Species at Risk Act
Action Plan Report Series

Report on the Progress of Action Plan Implementation for the Western Brook Lamprey, Morrison Creek population (*Lampetra richardsoni*) in Canada for the Period 2018 to 2022

Morrison Creek Lamprey

2025

Canada

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Cover illustration: Western Brook Lamprey, Morrison Creek population. Photo by Joy Wade.

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Preface

The *Species at Risk Act* (S.C. 2002, c.29) (SARA), requires reporting on the implementation of the action plan for a species at risk (via a progress report) 5 years after the final action plan was published on the Species at Risk Public Registry. This reporting must be done by the competent Minister.

The Minister of Fisheries is the competent minister under SARA for the Western Brook Lamprey, Morrison Creek population and has prepared this progress report.

Reporting on the progress towards implementing the action plan requires reporting on the collective efforts of the competent minister, provincial and territorial governments, and all other parties involved in conducting activities that contribute to the species' recovery. An action plan provides the detailed recovery planning (recovery measures) that supports the strategic direction set out in the recovery strategy for the species. Some of the identified broad strategies and recovery measures 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 action plan implementation.

As stated in the preamble to SARA, success in the recovery of species at risk depends on the commitment and cooperation of many different groups 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 recovering species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing the recovery strategy and action plan for the benefit of the Western Brook Lamprey, Morrison Creek population and Canadian society as a whole.

Acknowledgments

This progress report was prepared by Emma Branquinho (Fisheries and Oceans Canada [DFO]) with input from Maggie Boothroyd (DFO), Ahdia Hassan (DFO), Paul Grant (DFO) and Heather Bettger (DFO). To the extent possible, this progress report has been prepared with inputs from the Government of British Columbia and the City of Courtenay. DFO 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*), herein referred to as the Morrison Creek Lamprey[1], was listed as endangered under the *Species at Risk Act* (SARA) in 2003. The "Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada" was finalized and published on the Species at Risk Public Registry in 2018 (Fisheries and Oceans Canada [DFO] 2018). The action plan provided detailed recovery planning that supports the strategic direction set out in the "Recovery Strategy for the Morrison Creek Lamprey *(Lampetra richardsoni var. marifuga*) in Canada", which was finalized and published on the Species at Risk Public Registry in 2007 (National Recovery Team for Morrison Creek Lamprey [NRTMCL] 2007). Two progress reports on recovery strategy implementation have been published, the "Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey – Morrison Creek population (*Lampetra richardsoni*) in Canada for the Period 2007 to 2015", which was published in 2016 (DFO 2016) and the "Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey (Morrison Creek population; *Lampetra richardsoni*) in Canada for the Period 2016 to 2021", which was published in 2022 (DFO 2022).

The main threats identified for the Morrison Creek Lamprey include: unsustainable land use and water use, degraded water quality, reduction in prey base, climate change, excessive take of individuals for research, and recreational activities (NRTMCL 2007).

The action plan outlines recovery measures that provide the best chance of achieving the population and distribution objectives. The population and distribution objectives[2] for the Morrison Creek Lamprey are to:

- secure its long-term viability within its natural range
- resolve taxonomic uncertainties related to Morrison Creek Lamprey for the purposes of its effective protection and recovery
- maintain a self-sustaining population of Morrison Creek Lamprey within Morrison Creek
- maintain, and where possible enhance, the ecological integrity of habitat for Morrison Creek Lamprey
- increase scientific understanding of Morrison Creek Lamprey through additional investigation of its natural history, critical habitat and threats to its persistence
- foster awareness of Morrison Creek Lamprey and its conservation status, and encourage active local involvement in stewardship and habitat protection

The "Report on the Progress of Action Plan Implementation for the Western Brook Lamprey, Morrison Creek population (*Lampetra richardsoni*) in Canada for the Period 2018 to 2022" reports on the progress made by DFO and its partners towards implementing the action plan and achieving its objectives. During this time period, progress has been made in:

- periodic monitoring of the Morrison Creek Lamprey to confirm presence throughout the watershed and compare abundance and distribution to previous studies

[1] On Schedule 1 of the *Species at Risk Act* this species is officially called 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) and action plan (DFO 2018).

[2] The population and distribution objectives described in the action plan were previously referred to as the recovery goal and recovery objectives in the recovery strategy.

- monitoring for spawning activity within the Morrison Creek watershed to increase knowledge of habitat requirements
- restoration of Morrison Creek Lamprey habitat, including barrier removal to restore connectivity
- development and continuation of stewardship groups and partnership initiatives that contribute to the conservation and protection of the Morrison Creek Lamprey and the Morrison Creek watershed
- outreach to increase public awareness and provide education on the main threats to the Morrison Creek Lamprey, and to share progress made in efforts towards their recovery

It is unknown if the population and distribution objectives have been met (abundance and distribution trends are not available); however, Morrison Creek Lamprey continue to be encountered throughout their known range. Further work is required to support the recovery of the Morrison Creek Lamprey and its habitat. Priority next steps may include, but are not limited to: long-term monitoring to determine population and distribution trends, protection and restoration of Morrison Creek Lamprey habitat, clarifying knowledge gaps on Morrison Creek Lamprey prey, and investigation of connectivity and hydrological properties of Morrison Creek and its headwaters.

