

APPENDIX M

Elected Officials Engagement Supporting Documentation



MSA
1953 - 2018



April 17, 2018

To: Honourable Dominic LeBlanc

From: Mark Hambrook & Peter Cronin

Re: Miramichi Lake Smallmouth Bass Eradication

Dear Minister,

As co-chairs of the *Working Group on Smallmouth Bass Eradication in Miramichi Lake*, we are concerned that a lack of decisive action from your department is putting an entire ecosystem at risk. Illegally introduced smallmouth bass, first discovered in Miramichi Lake in 2008, represent a clear and present danger to the biodiversity, character, and species composition of the Miramichi River.

Our working group has committed significant time and financial resources to develop a clear plan for the eradication of smallmouth bass from Miramichi Lake. With full prior knowledge and encouragement from your department, our organizations hired two international experts on aquatic invasive species to study the situation.

Their final report presents a safe, feasible, practical, and legal plan for the complete removal of smallmouth bass, and restoration of the lake to its pre-introduction state.

At DFO's request, the contracted experts presented their findings at a meeting held July 27th, 2017, in Moncton. At the meeting, participants agreed to a list of next steps and actions. Minutes were subsequently prepared documenting these commitments (attached). Of the four actions identified, none have been completed that we are aware of. A follow-up letter was sent to DFO Gulf Region from this *Working Group* requesting an update (attached). It has gone unanswered.

This inaction heightens the risk that smallmouth bass will colonize the Miramichi River, which would have irreversible, negative effects on all native species.

A recent analysis prepared for your office stated that "control and remediation costs per aquatic invasive species can range between \$14-91 million per year." The Miramichi River generates \$16 million in annual spending on Atlantic salmon alone and creates 637 full-time job equivalents in the region. Native fish species in the river support vibrant traditional and recreational fisheries.

At an estimated cost of \$700,000, our proposal will preserve these benefits and prevent catastrophic future costs. Empowered by Canada's *Aquatic Invasive Species Regulations* and supported by the newly created Aquatic Invasive Species Fund, this project is achievable and realistic. Your May 2017 reply to the study on wild Atlantic salmon completed by the Standing Committee on Fisheries and Oceans cited Miramichi Lake as a prime candidate for funding.

The method we propose, eradication by rotenone, is the most common and most successful technique for aquatic invasive species control in the world. This plant-derived compound is traditionally used by indigenous communities in South America to harvest fish for food. Commercial formulations are used hundreds of times each year in the United States, Canada, and Europe. Experts favour decisive action to eliminate invasive species before they spread.

Notable examples include the B.C. government's bass and perch eradication in the Thompson River Valley, which two of your Gulf Region officials witnessed first-hand in September 2017. Norway regularly uses rotenone to restore entire Atlantic salmon rivers infested with the parasite *Gyrodactylus salaris*, and in 2012 the New Brunswick government used it to remove chain pickerel from another lake in the Miramichi watershed.

Specifically, we are asking that you direct your officials to complete the next steps identified in the minutes of July 27, and subsequently organize a meeting with members of this *Working Group* to provide a substantial update on the department's position and plan for Miramichi Lake.

With your decisive support, in less than a day, the threat of invasive smallmouth bass can be removed from the Miramichi watershed. Eradication by rotenone is widely accepted. It is safe to humans, birds, and mammals and has no long-term negative environmental effects. Our group is willing to assist in any practical way to ensure the integrity of one of Canada's greatest rivers.

We look forward to a reply,
Sincerely,



Mark Hambrook – Co-chair mark@miramichisalmon.ca (506) 622-4000



Peter Cronin - Co-chair pcronin18@gmail.com (506) 238-4616

The Working Group on Smallmouth Bass Eradication in Miramichi Lake was formed in 2016 to support the removal of illegally introduced aquatic species from the Miramichi watershed. Our members include the Atlantic Salmon Federation, Miramichi Salmon Association, Miramichi Watershed Management Committee, New Brunswick Salmon Council, New Brunswick Wildlife Federation, and the North Shore Micmac District Council.

Miramichi Lake Smallmouth Bass Eradication Next Steps and Baseline Work

August 9, 2017

The following details were discussed and agreed to on July 27, at a meeting in Moncton organized by the Working Group on Smallmouth Bass Eradication in Miramichi Lake. The meeting was called to review and discuss an expert report on the feasibility and technical requirements of eradication. Minutes of the meeting are attached.

NEXT STEPS

1. DFO will contact officials responsible for the \$43.8 million aquatic invasive species fund and report back to the Working Group and provincial representatives with details on who can access the fund (GC, NGOs, province?) and whether money is available for baseline work and the preparation of a detailed plan for eradication.
2. DFO will identify and meet with key people regarding the Aquatic Invasive Species Regulations. Officials will report back to the working group and provincial representatives with details on the criteria and necessity for a proponent, whether an application form exists, who receives an application, whether an application is necessary to begin the official permitting process, and instructions on how to apply.
3. DFO staff will use the expert report commissioned by the Working Group to brief senior management, including the Minister, and report back to the working group and provincial representatives to confirm.
4. ERD will use a section of the memorandum of understanding regarding inland fisheries between New Brunswick and the federal government to organize a meeting and discuss the issue of being a proponent and the expectations and responsibilities of each level of government regarding smallmouth bass eradication in Miramichi Lake.

BASELINE WORK FOR 2017

- It was agreed to at the July 27 meeting that there are several tests and surveys required to develop a detailed plan for successful and safe eradication.
- Electro-fishing survey of Lake Brook and feeder streams to assess presence of SMB
- Analysis of the feasibility and requirement for eDNA testing to confirm the presence of SMB in Lake Brook area

- Water velocity tests to measure travel time of Lake Brook to the Southwest Miramichi River
- Tests to determine the concentration of rotenone entering Southwest Miramichi River without deactivation
- Bioassay using lake water and Lake Brook water to determine lethal levels of rotenone concentration for yellow perch and/or SMB
- Assess feasibility of restoring boat electro-fishing effort until eradication is carried out

We will organize another meeting in August to develop the plan further, get updates, and plan for field work as soon as possible.

Miramichi Lake Smallmouth Bass Eradication Expert Report Technical Review Meeting

Minutes & Next Steps

July 27, 2017

Crowne Plaza Hotel, Moncton N.B.

Meeting between representatives of the Working Group on Smallmouth Bass Eradication in Miramichi Lake, Fisheries and Oceans Canada, Energy and Resource Development (N.B.), Fish Control Solutions, and University of Prince Edward Island

In attendance for all or part of the meeting:

Doug Bliss – DFO

Helen Kerr – DFO

Pierre Mallet – DFO

Neville Crabbe – Atlantic Salmon Federation

Brian Finlayson – Fish Control Solutions

Charlie Leblanc – N.B. Wildlife Federation

Frederic Butruille – DFO

Nathan Wilbur – Atlantic Salmon Federation

Peter Cronin – N.B. Salmon Council

Kathryn Collet – ERD

Chris Connell – ERD

Michel Biron – DFO

Renelle Doucette – DFO

Paul Chamberland – DFO

Mike van den Heuvel – UPEI

Debbie Norton – Miramichi Watershed Management Committee

Mark Hambrook – Miramichi Salmon Association

Matthew Hardy - DFO

Purpose: The purpose of this meeting, which was organized by members of the Working Group, was to review with key agencies the findings of the expert report prepared by Mike van den Heuvel (Canadian Rivers Institute/UPEI) and Brian Finlayson and Don Skaar (Fish Control Solutions). The report assesses the feasibility of smallmouth bass eradication in Miramichi Lake and presents options to achieve it. The goal was to identify next steps toward eradication.

Agenda:

1. Introductions – DFO, DERD, Working Group, Consultants
2. Expert Report summary and conclusions – Dr. Mike van den Heuvel, UPEI
3. Eradication options and best choice – Brian Finlayson, FCS (presentation followed by group discussion)
4. Timing and baseline work
5. Project funding

6. AIS regulations and establishment of agency responsibility
7. Next steps and intentions

Minutes

Peter Cronin opened the meeting by welcoming people in attendance. He indicated that there is broad consensus that smallmouth bass (SMB) pose a threat to the Miramichi ecosystem, citing DFO's sustained capture and removal efforts since 2008 which he said have cost close to \$1 million. Peter listed the organizations which make up the Working Group. They are: the Atlantic Salmon Federation, Miramichi Salmon Association, Miramichi Watershed Management Committee, New Brunswick Salmon Council, New Brunswick Wildlife Federation, and the North Shore Micmac District Council.

Chris Connell asked Peter how the working group originated.

Peter explained that when SMB were first discovered in Miramichi Lake in 2008, a group of NGOs worked together at that time to push for eradication, likely by rotenone, but were told it was not possible by DFO because it was not permitted under current regulations, despite the N.B. DNR project at Despres Lake. The Aquatic Invasive Species Regulations (AIS) have recently been established, and Peter noted there is now a legal avenue for eradication.

Mike van den Heuvel was called by Peter to present his summary of the report.

Mike presented a general overview of the expert report, including a history of the problem, options for eradication, planning, and costing.

He stated that using rotenone at Miramichi Lake is the only feasible and practical means of eradication, and that so far it appears DFO's containment and removal efforts have stopped the spread to Lake Brook and the Southwest Miramichi River. Mike also noted that DFO is responsible for aquatic invasive species and the province of New Brunswick has not accepted that authority to control them. He said it is important to confirm that bass have been contained to the lake to decide whether Lake Brook needs treatment or not.

Mike said the target window for treatment should be between September 1 and October 1, 2018. The 16 native species in the lake will be restored, ensuring Miramichi Lake remains a diverse boreal water body. He said keeping the fish in satellite tanks close to the lake is preferable for holding, compared to transporting them to an off-site location.

Mike noted rotenone breaks down faster under warm water conditions and that consideration should be given to effects on out-migrating juvenile gaspereau.

