



SPAWNER ABUNDANCE AND BIOLOGICAL CHARACTERISTICS OF STRIPED BASS (*MORONE SAXATILIS*) IN THE SOUTHERN GULF OF ST. LAWRENCE IN 2017

Context

The Striped Bass population of the southern Gulf of St. Lawrence had declined to less than 5,000 spawners in the late 1990s and subsequently increased to over 300,000 spawners by 2016. Due to conservation concerns, the commercial fishery closed in 1996 and the recreational and aboriginal fisheries for Striped Bass were closed in 2000. 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. With continued requests for additional access to southern Gulf Striped Bass, Fisheries and Oceans Canada (DFO) Gulf Ecosystems and Fisheries Management branch requested an update on the size of the spawning stock and information on biological characteristics to 2017. This Science Response Report results from the Science Response Process of February 19, 2018 on the update of indicators for the Striped Bass (*Morone saxatilis*) population of the southern Gulf of St. Lawrence, DFO Gulf Region, in 2017.

Background

Southern Gulf of St. Lawrence Striped Bass (*Morone saxatilis*) are distributed in near shore waters and estuaries from the eastern tip of the Gaspé Peninsula in Quebec to the northern tip of Cape Breton Island, Nova Scotia. The only annually predictable spawning location that has produced recruitment annually in the southern Gulf of St. Lawrence is the Northwest Miramichi River (NW); consequently, this was the location chosen to develop annual abundance indices. Since 1994, monitoring of bycatch in the commercial gaspereau trapnets of the Miramichi River has been the principal source of information for Striped Bass spawning population numbers for the southern Gulf. The spawner abundance was usually estimated from mark and recapture experiments in which adult Striped Bass were tagged early in May and monitored throughout June as they were captured and released as bycatch in the gaspereau fishery of the Northwest Miramichi Estuary (Bradford and Chaput 1996; Douglas and Chaput 2011). Catch per unit effort (CPUE) from this fishery has been used as an index of abundance for Striped Bass since 1993 (Douglas and Chaput 2011). Selected biological characteristics (e.g. fork length, age, sex, and spawning stage) were recorded from fish captured in commercial gaspereau trapnets (May) and at trapnet monitoring facilities operated by DFO Science (May-October).

Analysis and Response

Spawner abundance

For the purpose of the 2017 Striped Bass assessment program, one trapnet was operated in the NW Miramichi River between 24 May and 9 June to tag Striped Bass and collect biological

information on the population. In 2017, the regular gaspereau season in the NW Miramichi was scheduled from 6 pm on 1 June to 6 pm on 29 June. Commercial fishing effort for gaspereau in the NW Miramichi in 2017 was delayed because of small catches of gaspereau at downstream locations in Loggieville and Chatham and also because of large catches of Striped Bass. The first gaspereau trapnets in the NW Miramichi were not set until 5-6 June which resulted with first catches to monitor for Striped Bass bycatch on 7 June. Due to large catches of Striped Bass in the NW on June 9, many trapnets were emptied without counting, lifted, and not reset until June 12-15, after the majority of Striped Bass had spawned and left the system. Gaspereau catches were monitored regularly throughout the season with 47 of a possible 148 (32%) trapnet hauls sampled for Striped Bass bycatch in the NW.

Striped Bass bycatch data collected between 7 June and 14 June was considered to be the most appropriate information to use for estimating the abundance of Striped Bass spawners in the NW Miramichi. Similar to previous years, the bycatch of Striped Bass was highest early in the season and decreased to low levels by mid-June (Appendix 1). The first report of spawning Striped Bass in the Cassilis area (Northwest Miramichi) was on 30 May which coincided with water temperatures increasing above 12°C.

The Bayesian hierarchical model used in previous Striped Bass assessments was applied to the 2017 CPUE information from the gaspereau fishery (Chaput and Douglas 2011) (Appendix 2). Since 2014, an adjustment to the model has been made to account for the observed behaviour of Striped Bass carrying internal acoustic tags (DFO 2015, 2016, 2017). The movements of 70 Striped Bass carrying acoustic transmitters were monitored with receiver arrays anchored throughout the Miramichi during May and June 2017. 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) to the gaspereau trapnets of the Northwest Miramichi.

