

Risk Analysis, Fisheries Impacts and Management Options for the Control and Management of Introduced Fish Species in BC Freshwater Lakes and Rivers

Background:

In the early to mid-1990's, the Province of BC (Ministry of Environment, MoE) became aware that Yellow Perch and other spiny ray fish species had been illegally introduced into a number of small freshwater lakes in the BC Interior. MoE confirmed the presence of the in 6-7 pothole lakes with no direct outlet sources to anadromous waters. DFO was advised but left the management of the issue to the Province. It has now been confirmed that Yellow Perch are present in a larger number of lakes with at least three having direct access to anadromous waters.

Invasive aquatic species of freshwater fish, invertebrates and plants have the potential to alter and upset aquatic ecosystems. Numerous examples across North America and the world can illustrate the potential ecological and economic impacts of invasive species (e.g. Zebra Mussels, Asian Carp & Eurasian Milfoil). In British Columbia, recent illegal introductions of spiny rayed fishes (perch, pumpkinseed, largemouth bass and smallmouth bass) in the Interior Fraser watershed, Lower Fraser Valley, Columbia and Vancouver Island have caused concern regarding the possible spread in range and potential of these introduced fish to impact native salmon populations and fisheries as well as put at risk SARA listed dace species and COSEWIC listed interior coho salmon. Spiny ray species have the potential to dominate fish assemblages, through both predation and interspecies competition. Once these invasive species redistribute and enter into larger water bodies they put at risk all fish species. This threatens not only valuable regional trout sport fisheries, but all downstream salmon fisheries and fish species at risk within the Fraser River system. This problem, if left unchecked, has the potential to damage provincial and federal fisheries values. Once they become established there is little that can be done to control larger lakes and rivers systems.

Science Branch has developed a preliminary Yellow Perch technical paper detailing the habitat and ecology and known BC distribution of the fish as well as reviewed the possible impacts to native salmonid species through predation and competition (see Attachment 1).

The level of the threat to stocks and fisheries has not yet been defined. Similarly, the department needs to better understand and develop options for the management and control of these invasive fish species as well as develop a system to address other and future invasive species.

The Pacific Regional Director General requested the establishment of a working group (WG) to review the spiny ray fish's issues and bring a paper to the Regional Management Committee. The WG is proposing a Yellow Perch program as a pilot to develop research, inventory monitoring and management systems that can be used to address Yellow Perch and other future invasive aquatic species. This pilot is intended to initially focus on the illegally introduced Yellow Perch now found in a number of interior lakes. The Province of BC – Ministry of Environment (MoE), has documented fishery changes in a number of lakes containing perch. Gardom Lake near Enderby has had its rainbow trout fishery eradicated and replaced by a minor perch fishery. Most of the Provincial Region 3 lakes confirmed or

suspected of containing spiny rays have nominal or no outlet to salmon bearing waters. However, three are of particular concern to DFO because they are directly connected to anadromous fish bearing water bodies. One lake, Skamana, drains via Huihill Creek directly into the Lower Adams River. A second lake, Forest, drains via Sinmax Creek into Adams Lake. Gardom Lake has intermittent flows to the Lower Shuswap River. If Yellow Perch enter into the Thompson River drainage (Shuswap Lake), there is considerable risk to the world famous Adams River sockeye run, to a sizeable Interior chinook population, and to the COESWIC listed endangered Interior coho salmon.

In consideration of the identified potential threat to downstream anadromous stocks, the WG determined the need for the department to better understand the scope and possible threat to stocks of primary federal management. As such 2 funding applications have been submitted to the federal AIS program to acquire funding to better understand the issue as well as develop capacity to partner with the Province in the program's constituent parts; i.e. inventory, risk assessment, education, communications, consultation and enforcement. Both applications were rejected with limited funding, \$150K being provided to marine species issues only from \$650K of total applications.

Policy:

There is general support federally for taking a strong approach to managing or controlling aquatic invasive species.

Broad Federal Policy on Aquatic Invasive Species

Aquatic Invasive Species have been an issue of concern for some time. In 2003, the Standing Committee on Fisheries and Oceans released a report entitled, *Aquatic Invasive Species: Uninvited Guests*. While this report focused on issues in the Great Lakes, it does acknowledge the problems presented by aquatic invasive species, including those introduced through unauthorized fish stocking, and recommends a strengthened, coordinated federal approach to managing this problem.