Helen Kerr asked Mike what the relationship is between rotenone and water temperature and Mike explained warm water accelerates the break down and eventual disappearance of the chemical. Brian Finlayson added that pH also affects breakdown to undetectable levels.

Mike returns to his slides, focusing on mitigation and remediation. He explains the best option for remediation is to capture all native species in sufficient numbers from the lake, and keep them alive nearby in tanks to be replaced when water conditions return to normal after the treatment. In doing this he said it may be desirable to assess what the original fish community was and potentially remove other species that are native to NB but non-native to the lake, in addition to smallmouth bass.

Mike said another question is whether the invertebrate and other vertebrate communities need to be targeted with specific mitigation efforts. This may include species at risk like the brook floater mussel and wood turtle.

On monitoring, Mike acknowledged he has an interest in carrying this out through his affiliation with the Canadian Rivers Institute. He suggested a 3-5 year period after eradication to study plankton and the benthic invertebrate community.

Peter Cronin said that the principle focus of the working group is eradication, not necessarily monitoring. Chris Connell asked what effect removing monitoring from the eradication budget would have. Mike replied that it would reduce the estimated \$1 million expenditure by \$300-400k.

Helen Kerr asked if any commercial licenses or fisheries could be affected by eradicating SMB in Miramichi Lake. Frederic Butruille replies potentially yes - gaspereau. Chris Connell says gaspereau will be a big concern for DFO in this process. There is general agreement in the room, but acknowledgement that the timing of the proposed application in early fall will minimize impacts to gaspereau (adults will have already spawned and left the lake, and most juveniles will have emigrated as well).

Brian Finlayson added that rotenone does not affect plankton eggs or insect eggs, so the following spring they will hatch and provide food for gaspereau. Brian referenced another project where plankton levels were monitored the following year and levels were good. And, given the recommended fall timing, the impact on gaspereau would be minimal as they will almost have completely left the lake.

Peter welcomes Brian Finlayson to come forward and make a presentation on options for eradication and the preferred choice selected in the expert report. A copy of his presentation can be found here:

Brian outlines several options for eradication including physical removal, the introduction of a predator or pathogen, genetic manipulation, completely draining the lake, and the use of

rotenone. Of all these, he has concluded after 30-years of experience that rotenone is the best option – the most feasible and practical.

Brian said that two rotenone products are registered for use in Canada. He went onto describe the chemical as one that is naturally present in members of the bean family, one that has been used for centuries by indigenous peoples to kill fish for food, one that has been used as an organic pesticide, but is now most commonly used by indigenous fishermen and fish managers. 37 U.S. states have programs for eradicating invasive species with rotenone. It is also used throughout Canada, Europe, South Africa, New Zealand, and Australia. Approximately 10,000 kilograms are sold annually in the United States.

There are currently two companies producing rotenone for market sale. They are Central Life Sciences and TIFA Products. Brian goes on to show pictures and information about past treatments in Europe and the United States.

Speaking about Miramichi Lake in particular, Brian says you could expect all rotenone after a fall application to be gone in two weeks. He said a fall application ensures that all SMB eggs laid in spring will be hatched. He said the relatively high water temperatures in early September will ensure rotenone effectively kills SMB and levels would remain lethal to SMB for 8-days after the application.

Given the size of the lake, at 220 hectares of surface area, Brian determined it would take 153 30 gallon drums of rotenone to treat. It would take 1-2 days to deliver all the material into the water.

Helen Kerr asked if the estimated price includes transport to Miramichi Lake. Brian said yes it did. He added that the barrels would have to be staged in a 20x30m bermed and lined area before use.

Helen asked Brian about the cost of capturing and removing dead fish from the lake after treatment, if that is factored into the total estimate. Brian said yes it is.

Brian went on to talk about the option of deactivating rotenone in Lake Brook. With 3 days to 1 week of treatment with potassium permanganate he said it is doable at an estimated cost of \$55,000.

Paul Chamberland asked how much rotenone would travel to the Southwest Miramichi River if Lake Brook was not treated. Brian replied that likely very little would be detectable leaving Lake Brook, but that it is impossible to say with certainty without more data on Lake Brook and breakdown rates in the system. He said a test could be done to get a better estimate, but that perhaps deactivation is a reasonable step at relatively low cost to ensure fish are not killed in the river regardless of any test results or assumptions.

Helen Kerr asked what is the level of public acceptance. Brian Finlayson said based on his experience he would be surprised to see large opposition to this project. Mark Hambrook mentioned that when MSA and others met with camp owners in 2009-10 to talk about containment and removal many favoured a quick and definitive solution.

Helen asked what about First Nations. Peter Cronin pointed out that the North Shore Micmac District Council, representing the Mi'kmaq communities in the Miramichi Valley is part of the Working Group and their representative, Jim Ward, would be in attendance except for a scheduling conflict.

Brian Finlayson adds that there is a public relations plan in the expert report and it could be further developed to suit all parties.

Doug Bliss asked about doing a dilution test in Lake Brook to determine the levels of rotenone that could be expected to enter the Miramichi River. Mike van den Heuvel replied that this would be straight forward. Chris Connell asked Bliss if based on the results he would decide not to deactivate in Lake Brook. Bliss replied no, but said having an answer would be appropriate, especially if questioned by the public.

Chris Connell asked if it is not the best course of action to treat Lake Brook as well. Peter Cronin added that he believes the brook and its tributaries should be treated to ensure no bass remain in hard to reach places. Cronin said that the brook should be deactivated where it enters the Southwest Miramichi.

Kathryn Collet asked if it would be possible to do eDNA testing to confirm whether SMB are in Lake Brook and its tributaries. Mike van den Heuvel said that is an option.

Chris Connell asked if it's possible the presence of rotenone will simply move fish to sanctuary areas if any exist. Brian Finlayson said in his experience fish that come into contact with rotenone die instead of move. They do not tend to actively/consciously avoid it.

Finally, Brian concluded his presentation with descriptions of various treatments around the world and said that experience proves the value of baseline testing and planning before beginning.

The floor is opened to questions.

Kathryn Collet asked how the cost of removing dead fish from the lake is reflected in the report estimates. Mike van den Heuvel said he used the estimated time it would take to determine the cost of removal. Chris Connell mentioned on Despres Lake that some fish surfaced several days after treatment and generally removal of carcasses took a lot of effort. Peter Cronin says this is an aesthetic issue, but important.

Helen Kerr asks if the carcasses are considered toxic. Brian Finlayson replied that tests have confirmed less than 1 ppm rotenone in dead fish, meaning they are non-toxic to humans, animals, or the environment.

Chris Connell says at Despres Lake the permit to dispose of carcasses came from the New Brunswick Environment Department. A pit was dug, mounds placed in and limed.

Paul Chamberland mentioned a correspondence with DFO scientist Wayne Fairchild who has raised the issue of nonylphenol, a surfactant ingredient in registered rotenone formulations, that has been shown to affect salmon during the smoltification process. Brian Finlayson said by deactivating Lake Brook, these chemicals would be neutralized as well. He said nonylphenol will break down with potassium permanganate.

Peter Cronin moved onto discuss timing and required baseline work. He said that according to the working group the target date for eradication should be 2018, so he asked what needs to be done between now and then. Brian Finlayson replied that all of Lake Brook, including tributaries would have to be checked for SMB. The travel time of Lake Brook and a better estimate of the concentration of rotenone at the confluence of Lake Brook and the Southwest Miramichi River would also be needed. So too would bioassays need to be completed on yellow perch or SMB from the lake. Brian said yellow perch are a good surrogate for SMB.

Brian also mentioned the company producing rotenone may need a year to meet an order for 153 barrels.

Chris Connell said that there would need to be investigation for the presence of brook floater mussels and wood turtles, which are non-target species of concern.

Helen Kerr said that project timing should flow from a detailed project plan that lays all steps out logically and ensures no surprises will crop up. Nathan Wilbur replies that the point of this meeting was to review the expert report on feasibility and technical requirements, and putting together a detailed step-by-step eradication plan was not part of this exercise, instead it is a next step.

Paul Chamberland asks about the rotenone barrels and whether they could be rinsed on-site to render them non-toxic. Brian Finlayson replies that this is a standard procedure.

Mark Hambrook said that the Miramichi Salmon Association has a surplus of fibreglass tanks at their South Esk hatchery that could be moved to Miramichi Lake and used to store native fish from the lake to be reintroduced.

Michel Biron said there is a high degree of concern among camp owners at Miramichi Lake regarding chemical eradication and Mike van den Heuvel agreed based on preliminary discussions he had while visiting the lake.

Kathryn Collet said from a regulatory perspective the footprint of the project extends beyond the shoreline and needs to include areas used for staging, fish tanks, and carcass disposal. Helen Kerr added that considering concerns, social license must be built into every aspect of an eventual plan. Peter Cronin said we need to be considering some notice to camp owners to dispel any misinformation that may be circulating.

Helen Kerr asked who the proponent would be for the eradication. Frederic Butruille replied that DFO is the authority that would issue a permit, specifically it would come from the Fisheries Protection Program. Frederic said an application from the proponent would have to be submitted to the FPP.

Doug Bliss said on the timing, these are the kinds of things to be worked out. Doug said the expert report is a major first step and it's clear eradication is well within feasibility. He said now DFO must do some internal work, which would be at least 1 year to get anything set up. Doug said his suggestion would be realistically eradication would not be before 2019.

Peter Cronin said he is disappointed to hear 2019. It has been 10 years already, and people in the room are still not certain that DFO is onside with using rotenone to eradicate smallmouth bass from Miramichi Lake. Peter said he's uncertain if DFO is with the Working Group.

Doug Bliss replied that he cannot speak for the minister, that DFO officials will explain the report and results to him. Doug said he is supportive of coming to an ultimate decision.

Chris Connell said that the Province of New Brunswick is on-side. He said they have resources that can be drawn on, but they are unable to take any action until it is certain that eradication is going ahead.

Charlie Leblanc said that the report comes to a very fair conclusion and now it is time to take the next step.