The median of the estimated spawner abundance in 2017 was 994,000 with very wide confidence intervals (5th and 95th percentiles of 486,400 and 2,063,000) (Fig. 1). To estimate spawner abundance in 2017, the catch rates on individual sampling dates were assumed to be proportional to the abundance of adult Striped Bass in the Miramichi system. 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 system. Based on acoustically tagged bass, the proportions declined from 50% on 7 June to 3% on 14 June.

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 southern Gulf Striped Bass population. In 2017, the trapnet at Cassilis operated between 23 May and 27 October while the trapnet at Millerton operated between 4 June and 27 October. Catches of Striped Bass at these facilities in 2017 were the highest of the May/June time series ($n = 21,431$) and largely the result of five catches at Cassilis between 31 May and 8 June that ranged between 1,200 and 7,600 bass per day. Catches of Striped Bass at index trapnets ($n = 3,040$) in September/October 2017 decreased significantly compared to those at the same counting facilities in the previous spring (2017) and fall (2016) periods (Appendix 3). Low catches in the fall of 2017 could be attributed to a variety of factors related to an increased summer distribution along the lower north shore of Quebec and Labrador (see sections on Distribution and Sources of Uncertainty below).

The Recovery Potential Assessment (RPA) for Striped Bass, which was conducted to support the Species at Risk Act listing decision process, proposed a recovery limit and a recovery target for the southern Gulf Striped Bass spawning population in the Northwest Miramichi estuary (DFO 2006; Douglas et al. 2006). The proposed recovery limit was at least 21,600 spawners in

five of six consecutive years. Once that was achieved, then the proposed recovery target for considering fisheries access was $\geq 31,200$ spawners in three of six consecutive years. It was also suggested that the 5th percentile of the spawner abundance estimate be used to assess status relative to these recovery objectives (DFO 2006; Douglas et al. 2006). The abundance of Striped Bass spawners in the Northwest Miramichi in 2017 was sufficient to meet the RPA recovery limit and recovery target for the seventh consecutive year (2011 to 2017) (Fig. 1).

