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ASSESSMENT OF HABITAT QUALITY AND HABITAT USE BY THE STRIPED BASS (*MORONE SAXATILIS*) POPULATION OF THE ST. LAWRENCE ESTUARY, QUEBEC

*Striped Bass (*Morone saxatilis*)*
Source: Fédération québécoise des chasseurs et pêcheurs.

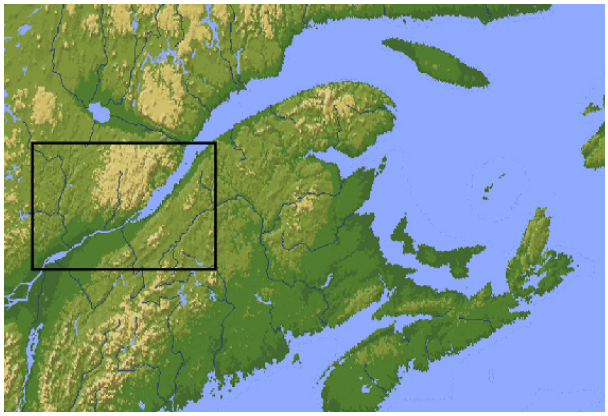

Figure 1. Distribution range of the Striped Bass population of the St. Lawrence Estuary. From Robitaille 2010.

Context

*In November 2004, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Striped Bass (*Morone saxatilis*) population of the St. Lawrence Estuary as extirpated (COSEWIC 2004). In 2002, the Ministère des Ressources naturelles et de la Faune du Québec (MRNF) began a reintroduction program in order to establish a new population able to reproduce and sustain itself.*

Fisheries and Oceans Canada (DFO), as the lead department for the Species at Risk Act (SARA) for aquatic species, has undertaken consultations on whether to add the St. Lawrence Estuary Striped Bass population to the SARA's list of species at risk. In the event the Striped Bass is added to the SARA, the Act states that critical habitat must be designated, to the extent possible and based on the best information available, in the recovery strategy of any threatened species, endangered or extirpated. If this critical habitat is unknown or partially identified, the recovery strategy must include a schedule of studies which, once completed, will provide for the designation of this habitat.

During the recovery potential assessment for Striped Bass conducted in 2005 (DFO 2006), the information presented was insufficient to determine critical habitat for the population of the St. Lawrence Estuary. A meeting organized by DFO on April 13, 2010 in Quebec City in conjunction with the MRNF and the Bureau d'Écologie Appliquée, helped update the available information on Striped Bass habitat and identify the knowledge required in order to designate the critical habitat. The advice taken from this meeting will be used for completing the recovery strategy and for developing the action plan for recovery, should the species be added to the SARA's list of species at risk.

SUMMARY

- Prior to its disappearance in the late 1960s, the Striped Bass population of the St. Lawrence Estuary spent its entire life cycle in the area between Lake Saint-Pierre and Rivière-du-Loup. Since its reintroduction, starting in 2002, Striped Bass have been captured mostly in the same sector.

- The spawning, incubation and larval stage sites have never been located. In 2008, juvenile Striped Bass were captured even though no stocking of this age group had occurred that year, which confirmed that these habitats were still present in the St. Lawrence River and Estuary.

- Prior to the disappearance of the Striped Bass, the first catches of juveniles (age 0+) started at Neuville in July, then gradually at sites downstream up to Rivière-Ouelle in late August. Since the reintroduction, juveniles have been caught in eel traps in September and October in the area from La Pocatière to Kamouraska, 96% of the catches were made in Anse Sainte-Anne and 4% downstream from this area.

- Immature and mature Striped Bass do not appear to be associated with a particular habitat, but they rather move based on the distribution and abundance of their prey. Variations in the longitudinal distribution of individuals based on age and time of year were recorded prior to the species' disappearance. Immature striped Bass were concentrated in the upper estuary, while Striped Bass aged 3+ and older could be found further upstream in winter and downstream in the summer.

- Before the population's disappearance, aggregations of adult size Striped Bass were observed in Lake Saint-Pierre in the winter. Since the reintroduction, many adult-sized Striped Bass have been observed in the spring in the warm water plume of the Gentilly-2 nuclear generating station in Gentilly and in the Rivière-du-Sud basin at Montmagny.

- Several anthropogenic threats could disrupt or destroy the habitat characteristics of Striped Bass. Dredging, changes to the shoreline, the plume of warm water produced by the Gentilly-2 nuclear generating station along with its management measures, the presence of contaminants, vessel traffic, the development or expansion of commercial or industrial ports, the development of underwater generators, disturbance caused by fishermen in concentration areas and the emergence of new exotic species are some examples.

- The identification and characterization of habitats used by the different development stages are necessary, with priority given to spawning, incubation and larval stage areas, habitats used by juveniles, concentration areas for mature individuals in spring and winter concentration areas.

- Data analysis of the extinct and the reintroduced population has helped identify important habitats for each development stage. Further studies on the reintroduced population are needed to locate these habitats and determine which should be designated as critical habitat. However, at this stage, it is clear that Anse Sainte-Anne at La Pocatière is an important habitat for juveniles in late summer and measures should be implemented to protect this habitat.

