Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat
Maritimes Region **Science Response 2020/011**

2018 MARITIMES WINTER RESEARCH VESSEL SURVEY TRENDS ON GEORGES BANK

Context

Fisheries and Oceans Canada (DFO) has conducted DFO 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 Region. 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 2018 DFO Winter RV Survey was conducted on the *Mersey Venture* due to mechanical issues experienced on both of the vessels normally used to complete the survey, the Canadian Coast Guard Ship (*CCGS) Alfred Needler and the CCGS Teleost*. The *Mersey Venture* was equipped with the Western IIA trawl and followed the standard protocols for the Maritimes RV surveys (Stone and Gross 2012). Both the *Mersey Venture* and *CCGS Teleost* were built as shrimp trawlers in the Langsten Slip-Batbygerri Shipyard in Tomrefjord, Norway, in 1988. They are of identical length and beam and are both powered by a 4,000 hp diesel engine. Survey indices from the *Mersey Venture* are not expected to differ from the two Coast Guard Research vessels normally used for this survey.

Fisheries and Aquaculture Management (FAM) 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, and Little Skate. The survey information will be used by FAM 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 2018.

This Science Response Report results from the Science Response Process of June 29, 2018, on the Maritimes Research Vessel Survey Trends on Georges Bank.

Background

The Georges Bank (5Z) Winter RV Survey has been conducted annually since 1987. The survey follows a stratified random sampling design, and it 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 Strata 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 may not be useful for species that primarily inhabit depths greater than 200 m in winter.

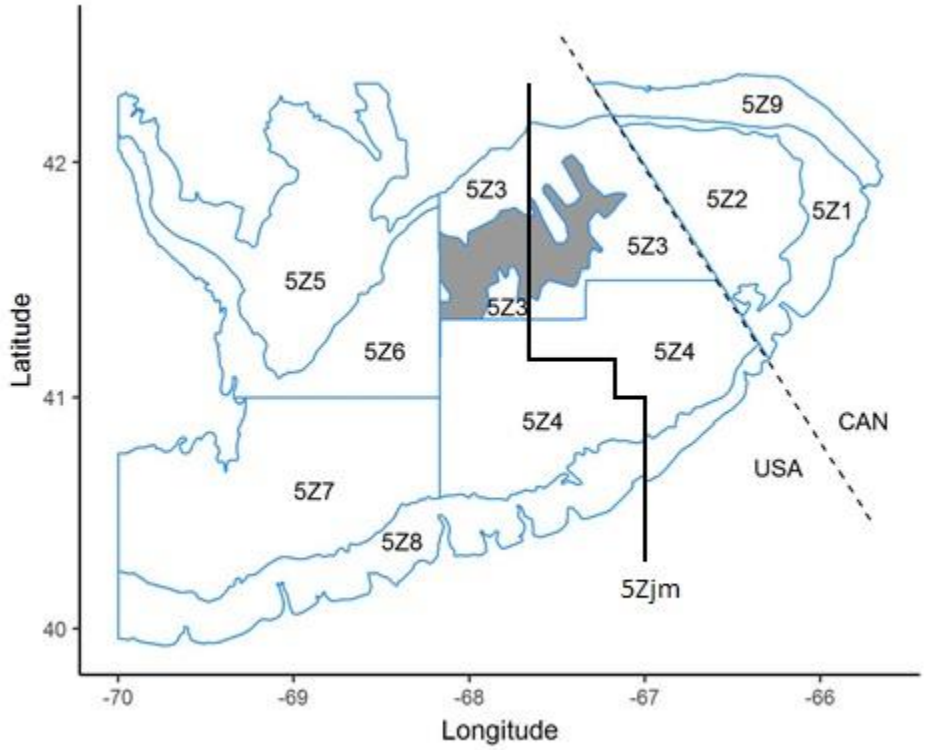

Figure 1. Georges Bank (5Z) Winter RV survey strata. No sets are made in the shoals of Georges Bank (Grey shaded area in 5Z3). The line bisecting 5Z3 and 5Z4 is the 5Zjm line, which is used for management of some species.

Analysis and Response

The 2018 DFO Winter RV Survey successfully completed 60 tows between March 20 and March 27, 2018. Due to problems with regular research vessels, sampling was only conducted in strata 5Z1–5Z4 and 5Z9, with 58 successful sets in strata 5Z1–5Z4. All sets were conducted by the Mersey Venture. Catch distribution plots and the long-term median catch per tow in each stratum surveyed are provided for the suite of species requested. Biomass index trends are shown for 5Z1–5Z4. Comparisons of 2017 and 2018 length frequencies (total abundance at length) from the survey catch in Strata 5Z1–5Z4 to the long-term median (1987–2016) are also included for the selected stocks.

The time-series of survey biomass indices and the 3-year running geometric mean (3-yr 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 index in Strata 5Z1–5Z4 + 5Z9 is included in order to demonstrate this.

Winter Skate and Little Skate have not been reliably distinguished at lengths less than approximately 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 2016, 2017, 2018, 3-year geometric mean, and 40% and 80% of the long-term (1987–2017) geometric mean. No time period averages (NA) were provided for mixed Little and Winter Skates because sampling began in 2014.

Species	2016	2017	2018	Current 3-yr GM	40% Long-term GM	80% Long-term GM
Cod	3,625	14,129	7,990	7,424	5,119	10,238
Haddock	232,880	149,090	198,942	190,445	19,895	39,791
Pollock	168	363	757	358	622	1,243
Yellowtail	1728	342	252	530	1,677	3,354
Smooth Skate	0.3	8	11	3	2	4
Thorny Skate	63	40	67	55	40	79
Barndoor Skate	281	20	345	124	30	61
Winter Skate	26,489	625	4,066	4,084	4,152	8,304
Little Skate	4,327	3,634	5,923	4,533	1,896	3,792
Mixed Winter/Little Skate	550	901	1,491	904	NA	NA

Atlantic Cod

Atlantic Cod were distributed throughout the survey area, with the largest catches primarily on the northeast portion of Georges Bank in 5Z1 and 5Z2 (Figure 2a). The 2018 survey biomass index falls between 40–80% of the long-term GM and the 3-yr GM is almost identical (Figure 2b). The 3-yr GM does not differ greatly with or without the inclusion of 5Z9 and follows the same trend. The abundance indices in 2018 are generally lower than in 2017 and closely resemble the long-term median until the size of >65 cm, where they continue to remain low (Figure 2c).

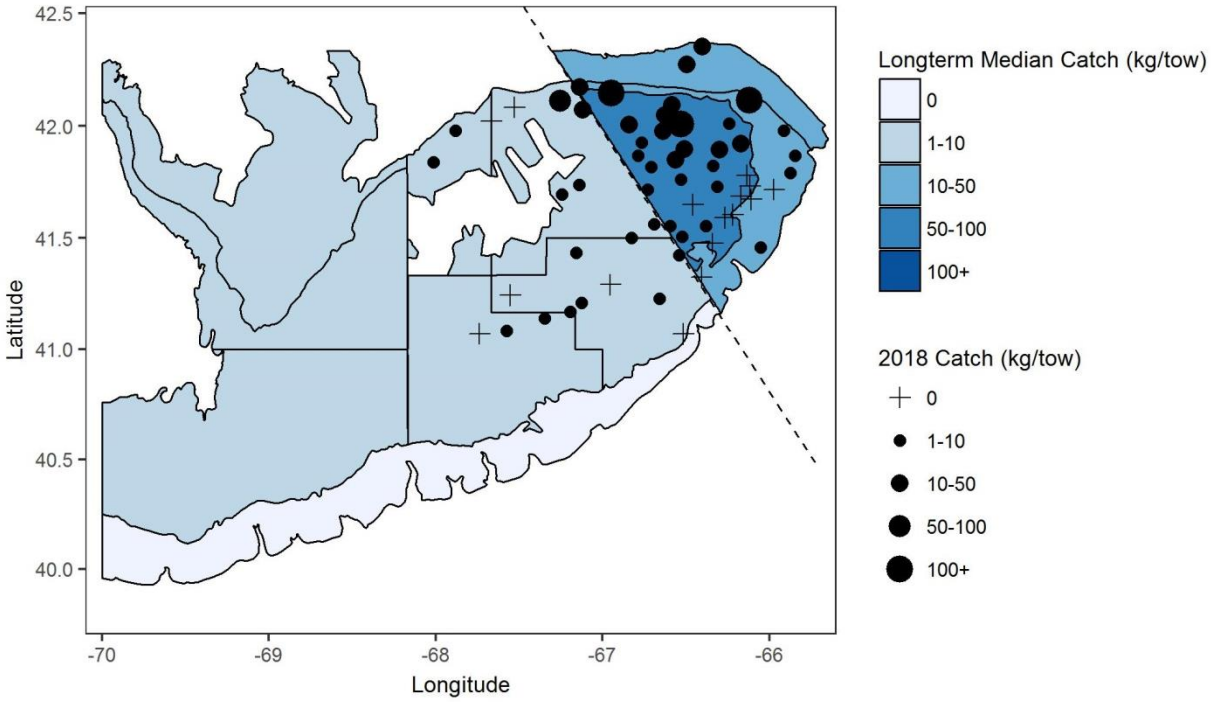

Figure 2a. Distribution of Atlantic Cod catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

