



UPDATE OF SPAWNER ABUNDANCE AND BIOLOGICAL CHARACTERISTICS OF STRIPED BASS (*MORONE SAXATILIS*) IN THE SOUTHERN GULF OF ST. LAWRENCE TO 2022

Context

The Striped Bass (*Morone saxatilis*) population of the southern Gulf of St. Lawrence (sGSL) had declined to less than 5,000 spawners in the late 1990s which led to conservation concerns and the closure of the commercial fishery in 1996 and of the recreational and Indigenous fisheries in 2000. The Striped Bass population subsequently increased to over 900,000 spawners by 2017. A small number of food, social, and ceremonial (FSC) fisheries were reinstated in 2012 and allocations of Striped Bass to Indigenous groups have gradually increased since then. The recreational fishery reopened in 2013 and a pilot Indigenous commercial fishery began in 2018. As the fisheries management measures were responsive to changes in abundance of the sGSL Striped Bass population, Fisheries and Oceans Canada (DFO) Fisheries and Harbour Management sector requested an update on the size of the spawning stock and information on biological characteristics to 2022.

This Science Response Report results from the Regional Peer Review of December 14, 2022 on the update of spawner abundance and biological characteristics of Striped Bass (*Morone saxatilis*) in the southern Gulf of St. Lawrence to 2022.

Background

Southern Gulf of St. Lawrence Striped Bass are distributed in near shore waters and estuaries from the north shore of the Gaspé Peninsula in Quebec to the northern tip of Cape Breton Island, Nova Scotia. The only confirmed spawning location known to produce annual recruitment in the sGSL is the Northwest Miramichi River (NW); consequently, this was the location chosen to develop annual abundance indices. Since 1994, monitoring of the bycatch in the commercial gaspereau trapnets of the Miramichi River has been the principal source of information for assessing the Striped Bass spawning population of the sGSL (Bradford and Chaput 1996; Douglas and Chaput 2011). Mark and recapture experiments and catch per unit effort (CPUE) from this fishery have been used as indices of abundance for sGSL Striped Bass (Douglas and Chaput 2011). In association with the run-timing of gaspereau, the start date of the four-week commercial gaspereau season in the NW has progressively shifted from 15 May in 1995 (and prior) to 1 June since 2014. Biological characteristics of Striped Bass (fork length, age, sex, and spawning stage) were recorded from fish captured in commercial gaspereau trapnets (May-June) and at index trapnet monitoring facilities operated by DFO Science (May-October).

Analysis and Response

Stock Status in 2022

Considering the size (fork lengths) and estimated abundance of Striped Bass adults sampled in May and June, the median estimate of eggs in spawners for 2022 was approximately 35,200 million, above the proposed Limit Reference Point (LRP) of 17,300 million eggs and below the proposed Upper Stock Reference Point (USR) of 54,300 million eggs. In 2022, the Striped Bass population of the sGSL was in the cautious zone of the Precautionary Approach (PA) management framework.

Spawner Abundance

In 2022, the regular gaspereau season in the NW was scheduled from 6 pm on 1 June to 6 pm on 29 June. The first gaspereau trapnet in the NW was set on 2 June which resulted in the first opportunity to monitor for Striped Bass bycatch on 4 June. Gaspereau catches were monitored regularly throughout the fishing season with 66 of a possible 177 (37%) trapnet hauls sampled for Striped Bass bycatch in the NW.

Striped Bass bycatch data collected between 4 June and 15 June was considered to be the most appropriate information for estimating the abundance of Striped Bass spawners in the NW. Similar to previous years, the bycatch of Striped Bass was highest early in the season and decreased to low levels by mid-June (Appendix, Figure A1). The first report of spawning Striped Bass in 2022 was in the Cassilis area (Northwest Miramichi) on 17 May (Appendix, Figure A1).

