, abundance, and biological condition on Georges Bank (for details see Stone and Gross 2012).

This survey was initially designed to provide abundance trends for fish and invertebrates between depths of about 30 m and 200 m; the depth range found in Strata 5Z1–5Z8 (Figure 1). Stratum 5Z9 covers the deeper water of the Fundian Channel and has only been sampled since 2010. Sampling is generally conducted between mid-February and mid-March with 103 stations allocated within Strata 5Z1–5Z9. Coverage of 5Z5–5Z8 has been irregular in recent years, due to mechanical issues and poor weather; however, the survey has covered 5Z1–5Z4 in all years. Survey indices are expected to be proportional to abundance for species that are found primarily in the shallower water on top of Georges Bank, but they may not be useful for species that primarily inhabit depths greater than 200 m in winter.

Sampling in the winter survey was undertaken in 4X strata in the late 1970s and early 1980s, These strata have been sampled periodically in the past decade, when time allowed. Inclusion of this broader sampling area is useful in understanding the distribution and abundance of

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deeper water fish for which the shallow water on top of Georges Bank is outside their prime habitat.
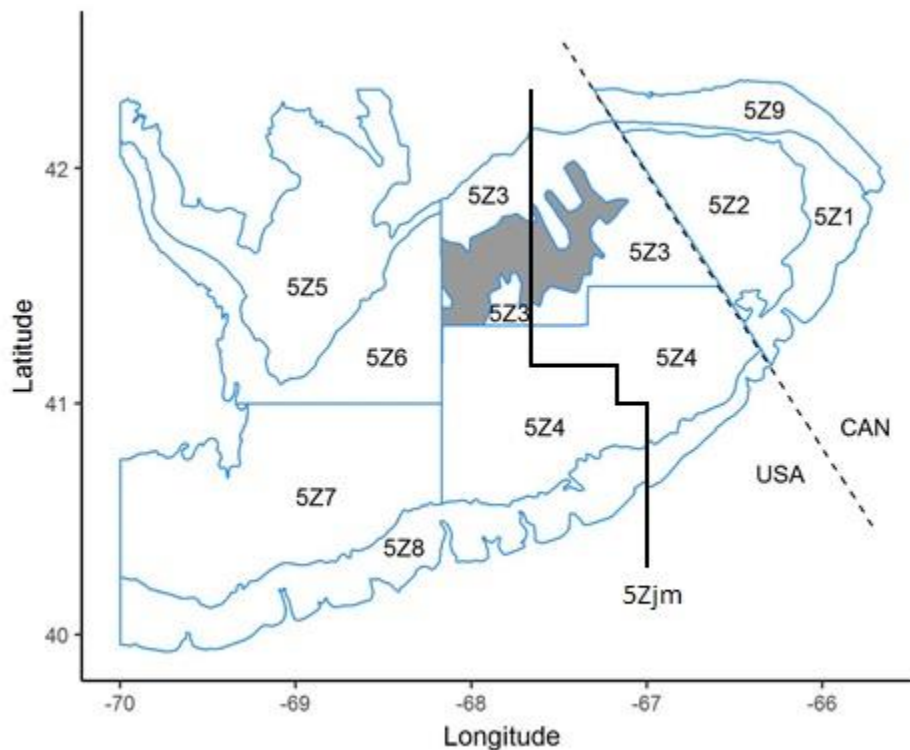

Figure 1. Winter RV Survey strata in 5Z. No sets are made in the shoals of Georges Bank (grey shaded area in 5Z3). The line bisecting 5Z3 and 5Z4 is the 5Zjm line, which is used for management of some species.

Analysis and Response

The 2019 Winter RV Survey successfully completed 99 tows in 5Z between February 19 and March 7, 2019, and a further 81 were completed in 4X between March 12–22, 2019. All sets were conducted by the *CCGS Alfred Needler*. Catch distribution plots are provided for each species. For 5Z stocks and species generally caught on top of Georges Bank, the distribution plot includes the long-term median catch per tow for 5Z strata. Biomass index trends are shown for 5Z1–5Z4. Comparisons of 2018 and 2019 length frequencies (total abundance at length) from the survey catch in 5Z1–5Z4 to the long-term median (1987–2017) are also included for the selected stocks.

The time-series of survey biomass indices and the 3-year running geometric mean (3yr-GM), are compared to 40% and 80% of the long-term GM to provide context for biomass levels. The GM was selected for these comparisons to reduce the impact of very high values observed in some years. The values are presented in Table 1. Information on the calculation of these indices is contained in Stone and Gross (2012).

For species that are normally found in water deeper than is found in 5Z1–5Z4 on Georges Bank, inclusion of a broader area may be needed to provide indices that are useful for monitoring

abundance trends. The 3-yr GM of biomass indices in Strata 5Z1–5Z4 + 5Z9, the Fundian Channel stratum where depth ranges from 183 m to 370 m, is included as an illustration of this.

Winter Skate and Little Skate cannot be reliably distinguished at lengths less than about 40 cm (for more information see McEachran and Musick 1973). The practice at-sea in most years was to record small skates as Winter Skate and to only record Little Skates when individuals displayed the diagnostic characteristics for adults of this species. Since 2013, those individuals that could not be clearly identified to species were recorded under a separate species code. Summaries of Winter Skate data presented here exclude all individuals smaller than 40 cm from earlier years, as fish in this length range likely included a mix of Little and Winter skates.

Table 1. Winter RV survey biomass indices (tonnes) by species for 2017, 2018, 2019, and 40% and 80% of the long-term (1987–2018) geometric mean (GM). No time period averages were provided for mixed Little and Winter skates because sampling began in 2014 (N/A).

Species	2017	2018	2019	Current 3yr GM	40% long-term GM	80% long-term GM
Cod	14,129	7,990	4,271	7,842	5,047	10,093
Haddock	149,090	198,942	96,907	142,182	20,749	41,498
Pollock	363	757	170	360	608	1,216
Yellowtail	342	252	57	170	1,540	3,080
Smooth Skate	8	11	3	6	2	4
Thorny Skate	40	67	1	13	39	78
Barndoor Skate	20	345	28	57	32	64
Winter Skate	625	4,066	5,369	2,592	3,831	7,661
Little Skate	3,634	5,923	2,547	3,799	1,909	3,817
Mixed Winter/Little Skate	901	1,491	1,866	1,159	N/A	N/A
Longhorn Sculpin	1,436	1,331	365	887	1,577	3,153
Ocean Pout	69	5	8	14	160	320

Atlantic Cod

Atlantic Cod catches were concentrated on the northeast portion of Georges Bank in 5Z2 (Figure 2a). The 2019 survey biomass index was below 40% of the long-term GM (Figure 2b). The 3yr-GM does not differ greatly with or without the inclusion of 5Z9 and remains between 40% and 80% of the long-term GM. The abundance indices for 5Z1-4 in 2019 were generally lower than in 2018. Abundance indices closely resembled the long-term median below 53 cm but remained low at larger sizes (Figure 2c).
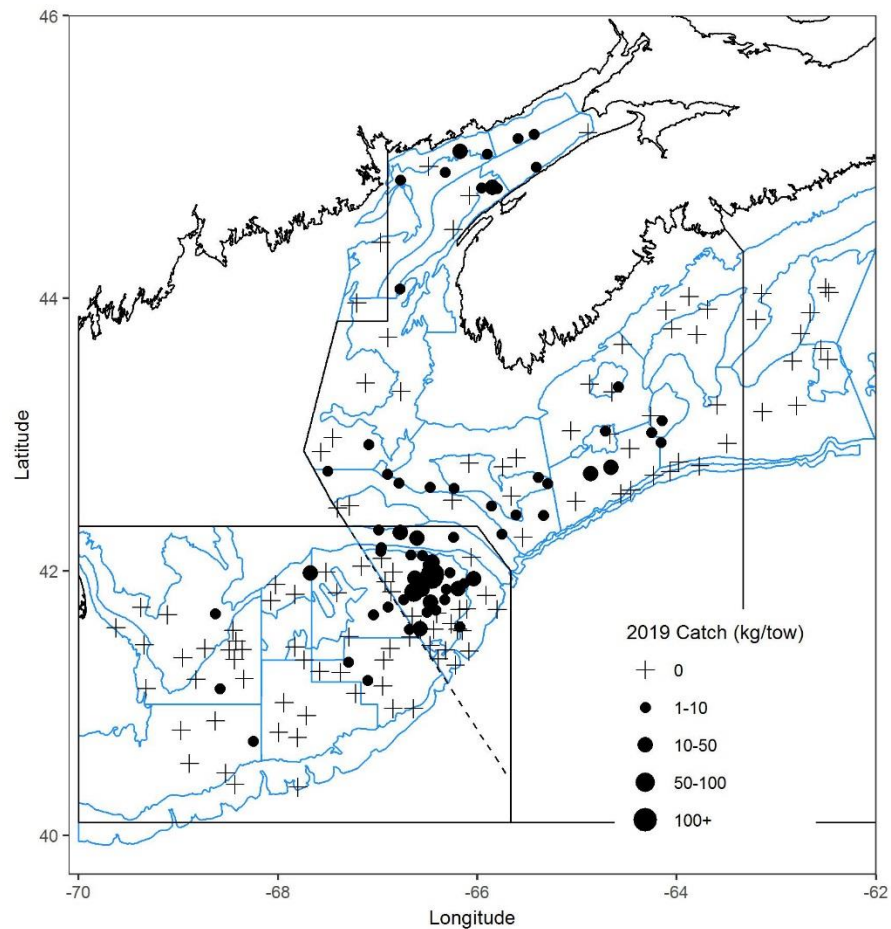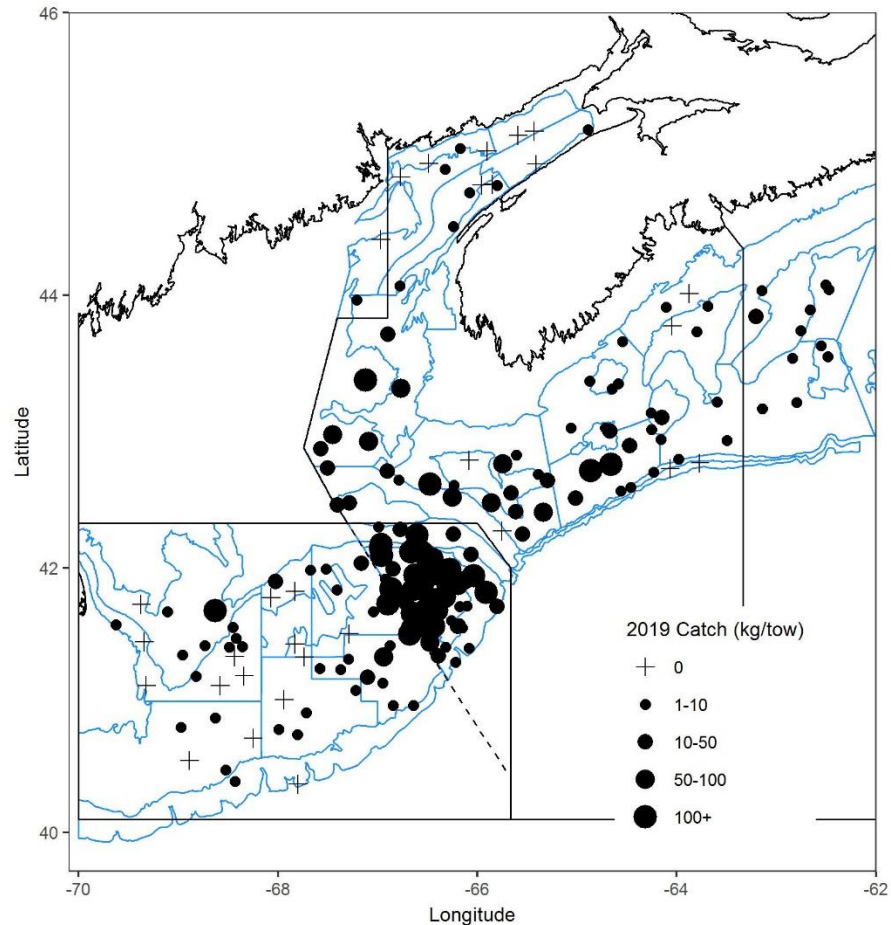