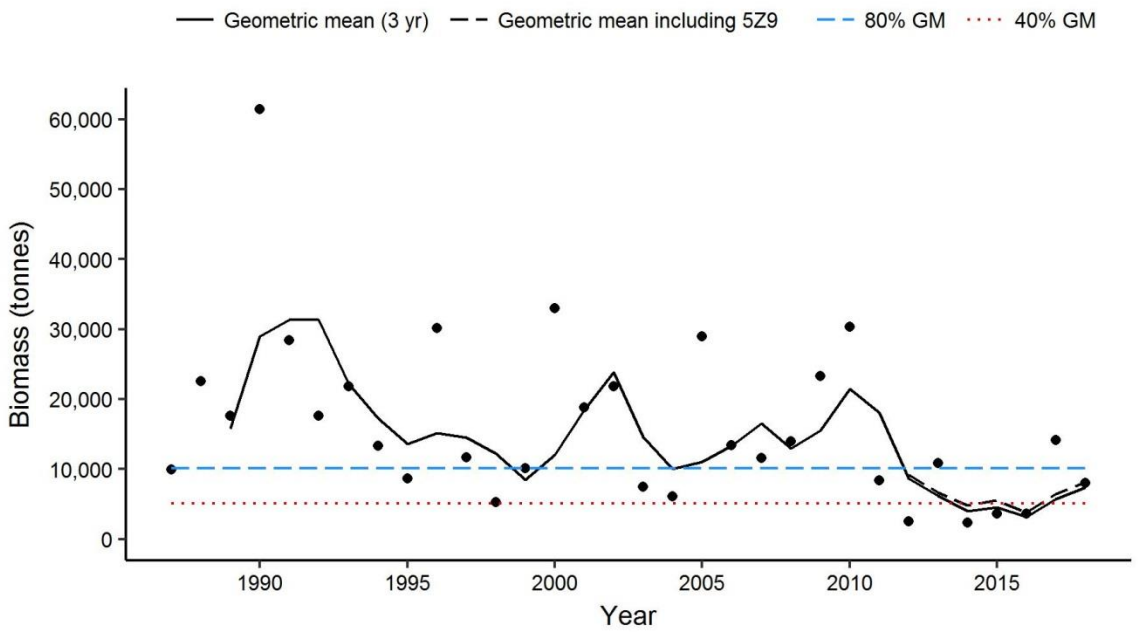

Figure 2b. Biomass index for Atlantic Cod in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

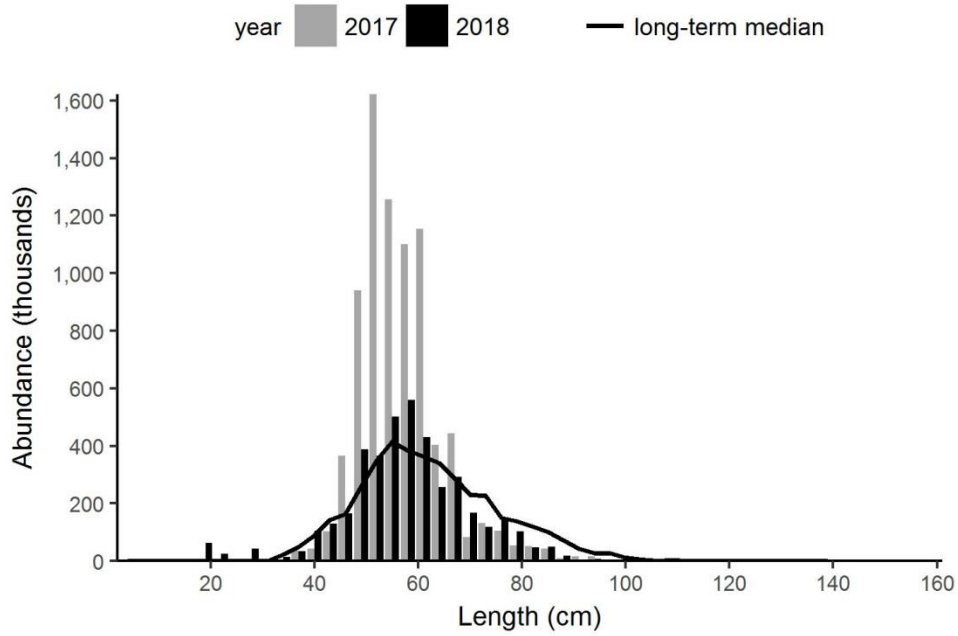

Figure 2c. Length frequency indices for Atlantic Cod in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands-at-length from the 2017 survey. The black bars represent the number in thousands-at-length from the 2018 survey. The solid black line represents the median number in thousands-at-length for the time period 1987–2016.

Haddock

Haddock were present in all sets in 2018 (Figure 3a). The 2018 Haddock biomass index is up from 2017 and is the third highest in the time-series (Figure 3b). The 3-yr GM with and without 5Z9 are virtually identical. Abundance indices in 2018 are high for lengths between 38 and 48 cm (Figure 3c). This is higher than the modal length in 2017 and tracks the growth of the very abundant 2013 year-class. Abundance was also very high for fish 26–30 cm. Large fish (over 50 cm) remain close to the long-term median.

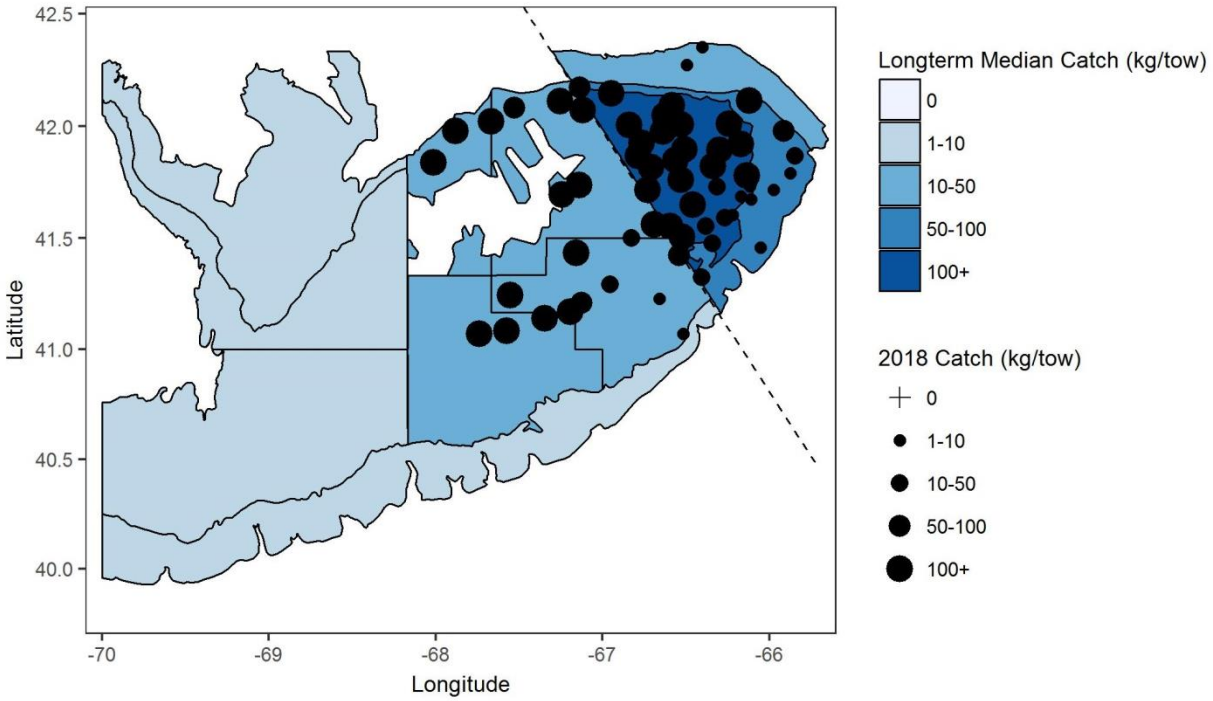

Figure 3a. Distribution of Haddock catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

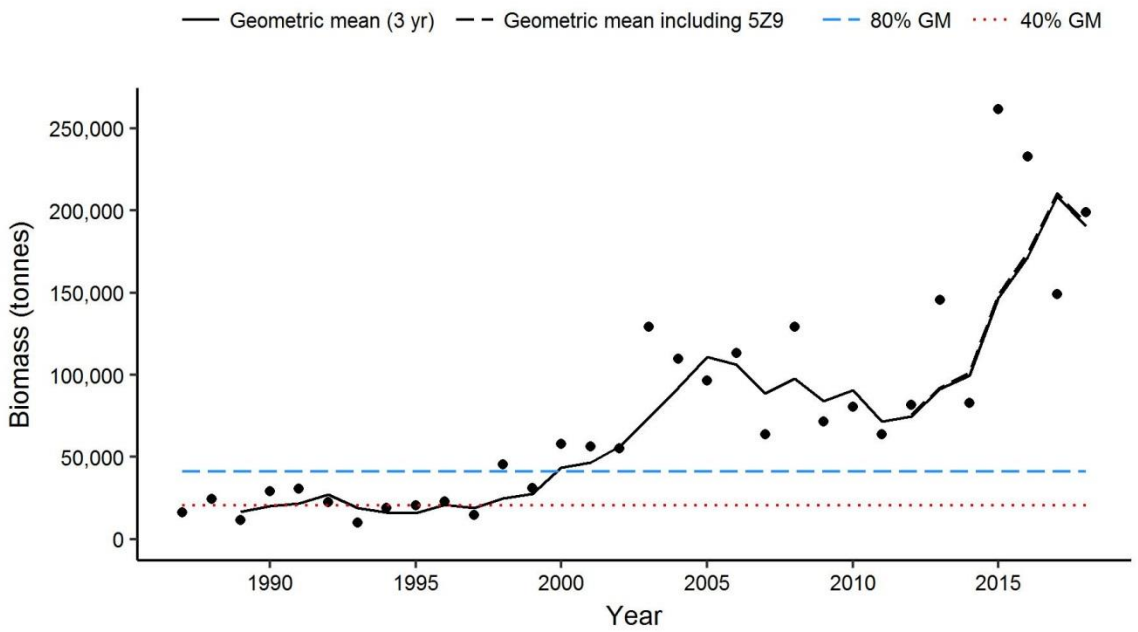

Figure 3b. Biomass index for Haddock in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