The Bayesian hierarchical model used in previous Striped Bass assessments was applied to the 2022 CPUE data from the gaspereau fishery (Chaput and Douglas 2011) (Appendix, Figure A2). Since 2014, an adjustment to the model has been made to account for the observed spawning behaviour of Striped Bass carrying internal acoustic tags (DFO 2022). The movements of 58 Striped Bass carrying acoustic transmitters were monitored with receiver arrays anchored throughout the Miramichi during May and June 2022. The tracking of acoustically tagged Striped Bass provided information on the daily distribution of spawners in the Miramichi system and therefore their availability (or not) for capture in the gaspereau trapnets of the NW (Appendix, Figure A1).

The median of the estimated spawner abundance in 2022 was 471,800 (5th to 95th percentiles range of 201,600 to 1,193,000) (Figure 1). The catch rates on individual sampling dates were assumed to be proportional to the abundance of adult Striped Bass in the NW. Spawner abundance for those dates was estimated as the product of the total spawner abundance at the beginning of the spawning period and the proportion of the acoustically tagged bass still in the Miramichi. In 2022, the percentages of acoustically tagged bass in the Miramichi declined from 48% on 4 June to 5% on 15 June (Appendix, Figure A1).

Catches of Striped Bass at DFO index trapnets at Millerton on the Southwest Miramichi River and at Cassilis on the Northwest Miramichi River provide fishery-independent indices of the sGSL Striped Bass population (Appendix, Figure A3). In 2022, the trapnet at Cassilis operated between 11 May and 25 October while the trapnet at Millerton operated between 25 May and 26 October. Counting individual Striped Bass at index trapnets when catches are large is impractical so estimation of the catch is sometimes required. The combined catch of Striped Bass at these facilities in May and June 2022 ($n = 35,000$) was the highest of the time series which began in 1998 (Appendix, Figure A3). The combined catch of Striped Bass at these facilities ($n = 5,700$) in September and October 2022 was lower than in 2021 (Appendix, Figure A3).

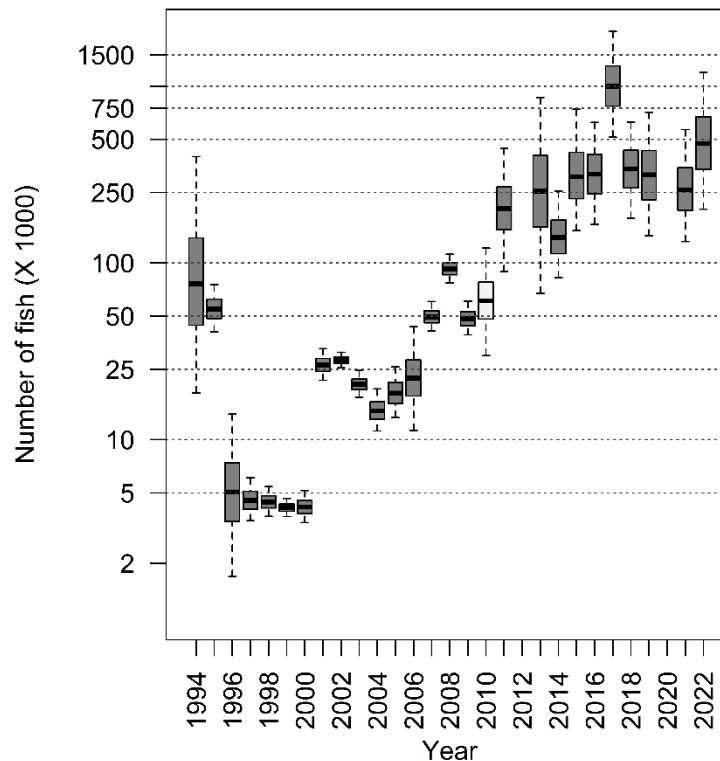


Figure 1. Estimated abundance of adult Striped Bass spawners in the Northwest Miramichi estuary between 1994 and 2022 shown on a logarithmic scale. Box plots are interpreted as follows: dash is the median, boxes are the interquartile range, and the vertical dashes are the 5th to 95th percentile ranges. The 2010 estimate (unshaded interquartile box) is considered to be an underestimate due to the earlier timing of the spawning events (Douglas and Chaput 2011). No estimates were available for 2012 or 2020 due to early spawning and Covid-19 restrictions, respectively. Data from this figure is available on Open Data [here](#).