Figure 2a. Distribution of Atlantic Cod catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
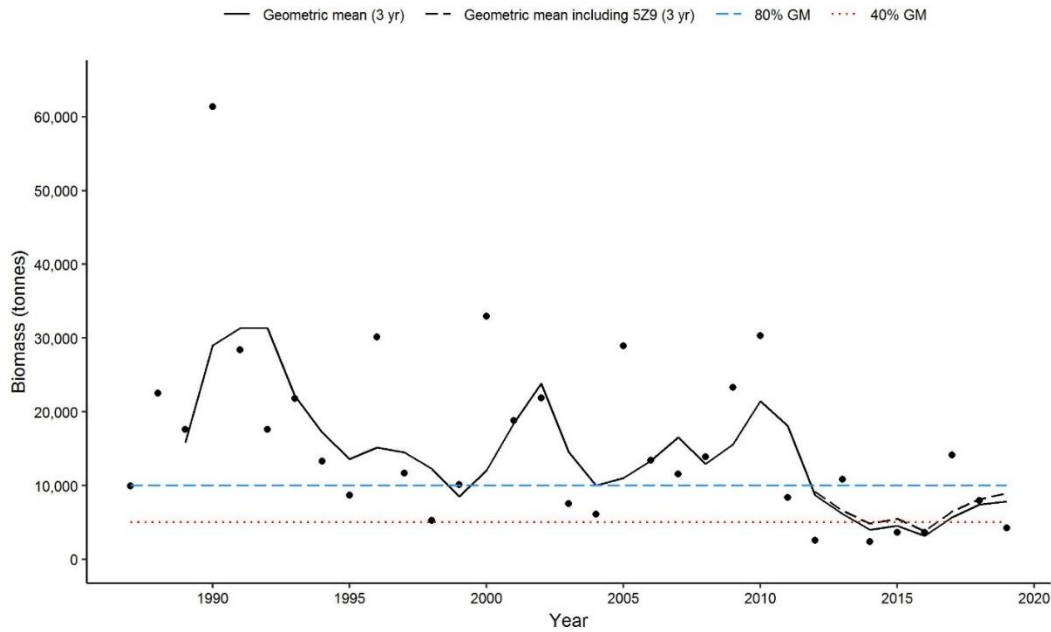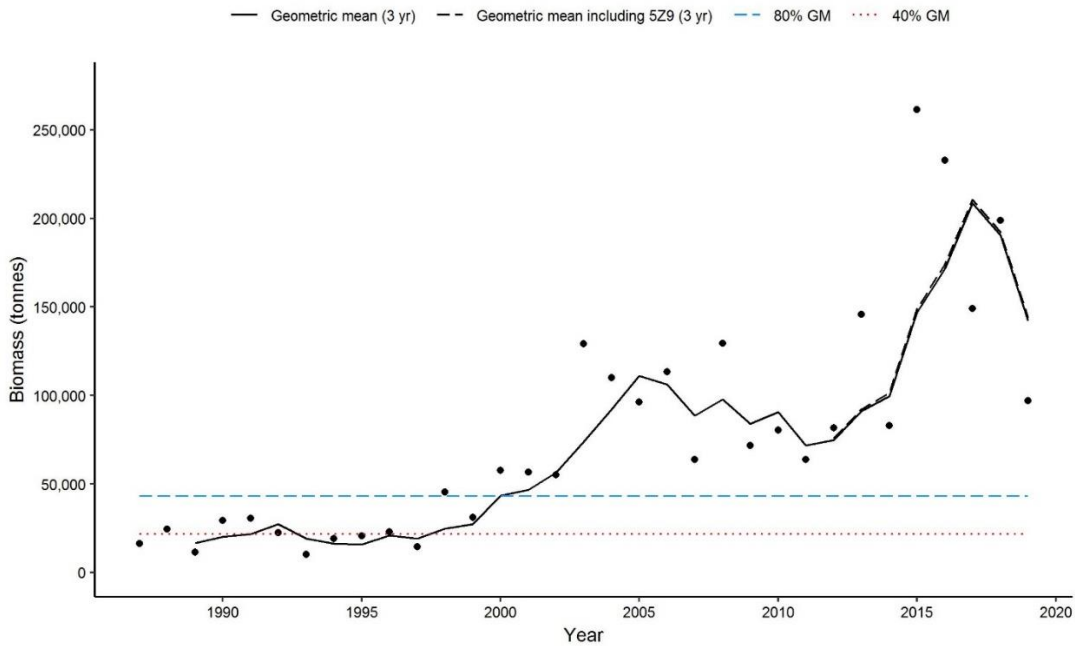
Figure 2b. Biomass index for Atlantic Cod in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
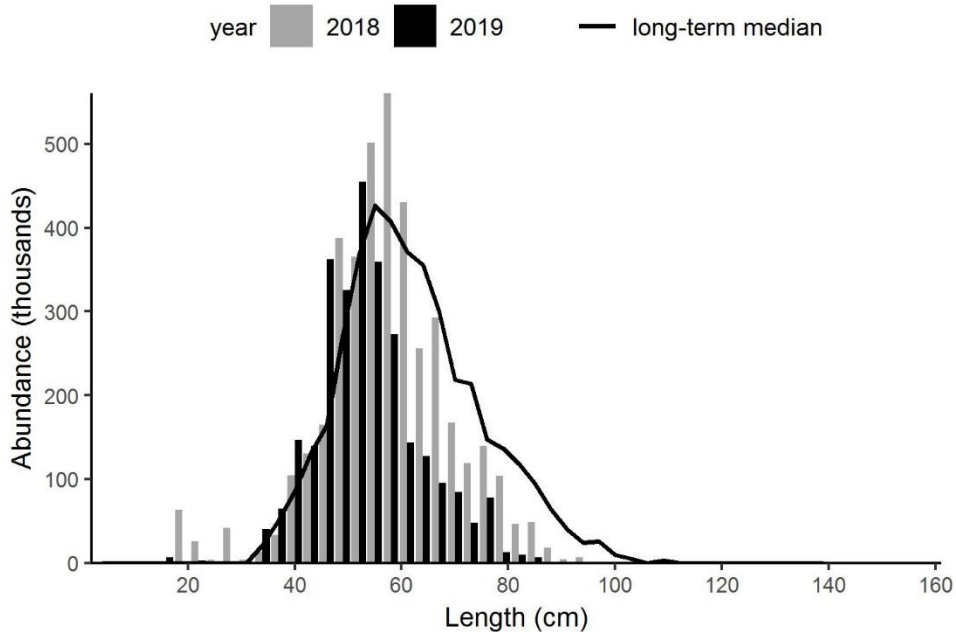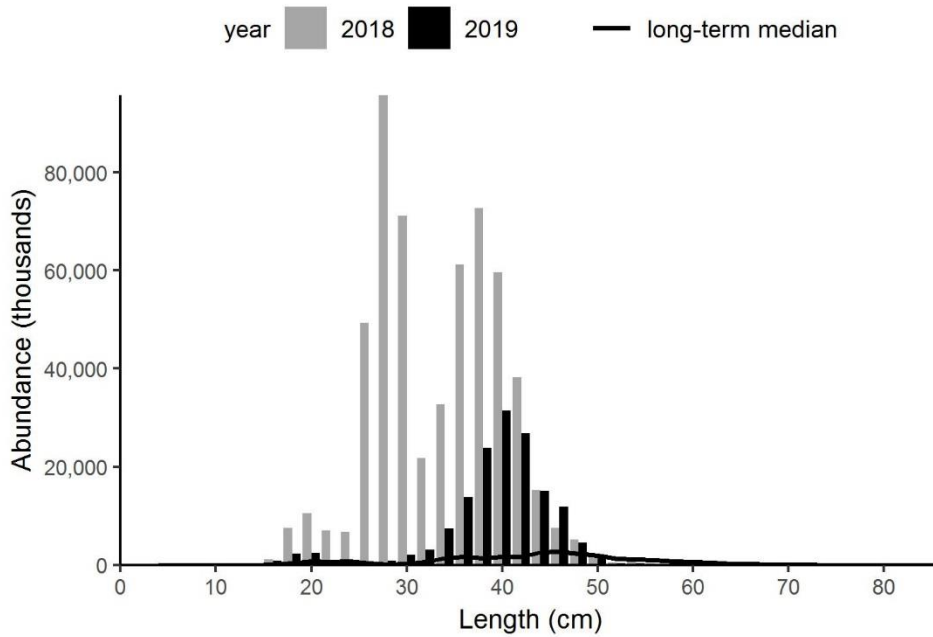

Figure 2c. Length frequency indices for Atlantic Cod in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Haddock

Haddock were present in over 85% of sets in 2019 (Figure 3a). The Haddock biomass index for 5Z1-4 in 2019 was lower than in 2018, but the 3-yr GM remained well above 80% of the long-term GM (Figure 3b). The 3yr-GM with and without 5Z9 are virtually identical. Abundance indices for 5Z1-4 from 2019 were similar to 2018 indices for lengths above 40 cm, but were lower at all other lengths, with little indication of incoming recruitment (Figure 3c).
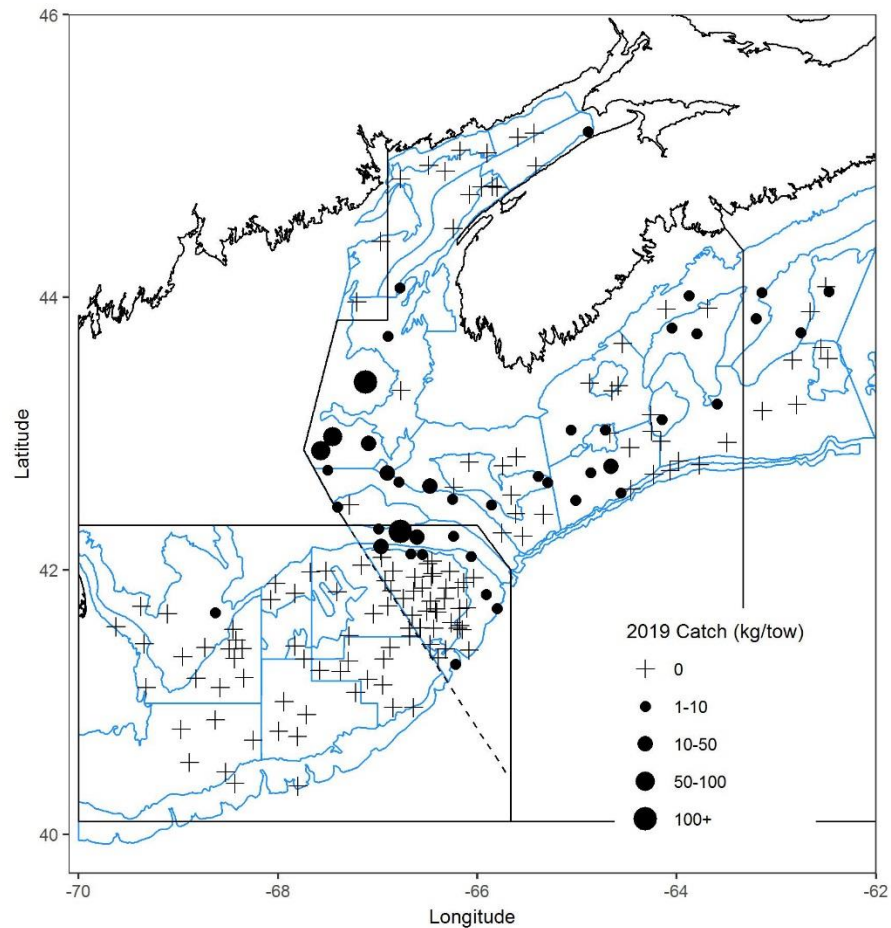

