The successful reintroduction of striped bass in the St. Lawrence River: from initial stocking to population monitoring

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CURRENT STATUS: INTERMEDIATE-GOOD

TREND: INCREASING[6]

HIGHLIGHTS

This information sheet summarizes the information available about the striped bass population in the St. Lawrence River. It reviews the historical context, the legal status of striped bass, and the activities carried out to monitor the recovery of the population and gather data. The presence of two known spawning grounds in the St. Lawrence River, the number of individuals caught as bycatch by commercial and recreational fishers, and a spatial distribution of the species that now exceeds the historic range are all signs suggesting that the population is in the process of recovering.

HISTORICAL BACKGROUND

The St. Lawrence striped bass, a mythical heritage species in Québec, was prized by recreational fishers, in particular for combative nature for anglers. However, the species began to disappear from the waters of the St. Lawrence in the late 1960s. Although the precise causes for its disappearance are not known, over-exploitation by both recreational and commercial fishers and habitat degradation have been suggested.

Despite the fact that no striped bass from the St. Lawrence River population were caught in the river after 1968, the official disappearance of the species was only declared in 1985 (Beaulieu, 1985). Shortly thereafter, the first attempts were made to reintroduce it into the St. Lawrence (Robitaille et Ouellette, 1991). In 2002, the first stocking (Figure 1)

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5 Direction de la gestion de la faune de la Capitale-Nationale–Chaudière-Appalaches, 1300, rue du Blizzard, local 100, Québec (Québec) G2K 0G9.
6 According to the information available from various sources, the striped bass population in the St. Lawrence River is currently increasing, but to an unknown degree.

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was carried out near Saint-Vallier by the Ministère des Forêts, de la Faune et des Parcs (MFFP) and its partners to reconstitute a self-sufficient population. What follows is an account of the successful reintroduction of a species into its natural environment: the return of the striped bass to the St. Lawrence.

Figure 1. Stocking of young striped bass in the St. Lawrence River (photo: Eliane Valiquette, MFFP).

STATUS OF THE STRIPED BASS POPULATION IN THE ST. LAWRENCE

In 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the state of the reintroduced striped bass population in the St. Lawrence River and designated it as an extirpated species. In 2011, the population was registered as a species at risk under the *Species at Risk Act* and, under the same Act, a recovery strategy was put in place that year by Fisheries and Oceans Canada (DFO). The state of the St. Lawrence population was reviewed in 2012 by COSEWIC, leading to a recommendation to assign «endangered» status. Since this assessment, the MFFP and its partners have worked closely together on a recovery strategy to reintroduce a self-sufficient population into the St. Lawrence River (DFO, 2017).

MONITORING OF THE RECOVERY

Several actions have been taken since the start of striped bass stocking operations in 2002 to exhaustively monitor the steps of the species' recovery in the St. Lawrence.

Monitoring of bycatch was, for many years, the only way of obtaining information on the distribution of striped bass in the St. Lawrence River. In addition, this type of monitoring provided evidence of abundance and made it possible to document certain biological parameters (growth, maturity, age, etc.) of individuals from the recovering population. The monitoring of incidental catches has been conducted since 2003 by the regional MFFP office for the Lower St. Lawrence. It provides annual data on incidental catches (number, date and place) of striped bass in the St. Lawrence River in commercial fishing gear such as fixed eel nets and sturgeon nets, by recreational fishers, and during scientific inventories conducted by various organizations. For example, 13,117 yearlings were caught in a fixed eel net (and returned to the water alive) in the fall of 2014. They were all derived from natural reproduction, a clear indication that the population was fully able to reproduce.

Recruitment monitoring is annual monitoring that began in 2013 to ascertain the abundance of yearlings (age 0+), monitor their growth from year to year, and predict variations in future adult abundance. The data is collected in September in 100 predetermined stations using a shore seine net (Figure 2). The sampling stations were scattered along the shores of the St. Lawrence and several islands within an area stretching from Trois-Rivières to La Malbaie on the north shore and from Bécancour to L'Isle-Verte on the south shore. Although still recent, this data revealed inter-annual variability (Figure 3) already noted in other striped bass populations using this biodemographic indicator.

