Brief Presentation to the House of Common's Standing Committee on Fisheries and Oceans on the Impact of the Rapid Increase of the Striped Bass in The Miramichi River and the Gulf of St. Lawrence

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The New Brunswick Salmon Council (the NBSC) is an Atlantic salmon conservation coalition comprised of 25 fish & game, environmental and First Nations organizations. A large majority of the members of our component organizations are primarily Atlantic salmon sport fishery participants and proponents, and they view wild salmon conservation as a means to achieve better recreational fishing results. Many also fish for other species, and support the establishment and maintenance of "good" fishing for species such as striped bass, brook trout, and smallmouth bass as well as salmon.

As an introduction, the following is an explanation of the differences between recreationally fishing for Atlantic salmon and striped bass, and a discussion of what differentiates "good" from "bad" fishing for each. Fishing for "bright" Atlantic salmon (as opposed to post-spawned "black" salmon or kelts) is not for the impatient. Sea-run Atlantic salmon sport fishing in eastern Canada is conducted only by means of fly-fishing, a technique that takes patience for an angler to rise above even the level of ineptitude. "Bright" salmon are on their spawning run, and in fresh water do not feed. Therefore, even when employing proper fly-fishing techniques, it can be extremely difficult for anglers, to hook them. Salmon fishing occurs above the tidal limit in flowing water. More than one bright salmon caught and landed per three rod-days (~0.3 fish per day) is considered acceptable fishing quality (W.C. Hooper, NBDNR Fisheries Biologist, Pers. comm. to J. Bagnall, 1980). A lower catch rate is considered poor fishing, and angler participation declines due to discouragement. So obviously, catch rates below 0.3 salmon per rod-day define the first kind (Type 1) of "bad" fishing. Bad fishing has happened recently on NB salmon waters. I have fished salmon for more than 40 years, and own a camp at the head-of-tide on the Northwest Miramichi River. In 2018 I caught three salmon in 50 days of fishing (0.06 fish per rod-day). These dismal 2018 catch results were typical for other people I know. In 2010, I caught 47 fish in 50 days, or almost one per day. This was good fishing.

Striped bass fishing normally occurs in the estuaries of rivers in NB, notably in the common estuary of the Southwest, Northwest, Little Southwest and Renous rivers. Striped bass fishing is concentrated during several weeks in the spring and again in the autumn. It is conducted by casting or trolling bait, artificial lures or artificial flies. My friends fish striped bass in the Northwest / Little Southwest arm of the upper Miramichi estuary from a small boat. Recently as well, anglers targeting Atlantic salmon have been catching striped bass in locations well above the head-of-tide in all Miramichi branches. Unlike bright Atlantic salmon, striped bass are feeding during the angling season, and between my three friends, they typically catch and release 50 to 60 striped bass per day for a 24-hour day (i.e. 3 anglers * 8 hours per day). This is equivalent to approximately 200 to 250 bass caught per 100 angler-hours. For comparison purposes, the average striped bass catch rate in the popular San Francisco Bay angling fishery ranged from six to 16 per 100 hours of fishing from 1980 to 2009 (IEP Newsletter, 2013). Recent catch rates in the Miramichi estuary represent the second type of bad fishing (Type 2); when so many fish are captured per rod-day, and the high catch rate is so predictable, that fishing becomes boring. Type 1 (few fish caught) "bad" fishing for bass would have occurred in the striped bass fishery in the early 2000s. Type 2 bad fishing for salmon seldom occurs.

Within the last 10 to 15 years there has been a meteoric increase in the striped bass population. Figure 1 depicts the Department of Fisheries and Oceans' (DFO, 2018) annual estimates of the Miramichi (and essentially the Gulf of St. Lawrence) striped bass spawning population. The figure is on a log scale to enable the full range in population strength to be demonstrated.