Figure 3a. Distribution of Haddock catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
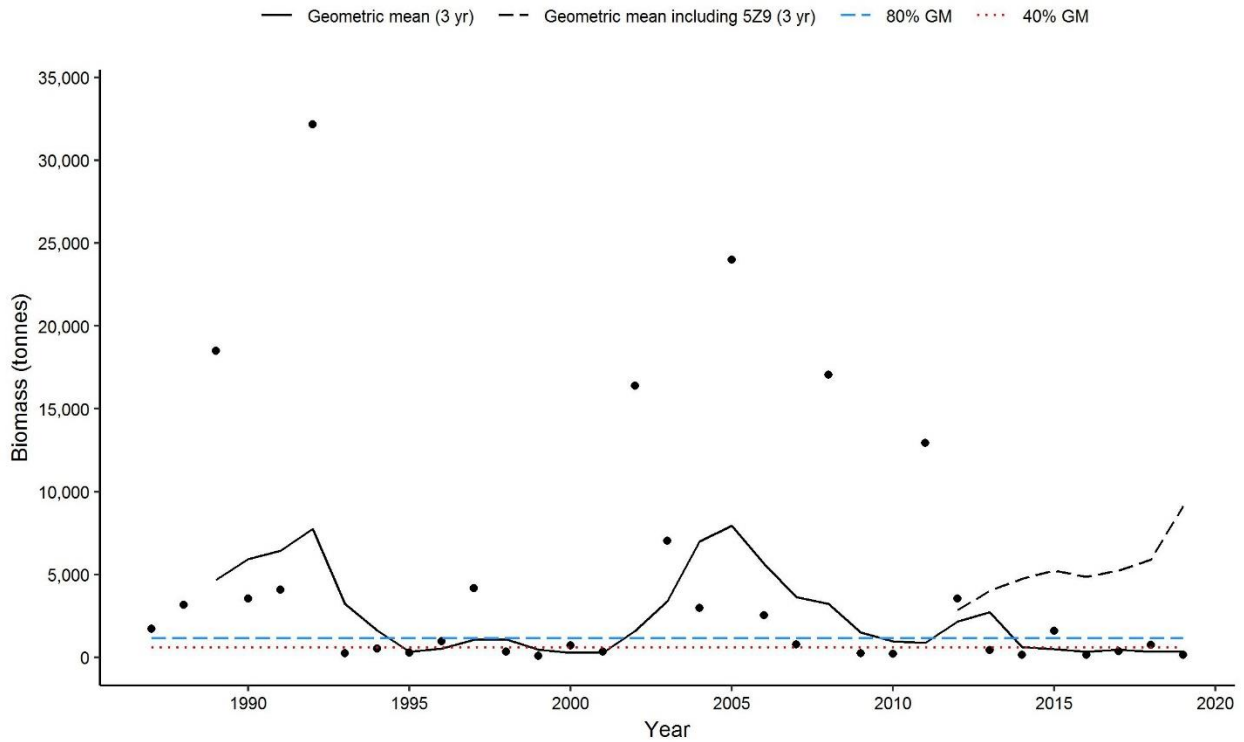
Figure 3b. Biomass index for Haddock in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

Figure 3c. Length frequency indices for Haddock in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Pollock

Pollock were only caught in seven sets in 5Z1-4 but were well distributed through the deeper water in 5Z9 and western 4X. The larger catches were taken in 5Z9 and in adjacent deep water strata in 4X, outside the standard area used for developing indices for Georges Bank (Figure 4a). The biomass index from 5Z1–5Z4 for 2019, along with the 3yr-GM, were below 40% of the long-term GM (Figure 4b). The 3yr-GM including 5Z9 was higher, with a slightly increasing trend. Inclusion of a broader area may be needed to provide indices that are useful for monitoring abundance trends.

Abundance indices for 5Z1-4 are lower than the long-term median at most lengths (Figure 4c).

Figure 4a. Distribution of Pollock catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.

Figure 4b. Biomass index for Pollock in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
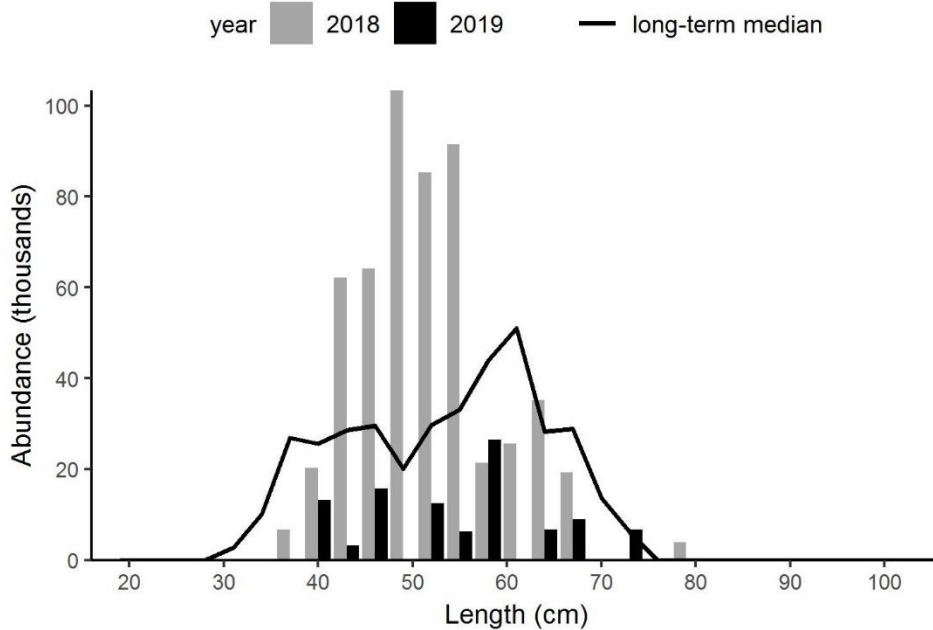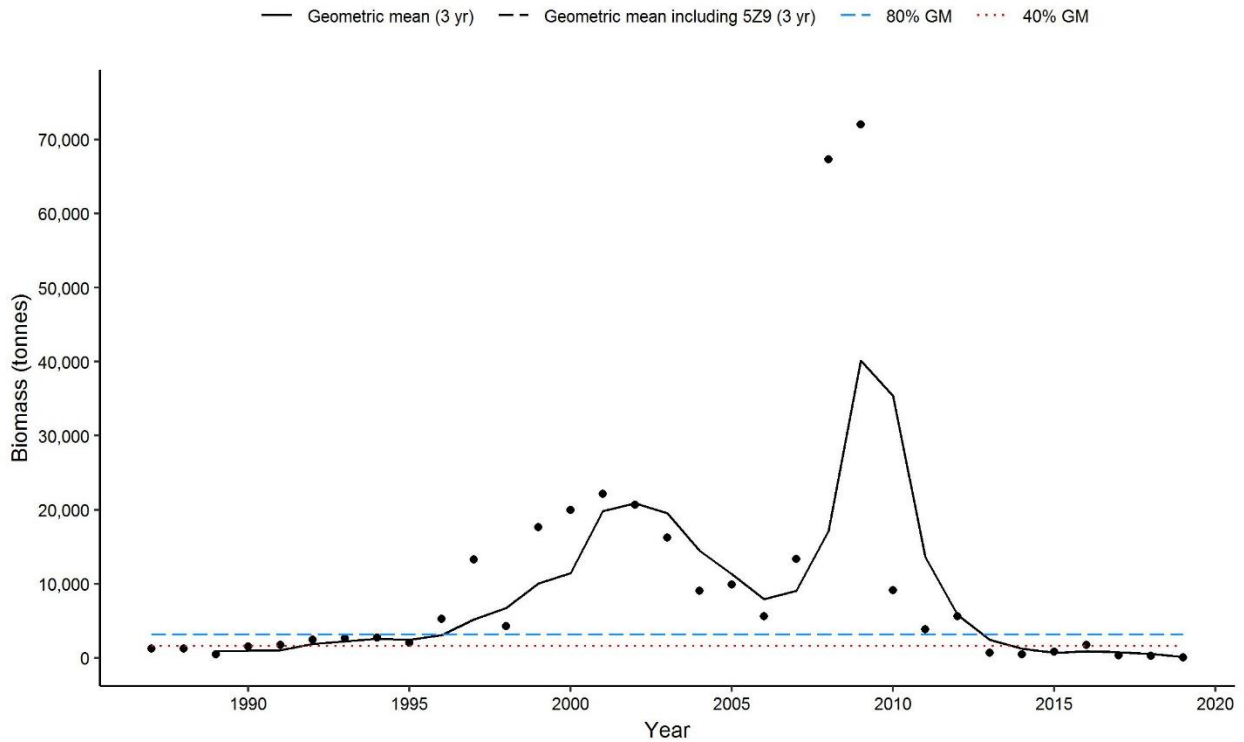

Figure 4c. Length frequency indices for Pollock in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Yellowtail Flounder

Yellowtail Flounder were found primarily in 5Z2 (Figure 5a). Catches were small in all areas and almost completely absent from Georges Bank outside of 5Z2. The biomass index for 5Z1-4 from 2019 was the lowest in the time series, and the 3yr-GM remained below 40% of the long-term GM for the sixth year in a row (Figure 5b). The 3yr-GM with and without 5Z9 were virtually identical. Abundance indices at all lengths were lower for 2019 than for 2018 and remained well below the median (Figure 5c).
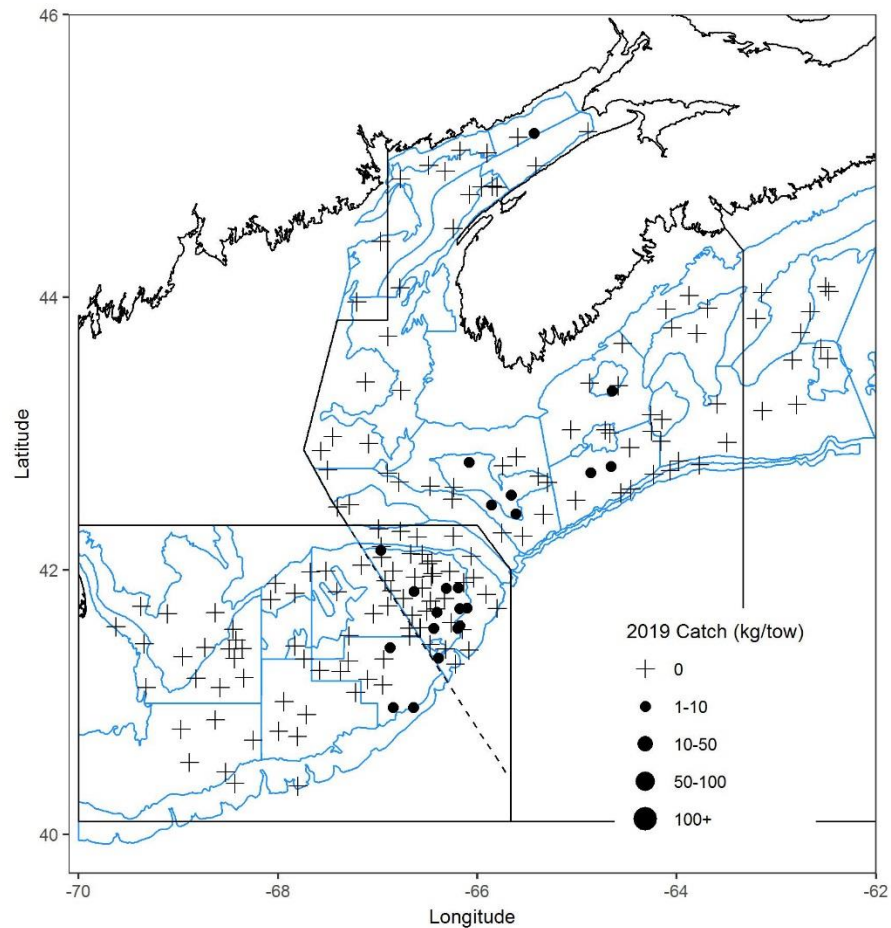
Figure 5a. Distribution of Yellowtail Flounder catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.