Figure 2. Use of a shore seine net at one of the 100 stations sampled annually in mid-September to calculate the recruitment rate in St. Lawrence River striped bass population (photo: Léon L'Italien, MFFP).

Spawner abundance monitoring is conducted by estimating, using a standardized index of catches per unit of effort, the number of spawners during the spawning period at two known reproduction sites in the St. Lawrence River: the bay of Beauport near Québec City (monitored since 2015) and the Rivière du Sud basin at Montmagny (monitored since 2017). All captured individuals are measured (fork length) to determine the size structure (Figure 4) and scales are also collected (since 2017) to determine the age structure. It is important to note that previous work located gathering sites and that the two previously-mentioned sites were also spawning grounds. At the time of monitoring, a PIT tag is inserted near the dorsal fin (by intramuscular injection) of all captured individuals so that they can be identified if caught again. Over time this will allow capture-mark-recapture analysis to estimate the apparent annual survival rate.

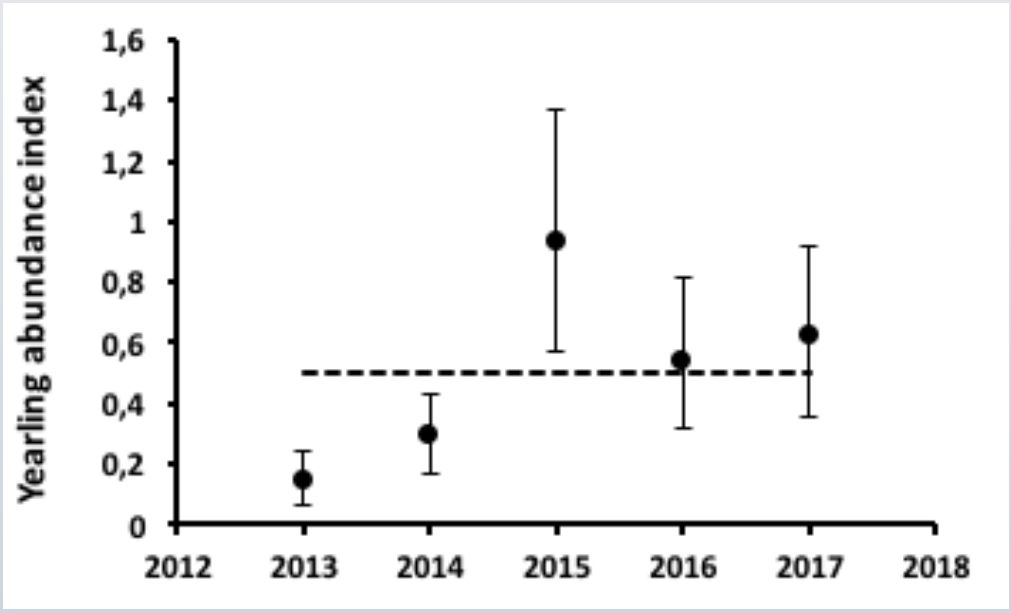


Figure 3. Annual variation in the abundance of striped bass yearlings in the St. Lawrence River population (2013–2017). The annual geometric mean for the number of young bass captured in the seine set (abundance index) and its 95% confidence interval are shown. The dotted line indicates the long-term mean.