BACKGROUND

Striped Bass (*Morone saxatilis*) is an anadromous percoid that moves between freshwater spawning habitats and brackish or salt water feeding sites to complete its life cycle. Spawning, incubation and the larval stage usually occur in freshwater or slightly brackish areas. Juvenile Striped Bass (age 0+) then move to the nearshore habitats of estuaries and then gradually downstream towards saline environments throughout the summer. Juvenile, immature and mature Striped Bass return to estuaries or freshwater habitats in the fall to spend the winter, apparently to escape the cold winter seawater. As Striped Bass grow, they become high order predators. Their diet includes invertebrates and soft-rayed fish such as American Shad (*Alosa sapidissima*), Alewife (*A. pseudoharengus*), Atlantic Herring (*Clupea harengus harengus*), Rainbow Smelt (*Osmerus morax*), Banded Killifish (*Fundulus diaphanus*) and Atlantic Tomcod (*Microgadus tomcod*).

In the St. Lawrence Estuary, before its disappearance in the late 1960s, Striped Bass mainly occupied an area between Lake Saint-Pierre and Rivière-du-Loup (Figure 1). Commercial catches were reported until 1965, when the last reported recreational fishing catches were made in 1968. In all likelihood, major changes to the ecosystem caused by dredging in the North Traverse, combined with overfishing during a period of low abundance in the last known concentration area, the Montmagny archipelago, have likely contributed to the disappearance of the Striped Bass.

In 2002, the Ministère des Ressources naturelles et de la Faune du Québec (MRNF) decided to reintroduce the Striped Bass in the St. Lawrence Estuary in order to establish a new population able to reproduce and sustain itself. In order to document the development of stocked Striped Bass, to assess population parameters, to locate their movements and to verify the occurrence of natural reproduction, a monitoring network was established in 2004. The number of Striped Bass captured (670 individuals) in relation to the number of stocked individuals at juvenile, immature and mature stages (6,300 individuals) suggests that the survival rate of individuals is high and they appear to be very vulnerable to fishing. However, fishing activities in freshwater and marine environments as practiced today, are unlikely to affect the survival and recovery of the Striped Bass population of the St. Lawrence Estuary (DFO 2010a).

ANALYSIS

Under the *Species at Risk Act*, critical habitat is the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or in an action plan for the species. These may be spawning, rearing, or feeding areas, migration routes or areas where the species formerly occurred. The fundamental assumptions underlying the designation of critical habitat are the existence of a positive relationship between habitat and population size and the need for a minimum habitat for achieving the recovery goal and objectives in terms of population and resulting distribution. For the Striped Bass population of the St. Lawrence Estuary, the available data on the lost population and the reintroduced population is currently insufficient to define a quantitative recovery target. However, the recovery potential assessment conducted in 2005 (DFO 2006) defined a qualitative target: a self-perpetuating population with occupation and occurrence areas similar to those of the lost population.

The analysis for evaluating habitat quality and its use by the Striped Bass population of the St. Lawrence Estuary was conducted according to the guidelines developed by the DFO (DFO 2007), using available data on the lost population (Robitaille 2010) and the reintroduced population (Pelletier *et al.* Unpubl. data).

Spawning, Incubation and Larval Stages

Distribution Range

The spawning, incubation and larval stage sites for Striped Bass of the St. Lawrence Estuary have never been located, either before its disappearance or since its reintroduction. The only clues available to try to locate the approximate spawning sites used by the Striped Bass population before it disappeared are from the catches of mature Striped Bass in the spring in Lake Saint-Pierre and the first catches of juveniles made in the region of Neuville in July (Striped Bass of about one month of age). At the time, scientists had speculated that the spawning period likely took place between mid-May and mid-June. Recaptures of large Striped Bass that had been tagged in May and June showed that they were capable of significant displacements, which makes it difficult to delineate a limited area to locate the spawning grounds.

Although there was no larvae stocking in 2008, juveniles were captured, which showed that spawning, incubation and larval stage sites are still present in the St. Lawrence. However, they have not been located. Large individuals (presumably mature) were also observed at two locations in the St. Lawrence; the plume of warm water at the Gentilly-2 nuclear generating station in Gentilly (mainly between March and May) and in the Rivière-du-Sud basin at Montmagny (mid-April to late May), where higher concentrations were observed. The use of these sites for spawning has not been confirmed. However, females whose eggs were released from pressure on the abdomen were observed in the plume of warm water. At this stage, the females are ready to spawn and egg survival in the abdominal cavity is very short. The maturity stage was determined in ten individuals observed in spring in Gentilly, and in seven of them, pre-spawning stages, spawning and post spawning were identified. However, it is unlikely that the physicochemical conditions produced by the plume of warm water from the nuclear generating station are conducive to egg survival.

Habitat Characterization and Function

The egg and larvae stages are the least mobile and most sensitive to changes in environmental characteristics. Spawning grounds and habitats used by larvae must generally have a combination of characteristics, including salinity under 12 ppm, moderate currents, and good availability of zooplankton to promote the production of individuals. The more specific characteristics of habitats used for spawning, incubation and larval development are not known in the St. Lawrence as these habitats have not been located.