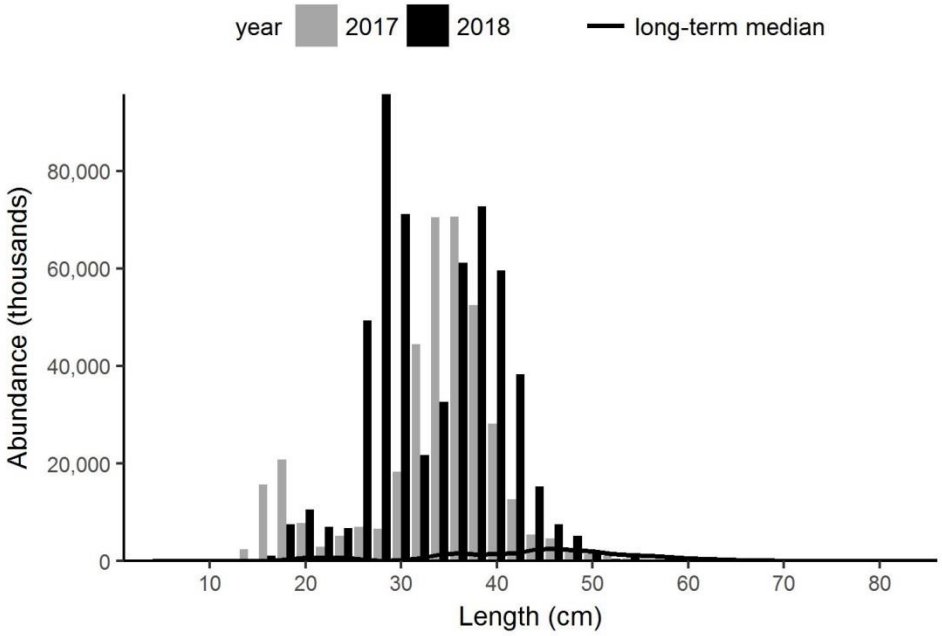

Figure 3c. Length frequency indices for Haddock in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The solid black line represents the median number in thousands at length for the time period 1987–2016.

Pollock

Pollock were only caught in six sets, with the largest catch in 5Z9, outside the area used for developing indices (Figure 4a). Although the biomass index from 5Z1–5Z4 is up slightly from 2017, the 3-yr GM remains below 40% of the long-term GM for the third year in a row (Figure 4b). The 3-yr GM including 5Z9 is visibly 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 are higher than the long term for lengths 42–54 cm but generally much lower for both bigger and smaller fish (Figure 4c).

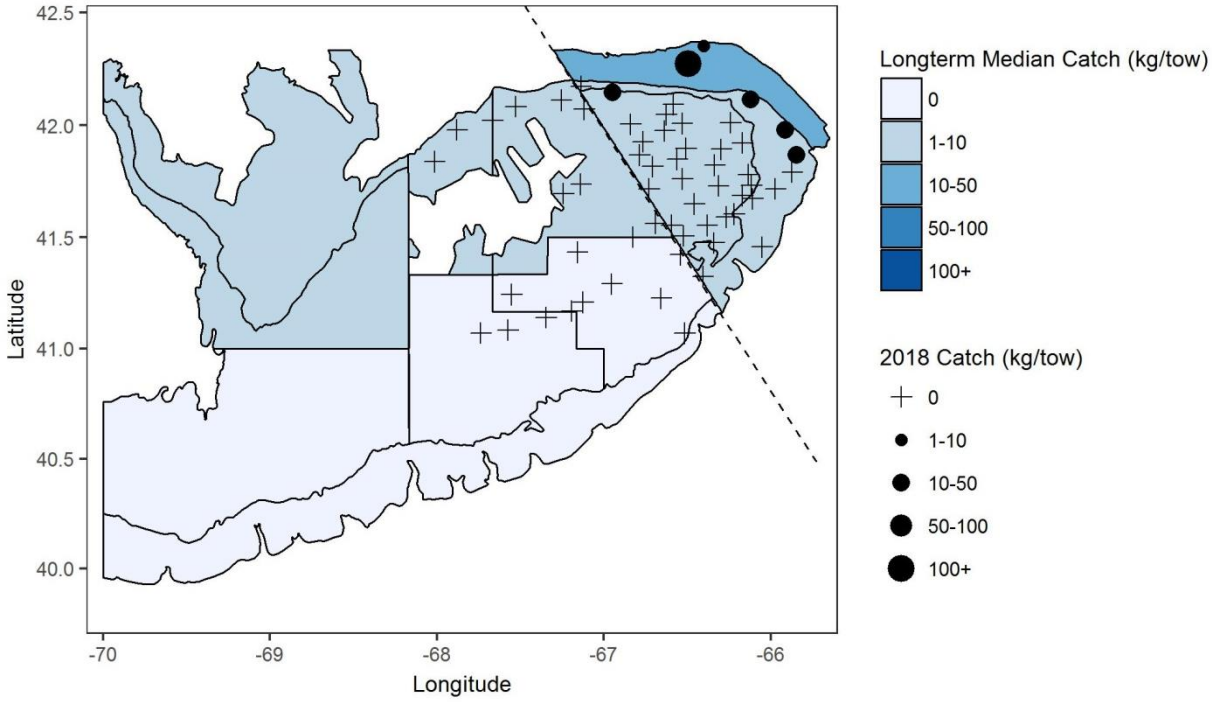

Figure 4a. Distribution of Pollock catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

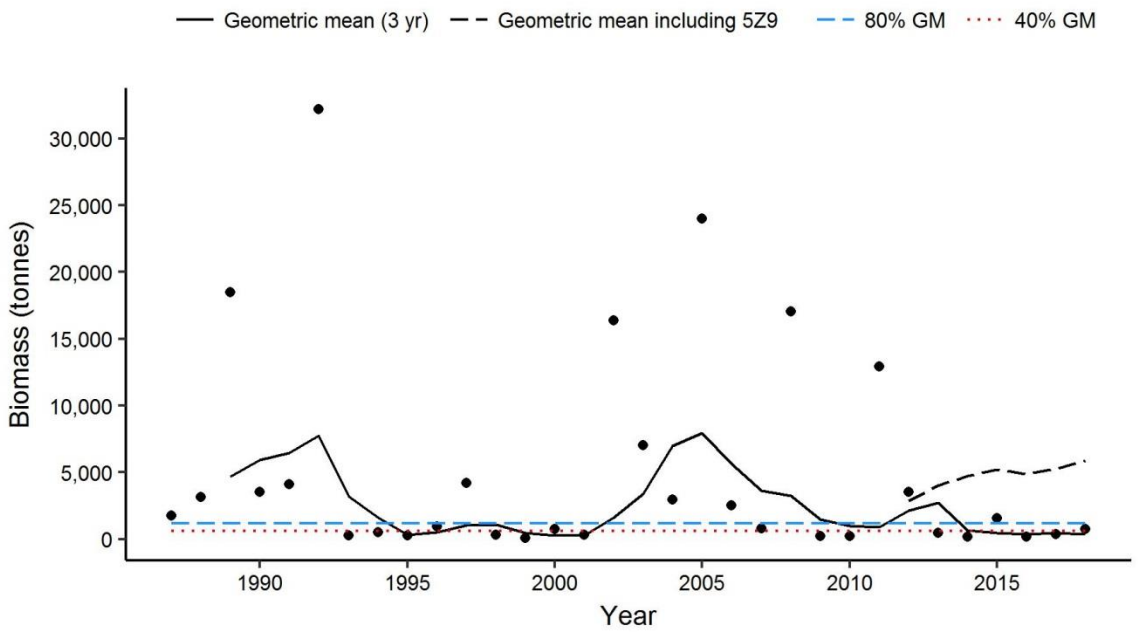

Figure 4b. Biomass index for Pollock in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

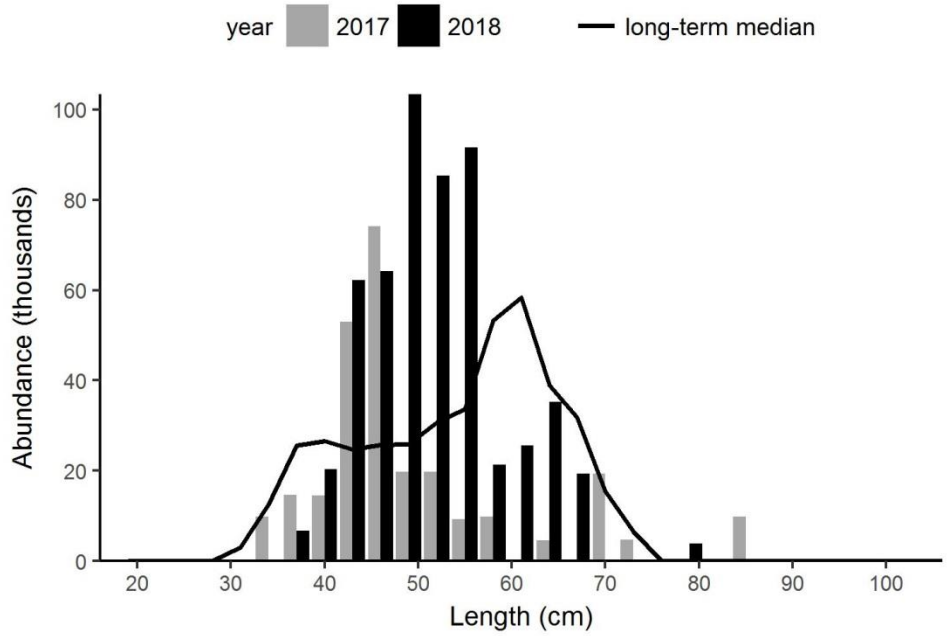

Figure 4c. Length frequency indices for Pollock in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The solid black line represents the median number in thousands at length for the time period 1987–2016.

