

Towards Restoring Fish Habitat Connectivity in BC

Fish Passage Technical Working Group Progress Report February 2012

Contents

What is the state of fish passage in BC?
.....2

What approaches have been used to fund and manage fish passage restoration?
.....3

Who is the Fish Passage Technical Working Group and what do they do?
.....4

What has been achieved so far?
.....5

What more needs to be done?
.....7

Highlights:

In response to the Forest Practices Board’s special investigation on fish passage (FPB 2009), the Province acknowledged that many stream crossings are barriers to fish resulting in valuable habitat no longer being accessible. As a result, the Joint Steering Committee (Assistant Deputy Ministers of Ministry of Forests & Ministry of Environment) formed the Fish Passage Technical Working Group in late 2007 to develop a strategic approach to ensure remediation efforts were targeted at high priority sites and to communicate to professionals the best practices for installing stream crossings.

- There are approximately 550,000 kilometres of roads (non-status, permitted forestry and resource roads, and public highways) in BC with an estimated 320,000 crossings on fish streams. Based on assessments to date, as many as 70% of these are likely to be culverts which have a high likelihood of impeding fish.



Why is the fish crossing the road? Because the culvert is impassible

- From 2008 through 2011, \$11.8 million was spent through the Forest Investment Account, now the Land Based Investment Program, to prioritize and restore fish passage problems on forestry roads.
- This work has produced almost 10,000 culvert assessments and has restored fish passage at 93 stream crossings, resulting in hundreds of kilometres of previously inaccessible stream habitat being made available to fish populations.
- Interest from licensees and the large number of high priority crossings that require restoration indicate that significant gains could be made with increased funding.

For more information contact:

Ian Miller, Resource Practices Branch
 Phone: 250-387-8398
 Email: Ian.C.Miller@gov.bc.ca

What is the state of fish passage in BC?

There are approximately 550,000 kilometres of roads with an estimated 320,000 crossings on fish streams in BC¹.

Based on culvert assessments done to date in BC, as many as 70%, or about 224,000 of these crossings are expected to be closed-bottom culverts, and 60-90%, or 135,000 to 200,000 of these closed-bottom culverts are likely to impede fish passage.

- Closed bottom structures (culverts) can act as a barrier to fish mainly due to increased water velocity, turbulence, a vertical drop at the culvert outlet, and/or maintenance issues.
- In 2009 the Forest Practices Board surveyed over 1,100 crossings across 19 watersheds and found that closed-bottom structures, which include culverts, posed a moderate to high risk to fish passage about 90% of the time on important and critical fish habitat and 96% of the time on marginal habitat. In response to these findings, the Board recommended that the, “government take the necessary action to ensure fish access is maintained and restored”, (pg 20, FPB 2009).
- Remediating problem stream crossings provides a higher return on investment compared to other in-stream restoration projects that recover less habitat, but require an equally intensive effort.
- Much of the effort to date has been on forestry and resource roads, which contain about 91% of all crossings, but culverts impeding fish passage also exist on highways, railways and other public roads (Mount et al. 2011).

What are the implications of low fish habitat connectivity?

- Fish passage failure at stream crossings constitutes a major loss of freshwater habitat for both migratory and resident fish populations in BC (Northcote and Hartman, 2004).
- Loss of habitat is a major threat to freshwater species at risk such as west slope cutthroat trout, bull trout and others.
- Fish form an integral link in aquatic and terrestrial ecosystems. For example, salmon returning to spawn are a major source of marine-derived nitrogen and their absence can impact an entire forest ecosystem, from grizzly bears to tree growth (SFU 2008, Field and Reynolds 2011).
- The isolation and restriction of fish populations can affect gene flow and lead to populations less able to adapt to changing conditions.
- Freshwater sport fishing supports the BC economy. In 2005, anglers spent \$480 million in BC, creating 3,875 person-years of employment and contributing \$125 million in tax revenues (GSGislason & Associates Ltd. 2009).



A culvert with a vertical drop at its outlet making it impassable to fish

¹ Source: Mount et al. 2011.

What are the legal requirements to ensure fish passage?

When constructing a crossing over a fish stream, the licensee with the road permit is responsible for following federal and provincial legislation. Federally, under the *Fisheries Act* administered by Fisheries and Oceans Canada, obstruction to fish migration is prohibited (sections 22 and 26) as is the harmful alteration, disruption or destruction of fish habitat (section 35) unless authorized. The federal *Species at Risk Act* (SARA) also prohibits killing, harming, or harassing listed species or the damaging or destroying of habitat.