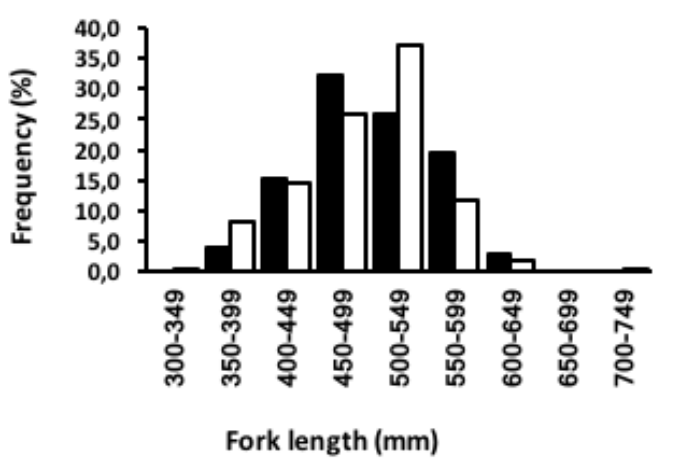


Figure 4. Frequency distribution by fork length (mm) in striped bass caught in the bay of Beauport (black bars) and the Rivière du Sud basin at Montmagny (white bars) during the spring 2017 spawn.

In addition to the monitoring conducted by the MFFP and its partners, data collection work has also been pursued as described below to look in more detail at the ecology of the St. Lawrence River striped bass in order to orient the recovery work more effectively.

STUDY OF SPATIAL AND TEMPORAL USE OF THE ST. LAWRENCE RIVER

This telemetric monitoring program began in 2010 and led to the gathering of significant new data about the movement of adult fish at different times of the year. The information can now be used, among other things, to better identify the habitats used for over-wintering and reproduction. In addition, by tracking the movement of the same fish over more than one year, it is now possible to study their fidelity to certain sites. Since the monitoring began, over 400 striped bass have been equipped with an acoustic transmitter (Figure 5) and are tracked using around 150 telemetric receivers deployed each year at strategic locations along the St. Lawrence River. The combined information collected about spatial and temporal use shows that the current distribution area is larger than the known historical range (Figure 6). The data also shows that striped bass in the St. Lawrence are able to travel over 40 km in a single day, indicating that they can cover significant distances in a short time, often in large groups. In addition, data on occurrences gathered using the telemetric receivers will be used to complete survival analyses, another useful indicator for monitoring population dynamics.

Figure 5. Installation of an acoustic transmitter on a sedated striped bass by senior MFFP technician Denis Fournier (photo: MFFP).