Assessment of Potential Habitats

Striped Bass show a high variability in the use of spawning habitats, so it is difficult to target the search for spawning sites, incubation and larval development areas exclusively to places with a particular range of physicochemical conditions. However, the known habitat characteristics for the Miramichi River population could be useful in trying to locate these habitats in the St. Lawrence since this is the most northerly population in America, and it uses a similar

environment to that of the St. Lawrence and is the source for stocking. In the Miramichi River, Striped Bass spawn only in a broad area approximately 10 km long in the northwest arm of the river, conditions are so specific that there is no spawning in the southwest section nearby. Eggs are released in an area subject to tidal freshwater. They are pelagic and kept suspended in the stream. After spending the winter at the head of the estuary and around the southern Gulf, mature Striped Bass return and concentrate, as soon as the ice disappears, in an area downstream from the spawning site. Reproduction occurs between late May and early June when the temperature is around 12-16ºC. Females appear to remain in the spawning area for only four or five days, while males may remain for a few weeks. They leave the spawning site quickly. The migration of adults during this period can be very fast, which may obstruct the interpretation of the spawning grounds based solely on the presence of adult-sized Striped Bass in various locations in spring (April-June).

Required Knowledge

The location of spawning, incubation and larval development sites is a priority to ensure the protection of habitats necessary to the recovery of the Striped Bass population of the St. Lawrence Estuary. Better knowledge of the period of time when the larvae are barely mobile would help locate the spawning sites. It is also necessary to determine whether these habitats are unique or multiple and contiguous or distant.

Juveniles (age 0+)

This development stage corresponds to young-of-the-year of age 0+ having completed their metamorphosis.

Distribution Range

Before the disappearance of the species in the St. Lawrence, the first catches of juvenile Striped Bass were reported in Neuville and Saint-Vallier in early July (Figure 2), then gradually in the following weeks in other sites of the south arm of Ile d'Orléans and finally, in late August in the northern arm of Ile d'Orléans and Rivière-Ouelle. Historical data show no evidence that these individuals moved either upstream or downstream with the arrival of the cold season. For example, in Montmagny or Rivière-Ouelle, where Striped Bass age 0+ were captured in the fall, individuals of age 1+ of similar size were captured the following spring.

Since the species' reintroduction, 193 juvenile Striped Bass were caught in fixed eel traps located in the St. Lawrence Estuary (Figure 3). Catches ranged from September to October during the period when the traps are usually installed. Despite a significant effort between La Pocatière and Rivière-du-Loup, 96% of juvenile Striped Bass collected were in Anse Sainte-Anne at La Pocatière and 4% downstream from that point. The absence of eel traps upstream from La Pocatière does not provide data for locating the habitats used by juveniles prior to September and to see whether this fall habitat is unique. The areas occupied by juveniles during the summer and winter have not been located.

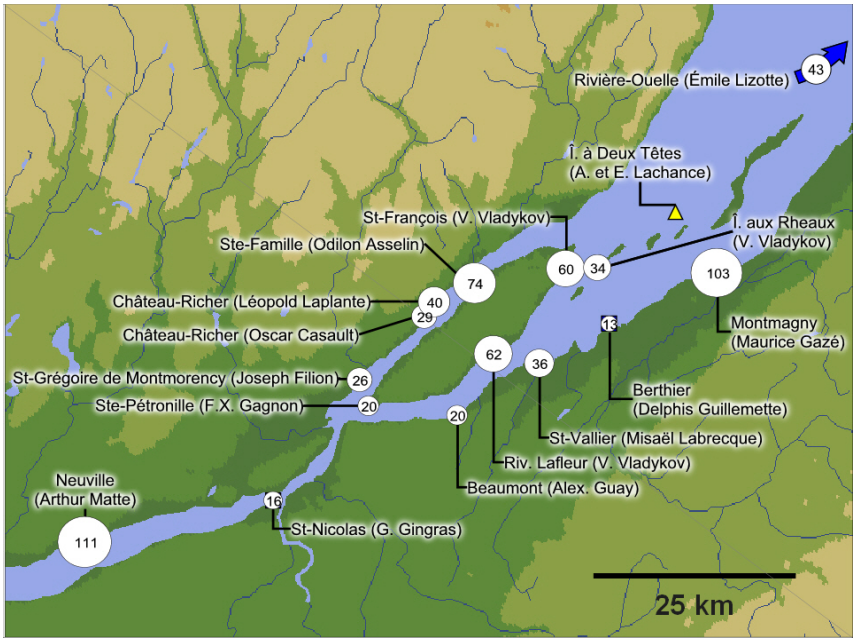

Figure 2. Localisation of the major fishing gear where juvenile Striped Bass were caught prior to the disappearance of the species between 1943 and 1962 and distribution of 687 specimens whose stomach contents were identified (From Robitaille 2005).