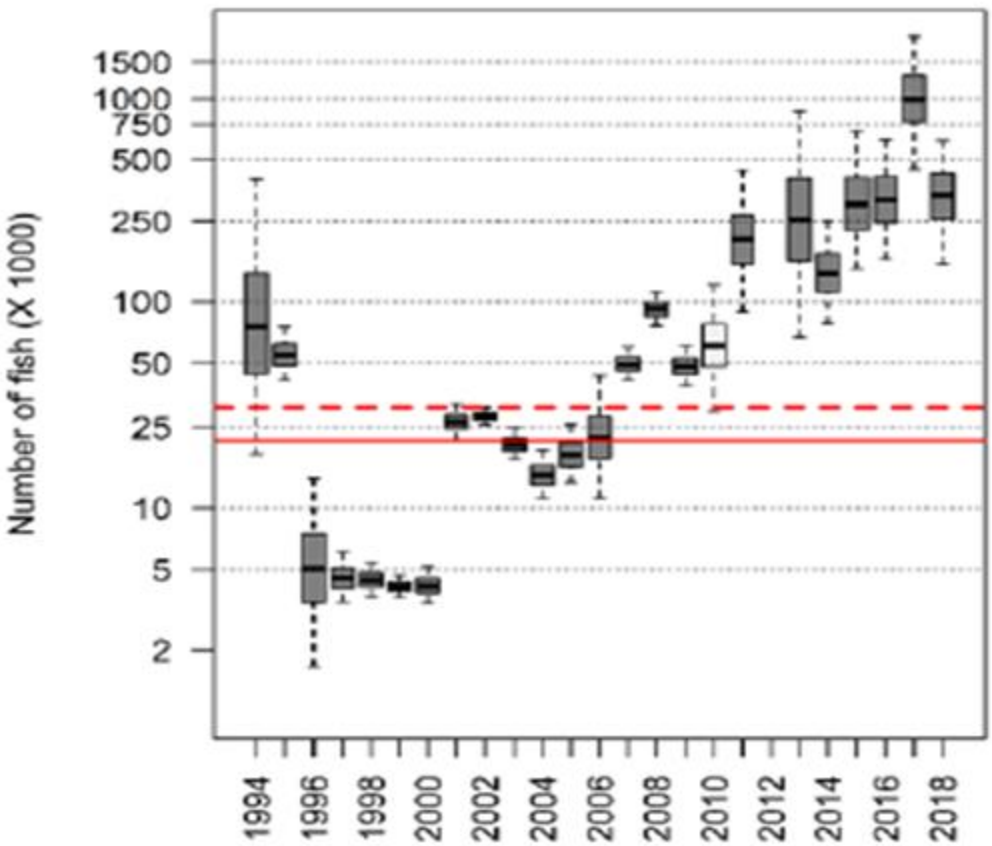

Figure 1 the Annual Miramichi Striped Bass Population - 1994 to 2018

A steep decline in Atlantic salmon returns to the Northwest Miramichi River has recently coincided with the striped bass population explosion. Since the late 1980s, a salmon-protection barrier has been installed in the headwaters of several NB rivers including the Northwest Miramichi. All small salmon (or grilse) and large salmon (or multi-sea-winter <MSW> salmon) that reach the barrier from June through mid-October are detained in a short section of river between two barrier nets and guarded 24-hours per day by wardens. The fish are released just prior to spawning. The barrier allows precise annual counts of grilse and MSW salmon, and provides an index for the strength of the annual spawning run. The annual numbers are presented in Figure 2. In recent years, salmon sports fisheries on the Northwest Miramichi have been mandatory catch-and-release and First Nations have greatly reduced their harvests. Otherwise recent counts of salmon and grilse reaching the barrier would be lower. Conversely, in the early years, if similar recent reductions in harvests had occurred, the numbers would be higher. What is immediately apparent in this figure is the rapid drop in grilse returns in the decade of the 2010s.