For several years, the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM) have been discussing aquatic invasive species in coastal and inland systems. A CCFAM working group has been developing a work plan to address the problem of aquatic invasive species. To this end, a draft action plan was completed in August 2004. (ref: http://www.cbin.ec.gc.ca/primers/ias_aquatic.cfm?lang=e) In October 2005, the CCFAM approved a two year implementation plan to deal with aquatic invasive species. (ref: http://www.scics.gc.ca/cinfo05/830861004_e.html)

The 2002 Report of the Commissioner of the Environment and Sustainable Development included a chapter on invasive species. The Report warned that the federal government has not responded effectively to invasive species that threaten Canada's ecosystems, habitats and other species. With respect to aquatic species, the report focused on the problem of ballast water, particularly in the Great Lakes. The Report recommended taking a much stronger approach to preventing and controlling invasive species.

The 2005 federal Budget announced \$85 M over five years for the management and control of invasive alien species. Of this, \$10 M was targeted at the Great Lakes for the Sea Lamprey Control Program.

Sea Lamprey Control Program

DFO is a participant in the Sea Lamprey Control Program (SLCP), coordinated by the Great Lakes Fisheries Commission (Canada-US body that oversees management of Great Lakes fisheries resources). Currently, the primary method of controlling sea lampreys is the application of selective lampricides that kill sea lamprey larvae in their nursery streams with little or no impact on other fish or wildlife. The lampricide used is called TFM (3-trifluoromethyl-4-nitrophenol) and has been in use since the late 1950s.

The lampricide program has been very effective in controlling the sea lamprey population, but it is very costly and alternative control methods are being investigated. These alternative methods include physical barriers that allow fish to pass with minimal disruption, a sterile-male-release technique where males are sterilized then released into streams to reduce fertilization of eggs, and an assessment program to better understand the population.

Parks Canada policy

Parks Canada has a general policy of ecosystem restoration, which is intended to re-establish the mix of species, numbers and processes. It includes removing species that are not naturally occurring populations.

In specific Park Management Plans, objectives are set with respect to aquatic species to monitor all species (including non-native species), and “to restore native fish and invertebrate populations on an experimental basis by reducing or eliminating non-native fish species and introducing native species.” This would imply controlling or eliminating non-native, including invasive species. It is clear with respect to plant species that the objective is to eliminate non-native species.

Several years ago (1997), Parks Canada developed a paper called Management Guidelines for Invasive Alien Species in Canada’s National Parks. The paper describes actions that could be taken to control invasive species, including prevention, as well as physical, biological and chemical methods of control. It is not clear if this paper was ever accepted as policy. (ref: <http://www.ecospherics.net/AlienSpecnew.htm>)

US policy

Alaska has had a problem with Yellow Perch being introduced into lakes on the Kenai Peninsula. If this species had invaded other lakes and rivers, it could have had a severe effect on salmonid populations. Because of the significant economic threat to sport fisheries, the Alaskan Department of Fish and Game used rotenone to eradicate the non-native perch

population. The pesticide breaks down rapidly and a lake can be restocked with fish in two to three weeks.

Given that Perch and other species (e.g. Northern Pike) have been introduced illegally, Alaska is also working on a public awareness and education campaign to inform residents of the illegality and risks of introducing non-native species to local lakes. (Source: http://www.adfg.state.ak.us/special/invasive/ak_ansmp.pdf)

The Province of BC:

The Province of BC has been dealing with the issue of illegally introduced Perch into interior lakes since the mid-1990's. As such, they have taken the lead on the issue due to its concerns for the very valuable recreational trout fishery and have undertaken an assessment and inventory program of infected lakes (see Attachment 2). BC is requesting DFO to partner in the development of management plans and operations. While the current Provincial plan is limited to a number of Interior lakes in the Shuswap Area (Provincial Region 3), MOE is now expanding its "Alien Sportfish Management", to include all of southern BC. There are well documented cases of invasive fish species in many lakes and streams on Vancouver Island, the Lower Mainland, the Okanagan and the Kootenays. These introductions especially largemouth bass in the lower mainland have the potential to become established within the sloughs and backwaters of the lower Fraser River. There is currently anecdotal information that this is occurring in some spots. This would introduce another voracious predator to all downstream migrating salmon fry and smolts from the entire Fraser system. Consequently, the Department needs to develop a Regional policy position and strategy to address this issue.