Figure 5b. Biomass index for Yellowtail Flounder in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
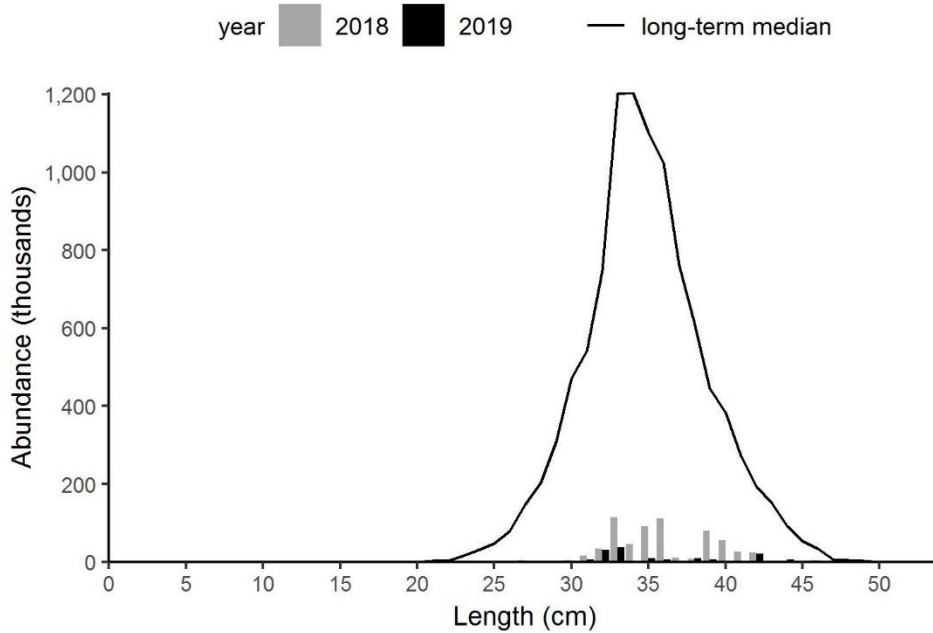

Figure 5c. Length frequency indices for Yellowtail Flounder in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Smooth Skate

Smooth Skate were caught in small numbers in 5Z and in only one set within the 5Z1–5Z4 index area (Figure 6a). Larger catches were taken in 5Z9 and in adjacent deep water strata in 4X, outside the standard area used for developing indices for Georges Bank (Figure 4a).

The biomass indices were very low for all years in 5Z1-4 (Figure 6b). Including 5Z9 in the biomass index gives a much higher 3yr-GM, with the highest value coming from 2019. Only one individual was caught in the 5Z1–5Z4 index area in 2019 (Figure 6c). The long-term median is 0 for all lengths, which indicates that the survey infrequently captures Smooth Skate at any length within the 5Z1–5Z4 area. Indices across a broader area (beyond 5Z) would be needed to more usefully monitor abundance trends for Smooth Skate.
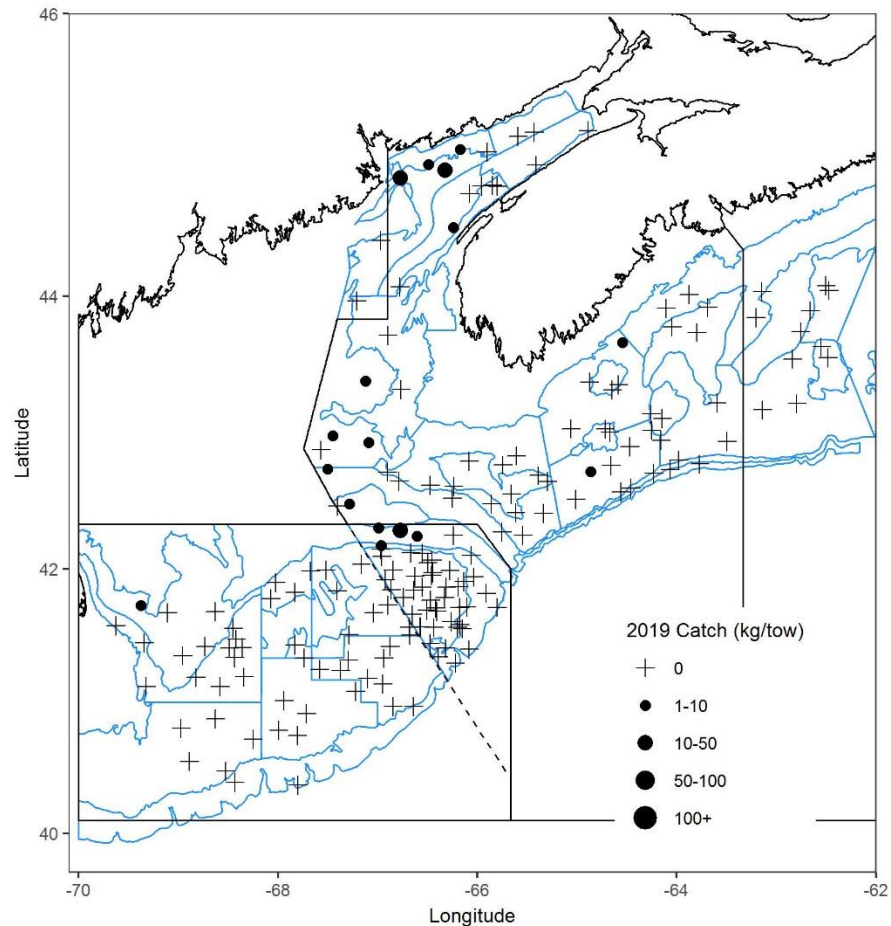
Figure 6a. Distribution of Smooth Skate catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
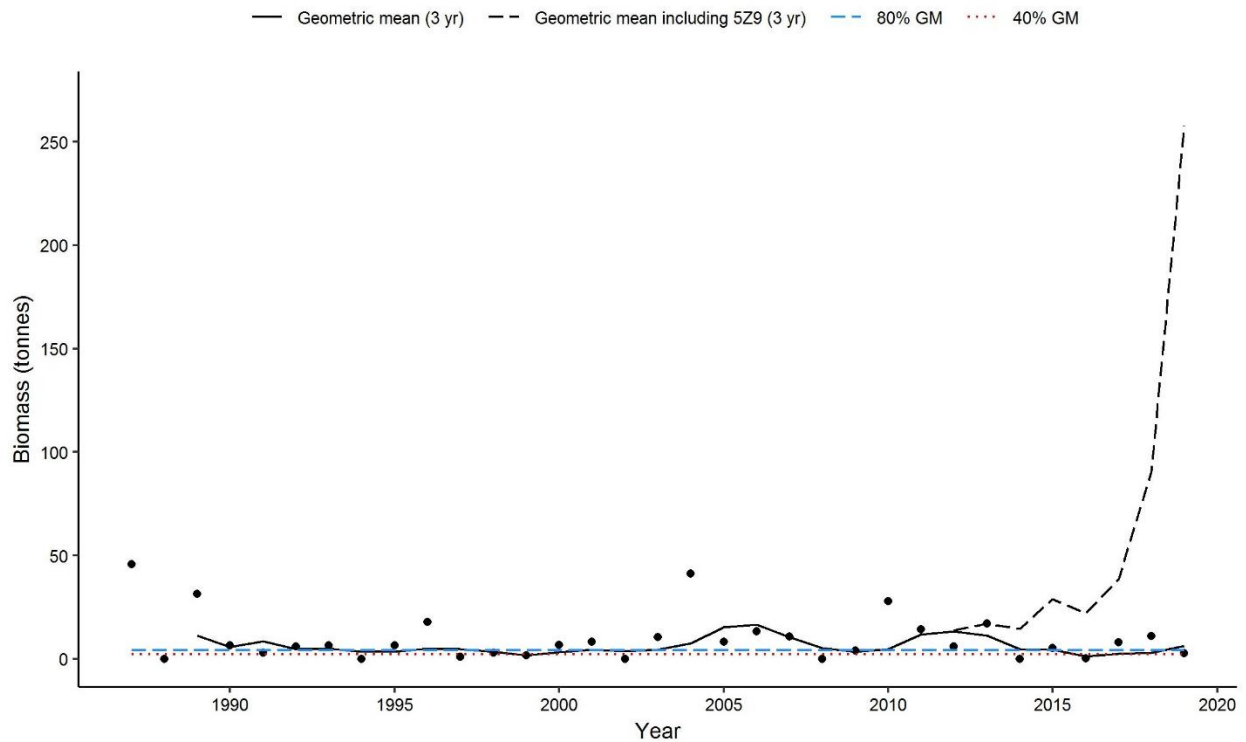
Figure 6b. Biomass index for Smooth Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
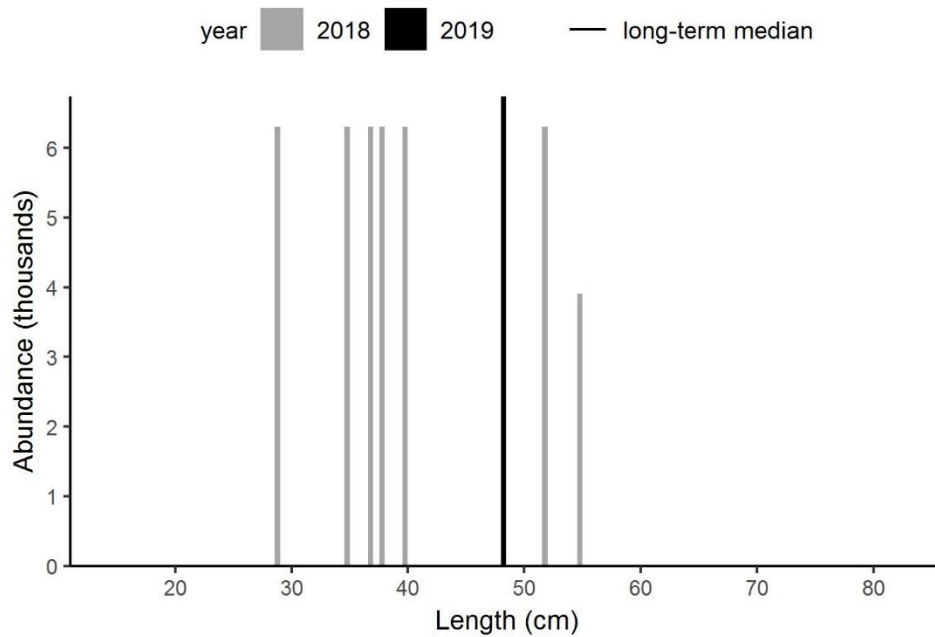

Figure 6c. Length frequency indices for Smooth Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The long-term median is 0 for all lengths.