Yellowtail Flounder

Yellowtail flounder were found primarily in 5Z2 (Figure 5a). Catches were small in all areas and almost completely absent from the southwestern sets. The biomass index for 2018 is the lowest in the time series and the 3-yr GM remains below 40% of the long-term GM for the fifth year in a row (Figure 5b). The 3-yr GM with and without 5Z9 are virtually identical. Abundance indices at most lengths were lower for 2018 than for 2017 and remain well below the median (Figure 5c). The size distribution is consistent with 2017.

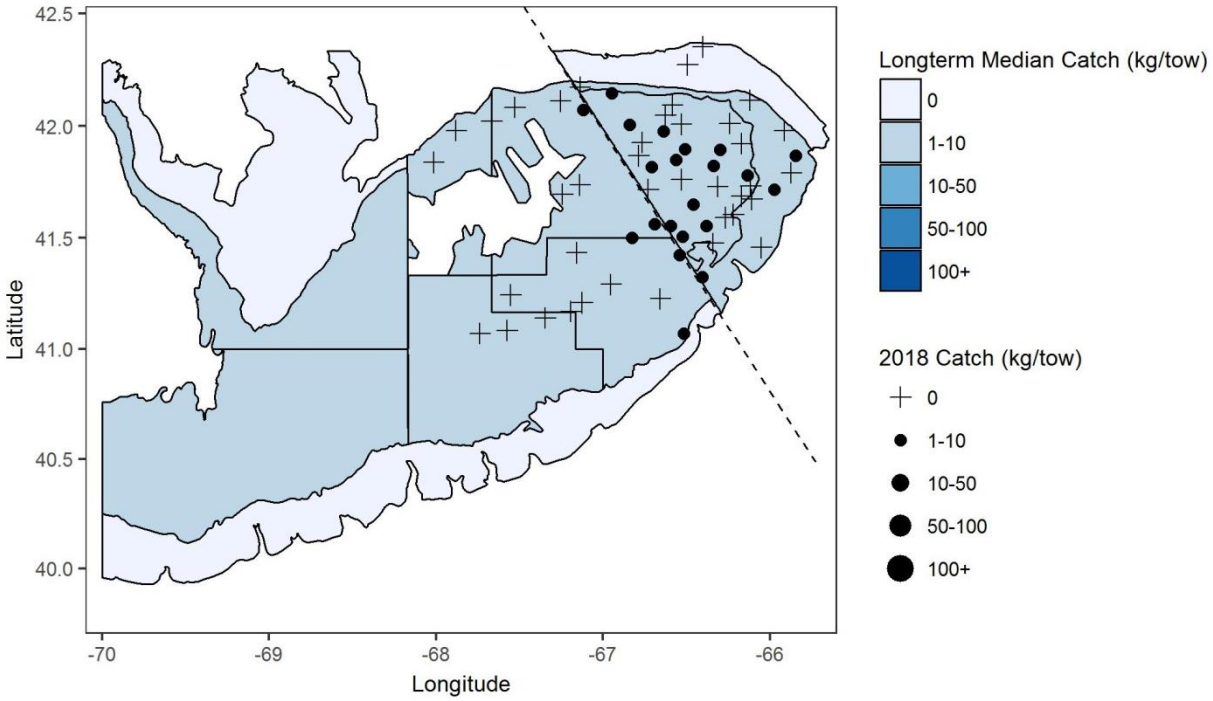

Figure 5a. Distribution of Yellowtail Flounder catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

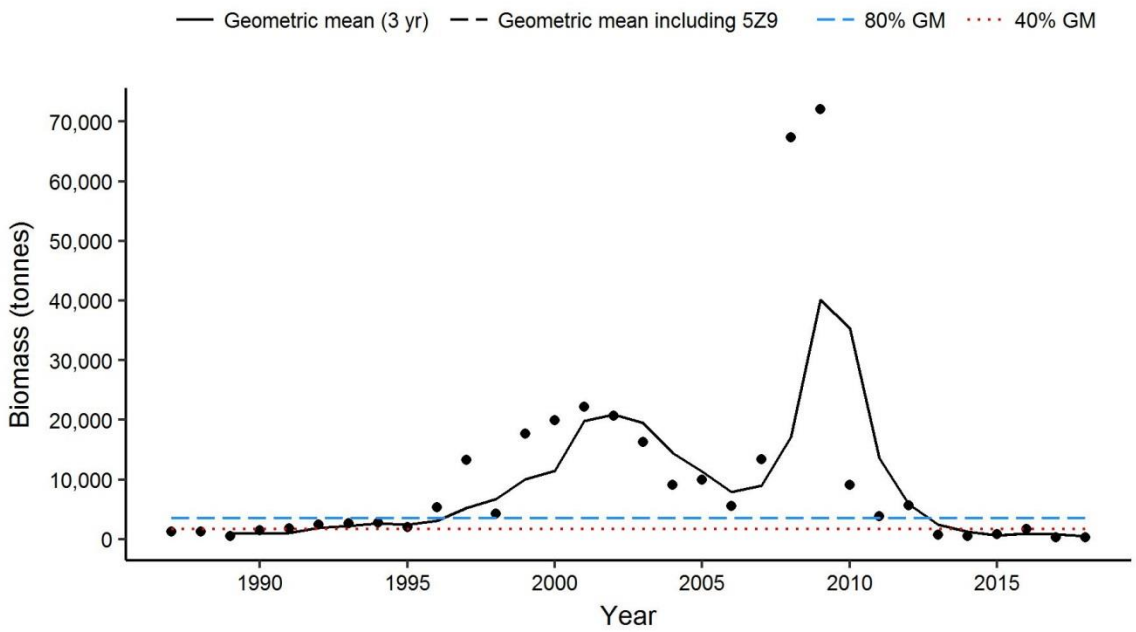

Figure 5b. Biomass index for Yellowtail Flounder in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line. The 3-year geometric mean including strata 5Z9 (since 2010) is almost identical and therefore this line is not visible. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987 to 2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

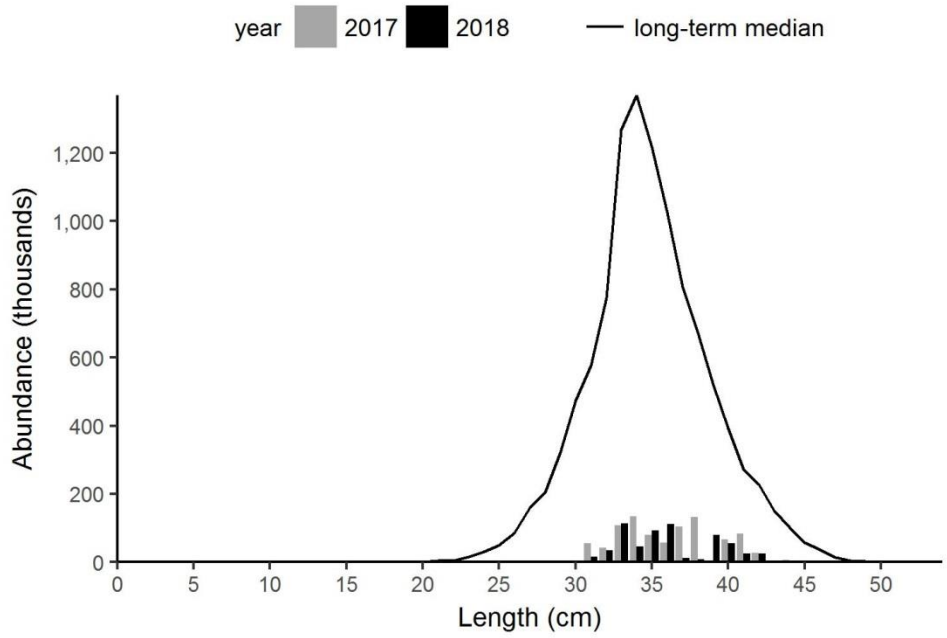

Figure 5c. Length frequency indices for Yellowtail Flounder in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The solid black line represents the median number in thousands at length for the time period 1987–2016.

Smooth Skate

Smooth Skate were caught in small numbers in 4 sets, only 2 of which fell within the 5Z1–5Z4 index area (Figure 6a). The biomass estimate is very low in all years (Figure 6b). Including 5Z9 in the biomass index gives a much higher 3-yr GM, with a significant increase since 2014. Inclusion of a broader area may be needed to provide indices that are useful for monitoring abundance trends. Only 7 individuals were caught in the 5Z1–5Z4 index area in 2018 (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.

