Species at Risk Act
Recovery Strategy Report Series

Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada for the Period 2007 – 2015

Morrison Creek Lamprey

2016

Canada

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Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under Section 46 of the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the competent ministers are responsible for reporting on the implementation of the recovery strategy for a species at risk, and on the progress towards meeting its objectives within five years of the date when the recovery strategy was placed on the Species at Risk Public Registry and in every subsequent five-year period, until its objectives have been achieved or the species' recovery is no longer feasible.

Reporting on the progress of recovery strategy implementation requires reporting on the collective efforts of the competent minister(s), provincial and territorial governments and all other parties involved in conducting activities that contribute to the species' recovery. Recovery strategies identify broad strategies and approaches that will provide the best chance of recovering species at risk. Some of the identified strategies and approaches are sequential to the progress or completion of others and not all may be undertaken or show significant progress during the timeframe of a Report on the Progress of Recovery Strategy Implementation (Progress Report).

The Minister of Fisheries and Oceans is the competent minister under SARA for the Western Brook Lamprey – Morrison Creek Population and has prepared this Progress Report.

As stated in the preamble to SARA, success in the recovery of species at risk depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in the recovery strategy and will not be achieved by Fisheries and Oceans Canada, or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the Recovery Strategy for the Western Brook Lamprey – Morrison Creek Population for the benefit of the species and Canadian society as a whole.

Acknowledgements

This Progress Report was prepared by the Department of Fisheries and Oceans Canada. The Department of Fisheries and Oceans would also like to express its appreciation to all individuals and organizations who have contributed to the recovery of the Western Brook Lamprey – Morrison Creek Population.

Executive Summary

The Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni)*, hereafter referred to as Morrison Creek Lamprey,[1] was assessed by COSEWIC as Threatened in April 1999. In May 2000, the species' status was re-examined by COSEWIC and designated Endangered, and subsequently listed under the *Species at Risk Act* as Endangered in June 2003. In July of 2007 the final *Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni *var.* marifuga*) in Canada* (NRTMCL 2007) was posted to the Species at Risk Public Registry. An updated COSEWIC assessment in 2010 confirmed the species' status as Endangered.

Key anthropogenic threats identified in the *Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni *var.* marifuga*) in Canada* include land use, water use, water quality and reduction in prey base. The recovery goal as identified in the Recovery Strategy for this species is to "secure its long-term viability within its natural range." It is likely that this population will always remain at some risk due to its extremely limited distribution.

This report documents the progress of Recovery Strategy implementation for Morrison Creek Lamprey. It summarizes progress that Fisheries and Oceans Canada, the Province of British Columbia's Ministry of Environment, and other interested parties have made towards achieving the goal and objectives set out in the Recovery Strategy including:

- conducting new research and monitoring activities (including advancing studies to support the identification of critical habitat); and
- completing management activities that help Canadians reduce impacts on, and better understand the threats to, Morrison Creek Lamprey.

[1] In Schedule 1 of the *Species at Risk Act* this species is officially listed as "Western Brook Lamprey– Morrison Creek population." In this document, the common name "Morrison Creek Lamprey" is used throughout, to maintain consistency with the Recovery Strategy (NRTMCL 2007).

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1 Background

1.1 Species Status

Assessment Summary – April 2010

Common name:
Western Brook Lamprey – Morrison Creek Population

Scientific name:
Lampetra richardsoni

Legal listing (*SARA*):
Endangered

COSEWIC status:
Endangered

Reason for designation:
This dimorphic population of lamprey is a small freshwater fish endemic to a small stream on eastern Vancouver Island. It is susceptible to habitat loss and degradation owing to its close proximity to a major highway and increasing urbanization in the watershed.

Occurrence in Canada:
British Columbia

Status history:
Designated Threatened in April 1999. Status re–examined and designated Endangered in May 2000 and in April 2010.