Estimate of Egg Deposition Relative to Reference Points

Reference points that conform to PA management principles were recently developed for the Striped Bass population of the sGSL (DFO 2021; Chaput and Douglas 2022). Model consensus was not achieved and two models (Model 4 and Model 5) were carried forward to define potential reference points. While the perspective on stock status is model dependent, DFO (2021) suggested that based on the trajectory of this population over the relatively short period of assessment, maintaining eggs above the LRP derived from Model 4 of 17,300 million (equivalent to approximately 330 thousand spawners depending on the biological characteristics for the year) should be sufficient to avoid serious harm. The proposed USR from Model 4 corresponded to the median estimate of 54,300 million eggs, equivalent to approximately 720 thousand spawners depending on the biological characteristics for the year.

Considering the size (fork lengths) and estimated abundance of Striped Bass adults sampled in May and June, the median estimate of eggs in spawners for 2022 was approximately 35,200 million (5th to 95th percentile range of 15,000 to 89,000 million) which was above the LRP and below the USR, positioning the stock in the cautious zone of the PA. The estimated abundance of the Striped Bass population of the sGSL has exceeded the LRP in all assessed years since 2017, while the USR has only been exceeded once (healthy zone in 2017) throughout the time series of spawner abundance estimates (Figure 2).

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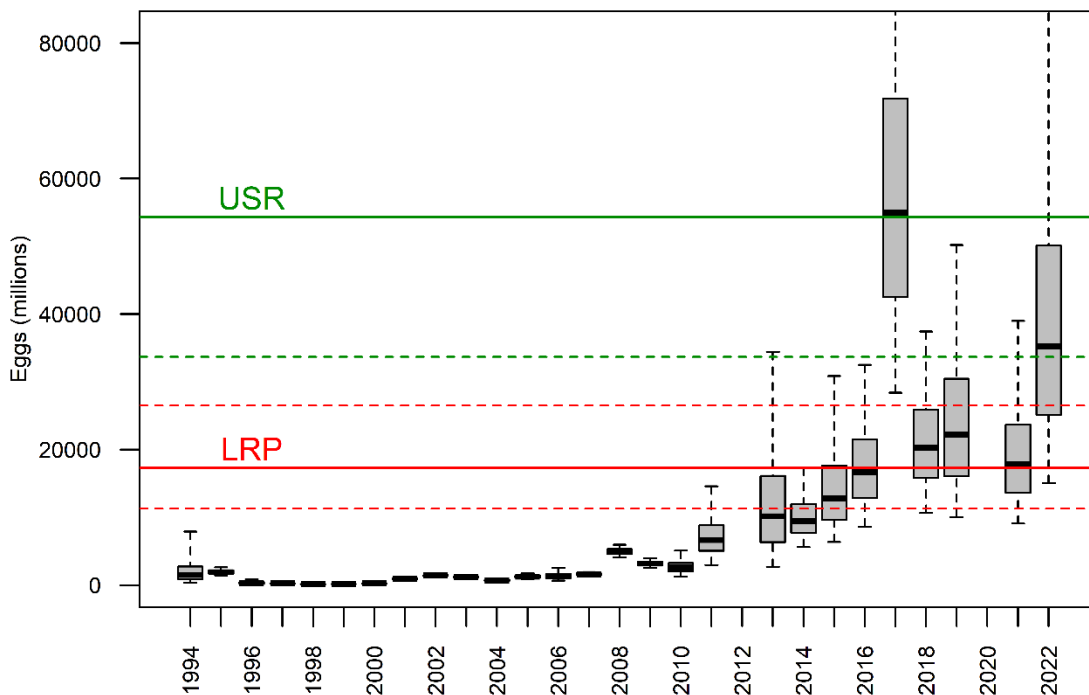