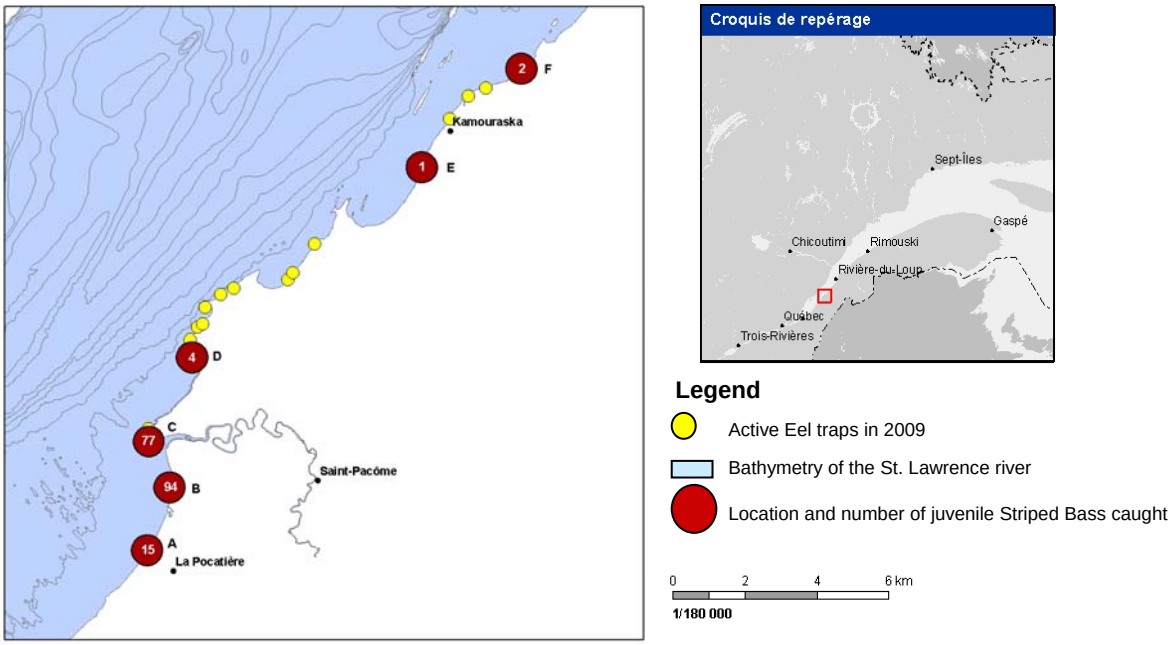

Figure 3. Location of juvenile Striped Bass collected by the monitoring network between 2005 and 2009 (n=193) (Pelletier et al. Unpubl. data).

Habitat Characterization and Function

Having reached the juvenile stage, Striped Bass of the year migrate to nearshore habitats of estuaries and then gradually downstream towards saline environments (0-15 ppm) throughout

the summer. In early July, juveniles are not yet very mobile and may need to feed on prey found locally. As the summer progresses, their growth gives them a greater swimming ability. They also become more resistant to changes in temperature, turbidity and salinity. These changes could explain why, before the disappearance of the species, juveniles were only caught in Rivière-Ouelle towards the end of August, when their size exceeded 65 mm.

Prey availability appears to be a significant habitat characteristic to maximize the growth of juvenile Striped Bass before winter. The analysis of stomach contents of Striped Bass collected before the population's disappearance has helped identify that feeding and growth for juveniles occurs primarily from July to October. In late October, the proportion of completely empty stomachs increased and a decreased number of organisms were observed. Prey varied from place to place and according to the period of season and included zooplankton, insects, worms, crustaceans and fish. The fish species most commonly identified in stomach contents were Rainbow Smelt, Alewife and Banded Killifish.

In 2004, some of the fishing stations between Neuville and Ile-à-Deux-Têtes, where juvenile Striped Bass were caught prior to the species' disappearance, were characterized. These stations were generally located away from the current, in coves or bays where the top of the foreshore provided seagrass beds. The substrate in the vicinity of the stations could be gravel, schist, sand or silt. For most of these stations, the spatial pattern had not really changed, except a few places where the top of the bank had been backfilled. However, some riparian habitats were radically altered, particularly in Saint-Grégoire de Montmorency and over about twenty kilometres between the Quebec bridge and the Ile d'Orléans bridge.

The area between La Pocatière and Kamouraska, where juvenile Striped Bass have been caught since their reintroduction, is a large intertidal area characterized by extremely heterogeneous abiotic phenomena. Shoals and strong currents bring a change in the salinity gradient changing rapidly from 10 to 18 ppm. The banks in this sector also represent an ichthyoplankton retention area where occurs, in the spring, Rainbow Smelt, Atlantic Herring and Capelin (*Mallotus villosus*) larvae. The circulation of the water mass at this location creates a significant thermal front characterized by lower temperatures of 6 to 7°C in summer downstream from Rivière-Ouelle. More specifically, the Anse Sainte-Anne area is a wide intertidal zone associated with shoals spanning 146.3 km^2. Surface sediments are varied and range from coarse to fine particles from east to west. This habitat appears to be used by juveniles for food.

Assessment of Potential Habitats

An habitat analysis between Neuville and Kamouraska helped identify an area of potential habitat for juvenile Striped Bass from the upper intertidal zone to a depth of 5 m, an area of 940 km^2 (Figure 4). Downstream from Kamouraska, juvenile distribution is hypothetically limited by the presence of colder water. The bottom topography of the entire potential habitat area is diverse and the sector is also characterized by significant production of crustaceans and several soft-rayed fish species, which could be prey for juvenile Striped Bass.