***Species at Risk Act* Status:**
Listed, Endangered (2003)

1.2 Threats

1.2.1 Threats to Morrison Creek Lamprey

Key anthropogenic threats identified in the *Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni *var.* marifuga*) in Canada* include land use, water use, water quality and reduction in prey base (NRTMCL 2007).

1.2.2 Activities Likely to Destroy Critical Habitat

Neither critical habitat nor activities likely to destroy critical habitat were identified for Morrison Creek Lamprey (MCL) in the Recovery Strategy; however, these will both be identified in a forthcoming Action Plan.

2 Recovery

2.1 Recovery Goal and Objectives

The Recovery Goal and Objectives[2] (identified in Sections 7 and 8 of the Recovery Strategy respectively), are as follows:

Recovery Goal

The recovery goal for MCL is to secure its long-term viability within its natural range. It is likely that this population will always remain at some risk due to its extremely limited distribution.

Recovery Objectives

1. Resolve taxonomic uncertainties related to MCL for the purposes of its effective protection and recovery.
2. Maintain a self-sustaining population of MCL within Morrison Creek.
3. Maintain, and where possible enhance, the ecological integrity of habitat for MCL.
4. Increase scientific understanding of MCL through additional investigation of its natural history, critical habitat and threats to its persistence.
5. Foster awareness of MCL and its conservation status, and encourage active local involvement in stewardship and habitat protection.

2.2 Performance Measures

Performance Measures (as outlined in Table 1 of the Recovery Strategy) are reproduced in Section 3.3 of this report.

[2] Referred to in the forthcoming *Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada* as "population and distribution objectives."

3 Progress towards Recovery

Section 46 of the *Species at Risk Act* requires the competent Minister to report on the implementation of the Recovery Strategy, and the progress towards meeting its objectives, within five years after it is included in the public registry and in every subsequent five-year period, until its objectives have been achieved or the species' recovery is no longer feasible. In the interest of capturing the most recent progress on the recovery of MCL, this document includes actions completed up to the end of 2015.

3.1 Research and Monitoring Activities

Table 1. Summary of achievements towards completing the Schedule of Studies and/or identification of critical habitat, as well as new research and monitoring activities conducted and/or ongoing since the completion of the Recovery Strategy in 2007

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
Activities from Schedule of Studies Outlined in 2007 Recovery Strategy.				
1.	Describe the basic habitat associations for each life stage.	3, 4	• Wade et al. (2015) described habitat associations for ammocoetes and adults (including nesting sites).	DFO;[4] FAS[5]
			• COSEWIC[6] (2010) described habitats for spawning, egg incubation and ammocoete development.	COSEWIC
			• Monitoring efforts summarized in row 13 of Table 1 further informed habitat associations.	Refer to row 13 of Table 1.
2.	Develop tools that would allow definitive identification of individual ammocoetes as belonging to either *L. richardsoni* or *L. richardsoni* var. *marifuga*.	1	• This activity has not been completed.	Not applicable
3.	Consolidate and report information previously collected on habitat use.	3, 4	• From 2003 to present, the MCS[7] have maintained a website[8] containing information on MCL, including documentation of field work (Morrison Creek	MCS; Project Watershed

[3] This column in based on the best available information; DFO acknowledges the large network of people that contribute to recovery of this species, and regrets any potential omissions in Tables 1 and 2.
[4] Fisheries and Oceans Canada.
[5] Fundy Aqua Services.
[6] Committee on the Status of Endangered Wildlife in Canada.
[7] Morrison Creek Streamkeepers.
[8] http://morrisoncreek.org/.