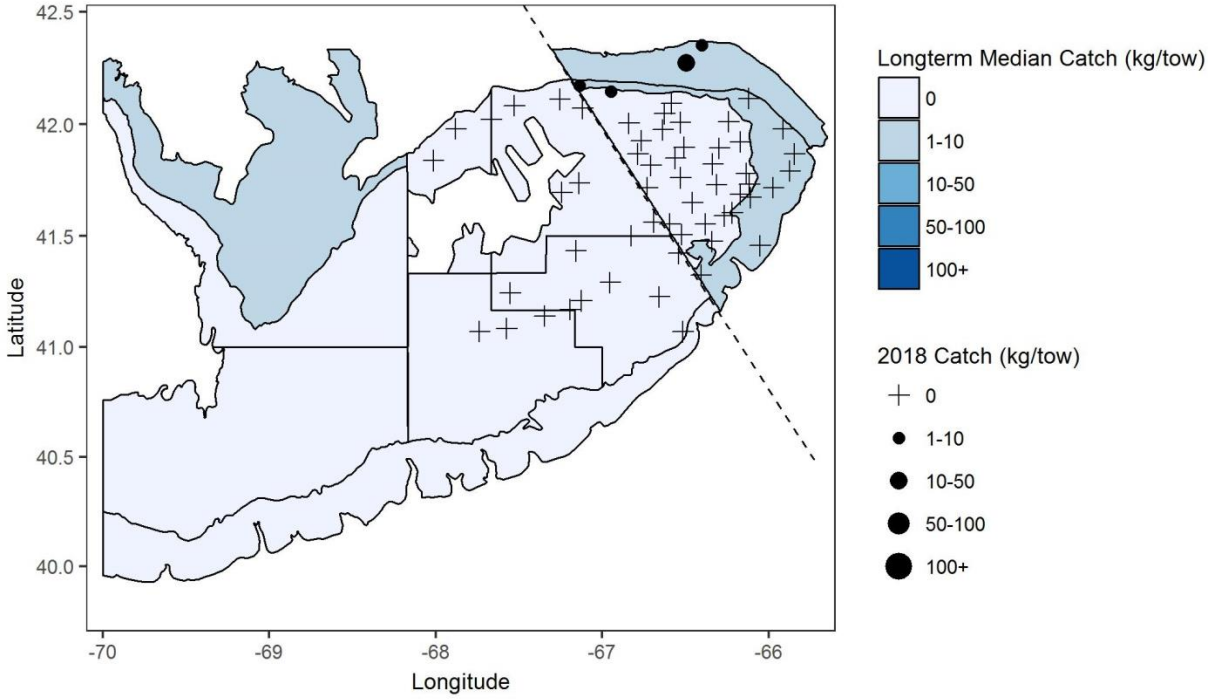

Figure 6a. Distribution of Smooth Skate catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

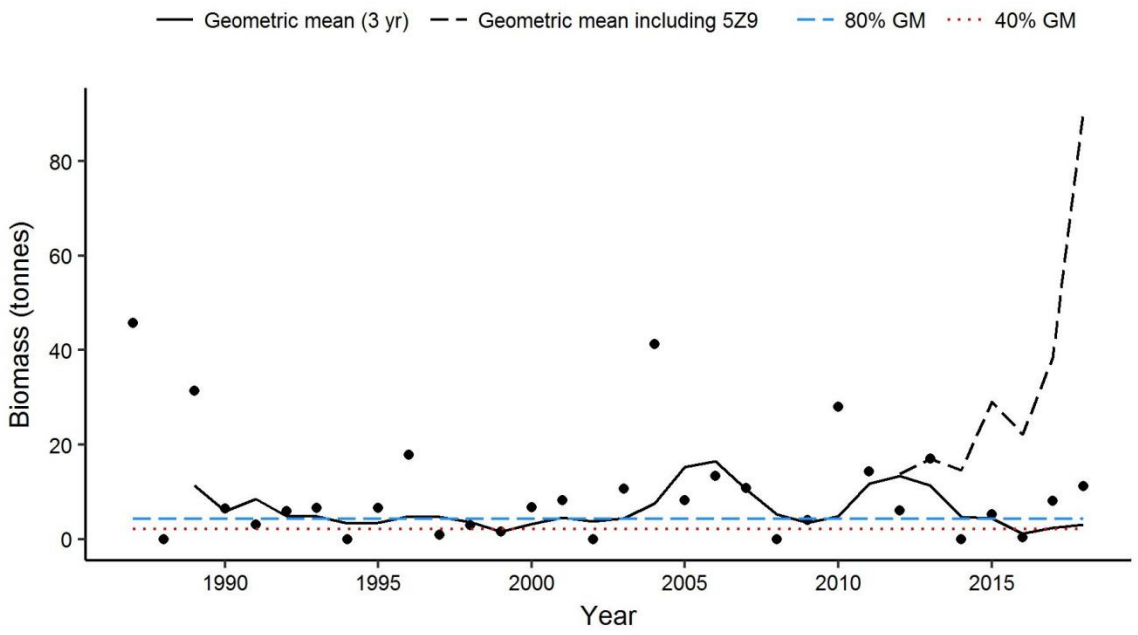

Figure 6b. Biomass index for Smooth Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

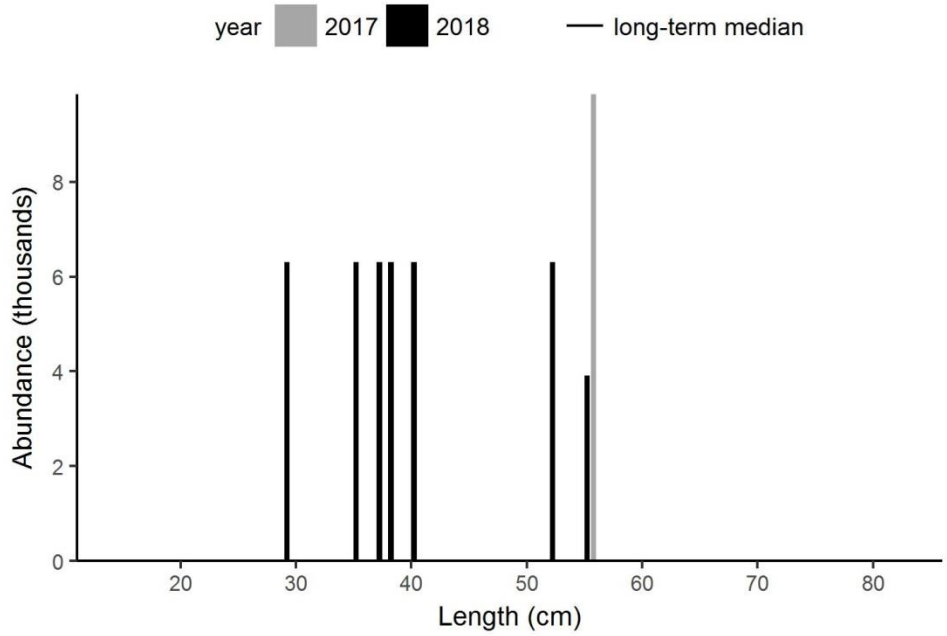

Figure 6c. Length frequency indices for Smooth Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The long-term median is 0 for all lengths.

Thorny Skate

Thorny Skate were caught in small numbers in 4 sets on Georges Bank, 3 of which were in 5Z1–5Z4 (Figure 7a). The 3-yr GM remains above 40% of the long-term GM for the second year in a row since 2013 (Figure 7b). The 3-yr GM does not differ greatly with or without the inclusion of 5Z9 and follows the same trend. Only 6 individuals were caught in 2018 (Figure 7c). The long-term median is 0 for all lengths, which indicates that the survey infrequently captures Thorny Skate at any length within the 5Z1–5Z4 area.

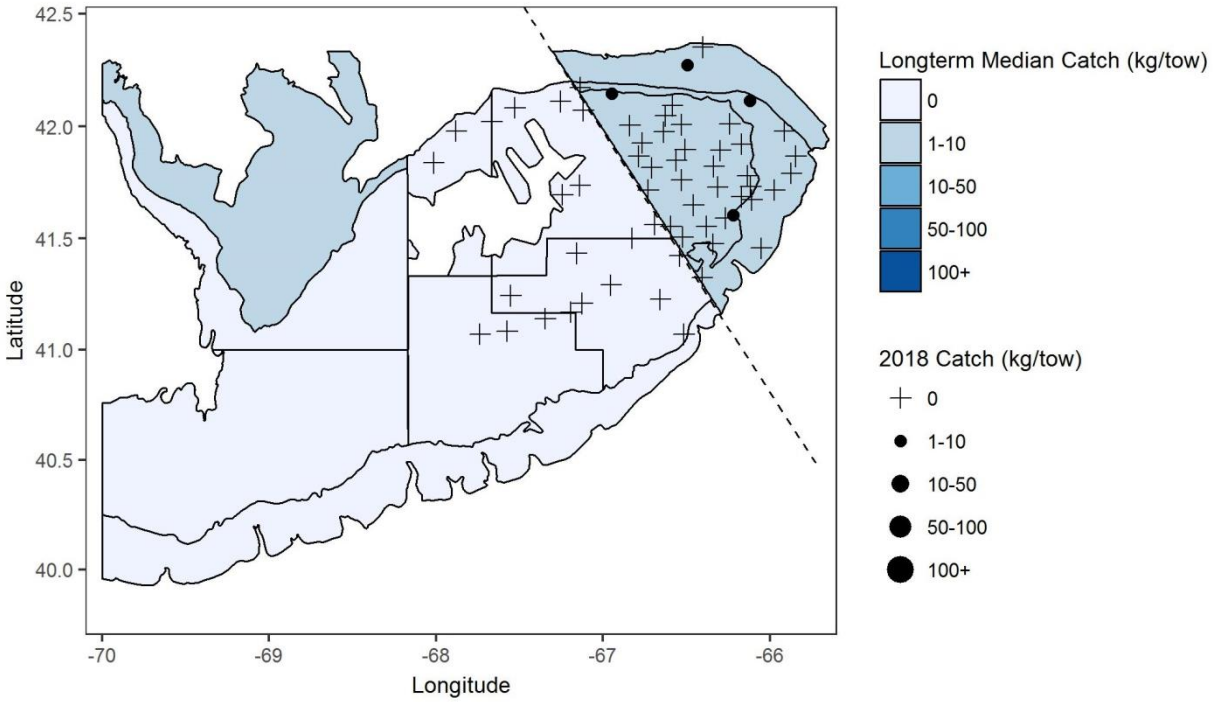

Figure 7a. Distribution of Thorny Skate catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