DFO remains committed to the survival and recovery of the Morrison Creek Lamprey. Work started and completed to date has built a strong foundation for continued research and recovery of this species. Progress made to date would not have been achieved without the contributions of our partners. DFO looks forward to continued collaboration and welcomes the participation of additional partners.

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1 Introduction

The “Report on the Progress of Action Plan Implementation for the Western Brook Lamprey, Morrison Creek population (*Lampetra richardsoni*) in Canada for the Period 2018 to 2022” (herein referred to as progress report) outlines the progress made towards meeting the recovery measures listed in the “Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada” (herein referred to as action plan; Fisheries and Oceans Canada [DFO] 2018) during the indicated time period. The action plan provides the detailed recovery planning that supports the strategic direction set out in the “Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni* var. *marifuga)* in Canada” (herein referred to as recovery strategy; National Recovery Team for Morrison Creek Lamprey [NRTMCL] 2007). This progress report is part of a series of documents for this species that are linked and should be taken into consideration together; including: the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports (COSEWIC 2000; COSEWIC 2010), the recovery strategy (NRTMCL 2007), the action plan (DFO 2018), the “Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni)* in Canada for the Period 2007 to 2015” (DFO 2016), and the “Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey (Morrison Creek population; *Lampetra richardsoni*) in Canada for the Period 2016 to 2021” (DFO 2022).

Section 2 of the progress report provides an overview of key information on the threats to the species, population and distribution objectives for achieving its recovery, and recovery measures. For more details, readers should refer back to the recovery strategy and action plan. Section 3 reports on the progress made towards the recovery measures identified in the action plan that support achieving the population and distribution objectives.

2 Background

2.1 COSEWIC assessment summary and threats to the species and its critical habitat

The listing of the Western Brook Lamprey, Morrison Creek population (*Lampetra richardsoni*) herein referred to as the Morrison Creek Lamprey[3], as endangered under the *Species at Risk Act* (SARA) in 2003 led to the development and publication of the recovery strategy in 2007 and the action plan in 2018 (NRTMCL 2007; DFO 2018). The recovery strategy and action plan are consistent with the information provided in the COSEWIC status report (COSEWIC 2000) and the COSEWIC summary information is included below.

In 2010, COSEWIC re-examined and confirmed the status of the Morrison Creek Lamprey as endangered (COSEWIC 2010).

[3] On Schedule 1 of the SARA this species is officially called “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 and action plan (NRTMCL 2007; DFO 2018).

Assessment summary – April 2010

Common name
Western Brook Lamprey, Morrison Creek Population

Scientific name
Lampetra richardsoni

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
British Columbia

Status history
Designated threatened in April 1999. Status re–examined and designated endangered in May 2000 and in April 2010.

Section 1.1 of the action plan provides information on the threats to the species' survival and recovery. These threats include: unsustainable land use and water use, degraded water quality, reduction in prey base, climate change, excessive take of individuals for research, and recreational activities.

Critical habitat for the Morrison Creek Lamprey was identified, to the extent possible, in section 2 of the action plan (DFO 2018).The action plan also provides examples of activities that are likely to result in destruction of critical habitat (that is, threats to critical habitat). The list of activities provided in table 6 of the action plan is neither exhaustive nor exclusive, and their inclusion has been guided by the relevant threats to habitat described in the recovery strategy and action plan. Refer to the action plan for more details on the activities likely to result in the destruction of critical habitat.

2.2 Recovery

This section summarizes the information, found in the recovery strategy (NRTMCL 2007) and the action plan (DFO 2018) on the population and distribution objectives that are necessary for the recovery of the Morrison Creek Lamprey. As stated in section 4 of the action plan, reporting on implementation will be done by assessing progress toward implementing the broad strategies identified in the recovery strategy (DFO 2018).

Section 1 of the action plan restates the following population and distribution objectives[4] necessary for the recovery of the species, which were identified in the recovery strategy:

[4] The population and distribution objectives described in the action plan were previously referred to as the recovery goal and recovery objectives in the recovery strategy.