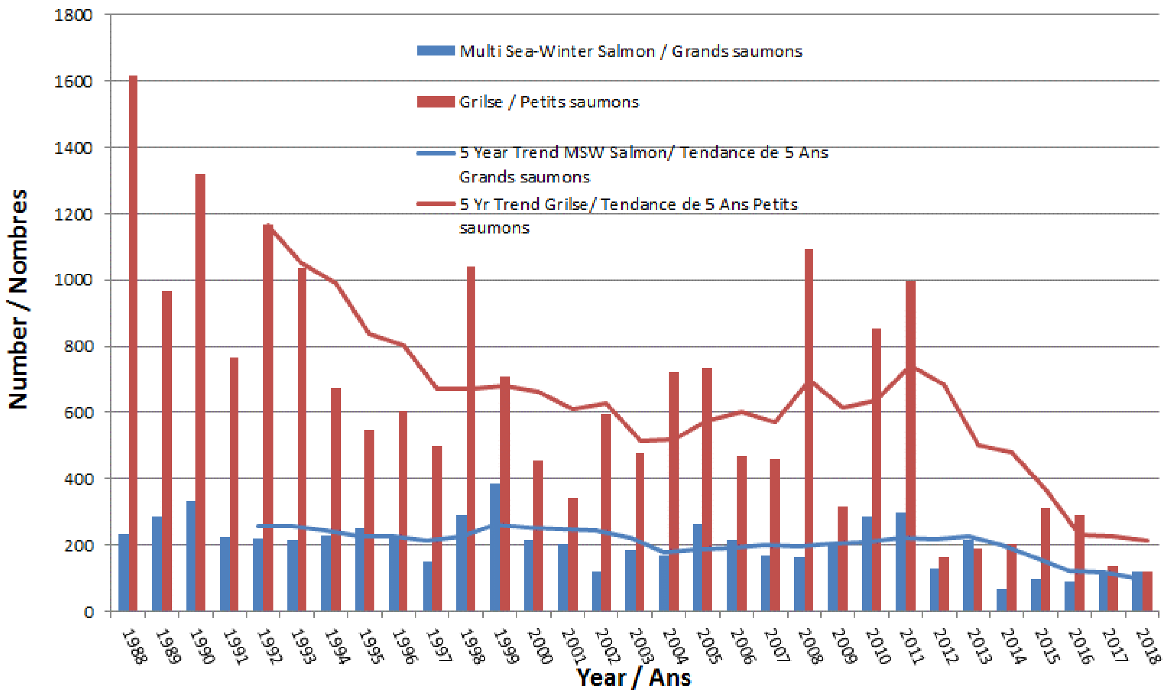

Figure 2 Annual Return Rates for Large (MSW) and Small (Grilse) Salmon to the Northwest Miramichi Salmon Protection Barrier

There is an obvious potential pathway of effect between striped bass and salmon numbers in that Atlantic salmon smolts, which are 12 to 18 cm long and only 20 to 50 g, migrate to the ocean from the various branches of the Miramichi in May at the same time every mature striped bass in the Gulf of St. Lawrence is spawning at, or travelling to or from their only known spawning grounds in the Northwest / Little Southwest arm of the upper Miramichi estuary. Mature bass weigh 1.5 kg of more. The salmon smolts from the Northwest and Little Southwest Miramichi rivers migrate directly through the bass spawning grounds (Figure 3). Although bass don't tend to feed while they are actively spawning, they do not spawn all the time during the spawning season. Bass eat salmon smolts and other things (Figure 4).

Figure 3 Striped Bass Spawning Closure Area in the Northwest / Little Southwest Miramichi Estuary

Figure 4 Striped Bass Stomach Contents – Several Salmon Smolts in left photo / Juvenile Lobsters in right photo (Source: Bonnie Wright, Coalition for Better Salmon Management)

Since the early 2000s, the Atlantic Salmon Federation and (the ASF) and DFO have surgically-implanted acoustic tags (pingers) into smolts on their seaward migration from the Northwest, Little Southwest and Southwest Miramichi rivers as well as into smolts from the Cascapedia and Restigouche rivers that drain to the Bay of Chaleur. Surviving fish are detected and recorded by acoustic receivers situated at critical points along the smolts' migration path. If pingers are not detected, the smolts are assumed to have died in the region between the last point of detection and the point that they were not detected. Figure 5 depicts the locations of the rivers studied and the major points of detection (receiver arrays) for the smolt tagging study.