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
			Streamkeepers n.d.).	
			• Wade (2011) and FAS (2012) reported on MCL sampling studies conducted throughout the 1980s. • Wade and MacConnachie (2014) reported on MCL sampling studies conducted between 2011 and 2014. • Wade et al. (2015) reported on information previously collected on MCL habitat use in the 1980s.	DFO; FAS
			• Beamish (2013) reported on MCL sampling studies conducted from 1977 – 1988.	DFO
4.	Review: a) historic and b) current habitat availability.	4	• COSEWIC (2010) summarized historic habitat loss.	COSEWIC

			• The following further informed historic habitat availability:
			  • Wade (2011) and FAS (2012) reported on MCL sampling studies conducted throughout the 1980s;
			  • Wade and MacConnachie (2014) reported on MCL sampling studies conducted between 2011 and 2014; and,
			  • Wade et al. (2015) reported on information previously collected on MCL habitat use in the 1980s.
				DFO; FAS

			• Beamish (2013) reported on MCL sampling studies conducted from 1977 – 1988, further informing historic habitat availability.	DFO
			• Monitoring efforts summarized in row 13 of Table 1 further informed current habitat availability.	Refer to row 13 of Table 1.
5.	Review a) historic and b) current population abundance.	4	• Robust MCL abundance estimates have not yet been completed.	Not applicable
6.	Set recovery targets for each life stage.	4, 5	• This activity has not been completed.	Not applicable
7.	Determine the extent and distribution of different habitat types available to the species.	2, 3, 4	• Refer to row 4 of Table 1.	Refer to row 4 of Table 1.

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
8.	Employ expert judgement to determine quantitative relationship between critical habitat and abundance.	2, 3, 4	• Robust MCL abundance estimates have not yet been completed.	Not applicable
			Wade et al. (2015) provided recommendations for the identification of MCL critical habitat.	DFO; FAS
9.	Use population targets, habitat type and species' abundance information to determine the number and location of distinct habitats required to maintain a viable population.		• Critical habitat will be identified in a forthcoming Action Plan for MCL.	DFO
General Approach: Undertake specific research activities to fill knowledge gaps and clarify threats				
10.	Address information gaps that inhibit conservation of Morrison Creek Lamprey.	4	• Beamish (2013) further informed basic biology (e.g. taxonomic status and phylogenetic relationships, life history, habitat use), and population abundance and dynamics.	DFO
			• FAS (2012), Wade (2011), Wade and Beamish (2014), Wade and MacConnachie (2014), and other monitoring efforts summarized in row 13 of Table 1 further informed basic biology (e.g. habitat use), and population abundance and dynamics.	DFO; FAS; refer to row 13 of Table 1
			• Critical habitat recommendations from Wade et al. (2015) further informed the status of key habitats and potential threats to these habitats.	DFO
			• Refer to row 11 of Table 1 for information gaps pertaining to threats.	Refer to row 11 of Table 1.
11.	Clarify and address threats to Morrison Creek Lamprey.	2, 4	• Though not explicitly identified as a threat to MCL, in 2006/07 the CDFGPA[9] installed a lamprey exclusion device on the intake for a hatchery facility in the Morrison Creek headwaters.	CDFGPA; GOC;[10] MCS & partners

[9] Courtenay and District Fish and Game Protective Association.
[10] Government of Canada.

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
			• In 2006/07 the MCS reviewed data from the RDCS[11] on movement of contaminants from the Comox Valley Waste Management Center towards the headwaters of Morrison Creek, further clarifying the threat of water quality and informing potential causes of mortality.	GOC; MCS & partners
			• In 2006/07 the MCS observed erosion sites and sediment sources along Morrison Creek, resulting in a report with remediation recommendations and a map of erosion sites.	GOC; MCS & partners
			• In 2008, the MCS conducted invasive species removal and extensive riparian planting (Palmer pers. comm. 2015). • In 2009, the MCS restored stream flow conditions to a channel of Morrison Creek, and conducted extensive riparian planting (Palmer pers. comm. 2015).	MCS
			• In 2009, the MCS and DFO enhanced a side channel, which dries each summer, in the Morrison Creek watershed through construction of riffle/pool complexes, the addition of large woody debris structures, complexing, and planting native species (Palmer pers. comm. 2015).	DFO; MCS; PSF[12]
			• COSEWIC (2010) summarized threats to MCL including: land development and forest harvest, spills, landfill leachate, and declining prey base.	COSEWIC
			• Wade et al. (2015) and DFO (2015) summarized threats to MCL including: excessive nutrient input, deleterious substance release, reduction in prey base, water withdrawals and/or impoundment, stream alterations for salmon habitat enhancement, sediment generating activities, and land-based activities which may alter aquatic habitat.	DFO; FAS

[11] Regional District of Comox-Strathcona.
[12] Pacific Salmon Foundation.