Figure 2. Estimated abundance of eggs in spawners (boxplots; eggs in millions) and status relative to the USR (solid green horizontal line) and the LRP (solid red horizontal line) reference points for the Striped Bass population of the southern Gulf of St. Lawrence, 1994 to 2022 (DFO 2021). The USR corresponds to the median estimate of eggs at 80% Bmsy and the LRP corresponds to the median estimate of eggs that result in 50% of Beverton-Holt K (half saturation). The dashed red and green lines are the 5th to 95th percentile ranges of the LRP and USR respectively. Note the 95th percentile line of the USR and the 95th percentile point for eggs in 2017 and 2022 are off the scale.

Biological Characteristics

The mean fork length (FL) of adult Striped Bass (assumed to be fish > 30 cm) measured in May and June 2022 was 50.8 cm (range 30.1 to 93.9 cm; n > 11,100). Thirty-three percent of Striped Bass sampled had fork lengths between 30 and 45 cm, 52% between 46 and 61 cm (equivalent to the retention slot regulation of 50 to 65 cm total length (TL)), and 14% were 62 cm or greater (Figure 3).

For adult Striped Bass sampled during the months of September and October 2022, the mean fork length was 47.2 cm (range 30.1 to 88.2; n > 3,400). Forty-four percent of Striped Bass sampled had fork lengths between 30 and 45 cm, 45% between 46 and 61 cm (equivalent to the retention slot regulation of 50 to 65 cm TL), and 11% were 62 cm or greater (Figure 3).