Thorny Skate

Thorny Skate were caught in small numbers in one set on Georges Bank, in 5Z1–5Z4 (Figure 7a) and were also low in abundance in nearby strata in 4X. Both the 2019 biomass index for 5Z1-4 and the 3yr-GM were well below 40% of the long-term GM and were the lowest in the time series (Figure 7b). The 3yr-GM does not differ greatly with or without the inclusion of 5Z9 and follows the same trend. Only a single individual was caught in 2019 in 5Z1-4 (Figure 7c). The long-term median is 0 for all lengths, which indicates that the survey now infrequently captures Thorny Skate at any length within the 5Z1–5Z4 area.
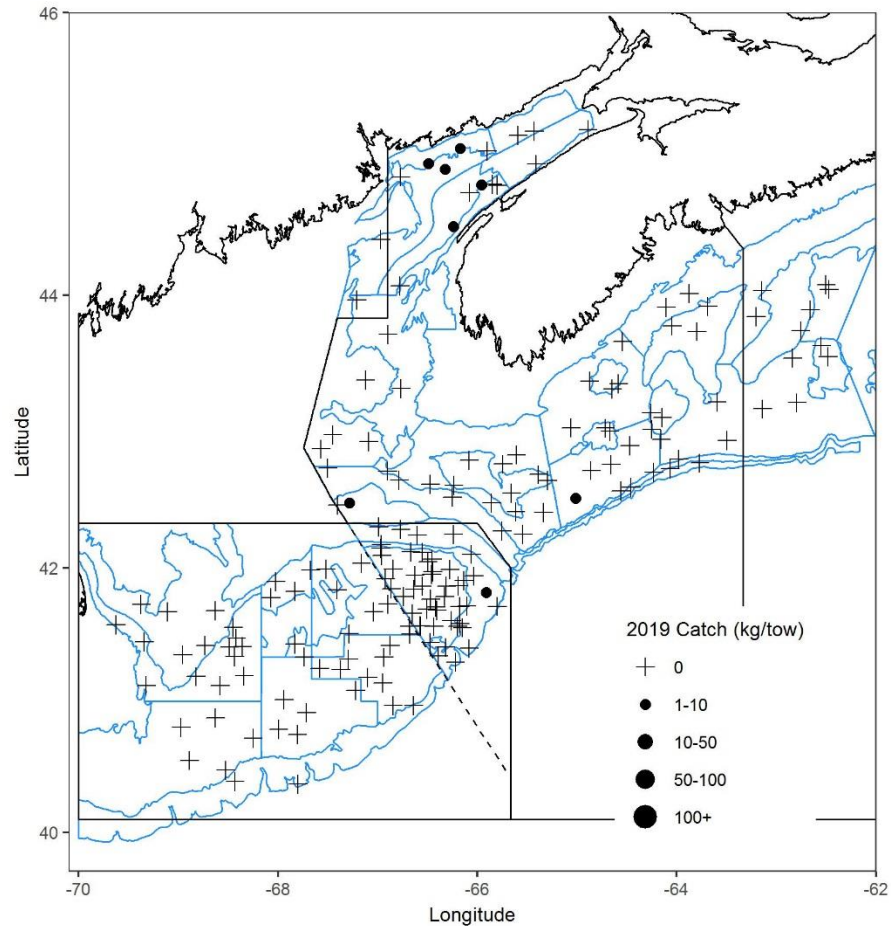
Figure 7a. Distribution of Thorny Skate catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
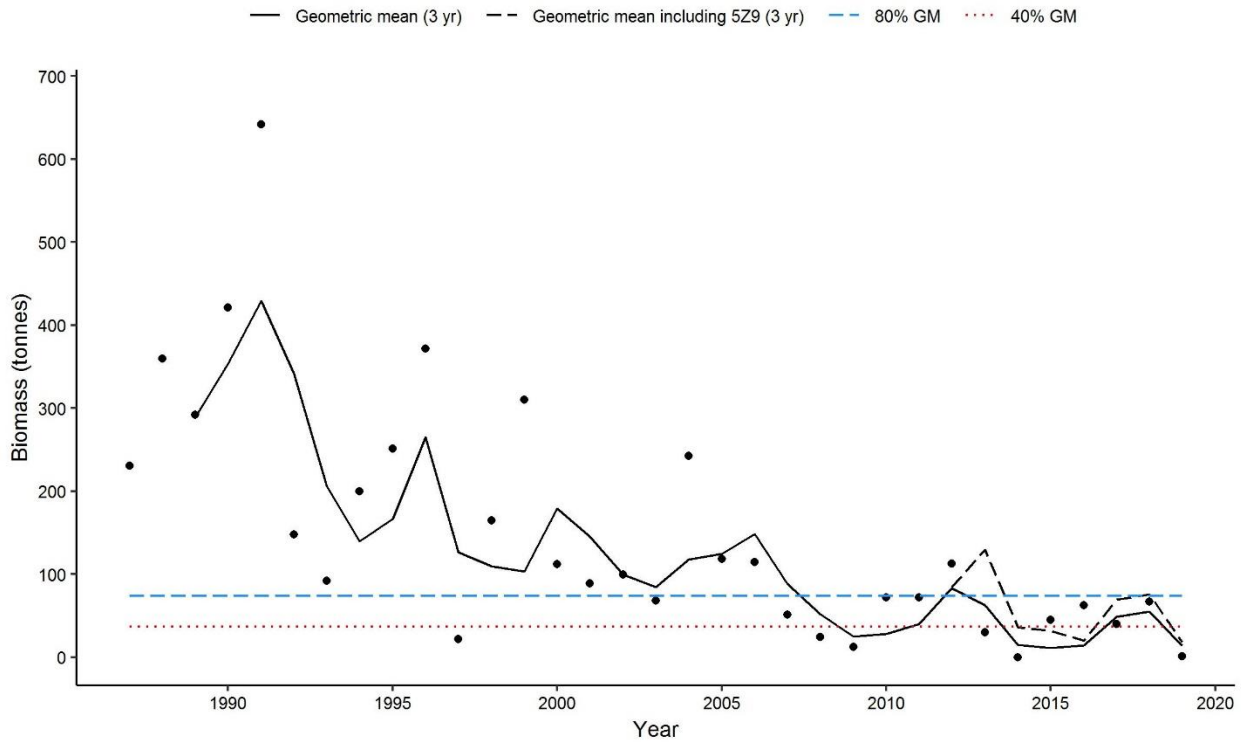
Figure 7b. Biomass index for Thorny Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
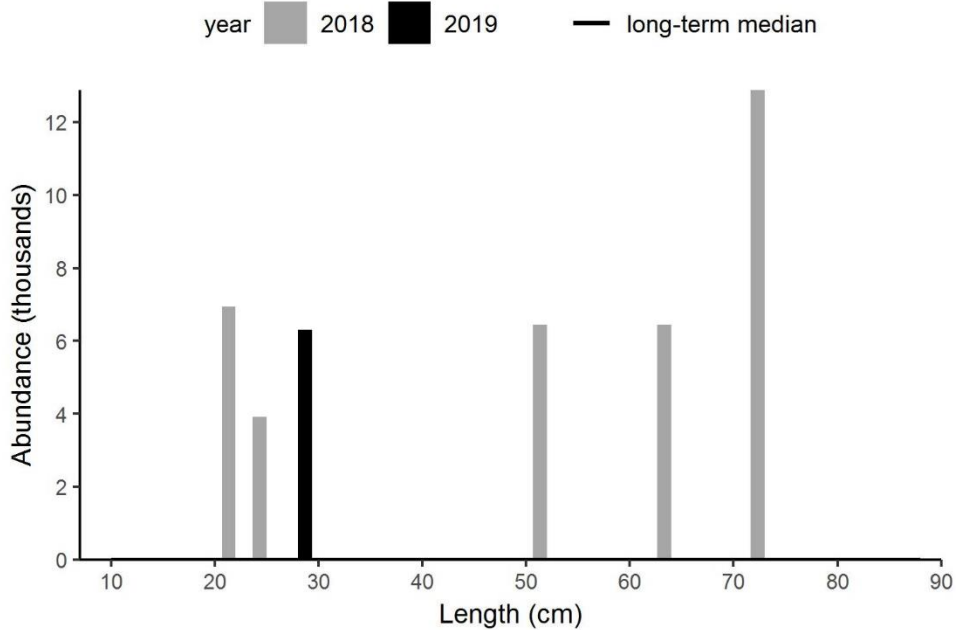
Figure 7c. Length frequency indices for Thorny Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The long-term median is 0 for all lengths.

Barndoor Skate

Barndoor Skate were captured along the edges of Georges Bank in small numbers in 12 sets, nine of which were in 5Z1–5Z4 (Figure 8a). The largest catches were taken in 5Z9 and in adjacent strata in 4X. The 2019 biomass estimate is below 40% of the long-term GM and the 3yr-GM is below 80% of the long-term GM (Figure 8b). Including 5Z9 in the biomass index gives a much higher 3yr-GM, with the highest value from 2019. All Barndoor Skates caught in 5Z1–5Z4 in 2019 were below 65 cm except one individual that was almost 120 cm (Figure 8c). The long-term median is 0 for all lengths, which indicates that the survey infrequently captures Barndoor Skate at any length within the 5Z1–5Z4 area.
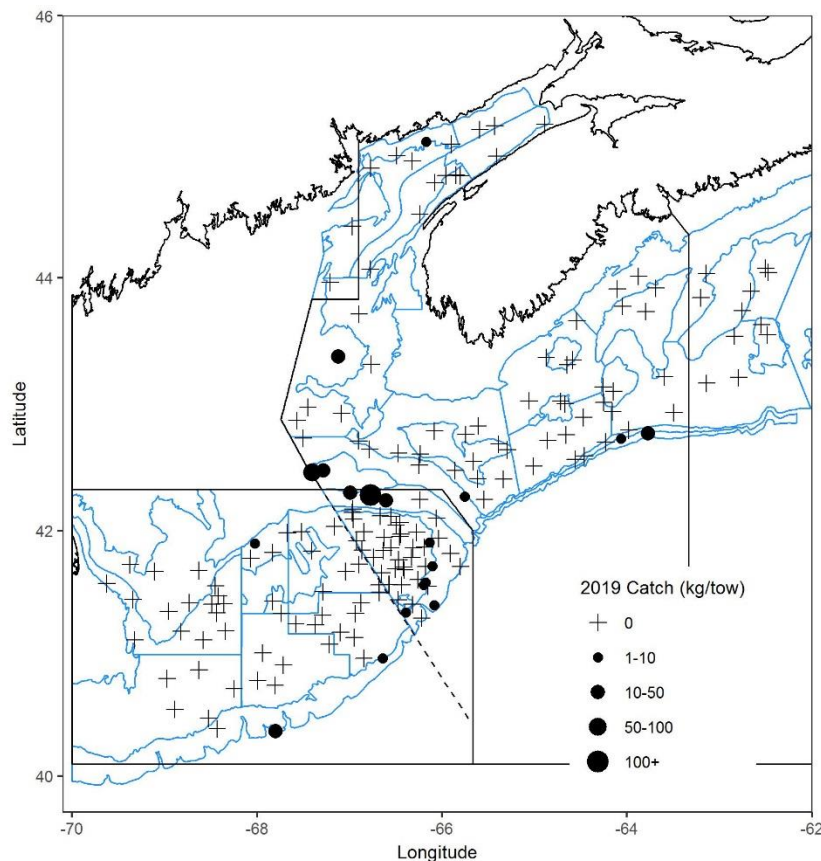