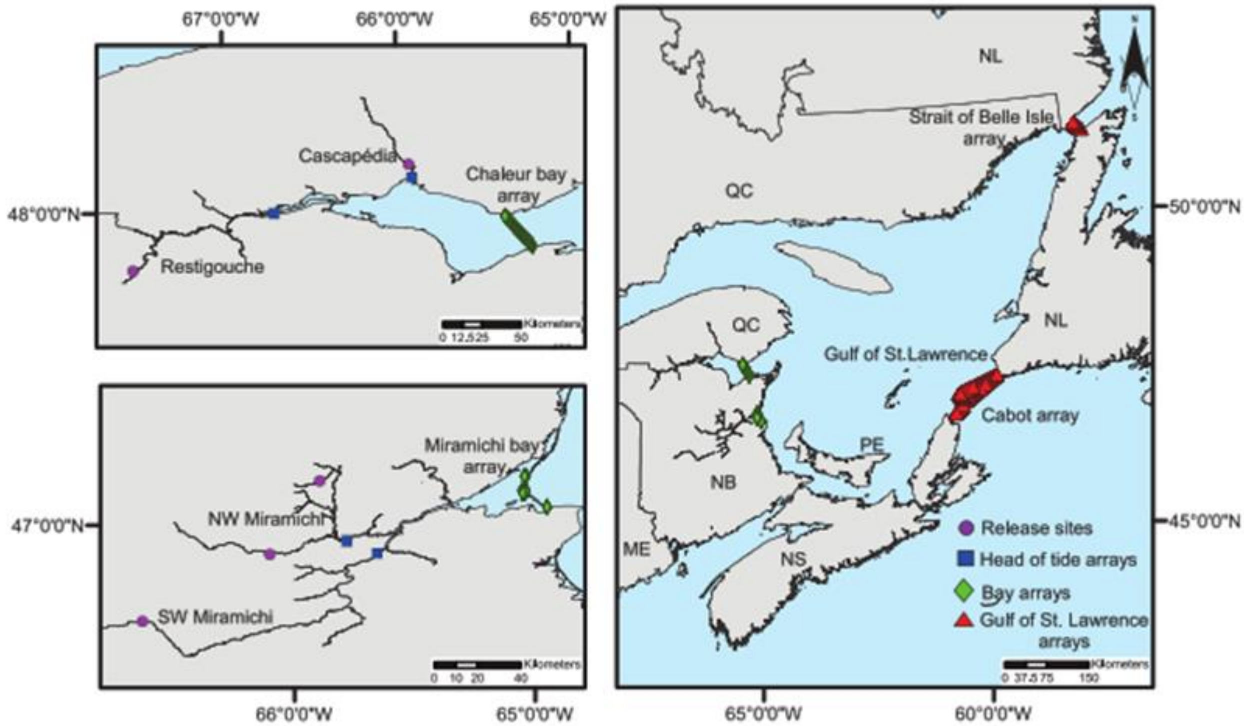

Figure 5 Locations of Rivers, Tagged Smolt Release Points and Receiver Arrays in the Post-Smolt (Source: Chaput et. al., 2018)

Figure 6 presents the smolt mortality rates that the study found for Northwest and Little Southwest Miramichi smolts (i.e. those fish that must migrate through the striped bass spawning grounds and then through the short distance of Miramichi Bay), with mortality rates of smolts from the Restigouche and Cascapedia rivers - fish that travel through the much longer Bay of Chaleur to reach the high seas. There was a 34-percentage point increase in the mean mortality rate of Northwest / Little Southwest Miramichi River smolts during the 2013 to 2017 period when compared with the 2003 to 2008 period. During the 2004 to 2017 period that was studied, the mean annual smolt mortality rate for smolts migrating through the Bay of Chaleur was consistent, and low in comparison with rates from both the early and late Miramichi periods.