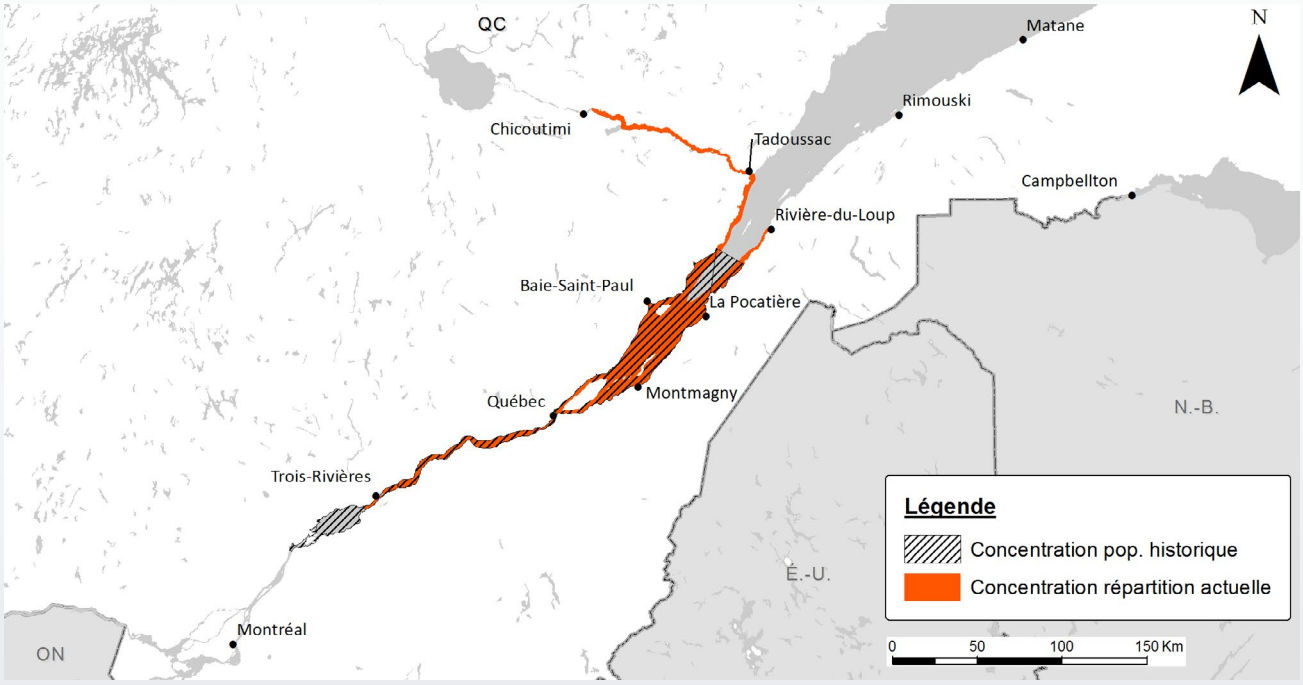
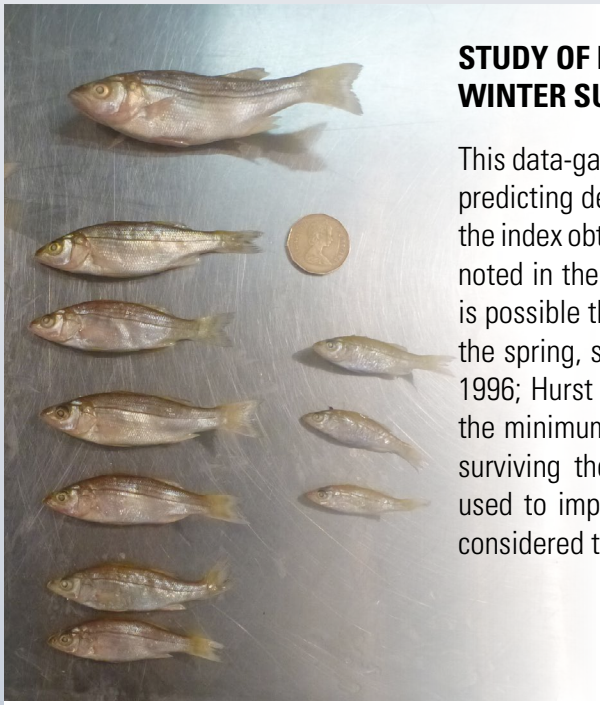


Figure 6. **Current and historic range of the St. Lawrence striped bass population, based on telemetric monitoring (current range) and bycatch monitoring (Robitaille, 2001; Valiquette et collab., 2017). The current range shown is where most observations were made, although other occurrences have been recorded as far west as Montréal.**



STUDY OF MINIMUM SIZE REQUIREMENTS FOR FIRST-WINTER SURVIVAL AMONG YEARLINGS

This data-gathering project began in 2017. The findings will be useful in predicting demographic trends in the striped bass population based on the index obtained from the recruitment monitoring. Given the variability noted in the size of yearlings just before their first winter (Figure 7), it is possible that small fish are less likely than larger fish to survive until the spring, since this has been observed in other populations (Bernier, 1996; Hurst et Conover, 1998). The goal of the project is to determine the minimum size that gives young striped bass a strong likelihood of surviving their first winter. Once established, this threshold will be used to improve the recruitment index by eliminating the individuals considered to have a low chance of survival.