Presently, the Provincial plan will focus on 7-9 Interior BC lakes containing Yellow Perch with initial management actions focussing on two lakes. The current timelines for this program is a minimum of 5 years: 2 years of preplanning, assessment and inventory work; subject to the results of that work, treatment of 2 lakes in year 3; and up to 3 more lakes in both year 4 & 5. However MOE has now indicated at the last joint DFO/MOE meeting their anticipation of taking some actions this fall/winter (2006/07).

The MoE have undertaken policy and program development which has formulated policy document titled *A Strategic Work Plan to Address Non-native Sportfish in BC* (see Attachment 3). This document lays out program goals and a hierarchical decision-making framework to determine management actions based on biophysical considerations and management objectives.

MoE has secured funding to undertake priority program activities and is requesting DFO participation in the following activities (see Attachment 4):

- A spring inventory and distribution assessment
- Development of a strategic list of priority lakes for management
- Contributing towards the enforcement reward
- Development of communications tools
- Development and delivery of public information and consultation sessions

First Nations Participation:

The issue of invasive in lakes within the Shuswap Drainage has been brought to the attention of the (SFC) Secwepemc Fisheries Commission. The SFC represents 7 bands within the Secwepemc traditional territory which the Shuswap drainage is a part of. The SFC is supportive of the work that DFO is proposed to carry out for this year. They are not able to provide financial support to the program but are willing to help out with the field activities should funding come available. They are also in support of helping with the delivery of public information. DFO has committed to keep the flow of information available to them as we learn more about this issue.

Other Program Participants:

The Province has support in principle to manage and control invasive fish species by the Freshwater Fisheries Society of BC, the Fraser Basin Council, the BC Wildlife Federation, the SFU REM Program, the UBC Fisheries Centre and local angling organisations. The Province and these other groups will also be important partners with DFO in the undertaking of this program.

DFO has been asked and has attended two meetings with local sport fishing associations to update them on DFO's actions and plans to participate in AIS management. Additionally, the Region has responded to an MCU to the Minister received from the same groups (see Attachment 5)

The first meeting was with the Kamloops Fish and Game Club where we presented them with the information gathered so far and proposed work we have planned. The club was supportive of the work but felt the problem was of more urgency and should be dealt with in a more timely fashion.

DFO has also reported back to the local Mid Fraser Thompson Okanagan Sport Fish Advisory Committee. This committee put a motion forward to the Main Board of the Sport Fish Advisory Board that DFO and the Province of BC should work together on this problem. The Board was happy that there was progress on the two agencies working together, but they felt something should be done as far as eradication within this year.

Regulatory Considerations:

There are various Sections from three separate pieces of federal legislation that will have to be considered as part of any AIS control and treatment program: the *Fisheries Act* (FA), the *Canadian Environmental Assessment Act* (CEAA) and the *Species at Risk Act* (SARA).

Under the *Fisheries Act*, there is likely a need to consider at least 3 Sections of the Act. S. 32 prohibits the killing of fish by means other than fishing unless authorised; S. 35(1) prohibits the harmful alteration, disruption or destruction of habitat unless authorised; and S. 36(3) prohibits the introduction of deleterious substances into fish-bearing waters unless under regulation.

There are a number of ways that may trigger the requirement for an environmental assessment under *CEAA*; these include the issuance of a federal permit (i.e. a S. 32 or S. 35(2) authorisation, or the contribution of federal money to the project. A CEAA EA will assess

whether there are significant environmental affects from the project, as well as require extensive consultations. DFO permits will not be able to be issued unless there has been a successful EA concluded.

There is the possibility that any control and treatment program for AIS's may impact listed *SARA*, COSEWIC or Provincially Blue or Red listed species of aquatic animals, invertebrates or vegetation. As such, it will be necessary to properly inventory all possibly treated lakes and develop full management plans for any sensitive species.

Recommended Management Approach:

DFO needs to develop a Risk Analysis and Management Protocol to identify, inventory, research, assess, manage and monitor Freshwater Invasive Species. The WG is proposing to engage with the Province of BC and various public groups and academic institutions to undertake a comprehensive 3 part program to address the management of spiny-ray invasive species in BC Interior Lakes.