The population and distribution objectives for Morrison Creek Lamprey are to:

1. secure its long-term viability within its natural range
2. resolve taxonomic uncertainties related to Morrison Creek Lamprey for the purposes of its effective protection and recovery
3. maintain a self-sustaining population of Morrison Creek Lamprey within Morrison Creek
4. maintain, and where possible enhance, the ecological integrity of habitat for Morrison Creek Lamprey
5. increase scientific understanding of Morrison Creek Lamprey through additional investigation of its natural history, critical habitat and threats to its persistence
6. foster awareness of Morrison Creek Lamprey and its conservation status, and encourage active local involvement in stewardship and habitat protection

3 Progress towards recovery

The recovery strategy (NTRMCL 2007) for the Morrison Creek Lamprey divides the recovery effort into 10 broad strategies[5] and the action plan identifies 16 associated recovery measures (see tables 1 to 3 in the action plan; DFO 2018):

Broad strategy 1: establish and support a Recovery Implementation Group (RIG) or alternative working group for Morrison Creek Lamprey.

- Recovery measure 15: participate in a group that supports the conservation and protection of the population, and undertake watershed-based stewardship initiatives that increase understanding and awareness of the population. For example:
    - promote and adopt best practices; and,
    - explore options for conservation of important headwater habitats outside of critical habitat
- Recovery measure 16: sample other Western Brook Lamprey populations and compare them to Morrison Creek Lamprey to determine the genetic relationship within and between the populations

Broad strategy 2: address information gaps that inhibit conservation of Morrison Creek Lamprey.

- Recovery measure 1: continue to investigate presence and distribution of the population in the Upper Morrison Creek watershed, and in the natural and artificial side channels and tributaries of Morrison Creek and Arden Creek
- Recovery measure 4: identify Morrison Creek Lamprey prey preference, feeding rates, and estimate prey abundance and trends

Broad strategy 3: clarify and address threats to Morrison Creek Lamprey.

- Recovery measure 6: assess and identify physical barriers to Morrison Creek Lamprey movement and potential areas for habitat restoration
- Recovery measure 11: remediate barriers and conduct in-stream habitat restoration / creation / complexification projects to attenuate high and low water flows which may affect lamprey movement
- Recovery measure 12: in new and existing developments, install and maintain oil separators in potentially high-risk drains and explore options for disposal of waste materials

[5] Referred to as “strategies” within the recovery strategy and “broad strategies” within the action plan.

- Recovery measure 13: define discharge levels in Morrison Creek and Arden Creek throughout the year to better inform potential water conservation options

Broad strategy 4: conduct studies to help define critical habitat for Morrison Creek Lamprey.[6]

Broad strategy 5: 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.

- Recovery measure 7: conduct studies to assess connectivity in key headwater areas and geospatially assess the hydrological properties of Morrison Creek and its headwaters (including wetlands). This may include groundwater measurements using previously drilled monitoring wells in headwater areas
- Recovery measure 8: develop tools that would enable definitive identification of ammocoetes as either the non-parasitic or parasitic type of Morrison Creek Lamprey
- Recovery measure 9: identify and evaluate water management options to satisfy both conservation and stakeholder needs in the following ways: share information on Morrison Creek Lamprey; and, engage relevant agencies about conservation and water management options

Broad strategy 6: develop and implement a long-term monitoring program.

- Recovery measure 3: develop a sufficiently robust monitoring plan to provide for a clear indication of the progress achieved towards securing the population's long-term viability within its natural range and maintaining a self-sustaining population within the Morrison Creek watershed
    - Monitoring efforts may include:
        - lamprey presence, distribution, habitat use, nest distribution, spawning site locations, specific critical habitat attributes, and trends
        - water quality parameters such as oxygen, temperature, flow and pH
        - population and distribution of the watershed's aquatic communities (ecological dynamics, particularly prey/predator relationships); and
        - aquatic invasive species presence
- Recovery measure 5: implement the monitoring plan for Morrison Creek Lamprey

Broad strategy 7: establish water quality and water use objectives for Morrison Creek.

- Recovery measure 10: develop water quality objectives that address the population's biological needs and parameters that affect the quality of its habitat

Broad strategy 8: inform and educate stakeholders and the general public about the species and general biodiversity values.

- Recovery measure 15: refer to broad strategy 1 for description of recovery measure 15
- Recovery measure 16: refer to broad strategy 1 for description of recovery measure 16

Broad strategy 9: work with local government, land developers, and others to improve and encourage watershed stewardship.

- Recovery measure 14: share information about Morrison Creek Lamprey and encourage landowners and relevant levels of governments to consider the population in the

[6] Critical habitat was identified in the action plan. This broad strategy is complete and has no associated recovery measure.

development, implementation, and updating of land use plans, official community plans, by-laws and management guidelines

Broad strategy 10: develop sound protocols for scientific investigations.

- Recovery measure 2: develop allowable harm estimates and collection guidelines for Morrison Creek Lamprey, which encourage the use of minimally invasive sampling and handling techniques

Progress in carrying out these broad strategies and recovery measures is reported in section 3.1.

3.1 Activities supporting recovery

Table 1 provides information on the implementation of activities undertaken to address the broad strategies and recovery measures identified in the recovery strategy and the action plan, respectively (DFO 2018; NRTMCL 2007). A number of recovery activities were implemented prior to 2018 and progress has been documented in the "Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni*) in Canada for the Period 2007 to 2015" (DFO 2016) and the "Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey (Morrison Creek Population; *Lampetra richardsoni*) in Canada for the Period 2016 to 2021" (DFO 2022).