Doug Bliss said it has been 10 years, but more progress has been made in the last 12 months than ever before, and that has to count for something.

Debbie Norton said the government continues to spend money on containing and removing the fish, approximately \$500,000 so far, and like Peter she is disappointed to hear of 2019. Debbie said doing nothing is not acceptable.

Doug Bliss agreed. He also said that in the meantime DFO will continue with the containment and removal operation at the lake. He said they will use the report to brief the minister.

Mike van den Heuvel said we still don't know who would apply. Peter Cronin said the Working Group could apply, but that's beside the point until we know if DFO is onside.

Chris Connell asked if it made sense for someone to just apply and kickstart the process. Frederic Butruille replied that DFO cannot be the proponent. Helen Kerr added that people in Ottawa will ask who is the proponent? And not having an answer could hurt chances of success.

Debbie Norton wanted to know what next steps are. Mark Hambrook said we now know DFO will not be the proponent, so the Working Group will have to decide and discuss. Chris Connell added that from the provincial perspective becoming the proponent could lead to taking on more responsibility than there are resources available.

Nathan Wilbur said that two important hurdles in eradicating smallmouth bass from Miramichi Lake have recently been overcome, the issue of the proponent aside. The expert report has demonstrated that eradication is feasible and practical with a high likelihood of success, and eradication is now legal under the new AIS regulations. These have been two obstacles over the past 10 years, since bass were discovered in the lake.

Debbie Norton said that the MSA and MWMC have met several times with Gulf Region RDGs since smallmouth bass were discovered in the lake in 2008 and were assured that as soon as the AIS regulations were finalized and it was legal to eradicate the bass using rotenone, there would be action and eradication would happen. She has not seen that action and is disappointed to see DFO not acting with urgency on this.

Brian Finlayson said it would be highly unusual for anyone except a public agency to be the proponent in a rotenone application, and it's likely not a good idea to set a precedent for non-government agencies carrying out eradication. Chris Connell reasserted that the province is supportive and will contribute resources under the right conditions.

Participants break for lunch

Peter Cronin outlined goals for the remainder of the meeting. They are to agree on next steps and the intentions of all parties. He began by asking what baseline work should be prioritized. Neville Crabbe lists all the tasks and objectives requested or suggested so far and commits to creating a detailed plan to be distributed and acted on.

Peter Cronin asked on timing if there is consensus that the fall is best. The room is in agreement.

Doug Bliss said he would inquire about the announced \$43.8 million aquatic invasive species fund. Helen Kerr pondered who the best person to contact would be. Neville Crabbe passed the name of Becky Cudmore to Doug and Helen. ASF had asked questions about this funding earlier and she was identified as the point person.

Nathan Wilbur said that people in the room were under the impression that when the new Aquatic Invasive Species Regulations were introduced that there would be action, not uncertainty. Doug Bliss replied that they will find a contact who can explain the application

process for initiating an eradication under the new regulations. As it stands now, folks in the room, DFO included, have no knowledge of what the application process is under AIS.

Chris Connell said there is a mechanism in the MOU signed between DFO and ERD for the management of inland fisheries where officials are supposed to meet and discuss issues annually. He said this has not happened in years and suggested a meeting be convened to discuss the issue or who the proponent will be.

Chris added that the more information ERD has about what it means to be the proponent, the better they make informed arguments to their Minister.

Peter Cronin asked Doug Bliss, is rotenone the preferred choice? Doug replied, 'In terms of eradication, yes, you bet.'

Chris Connell asked if DFO has any doubt that SMB are a threat to the Miramichi. Doug Bliss said that regardless, decisions like whether to eradicate fish from a lake don't rest with DFO Science. They are Management decisions.

Helen Kerr said there is a possibility that if eradication is successful, someone could quickly reintroduce SMB. Peter Cronin said it is similar to enforcement targeting speeding or poaching. Officers know they cannot completely stop all illegal acts from occurring, but they still take action on the ones they can. He also questioned why there would be any Aquatic Invasive Species Regulations if eradication was not a legitimate option.

Neville Crabbe said that the public relations plan in the expert report includes direction on de-normalizing the act of introducing fish and animals in new environments, similar to the change in behaviour around smoking. There is a specific education component outlined in the Expert Report public relations plan to reduce the risk of re-introduction.

Kathryn Collet said there are some existing videos produced by the province around the time of the discovery of SMB in Miramichi Lake that attempt to influence behaviour.

Peter Cronin asked Doug Bliss, do you support an application of rotenone? Doug Bliss replied, provisionally yes, but many things must be looked at. These include species at risk, invertebrates. He said we find ourselves in a new situation considering the AIS regulations.

Chris Connell asked Doug Bliss, what the flavour of his shop is, trying to ascertain the perspective of DFO science officials. Doug said everything from the report is being considered, that the people assembled today are interested in eradication, and another element to be considered is human health.

Kathryn Collet asked about getting certified applicators to do the actual spread of rotenone. Brian Finlayson replied that he offers a course in Utah in May. Kathryn mentioned there is a

provincial certification that would be required too and that the province has certified pesticide applicators.

Chris Connell raised the issue of nonylphenol and asked Paul Chamberland to clarify what the issues are with Wayne Fairchild. Paul said they will determine if this is a relevant issue. Chris also mentioned that restoring the boat electrofishing in the interim at Miramichi Lake should be a consideration in the baseline work plan in order to do all that can be done to contain bass in the lake until eradication.

Charlie LeBlanc said it's important to regroup and ensure the support of First Nations. All in the room agree.

Neville Crabbe committed to producing minutes from the meeting, a proposed schedule for baseline work, and a list of next steps and intentions from the people present.

Peter Cronin adjourned the meeting and thanked people for their participation.



Ottawa, Canada K1A 0E6

JUL 05 2018

Mr. Mark Hambrook
Mr. Peter Cronin
Co-Chairs
Working Group on Smallmouth Bass Eradication in Miramichi Lake
< mark@miramichisalmon.ca >
< pjcronin18@gmail.com >

Dear Mr. Hambrook and Mr. Cronin:

Thank you for your correspondence of April 17, 2018, regarding smallmouth bass in Miramichi Lake.

Since the July 2017 meeting between the working group, Fisheries and Oceans Canada (DFO) and the province of New Brunswick, a new Aquatic Invasive Species (AIS) National Core Program has been established. It is the first nationwide AIS management initiative in Canada. The 2017 budget provided \$43.8 million over five years to DFO to continue and expand AIS programming. This plan includes measures to prevent the introduction of invasive species, to respond rapidly to the detection of new species, and to manage the spread of already established invasive species.

The initiative does not include specific funding to support a Grants and Contributions program for sponsoring AIS initiatives proposed by non-governmental organizations or provincial partners. Nonetheless, the Department continues to address AIS through federal, provincial and territorial cooperation, as well as through the development of regulatory tools to prevent their introduction and spread.

A number of steps have been taken to ensure progress on the action items discussed during your July 2017 meeting. At this time, the potential application of rotenone for a chemical eradication project presents a number of challenges, including the identification of a proponent, a project proposal and the need for this initiative to be informed by substantial consultation with Indigenous communities and the public in New Brunswick.

The Department's preferred approach is to continue to use physical control techniques in collaboration with you, other members of the working group, and the province of New Brunswick. DFO will not be a proponent for a chemical eradication project in Miramichi Lake and will remain solely as a regulator for such a project.

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If a formal request were received from a proponent in New Brunswick, the proposed project would require an AIS regulatory review and a formal science review. As per section 28 of the *Aquatic Invasive Species Regulation*, the review must take into account alternative measures, the impact of the deposit on fish, fish habitat or the use of fish and public safety.

A meeting of the working group with DFO and New Brunswick officials will help ensure an adequate follow-up to the July 2017 discussion. DFO officials from the Gulf Region will contact you shortly to organize such a meeting. In the meantime, if you need more information on the AIS National Core Program, please contact the Gulf Region AIS Coordinator, Daniel Bourque, by email at < daniel.bourque@dfo-mpo.gc.ca > or by telephone at 506-851-3169.

Again, thank you for providing me with your thoughts on this matter. I trust that my response has addressed your concerns.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'D. LeBlanc', written in a cursive style.

Dominic LeBlanc, P.C., Q.C., M.P.
Minister of Fisheries, Oceans and the Canadian Coast Guard

c.c.: Mr. Neville Crabbe
Director of Communications, Atlantic Salmon Federation



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Letter sent to all NB MPs and MLAs

November 25, 2019

Mr. Gilles LePage
MLA for Restigouche West
647 avenue des Pionniers
Suite 4
Balmoral, NB E8E 1B3

Re: Halting the spread of smallmouth bass in the Miramichi

Dear Mr. LePage,

As co-chairs of the Working Group on Smallmouth Bass Eradication in Miramichi Lake, we are writing to inform you of a situation that threatens an entire ecosystem and a way of life. Smallmouth bass have escaped into the Miramichi River from Miramichi Lake, where they were discovered more than ten years ago following an illegal introduction. Decisions made by Fisheries and Oceans Canada in the next four months will decide the fate of one of Canada's great rivers, famous for its wild Atlantic salmon. We need your help to save the Miramichi for future generations.

Smallmouth bass are one of Canada's most notorious aquatic invasive species. They are voracious, adaptable, and alter entire ecosystems. Fisheries and Oceans Canada concluded in 2009 that if smallmouth bass become established in the Miramichi River, "a measurable decrease in abundance of native populations is likely to occur." Their presence threatens Indigenous and recreational fisheries that provide sustenance and employment to thousands of people every year.

Unfortunately, the situation we are witnessing was entirely preventable. DFO had 11 years to eradicate smallmouth bass from Miramichi Lake but chose not to. Officials were warned repeatedly that their strategy of containment and removal would fail, but those cries fell on deaf ears.

Fortunately, there is a solution if we act quickly. Smallmouth bass can be eradicated from Miramichi Lake and the Miramichi River by applying rotenone. It's the most common method of aquatic invasive species control worldwide. Rotenone is used successfully every year in Canada, the United States, and Europe.