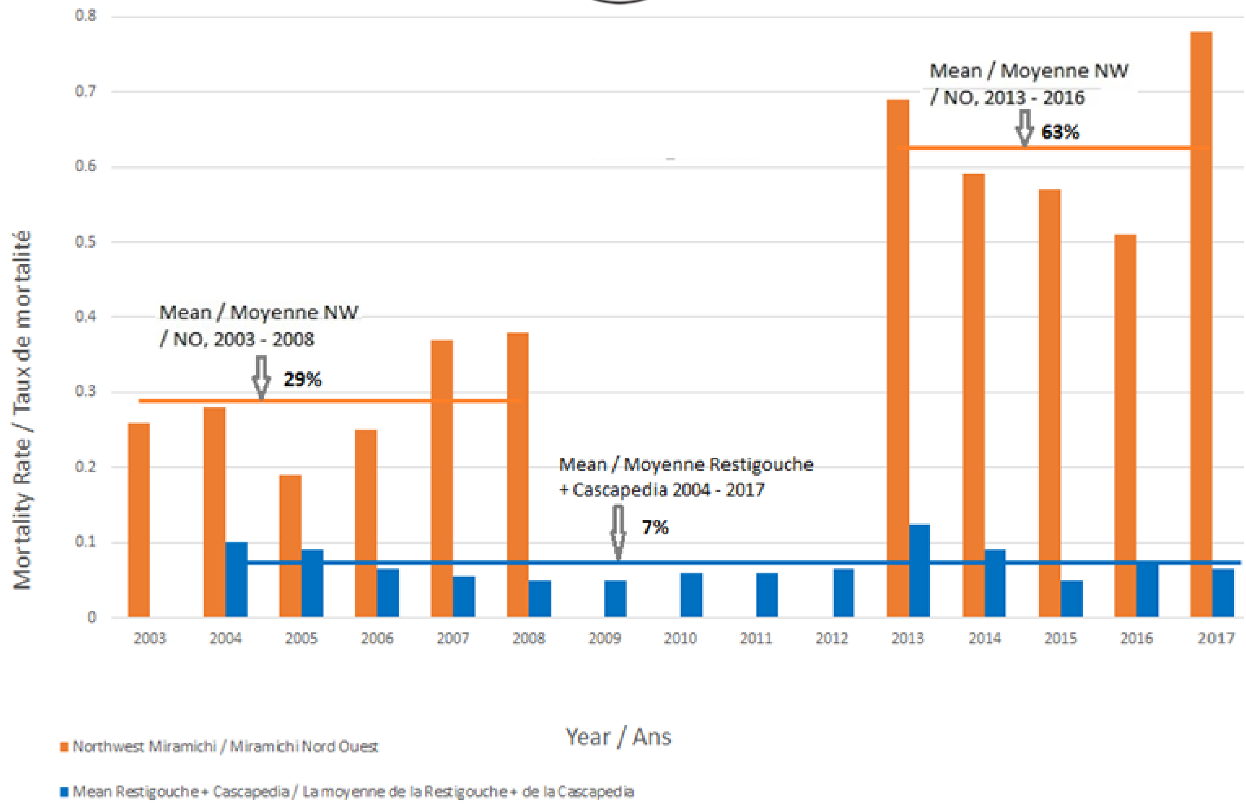

Figure 6 Annual Mortality Rates for the Northwest / Little Southwest Miramichi River Smolts during Miramichi Bay Passage Compared with the Mean Mortality Rates for Cascapedia and Restigouche River Smolts through the Bay of Chaleur

These results were recently published (Chaput et. al., 2018). The authors indeed concluded that, among NW / LSW Miramichi smolts travelling through Miramichi Bay, there had been an increase in their mean annual mortality rate compared with a decade earlier, and compared with the relatively stable and low mortality rate among smolts travelling through the Bay of Chaleur. The authors admitted that one possible reason for the increased mortality was from increased predation from the coincident increase in the numbers of spawning striped bass present at the time of the smolt migration. However, they offered alternative explanations they considered worth exploring. These were:

1. The authors referred to an earlier paper (Daniels et. al., 2018) on which three of them collaborated. The study looked at the 2013 to 2016 migration paths of smolts and striped bass in the Miramichi estuary. They found that acoustically-tagged smolts travelled from their home rivers and rapidly moved straight out to sea. Tagged striped bass moved around in the estuary, travelling intermittently towards, and then away from the head-of-tide. They reasoned that any smolt eaten by a bass would adopt a "bass trajectory" as they assumed that the acoustic transmitter would have been eaten along with the smolt. They found that from 2013 to 2016, 1.9% to 17.5% of the 514 tagged smolts adopted a bass-like migration pattern. This was far lower that indicated in the more recently published analysis of the mean within-estuary smolt mortality for Northwest Miramichi River smolts (i.e. 63% for '13 to '17 – Figure 6).