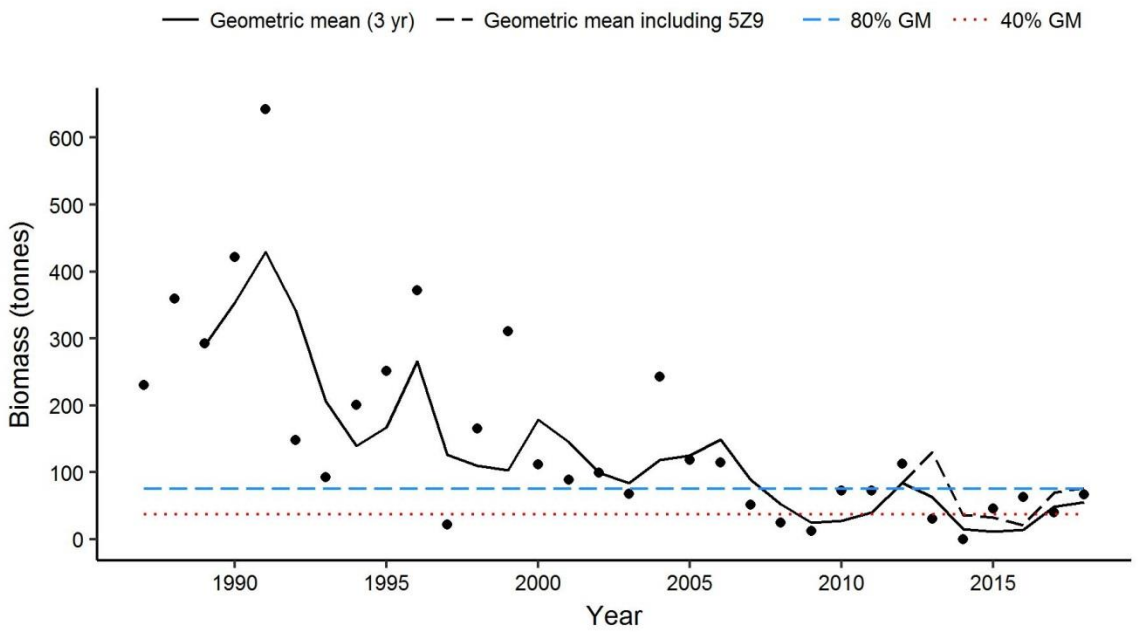

Figure 7b. Biomass index for Thorny Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

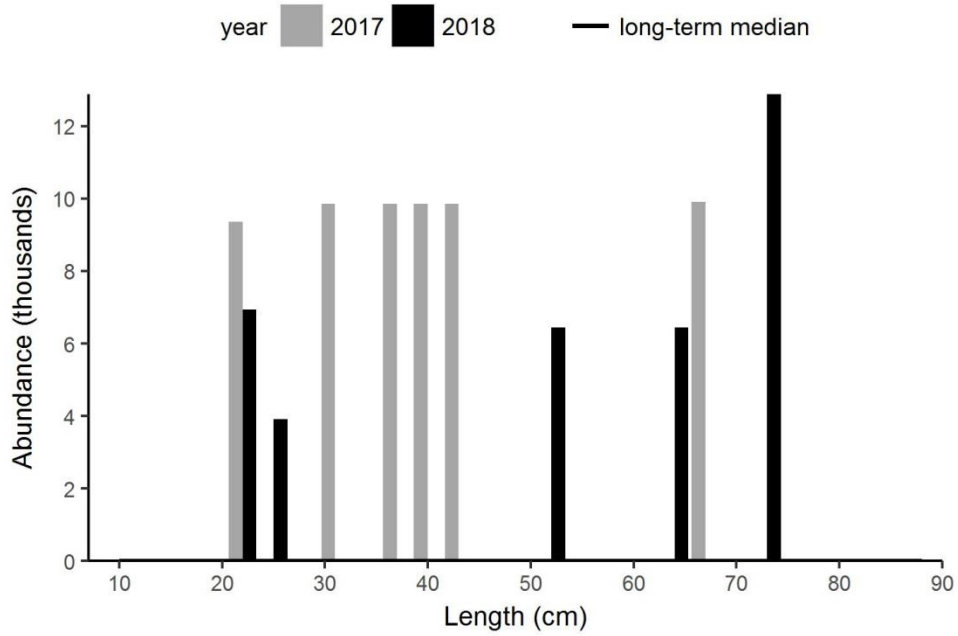

Figure 7c. Length frequency indices for Thorny Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The long-term median is 0 for all lengths.

Barndoor Skate

Barndoor Skate were captured along the edges of Georges Bank in small numbers in 12 sets, 10 of which were in 5Z1–5Z4 (Figure 8a). The 2018 biomass estimate and the 3-yr GM are both above 80% of the long-term GM (Figure 8b). Including 5Z9 in the biomass index gives a much higher 3-yr GM, with a significant increase starting in 2015. All Barndoor Skates caught in 2018 were below 65 cm except 1 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.

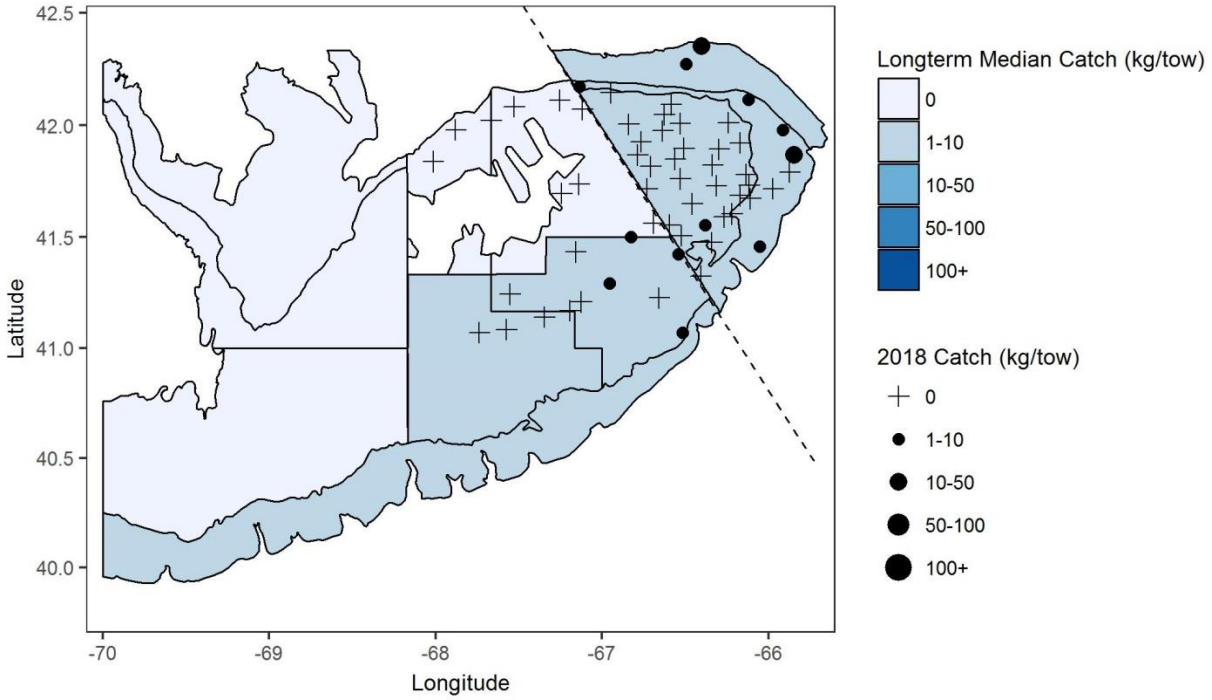

Figure 8a. Distribution of Barndoor Skate catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

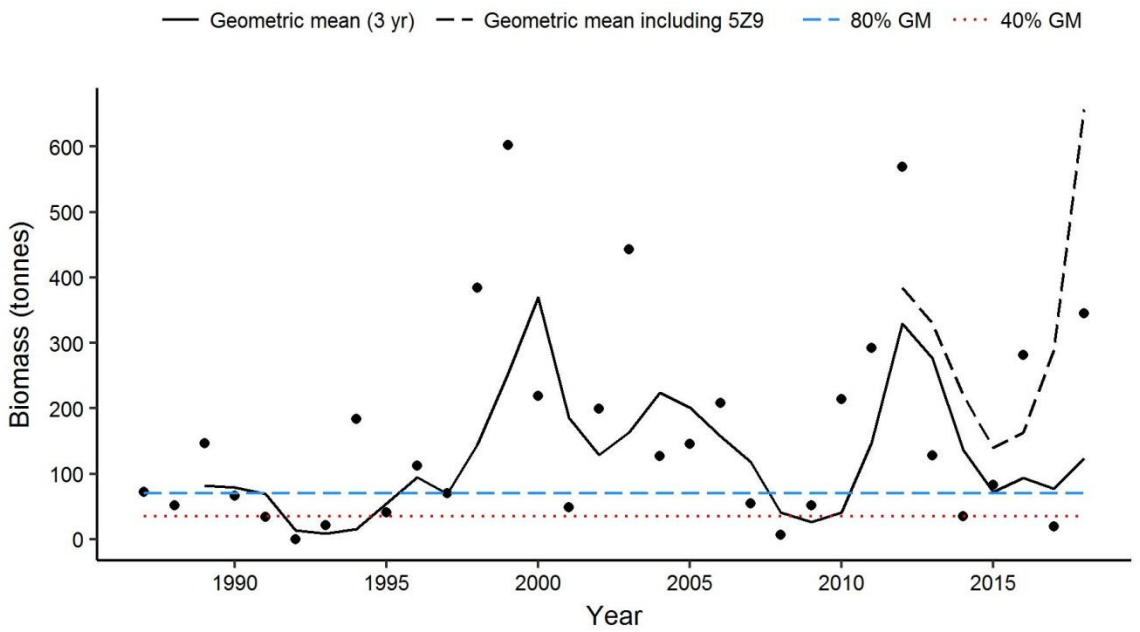

Figure 8b. Biomass index for Barndoor Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