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
			• Though not explicitly identified as a threat to MCL, in 2014 CEL[13] improved fish passage through a culvert in Morrison Creek.	CEL; COC;[14] DFO; MCS
			• Wade and Beamish (2014) identified barriers affecting the movement of MCL as a potential threat to MCL, and further informed current habitat availability.	DFO; FAS
			• In 2014/15 CEL conducted a detailed stream survey of two MCL barriers in Morrison Creek (identified in Wade and Beamish; 2014), followed by preparation of detailed designs, and purchase of equipment in preparation for their remediation; in 2015 FAS, DFO and the MCS improved fish passage through these two barriers.	CEL; FAS; DFO; MCS; HCTF;[15] FWCP[16]
General Approach: Delineate and protect key habitats				
12.	Conduct studies to help define critical habitat for Morrison Creek Lamprey.	3, 4	• Activities summarized in rows 1 through 5, 7 through 10, and 13 contributed to the identification of critical habitat.	Refer to rows 1 through 5, 7 through 10, and 13 of Table 1.
General Approach: Design and implement sound monitoring programs				
13.	Develop and implement a long term monitoring program.	2, 3	• In 2007, KWE[17] and the MCS sampled MCL to monitor effectiveness of previous restoration measures in Morrison Creek.	KWE; MCS
			• Between 2002 and 2009 the MCS and DFO opportunistically sampled MCL using a smolt fence from late April to early June (Palmer pers. comm. 2015).	DFO; MCS
			• In 2008, the MCS recorded temperature data (Palmer pers. comm. 2015).	MCS

[13] Current Environmental Ltd.
[14] City of Courtenay.
[15] Habitat Conservation Trust Fund.
[16] British Columbia Hydro's Fish and Wildlife Compensation Program.
[17] Komori Wong Environmental.

#	Strategy	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved[3]
			• Researchers conducted MCL sampling each year between 2009 and 2015 (Wade 2011, FAS 2012, Wade and Beamish 2014, Wade and MacConnachie 2014), focusing on various objectives, including: ○ relative abundance monitoring; ○ morphological measurements; ○ fin clipping for genetic analysis; ○ habitat associations by life stage; and, ○ in cooperation with HFM,[18] extent of range in headwaters.	DFO; FAS
			• In 2006/07, the MCS created a map of potential MCL spawning areas based on monitoring efforts, further informing current habitat availability and characteristics of spawning habitat (Palmer pers. comm. 2015).	GOC; MCS & partners
			• Harvey and Brown (2013a, 2013b) incorporated best collection and monitoring approaches into draft SARA multi-species compendium reports.	DFO
			• Wade and Beamish (2014) identified barriers affecting the movement of MCL, further informing current habitat availability.	DFO; FAS

[18] Hancock Forest Management.

3.2 Management Activities

Table 2. Summary of Activities undertaken to reduce or eliminate threats to the MCL, threats to critical habitat and/or threats to its residence

#	Activity Description	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved
General Approach: Establish and support stewardship initiatives				
14.	Establish and support a Recovery Implementation Group (RIG) or alternative working group for Morrison Creek Lamprey.	4,5	• While no official RIG has been established, the MCS is a key organization in conducting stewardship activities and monitoring in the Morrison Creek watershed since 1995 (Palmer pers. comm. 2015).	GOC; MCS & partners
15.	Inform and educate stakeholders and the general public about the species and general biodiversity values.	5	• From 2003 to present the MCS have maintained a website containing information on MCL; currently, it contains photos, video clips and information on MCL habitat and ecology, extensive maps and information about the watershed, other species present and the headwaters in particular (Palmer pers. comm. 2015). • In 2006/07 the MCS developed a lamprey educational program for school children, bringing awareness to its status, ecology, and evolutionary significance (Palmer pers. comm. 2015). • In 2007 the MCS (Palmer pers. comm. 2015): o hosted a Streamkeepers course within the Morrison Creek watershed including a presentation dedicated to the biology and habitat requirements of MCL; o installed two interpretive signs about MCL in Courtenay municipal parks. o produced interpretive signs including photos and information about MCL; o conducted a series of interpretive walks with local residents; o worked with DFO to produce educational material about MCL for school children, including slides, activities and a PowerPoint presentation; o hosted a local Streamkeepers course including information about MCL.	GOC; MCS & partners