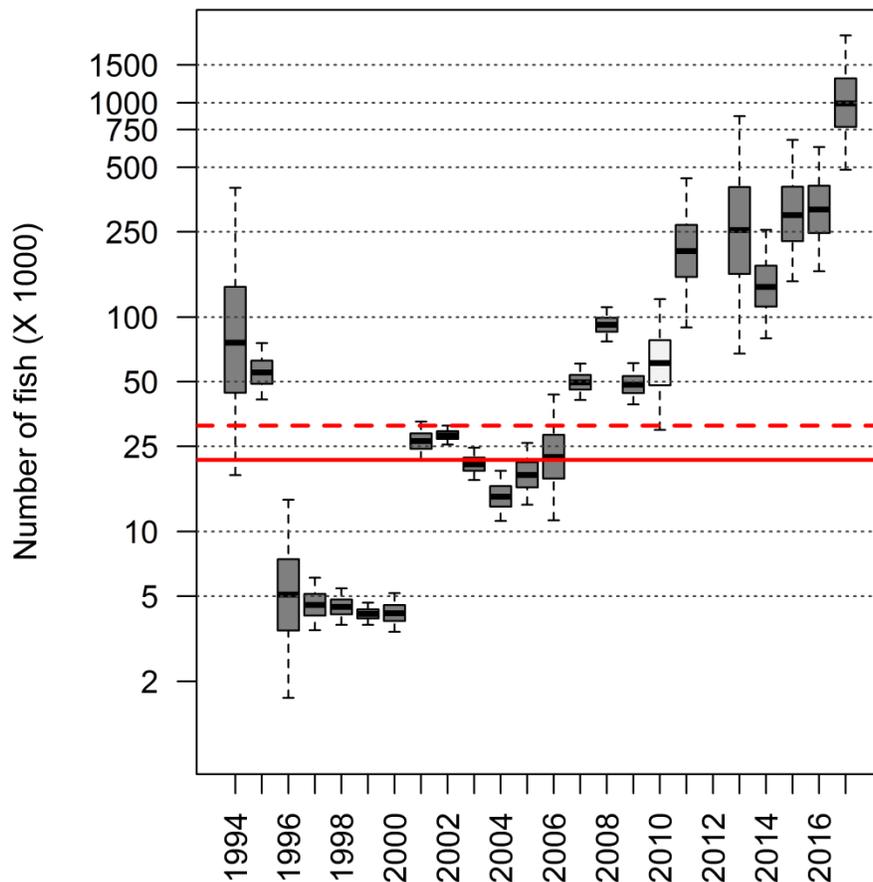


Figure 1. Estimated abundances of adult Striped Bass spawners in the Northwest Miramichi estuary between 1994 and 2017. The estimates are shown on a logarithmic scale for visibility of the full range of abundance values over the time series, from low abundances of approximately 5,000 spawners during 1996 to 2000 to the 2017 high value of approximately 1 million fish. The estimate for 2010 (unshaded interquartile box) is considered to be an underestimate due to the earlier timing of the spawning events (Douglas and Chaput 2011). There is no estimate for 2012 because spawning was very early and bass left the sampling area prior to monitoring activities (DFO 2013). 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 solid and dashed horizontal lines show the recovery objectives defined in the Recovery Potential Assessment in support of the Species at Risk Act listing decision process (DFO 2006).

Biological characteristics

The mean fork length (FL) of adult Striped Bass (assumed to be fish > 30 cm) measured in May and June 2017 was 48.0 cm (range 30.8 to 91.0 cm; $n > 5,700$). Forty-one percent of Striped Bass sampled had fork lengths between 30 and 45 cm, 54% between 46 and 61 cm (equivalent

to the retention slot regulation of 50 to 65 cm total length [TL], and 5% were 62 cm or greater (Fig. 2).

For adult Striped Bass sampled during the months of September and October 2017, the mean fork length was 47.9 cm (range 30.5 to 90.1; $n > 1,500$). Thirty-six percent of Striped Bass sampled had fork lengths between 30 and 45 cm, 57% between 46 and 61 cm (equivalent to the retention slot regulation of 50 to 65 cm TL), and 7% were 62 cm or greater (Fig. 2).