In the face of DFO's protracted inaction, in 2016 our organizations sought out North America's leading experts on aquatic invasive species eradication. We commissioned a report on the best options for restoring Miramichi Lake, including a science-based plan to execute the recommendation.

The report identified that using rotenone is the only option with a high likelihood of success. Rotenone is a naturally derived organic compound found in the roots of equatorial bean plants and traditionally used by Indigenous communities to fish for food. Rotenone is favoured among fisheries managers because it is highly effective on fish, but not harmful to humans, animals, or birds when used properly. It breaks down rapidly in the environment. After just 72-hours, normal human use of a treated waterbody can resume.

DFO has refused to lead efforts to eradicate smallmouth bass from the Miramichi watershed, despite being the responsible agency for aquatic invasive species. Officials have declared they will stand back and



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Conservation
Council

regulate. So, in April 2019, the North Shore Micmac District Council, a member of the Working Group, stepped up to submit an official application to eradicate smallmouth bass from Miramichi Lake.

Then things changed. In August, the first bass was photographed in the Southwest Miramichi River and 36 have been removed since. This has expanded the scope of required action and our Working Group is now pushing for the eradication of smallmouth bass from the lake and river in the fall of 2020, before they become entrenched.

According to the International Union for the Conservation of Nature, next to habitat loss, invasive species are the greatest threat to biodiversity worldwide. The Miramichi is one of Canada's great rivers and has provided for so many people for so long. It now faces an existential threat, and we are compelled to act.

We need your support in public and in private meetings to help ensure our effort is a success. Eradication by rotenone is routinely carried out elsewhere. It works and does not present a threat to humans, animals, or the environment. The only long-term effect is the eradication of unwanted invasive species.

Members of our Working Group would also be pleased to meet with you and answer any questions. In the meantime, please visit www.miramichismallmouth.com. Here you will find our expert report, along with case studies of successful rotenone use in New Brunswick and around the world.

Sincerely,

Nathan Wilbur, PEng
Working Group Co-Chair
Director, New Brunswick Programs
Atlantic Salmon Federation
nwilbur@asf.ca
(506) 442-2185

Mark Hambrook
Working Group Co-Chair
President,
Miramichi Salmon Association
mark@miramichisalmon.ca
(506) 622-4000

The Working Group on Smallmouth Bass Eradication in Miramichi Lake was formed in 2016. Our members include the Atlantic Salmon Federation, the Maliseet Nation Conservation Council, the Miramichi Salmon Association, the Miramichi Watershed Management Committee, the New Brunswick Salmon Council, and the North Shore Micmac District Council.



31 January 2019

Hon. Mike Holland, Minister
Dept. of Energy and Resource Development
PO Box 6000, Fredericton, NB E3B 5H1

Hon. Jeff Carr, Minister
Dept. of Environment and Local Government
PO Box 6000, Fredericton, NB E3B 5H1

SUBJECT: Smallmouth bass eradication from Miramichi Lake

Dear Minister Holland and Minister Carr:

Invasive, non-native smallmouth bass were discovered in Miramichi Lake in 2008. The risk of their inevitable escape into the broader Miramichi River system is a significant threat to the Miramichi ecosystem and wild Atlantic salmon in particular. At risk are the First Nations' food, social and ceremonial fisheries and the recreational salmon fishery, valued at \$16 million to the GDP and supporting 637 full time equivalent jobs in rural New Brunswick communities.

A broad working group of stakeholders, including Mi'kmaq and Maliseet Indigenous organizations, have assembled to eliminate the threat to Atlantic salmon and thereby finally address this undeniably grim outcome. The Working Group has contracted international experts on eradication of aquatic invasive species to assess options for eradication and design a scientific plan based on the most practical and feasible option with the highest likelihood of success.

The federal and provincial governments have a shared responsibility to manage aquatic invasive species and the province of New Brunswick has a significant stake in maintaining the health of Atlantic salmon on the Miramichi River system.

On behalf of the Working Group, we request a joint meeting with you at your earliest convenience to discuss the background of this issue, the expert report and more importantly where the province, under your leadership, can assist in eradicating this significant threat to one of our most valued natural resources.

Yours in Conservation,

PETER J CRONIN
Co-Chair of Working Group
New Brunswick Salmon Council

MARK HAMBROOK
Co-Chair of Working Group
Miramichi Salmon Association

The Working Group includes in alphabetical order: Atlantic Salmon Federation, Maliseet Nation Conservation Council, Miramichi Salmon Association, Miramichi Watershed Management Committee, New Brunswick Salmon Council, New Brunswick Wildlife Federation and the North Shore Micmac District Council



Maliseet Nation
Conservation
Council

Meeting of the Working Group
for eradication of smallmouth bass from Miramichi Lake
with

Hon. Mike Holland, Minister
Dept. of Energy and Resource Development

Hon. Jeff Carr, Minister
Dept. of Environment and Local Government

3 PM, 6 March 2019
Hugh John Flemming Forestry Complex
Minister's Boardroom

DRAFT Agenda

1. Introductions and Who is the WG
2. History of the issue including the major challenges to date
3. Eradication Plans (Expert Report)
4. Current status
5. Communication Plan
6. How can the Province help to address the risk
7. Next steps

The Working Group includes in alphabetical order: Atlantic Salmon Federation, Maliseet Nation Conservation Council, Miramichi Salmon Association, Miramichi Watershed Management Committee, New Brunswick Salmon Council, New Brunswick Wildlife Federation and the North Shore Micmac District Council



Eradication of Smallmouth Bass from the Miramichi Watershed Summary of Information

Prepared by: The Working Group

Date: January 2020

This summary is intended to provide information on the background, current status, and next steps for the eradication of smallmouth bass from the Miramichi watershed. Please do not distribute to the public.

Background

- Illegally introduced, non-native smallmouth bass (SMB) were discovered in Miramichi Lake in 2008 and it is the first known occurrence in the Miramichi watershed
- SMB poses a significant risk to the entire Miramichi ecosystem and its Atlantic salmon, which supports First Nations Food, Social, and Ceremonial fisheries. Atlantic salmon also supports a culturally and economically important recreational fishery worth \$16 Million annually to the GDP and 637 full time equivalent jobs in rural communities
- DFO's program to "contain and reduce" SMB in the lake will not eradicate them and our groups continuously warned Fisheries and Oceans Canada (DFO) since 2008 that the bass would eventually escape into the river
- This program is costing DFO ~\$100K/year, indefinitely. They have already spent ~\$1 M since 2008
- All age classes of SMB continue to be captured every year since DFO began the contain and reduce program in 2009; the program has failed to achieve its goal
- Until 2015, government would not consider eradication using a deleterious substance for two main reasons: 1) there was no legislation allowing it, 2) DFO thought it was technically not possible
- In 2015, federal Aquatic Invasive Species legislation (under DFO) came into effect which now legally allows the use of a deleterious substance registered in Canada to control unwanted invasive species. The purpose of the federal government legislation is to create a tool that allows timely action in cases like Miramichi Lake.
- In August 2019, SMB were discovered in the Southwest Miramichi River a short distance downstream from Lake Brook, which drains Miramichi Lake.
- Indigenous groups, NGOs, the province, and DFO carried out an emergency short-term action plan to remove as many bass from the river as possible through angling, electrofishing, and netting
- Environmental DNA (eDNA) surveys showed that the bass are limited to about a 10 km reach of river
- The urgency is greater than ever to eradicate the bass in the lake and river before they spread
- Eradicating SMB is a remediation measure that will have a temporary impact, but will eliminate the risk of the invasive fish **permanently** establishing in the Miramichi River system to the detriment of the native ecosystem and fisheries it supports. **Eradication is ultimately a conservation action** to maintain the integrity of the entire river system.

Our Goal

- To eradicate SMB from Miramichi Lake and the Southwest Miramichi River, thereby avoiding a permanent disaster for Atlantic salmon and the native ecosystem of the greater Miramichi river system.

Expert Report and Eradication Plan

- After nearly a decade of lobbying the federal and provincial governments to eradicate SMB, with no success, a Working Group was formed to carry the effort to the next step. The Working Group is:
 - Atlantic Salmon Federation
 - Maliseet Nation Conservation Council
 - Miramichi Salmon Association
 - Miramichi Watershed Management Committee
 - New Brunswick Salmon Council Inc.
 - New Brunswick Wildlife Federation
 - North Shore Micmac District Council
- The Working Group identified the need for a 3rd party Expert Report and hired two international experts to explore eradication options and prepare a plan to eradicate SMB from Miramichi Lake
 - Brian Finlayson - Fish Control Solutions from California
 - Dr. Mike van den Heuvel - Director of Canadian Rivers Institute, UPEI

Expert Report Key Findings

- An exhaustive list of eradication options was explored, rotenone was found to be the best option
- Rotenone treatment is a well-developed method and has been used successfully all over the world to eradicate unwanted aquatic invasive species, including in Canada. It is a common fisheries management tool in North America and is safe for use by humans, and is approved for use in Canada under the Pest Management Regulatory Agency (PMRA).
- Rotenone is a natural substance found in the roots of a plant in the bean family, used for centuries by indigenous peoples worldwide to harvest fish for food
- Rotenone would kill the fish in Miramichi Lake, but some zooplankton and invertebrates are resilient and would remain to form the foundation of the food chain as the lake recovers
- Case studies show that invertebrate and fish populations in lakes recover quickly after treatment
- **Take-Home Messages:**
 - SMB eradication using rotenone on the Miramichi is technically feasible and practical
 - It is now legal under federal AIS regulations
- **Mitigation Measures:**
 - Rotenone breaks down naturally (days), however as an additional safeguard, it would be deactivated at the downstream end of treatment using potassium permanganate
- **Timing:** September
 - Rotenone is effective on SMB and has rapid natural breakdown at temps 15-18°C
 - Avoids impacts to gaspereau; adults and juveniles have already left the lake
- **Public Relations Plan:**
 - Report outlines a public relations plan to communicate the project to Indigenous Peoples, camp owners, local communities, NGOs, politicians, and the public
- **Monitoring Plan:**
 - Report recommends that the lake be monitored for 3-5 years post treatment to document the recovery of the ecosystem
 - Monitoring opportunity for Maliseet and Mi'kmaq environmental technicians
- **Cost Estimate:** ~\$1 Million (~\$600K for the treatment and mitigation, ~\$400K for monitoring)

Responsibility/Authority

- In New Brunswick, aquatic invasive species authority falls under the responsibility of DFO; the province has a role to play in managing AIS and a significant stake in Atlantic salmon sustainability

DFO Position

- After ineffective attempts to receive a position from DFO, the Working Group wrote DFO Minister in 2017
- A letter was finally received in April 2018 from former Minister Dominic Leblanc stating DFO prefers to continue the 'contain and reduce' method and will not be the proponent on an eradication project but will serve as the regulator and accept applications.