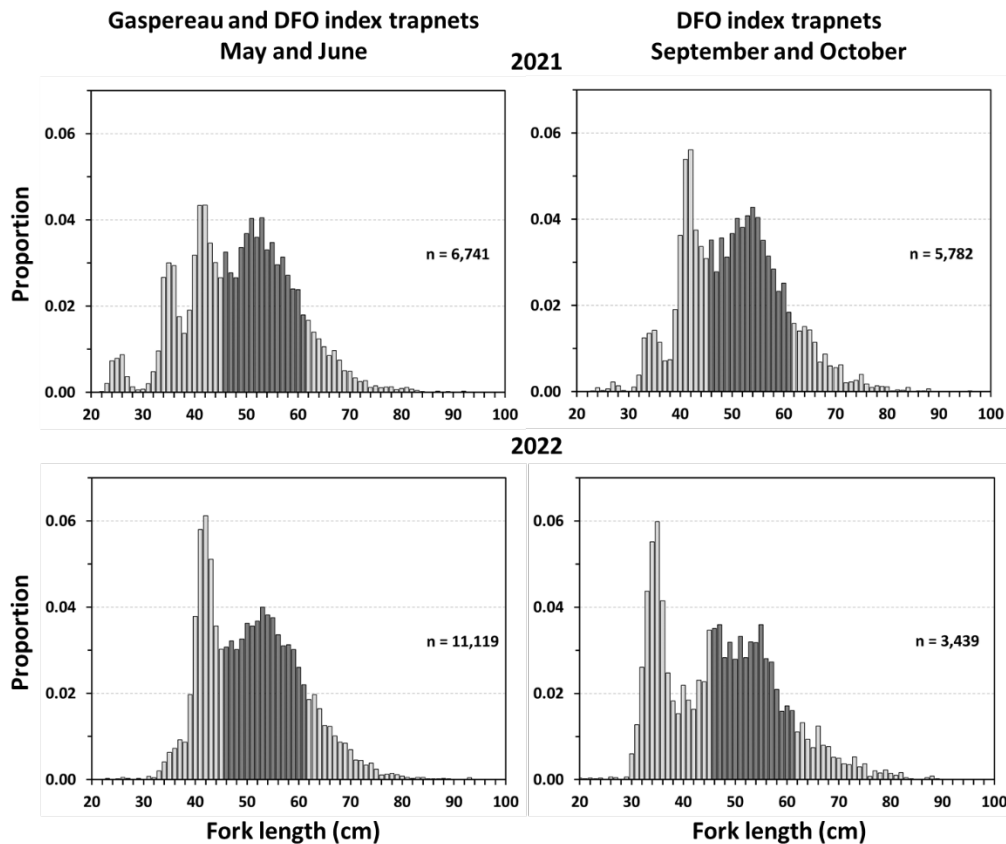


Figure 3. Relative fork length (cm) frequency distributions of Striped Bass sampled in May and June (left panel) and in September to October (right panel) from the gaspereau trapnet in the Northwest Miramichi and DFO index trapnets in 2021 (upper row) and 2022 (lower row). The dark grey shading represents Striped Bass between 46 and 61 cm fork length which is equivalent to the current recreational fishery regulation slot size for retention of bass between 50 to 65 cm total length.

Conclusions

Striped Bass spawner abundance in 2022 was estimated at 471,800 fish with large uncertainty (5th and 95th percentile range of 201,600 to 1,193,000), as in previous years.

Considering the size (fork lengths) and estimated abundance of Striped Bass adults sampled in May and June, the median estimate of eggs in spawners for 2022 was approximately 35,200 million (5th to 95th percentile range of 15,000 to 89,000 million).

The median of the estimated egg abundance in adult Striped Bass was above and below the proposed LRP and USR respectively in 2022 and placed the stock in the cautious zone of the PA management framework, similar to all years since 2017 (with the exception of 2020 when no stock assessment was conducted). The proposed USR for Striped Bass in the sGSL has only been met or exceeded once (healthy zone in 2017) throughout the time series of spawner abundance estimates.

Assessment results for 2022 have only been presented here in relation to reference points calculated from one (Model 4) of the two models accepted during the derivation of reference points for sGSL Striped Bass (DFO 2021; Chaput and Douglas 2022). Reference points derived

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from Model 5 have not been dismissed and refinements to all models may be required in the future as the population dynamics of this stock become better understood.

In 2022, Striped Bass that measured within the recreational fishery retention size slot of 50 to 65 cm TL (equivalent to 46 to 61 cm FL) was the most abundant size group in the spring (52%) and remained the same in the fall (45%).

The fishery independent catches at the DFO index trapnets in 2022 confirm the sustained higher spawner abundance of Striped Bass in recent years.

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Sources of Information

This Science Response Report results from the Regional Peer Review of December 14, 2022 on the update of spawner abundance and biological characteristics of Striped Bass (*Morone saxatilis*) in the southern Gulf of St. Lawrence to 2022. No additional publications from this process will be produced.

- Bradford, R.G. and Chaput, G. 1996. [The status of striped bass \(*Morone saxatilis*\) in the southern Gulf of St. Lawrence](#). DFO Atl. Fish. Res. Doc. 96/62: 36 p.
- Chaput, G. and Douglas, S. 2011. [Hierarchical Bayesian model to estimate the spawning stock of Striped Bass \(*Morone saxatilis*\) in the Northwest Miramichi River, 1994 to 2010](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2011/081. iv + 51 p.
- Chaput, G. and Douglas, S. 2022. [Fisheries reference points for Striped Bass \(*Morone saxatilis*\) from the southern Gulf of St. Lawrence](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2022/029. xiv + 153 p.
- DFO. 2021. [Reference points for Striped Bass \(*Morone saxatilis*\) for the southern Gulf of St. Lawrence population](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2021/018. (Erratum: December 2022).
- DFO. 2022. [Update of spawner abundance and biological characteristics of Striped Bass \(*Morone saxatilis*\) in the southern Gulf of St. Lawrence to 2021](#). DFO Can. Sci. Advis. Sec. Sci. Resp. 2022/024.
- Douglas, S.G. and Chaput, G. 2011. [Assessment and status of Striped Bass \(*Morone saxatilis*\) in the Southern Gulf of St. Lawrence, 2006 to 2010](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2011/097. iv + 22 p.