Table 1. Details of activities supporting the recovery of the Western Brook Lamprey, Morrison Creek population from 2018 to 2022.

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
1	1: Establish and support a Recovery Implementation Group (RIG) or alternative working group for Morrison Creek Lamprey 8: Inform and educate stakeholders and the general public about the species and general biodiversity values	15: Participate in a group that supports the conservation and protection of the population, and undertake watershed-based stewardship initiatives that increase understanding and awareness of the population. For example: • promote and adopt best practices; and, • explore options for conservation of important headwater habitats outside of critical habitat	Stewardship groups and partnerships within the Morrison Creek watershed contributed to the conservation and protection of the Morrison Creek Lamprey over the reporting period, including: • the Morrison Creek Streamkeepers (MCS), who are a group of community members that actively complete projects aimed at preserving, rehabilitating, and promoting public awareness of the Morrison Creek watershed • the Comox Valley Land Trust (CVLT) and the Comox Valley Regional District (CVRD), who formed a partnership with the goal of protecting the Morrison Headwaters Nature Preserve • School District 71 conducted student education programs on conservation and habitat restoration for Morrison Creek Lamprey. Students helped	**BCPF**, **CVLD**, **CVLT**, **DFO**, **local governments**, **MCS**, **stakeholders**, **and stewardship groups**

[7] When more than one participant is associated with implementation of a recovery measure, they are listed in alphabetical order and the lead is bolded.

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			replant riparian areas of Arden Creek as part of a habitat restoration project Broad watershed-based stewardship initiatives have occurred within the Morrison Creek watershed over the reporting period that contribute to the conservation and protection of the Morrison Creek Lamprey, including: • in 2019, 55 acres of the headwaters of Morrison Creek, which includes Morrison Creek Lamprey critical habitat, were purchased by the CVLT for protection and preservation; this area is managed by the City of Courtenay as the Morrison Headwaters Nature Preserve • in 2022, a collaboration between BC Parks Foundation (BCPF) and CVLT raised the funds required to purchase and protect all 715 acres of the headwaters of the Morrison Creek watershed Educational materials and outreach has raised public awareness of the Morrison Creek Lamprey. Activities include: • in 2020, interpretive signage was updated at Puntledge Park by MCS to promote public awareness of the ecological importance of the Morrison Creek watershed and the Morrison Creek Lamprey • in 2021, public outreach signage was developed by Fisheries and Oceans	

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			Canada (DFO) to educate on Morrison Creek Lamprey biology as well as the protections it is afforded under the *Species at Risk Act* (SARA), and 2 signs were installed at the Roy Morrison Park and Puntledge Park • in 2022, a webinar titled “Biodiversity of the Morrison Creek Headwaters” was hosted by Comox Valley Nature and facilitated by the Canadian Society of Environmental Biologists; the recording is available to the public on the Comox Valley Nature website • Morrison Creek Lamprey awareness and conservation actions for the species have been promoted at community events by local stream keepers • outreach presentations have been conducted at schools, local communities, and community environmental groups • the Morrison Creek Lamprey has been highlighted in media coverage, including for the land acquisition of the Morrison Headwaters Nature Preserve • the Morrison Creek Lamprey was highlighted in a chapter of “Animals, Health and Society” titled “Application of Harm Reduction Thinking to the Conservation of Uncharismatic Species” (Wade 2020)	

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
2	1: Establish and support a Recovery Implementation Group (RIG) or alternative working group for Morrison Creek Lamprey 8: Inform and educate stakeholders and the general public about the species and general biodiversity values	16: Sample other Western Brook Lamprey populations and compare them to Morrison Creek Lamprey to determine the genetic relationship within and between the populations	Sampling of other Western Brook Lamprey populations to compare to the Morrison Creek Lamprey has not occurred during the reporting period. However, other studies relevant to the question of lamprey population structure that can inform Morrison Creek Lamprey management were conducted, including: • a literature review explored and compared the biology, threats, monitoring needs, and conservation of *Lampetra* satellite species with a focus on the Western Brook Lamprey (Clemens and Wade 2023[8]). • a study examined the population structure of the Western Brook Lamprey from a contemporary and historical perspective in the Columbia River Basin (Spice et al. 2019).	**Academia**
3	2: Address information gaps that inhibit conservation of Morrison Creek Lamprey	1: Continue to investigate presence and distribution of the population in the Upper Morrison Creek watershed, and in the natural and artificial side channels and tributaries of Morrison Creek and Arden Creek	A 2022 publication summarized past survey efforts for Morrison Creek Lamprey. Trapping surveys of the Morrison Creek Lamprey occurred at 9 sites in Morrison Creek between 2011 and 2021, with 3 of the sites in the headwaters, which were sampled in 2015, 2016, 2017, and 2019 (Wade 2022). Results included: • confirmed presence of the Morrison Creek Lamprey in the headwaters of Morrison Creek • highest catches were in headwater sites	**DFO**

[8] Work was completed within the reporting period.