Year 2 (06/07) summer inventory work and field program will require more labour in the form of casual technicians, or students. The results of year 1 & 2 inventory work will be critical in establishing the abundance, distribution, and range of the invasive species, and will therefore define the scope of the issue.

Flexibility is required in the inventory component of the program to allow a rapid and immediate expansion of the field inventory program in years 2 and beyond in the event invasive species are found to have expanded beyond the known water bodies.

Component 1 - Pre-treatment

1. Collection of Knowledge and Improved Communication: We must first have a firm grounding in the various methods available to deal with invasive fish species. Many agencies in both the US and Canada are dealing with the similar issues and concerns surrounding invasive species that the Thompson/Shuswap area is now facing. This represents a large body of work and experience which we are able to draw from. It is both prudent and expedient to communicate with those who have been working with these issues longer than us and are at a more advanced stage of management and public consultation. We can learn from their failures as well as their successes.
2. Biological and Economic Risk Assessments: The scope of the problem (range and distribution of invasive species, rate of spread, potential for species interactions etc) must be defined. This would permit us to assess the biological and economic risks and options to management. We would also be able to assess the likelihood of efficacy and success and to clarify the environmental and economic tradeoffs of various management options as well as impacts on various time scales.
3. Policy Formulation: The nature of the issue and some of the proposed treatment options has program and policy implications for the entire Pacific Region. One of the treatment options (lake poisoning) raised questions as to; species control, species reintroduction, water management and public perception. As such, the Department will need to

formulate a policy on the management of invasive species that specifically addresses the use of various treatment options.

4. Species at Risk Considerations: Potential threats by both invasive species and treatments options to provincially blue-listed, COSEWIC listed and SARA listed aquatic and terrestrial populations will need to be assessed as part of the program.
5. Inventory: Conduct a species composition inventory, with attention to salmonid, indigenous, and provincially blue-listed, COSEWIC listed and SARA listed aquatic and terrestrial populations. Invertebrates, plants and other important species will be included in the inventory methodology in order to ensure that the entire aquatic assemblage is defined prior to treatment. There will also be an inventory of water bodies in the immediate vicinity to determine if invasive species have migrated past their place of introduction, out of isolated locations, and into larger water bodies. In this pilot project, assess if fish are spreading only through intentional introduction or whether there is some natural redistribution from originally introduced stock.
6. Treatment Education and Consultation: Materials, methods, and options for eradication and control of introduced fish species need to be summarized in supporting documents for public education and consultation. These include FAQ's sheets, control strategy summaries and copies of relevant materials addressing issues which are certain to be raised by the public. Public meetings and potentially door to door consultation and survey of property owners adjacent to the water bodies would be undertaken prior to any treatments.
7. Control Enforcement/Reward & Education: The management program will consist of control components designed to stop the further illegal introduction of species into more Interior lakes. DFO - C&P and the MoE - COS should be engaged to undertake investigations and education to intercept the spread of species. An important element includes an ongoing initiative by the MoE and the BC Wildlife Federation. They have committed \$5K each as a reward that leads to the capture and conviction of anyone spreading invasive fish species into Interior lakes. This initiative has been matched by DFO – BCI which has also committed \$5K. Presently, there are organized groups of anglers including the West Coast Bass Anglers Association that promote the introduction of spiny ray fishing in BC. Education of them and other similar groups, the general fishing community, and the public needs to be undertaken to reduce or control the spread of these fish. This may require DFO representatives speaking at the meetings of various sports groups and trade shows and expressing our concerns over fish introductions.

Component 2 - Treatment

Subject to the results of Component 1 a risk assessment and decision matrix are needed to guide the management options. If a decision to proceed with active management and possible treatment, the following elements would be considered:

1. Selection of the appropriate treatment strategy for each situation.
2. Undertake a public awareness program. Develop a media communication strategy.

3. Develop project implementation and management plans that include application, monitoring, safety, security and contingency plans.
4. Develop strategies for the removal and maintenance of representative components of the non-target fish and invertebrates for possible reintroduction to the treated lakes.

Component 3 - Post Treatment

1. Post project monitoring and assessment.
2. Site and lake clean up.
3. Species reintroduction and recovery assessment.
4. Ongoing public education and enforcement action including liaison with sports fishing groups.
5. Consider expansion of the program to other parts of Pacific Region impacted by invasive species.