Proponent

- The North Shore Micmac District Council (NSMDC) has voluntarily committed to being proponent
- The Working Group has signed a letter of mutual support indicating the group will remain unified, share tasks, and collaborate to build public and community support in a transparent, respectful way

Recent Progress

- April 2019 – NSMDC submitted an application to DFO to eradicate SMB from Miramichi Lake
- DFO subsequently requested additional information, which was provided by NSMDC
- December 2019 – DFO released its CSAS science review of the original application (not including the additional information that was provided)
- NB DELG released the project from Environmental Impact Assessment after initial screening, given the urgency of the eradication for the long-term conservation of the ecosystem and species at risk, and considering short-term impacts of rotenone treatment versus long term impacts of an established smallmouth bass population

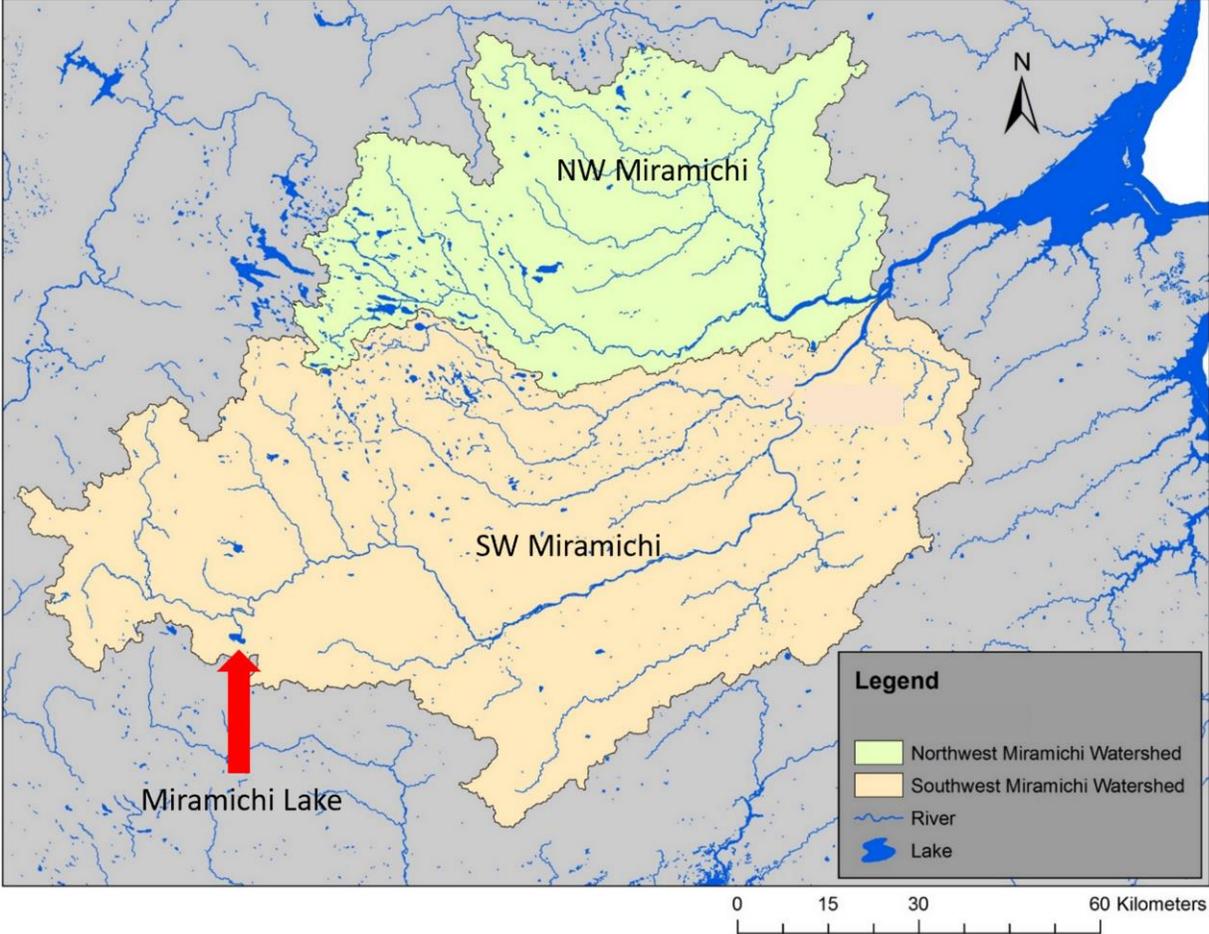
Funding

- A request has been submitted to DFO for full funding of the program given the federal government's official responsibility to manage AIS

Timeline & Key Next Steps

- Consultant to complete eradication plan for the Southwest Miramichi River (January 2020)
- Working Group to amend the AIS application to include treating a ~10 km reach of river
- DFO will review the amended application
- The Working Group and hired experts will implement components of the communications plan
 - Meet with camp owners (January 26, 2020)
 - Meet with Eel Ground and Red Bank First Nations (January 27, 2020)
 - Meet with provincial and federal officials (January 27-28, 2020)
 - Meet with local communities (TBD)
- Complete appropriate consultations (undetermined timeline)
- Apply for necessary permits (winter 2020)
- Order rotenone (spring 2020)
- Conduct eDNA surveys to finalize SMB distribution in the river prior to treatment (summer 2020)
- Establish treatment teams: operations, support, safety, public relations, monitoring (summer 2020)
- Carry out eradication (September 2020)

Miramichi Lake



Map – Location of Miramichi Lake in relation to the greater Miramichi watershed, whose ecosystem is threatened by the establishment of invasive, non-native smallmouth bass from the lake.

Presentations made by Brian Finlayson and Steve Maricle
to Ministers Carr, Holland, & Stewart

January 28, 2020

Eradication of High-Risk Invasives in the Thompson Drainage



Ministry of Environment

British Columbia's Fisheries

Divided into 8 distinct Management Regions

Primary Fisheries target Salmonid stocks

Include 5 salmon species, 2 trout species and 3 char species

The Rocky Mountains separate BC from most species on the east side of the mountains

Many of these species pose serious threat to Salmonids

Recreational Fishing in BC generates over \$One Billion/Yr

Thompson Region Fisheries Management



Thompson River Watershed

56,000 Km² - $\frac{3}{4}$ the size of New Brunswick

Supports many of the highest valued Salmon & Trout stocks in the Province

Recreational Fisheries Generates over \$150 Million in Revenue

Thompson Drainage - 1996 Spiny-ray Invasion



Smallmouth Bass



Yellow Perch



Largemouth Bass



Pumpkinseed Sunfish

Impacts to Lakes from Spiny-Ray Fish

- Very quickly the pre-existing trout were outcompeted and replaced by perch and bass.
- Impacts to ecosystem were evident with population levels of amphibians and invertebrates crashing.
- Major downstream threat to Thompson drainage which is home to the endangered Interior Fraser Coho, Thompson Steelhead and world famous Adams River Sockeye



Impact to Whole Ecosystem

Evidence



Gardom Lake Impact of Invasives

Largest lake we treated-35 Residents and one Camp

Residents formed “The Friends of Gardom Lake”

Document the Ecological Richness (ER) of the lake

Following bass introductions, ER declined by 60%

Included Insects, amphibians, mammals & birds

Used to be kept awake at night by frogs

Became an event to actually hear one

Surface Area: 76 ha
Average Depth: 8.8m
Max Depth: 25m



Time to draw a line

Couldn't put our head in the sand any longer.

Needed to develop a Plan



The Plan

■ Issues:

1) Deal with future illegal introductions

Incentives and Disincentives

Public Education and Awareness

2) Deal with existing populations

Full lake Chemical treatments

Stop Further Movement!