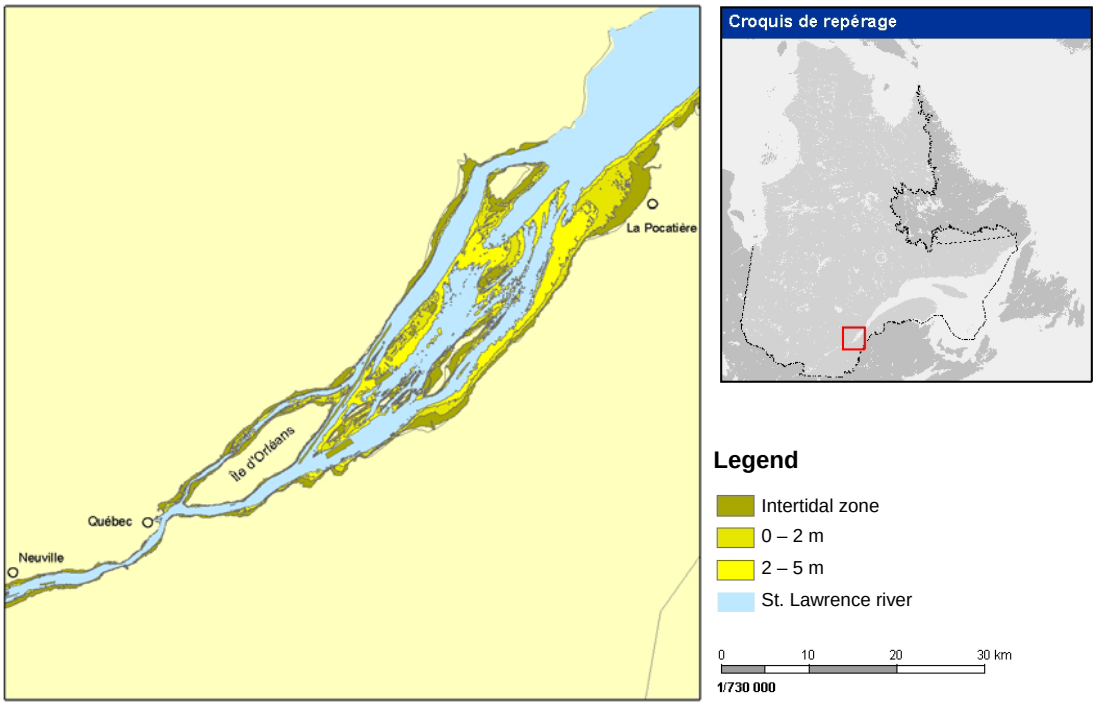

Figure 4. Delineation of potential habitats for juvenile Striped Bass in the St. Lawrence upper estuary (Pelletier et al. Unpubl. data).

Required Knowledge

The primary knowledge gaps concerning the habitat of the reintroduced juvenile Striped Bass population is the lack of information on the distribution of juveniles upstream from La Pocatière in summer due to the lack of fishing gear. Since the reintroduction, these habitats are probably still used by juveniles, but it is impossible to confirm. The distribution range of juvenile Striped Bass during the winter is also unknown, but is probably located in the St. Lawrence River upstream from salt water below 0ºC temperature. The absence of information on habitat use by juveniles is a major knowledge gap, but is considered lower priority than identifying spawning, incubation and larval stage habitats.

Immature and Mature Individuals

The criterion used to distinguish immature and mature fish (i.e. individuals having reached sexual maturity) differs for the lost and reintroduced population. The data for the lost population indicates that the immature stage includes individuals below the age of 3+ and the mature stage individuals of age of 3+ and older. For the reintroduced population, the immature stage includes males (total length) of less than 400 mm and females smaller than 450 mm. The mature stage includes males of 400 mm or larger and females of 450 mm or larger.

Distribution Range

Before the disappearance of the species, all recaptures of tagged Striped Bass of age 1+ and older (mature and immature) were reported between the Lake Saint-Pierre archipelago and

Rivière-du-Loup (Figure 5). During the summer, Striped Bass were abundant around Ile d'Orléans, in the Montmagny archipelago and along the south shore up to Kamouraska. They were also present on the north side of the St. Lawrence river, along Ile d'Orléans and Côte de Beaupré up to Cape Tourmente and frequented mostly shoals, around islands, islets and reefs as well as shallow waters.