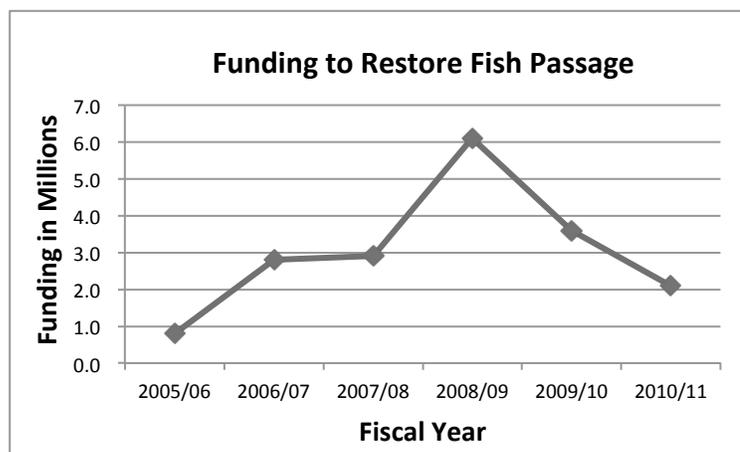
Provincial legislation to protect fish passage has changed over time. In 1995, with the passing of the *Forest Practices Code*, a clear requirement for forest licensees to ensure safe fish passage at all stream crossings was brought into force. This requirement continued with the introduction of the *Forest and Range Practices Act* (FRPA) in 2004. Licensees granted road permits issued under the *Oil and Gas Activities Act* must also ensure that a road crossing does not impede fish passage.

If the works are not authorized under the *Forest Practices Code*, the *Forest and Range Practices Act*, or the *Mines Act*, then the licensee must follow the requirements of the *Water Act* for activities in and about a stream. The *Standards and Best Practices for In-stream Work* Guidebook (MOE 2004) states that culvert installations must ensure fish passage.

Stream crossings that impede fish passage on forestlands, and that were built before the *Forest Practices Code* legislation was passed in June 1995, are eligible for government funding to remediate the crossing. It is estimated that about 51% (or about 166,000 crossings on fish streams) are on non-status roads, such as old abandoned resource roads that were built before 1995. Another 40% (about 127,000 crossings on fish streams) are on permitted forestry and resource roads for which the responsibility for fish passage is known (e.g. licensee, government, tenure holder). Compliance and enforcement officers within the BC Ministry of Forests, Lands and Natural Resource Operations regularly evaluate fish passage on these crossings. The remaining 9% (about 29,000 crossings on fish streams) are on public roads and highways.

What approaches have been used to fund and manage fish passage restoration?

Funding for fish passage restoration work began in 1995 when the BC Government introduced the Watershed Restoration Program under Forest Renewal BC (FRBC). The program was designed to restore, protect and maintain forest resources, including non-timber values such as fisheries, which had been adversely impacted by past forest management activities. Funding for fish restoration and rehabilitation was reshaped in 2002 with the introduction of the Forest Investment Account (FIA). In 2007 with direction from the Joint Steering Committee (ADM of MoF & MoE), targeted funds were allocated to specifically set priorities and fix pre-1995 problem fish stream crossings. In 2010 funding for the Fish Passage Program was shifted to the Land Based Investment Strategy (LBIS).



Under FRBC and FIA and until 2009/2010, the Fish Passage Program was proponent-driven with licensees identifying projects and applying for funds to complete the work. A third party administrator played a major role in the delivery of the program by approving applications and managing funds. This model began to become more focused in 2007 with the establishment of the Fish Passage Technical Working Group.

As of the start of fiscal 2011/2012, the Fish Passage Project under LBIS is no longer proponent-driven. Although a third party still provides administrative support and financial management, the Fish Passage Technical Working Group (FPTWG), rather than licensees, identifies high priority areas to conduct assessments and remediate crossings. The FPTWG now works directly with BC Timber Sales to complete assessments and works together with the third party administrator and tenure holders to restore crossings.

Who is the Fish Passage Technical Working Group and what do they do?

With evidence mounting on the magnitude and distribution of impeded stream crossings, the Government of BC together with Fisheries and Oceans Canada, the Council of Forest Industries, and the Coast Forest Products Association, determined that government should play a larger role in prioritizing future restoration activities. The Fish Passage Technical Working Group (FPTWG) was formed in 2007 following a directive from the inter-agency Joint Steering Committee (JSC). Members of the FPTWG are from the BC Ministry of Environment; BC Ministry of Forests, Lands and Natural Resource Operations, and Fisheries and Oceans Canada (see list of current members on page 8).

The overarching goal of the FPTWG is to raise awareness of the fish passage problem at stream crossings and to identify and implement solutions. Most of the work carried out by the FPTWG is done through the Fish Passage Program under the Land Based Investment Strategy (LBIS). The FPTWG, however, is also working to expand its network of partners to target the remediation of stream crossings on all roads (rather than just pre-1995 forest roads), and to ensure that the installation of new culverts is done in a manner that does not impede fish passage.