Therefore, the NBSC assumes the authors are suggesting that another or additional major mortality factors to bass predation have caused the recently elevated Northwest / Little Southwest Miramichi smolt mortality rates. However, officials of the ASF, the organization that employs three of the authors of the later paper, readily admit that tags in smolts could be spit out by bass, not consumed, defecated out, or that the bass, after swallowing a transmitter, might not cross enough acoustic receiver lines to allow the track to be interpreted as a predation event.

2. The authors found that shorter smolts had higher mortality rates than for longer individuals. They speculated that the Northwest Miramichi River smolts used in the 2013 to 2016 period may have been shorter than the Little Southwest Miramichi smolts that were tagged in 2003 to 2008. The authors however did not present the actual smolt length data for the various years. By failing so, they demonstrate little confidence in this hypothesis.

3. The authors noted that the 2013 to 2016 smolts came from the Northwest Miramichi, into which leachate from the tailings from a decommissioned copper / lead / zinc mine drained, whereas the '03 to '08 smolts came from the un-impacted Little Southwest Miramichi drainage. They raised the spectre of "Atlantic salmon smolt vulnerability to episodic acidification and elevated concentrations of bioavailable aluminum during spring snow melt", which "<u>cannot be excluded</u> as a factor contributing to the lower apparent survival rates in the Northwest Miramichi smolts in the latter part of the time series as well as a factor contributing to differences between the Miramichi Bay and the Chaleur Bay rivers."

   When the NBSC asked an NB Department of Environment and Local Government Approvals Branch official about this hypothesis, he pointed out that the acid tailings run-off had been effectively neutralized decades ago, and that the decommissioned mine had undergone a major tailings treatment system upgrade prior to mine closure in 2000. In addition, many additional improvements have been made since then (D. Stymiest, NBDELG, pers. comm. to J. Bagnall, 2019). Furthermore, the NBDEL official offered the conclusions of an Environmental Effects Monitoring program from 2015. In summary, they were:

   - All water quality parameters met Canadian Water Quality Guidelines in the Tomogonops River (the Northwest Miramichi River tributary into which the mine effluent drains).
   - Standard fish health evaluation indicated no effects on the early life stage survival or growth of the bioassay species, the brook trout.
   - Assessment of fish health of the South Branch Tomogonops River suggested no effects on the early life history survival, and little, if any, mine-related effects on the trout population.

   Furthermore, the salmon barrier counts (Figure 2) don't suggest an environmental problem in the Northwest Miramichi River in the 1980s and '90s. This was before the new treatment system upgrade had been implemented, and when the Tomogonops River tributary to the Northwest Miramichi, the stream that received effluent actually was contaminated with heavy metals.

Salmon fishing in the 1980s and '90s was much more productive than it has been in recent years.

The NB Salmon Council questions why DFO does not admit the obvious: The decline in salmon returns in the years after 2011 was caused by increased predation by striped bass. Suggesting alternative causes is classic "paralysis by analysis". Figure 7 uses the moving average count for the year in question plus previous three years (four-year moving average) to establish the trend in annual Miramichi estuary striped bass spawning numbers (red horizontal line) as well as that of grilse returns to the Northwest Miramichi Salmon barrier (green horizontal line). Grilse returns are a better indicator of potential bass predation rates than those of large, multi-sea-winter salmon because grilse were smolts during the spring prior to their return year. MSW salmon return as maiden fish two years after migrating as smolts, and since Atlantic salmon survive after spawning, the MSW component of an annual run can be comprised of several smolt year classes. Therefore, Figure 7 compares bass numbers in one year (the year of smolt migration and potential exposure to bass predation) with grilse returns to the barrier one year later.