- Reward up to **\$20,000**
- Public **E**ducation and Awareness
 - Public information meetings
 - Media & Signage
- Increase **E**nforcement presence
- Closed all 12 Lakes with Spiny-Ray Species
- **E**radicate

Engagement

Convincing the Public

- Hosted meetings with various groups including:
 - Local Residents
 - First Nations (F/N)
 - Fish and Game Clubs
 - Naturalist Clubs
 - Community Groups



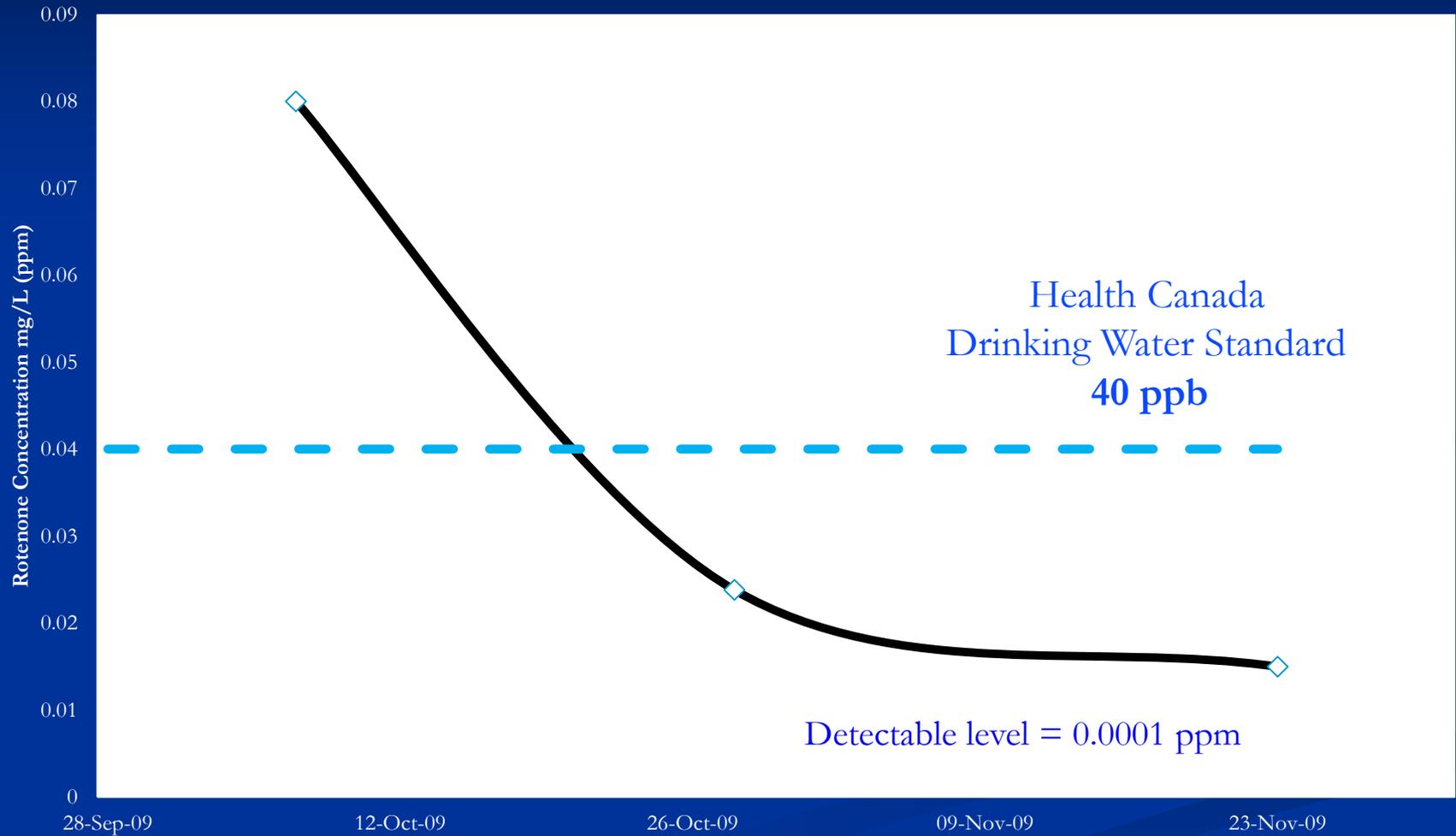
Imperative that F/N and the Public Supported our efforts

Lake Treatment Day

Application techniques



Rotenone Water Results



Results Post-Treatment

Created some of the best lake fisheries in the Province

Eliminated the threat of Spiny-ray establishment in the Thompson mainstem



Final Important Points

A Biological Pollutant is Forever

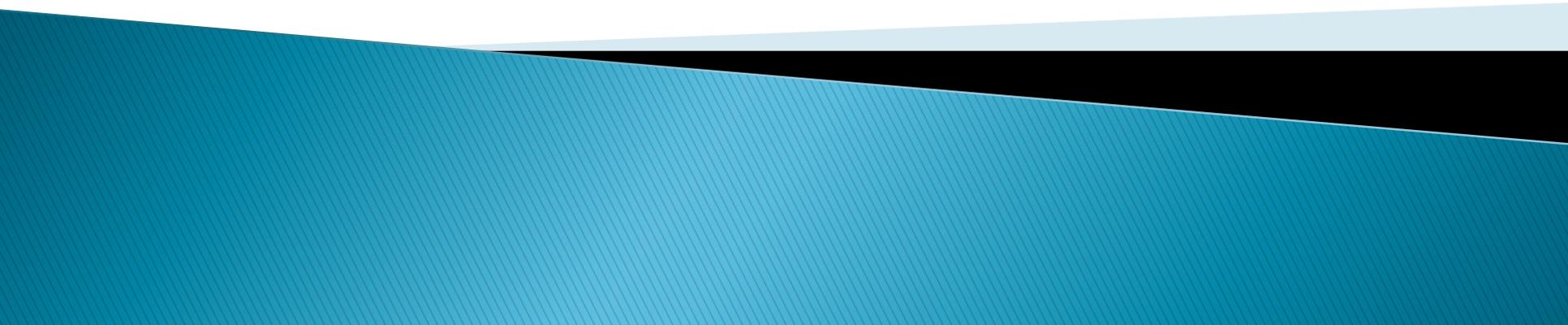
**Don't let someone Decide your
Ecological Future**

Questions?

Miramichi Lk & SW Miramichi Rv SMB Eradication

Proposed Rotenone Treatment Preliminary Treatment Plan

Brian Finlayson & Don Skaar
Fish Control Solutions, LLC



Why Rotenone?

Eradication Options Considered

Options	Comments
Physical Removal – nets & electrofishing	Limited success in achieving eradication; most promising in very simple environments. May lead to decreased intraspecific competition and accelerated maturation of SMB and thus, greater recruitment. SMB control in Miramichi Lake between 2010-2017 decreased SMB biomass, but several age classes of fish still present.
Biological Control – predator & pathogen	Rarely been used for eradication due to lack of potential, selective control agents. Predators will likely attack Atlantic Salmon too. Pathogens carry risks to other non-target species and other environmental concerns. Two SMB parasites (tapeworm and protozoan) are known but would need to be tested.
Genetic Manipulation – sterile or triploid individuals	Generally not 100% sterile. More sophisticated methods such as genetic control would take years and much study.
Dewatering	Likely impractical due to lack of water barrier to keep Miramichi Lake from backfilling, relatively level topography and ensuring no SMB are discharged downstream.
Explosives – detonating cord	Not effective in water depths > 3 m
Chemicals	Rotenone is the most prevalent chemical used for eradication. Exposure times and concentrations of rotenone necessary to kill fish are well known and technologies for treatment of lakes and streams are well developed.

Weaknesses & Limitations of Previous Rotenone Eradication Projects

- ▶ Insufficient planning & crew training (often emergencies)
 - ▶ Inaccurate/incomplete target species mapping
 - ▶ Insufficient rotenone exposure (low concentration & short exposure) & not correcting for dissipation over time & space
 - ▶ Insufficient real-time monitoring to judge/correct for effectiveness of treatment & deactivation
 - ▶ Generally, declining success rate with increasing treatment size & complexity due to compounding of the 4 factors above
- 

Lessons Learned

- ▶ Treat at rate based on toxicity of product in site water using target fish or surrogate (min 4 x LC₅₀ value)
 - ▶ Identify & verify presence/absence of target fish within eradication area & effectiveness of fish “barriers”
 - ▶ Treat all known water within eradication area capable of affecting treatment including upwelling groundwater
 - ▶ Utilize sentinel fish in strategic locations to allow for real-time corrections of rotenone and KMnO₄ rates
 - ▶ Treat when water temperatures >10 °C
 - ▶ Train crew on proper use of PPE & equipment
- 

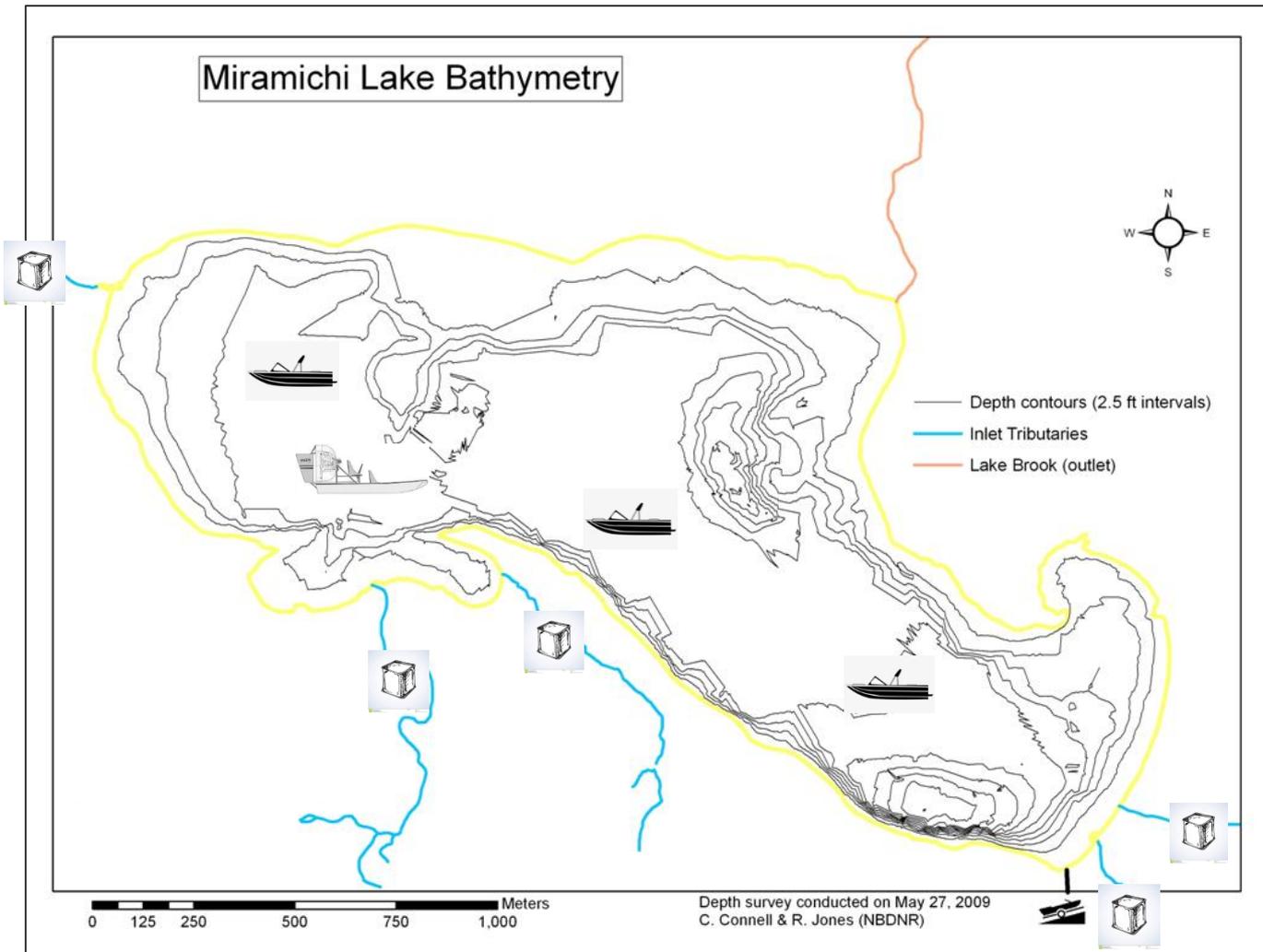
Considerations for Treatment in Early September