#	Activity Description	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved
			• In 2008, 2009 and 2012 the MCS shared MCL and watershed information with people attending an Earth Day event (Palmer pers. comm. 2015). • In 2009, the MCS produced video about the Morrison Creek watershed and MCL, posted on their website (Palmer pers. comm. 2015). • In 2010, the MCS hosted watershed walks in the Morrison Creek watershed (Palmer pers. comm. 2015). • In 2011, the MCS delivered a PowerPoint presentation on MCL and Morrison Creek to a neighbourhood group (Palmer pers. comm. 2015). • In 2013, the MCS hosted Morrison Creek watershed walks for Puntledge Elementary and Lake Trail Middle School students, with the latter group participating in invasive species removals (Palmer pers. comm. 2015). • In 2014, the MCS delivered a PowerPoint presentation about MCL and protection of the Morrison Creek headwaters at their Annual General Meeting (Palmer pers. comm. 2015). • In 2015, the MCS (Palmer pers. comm. 2015): o conducted a series of Interpretive Walks; o engaged local students in riparian planting at stream restoration sites; and, o delivered a presentation about MCL.	
16.	Work with local government, land developers, and others to improve and encourage watershed stewardship.	5	• In 2006/07, the MCS: o engaged six youth in ecological restoration activities in Morrison Creek; o attended meetings with the Comox-Strathcona Regional District, City of Courtenay, the Town of Cumberland Planners and a private landowner's representative, to negotiate further protection of the Morrison Creek	GOC; MCS & partners

#	Activity Description	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved
			headwater wetlands; and, ○ held meetings with municipal governments resulting in BMPs[19] for development permits and continued notification of future development. • In 2007, the MCS: ○ met with representatives of three local governments, raising the profile of MCL and the Morrison Creek watershed; ○ liaised with municipal staff regarding compliance relating to MCL habitats • In 2010, the MCS provided input to a Regional Growth Strategy pertaining to land use planning (Palmer pers. comm. 2015). • In 2011 and 2012, the MCS provided recommendations for local construction works near potential MCL habitats (Palmer pers. comm. 2015). • In 2013, the MCS: ○ participated in, and made a submission to, the Arden Corridor Local Area Plan consultation process, pertaining to portions of the Morrison Creek watershed. ○ liaised with agencies, municipal staff, and industry regarding compliance relating to MCL habitats, and habitat restoration • In 2014, the MCS collaborated with the COC to produce and distribute an information package promoting responsible streamside development and living near streams. • In 2015, the MCS: ○ delivered a PowerPoint presentation about MCL, Morrison Creek watershed protection, and best management practices at CAVI.[20]	

[19] Best Management Practices.
[20] Convening for Action on Vancouver Island.