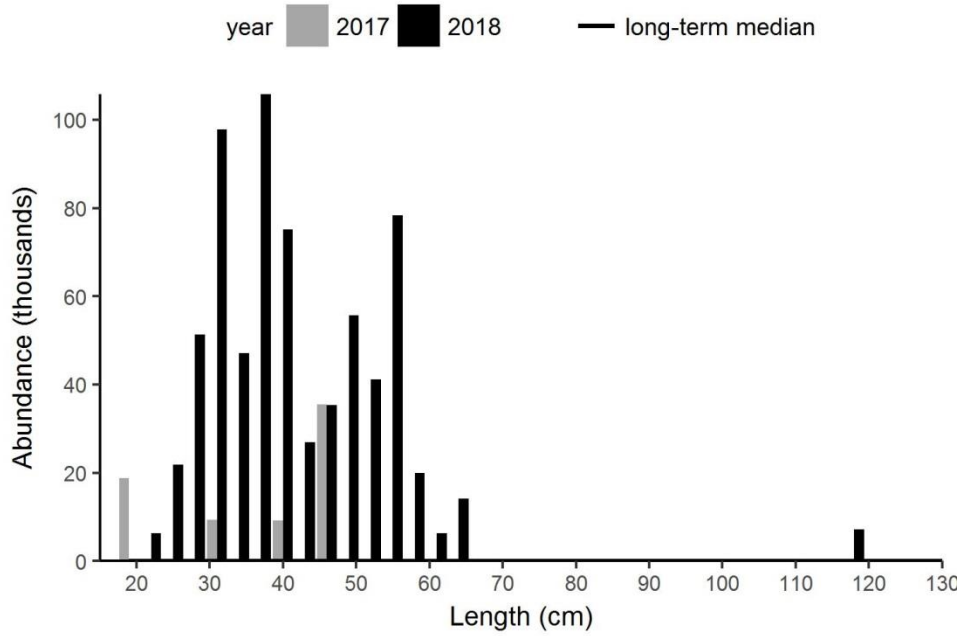

Figure 8c. Length frequency indices for Barndoor Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The long-term median is 0 for all lengths.

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 2018 survey was primarily along the edges of the northern bank as well as the middle of the southwestern bank (Figure 9a). The biomass index has increased since 2017 but remains below 40% of the long-term GM (Figure 9b). The 3-yr GM is slightly higher with the inclusion of 5Z9 in some years. The abundance indices are well below the long-term median for smaller Winter Skates but are at or above the median starting at 70 cm (Figure 9c).

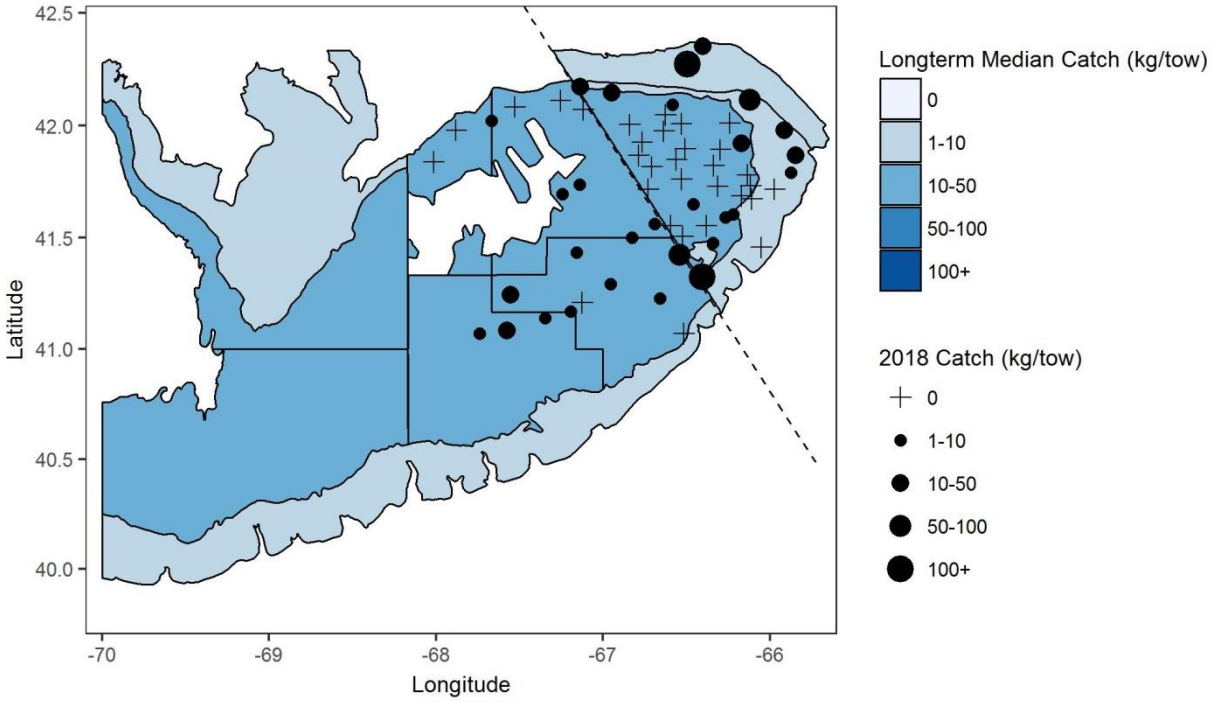

Figure 9a. Distribution of Winter Skate catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

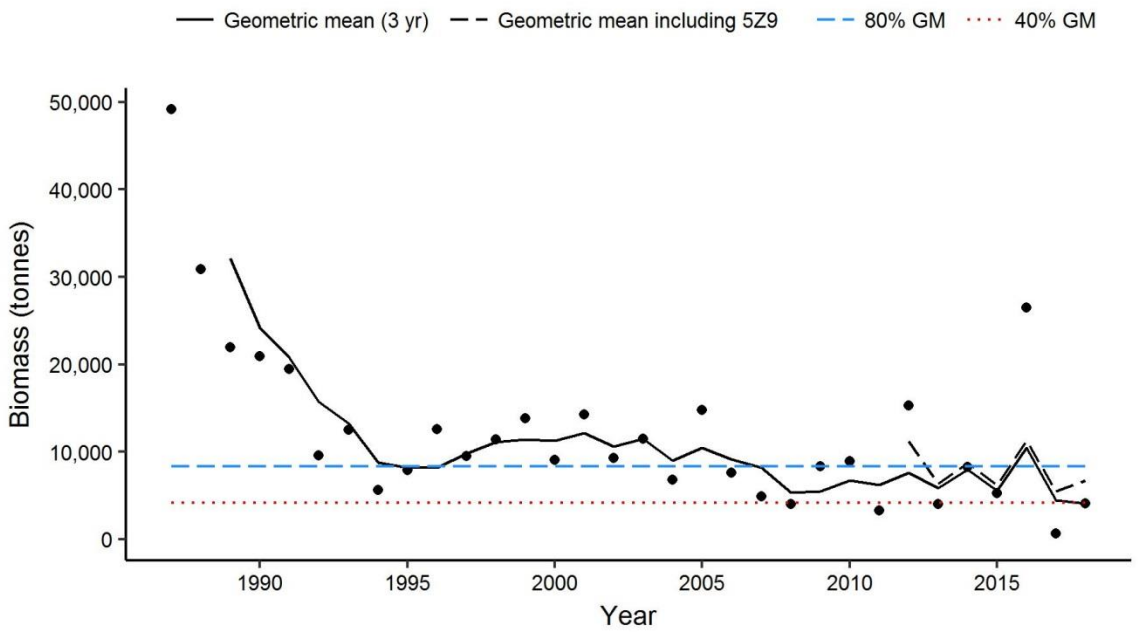

Figure 9b. Biomass index for Winter Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

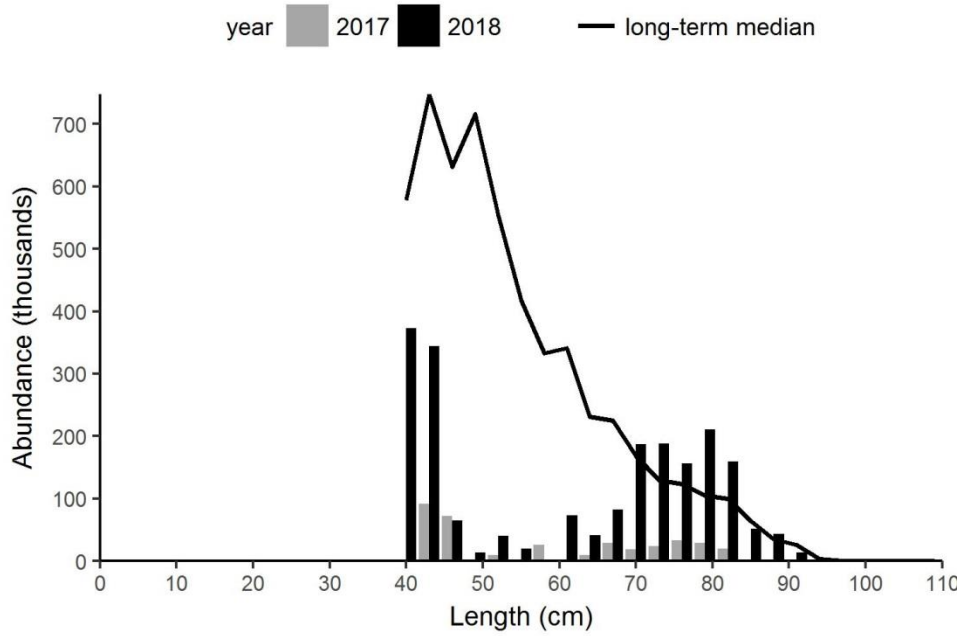

Figure 9c. Length frequency indices for Winter Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The solid black line represents the median number in thousands at length for the time period 1987–2016.