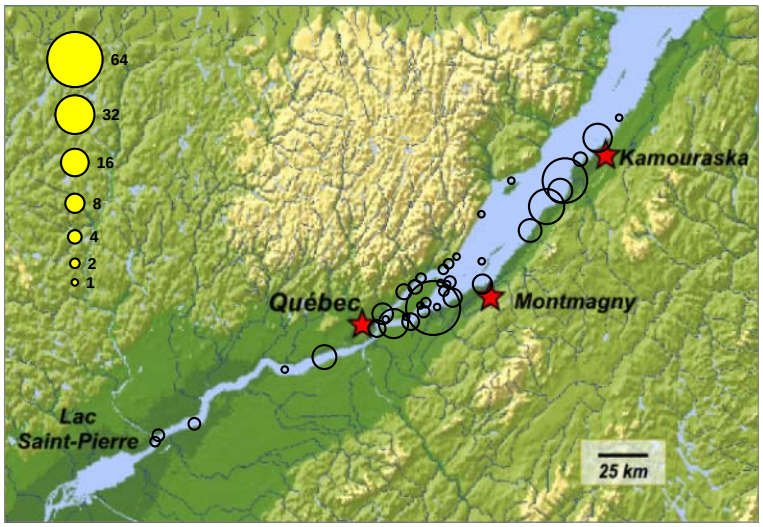

Figure 5. Location of recaptures of immature and mature Striped Bass prior to the species' disappearance (n = 284). The surface of the circles represents the number of recaptures par area (From Robitaille 2010).

Recaptures of tagged Striped Bass show a change in distribution associated with the seasons. Generally, recaptures were made further downstream during the feeding and growth months (July-October) than during the rest of the year (November-June). Moreover, these seasonal changes in the distribution of Striped Bass differed by age. During the feeding period, Striped Bass of age 3+ or more were recaptured further downstream than immature individuals. Immature Striped Bass were caught mainly in the vicinity of Quebec and Ile d'Orléans, while mature individuals predominated in the east, near Kamouraska. In the years that preceded the disappearance of the St. Lawrence Estuary population, immature Striped Bass were concentrated mainly in the Montmagny archipelago. During the cold season, Striped Bass of age 2+ were recaptured further downstream (20 km average), while Striped Bass of age 3+ and older (mature) moved upstream (average of 72 km). Mature individuals seemed to spend the winter in Lake Saint-Pierre, where they were captured primarily when the ice melted.

Since the reintroduction of Striped Bass, catches and observations of immature individuals stretch from Montreal to Baie-Comeau on the north shore of the St. Lawrence and up to Rivière-du-Loup on the south shore (Figure 6). Data are insufficient to highlight preferred concentration areas for immature individuals, although catches are more abundant in the Lower St. Lawrence in the fall, probably due to the high fishing effort in this area at this time of year.

For mature Striped Bass, catches and observations were recorded from Montreal to Rimouski, including the Saguenay River (Figure 7). In summer and fall, when fishing effort is more important, mature Striped Bass occupy the entire distribution range. The most significant catches and observations were made in the Quebec region upstream from Ile d'Orléans, but these have often been associated with stocking activities conducted in the days or weeks prior in the same area. For the winter period, only three observations of mature Striped Bass have

been reported. Because Striped Bass do not feed much in winter, it is difficult to pinpoint the areas they use from observations made by recreational fishermen. In spring, the majority of catches and observations of mature Striped Bass reported were primarily made in the Rivière-du-Sud basin at Montmagny and at the Gentilly-2 nuclear generating station in Gentilly. For now, there have been no reported observations in Lake Saint-Pierre in winter or spring. Thus, it is impossible to determine whether this area is used as a winter refuge.

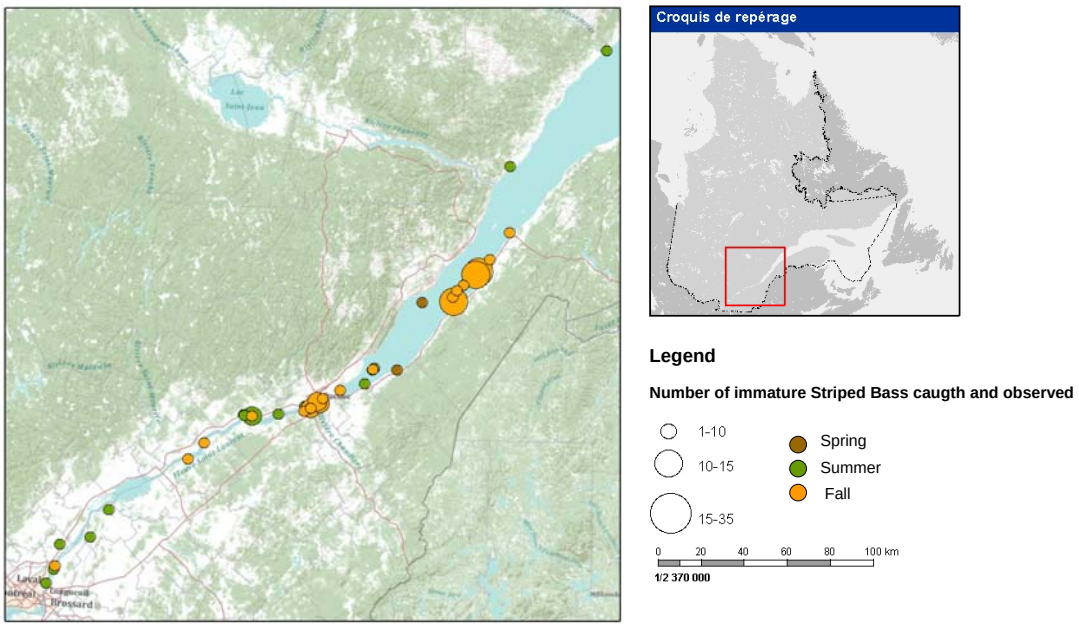

Figure 6. Location of catches and observations of immature Striped Bass (n = 184 individuals handed over to the MRNF and 53 reported observations) (Pelletier et al. *Unpubl. data).*