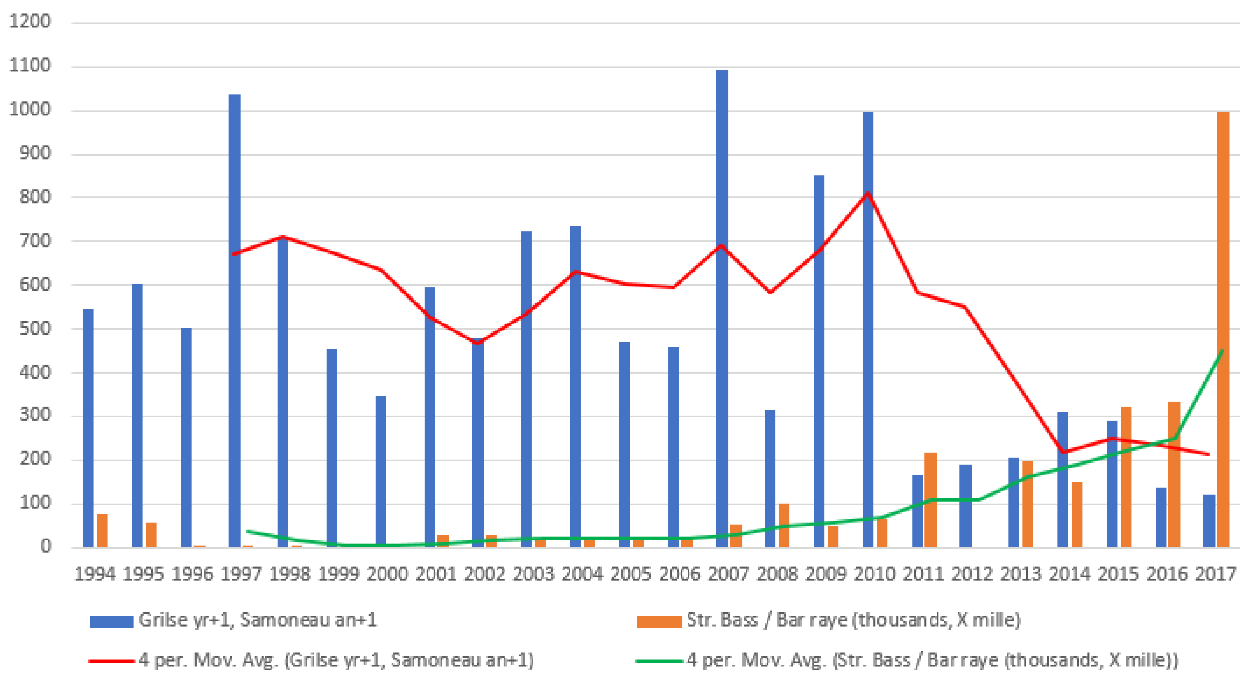

Figure 7 Values and Four Year (One Grilse Generation) Moving Average Trends in Grilse and Striped Bass Return Rates

Correlation is often used to evaluate the relationship between two sets of numbers. If one set increases or decreases in lock-step with the other, the correlation coefficient approaches 1, or 100%. If the set of numbers decreases as the other increases and vice versa, the coefficient approaches minus -1, or minus-100%. A coefficient value of zero means there is no correlation between the two sets of numbers. The correlation coefficient between the numbers of bass spawners and salmon returns to the Northwest Miramichi barrier over the entire period illustrated in Figure 7 is minus-57%. That for 2013 to 2017 is minus-67%. The correlation for the entire period can be judged as "moderately strong", and the recent value is "strong" (bjm.com, undated).

Correlation does not necessarily equate with causation, but lack of correlation eliminates causation. In his presentation, Mr. Jeff Wilson, the Striper Cup organizer, implied lack of causation, when he stated that global warming was the cause of salmon decline while suggesting that warm weather for several years in a row caused the bass population explosion – i.e. a potential common cause (increasing temperatures) rather than cause (too many predatory striped bass) and effect (decline of salmon populations). Interpretation of Figure 6 suggests it is during their migration through Miramichi Bay in the spring that salmon have experienced their recent decline in abundance, and that the decline is probably due to predation. At this time of year the water temperatures in Miramichi Bay are far below the lethal threshold for salmon. Also, river reaches within all branches of the greater Miramichi system become lethally warm for pre-spawning adult salmon every year. Salmon avoid this warm water by travelling to the cool headwaters early in the year or by congregating in downstream cold-water refuges. When so concentrated, the salmon are vulnerable to illegal fishing and poaching, and these cold-water pools are often closed to angling when the rest of the river becomes too warm for salmon to survive there.