Appendices

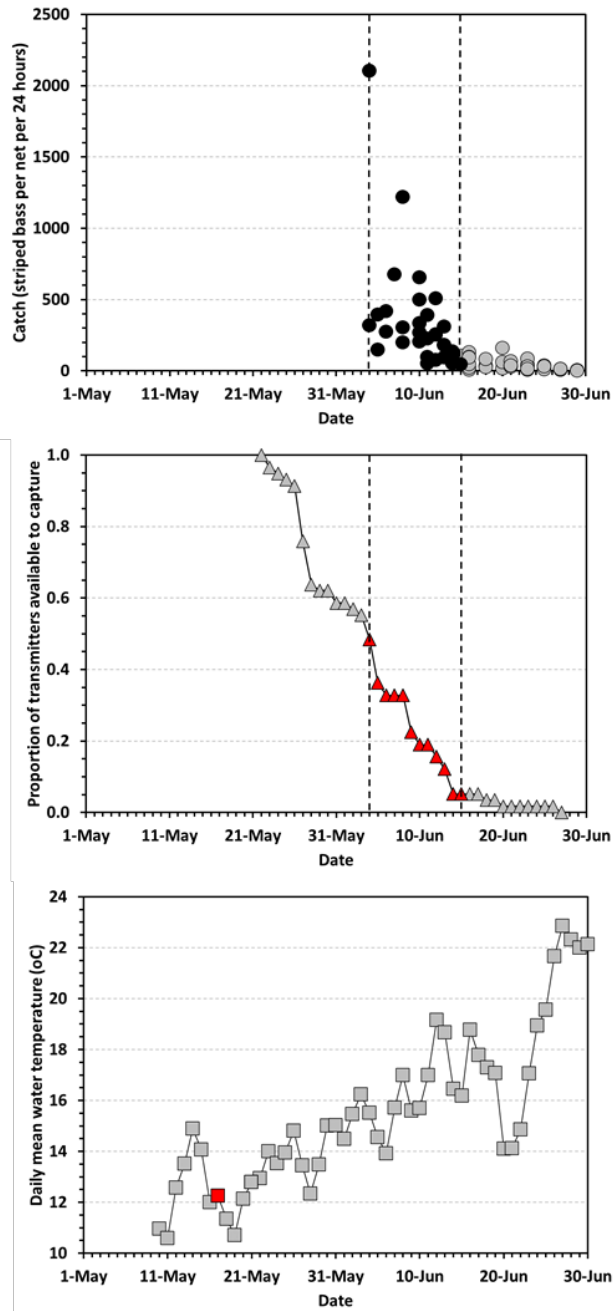


Figure A1. The number of Striped Bass captured per individual net per day in the commercial gaspereau fishery trapnets of the Northwest Miramichi estuary in 2022 (upper panel) with the Striped Bass bycatch data (black circles) and the period (vertical dashed lines) used in the CPUE analyses. The estimated proportion of available acoustically tagged bass present in the Miramichi (upstream of Loggieville) in May and June 2022 (middle panel) with the proportions (red triangles) and the period (vertical dashed lines) used in the CPUE analyses. The bottom panel depicts the mean daily water temperature in May and June at the DFO Cassilis trapnet which is adjacent to the Striped Bass spawning area and the red square represents the temperature on May 17, the date of the initial observation of Striped Bass spawning in the upper Northwest Miramichi estuary in 2022.