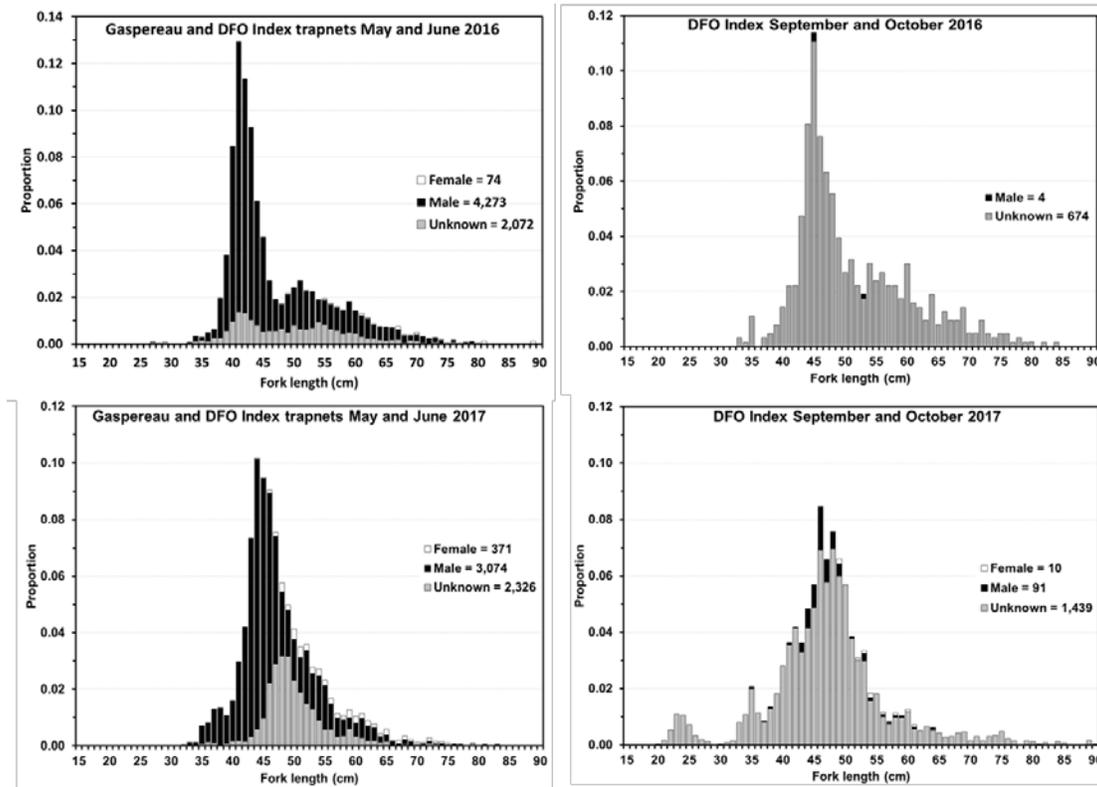


Figure 2. Fork length (cm) distributions of Striped Bass by sex and season. For the spring samples, a large portion of the Striped Bass identified as unknown sex are very likely female. The left panels summarize the frequency by fork length of Striped Bass sampled in the Gaspereau trapnets in the Northwest Miramichi and in DFO index trapnets in May and June 2016 (upper) and 2017 (lower). The right panels summarize the frequency by fork length of Striped Bass sampled at DFO index trapnets in September and October in 2016 (upper) and 2017 (lower).

Distribution

Until the summer of 2017, the northern limit of the confirmed distribution for southern Gulf of St. Lawrence Striped Bass had been the Gaspé Peninsula (COSEWIC 2004, 2012). During the summer of 2017, tags that had been previously placed on Striped Bass in the Miramichi River and East River (Pictou, NS) (Table 1; Fig. 3) were returned by anglers and commercial fishermen from the St. Lawrence estuary and the lower north shore of the St. Lawrence and southern Labrador. Evidence of the increased distribution of southern Gulf Striped Bass outside its historically confirmed range in 2017 was corroborated by numerous media and social media reports of Striped Bass in estuaries, freshwater, and coastal waters of the St. Lawrence estuary, lower north shore, and southern Labrador. To date, there have not been any recaptures of Striped Bass tagged in the Miramichi to the east of the Gulf of St. Lawrence (along the Atlantic coast of Nova Scotia and Bay of Fundy).

Table 1. Location and dates of Striped Bass recaptured during the summer of 2017 in coastal waters north of Gaspé Quebec, the previous northern limit of distribution for the southern Gulf of St. Lawrence Striped Bass population. Initial tagging dates and locations for the recaptured bass have also been included.

Recapture location	Recapture date	Tagging location	Tagging date
(1) Grande Vallée, Quebec	June 30, 2017	Miramichi, NB	October 9, 2012
(2) Rimouski, Quebec	July 18, 2017	Miramichi, NB	May 21, 2015
(3) Sainte-Anne des Monts, Quebec	July 26, 2017	Pictou, NS ¹	June 16, 2015
(4) Baie des Loups, Quebec	July 29, 2017	Miramichi, NB	October 4, 2012
(5) Forteau Bay, Labrador	August 28, 2017	Miramichi, NB	May 31, 2016

¹ Data from Colin Buhariwalla, Acadia University

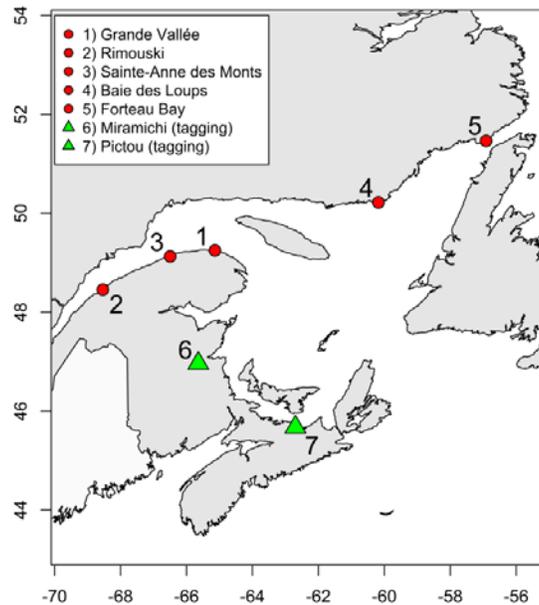


Figure 3. Tagging locations of Striped Bass and recapture locations (numbers refer to Table 1) outside the previous northern limit of distribution for the southern Gulf of St. Lawrence population.