- ▶ SMB spawning & fry emergence completed
- ▶ Post-spawned gaspereau & most juveniles gone
- ▶ Minimum discharge in SW Miramichi RIV:
 - Minimize rotenone use
 - Minimize KMnO_4 use
- ▶ High H_2O temperature:
 - Optimum SMB response to rotenone in LK & RIV
 - Rapid dissipation of rotenone in LK
 - Optimum KMnO_4 deactivation in RIV

Verification of Miramichi Lake Information @ Treatment Date

- ▶ LK Volume & discharge to Lake Brook
- ▶ Travel time from barrier to SW Miramichi River
- ▶ Discharges of all inlets to LK
- ▶ SMB distribution in all tributaries
- ▶ SMB distribution in Lake Brook
- ▶ Reverification of rotenone toxicity tests:
 - Yellow Perch or Brook Trout
 - On site Miramichi Lake water
 - Noxfish II rotenone formulation

Miramichi Lake 2-Day Rotenone Application



Legend

-  Drip Stations
-  Boats
-  Airboat

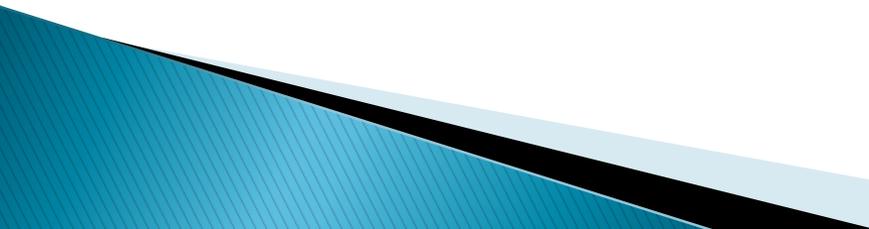
Cost Estimate (CAD) for Treating Miramichi Lake

Parameter	Description
ROTENONE (preliminary estimate) 30-gallon Noxfish II Drums Including transportation to Miramichi Lk	75 @ \$2937 = \$220,275 total
EQUIPMENT - LAKE Semi-closed Application Systems Honda WX15 High Pressure Pump	3 @ \$914 each = \$2,742
EQUIPMENT - LAND Land Dripcans/Sprayer	5 @ \$326 each = \$1,630
EQUIPMENT - SAFETY Respirator, goggles, coveralls & gloves,	2 sets/application staff @ \$52/set 11 staff x 2 sets x \$52 = 1,144
OPERATIONS STAFF A. Boat Staff @ 2/boat & 3 boats = 68 staff 2 Application + 1 Travel Day	A. 6 staff x 8 h/d x 3 d = 144 h 144h x \$78/h = \$11,232
B. Land Staff @ 5 staff (dripcan/sprayer) 2 Application + 1 Travel Day	B. 5 staff x 8h/d x 3d = 120 h 120h x \$785/h = \$9,360
SUPPORT/LOGISTICS STAFF 2 Application + 1 Travel Day	2 staff x 8/h/d x 3d = 48 h 48h x \$78/h = \$3,744
SUPERVISOR/SAFETY STAFF 2 Application + 1 Travel Day	1 staff x 8/h/d/ x 3d = 24 h 24h x \$156/h = \$3,744
TRAVEL (lodging & per diem) Lodging @ \$91 d Per diem @ \$51/Travel Day	14 staff x 3 d x \$179/d = \$7,510
Monitoring Rotenone Residues	20 samples @ \$261 sample = \$5,221

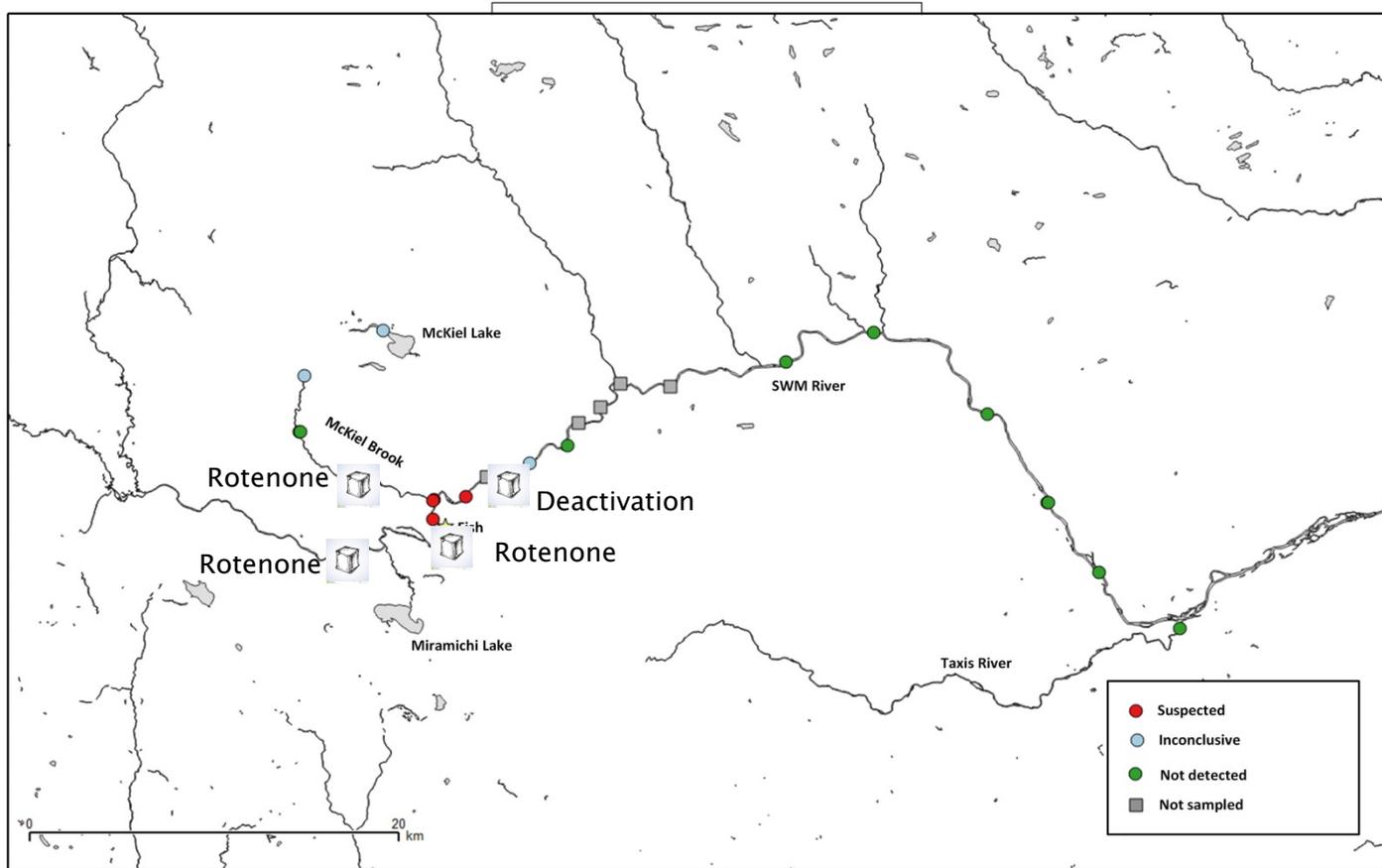
Rotenone 220,275
Equipment 5,516
Staff & expenses 35,559
Rotenone monitoring 5,221

\$266,602

Verification of SW Miramichi RIV from Lake to McKiel Brooks

- ▶ Discharge & travel time
 - ▶ Open canopy, stream width, depth & slope
 - ▶ IDs of all inlets & discharges to RIV
 - Bifurcations & connected wetlands
 - Connected seeps, springs & tributaries
 - ▶ SMB distribution within the treatment area using electrofishing & eDNA
 - ▶ Water quality (pH, organics, turbidity & conductivity)
- 

SW Miramichi Rv Treatment Stretch



Cost Estimate (CAD) for Treating SW Miramichi River

Parameter	Description
SW Miramichi Discharge m ³ /s	5.3 m ³ /s d/s McKiel Brook
Rotenone (preliminary estimate) 30-gallon Noxfish II Including transportation to Miramichi Lk	45.4 gallons/dripstation 136-272 gallons total for 3-6 stations 4.5-9 30-gallon drums \$13,216-26,433
KMnO ₄ 4 ppm for 24 h = 1.27 kg/min	1,832 kg for 24 h @ \$17.23 \$31,565
Equipment	
Peristaltic pump system & generator (1 per site)	\$2,481/unit
Dripcan system (3 per site)	\$310/unit
Sprayers	\$100/unit
Auger & generator	\$4,309/unit
Hach DPD test kit	\$776
Operations Staff	
TRAVEL (lodging & per diem)	
Lodging @ \$91/d	
Per diem @ \$51/Travel Day	