Figure 7. **Yearlings sampled in September during recruitment monitoring of striped bass in the St. Lawrence. There is a clear variation in the size of individual fish, despite them all being born the same year (photo: Francis Moore, MFFP).**

INVENTORY OF POTENTIAL SPAWNING GROUNDS

This inventory will make it possible to study the sectors suspected of being used by striped bass for spawning, based on reports from the general pubic and users of the land. Several sites have been studied over the years, mainly in 2013, 2014 and 2015. In 2016, zooplankton nets were used to sample striped bass eggs and larvae downstream from the bay of Beauport, confirming their status as spawning sites. In 2014, larvae were sampled further downstream in the two channels on either side of Île d'Orléans. The species identification was officialised in both cases using molecular tools in a specialized fish genetics laboratory to ensure that the eggs were not white perch or another species having similar eggs or larvae.

FEEDING STUDY

The goal of this study is to identify the stomach contents of the striped bass sampled to understand what the species eats in various sectors of the St. Lawrence at various times of year. The analyses conducted to date show that their prey changes as they age, from small invertebrates at a young age to small forage fish such as rainbow smelt and tom-cod as they get older. The analysis continues.

WHEN THE REINTRODUCED AND THE ORIGINAL POPULATION MEET

As explained in detail in the information sheet the condition of the St. Lawrence, «La réintroduction du bar rayé dans le Saint-Laurent» (Legault et collab., 2008), the striped bass population in the St. Lawrence derives from young fish captured in the Miramichi River in New Brunswick, which is the only known spawning site for the striped bass population in the south of the Gulf of St. Lawrence. The fish taken from the Miramichi River for the program to reintroduce striped bass into the St. Lawrence River were kept in fish farms until they reached maturity, in order to produce young fish for stocking purposes. During this time, the population in the south of the Gulf of St. Lawrence was expanding both demographically and spatially and, in recent years, individuals from the population have been observed to reach the St. Lawrence River. The most recent estimate of abundance by the DFO is 994,000 spawners (DFO, 2018).

Thanks to telemetric monitoring and the assistance of DFO researchers, it has been possible to monitor the movement of certain individuals from the St. Lawrence River to the Miramichi River. In the opposite direction, individuals from the south of the Gulf of St. Lawrence have been observed in the St. Lawrence River, including some in the area of Montmagny. Individuals from both populations have also been found in the part of the river stretching from Rivière-du-Loup to Cap-Gaspé (Valiquette et collab., 2017). Recently, a major research project using otolith chemistry (the otolith is a small bone in the inner ear of fish) was able to determine the most probable origin of the individuals caught at various locations in this sector. This technique makes it possible to identify the source population based on the chemical signature of various elements, including strontium and calcium, found in the otolith and comparing it to the signature of the various possible striped bass spawning sites (the chemical signature of the water). The results obtained in 2017 suggest that the sector between Rivière-du-Loup and Cap-Gaspé is frequented mainly by the southern Gulf of St. Lawrence population, since 98.4% of the individuals caught came from that population (Figure 8; Valiquette et collab. 2018). The telemetric data obtained in the same sector between 2015 and 2017 also suggest that around 5% of individuals marked in the St. Lawrence River are present. Striped bass from the St. Lawrence River population therefore make only marginal use of the sector from Rivière-du-Loup to Cap-Gaspé.