Sources of Uncertainty

Evidence from tag returns indicates that a component of the southern Gulf Striped Bass population migrated further north in 2017 than previously known. The reason for this extended migration and whether it will be repeated in future years is unknown but it may have been associated with above average sea water temperatures in the Gulf of St. Lawrence in recent years (Galbraith et al. 2017).

Exposure to new sources of fishing mortality occurred for southern Gulf Striped Bass that migrated north in 2017 but the impact on the population is unknown. One tag was returned from a commercial fisherman in Forteau Bay, Labrador, that intercepted the bass in a cod gillnet. Catches of several tens of thousands of pounds of Striped Bass were reported in this area. Striped Bass were also reported intercepted in herring nets and halibut trawls along the south coast of Labrador but the interception rate or bycatch mortality in these fisheries were not reported.

The low catches of Striped Bass in the fall of 2017 at index trapnets in the Miramichi may reflect increased mortality during the summer months, a delay in returning to the Miramichi to

overwinter due to an extended summer migration or warmer coastal waters, or the choice of an alternate overwintering site to the Miramichi River.

Striped Bass may have delayed their return to the Miramichi in the fall of 2017. The trapnets were fished until 27 October in 2017, which is at least one week later than in most previous years, however, the water temperatures during the fall of 2017 were consistently above 10°C which contrasts with 2016 when the water temperatures were consistently below 10°C after 1 October. If there was a delay in the timing of the return of Striped Bass to the Miramichi in the fall of 2017, it can be resolved when hydroacoustic receivers are retrieved in the spring of 2018.

Conclusions

The monitoring of the movements of Striped Bass onto and away from the spawning grounds using acoustic telemetry provides a method of estimating the total spawning population by correcting for the proportion of spawners that were available to capture in the bycatch monitoring program of the gaspereau fishery. Spawner abundance in 2017 was estimated at 994,000 fish but with very large uncertainty (5th and 95th percentile range of 486,400 to 2,063,000), as in previous years. The increased spawner abundance in 2017 from 2016 would be consistent with a strong recruitment of females in 2017, based on the length frequency distribution of the unknown sex in 2017 and the older age at first maturation of females, rather than a strong recruitment of age 3 males (30 - 40 cm) in 2017. The recovery objectives outlined in the Recovery Potential Assessment for the southern Gulf Striped Bass population were met for the seventh consecutive year in 2017.

Although the Striped Bass spawner abundance estimate for 2017 is very uncertain, other abundance indicators, including the highest catch rates of Striped Bass in the 2017 gaspereau fishery (Appendix 2), the highest catches of Striped Bass at DFO index trapnets in the fall of 2016 and again in the spring of 2017 (Appendix 3), and the reports of the extensive presence of Striped Bass north of its previously documented distributional range in 2017, are all consistent and show more than a 100 fold increase in abundance in 2017 compared to levels estimated in the 1990s from the same indices.

In 2017, 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 (54%) and remained the same in the fall (57%).

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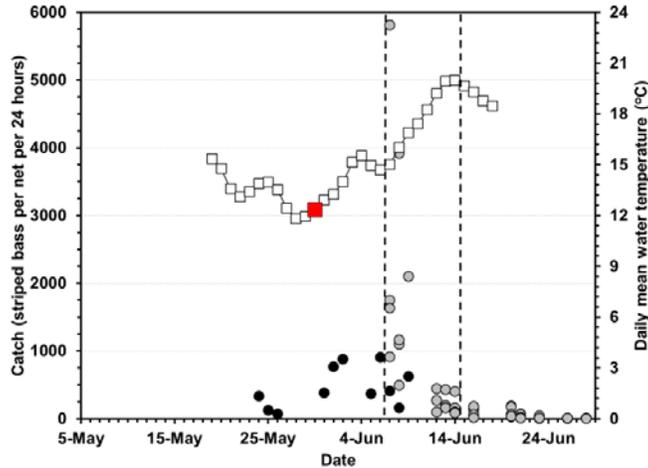
Sources of information

This Science Response Report results from the Science Response Process of 19 February 2018 on the update of indicators of the Striped Bass (*Morone saxatilis*) population of the southern Gulf of St. Lawrence, DFO Gulf Region, in 2017. No additional publications from this process will be produced.