Figure 8a. Distribution of Barndoor Skate catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
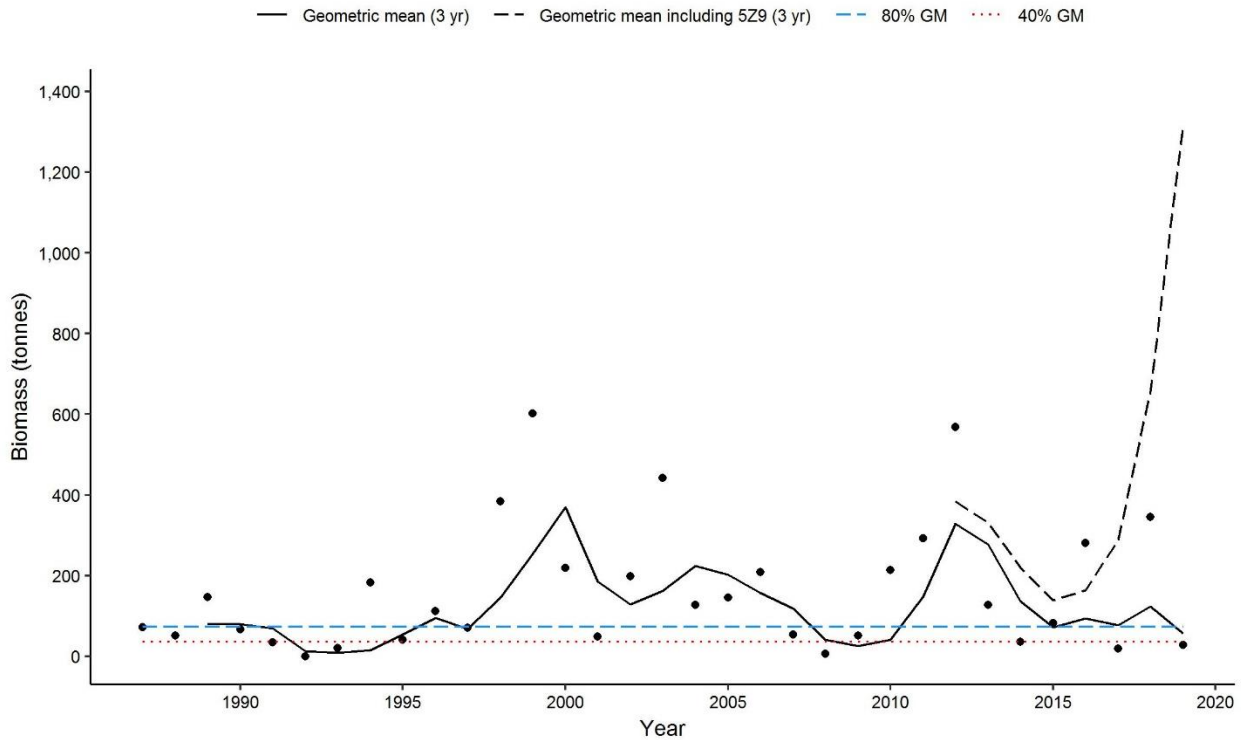
Figure 8b. Biomass index for Barndoor Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
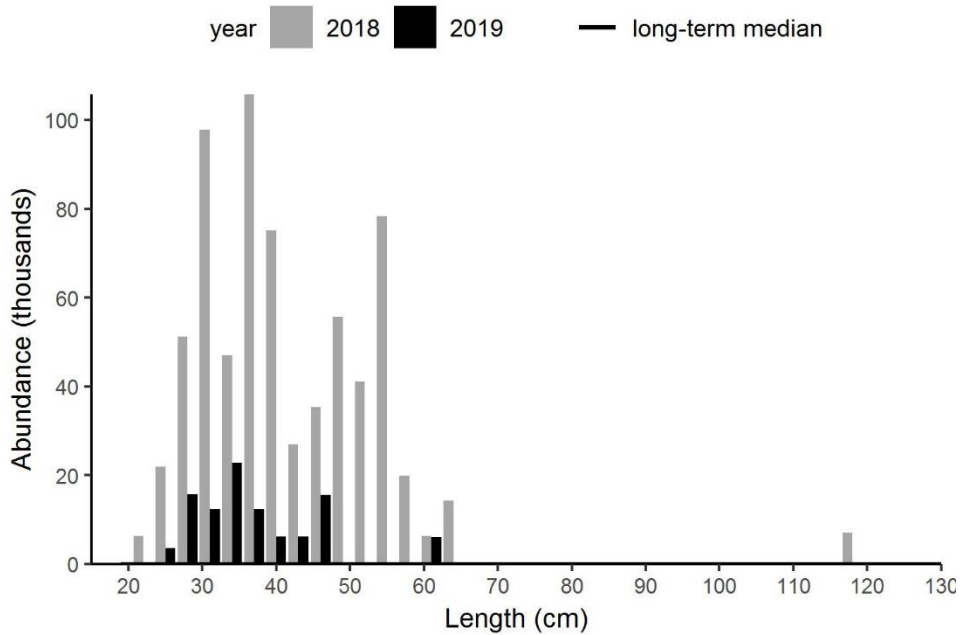

Figure 8c. Length frequency indices for Barndoor Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The long-term median is 0 for all lengths.

Winter Skate

At lengths below 35–40 cm, it is very difficult to distinguish Little and Winter skates. Common practice at-sea in the past was to group all small skates as Winter Skates if they lacked the features of sexual maturity used to identify Little Skate. These small skates (<40 cm) are now separated from either Little or Winter skates at-sea. For purposes of comparisons over time, only data for Winter Skate above 39 cm were included in these summaries.

The distribution of Winter Skate catches in the 2019 survey was primarily on the north-east peak and along the southern flank of Georges Bank (Figure 9a), with few caught in adjacent strata in 4X. The biomass index has increased since 2017, but the 3-yr GM remains below 40% of the long-term GM (Figure 9b). The 3yr-GM is slightly higher with the inclusion of 5Z9 in some years, but 5Z1-4 account for the bulk of the catch. The abundance indices are well below the long-term median for smaller Winter Skates but are at or above the median starting at 66 cm (Figure 9c).
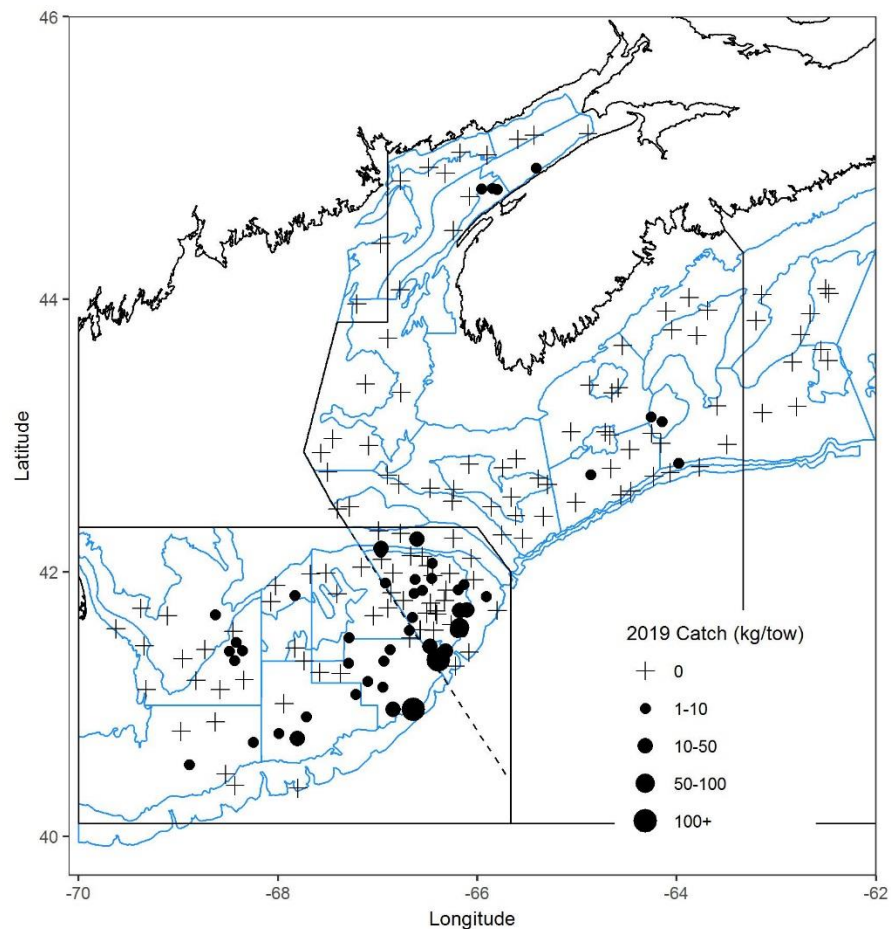

Figure 9a. Distribution of Winter Skate catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
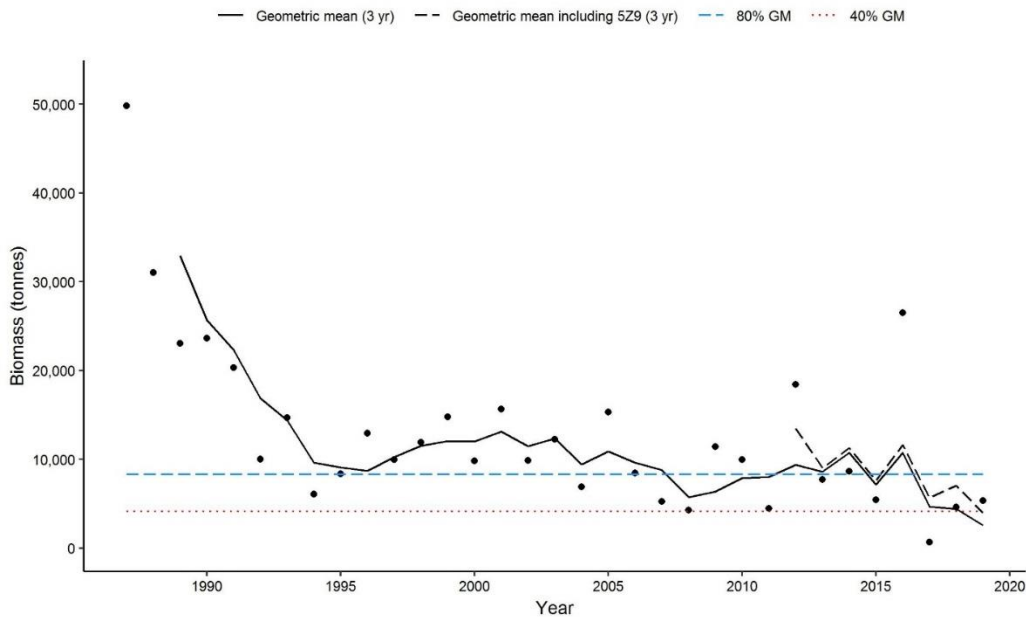
Figure 9b. Biomass index for Winter Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
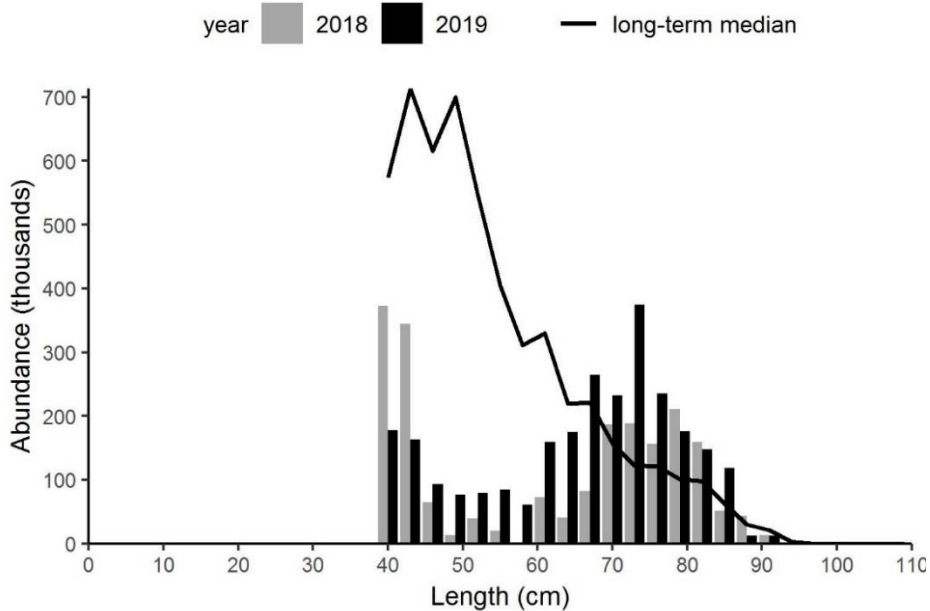