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
4	2: Address information gaps that inhibit conservation of Morrison Creek Lamprey	4: Identify Morrison Creek Lamprey prey preference, feeding rates, and estimate prey abundance and trends	Studies on prey preference, feeding rates, and prey abundance were not conducted during this reporting period.	N/A
5	3: Clarify and address threats to Morrison Creek Lamprey	6: Assess and identify physical barriers to Morrison Creek Lamprey movement and potential areas for habitat restoration	Arden Creek was identified as a potential area for restoration, and restoration efforts were completed in 2021 (refer to row 6). Barriers to fish movement were discovered in the mainstem of Morrison Creek during a passive trapping survey of the Morrison Creek Lamprey in July 2021. A large log jam and multiple smaller ones were found on the lower reaches of Morrison Creek and it is suspected they may have prevented access to habitat, contributing to the low catch success of the survey for the year (Wade et al. 2021).	**DFO**, MCS
6	3: Clarify and address threats to Morrison Creek Lamprey	11: Remediate barriers and conduct in-stream habitat restoration / creation / complexification projects to attenuate high and low water flows which may affect lamprey movement	In collaboration, the MCS, DFO, Pacific Salmon Foundation, School District 71, and Current Environmental Ltd completed the Arden Creek Restoration Project, a habitat remediation project in a 900 m reach of Arden Creek in 2021 to improve Morrison Creek Lamprey spawning and early rearing habitat. The project activities included: instream complexing, spawning gravel placement, removal of debris jams, riparian restoration, baseline surveys, and effectiveness monitoring. Results included: • in 2022, 10 lamprey nests were observed within the remediated habitat where lamprey spawning had not been observed since 2005 (Paul Grant pers. comm. 2024) • the remediated habitat was observed	Current Environmental Ltd., **DFO**, MCS, Pacific Salmon Foundation, School District 71

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			to have increased hydraulic complexity and reduced sedimentation (Paul Grant pers. comm. 2024) Barriers identified in Morrison Creek in 2021 (refer to table 1, row 5) were removed subsequent to discovery (Wade et al. 2021).	
7	3: Clarify and address threats to Morrison Creek Lamprey	12: In new and existing developments, install and maintain oil separators in potentially high-risk drains and explore options for disposal of waste materials	Installing oil separators in high-risk drains and exploring options for disposal of waste materials was not completed during the reporting period. However, an integrated rainwater management plan is in development by the City of Courtenay, which aims to integrate best management practices for underground infrastructure to promote adequate drainage and mitigate the impacts of stormwater on the watershed (Tazzioli pers. comm. 2023).	**City of Courtenay**
8	3: Clarify and address threats to Morrison Creek Lamprey	13: Define discharge levels in Morrison Creek and Arden Creek throughout the year to better inform potential water conservation options	A wetland and tributary mapping and hydrological study was conducted to increase understanding of the hydrology of Morrison Creek headwaters. This study included the collection of water level, temperature, and discharge data at 7 sub-basins within the headwaters (Current Environmental Ltd and Morrison Creek Streamkeepers 2020). Results included: • all tributaries maintained good flow and water temperature (maximum did not exceed 18.5°C) throughout the year • all tributaries and their springs and seeps were determined to be responsible for sustaining the base flow in Morrison Creek	**Current Environmental Ltd.**, **MCS**

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			• all aquifers upslope to the south and west of the headwaters were important for maintaining flow regime within the tributaries and mainstem of Morrison Creek	
9	4: Conduct studies to help define critical habitat for Morrison Creek Lamprey	No recovery measure was associated with this broad strategy, which is complete as the action plan identified critical habitat for the species	Refer to section 3.1.1 Critical habitat identification and protection	**DFO**
10	5: 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	7: Conduct studies to assess connectivity in key headwater areas and geospatially assess the hydrological properties of Morrison Creek and its headwaters (including wetlands). This may include groundwater measurements using previously drilled monitoring wells in headwater areas	A wetland and tributary mapping and hydrological study was completed in the headwaters of Morrison Creek from 2019 to 2020 (refer to row 8 for study details; Current Environmental Ltd and MCS 2020). This study mapped 4.8 km of new tributary habitat and 13.5 ha of new wetland habitat, and collected data on groundwater level and temperature in 2 previously established monitoring wells.	**Current Environmental Ltd.**, **MCS**
11	5: 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	8: Develop tools that would enable definitive identification of ammocoetes as either the non-parasitic or parasitic type of Morrison Creek Lamprey	A tool that enables differentiation between parasitic vs non-parasitic types at the ammocoetes life stage was not developed during the reporting period.	N/A
12	5: Develop a watershed-scale sustainability plan that includes: 1) identification of key habitat,	9: Identify and evaluate water management options to satisfy both conservation and stakeholder needs in the following ways:	A report that mapped the wetland and tributaries and studied the hydrological properties of Morrison Creek was developed in 2020, which could be used to inform future	DFO, **MCS**