Mr. Wilson also raised a 2016 unpublished DFO study of bass stomach contents that estimated salmon smolts comprised only 2% of that content. Considering bass can eat up 3% of their body weight per day (Harrell, undated), this could be 100s of thousands of smolts. The unpublished study (DFO, 2016) was referenced by Andrews et. al. (2018). These authors concluded that "It is difficult to assess the stated predation rate". However, they noted that "1844 Striped Bass stomachs were examined, ~600 from May 1-June 9 (2013-2015) by means of angling and commercial trap nets for herring" <probably actually gaspereau>. "Among those sampled, 32% (n=587) stomachs contained prey. Five percent (n=28) of the Striped Bass that had consumed prey … consumed smolt, and these 28 individuals collectively consumed 48 smolt". The NBSC notes that the 40-day (May 1 to June 9) duration of the focused portion of the study is still too long, as the smolt migration on the Miramichi river is complete with three weeks (T. Pettigrew, NBDERD fisheries biologist, retired, pers. comm. to J. Bagnall, 2018). This means that for a significant duration of the study, there were no salmon smolts present for the bass to consume.

Mr. Wilson also emphasized that a decline in the rainbow smelt run in 2018 may have caused the decline in striped bass numbers from 2017 to 2018 (Figure 1). The smelt is an important forage species for many predators including post-spawned Atlantic salmon and striped bass. We at the NBSC agree that there seemed to be a large decline in smelt population in 2018 in comparison with previous years. We suspect that the decline was due to heavy predation by the over-abundant striped bass population.

After all is said, the NB Salmon Council agrees with Mr. Wilson in supporting the maintenance of a healthy striped bass population. However, we disagree with his proposed target number of 300,000 spawners. The data that we have presented here indicate that this bass population set point favoured by Mr. Wilson is too high, and would continue to depress salmon populations as well as those of important forage species such as the rainbow smelt. We therefore recommend:

1. That a robust harvest of bass occurs, and that it be annually modified with the goal of bringing the Gulf striped bass population into balance with the environment. Comparing the annual bass abundance in Figure 1 with the salmon barrier counts (Figure 7), suggests that the bass number tipping point beyond which salmon returns suffer is approximately 100,000. If bass returns were kept to fewer than this value, two "good" fisheries could be maintained instead

of two "bad" ones. Incidentally, the 100,000-bass spawner target endorsed by Mr. Wilson (note Mr. Wilson proposed an upper limit of >300,000. This was an error in the submission.) is greater than three times the Canadian Species at Risk Recovery Target of 31,200 for the species in the Gulf (the dashed red line in Figure 1), and almost five times the Recovery Limit of 21,600 (solid red line in the same figure) (DFO, 2011). *(Note: The 100,000 value is a proposed recruitment target. Fisheries could bring this level to ~50,000 by the time of spawning – i.e. a proposed Upper Stock Limit.)*

2. That there be no length slot limit for bass retention in all fisheries, and that a liberal retention limit be established in the recreational fishery for striped bass, particularly in the upland, non-tidal river reaches of the Miramichi system, where striped bass have invaded, and are probably predating juvenile salmonids as well as other species that inhabit the river.

3. That a smolt-to-adult supplementation program be implemented in alternate years on the Northwest and Little Southwest Miramichi rivers and maintained until the salmon population rebounds and again provides acceptable First Nations' Food, Social, Ceremonial, and sport fishery benefits. Such a program would keep egg deposition, and therefore Atlantic salmon smolt production, at levels that will allow adult salmon returns to rapidly rebound following relief of the extraordinary predation pressure from striped bass.

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