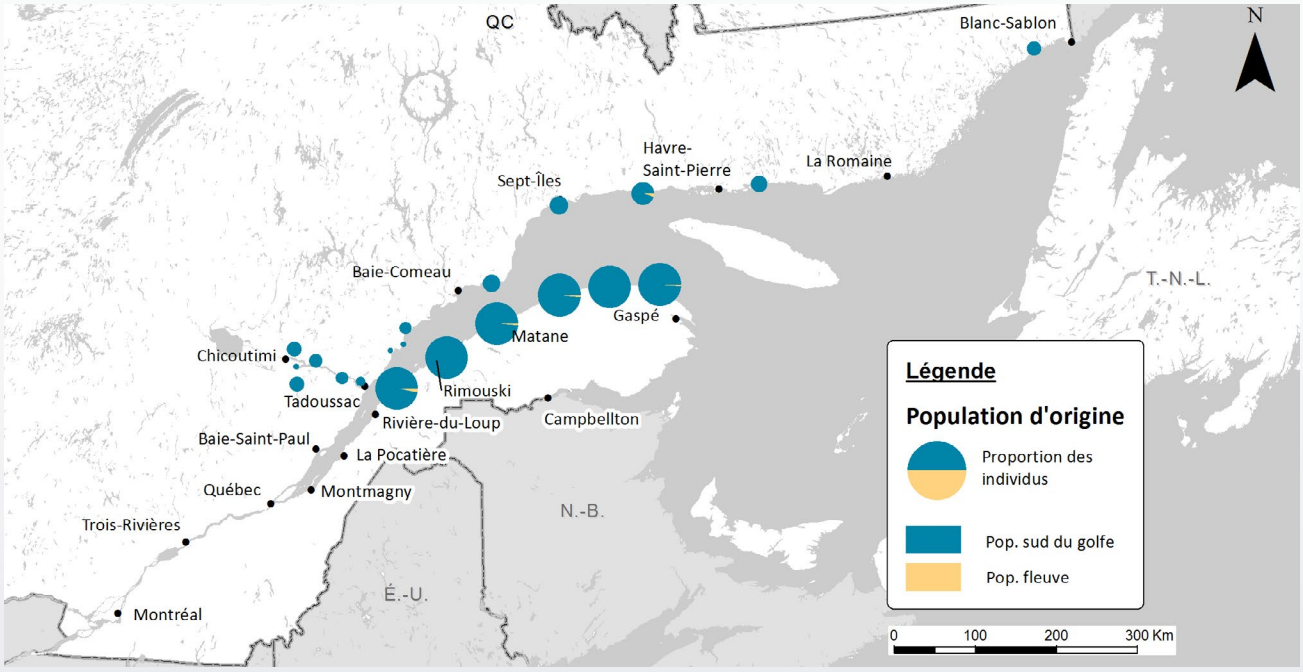


Figure 8. Findings from the population-of-origin survey of individuals sampled in 2017 using the otolith chemistry technique. The size of each circle is proportional to the number of individuals sampled at each site; the smallest circles represent a single individual, the larger circles 60 individuals.

CONCLUSION

The sustained effort to reintroduce striped bass to the St. Lawrence River has been successful, but it is not yet possible to state that the population has fully recovered despite the encouraging signs observed in recent years (DFO, 2017). It is only prudent to ensure that the population is able to maintain its numbers despite the environmental variability it faces. A program of annual monitoring of biodemographic indicators is the most suitable conservation and management tool that can be used to maximize the likelihood of full recovery. Once the St. Lawrence River striped bass has reintegrated the whole of its ecosystem and has potential for harvesting, it will once again be possible to fish for a species with legendary combative status.

Based on the information available, the state of the striped bass population in the St. Lawrence River is steady since the last assessment in 2014, and is considered to be intermediate—good. Data on the growth and distribution of individuals is considered to be good, while data on reproduction and abundance is intermediate (Figure 9), explaining the intermediate—good overall result. Ongoing monitoring of the species' recovery and data collection work will provide more insight into the population's reproduction and abundance.

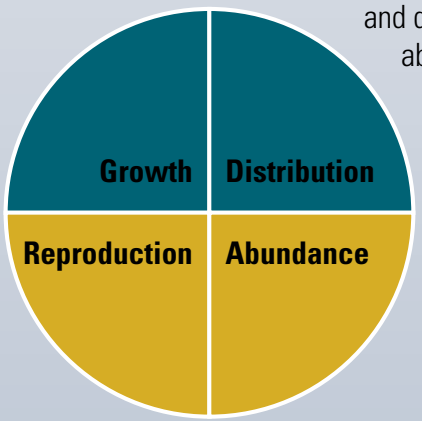


Figure 9. Indicators associated with the striped bass population in the St. Lawrence River. Growth and distribution are considered to be «good» (green), while reproduction and abundance are considered to be «intermediate» (yellow).

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