Little Skate

Little Skate were distributed across Georges Bank in 2018, especially in the southwest and edge of the Bank (Figure 10a). The 2018 biomass index is higher than in the previous three years, but the 3-yr GM remains below 80% of the long-term GM for the second year in a row (Figure 10b). The 3-yr GM with and without 5Z9 are virtually identical. Like 2017, the abundance indices were at or above the long-term median below 47 cm but below for all lengths above 47 cm (Figure 10c).

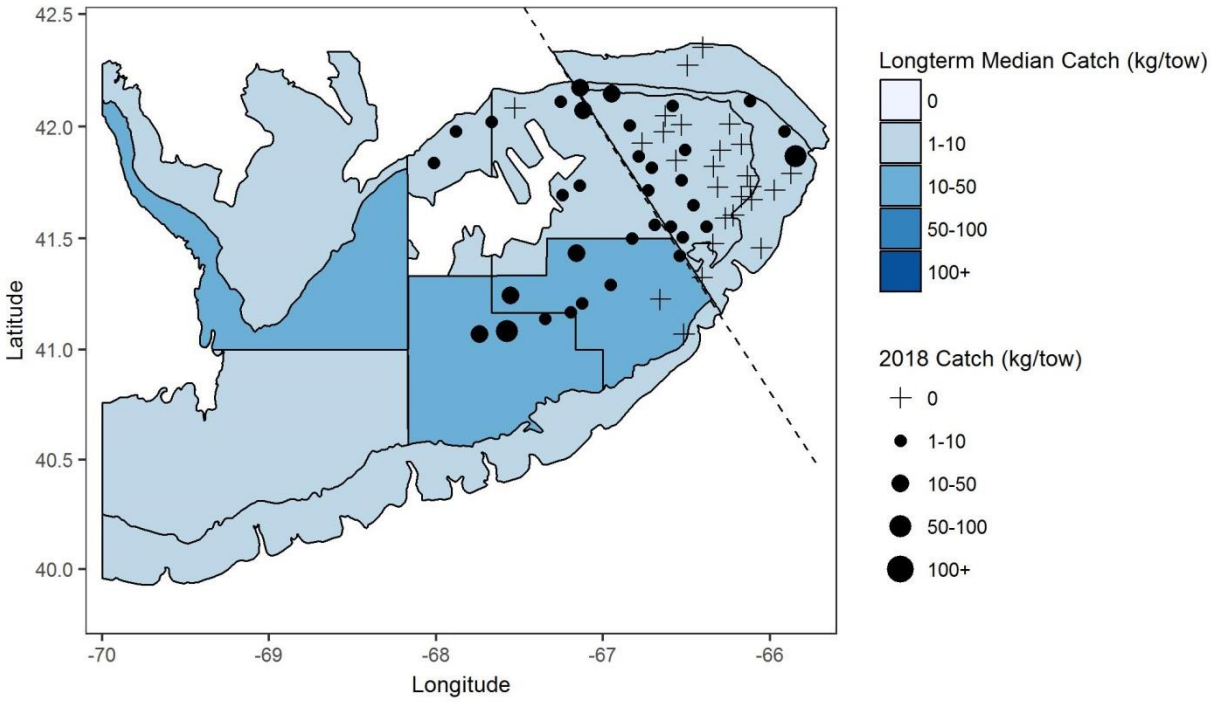

Figure 10a. Distribution of Little Skate catches during the 2018 Winter RV Survey. Long-term median catch (kg/tow) of individual strata is represented by shades of blue. Black circles represent catches. The circle area is proportional to the 2018 catch size. Zero catch is represented by the + symbol.

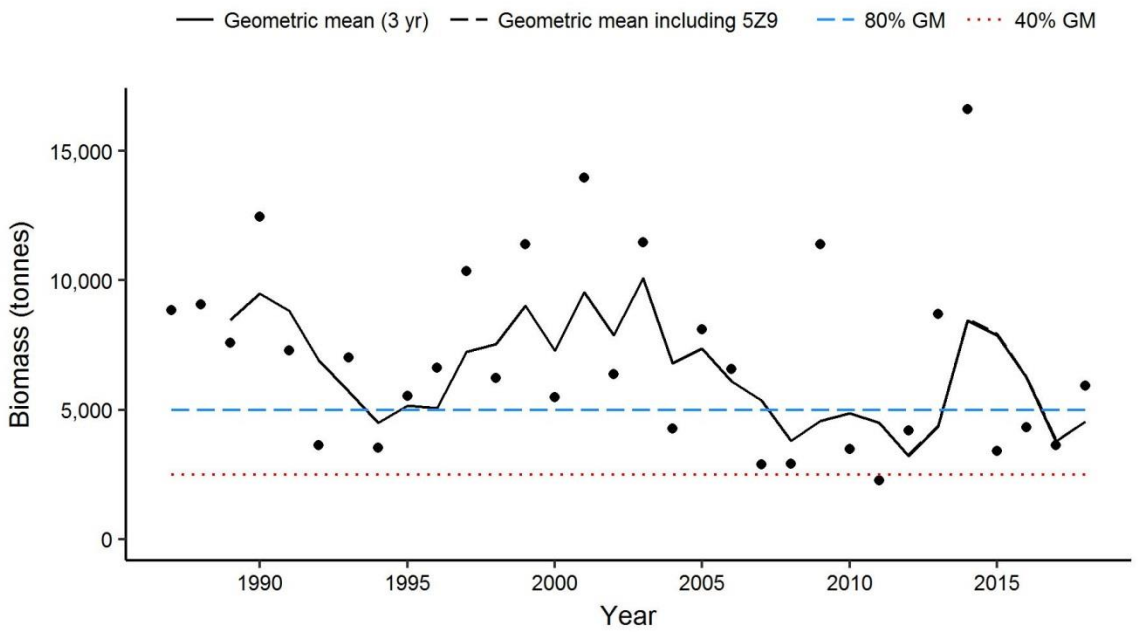

Figure 10b. Biomass index for Little Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The 3-year geometric mean biomass (5Z1–5Z4) is represented by the solid black line and the 3-year geometric mean including strata 5Z9 (since 2010) is represented by the dashed black line. The dashed and dotted horizontal lines represent 80% and 40% of the long-term geometric mean (1987–2017), respectively. The large black dots represent the biomass estimate (5Z1–5Z4) for that year.

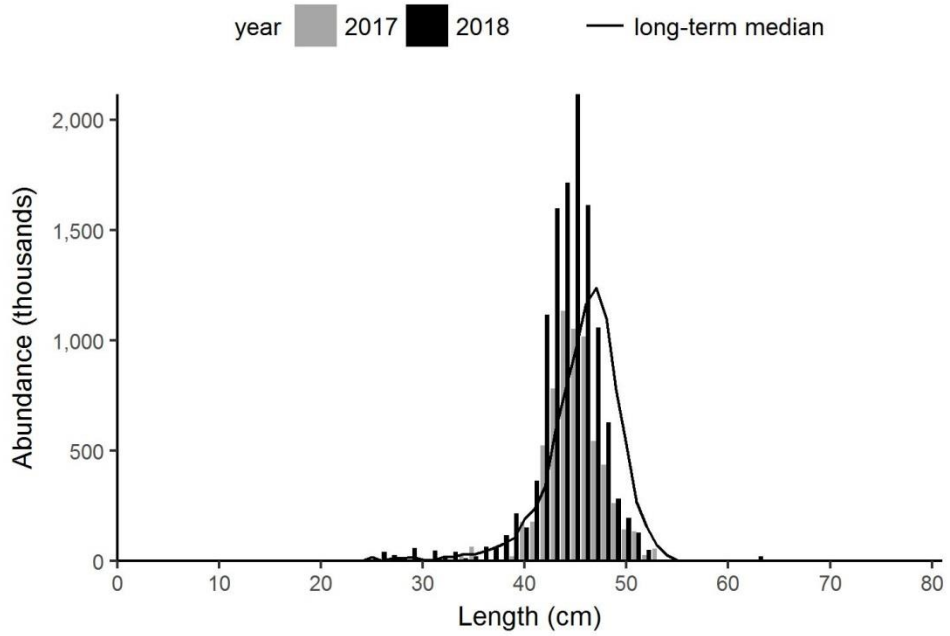

Figure 10c. Length frequency indices for Little Skate in Strata 5Z1–5Z4 from the Winter RV Survey. The grey bars represent the number in thousands at length from the 2017 survey. The black bars represent the number in thousands at length from the 2018 survey. The solid black line represents the median number in thousands at length for the time period 1987–2016.

Conclusions

The 3-yr GM biomass indices in 2018 for strata 5Z1–5Z4 from the Winter RV Survey were below 40% of the long-term GM (1987–2017) biomass for Pollock, Yellowtail Flounder, and Winter Skate.The 3-year GM biomass indices were between 40–80% of the long-term GM for Atlantic Cod, Thorny Skate, Smooth Skate, and Little Skate. For Haddock, the 3-yr GM biomass index was the third highest in the series. For species such as Smooth Skate, Pollock, and Barndoor Skate, inclusion of a broader area including strata 5Z9 made an important difference to the 3-yr GM and may be needed to provide indices that are useful for monitoring abundance trends.

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