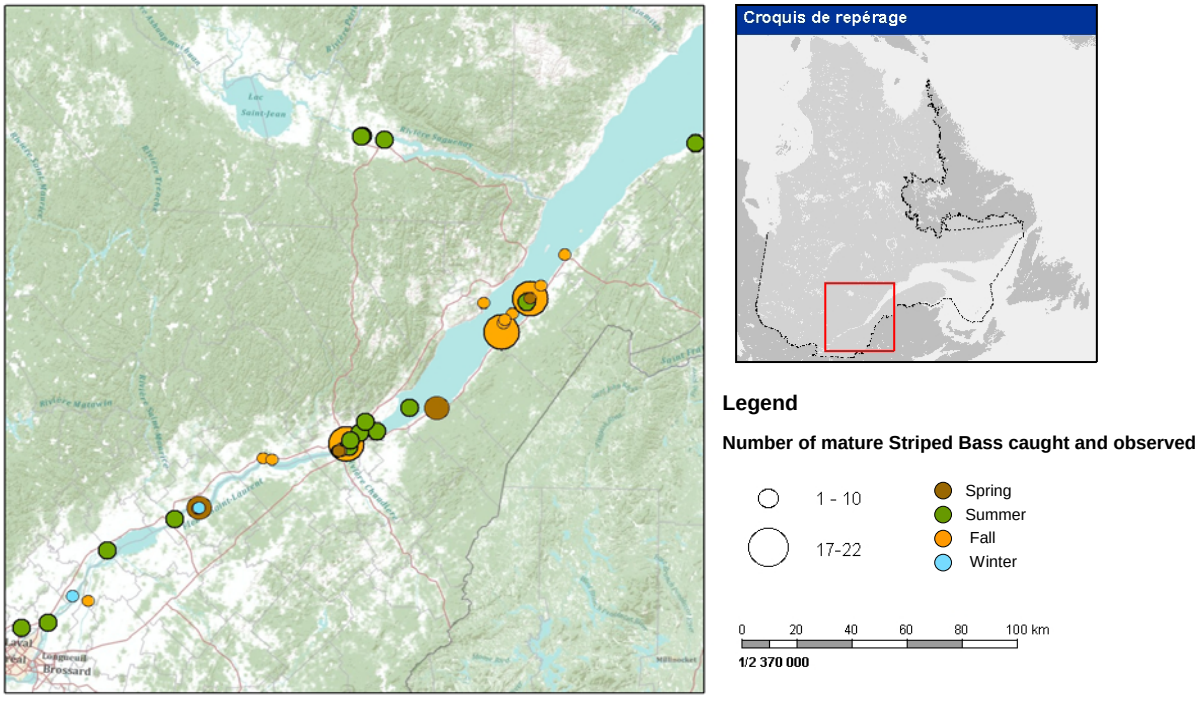

Figure 7. Location of mature Striped Bass catches and observations (Pelletier et al. Unpubl. data).

Habitat Characterization and Function

Prior to the species' disappearance, immature and mature Striped Bass in the St. Lawrence Estuary occurred in a limited part of the estuary during the feeding months and moved a lot within this area. Although recaptures of tagged Striped Bass reveal that movements sometimes reached 30 km per day, the distance between the tagging and recapture areas shows no increase with the seasons, either for Striped Bass in general or for a specific age category.

The constant movement of immature and mature Striped Bass makes it difficult to link their presence to the specific habitat characteristics. However, they are more tolerant than the larvae and juveniles to changes in temperature, dissolved oxygen, salinity and current velocity, which allow them to frequent a larger portion of the estuary. The definition of a habitat, especially during the summer months, should therefore be based more on the distribution and abundance of their prey. The analysis of stomach contents of immature and mature Striped Bass caught in the 1950s showed that Striped Bass had a preference for crustaceans and soft-ray fish, including the clupeids group at the juvenile stage which occupied a prominent place during the summer. However, in their absence, Striped Bass fed on the most abundant prey in their environment.

In winter, the water temperature (below 0ºC) could be a limiting factor for Striped Bass; hence the likely use of thermal refuges in freshwater.

Since their reintroduction, adult size individuals have been observed in spring in the Rivière-du-Sud basin at Montmagny where concentrations have been observed for a few years from mid-April to late May and in the area of the Gentilly-2 nuclear generating station in Gentilly primarily between March and May. For now, even though females whose eggs were released with pressure to the abdomen have been observed, it is impossible to determine whether these groups of individuals are related to spawning.

Assessment of Potential Habitats

There appears to be a combination of factors, such as food resources, predation, weather and environmental conditions, related to habitat use by immature and mature Striped Bass. During the feeding period, Striped Bass possibly move depending on the availability of their prey. It is more difficult to identify potential habitats during this period in the historical distribution range or in their current range. In winter, Striped Bass probably use freshwater habitats such as the upper part of the St. Lawrence or some of the rivers flowing into the St. Lawrence. All of the historical range should be considered as potential distribution range.