Specific objectives of the FPTWG are to:

1. Refine the scope of the problem through a combination of field assessments and GIS analysis.
2. Develop a strategic approach for selecting remediation sites, which will provide the greatest return on investment in terms of amount of high-value fish habitat restored.
3. Allocate funding to remediate road crossing sites which block fish passage.
4. Conduct targeted training and extension.
5. Identify and acquire funding for stream crossing remediation.

What has been achieved so far?

Improving current understanding of the fish passage problem

As a first step to better understand the scope and extent of the fish passage problem in BC, the FPTWG directed funds towards collecting more information. Field assessments are necessary to ground truth the magnitude of the fish passage problem and to identify high priority sites for remediation. Using a standardized protocol developed by the FPTWG, almost 10,000 assessments have been conducted so far. Each year, as more assessments are completed, the understanding of the scope and extent of the fish passage problem improves.

With this large influx of data it became clear that a specially designed database was necessary to store, analyze and communicate the data. The Provincial Stream Crossing Information System (PSCIS) is a new spatially referenced database which houses information about assessments, designs, and completed installations. This “one-stop” database allows the FPTWG to identify areas of high priority, coordinate the delivery of the fish passage restoration work, and share information with licensees and other delivery partners.

Another step in improving current understanding of the fish passage problem in BC was to conduct a detailed GIS analysis that included:

- piecing together road datasets to create as complete a road layer as possible;
- overlaying the combined road layer with streams to identify road crossings;
- developing a model to predict fish habitat; and
- identifying stream crossings on fish habitat.

This analysis has been published (Mount et al. 2011) and an earlier version of the analysis was used by the Forest Practices Board to provide context in their report, which raised awareness of the magnitude of the fish passage problem in BC (FPB 2009).

The goals of ongoing work are to: 1) continue to better understand the scope of the fish passage problem; 2) continue to refine and improve decision-support tools to identify restoration priorities; and 3) to track the amount of fish habitat restored and made available through remediations.

Developing a strategic approach to prioritize remediation projects

The strategic approach is based on the GIS model described above, which identifies stream crossings on fish habitat, and combines this with assessment data that have verified problem sites and fish habitat. Together these two data inputs are used to identify the highest priority remediation projects in terms of the potential to gain high quality fish habitat. The approach has four key components:

1. Identify high value fish watersheds to focus work;
2. Develop and apply in a systematic manner a standardized assessment methodology to determine fish passage;
3. Review data from all culverts assessed in a watershed area so that repair of the highest priority problem culverts can be carried out; and
4. Monitor to ensure objectives are being achieved.

Steps 1 and 2 have already been completed and steps 3 and 4 are ongoing to select sites each fiscal year for further remediation work. For more information, see [The Strategic Approach: Protocol for Planning and Prioritizing Culverted Sites for Fish Passage Assessment and Remediation](#).

Remediating stream crossings to re-connect fish habitat

Since fiscal year 2008/2009, 93 stream crossings have been remediated to restore fish passage. Of these, 59 were installations of new embedded culverts or arch culverts and 34 were remediated by building new bridges (See Table 1). In 2008/2009 the average amount of habitat gained per stream crossing remediated was 3.6 kilometres, which increased to 5.4 kilometres in 2009/2010. The average price of recovering a metre of fish habitat was \$92 in 2008/2009 and in 2009/2010 this decreased to \$48 per metre.

Table 1. Fish Passage Outputs 2008 - 2011

Fiscal Year	Total Expenditures (Millions)	Assessments	Number of Culverts installed*	Number of Bridges installed*
2008/09	\$6.10	4,683	27.5	16.5
2009/10	\$3.60	4,594	23	11
2010/11	\$2.10	665	8.5	6.5
Total	\$11.80	9,942	59	34

* Half values indicate work carried over between fiscal years

Training and Extension

The FPTWG has been active in creating and updating standards such as the new methodology for conducting stream crossing assessments and the updated engineering activity standards for design, construction, and post-construction inspections for the restoration of fish passage. The FPTWG has also worked closely with the Compliance and Enforcement Branch of the Ministry of Forests, Land and Natural Resource Operations to define "material adverse effect"; the test used in the *Forests and Range Protection Act* to protect fish passage at stream crossings.

Past training efforts have been focused on the closed bottom structure assessment methodology, first through face-to-face courses, and later through the development of an online learning module. Future training will focus on planning and installation of stream crossings using case studies and demonstration sites. This will help ensure that the estimated several thousand new stream crossings installed each year in BC (Harper and Quigley 2000) are installed correctly.