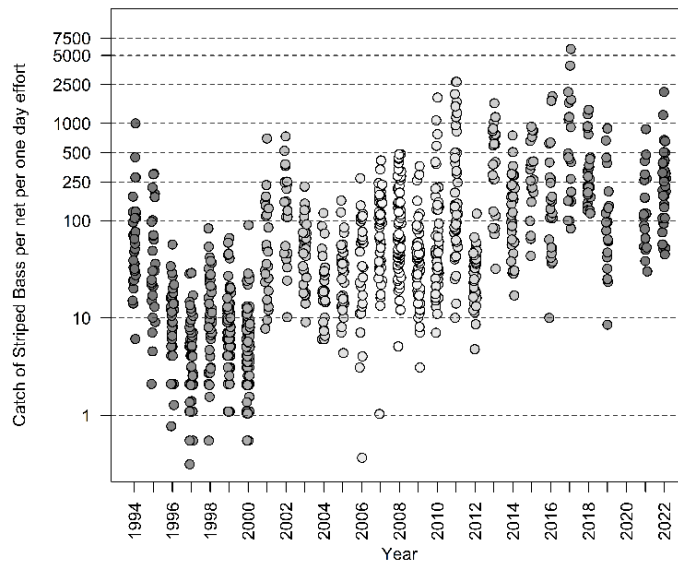


Figure A2. The number of Striped Bass captured per net per day of effort from monitoring of the commercial gaspereau fishery in the Northwest Miramichi between 1994 and 2022 shown on a logarithmic scale. The catch rates are not adjusted for the proportion of the spawners available for capture in the fishery. In 2012, the spawning was very early and the majority of the fish were considered to have left the area and were not available to the fishery, hence no estimate was provided for that year. Striped Bass bycatch monitoring did not occur in 2020. The points within a year are jittered slightly for clarity.

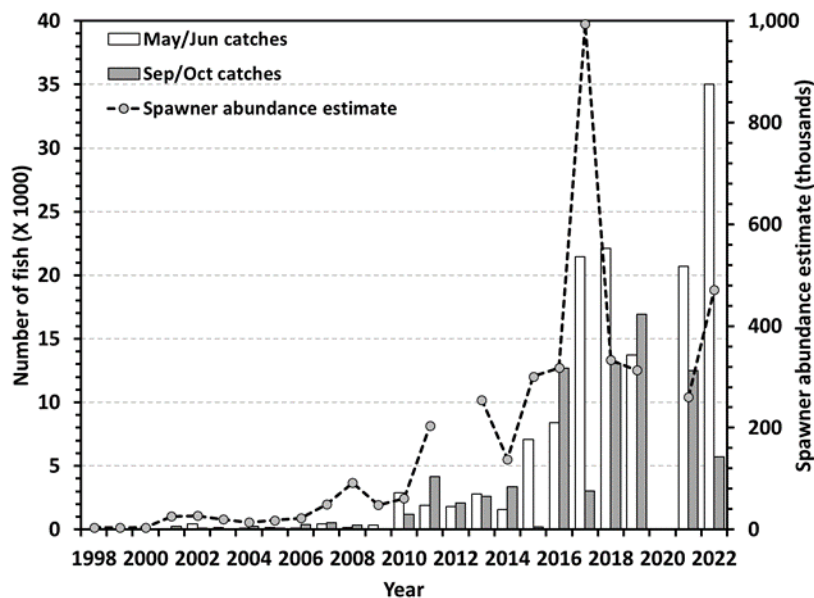


Figure A3. The combined number of adult (assumed >30 cm FL) Striped Bass captured in the DFO index trapnets at Cassilis on the Northwest Miramichi River and at Millerton on the Southwest Miramichi River during the spring (May/June) and autumn (Sep/Oct) from 1998 to 2022. The catches during the fall season in 2015 were very low due to flood conditions which ended the monitoring program on Sept. 30 for the Southwest Miramichi trapnet and suspended it for the Northwest Miramichi trapnet for five days during the first week of October. DFO index trapnets were not operated in 2020.

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