#	Activity Description	Recovery Objectives Addressed	Activities Completed or Underway	Organizations Involved
			○ liaised with funders, local government and local land conservation organizations regarding potential protection of the Morrison Creek habitats; ○ met with CVRD[21] staff and a local elected representative to explore protection of the Morrison Creek Headwaters; and, ○ discussed developments and infrastructure projects potentially impacting Morrison Creek habitats with City of Courtenay staff.	
General Approach: Delineate and protect key habitats				
17.	Develop a watershed-scale sustainability plan that includes: 1) identification of key habitat, flow and water quality values for lamprey, and 2) guidelines to avoid localized and watershed-scale impacts, which can be incorporated into effective decision making.	1,2,3	• Though MCL were not addressed specifically, in 2006/07 local governments incorporated Morrison Creek Watershed considerations into a draft Highway Spill Response Plan.	BC MOE; GOC; MCS
			• Though MCL were not addressed specifically, in 2014 the CVRD developed a Comox Lake Watershed Protection Plan (Wedler Engineering LLP 2011).	CVRD
18.	Establish water quality and water use objectives for Morrison Creek.	4,5	• This activity has not been completed.	DFO
19.	Develop sound protocols for scientific investigations (e.g., limit number of fish collected each year, etc.).	2	• Harvey and Brown (2013a, 2013b) incorporated best collection and monitoring approaches into draft SARA multi-species compendium reports.	DFO

[21] Comox Valley Regional District.

3.3 Summary of Progress towards Recovery

Action Planning

DFO, in collaboration with the BC MOE, is developing a forthcoming *Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada* as part of the Government of Canada's ongoing commitment to the conservation of species at risk through the implementation of the *Species at Risk Act*.

Report on Performance Measures

Performance measures (as outlined in the Recovery Strategy) and their outcomes are addressed below.

1) **Has a RIG or working group been established? Is the RIG adequately supported with funding and technical expertise? Has an Action Plan been developed? Is the RIG achieving the goals outlined in the Recovery Strategy?**

   Groups such as the MCS (a non-profit, volunteer-based environmental organization located in Courtenay, British Columbia) perform similar functions to a RIG. Staffing and operations funding for the MCS is largely obtained on a year-to-year basis. Specifically, the MCS have been supported via funding, technical expertise, and in-kind contributions from the following organizations: City of Courtenay, British Columbia Ministry of Transport, Government of Canada, Comox Valley Project Watershed Society, Public Conservation Assistance Fund and the Comox Valley Regional District, Pacific Salmon Foundation, Habitat Conservation Trust Foundation, Fish and Wildlife Compensation Program (BC Hydro), Timber West, Current Environmental, and other local consulting biologists (Palmer pers. comm. 2015).

   DFO is developing a draft Action Plan for the MCL in cooperation with the Province of British Columbia's Ministry of Environment.

   The recovery goal for MCL to "secure its long-term viability within its natural range" may never be fully achieved due to its endemic nature; however, in the timeframe of this report many achievements (outlined in Tables 1 and 2) contributed to the recovery goal of the species.

2) **Are there key information gaps that inhibit conservation of Morrison Creek Lamprey?**

   Refer to row 10 of Table 1 for activities addressing information gaps. Several additional items remain to be addressed, namely related to: population abundance and dynamics; prey identification and abundance; hydrological connectivity in headwaters; taxonomic status and phylogenetic relationships; and, habitat use by different life stages (NRTMCL 2007; Wade et al. 2015).

3) **Have threats been clarified and assessed? Are threats being mitigated?**

Threats are further summarized and expanded upon in a Status Report (COSEWIC 2010), a CSAS[22] Science Advisory Report (DFO 2015) and Research Document (Wade et al. 2015) as well as a forthcoming Action Plan.

Stewards, consultants, and researchers addressed threats relating to: incidental mortality in a hatchery facility, potential contaminants, erosion, channel drying, works in and around water, invasive plants, and fish passage (refer to row 11 of Table 1 for details).

4) Has critical habitat been defined for Morrison Creek Lamprey?

Wade et al. (2015) and DFO (2015) provide recommendations for the identification of critical habitat. Critical habitat will be officially identified in the forthcoming *Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada*.

5) Have key areas in the watershed (i.e., those that are disproportionately important for maintaining habitat and the natural flow regime) been identified? Has a watershed plan that recognizes these habitats as important been developed? Have key habitats been effectively protected?

Wade et al. (2015) and DFO (2015) provide recommendations for the identification of critical habitat. Critical habitat will be officially identified in the forthcoming *Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada*. Both of these documents assist in the identification of key areas in the watershed.