Methods:

The first year of this program (06/07) will define the problem and outline the strategies available.

1. Inventory downstream receiving waters from the 3 highest risk lakes connected directly to anadromous waters to attempt to determine if Yellow Perch have out-migrated from the infected lakes, and whether they have developed self-sustaining populations (e.g. Adams Lake, Adams River, Little Shuswap Lake, South Thompson River and Shuswap River).
2. Inventory of lakes and adjoining areas (3 lakes first). Yellow Perch dominate the littoral area of lakes so the foreshore of the lakes will be surveyed. This will require either a beach seine, or possible pole-seine operated by a three person crew. One week of survey per lake and adjacent areas (3 weeks) should provide a good indication of the relative abundance, distribution and biological characteristics of Yellow Perch and all common native fish. If the Yellow Perch distribution extends beyond the known range, the survey must be expanded.
3. Complete a discussion paper on available knowledge on the introduced species and present possible areas of interaction (predation/competition) between the introduced species and both salmonids and species at risk.
4. Preparation of a 2nd discussion paper – This will outline various treatment options, and risk for Yellow Perch in the interior (Decision Matrix/Risk Assessment).
5. As knowledge is accrued, a presentation outlining the problem and DFO's concerns will be prepared. This will be incorporated into our communication strategy.

Deliverables:

First year (06/07)

1. Initiate inventory and assessment programs for 3 highest risk lakes as well as downstream anadromous receiving waters.

2. Formalised partnership with the Province and other groups.
3. Participate in Reward Program.
4. Develop education/communication strategies and initiate.
5. Two discussion papers: a) Possible interactions; b) Treatment options.
6. Initial development of a communication and media strategy and presentation.
7. Initial stages in Federal policy formulation (Need more clarity as to what the two year implementation plan contains).
8. Initiation of C&P enforcement strategy development in collaboration with the COS.

Second Year (07/08)

1. Inventory Paper (data report) or contractor's document.
2. Draft Federal Policy on Invasive Species Management in Pacific Region.
3. Treatment Strategy (Decision Matrix) focussing on the first 3 lakes.
4. Continue communication/education strategy.

Funding Required:

Year 2 and beyond subject to year 1 results. If there is a conclusive determination that AIS's are unable to successfully migrate from seeded lakes, or successfully reproduce and impact anadromous populations, the Dept. may determine to ramp down its engagement in the program and support a Provincial lead in resident Lake Management.

Funding options, based on an as yet determined level of DFO engagement, are variable.

Option 1.

Presently, the BCI is undertaking a synoptic survey of potential downstream receiving waters to try to determine if AIS's have successfully migrated out of the infected lakes. This program is being undertaken entirely with limited existing A-base resources and staff, and as such will not be able to make conclusive findings as to the migration and distribution of perch. Furthermore, it will not be able to provide certainty with regards to determining the reproductive viability and survival, and interspecies competition. It is anticipated that the A-base funded spring program will cost approximately \$10-15K in travel, equipment and logistical costs, and approximately \$20K in salary and OT. This is in addition to the \$5K committed to the Reward Program. This funding is limited in duration to the spring assessment period, due to the fact that resources, equipment and staff will have to be redirected to primary responsibilities following the spring program.

Option 2.

If the requested funds below are provided in addition to committed A-base support, it will be possible to undertake a comprehensive field assessment program and provide the deliverables identified above. These resources will allow for a project manager to run the program, develop the required assessment, contribute to the development of guidance and policy documents and coordinate with provincial counterparts. The manager will also participate in the development of education and stewardship products, participate in consultations, and

engage and coordinate with First Nations and sport fishing groups. The manager will also undertake participation in any subsequent management and treatment programs. A seasonal field crew can also be engaged to undertake the assessment component of the program as well as any possible management and treatment programs. Full funding will also allow for the engagement and participation of Science Branch in the design and implementation of assessment and management programs.

		06/07	07/08	08/09	Total
Funds Requested For AIS Program		\$145K	\$150K	\$150K	\$445
A-Base Contribution to the Project	FTE	1	0.6	0.6	2.4
	Sal	\$50K	\$50K	\$50K	\$150
	O&M	0	0	0	0
	Capital	Boats & Equip.	Boats & Equip.	Boats & Equip.	Boats & Equip.