Figure 9c. Length frequency indices for Winter Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Little Skate

Little Skate were distributed across Georges Bank in 2019, with few caught in 5Z9 or adjacent deep water strata in 4X (Figure 10a). The 2019 biomass index for 5Z1-4 is the second lowest in the series, and the 3yr-GM remains below 80% of the long-term GM for the third year in a row (Figure 10b). The 3yr-GM with and without 5Z9 are virtually identical. The abundance indices were below the long-term median for most lengths in 2019 (Figure 10c).
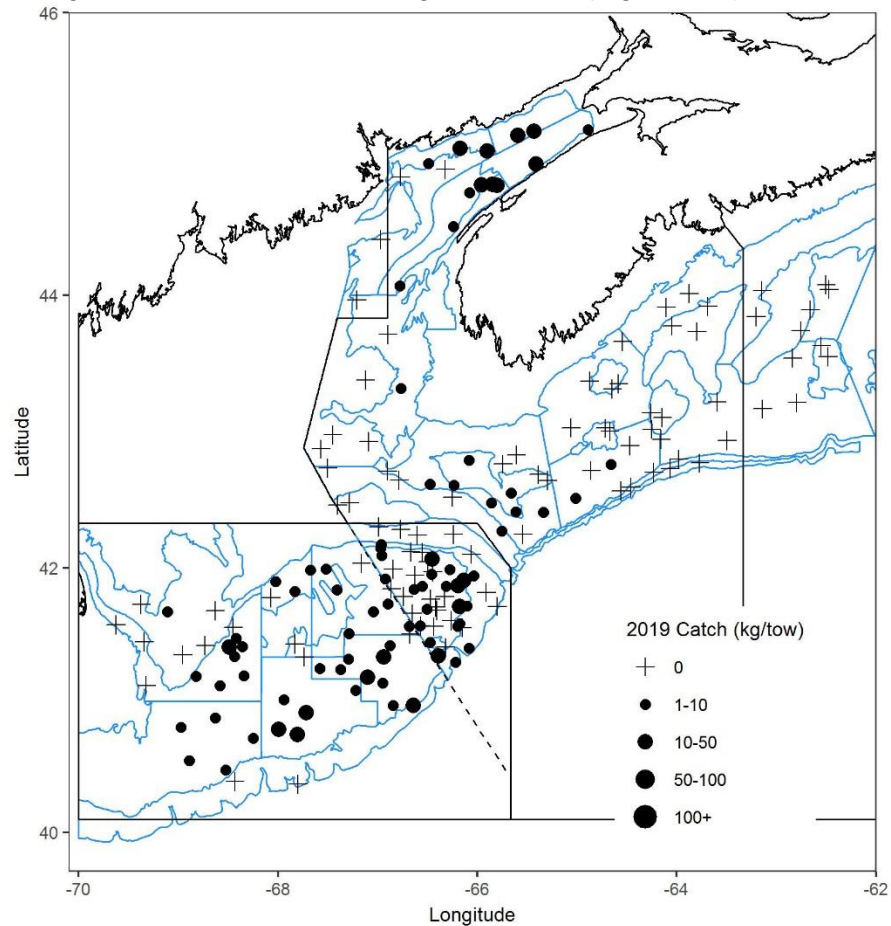

Figure 10a. Distribution of Little Skate catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
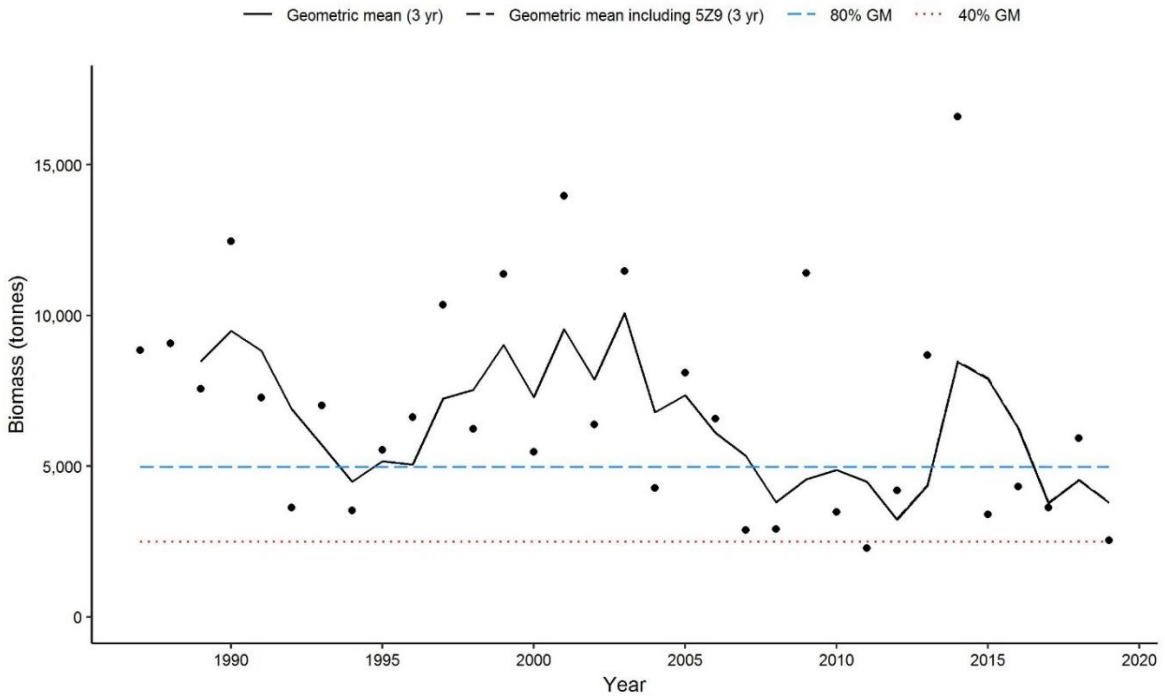
Figure 10b. Biomass index for Little Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
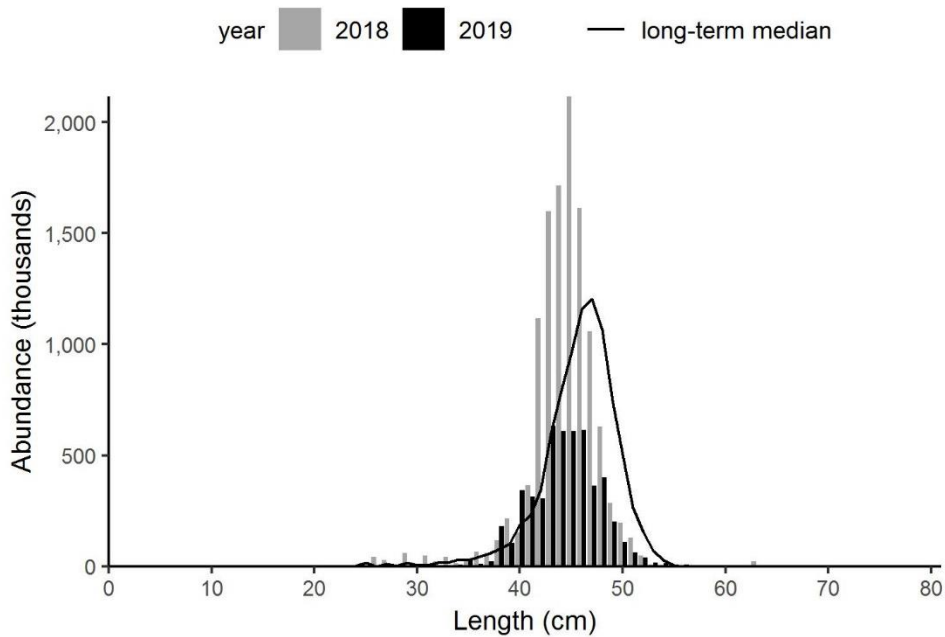

Figure 10c. Length frequency indices for Little Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Longhorn Sculpin

Longhorn Sculpin were distributed across Georges Bank in 2019, with few caught in 5Z9 or adjacent deep water strata in 4X (Figure 11a). The 2019 biomass index for 5Z1-4 is the lowest in the series, and the 3yr-GM remains below 40% of the long-term GM (Figure 11b). The 3yr-GM with and without 5Z9 are virtually identical, since this species is generally found in shallower water. The abundance indices in 2019 were below the long-term median for most lengths but above the median at lengths <13 cm (Figure 11c).
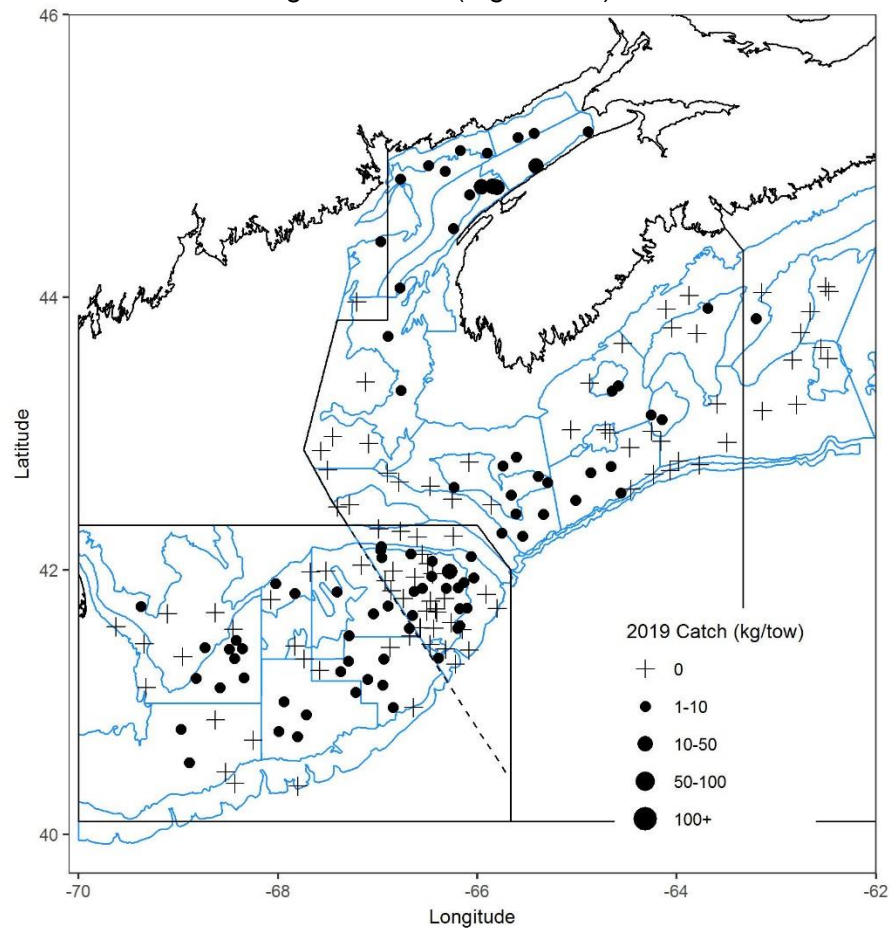