Though not specific to MCL, in 2011 the Comox Valley Regional District published the Comox Lake Watershed Protection Plan (Wedler Engineering LLP 2011).

Additionally, several parks and protected areas such as the Linton Conservation Area, Roy Stewart Morrison Nature Park and Puntledge Creek are located along Morrison Creek and offer some habitat protection.

6) Have monitoring programs been implemented? How long has a monitoring program been in place? Is it effective? Is it a benign activity for the population? Is funding secure for the long term?

Though an official monitoring program has not been established, refer to row 13 of Table 1 for details of monitoring conducted by stewards, consultants, researchers, and government.

Harvey and Brown (2013a, 2013b) incorporated best collection and monitoring approaches into draft SARA multi-species compendium reports, which will inform the development and implementation of a comprehensive monitoring plan.

Effectiveness of a monitoring program is pending full implementation and analysis of data from multiple years. Funding is largely obtained on a year-to-year basis. Though

[22] Canadian Science Advisory Secretariat.

expected to be benign, population level impacts from existing monitoring are not assessable until robust population estimates are established.

7) **Have water quality and water use objectives been established and communicated to relevant regulators and stakeholders?**

Water quality and water use objectives have not yet been completed. Communication of objectives is pending their development.

8) **Have educational materials been produced? Has public perception and awareness been affected? How many classes have received educational presentations? Has public perception and awareness been affected?**

The MCS have developed PowerPoint presentations, classroom activities, press release packages, reports for private landowners, and a Streamkeepers course with a section on MCL. The MCS also maintained a website[23] with educational materials, attended Earth Day events and meetings with local and regional governments, posted interpretive signs, and engaged youth in watershed walks and ecological restoration activities. Refer to rows 15 and 16 of Table 2 for more details. Without a follow-up survey it is difficult to measure the extent to which public perception and awareness have been affected by such activities.

9) **Have forest harvest and land management criteria been developed? Is forest harvest and land development meeting the criteria? Have BMPs been developed and communicated? Is there compliance with BMPs?**

In 2006/07 the MCS met with local government agents responsible for reviewing and approving development proposals in the Morrison Creek Watershed to encourage the adoption of BMPs; participants resolved that variance from the existing Official Community Plan and Riparian Area Regulations would only be considered on a case by case basis, and that the MCS would be notified of development applications in the watershed. Currently, the "Rural Comox Valley Official Community Plan Bylaw No. 337, 2014", which is publicly available online, includes development permit guidelines for the "aquatic and riparian habitat development permit area."

Private Managed Forests are administered under the provincial *Private Managed Forest Land Act* (PMFLA) by an independent provincial agency, the Managed Forest Council (Council), also established under the PMFLA. The Council mandate is to encourage forest management practices on private Managed Forest land, including monitoring forest practices and the protection of key public environmental values as established by regulation on private managed forest land. To that end, the Council conducts forest practices audits to provide assurance that standards for the protection of public resource values on private managed forest land are being met.

Hancock Forest Management has been participating voluntarily in the Managed Forest Land Program since 1995. Audits conducted by the Managed Forest Council or formerly the Private Managed Forest Land Council on a bi-annual basis indicate that Hancock Forest Management is managing their properties in the Morrison Creek Watershed in

[23] http://morrisoncreek.org/

accordance with their management commitment and PMFLA regulatory requirements. Specifically, riparian buffers and reforestation practices have met or more often, exceeded requirements.

In addition, the forthcoming Action Plan for MCL includes an action encouraging updating land use plans, official community plans, by-laws and management guidelines with MCL considerations. Compliance monitoring of bylaws and Riparian Area Regulations rests with provincial, regional and municipal governments.

10) Have scientific investigation protocols been set and communicated? Have they been implemented?

Harvey and Brown (2013a, 2013b) incorporated best collection and monitoring approaches into draft SARA multi-species compendium reports, which will inform the development and implementation of a comprehensive monitoring plan. Communication and implementation of protocols are pending publication.

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