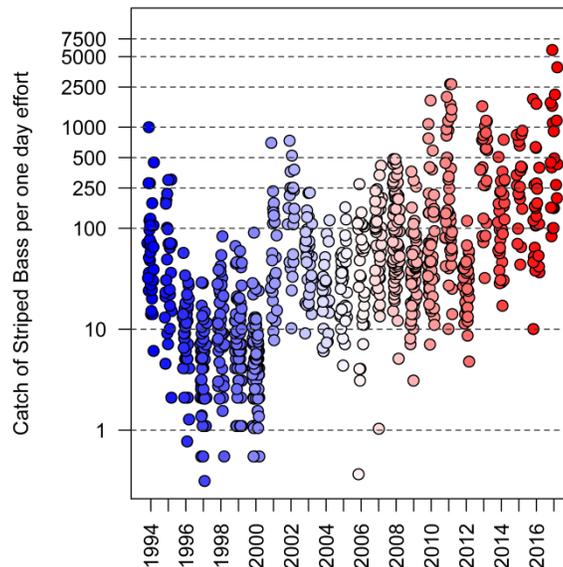
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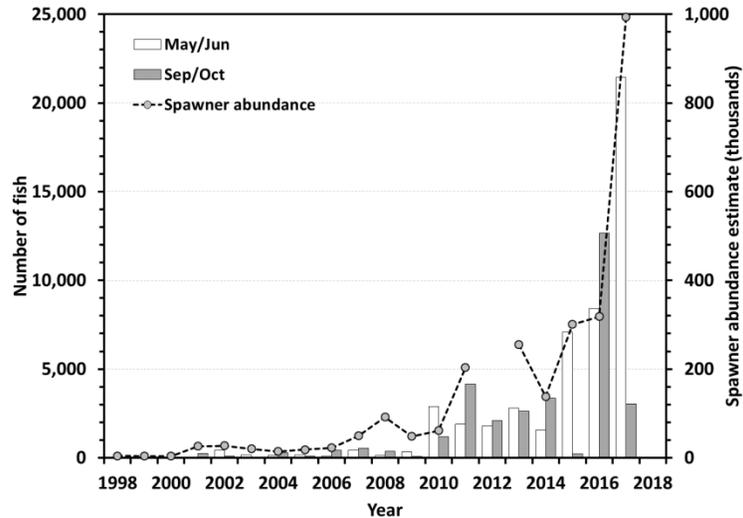
Appendices



Appendix 1. The number of Striped Bass captured per net per day in a single trapnet used early in the season to collect biological information on the population (black circles) and in trapnets used in the commercial gaspereau fishery of the Northwest Miramichi estuary in 2017 (grey circles). Vertical hatch lines encompass the Striped Bass bycatch data and the period which were used in the CPUE analyses. Squares show the mean daily water temperature and the red square represents the temperature on May 30, the date of the initial observation of Striped Bass spawning in the upper Northwest Miramichi estuary in 2017.



Appendix 2. The number of Striped Bass captured per net per day from monitoring of the commercial gaspereau fishery in the Northwest Miramichi, 1994 to 2017. 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. The points within a year are jittered slightly for clarity.



Appendix 3. The combined number of 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/Jun) and autumn (Sep/Oct) from 1998 to 2017. The median estimates of spawner abundance are also shown for comparison. The catches during the fall season in 2015 are very low due to flood conditions which ended the monitoring program on Sept. 30 for the Southwest Miramichi trapnet and the Northwest Miramichi trapnet was not operating for five days during the first week of October.

This Report is Available from the :

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