Required Knowledge

Given the high mobility of immature and mature Striped Bass and their tolerance to a wide range of physico-chemical conditions, habitat for these two stages is not likely limited, except for the spawning grounds and winter concentration areas. Thus, for adult individuals, priority should be given to identifying spawning sites. Studies are also needed in both areas where several mature Striped Bass have been captured in order to characterize and determine their function. In the Gentilly area, it would also be useful to assess the potential impacts of the plume of warm water on reproduction and survival of eggs and larvae and more generally, on the species' recovery. The location of wintering areas for immature and mature Striped Bass

would help protect them, should they gather in large numbers in some places. Although priority is not as high, it would be important to locate and characterize the others habitats used by these two stages of development.

Threats to Habitat

Dredging is the most significant threat to habitat, especially for juvenile and immature individuals. Maintenance work is carried out each year to clear the shipping channel of sediments that accumulate. This work may become more important with the potential development of the St. Lawrence Seaway, or as a result of the decrease in water levels caused by climate change. The deposits and discarding of sediment, along with the increase in current in the dredged channel followed by a change in salinity and availability of prey, would probably have a significant impact on the habitat used by Striped Bass. Moreover, the disappearance of the species in the St. Lawrence Estuary occurred in the years that followed the development of the seaway (1954-1959). Major changes to the ecosystem caused by dredging combined with overfishing during a period of low abundance in the last known concentration area are the main theories for the disappearance of Striped Bass in the St. Lawrence Estuary.

Dredging practices have changed in recent decades. In the 1970s, the use of sites designated for dumping dredged material in deep water was introduced. Also, since 2009, the disposal site south of Ile Madame (located near the feeding areas used by immature Striped Bass prior to the species' disappearance) is no longer used. At a smaller scale, other sectors can also be dredged (e.g. marina) and have impacts that must be taken into account.

Other threats can affect Striped Bass, including the disruption or destruction of banks (e.g. dewatering, backfilling, artificial embankments, dikes). Between the Quebec bridge and the Ile d'Orléans bridge, riparian and aquatic habitats have suffered considerable losses over more than twenty kilometres, which has reduced the amount of available habitat for Striped Bass during their first summer. The plume of warm water produced by the Gentilly-2 nuclear generating station changes the physicochemical conditions in that area. The plume of warm water and the plant's management approaches (e.g. emergency shutdowns, maintenance shutdowns) could jeopardize the health and survival of individuals who frequent the area in addition to causing a premature development of gonads and an additional expenditure of energy. This could have an impact on recruitment should a high percentage of the population's mature individuals frequent this sector. Other threats include the presence of contaminants (agricultural or industrial pollution), shipping traffic (e.g. possibility of spills), development or expansion of commercial and industrial ports, development of underwater generators, disturbance caused by fishermen in concentration areas (abandonment of a preferred habitat) and the occurrence of exotic species. Since the distribution of Striped Bass also seems conditioned by the distribution and abundance of prey, threats that may impact the prey should also be considered. For example, the threats that affect the prey's spawning grounds, even if they are located outside the Striped Bass distribution range, could impact the recovery of the Striped Bass population.

Sources of Uncertainty

The data collected on the population before its disappearance are sketchy and were not collected according to a systematic sampling approach, but rather by opportunity with the collaboration of commercial and recreational fishermen, which limits the location and habitat characterization formerly used. Moreover, since the St. Lawrence ecosystem has changed

considerably in recent years, some sectors previously used might not be available for the reintroduced population.

The data from the reintroduced population also depend on the cooperation from fishermen to report their catches and observations. Given the small number of Striped Bass reintroduced and the decrease in the number of commercial fishermen who participate in the monitoring network, it is currently difficult to assess habitat use by Striped Bass.

CONCLUSION

The analysis of the knowledge acquired on the Striped Bass population of the St. Lawrence Estuary before its disappearance provides a delineation of areas likely to be frequented again by the species and the data collected through the monitoring network have confirmed the use of some of these areas by the reintroduced population. Moreover, this analysis has identified important habitats for each stage of development, but has not provided locations. Further studies on the reintroduced population are needed to locate and determine which of these important habitats will be designated as critical. There is a high priority to locate and characterize the site or sites for the species' spawning, incubation and larval stages, as well as the habitats used by juveniles and the concentration areas for mature individuals in spring. In addition, winter concentration areas are habitats that need to be located and characterized.

For now, several mature individuals have been observed in spring in the warm water plume of the Gentilly-2 nuclear generating station in Gentilly and in the Rivière-du-Sud basin in Montmagny, but the use of these areas for reproduction has not been confirmed and it was impossible to determine their significance for the survival and recovery of the species. The presence of eel trap-nets between La Pocatière and Rivière-du-Loup has helped locate a concentration area of juveniles in Anse Sainte-Anne at La Pocatière in September and October. It is clear that this habitat is an important habitat for this stage of development and measures should be implemented to protect this habitat.

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