Figure 11a. Distribution of Longhorn Sculpin catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
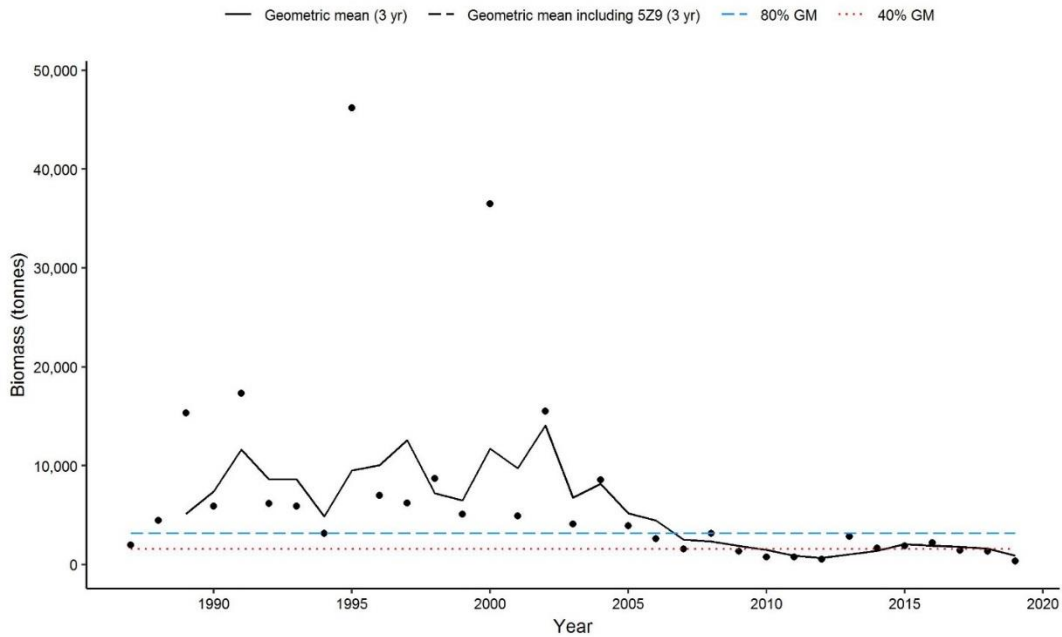
Figure 11b. Biomass index for Longhorn Sculpin in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
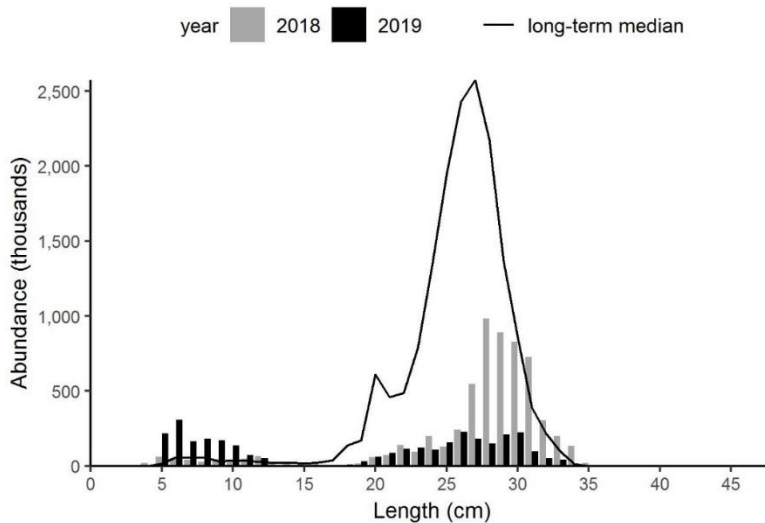

Figure 11c. Length frequency indices for Longhorn Sculpin in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Ocean Pout

Ocean Pout were caught in four sets on Georges Bank, three of which were in 5Z1–5Z4, and were not caught in 5Z9 or adjacent deep water strata in 4X (Figure 12a). Both the 2019 biomass index for 5Z1-4 and the 3yr-GM are well below 40% of the long-term GM and are the lowest in the time series (Figure 12b). The 3yr-GM does not change with the inclusion of 5Z9, as this species is not generally found in deeper water. Only five individuals were caught in 5Z1-4 in 2019 (Figure 12c).
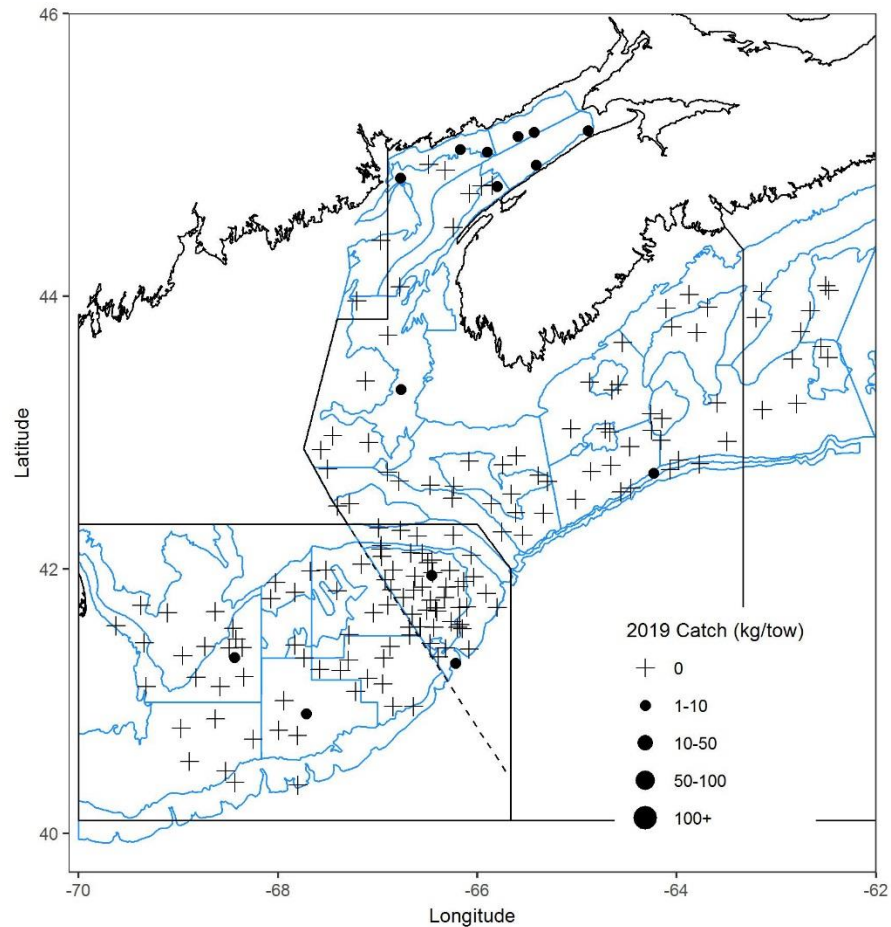

Figure 12a. Distribution of Ocean Pout catches during the 2019 Winter RV Survey. Black circles represent catches. The circle area is proportional to the 2019 catch size. Zero catch is represented by the + symbol.
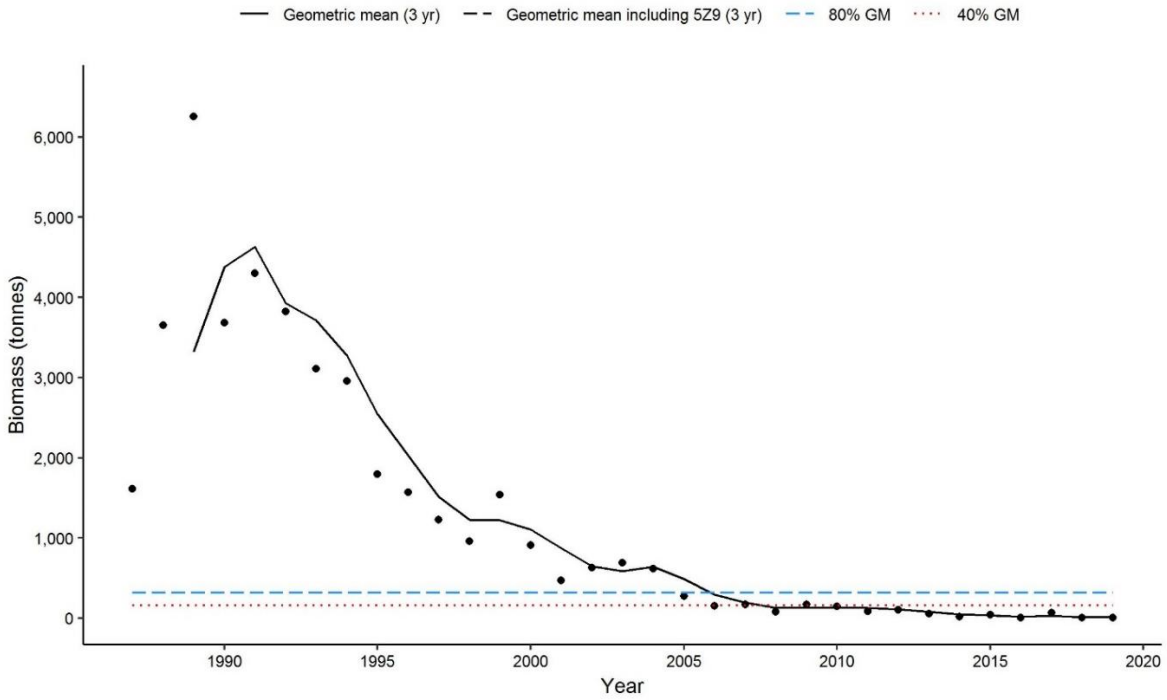
Figure 12b. Biomass index for Ocean Pout in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2018), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.
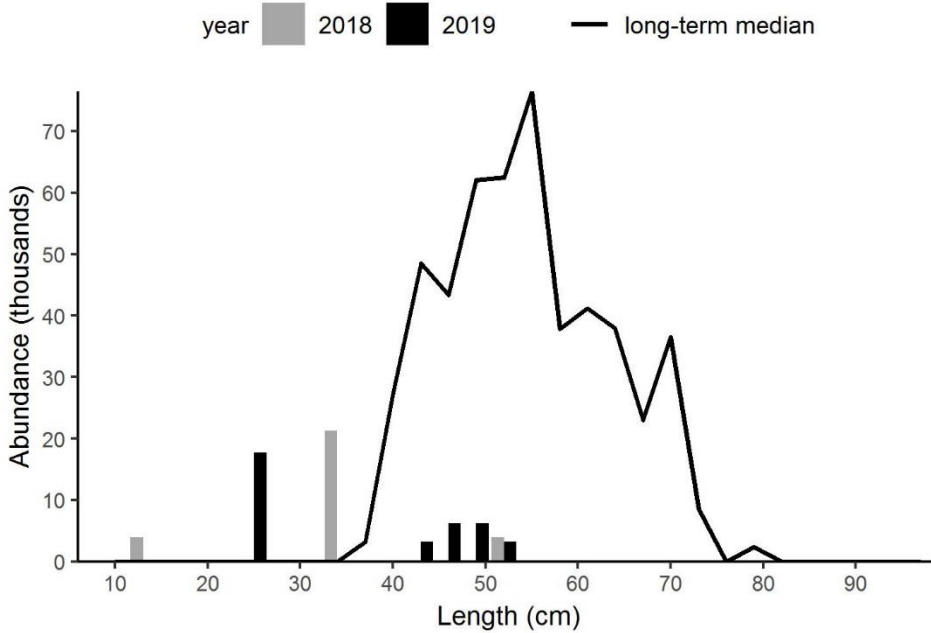

Figure 12c. Length frequency indices for Ocean Pout in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2018 survey. The black bars represent the number in thousands at length from the 2019 survey. The solid black line represents the median number in thousands at length for the time period 1987–2017.

Conclusions

The 3-year GM biomass indices in 2019 for strata 5Z1–5Z4 from the Winter RV Survey were below 40% of the long-term GM (1987–2017) biomass for Pollock, Yellowtail Flounder, Thorny Skate, Winter Skate, Longhorn Sculpin, and Ocean Pout. For species such as Smooth Skate, Pollock, and Barndoor Skate, inclusion of strata 5Z9 made a clear difference to the 3yr-GM. Monitoring abundance trends for these species, which have a much broader stock area and which are primarily distributed in deeper water in winter, will require analyses of data from outside the standard 5Z1-4 area used for Georges Bank stocks. For some species, this may involve combining information from the winter and summer surveys.

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Sources of Information

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