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
	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	• share information on Morrison Creek Lamprey; and, • engage relevant agencies about conservation and water management options	water management and sustainability plans (refer to row 8; Current Environmental Ltd and Morrison Creek Streamkeepers 2020). Refer to row 1 for activities that shared information on the Morrison Creek Lamprey within the reporting period.	
13	6: Develop and implement a long- term monitoring program	3: Develop a sufficiently robust monitoring plan to provide for a clear indication of the progress achieved towards securing the population's long-term viability within its natural range and maintaining a self-sustaining population within the Morrison Creek watershed. Monitoring efforts may include: 1) lamprey presence, distribution, habitat use, nest distribution, spawning site locations, specific critical habitat attributes, and trends; 2) water quality parameters such as oxygen, temperature, flow and pH; 3) population and distribution of the watershed's aquatic communities (ecological dynamics, particularly prey/predator relationships); and, 4) aquatic invasive species presence	A long-term monitoring program has not been developed; however, the Morrison Creek Lamprey has been monitored through periodic studies. Refer to row 14 for monitoring and research work completed within the reporting period.	N/A
14	6: Develop and implement a long- term monitoring program	5: Implement the monitoring plan for Morrison Creek Lamprey	Although a long-term monitoring program has not been implemented, periodic studies indicate the Morrison Creek Lamprey continue to be encountered throughout their	**DFO**

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			known range. A summary report of passive trapping data for the Morrison Creek Lamprey between 2011 and 2021 in the mainstem of Morrison Creek was published in 2022 (Wade 2022). Wade et al (2019) compared trapping survey results in the headwaters and mainstem of Morrison Creek over time. Results indicate that catches were much lower from trapping surveys between 2011 and 2017 compared to the 1970s and 1980s. A passive trapping survey was conducted in the mainstem of Morrison Creek for ongoing population monitoring (Wade et al. 2021). The total number of lamprey caught in 2021 using this method was the lowest since monitoring began in 2011, which may have been due to barriers preventing access to habitat (refer to row 5). A report detailing opportunistic observations of nest building and spawning of the Morrison Creek Lamprey was published in 2022 to increase knowledge of habitat requirements for the population (Wade and Grant 2022). Results include: • all observations occurred within a 55 m^2 area near the confluence with Puntledge River • spawning activity was reported on May 15, 2021 and was monitored until June 9th with a total of 36 observed spawning events occurring during that time period	

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
			• a maximum of 6 different nesting areas were reported, with spawning areas composed of hard packed substrate covered by sand, pebbles and small stones • small stones or pebbles greater than 1 cm in diameter were observed to have been moved and placed at the edge of nests	
15	7: Establish water quality and water use objectives for Morrison Creek	10: Develop water quality objectives that address the population's biological needs and parameters that affect the quality of its habitat	Water quality objectives for Morrison Creek were not established during the reporting period. Refer to row 8 for summary information about wetland and tributary mapping that may help inform future development of water quality objectives (Current Environmental Ltd and MCL 2020).	Current Environmental Ltd, MCS
17	9: Work with local government, land developers, and others to improve and encourage watershed stewardship	14: Share information about Morrison Creek Lamprey and encourage landowners and relevant levels of governments to consider the population in the development, implementation, and updating of land use plans, official community plans, by-laws and management guidelines	The Morrison Creek Lamprey and its critical habitat was considered and incorporated into the City of Courtenay's Official Community Plan (Gothard pers. comms. 2023). • the Arden Local Area Plan was revised but retained its language on protecting environmentally sensitive areas in Courtenay • mention of the Morrison Creek Lamprey is included in the Lake Trail Neighbourhood Centre profile Refer to row 1 for more information sharing activities related to this recovery measure.	**City of Courtenay**
18	10: Develop sound protocols for scientific investigations (for example,	2: Develop allowable harm estimates and collection guidelines for Morrison Creek Lamprey, which encourage the	Allowable harm estimates for the Morrison Creek Lamprey were not developed during the reporting period.	Academia, DFO

#	Broad strategy	Recovery measure	Descriptions and results	Participants[7]
	limit number of fish collected each year, etc.)	use of minimally invasive sampling and handling techniques	A study investigating sampling methods and survey designs for larval lampreys was published in 2022 (Clemens et al. 2022). The “Best management guidelines for native lampreys during in-water work” was developed by the Lamprey Technical Working group with the goals of minimizing impact to native lampreys in North America during in-water work and improving instream habitat restoration projects for lampreys (Lamprey Technical Workgroup 2020).	