In 1997 and again in 2002, the BC government introduced a Stream Crossing Guidebook that facilitated the development of site-specific management strategies and prescriptions to meet resource management objectives. The FPTWG is working to update this guidebook.

What more needs to be done?

BC has a diverse range of freshwater fish species that are supported by unique watersheds across the province. The removal of fish passage barriers will significantly improve fish populations and aquatic health; the resilience of aquatic ecosystems to climate change; and the maintenance of the commercial, aboriginal and recreational fisheries. Removal of fish passage barriers will also help to ensure compliance with federal and provincial legislation; demonstrate that the Province is continuing to ensure aquatic connectivity is maintained; and follow-up on Government's response to the Forest Practices Board special investigation on Fish Passage (FPB 2009).

Both the interest from licensees and the large number of high priority crossings that require restoration indicate that significant gains could be made with increased funding. Licensee and BCTS responses to a previous Call for Proposals indicate that there is interest to undertake about \$10 million of projects per year, or about 100 projects (the average cost to replace a culvert that fails to pass fish is about \$100,000). A substantial and sustained funding increase would result in meaningful improvements to the current fish passage situation.

Historic problems have also been identified at stream crossings with railways, highways, oil and gas roads, and municipal roads, yet no clear funding sources exist to remediate fish passage problems outside the forestry realm. Additional partners are needed to address the full scope of the fish passage problem in BC.

References

GSGlason & Associates Ltd. 2009. Freshwater Sport Fishing in British Columbia, Sending ripples through the Provincial Economy. Accessed on the internet at: http://www.gofishbc.com/pr_economicstudynov182009.htm
Accessed on October 2, 2011

Forest Practices Board. 2009. Fish Passage at Stream Crossings: Special Investigation. Accessed on the Internet at: <http://www.fpb.gov.bc.ca/publications.aspx?id=3714>
Accessed on October 5, 2011

Harper, D.J. and Quigley, J.T. 2000. No net loss of fish habitat: An audit of forest road crossings of fish-bearing streams in British Columbia, 1996-1999. Canadian Technical Report of Fisheries and Aquatic Sciences 2319. Published by Fisheries and Oceans Canada.

Ministry of Environment. 2004. Standards and Best Practices for In-stream work. Available on the Internet at: <http://www.env.gov.bc.ca/wld/documents/bmp/iswstdsbpsmarch2004.pdf>
Accessed on November 21, 2011

Mount, C., Norris, S., Thompson, R., and Tesch, D. 2011. GIS modeling of fish habitat and road crossings for the prioritization of culvert assessment and remediation. Streamline Watershed Management Bulletin. Vol 14:7-13

Northcote, T.G. and G.F. Hartman, editors. 2004. Fishes and forestry: worldwide watershed interactions and management. Blackwell Science, Oxford, UK.

Field, R.D. and J.D. Reynolds. 2011. Sea to sky: impacts of residual salmon-derived nutrients on estuarine breeding bird communities. Proceedings of the Royal Society B. Vol 278: 3081-3088

SFU 2008. Salmon and Nutrients: A seminar on science and policy. Proceedings. Available on the Internet at: http://www.sfu.ca/biology/faculty/reynolds/The_Reynolds_Lab/Publications_files/Field%20and%20Reynolds%202011%20Proc%20B.pdf
Accessed on November 14, 2011

Members of the Fish Passage Technical Working Group

- **Ian Miller** (Chair), Manager, Resource Practices Branch, Ministry of Forests, Lands and Natural Resource Operations
- **Richard Thompson**, Monitoring Unit Head, Ecosystems Sustainability Section, Ecosystems Protection & Sustainability Branch, Ministry of Environment
- **David Maloney**, Forest Water Management Officer, Resource Practices Branch Ministry of Forests, Lands and Natural Resource Operations
- **Brian Chow**, Chief Engineer, Engineering Branch, Timber Operations and Pricing, Ministry of Forests, Lands and Natural Resource Operations
- **Craig Mount**, Aquatic Habitat Geomorphologist, Knowledge Management Branch, Ministry of Environment
- **Peter Tschaplinski**, Research Scientists, Aquatic Conservation Science Section, Ecosystem Protection & Sustainability Branch, Ministry of Environment
- **Bradley Koroluk**, Habitat Management Biologist Oceans, Habitat and Enhancement Branch BC North Coast, Fisheries and Oceans Canada
- **Holly Pulvermacher**, Habitat Management Biologist, Regional Headquarters, Fisheries and Oceans Canada
- **Monty Locke**, Forest Investment Specialist, Harvesting and Silvicultural Practices, Resource Practices Branch, Ministry of Forests, Lands and Natural Resource Operations
- **Dave Hamilton**, Engineering Specialist, BC Timber Sales