CAD
 Rotenone \$ 13-26 K
 KMnO₄ 31,565
 Equipment ?
 Staff & expenses ?
Total ≈ \$100,000

Overview of Rotenone Treatment

- ▶ Day 1
 - Set-up staging area on Miramichi Lake
 - Inventory rotenone, KMnO_4 , boats, drip stations, augers, safety equipment
- ▶ Day 2
 - Safety training
 - Staff locate treatment markers and set-up & test equipment
- ▶ Day 3
 - Begin treatment of tributaries & Miramichi Lake
 - Begin treatment of SW Miramichi River & possibly Lake & McKiel Brooks
 - Begin deactivation of SW Miramichi River d/s McKiel Brook
 - Debriefing on treatment
- ▶ Day 4
 - Continue treatment of tributaries and Miramich Lake
 - Continue deactivation until caged fish survive in SW Miramichi River
 - Debriefing on treatment
- ▶ Day 5
 - Disassemble staging area & load-up equipment



June 3, 2020

To: David Coon, Leader, Green Party of New Brunswick
From: Neville Crabbe on behalf of the Working Group on Smallmouth Bass Eradication in the Miramichi
Re: Questions about ecosystem recovery

Mr. Coon,

I took some time last evening and today to compile evidence and information about ecosystem recovery following the application of rotenone in an aquatic environment.

Before I launch in, there is one point that helps contextualize and rationalize everything that follows: You must weigh the consequences of acting against those of inaction. The ingredients in rotenone formulations dissipate quickly and the ecosystem rebounds over the course of months and years. A biological pollutant, smallmouth bass in this case, is forever.

Most of the information below was originally compiled to support the application to eradicate that was submitted to Fisheries and Oceans Canada. If you wish, you can view the entire application package here: <https://drive.google.com/drive/folders/1yw72Gr3P6ctG8HPf6pkxIOP-rvdbASH?usp=sharing>

Impact to ecology of the treatment area & species recovery

- 1. Effects on fish:** There are 18 fish species known to occur in the treatment area (lake, brook, and river). At a proposed treatment concentration of 0.075 mg/l of active ingredient, the rotenone is expected to be lethal to 16 of the 18 species. Brown bullhead and golden shiner are predicted to survive according to Marking and Bills (1976).

Mitigation: The primary mitigative measure to reduce effects on non-target fish species is timing. There is a large run of alewife that come up Lake Brook into Miramichi Lake each spring. They spawn, and young-of-the-year leave in significant numbers through July and August (DFO 2009, DFO 2013). Conducting a rotenone treatment in September, as planned, means few if any alewife will be directly impacted.

Other migratory species like Atlantic salmon, brook trout, American eel, and sea lamprey will be affected, but habitat will be filled by new individuals moving in post treatment. The entire treatment area is open and accessible all the way to the Gulf of St. Lawrence.

Deactivation using potassium permanganate will occur at the downstream limit of the treatment area. Potassium permanganate is a common water purifying agent, and its use to deactivate rotenone is standard operating procedure. It binds to rotenone and makes it no longer lethal to fish. This is a key mitigative measure for the project.

Monitoring: A comprehensive 5-year ecological monitoring plan will document the recovery of the lake, brook, and river. This will be carried out by Indigenous biologists and technicians.

Restoration: Our current application to DFO includes two options for reestablishment of the native fish community. We initially proposed a Noah's Ark operation, setting up streamside tanks and holding fish for reintroduction once the rotenone subsided, but DFO panned that idea as complicated and unnecessary. DFO suggested allowing natural recolonization post-treatment; however, we decided to take a more proactive approach to accelerate recovery. We have asked DFO to indicate their preference for one of the following two options:

Option 1: Take no action on migratory species because they will recolonize naturally and monitor for the presence of non-migratory species returning to the treatment area. If after two years no recovery of non-migratory fish species is noted, 100 individual adults of each species will be collected from nearby lakes and transplanted into the treatment area.

Option 2: Transplant non-migratory fish species from nearby lakes the spring following treatment given that studies indicate the plankton and invertebrate food base has generally recovered by then (references below). The long-term monitoring plan will determine the success of the recolonization.

In both Option 1 and Option 2, the performance measure will be the presence of juveniles and adults of the pre-treatment fish assemblage in the treatment area.

2. Effects on the ecosystem: The effects of rotenone will be contained to surface water and limited to gill-breathing aquatic species that inhabit the treatment area.

a) Groundwater: Finlayson et al. in 2001 conducted a comprehensive survey of wells adjacent to nine waterbodies treated with rotenone products in California. Test were conducted between one and 456 days post treatment and no residues of active or inert ingredients were found.

This is the result of rotenone's inability to move through soil and sediment, less than an inch in most cases, and the tendency of rotenone to bind to organic materials where its effectiveness is rapidly degraded.

A review by the Washington Department of Fish and Game (Hisata 2002) concluded there is no overall risk to human health from commercial rotenone formulations when product label instructions are followed.

Mitigation: Not necessary

- b) Plankton and insects:** With a planned treatment concentration of 0.075 mg/l active ingredient, some plankton species would be vulnerable, yet according to Hobbs et al. (2006) insects and invertebrates are much less susceptible to toxic effects.

Mitigation: Again, timing is the primary mitigative factor when it comes to plankton. By September, plankton species in the lake have laid eggs in the water. Because rotenone is not able to pass through the chorion membrane of eggs, planktonic communities will emerge on-time the following spring. This resurgence to pre-treatment levels has been well documented.

As Eilers (2008) and McGann (2018) both found, plankton, insect, and invertebrate populations rebound rapidly post treatment, achieving pre-treatment levels or greater without the additional pressure from invasive species. This flourishing provides a food base for the recovery of fish lost in the treatment.

- c) Amphibians:** Depending on the life stage present at the time of treatment, amphibians can be killed by rotenone. Larval stages are particularly sensitive due to their gill breathing. Adult amphibians are typically not impacted.

Mitigation: Timing is a key mitigative strategy to reducing negative effects on amphibians. By fall, gill breathing amphibians are not generally present in Miramichi Lake, Lake Brook, of the Southwest Miramichi River. In fact, Billman (2012) found no difference in tadpole abundance in rotenone treated areas one year after the use of rotenone, despite all tadpoles being killed during the treatment. This is because adults and eggs are not affected, setting the stage for rapid replacement of lost individuals.

- d) Birds and reptiles:** The literature and experience around the world indicate the risk to birds and reptiles from the use of rotenone is low to negligible. Because of the rapid breakdown of rotenone, piscivorous birds are unable to consume enough affected fish to experience any toxic effects. The same goes for reptiles that consume fish (EPA 2006; 2007). Some studies, like McCoid and Bettoli (1996), have looked at the direct affect of rotenone on turtle species and found at treatment levels of 3mg/l of 5% rotenone, toxic effects are observed. In our case, we are treating at less than half that established threshold.

Mitigation: Timing and treatment concentration are the primary mitigative measures in this case. It's possible that birds returning to the lake in the year following treatment will find diminished food sources, but proximity to other waterbodies bode well for such individuals. In reviewing our proposal, the Canadian Wildlife Service has deemed the treatment to not be a threat to migratory bird species.

Wood turtles have come up in discussion around the project, but the literature, like McCoid and Bettoli (1996), suggest they will not be directly affected, and with their preferred habitat on land, they will not likely be exposed. The province's Species at Risk group has reviewed the application and assessed possible effects on species at

risk, including wood turtle, Atlantic salmon, and American eel. They have deemed that the proposed treatment impacts will be spatially and temporally limited so do not pose a population level threat, and any negative is far outweighed by the irreparable harm that will come if smallmouth bass establish themselves in the Miramichi watershed.

- e) **Mammals:** There are many mammal species present in the treatment area, but none are anticipated to be affected by the use of rotenone. The Washington Department of Fish and Game (Hisata 2002) provides an excellent review of the human health risks and is clear that this product is safe when used according to the product label. The United States EPA, looking at effects on humans, has determined that rotenone concentrations below 90-parts per billion are safe for human contact. In our case, we are treating at 75-parts per billion, but of course human contact will be eliminated altogether through standard operating procedures using personal protective equipment and following the product label.

See this information page from the Alaska Department of Fish and game for more:
<http://www.adfg.alaska.gov/index.cfm?adfg=rotenone.health>

- 3. **Persistence in the environment:** Rotenone is favored in fisheries management because of its effectiveness and rapid breakdown. Brian Finlayson, a world expert on invasive fish eradication contracted by our organizations, has determined that a treatment of rotenone at 0.075 mg/l of active ingredient will have a half-life of 2.5 days and be undetectable after 18-days.

Rotenone is considered to have a low potential for bioconcentrating in aquatic organisms according to Gingerish and Rach (1985) and is not persistent in the environment because of the rapid breakdown in water and by sunlight according to Thomas (1983) and Draper (2002).

Conclusion: No doubt applying rotenone to Miramichi Lake, Lake Brook, and the Southwest Miramichi River will have short term acute impacts. However, the only lasting effect of the treatment will be the eradication of smallmouth bass. This is short-term pain for the long-term health of an entire ecosystem, and it should have been done by government immediately after the discovery of smallmouth in 2008. The use of rotenone in Canada is regulated under the federal Aquatic Invasive Species Regulations and permitted by Health Canada's Pest Management Regulatory Agency.

As you're aware, next to habitat loss, invasive species are the greatest threat to biodiversity worldwide. Put another way, the only more damaging thing we could do aside from letting smallmouth bass colonize the Miramichi is to physically destroy the habitat that native fish communities require.

This is decisive conservation action supported by Indigenous communities and the Canadian environmental movement. We sincerely hope the Green Party is behind us as well.

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