3.1.1 Critical habitat identification and protection

Critical habitat for the Morrison Creek Lamprey was identified to the extent possible in the action plan using the best available information, and provides the functions, features, and attributes necessary to support the species' life-cycle processes and to achieve the species' recovery goal and objectives. A SARA critical habitat order was established in May 2019 under subsections 58(4) and (5) of SARA which invoked the prohibitions in subsection 58(1) against the destruction of critical habitat (SOR/2019-123). Section 2.2 of the action plan provides examples of activities likely to result in the destruction of critical habitat.

3.1.2 Socio-economic impact

Under section 55 of SARA, the responsible federal minister is required to undertake "an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation". This section summarizes the socio-economic costs and benefits associated with implementing the recovery measures in the action plan between 2018 to 2022.

As per section 49(1)(e) of SARA, the action plan included a socio-economic evaluation of the costs of the action plan and the benefits to be derived from its implementation (section 3 of the action plan). Many of the economic costs associated with implementation of recovery measures have been, and will continue to be, borne by government agencies such as DFO. All of the recovery measures outlined in the action plan are expected to be low cost (DFO 2018). Recovery measures were anticipated to be funded from existing federal resources, as well as supplemental funds from annual programs such as the Habitat Stewardship Program, Indigenous Partnerships for Species at Risk (formerly the Aboriginal Fund for Species at Risk), and the Canada Nature Fund for Species at Risk. However, during the reporting period, no applications for projects targeting the Morrison Creek Lamprey were received, and therefore no projects were funded. Most of the recovery measures for the Morrison Creek Lamprey will require a collaborative implementation approach; however, the overall costs for Canadian partners and government (financial and/or in kind) is still expected to be low (DFO 2018).

The socio-economic benefits that have resulted from the implementation of the action plan include contributing to meeting the population and distribution objectives for the Morrison Creek Lamprey, as well as positive impacts on biodiversity and the value individuals place on preserving biodiversity (Federal, Provincial, Territorial Governments of Canada, 2014). These recovery actions have provided broader ecosystem and non-market benefits.

The conservation of species at risk is essential to the Government of Canada's commitment to conserving biodiversity and is important to Canada's economic and natural wealth.

3.1.3 Recovery feasibility

Recovery was determined to be feasible for the Morrison Creek Lamprey within the recovery strategy (NTRMCL 2007). No new information has been gathered that would suggest that the Morrison Creek Lamprey no longer meet the recovery feasibility criteria laid out in the recovery strategy.

4 Concluding statement

Over the reporting period (2018 to 2022), through the implementation of activities supporting the broad strategies identified in the recovery strategy and their associated recovery measures identified in the action plan, progress has been made in implementing the action plan and achieving its objectives for the Morrison Creek Lamprey, including:

- periodic monitoring of the Morrison Creek Lamprey to confirm presence throughout the watershed and compare abundance and distribution to previous studies
- monitoring for spawning activity within the Morrison Creek watershed to increase knowledge of habitat requirements
- restoration of Morrison Creek Lamprey habitat, including barrier removal to restore connectivity
- development and continuation of stewardship groups and partnership initiatives that contribute to the conservation and protection of the Morrison Creek Lamprey and the Morrison Creek watershed
- outreach to increase public awareness and provide education on the main threats to the Morrison Creek Lamprey, and to share progress made in efforts towards their recovery

While the population trend of the species is unknown, as population abundance and distribution trends are not available, Morrison Creek Lamprey continue to be encountered throughout their known range. Further work is required to support the recovery of the Morrison Creek Lamprey and its habitat. Priority next steps may include, but are not limited to:

- developing and implementing a long-term monitoring program
- continued protection, preservation, and restoration of Morrison Creek Lamprey habitat throughout the watershed
- conducting research to address knowledge gaps on the species prey
- assessing and reporting on the connectivity and hydrological properties of Morrison Creek and its headwaters

DFO remains committed to recovering the Morrison Creek Lamprey. The work started and completed to date has built a strong foundation for continued research and recovery of this species. Progress made to date would not have been achieved without the contribution from our partners including the Morrison Creek Streamkeepers, Comox Valley Land Trust, Comox Valley Regional District, City of Courtenay, British Columbia Parks Foundation, Joy Wade (Fundy Aqua Services), and Current Environmental Ltd. DFO is looking forward to continuing this successful collaboration and welcomes the participation of additional partners.

5 References

Clemens, B.J., J.E. Harris, S.J. Starcevich, T.M. Evans, J.J. Skalicky, F. Neave, and R.T. Lampman. 2022. Sampling methods and survey designs for larval lampreys. North American Journal Of Fisheries Management 42:455−474.

Clemens, B.J. and J. Wade. 2023. Conservation biology of the *Lampetra* satellite species of western North America, with a focus on Western Brook Lamprey (*L. richardsoni*). Canadian Manuscript. Report of Fisheries and Aquatic Sciences 3258: vi + 26 p.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2000. COSEWIC assessment and update status report on the Morrison Creek lamprey *Lampetra richardsoni* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 14 pp.

COSEWIC. 2010. COSEWIC assessment and status report on the Western Brook Lamprey *Lampetra richardsoni,* Morrison Creek Population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 27 pp.

Current Environmental Ltd and Morrison Creek Streamkeepers. 2020. Morrison Creek Headwaters Wetland and Tributary Mapping & Hydrological Study. 34 pp. Available online at: Morrison Creek Streamkeepers [accessed August 2021].

DFO (Fisheries and Oceans Canada). 2015. Review of the information for the identification of critical habitat for Morrison Creek lamprey. DFO Canadian Science Advisory Secretariat Science Advisory Report 2015/009. 9 pp.

DFO (Fisheries and Oceans Canada). 2016. Report on the progress of recovery strategy implementation for Morrison Creek Lamprey (*Lampetra richardsoni)* in Canada for the period 2007 – 2015. *Species at Risk Act* Recovery Strategy Report Series. Fisheries and Oceans Canada, Ottawa. iii + 18 pp.

DFO (Fisheries and Oceans Canada). 2018. Action Plan for the Western Brook Lamprey – Morrison Creek Population (*Lampetra richardsoni)* in Canada. *Species at Risk Act* Action Plan Series. Fisheries and Oceans Canada, Ottawa. v + 39 pp.

DFO (Fisheries and Oceans Canada). 2022. Report on the Progress of Recovery Strategy Implementation for the Western Brook Lamprey (Morrison Creek population; *Lampetra richardsoni*) in Canada for the Period 2016 to 2021. *Species at Risk Act* Recovery Strategy Report Series. Fisheries and Oceans Canada, Ottawa. vi + 17 pp.

Federal, Provincial, and Territorial Governments of Canada. 2014. 2012 Canadian nature survey: Awareness, participation, and expenditures in nature-based recreation, conservation, and subsistence activities. Ottawa, ON: Canadian Councils of Resource Ministers. 188 pp.

Gothard, N., pers comm. 2023. Correspondence to M. Boothroyd and E. Branquinho. December 2023. Manager of Community & Sustainability Planning, Development Services. City of Courtenay, British Columbia.

Grant, P., pers comm. 2024. Correspondence to E. Branquinho and M. Boothroyd. March 2024. Research Scientist, DFO. Sidney, British Columbia.

Lamprey Technical Workgroup. 2020. Best management guidelines for native lampreys during in-water work. Original Version 1.0, May 4, 2020. 26 pp. + Appendices. Available: https://www.pacificlamprey.org/ltwg/.

National Recovery Team for Morrison Creek Lamprey. 2007. Recovery Strategy for the Morrison Creek Lamprey (*Lampetra richardsoni* var. *marifuga)* in Canada. *Species at Risk Act* Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa. v + 24 pp.

Spice, E.K., T.A. Whitesel, G.S. Silver, and M.F. Docker. 2019. Contemporary and historical river connectivity influence population structure in Western Brook Lamprey in the Columbia River Basin. Conservation Genetics 20:299‑314.

Tazzioli, J. pers comm. 2023. Correspondence with E. Branquinho and M. Boothroyd during Morrison Creek Lamprey Progress Report Meeting (hosted online). November 2023. Manager of Engineering, Engineering Projects. City of Courtenay, British Columbia.

Wade, J., N. Pinnell, G. Kosmider, and S. MacConnachie. 2015. Information to support the identification of critical habitat for the Morrison Creek Lamprey (*Lampetra richardsoni* var. *marifuga*). DFO Canadian Science Advisory Secretariat Research Document. 2015/031. v + 30 p.

Wade, J., L. Dealy, V. Hodes, and S. MacConnachie. 2019. Morrison Creek Lamprey (*Lampetra richardsoni*) trapping survey, June 2017. Canadian Manuscript. Report of Fisheries and Aquatic Sciences:3183: iv + 6 p.

Wade, J. 2020. Application of Harm Reduction Thinking to the Conservation of Uncharismatic Species. Pp. 271-278. *in* C. Stephen (ed.), Animals, Health and Society, CRC Press, London.

Wade, J., L. Dealy, and P. Grant. 2021. Passive Trapping of Western Brook Lamprey (*Lampetra richardsoni*), Morrison Creek population in 2021. Canadian Manuscript. Report of Fisheries and Aquatic Sciences:3230: v + 6 p.

Wade, J. 2022. Summary of 2011-2021 trap data for the endangered Morrison Creek Lamprey *(Lampetra richardsoni*). Canadian Technical Report. Fisheries and Aquatic Sciences:3469: vi + 17 p.

Wade, J., and P. Grant. 2022. Opportunistic observations of nest building and spawning of the endangered Western Brook Lamprey, Morrison Creek population (*Lampetra richardsoni*). Canadian Manuscript. Report of Fisheries and Aquatic Sciences:3251: v + 11 p.